# COST REIMBURSEMENT CONTRACT WITH AN EDUCATIONAL INSTITUTION

AGENCY FOR INTERNATIONAL DEVELOPMENT NEGOTIATED CONTRACT NO. AID/ta-C-1211

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|---|---|
| NEGOTIATED PURSUANT TO THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED, AND EXECUTIVE ORDER 11223 | TOTAL ESTIMATED CONTRACT COST<br>$828,157 (See Article VI) |
| CONTRACT FOR: Research on Inheritance and Improvement in Protein Quality & Content in Maize<br>PROJECT NO:<br>931-17-130-524-73 | CONTRACTOR (Name and Address)<br>Purdue Research Foundation<br>NAME<br>Office of Sponsored Research<br>STREET ADDRESS<br>West Lafayette, Indiana 47907<br>CITY, STATE, AND ZIP CODE |
| ISSUING OFFICE (Name and Address)<br>Agency for International Development<br>Office of Contract Management<br>Central Operations Division<br>Washington, D.C. 20523 | |
| ADMINISTRATION BY<br>CM/COD/TAB | COGNIZANT SCIENTIFIC/TECHNICAL OFFICE<br>TA/AGR |
| MAIL VOUCHERS (Original and 3 copies)<br>TO:<br>Agency for International Development<br>Office of the Controller<br>Washington, D.C. 20523 | ACCOUNTING AND APPROPRIATION DATA<br>PIO/T NO. 3157577<br>APPROPRIATION NO. 72-11X1023<br>ALLOTMENT NO. 402-31-099-00-22-51 |
| EFFECTIVE DATE<br>JUN 30 1975 | ESTIMATED COMPLETION DATE<br>March 31, 1978 |

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 Indiana with its principal office in Lafayette, Indiana, 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.

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 September, 1974, and Additional General Provisions (form AID 1420-23D)

| | |
|---|---|
| NAME OF CONTRACTOR<br>Purdue Research Foundation | UNITED STATES OF AMERICA<br>AGENCY FOR INTERNATIONAL DEVELOPMENT |
| BY (Signature of authorized individual)<br>M Andrews | BY (Signature of Contracting Officer)<br>V. C. Perelli |
| TYPED OR PRINTED NAME<br>T. M. Andrews, Vice President & General Manager | TYPED OR PRINTED NAME<br>V. C. Perelli |
| TITLE | CONTRACTING OFFICER |
| DATE<br>6-30-75 | DATE<br>JUN 30 1975 |

AID 1420-23A (4-73)

SCHEDULE
COST REIMBURSEMENT CONTRACT WITH
AN EDUCATIONAL INSTITUTION

Contract No. AID/ta-C-1211

TABLE OF CONTENTS
SCHEDULE

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



GENERAL PROVISIONS

1. The General Provisions applicable to this contract consist of Form AID 1420-23C entitled "General Provisions - CostReimbursement Contract with an Educational Institution, dated 7/74, which includes provisions 1 through 38; and Form AID 1420-23D entitled "Additional General Provisions - Cost Reimbursement Contract with an Educational Institution," dated 9/74, which includes provisions 1 through 18.

## SCHEDULE

### ARTICLE I - STATEMENT OF WORK

For the period as hereinafter set forth in the schedule the Contractor shall make available and employ its research and development facilities as personnel to perform a Research and Development program directed toward improvement of the protein quality and content in maize in order to improve the nutritional quality of maize for use in the LDC's.

Objectives: The specific objectives of the project are:

1. In cooperation with other maize breeding programs (particularly that of CIMMYT), expand the search for and evaluation of new mutants and germplasm sources with improved protein quality and quantity, both in existing maize populations and by means of chemical mutagens and to introduce these new mutant genes into lines and populations of use to breeders in LDC's.

2. To concentrate on the development of double and multiple combinations of endosperm mutants and determine the effect of associated interactions on nutritional quality, physical properties of the kernel and agronomic characteristics, with a view to the improvement of grain type and yield as well as protein content and quality.

3. To determine the extent of interactions of both genetic backgrounds and environment with individual or combinations of endosperm mutants and how such interactions may influence protein quality and breeding methods.

4. In cooperation with CIMMYT and other maize workers, develop special varieties and source breeding materials with improved nutritional and agronomic characteristics for use in the LDC's. Special emphasis will be given to Opaque-2 and Sugary-2 Opaque-2 materials adapted to more

temperate regions.

Scope of Work - The Specific Work Plans for 1975-1976 along with projected work plans for 1976-1978 are contained in Attachment 1 hereto.

ARTICLE II. KEY PERSONNEL

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

| Name | Position |
|---|---|
| D.V. Glover (75% effort/FY-9 MM) | Principal Investigator (Project Director) |

B. The individual specified above is 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

C. (1) The Contractor shall obtain A.I.D.'s approval to change the principal investigator or project leader, or to continue the research work during a continuous period in excess of three months without the participation of the approval principal investigator or project leader.

