

PROJECT STATEMENT

Date: November 20, 1972

PROJECT SUMMARY

1. Statistical

Project Title: Improving the Nutritive Value of Cereal Based Foods

New or Extension: Proposed Extension of AID/csd 1586

Contractor and Address: Food and Feed Grain Institute  
Kansas State University  
Manhattan, Kansas 66506

Principal Investigator: Dr. William J. Hoover

Duration: RAC Authorized Period - Thru March 31, 1973  
Proposed Extension Period April 1, 1973 to March 31, 1975

Total Estimated Cost: \$300,000  
FY 1974 - \$150,000  
FY 1975 - \$150,000

Previous Project Funding:

Total	\$833,257
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Project Monitor: TA/N, Dr. Harold Rice

2. Narrative

This project will develop basic technical know-how for improving the nutritive value of cereal based foods and will also introduce that know-how into programs aimed at improving the nutritional health of persons in the LDCs.

(same project number)

As a result of past work under the contract KSU has found that the use of sodium steroyl lactylate and certain other additives permit the incorporation of soy flour and other protein fortificants in leavened breads at high levels without damage to bread quality. This technical breakthrough is widely recognized as an outstanding contribution to cereal fortified technology and provides a means whereby wheat flour used in bread baking can be made significantly more nutritious. Recog-

nizing the value of this discovery, Food for Peace and USDA have provided for the distribution of soy fortified wheat flours containing sodium steroyl lactylate in Title II programs. One of the principle objectives of this continued project is to promote further utilization of this know-how in LDCs.

Additional objectives of the project are (1) to extend the technology developed under the contract to pasta products, biscuits, tortillas and other traditional cereal based foods, (2) to undertake cost benefit studies and assess the economic and sociological benefits of such products and (3) to evaluate the nutritive, organoleptic, and functional properties of nutritionally improved cereal ingredients and food products.

KSU represents a unique resource to undertake this project. The multi-disciplinary staff of scientists, technologists, and engineers and the \$3 million specialized Food and Feed Grain Institute faculty at KSU have for years provided science and industry with a continuous flow of technology for development. Through this project, A.I.D. can continue to utilize this valuable resource for improving the nutritive value of cereal based foods.

#### EXPANDED NARRATIVE STATEMENT

##### 1. Project Description and Background

Cereal grain products provide the major sources of protein and calories in the diets of low income persons in the LDCs. However, cereal grains contain poor quality protein at low levels and are lacking in certain important vitamins and minerals. These deficiencies are especially damaging to weaning age and other preschool children, the age group most severely affected by malnutrition. Thus, introducing supplementary nutrients into cereal grain foods provides an ideal method for improving the diets of persons in the LDCs.

In practice, supplementary nutrients are best added to processed cereal grains such as wheat flour, corn meal, and the like or the food products made from processed grains such as bread, biscuits, pasta products and similar foods. Also processing generally must be undertaken in some central facility in order to control proper addition of supplementary nutrients. Thus centrally processed cereal grains are important vehicles for overcoming malnutrition in LDCs.

Although in principle fortification of cereal based foods is simple, in practice fortification is sometimes complex and difficult to undertake. For example, the nutritive value of white leavened bread, a widely consumed cereal product in LDCs, can be improved significantly by the addition of oil seed proteins and similar low cost protein supplements.

However, until recently it was also recognized that addition of anything more than token amounts of oil seed protein to white leavened bread reduced the volume, damaged the grain, and otherwise rendered the bread unacceptable. Now, however, as a result of technology developed at KSU, it is possible to add 12 percent or more of soy flour or other protein concentrates to leavened bread without reducing quality.

Similarly, protein fortificants such as soy flours may be readily available in LDCs and it may be necessary to develop indigenous sources of such fortificants. The specialized knowledge of grain processing techniques, such as fine-grinding/air-classification, and the exceptionally versatile pilot processing facilities at KSU make that institution uniquely qualified to develop appropriate sources of fortificants for use in the LDCs.