(2) The Contractor shall consult with A.I.D. if the principal investigator plans to, or becomes aware that he will, devote substantially less effort to the work than anticipated. If AID determines that the reduction of effort would be so substantial as to impair the successful prosecution of the research,

A.I.D. may request a change of principal investigator, terminate the research effort or make any other appropriate modification of the research agreement.

ARTICLE III. CHANGES IN RESEARCH METHODS, PROCEDURES, OBJECTIVES OR PHENOMENA UNDER STUDY

A. The principal investigator 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. LEVEL OF EFFORT (Illustrative)

A. During the period April 1, 1976 through March 31, 1978, the estimated illustrative level of effort for the performance of this contract shall be 410.4 man-months of direct labor at an average rate of approximately 136.8 man-months per year.

B. The estimated composition of the total man-months of direct labor is as follows:

| Category | Man-Months |
|---|---|
| Professional | 320.4 |
| Non-Professional | 54.0 |
| Extra Hourly Labor | 36.0 |
| Total | 410.4 |

ARTICLE V. PERIOD OF CONTRACT

The effective date of this contract is the date of the Contracting Officers signature and the estimated completion date is March 31, 1978.

ARTICLE VI. 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", if applicable. | $250,000 |
| 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", if applicable. | $578,157 |
| | Total Estimated Contract Cost | $828,157 |

NOTE: It is estimated that the aforesaid amounts will be sufficient to complete the work required hereunder as set forth in the Schedule article entitled "Statement of Work".

ARTICLE VII. BUDGET

The following budget sets limitations for reimbursement of dollar costs for individual line items. Within the total estimated cost of this contract for each funding period, the contractor may adjust line item amounts up to fifteen percent of each line item in the budget for the performance of this contract, without prior written approval of the Contracting Officer. (See Attachment II hereto).

ARTICLE VIII. ESTABLISHMENT OF OVERHEAD RATE.

Pursuant to the provisions of General Provisions No. 8 of this contract entitled "Negotiated Overhead Rates" a predetermined rate or rates shall be established for each of the Contractor's accounting periods during the term of this Contract.

For the initial period the rates are:

| TYPE | PERIOD | ON-CAMPUS | OFF-CAMPUS |
|---|---|---|---|
| Predetermined | FR: 04-01-75<br>TO: 06-30-76 | 68.5 | 40.4 |
| | FR: 07-01-76<br>TO: Until Amended | | |

Distribution Base: Direct Salaries and Wages including holiday, vacation and sick pay, but excluding other Fringe Benefits.

ARTICLE IX. MODIFICATION TO THE GENERAL PROVISIONS

A. General Provision No. 7. entitled "Allowable Cost and Payment" - Delete in its entirety and substitute in lieu thereof Attachment III hereto entitled "Federal Reserve Letter of Credit for Advance Payment".

ARTICLE X. MODIFICATION TO ADDITIONAL GENERAL PROVISIONS

A. Additional General Provision No. 3 entitled "Personnel" - Notwithstanding the provision in the above Additional General Provision requiring prior written approval by the Contracting Officer for all international travel directly and identifiably funded by AID under this contract, 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 and technical office of AID 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.

ARTICLE XI. ADDITIONAL CLAUSES

A. Prior to making any visits to the LDC's the Contractor will review his plans with the Technical Assistance Branch, (TA/AGR) AID Washington.

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He will keep AID Missions in countries to be visited fully informed on 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 outcomes of consultations. He 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 XII. REPORTS

A. The annual technical research report will be prepared in accordance with the "Guidelines for Preparation of the Research Annual Report", Attachment IV hereto.

B. In addition to the annual technical report of research progress, a fiscal report will be submitted on a six months interval basis. Five copies of the fiscal report will be submitted to the Office of the Controller, Agency for International Development, Washington, D.C. 20523.

C. Reporting dates - Reports will be due 45 days after the close of the reporting period or November 15, 1975 and May 15, 1976, respectively for the fiscal report and May 15, 1976 for the first annual research report. The terminal research report will be due in lieu of the annual report on May 15, 1978.

ARTICLE XIII - SUBCONTRACTS

A. During the period of this contract, the contractor is authorized to enter into sub-contracts for Winter Nurseries and chemical & biological analyses. placement of the sub-contracts shall be made in accordance with General Provision No. 16 entitled "Sub-Contracts and Purchase Orders".

B. The Contractor shall submit a copy of the proposed subcontracts to the Contract Officer for prior written approval of their terms and conditions.

## WORK PLANS

The Contractor shall perform the following work plans during the period 1975 - 1978.

1. New genes and germplasm to provide improved protein quality.

a. Some of the new mutants have shown high lysine in preliminary analyses. Others have shown stable inheritance in F2 ratios but have not yet been analyzed for lysine.

(1) 1975-1976 - The mutants which have shown high lysine values will be retested in the subsequent generation. Those not yet analyzed but with stable inheritance patterns shall be analyzed. Allele testing will continue against all known genes of similar phenotype.

(2) 1976-1978 - The Contractor shall continue allele and linkage tests and start introduction of any promising new mutants into elite germplasm, and combine and evaluate epistatic effects with other genes such as opaque-2, floury-2 and sugary-2.

b. Use of ninhydrin technique adapted to screening hard endosperm types to search for opaque-2 with "normal" phenotype.

(1) 1975-1976 - With tests of material from the Germplasm Bank (CYMMYT) as a base, the search shall be broadened to new collections from the most promising areas indicated by the screening process, and shall be extended as well to mutants developed through the use of chemical mutagens.

(2) 1976-1978 - The search shall be further broadened and promising material analyzed in more detail in a subsequent generation. Completely modified opaque-2, and/or new high lysine germplasm of "normal" phenotype

will be the object of the search. Promising new mutants will undergo further evaluation as in A-1 above.

c. Results from selection studies by Dr. M.S. Zuber at University of Missouri and discussion with CIMMYT breeders at a recent coordinating conference point to the need for definitive data on selection for improved protein quality in normal maize. This approach would have the theoretical advantage of improving protein quality without the agronomic disadvantages of lower yield, ear rots and/or grain insect damage associated with the use of the mutant genes.

(1) 1975-1976 - The Contractor shall analyze normal kernels from segregating families (ears) of the original random mated versions of Temp HA and Temp HB. Approximately 100 ears in each variety shall be analyzed for protein and lysine. If there are a promising number of lysine families then 100 additional ears in each variety will be analyzed.

(2) 1976-1977 - In winter nursery the Contractor shall intercross the 25 families with highest lysine content.

(3) 1977-1978 - The Contractor shall test 100 full sib families for another cycle of recurrent selection. A decision will be made at this time depending on results obtained whether to continue this approach.

2. The Contractor shall develop populations with improved protein or qualities for temperate areas (Objective 4).

a. Two opaque-2 populations designated Temp HA and Temp HB were developed and have undergone mild selection pressure for modified kernel type and resistance to H. turcicum and smut (Ustilago zeae). In the summer of 1974, full sibs were yield

tested at four worldwide locations.

(1) 1975-1976 - Based on agronomic performance and protein quality 150 full sibs will have been made among selected families in each population in the winter nursery. These shall be yielded tested at 4 or 5 worldwide locations.

(2) 1976-1978 - Continue full sib selection for agronomic performance, modified kernel types and protein quality. When either or both populations show promise at a location one may wish to practice intensive testing for more specific adaptation to that area. These populations could fit into a reciprocal recurrent selection program for development of a population cross hybrid.

b. Maximum effort will be placed on the development of the Temp ~~HA~~ and Temp HB sugary-2 opaque-2 populations. A full-sib family selection method to improve these high lysine sugary-2 opaque-2 maize populations is being used. Based on chemical analysis for protein quality, kernel size, weight and vitreousness, family selections will be made. Plant-to-plant crosses shall be made among selected families in the 1975-winter nursery.

(1) 1975-1976 - 200 selected full-sib families in each population shall be yield tested and simultaneously grown in the 1975-summer breeding nursery to be self-pollinated. Ears harvested from each family will be analyzed for protein quality, kernel size, weight and vitreousness and poorer families discarded. Selected families will be grown in

the 1976-winter breeding nursery to make 200 full sib meetings among each selected group.

A very limited effort on the development of the Temp HA and Temp HB $\underline{wx}\ o_2$ and $\underline{bt_2}\ \underline{O_2}$ populations will be made.

2. 1976-1978 - The Contractor shall continue full sib selection as outlined above in the populations. After some progress has been realized in these populations, particularly the sugary-2 opaque-2 populations may be introgressed into the opaque-2 Temp HA and Temp HB populations (Sec. b-1) which will have had selection for agronomic quality and wide adaptation characteristics.

3. The Contractor shall perform the selection for higher protein content in double-mutant combinations. (Objective 4)

   a. Selection for protein content in the sugary-2 opaque-2 double mutant combination. The sugary-2 opaque-2 double mutant genotype is being back-crossed into at least two agronomically desirable selections of "opaque-2, high protein" line recoveries in each of the OH43, B14 and B 37 inbred sources recovered from crosses to Illinois High Protein material. The first and second backcrosses were made in the 1974-summer nursery.

   (1) 1975-1976 - Based on evaluations for agronomic performance. kernel quality, kernel size, and protein quality the Contractor shall continue backcrossing and selection for increased levels of protein.

(2) 1976-1978 - The Contractor shall continue backcrossing and selection for improvement in protein nutritional quality within the sugary-2 opaque-2 selected recoveries.

b. Selection for protein content in the multialeuron sugary-2 opaque-2 inbreds were made in 1974-1975.