#### Progress Report

Work on this project was started in 1968 and thus far the project has made good progress in developing and introducing technology for improving the nutritive value of cereal based foods. Perhaps the most useful output of the project, certainly the most widely known one, has been the previously mentioned discovery by KSU that sodium and calcium steroyl lactylates permit the incorporation of oil seed flours and other protein fortificants in leavened bread. As a part of the contract, KSU personnel have promoted the utilization of this discovery in all the regions serviced by A.I.D. Success of the project has been indicated by requests from the Food for Peace officers in the Philippines and India for a soy fortified bread flour formulated by KSU and approval of that formula by USDA for distribution under Title II.

Since approximately one billion pounds per year of wheat flour valued at about \$60 million is distributed through USDA funded donation programs, the potential magnitude of the KSU discovery is enormous.

#### Specific Accomplishments

A. In accordance with contract requirements, a systematic evaluation of the chemical, physical, nutritional, functional and organoleptic properties of protein-rich foodstuffs as fortificants in cereal based foods has been made on defatted soy flour, peanut flour, cottonseed flour, chick-pea flour, broad bean flour and fish protein concentrate. The results of this systematic evaluation have established the limits of levels of usage in breads, cous-cous and chapatis from an organoleptic standpoint.

From such basic information product specifications and processing procedures can be developed to optimize the combination of cost, nutrition and acceptability of fortified cereal based foods.

B. An assessment of the potential indigenous sources of protein-rich foodstuffs in Morocco and Pakistan was completed. This included an evaluation of production, both current and potential; marketing channels and prices; current uses; and the current village and commercial processing capabilities in the countries.

C. A similar assessment was made for the cereal grains and especially wheat which is the base for the foods to be fortified.

D. The basic technology was developed to manufacture a protein-rich flour from chick-peas and broad beans, the two leading indigenous protein-rich crops.

E. The basic technology for producing protein fortified cous-cous, chapatis and yeast leavened breads was developed.

F. Studies extending this technology to the production of protein fortified cookies and pasta products are underway.

G. Limited field testing of bread in Morocco and chapatis and buns in Pakistan has been completed. The analysis of these results will be completed soon.

H. Overseas tests which have been carried out include the following:

(1) Morocco: The Ministry of Education, in cooperation with the Catholic Relief service, food for Peace and KSU, has carried out a limited acceptability test, in several schools, of bread made with soy fortified bread flour. An order for 5,000 pounds of additional material has been requested for further testing.

The importance of determining the most appropriate food for fortification programs in each country is illustrated by the experience in Morocco. Prior to the initiation of this research project, cous-cous was chosen as the product for study in North Africa. During the survey phase of the project it became obvious that cous-cous, while a popular staple in the diet, was eaten maybe two or three times a week primarily because it constitutes a comparatively expensive meal. Bread, on the other hand, is eaten three times a day (about 1½ lb. per capita per day) by Moroccans. Work was therefore initiated on bread in addition to cous-cous and technologies for both products developed.

(2) Miscellaneous Countries:

KSU personnel have been closely associated with efforts in the following countries:

(a) India: Food for Peace, CARE, Western Wheat Associates and Modern Bakeries have tested bread and buns made from soy fortified

bread flour. The Government of India has announced plans to feed 800,000 children with this product beginning January 1, 1973. Orders have been placed with Food for Peace.

(b) Philippines: Food for Peace and CARE have tested soy fortified bread flour in a newly formulated Nutribun which is less expensive than the current bun. Orders have been placed. This program feeds over a million children per day.

(c) Taiwan: The Government of Taiwan, Western Wheat Associates and American Soybean Institute have collaborated to test soy fortified bread flour in bread, cookies, noodles and Chinese steam bread. The Government of Taiwan has ordered substantial quantities of ingredients to test products in school lunches and to feed the Army.

(d) Mexico: The Government of Mexico through the Council of Science and Technology, the Ministry of Education, CONOSUPO (government owned bakeries) and the American Soybean Institute have thoroughly tested the commercial production of bolillos (one million/day) based on soy fortified bread flour. Contracts for the school lunch program will be let soon.