(1) 1975-1976 - Selection and continued backcrossing to the recurrent double-mutant lines shall be made to increase the proportion of aleurone tissue relative to the starch portion of the endosperm in an additional effort to improve the protein nutritional quality. Detailed genetic and agronomic evaluation of the increased aluerone layered recoveries.

(2) 1976-1978 - Advanced generation recoveries shall be selected for increased number of aleurone layers and protein quality in the endosperm as further backcrossing proceeds to develop isogenic material and eventual evaluation in hybrids.

4. Detailed generic and agronomic evaluation of independent (mutant) sources of opaque-2 gene (Objective 1).

Seven opaque-2 sources are being backcrossed into common inbred sources W64A and B37 to evaluate possible differences among the sources. The fifth or sixth back-rosses have been made.

(1) 1975-1976 - In summer nursery the Contractor shall evaluate preliminary crosses and inbred sources for agronomic performances, grain quality, and protein quality to determine possible

differences among mutant sources. Continue backcrossing and make more advanced crosses.

(2) 1977-1978 - The Contractor shall continue backcrossing and evaluation if there are any differences among the sources. Expand this phase if some sources are more promising, or if there is evidence that opaque-2 is structually a multiple allele.

5. Modifier genes - To achieve a more normal phenotype for consumer acceptability and ear rot and grain insect resistance detailed studies of modified types shall be conducted. (Objective 3).

a. A modified opaque-2 synthetic $hMo_2$ has been developed from Cornbelt germplasm and released as a source of modifier genes. Areas of research to answer some questions involving modified opaque-2 types are as follows:

(1) A very critical question involving the practical utilization of selected high lysine modified opaque-2 types concerns the stability of the characteristics under random mating and various environmental conditions when used by the farmer.

If these populations tend to lose their modified or high lysine characteristics the farmer will be dissatisfied. Also if continued or frequent selection pressuer is necessary to maintain high lysine and modified characteristics this approach may not be too practical.

d. The sugary-2 opaque-2 double mutant genotype has been crossed with specific selections for modified opaque-2 vitreous kernel phenotype.

d. (1) 1975-1976 - The Contractor shall continue backcrossing and selfing out in advanced generation materials and continued full sib selection in sub-population of Tem HB modified $o_2$, and the Contractor shall evaluate the sugary-2 opaque-2 genotype in the modified opaque-2 backgrounds for progress in protein quality improvement, kernel vitreousness, and seed size.

d. (2) 1976-1978 - The Contractor shall evaluate for agronomic performance, protein quality, kernel size and degree of modification and determine if approach is practical before continued selection as outlined above.

6. Development of superior opaque-2, sugary-2 opaque-2 and waxy opaque-2 inbreds in hybrids. (Objective 4)

Experimental hybrids are currently being tested by this project and in ccoperative uniform tests with the public corn breeders in the U.S. cornbelt region. Some of the better hybrids have been distributed for evaluation in other temperate areas of the world.

(1) 1975-1976 - The Contractor shall continue inbred development and hybrid evaluation.

(2) 1976- 1978 - More promising hybrids shall be evaluated in uniform tests in temperate areas in cocperation with CIMMYT, FAO and other organizations. Superior lines will be released to interested countries or seed companies.

Modified and non-Modified versions of synthetics Temp HA $o_2$ and Temp HB $o_2$ and high and low lysine selections of modified and non-modified versions of synthetic $HMo_2$ have been random mated successively for two or three generations.

a. (2) 1975-1976 - The Contractor shall evaluate the random mated generations of the eight populations described above in several environments.

a. (3) 1976-1977 - The Contractor shall continue the testing for a second year as necessary to obtain definitive data.

b. Data on relationships of agronomic performances to modified types and protein quality shall also be obtained in the above 1.A. experiments in 1976-1977.

c. Current research has shown that selection for modified opaque-2 types result in lower lysine levels and a shift in the protein fractions (Landry-Monreaux method) toward that found in normal maize. High protein quality types can be obtained in modified types by selection. However, it is not known what change(s) occurs in protein fractions or protein quality of those fractions to achieve those types. Understanding these changes could lead to more efficient selection criteria.

c. (1) 1975-1976 - The high and low lysine version of the modified and non-modified versions selected in $HMo_2$ (sec. 2-a1) shall be subjected to protein fractionation, protein quality (amino acid patterns) of these fractions and electrophoretic separation of proteins.

B'

7. A. Endosperm Mutant Interactions. (Objective 2)

To explore the potential of genetic interactions among endosperm mutants particularly sugary-2 opaque-2 for improving protein quality, kernel characteristics, digestibility and consumer acceptability, continued effort is being made in evaluating genetic interactions of endosperm mutants with opaque-2 and promising new protein quality mutants which may be discovered.

(1) 1975-1976

(a) The Contractor shall continue endosperm mutant and opaque-2 double-mutant isogenic line development and hybrid evaluation.

(b) The Contractor shall expand emphasis on the sugary-2 opaque-2 genetic system and continue some emphasis on waxy opaque-2.

(c) Because of the current possibilities that sugary-2 opaque-2 holds for improving kernel quality, digestibility, caloric content and protein quality; and the digestibility and protein quality in waxy opaque-2 (glutnous corn) detailed studies are being conducted (see also sections 1-c1, 10c2, and 2-c).

(d) The Contractor shall continue study with sugary-2 and sugary-2 opaque-2 gene interactions in high and low oil selections to evaluate their effect on caloric content and protein quality. Evaluate agronomic performance, kernel, oil and protein quality in the sugary-2 and sugary-2 opaque-2 high and low oil background recoveries of $F_2$, $F_3$, generations in a replicated uniform nursery.

Continue study of sugary-2 endosperm dosage interaction and effects of outcrossing on protein quality, kernel size and weight and related characters in sugary-2 and sugary-2 opaque-2 corn.

(e) Developmental studies shall be conducted with sugary-2 and sugary-2 opaque-2 in isogenic hybrids to determine limiting factors to seed size. Dry matter accumulation will be studied. The effects of plant stand, thinning date and kernel competition on seed size of sugary-2 and sugary-2 opaque-2 hybrids will be studied.

(f) Detailed genetic and agronomic evaluation of independent mutant sources of the sugary-2 gene. The Contractor shall continue backcrossing into common inbred backgrounds to evaluate differences among sources.

(g) The Contractor shall conduct basic research on the nature of the proteins in certain key mutants and double-mutant combinations, particularly sugary-2 opaque. The nature of the protein body characteristics, matrix protein, distribution and protein-profiles shall be investigated.

7 B 1976-1978 - The endosperm mutant interaction studies are complex and require a number of generations to develop. As new findings are discovered and new genotypes developed they will be examined for their agronomic quality, kernel characteristics and acceptability, protein, carbohydrate and oil quality and quantity, and biological value for potential food and feed use.

The Contractor shall continue detailed agronomic genetic and nutritional studies outlined above and in section "g" with continued evaluation as to practical value of new speciality corns. As new materials of promise are developed and if deemed practical they will be incorporated into populations and long time breeding and selection programs employed to develop utilizable materials with wide adaptation.

(Continuation of page ~~11~~ of Work Plan)

8 Improved analytical and biological methods. (Objectives 1, 2 and 3)

1975-76 - The development of the ninhydrin method for screening both floury and hard endosperm types of maize has increased the need for a rapid method for determining the quantitative lysine level in ninhydrin-positive seeds. This laboratory will continue to search for better methods and will evaluate new methods proposed by other laboratories. Two new methods to be tested are the ninhydrin colorimetric method for peptide bound lysine of Wall and coworkers, and the fluorometric dansyl chloride method of Kaul and coworkers. Cooperate with other workers on development of improved simple analytical and biological methods for evaluating protein quality in maize.

Study amino acid pathways leading to lysine biosynthesis in developing opaque-2 maize endosperms. Several enzymes involved in lysine biosynthesis in maize are subject to feedback control by the end product, lysine. The levels of these enzymes in opaque-2 and normal endosperm will be determined to see if mutations have occurred.

1977-78 - Current methods of analysis of corn will be improved and new methods evaluated. This information will be provided to laboratories in the developing countries. Continue studies on the mechanism of protein biosynthesis in opaque-2 maize.

9 Protein nutritive value. (Objectives 2, 3 and 4)

1975-76 - Feeding trials with rats and swine will be undertaken with the cooperation of the Department of Animal Sciences, for initial evaluation of new genetic materials (sugary-2, sugary-2 opaque-2, waxy, waxy opaque-2, opaque-2 and the normal counterpart 3-way hybrids).

1977-78 -

a. A cooperative study will be carried out with the Department of Foods and Nutrition to:

(1) evaluate in adult human subjects the nutritional value of the sugary-2 opaque-2 double-mutant corn compared to opaque-2 corn;

(2) to compare the response of human subjects to those sources of intact protein and

(3) to evaluate in feeding trials with rats combinations of nutritionally improved corns in food blends characteristic of those consumed in various parts of the world.

b. The new genetic types will be evaluated for milling quality. Food products and raw ingredients from genetically improved high lysine corns will be evaluated for

(1) keeping quality-factors,

(2) sensory evaluation and acceptance, and

(3) proximal composition of the products.