(e) Limited tests have been conducted in Korea, Turkey, Ethiopia, Guatemala, Venezuela, Colombia, Peru and Ceylon. It is anticipated that more extensive efforts will be carried out in these and other countries which have ordered samples of soy fortified bread flour from Food for Peace.

The success of this project in providing new technology for improving the nutritive value of cereal based foods points toward two major activities to be undertaken in an extension of the project: (1) continuation of the work on development of additional nutritionally improved cereal based products including development of technology for producing protein supplements, evaluation of the acceptability and nutritive value of the products, and the utilization of the products and know-how in LDCs, and (2) intensification of efforts to implement programs for utilizing the technology already developed, especially the fortification of leavened breads with proteins.

## 2. Significance to A.I.D. Objectives

One of the key problems identified by the Office of Nutrition is lack of availability of low cost nutritional foods, and one of the main elements in A.I.D. strategy for alleviating malnutrition in LDCs is to identify means of furnishing low-cost nutritionally-improved foods to malnourished segments of LDC populations. A.I.D. recognizes that there is no single solution to this problem but rather that a number of low-cost nutritionally-improved foods must be developed, each fashioned to satisfy the needs and desires of a segment of the nutritionally deprived

population. Thus in order to solve this key problem and implement A.I.D. strategy, it is essential that A.I.D. support efforts to develop nutritionally-improved foods designed to satisfy the requirements of particular target groups.

The subject contract is directed to the solution of a part of this key problem, to the development of low-cost, cereal-based, nutritionally improved foods. Successful completion of the project would be expected to result in partial solution of the problem and ultimately in improved nutritional health of large segments of LDC populations.

### 3. Relation to Existing Knowledge

Thousands of scientific and technical articles and hundred of texts have been published on cereal grain processing, nutrition, economics, marketing, and other topics related to work on this project. Many publications in these areas have originated from KSU and have been authored by members of the contract team. The KSU contract team is therefore well prepared to utilize existing knowledge to the benefit of the project.

### 4. Relation to Other Research

Certain other A.I.D. research projects are related to this project in that they also strive to develop, introduce, and/or evaluate nutritionally improved cereal-based food products. Specifically, the A.I.D. sponsored fortification projects in Tunisia (wheat), Thailand (rice) and Guatemala (corn) have related objectives. Also the A.I.D. sponsored project in Chile to explore development and introduction of locally made extrusion processed high protein mixtures relates to this project. Additionally certain USAID Missions have undertaken or are undertaking or considering projects with similar goals, e.g. groundnut fortified atta (wheat flour) and lysine fortified bread in India, soy fortified cassava in Brazil, and lysine fortified wheat in Pakistan.

It is not surprising that a number of A.I.D. projects should address the same general topic of improving nutritional health through introduction of nutritionally improved cereal foods. As outlined in Section 2 (above), lack of low-cost nutritionally improved foods is a key problem and calls for a broad, multi-pronged solution. Each of the AID sponsored projects is designed to address this key problem in a somewhat different way so that collectively the group of projects represents an A.I.D. response to the problem.

### 5. Proposed Work Plan

From a consumption standpoint both leavened and unleavened bread products are extremely important. Consumption patterns vary from area to area, from rural to urban populations, and between economic strata.

The basic technology has now been developed for preparing yeast leavened breadstuffs fortified with protein concentrates. Undoubtedly, minor modifications will be needed to adapt this technology to all of the various product forms and local conditions. The basic technology is now also available for preparing fortified cous-cous and chapati type products. The research efforts during the period of extension will be directed to the preparation of supplemental unleavened foods such as noodles, cookies, biscuits and tortillas.

A. Scope of Work - The activities which will be undertaken during the proposed two year extension of the project will include the following:

(1) The high protein bread technology developed during the earlier phases of the project will be introduced into additional nutrition programs, especially into bread produced for commercial distribution.

(2) The basic technologies developed under the earlier phases of the project will be extended to other traditional cereal based foods, i.e. biscuits, pasta products, and tortillas which are commonly consumed by small children.

(3) Economic evaluations or cost-benefit studies will be made to evaluate the economic and sociological benefits resulting from the use of developed products in applied nutrition programs.