# BUDGET

| LINE ITEM | Funds Available (i.e. obligated) FR: 04-01-75 TO: 03-31-76 | Projected Budget FR:04-01-76 TO:03-31-77 | Projected Budget FR:04-01-77 TO:03-31-78 | Total Budget FR:04-01-75 TO:03-31-78 |
|---|---|---|---|---|
| 1. Salaries & Wages | $ 115,763 | $ 128.429 | $ 134,897 | $ 379,089 |
| 2. Fringe Benefits | 9,509 | 10,799 | 11,423 | 31,731 |
| 3. Overhead (68.5%) | 79,298 | 87,974 | 92,404 | 259,676 |
| 4. Travel & Transportation | 5,000 | 6,908 | 7,022 | 18,930 |
| 5. Other Direct Costs | 2,000 | 2,590 | 2,690 | 7,280 |
| 6. Equipment, Vehicles Materials & Supplies | 10,430 | 13,390 | 14,125 | 37,945 |
| 7. Sub-Contracts | 28,000 | 31,800 | 33,706 | 93,506 |
| Total | $ 250,000 | $281,890 | $296,267 | $828,157 |

A. The "Funds Available" column represents the total funds authorized to be expended by Contractor during the period indicated (See Article VI of the Schedule entitled "Estimated Contract Cost, Obligated Funds, and Limitation of Funds") total Contract expenditures shall not exceed the grand total of funds available.

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.

B. Pre-Contract Costs

The allowable cost of performance of this Contract shall include all

allowable and allocable costs which have been incurred by the Contractor in anticipation of this Contract on and after April 1,1975 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 under this contract, provided however, that such pre-contract costs shall not exceed $39,600 unless such amount is subsequently increased in writing by the Contracting Officer.

Federal Reserve Letter of Credit

for Advance Payment (Apr. 1975)

(a) AID shall open a Federal Reserve Letter of Credit in favor of the Contractor in the amount of $ 250,000 available for obligation under this contract against which the Contractor may present payment vouchers, The amount drawn by the Contractor during any calendar (month) of this contract shall not exceed $ 35,000 without the prior written authorization of the Contracting Officer. The amount of the payment voucher shall not be in an amount less than $10,000 nor more than $1,000,000 but within the specific dollar ceiling on (monthly or quarterly) withdrawals.

(b) In no event shall the accumulated total of all such payment vouchers exceed the amount of the Federal Reserve Letter of Credit.

(c) If at any time, the Contracting Officer determines the Contractor has presented payment vouchers in excess of the amount or amounts allowable in (a) and (b) above, the Contracting Officer may: (1) cause the Federal Reserve Letter of Credit to be suspended or revoked; or (2) direct the Contractor to withhold submission of payment vouchers until such time as, in the judgment of the Contracting Officer, an appropriate level of actual, necessary and allowable expenditures has occurred or will occur under this contract; and/or (3) request the Contractor to repay to AID the amount of such excess. Upon receipt of the Contracting Officer's request for repayment of excess advance payments, the Contractor shallpromptly comply with such request.

(d) Procedure for Contractor.

(1) After arranging with a commercial bank of its choice for operation under this arrangement and obtaining the name and address of the Federal Reserve Bank or branch serving the commercial bank, the Contractor shall deliver three originals of Standard Form 1194, "Authorized Signature Card for Payment Vouchers on Letters of Credit" signed by those official(s) authorized to sign payment vouchers against the Federal Reserve Letter of Credit and by an official of the institution who has authorized them to sign.

(2) Upon execution of the contract, the Contractor shall receive one certified copy of the Federal Reserve Letter of Credit.

(3) The Contractor shall confirm with his commercial bank that the Federal Reserve Letter of Credit has been opened and is available if funds are needed.

(4) To receive payment, the Contractor shall:

(i) Periodically, although normally not during the last five days of the month, prepare payment vouchers (Form TUS 5401) in an original and three copies.

(ii) Have the original and two copies of the voucher signed by the authorized official(s) whose signature(s) appear on the Standard Form 1194.

(iii) Present the original, duplicate, and triplicate copy of theForm TUS 5401 to his commercial bank.

(e) Retain the quadruplicate copy of the voucher.

(5) Each drawdown should be initiated at approximately the same time that checks are issued by the organization in payment of program liabilities including those for allowable indirect costs, and in an amount approximately equal to the Federal share of such payments. Therefore, there is no necessity for the recipeint organization to maintain balances of Federal cash other than

the small balance necessary to provide for an element of bank float.

(6) A report of expenditures is prepared and submitted to the office of Financial Management, within thirty days of disbursement. This report, submitted on Standard Form 1034, "Public Voucher for Purchases and Services Other Than Personal:, and supported by certifications, listing of withdrawals, and documentation as required, itemizes expenditures made, identifying funds expended by line item of the approved budget and/or category supporting the agreement.

(7) The report of expenditures on Standard Form 1034 is reviewed against the contract provisions, and any disbursement improper under the contract is disallowed, The Contractor is notified of the reason for the disallowance and is directed to adjust the next periodic report of expenditures to reflect the disallowance and to reduce its next payment voucher against the Federal Reserve Letter of Credit by the amount of the disallowance.

(8) Simultaneously with the submission of the report of expenditures, the Contractor submits to the Controller a status report on the Federal Reserve Letter of Credit as of the close of the period covered by the report of expenditures. The report is prepared in the following format:

Status of Funding Report

Federal Reserve Letter of Credit (FRLC)

No._____

Period from_____through_____

A. Letter of Credit Position

1. Current amount of FRLC (including amendments) through reporting period $_____

2. Payment Vouchers on Letter of Credit presented (Form Tus-5401):

   a. Credited prior to reporting period $_____

   b. Credited during reporting period via TUS-5401 Voucher Nos._____ through inclusive $_____

   c. Presented byt not credited during report via TUS-5401's numbered _____through _____ inclusive $_____

3. Total of all Payment Vouchers against FRLC credited or presented. $_____

4. Balance of FRLC not drawn or requested this reporting period $_____

5. Cash Position

   1. Cash on hand at beginning of period $_____

   2. Plus: cash drawn during period $_____

   3. Plus: refunds, rebates or other amounts received, to the extent allocable to disbursements charged against this FRLC $_____

   4. Total cash available (sum of 1,2, and 3) $_____

   5. Less: disbursements during period $_____

   6. Balance of cash on hand at close of reporting period $_____

   7. Estimated number of days requirements covered by balance on hand (Item 6 above) Days:_____

   8. Advances to subcontractors $_____(included in B. 6 above)

(f) Refund of Excess Funds.

(1) If all costs have been settled under the contract and the Contractor fails to comply with the contracting Officer's request for repayment of excess Federal Reserve Letter of Credit funds, the Government shall have the right, on other contracts held with the Contractor, to withhold payment of Federal Reserve Letter of Credit or other advances and/or withhold reimbursements due the Contractor in the amount of the excess being held by the Contractor.

(2) If the Contractor is stillholding excess Federal Reserve Letter of Credit funds on a contract under which the work has been completed or terminated but all costs have not been settled, the Contractor agrees to:

(i) Provide within 30 days after requested to do so by the contracing officer, a breakdown of the dollar amounts which have not been settled between the Government and the Contractor. (The Contracting Officer will assume no costs are in dispute if the Contractor fails to reply within 30 days.);

(ii) Upon written request of the contracting officer, return to the Government the sum of dollars, if any, which represents the difference between (1) the Contractor's maximum position on claimed costs which have not been reimbursed and (2) the total amount of unexpended funds which have been advanced under the contract; and

(iii) If the Contractor fails to comply with the Contracting Officer's request for repayment of excess Federal Reserve Letter of Credit funds, the Government shallhave the right, on other contracts held with the Contractor, to withhold payment of Federal Reserve Letter of Credit or other advances and/or withhold reimbursements due the Contractor in the amount of the excess being held by the Contractor.

ATTACHMENT IV

January 20, 1972

# GUIDELINES FOR PREPARATION

# OF THE

# RESEARCH ANNUAL REPORT

The attached guidelines suggest the format and the detail for annual research reports that are required in all research contracts. The research contractor will submit thirty-five copies of the report with appendices to the A.I.D. Project Manager. The A.I.D. Project Manager will submit two copies to TA/RUR and two copies to the A.I.D. Reference Center.

The outline should prove useful to the contractor in preparing the report, and provide an improved basis for annual project reviews. The contractor is encouraged to develop a self-contained report as outlined below in approximately fifteen double-spaced pages. Additional material may be annexed as necessary for a comprehensive report. The fifteen page report is intended to provide a bareboines statement of the effectiveness of research resources and methods in producing research results according to annual work plans, and the significance of these research results for the solution of the problem being addressed. Annexed material is essential for a critical review of assertions regarding findings, significance, etc.

## REPORT SUMMARY 1/

A. 1. Project Title and Contract Number:

2. Principal Investigator, Contractor and Mailing Address:

3. Contract Period (as amended): 2/ from _____ to _____

4. Period covered by Report: from _____ to _____

5. Total A.I.D. funding of contract to date:

6. Total expenditures and obligations through previous contract year: 3/

7. Total expenditures and obligations for current year: 3/

8. Estimated expenditures for next contract year:

B. Narrative Summary of Accomplishments and Utilization

(In this space provide a concise statement of the principal accomplishments during (1) the period of the report and (2) life of the project in relation to research objectives and actual or potential operational significance.

This information does not substitute for a full discussion of the same points required in the body of the Annual Research Report as outlined below.)

Identify significant problems or accomplishments in the progress of the project related to the volume, effectiveness, or scheduling of the manpower, equipment, travel, etc., made available by these expenditures.

Discuss significant changes or modifications in project management, in the staffing pattern, physical facilities, institutional environment, etc.

G. Work Plan and Budget Forecast for Coming Year

Taking into consideration the past year's progress and expenditures and the work remaining to be done over the life of the project, present a work plan and budget for the coming year.

1. anticipated accomplishments for the coming year.

2. procedures to be used and activities to be carried out.

3. significant factors that you anticipate that will promote or impede accomplishments.

4. a plan for dissemination and utilization of the expected results of the research in the U.S. and in LDCs as applicable.

5. a budget statement that shows planned expenditures for each of the major inputs (personnel, equipment, travel, LDC involvement, etc.) according to the major accomplishments, or work targets that are planned for the coming year's work.

H. Appendices

Reports of technical data and analyses (Par. D. 2)
A bibliographic list with abstracts of papers and publications (Par. E. 1)
A list of uses made of research findings and reports (Par. E. 1)
Other appendices as appropriate.

1/ "Report Summary": Statistical Information (Item A) and the Narrative Summary of Accomplishments (Item B) should be reported on a single page. This page will be for general public use as well as project management purposes, and should be written for a general rather than a technical audience.

2/ Item 3 - Contract Period (as amended): Report the original date of the contract and closing date as prescribed by the contract or any amendment thereto.

3/ Items A 6-8: These items refer to expenditures including firm obligations by the contractor. Obligations are the contractor's legal but unpaid commitments, i.e., subcontracts, purchase orders, etc.; and other related accruals through the end of the reporting period. A "contract year" is one between anniversary dates of the contract.

# ANNUAL RESEARCH REPORT

## A. General Background

Prepare a concise statement that provides the background and rationale that led to the initiation of the project. This summary should state the nature and importance of the problem to which the research is addressed, and the rationale that links the research activity to the problem.

## B. Statement of Project Objectives as Stated in the Contract

The purpose of this section is to record in a precise and concise way the objectives of the research project. The objectives as stated in the contract may have been interpreted, expanded or further defined in other documents and mutually agreed to by A.I.D. and the contractor. This section should reflect the contractual objectives as modified by these supplementary understandings.

## C. Continued Relevance of Objectives

Does your research to date, or other circumstances, indicate a need for modification of project objectives as stated in the contract? If so, in what respects?

## D. Accomplishments to Date

1. Findings: Provide a statement of the principal and significant findings and other accomplishments for the reporting period as they relate to the anticipated results in the year's work plan. (See material for the year similar to that requested in G.1. below for the coming year.)

Discuss the operational significance of the findings of the current year's research for attainment of project objectives as stated in Section B above. The discussion should include reference to existing knowledge, recent research findings by others, and cumulative findings and accomplishments of this project.

Also discuss side effects of the work, positive or negative. For example, do the findings to date suggest unexpected complications for the application of findings; do they suggest the need for more direct approaches to the problem than were originally anticipated; or is the research developing information and insights not expected in the scope of the work?

2. Interpretation of Data and Supporting Evidence:

Summarize briefly the evidence and analysis that support the findings cited above. To permit a critical analysis of the evidence and analysis, expand as necessary in an appendix to each copy of the report.

3. Research Design: State briefly any significant modifications made in the research design prior to the current reporting period.

Are the present techniques, instruments or mode of inquiry appropriate and/or optimal for the study design? In view of the findings of the past year or your experience with the research measures employed, do you recommend modifying (1) the research design or (2) research techniques? For example, have there been special problems of data availability, sampling, data processing, or ineffective techniques? Have research findings revealed technical relationships that suggest a continuation of present methods or do they suggest a new approach?

E. Dissemination and Utilization of Research Results

1. Briefly describe efforts made under the contract to disseminate the results of the research project. Attach as appendices two lists: (1) a bibliographic list and an abstract not exceeding 200 words of papers and publications developed under the contract and (2) a list of short statements that identify each known use of materials produced by the project for seminars, conferences, translations, or as background material for speeches, policy statements, etc.

2. Cite evidence and cases known to you that findings of the research project are being used in LDCs, the U.S., or both, in training, direct application to the problem, etc.

3. Has the experience of the past year suggested new or more effective ways to expand the use of research results? If so, discuss the experience and as appropriate include proposed steps in the work plan (Item G below). Indicate whether your proposals can be carried out under current provisions of the contract, or would require new contract arrangements by A.I.D.

4. Discuss the extent and nature of considerations to involve LDC personnel and/or institutions as an appropriate activity of the project. If judged appropriate, discuss the kind and extent of LDC involvement in (a) planning the project, (b) the execution of the field work, (c) the analysis and reporting of results. Plans to involve LDCs in the future should be reflected in the work plan in Item G (4) below.

5. Under separate cover forward four copies of publications, seminar reports, translations and other materials representing efforts to disseminate results of the research project, and evidence of the results being utilized by LDC or U.S. people or institutions.

F. Statement of Expenditures and Obligations and Contractor Resources

Provide a statement of expenditures and obligations related to the budget plan for the year. This statement should show expenditure and obligations for each of the (1) major inputs (Personnel, equipment, travel, etc.) according to (2) the major accomplishments or work targets that had been planned for the year's work.

Identify significant problems or accomplishments in the progress of the project related to the volume, effectiveness, or scheduling of the manpower, equipment, travel, etc., made available by these expenditures.

Discuss significant changes or modifications in project management, in the staffing pattern, physical facilities, institutional environment, etc.

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