(4) Additional protein sources including sunflower, triticale, fish protein concentrate, sesame, rapeseed, soy (including extrusion-cooked soy) will be evaluated.

(5) Studies and economic evaluations of protein concentrates from legumes, particularly chickpeas and broadbeans will be made.

(6) The nutritive value of selected products will be evaluated using NPV, BV and the Hegsted test method in addition to PER.

As in the past, LDC institutions including universities, research institutes, government departments, etc. will be invited to join with KSU in carrying out the activities of the project. Although these institutions are essential to successful completion of some aspects of the project, e.g. evaluating the acceptability of nutritionally improved products, it is recognized that involvement of LDC institutions in the project will also lead to greater likelihood that the findings of the project will be implemented.

It is estimated that 65% of the total effort will be devoted to the technological aspects of the program and 35% to the economic aspects.

B. Program of Work - The program will be undertaken over a two year period. Introduction of the technology for fortifying bread with

supplementary oilseed protein on a pilot basis in two to three additional LDCs is envisioned as a 1½ to 2 year endeavor. This activity will necessarily involve (1) identification of appropriate countries for implementation, (2) formulation of acceptable bread products based on KSU-developed technology, (3) development of appropriate marketing techniques to reach the intended target groups, and (4) evaluation of the success of the pilot projects.

Additional activities under the project are continuation of present on-going project activities. It is expected that the activities as outlined in the preceding section can be completed during a two year extension of the project. An expanded outline of the Program of Work is given below.

The program will consist of the following activities:

- (1) Formulating cereal food products to include soy, groundnut, cottonseed, sunflower and/or other proteins.
- (2) Determining the composition and nutritive value of the formulated foods.
- (3) Evaluating the acceptability of the foods using taste panels to identify potentially acceptable products.
- (4) Field testing to determine marketability.

Those cereal foods which show strong promise would be introduced into LDC through programs developed jointly by A.I.D., the USAID missions concerned with the improved foods, and by other groups interested in the foods such as the host country government. Naturally the programs would be expected to vary depending on many special circumstances and a general approach to programming cannot be outlined simply.

Special attention will be given to the economic aspects of developing and introducing improved cereal based foods. The attached draft outline by KSU is illustrative of the type of economic research which will be undertaken. It should be emphasized, however, that a general approach being suggested for Pakistan and Morocco might require substantial modification in order to be applied to other products and other countries.

(a) Work Plan for Economic Analysis of Introduction of Improved Cereal-Based Foods in Morocco and Pakistan

At one time the oilmills in Morocco only imported soybeans. At the beginning of this study they switched, for economic reasons, to imported sunflowers. Now, sunflowers have become an important indigenous crop and it may prove to be the best indigenous

source of protein in Morocco. However, it is assumed that fortified products in Morocco will be based on imported soy flour for the next several years, until the production of sunflowers, chickpeas or perhaps soybeans in Morocco increases.

In Pakistan the story is quite similar. There is no substantial crop presently available as an indigenous protein source and imported soy flour will serve as a base for nutrition programs until the yield per acre of the economic value of chickpeas improves or until soybeans can be established as an indigenous crop in Pakistan.

### 1. Objectives

a. Determine costs of soy-enriched bread in Morocco and soy-enriched chapatis in Pakistan in comparison with costs of the traditional product and with the best alternative food of equal nutritive value and acceptability.

b. Describe best program for delivery of the improved food and alternative food to selected sectors of the population.

c. Estimate the price elasticity of demand for the nutritionally-improved foods.

d. Project the proportion of the population that would utilize the improved food under stated cost and program conditions and estimate the material, manpower and financial requirements associated with the size of program.

### 2. Procedure

a. Ascertain unit cost, at wholesale, for production of the most promising enriched food for Morocco (bread) and Pakistan (chapati), and of the same foods as prepared traditionally, and of the best alternative food or food supplement to give approximately equal nutritional value.

Costs would be shown for both domestic and imported ingredients. Processing costs would be estimated.

i. The "equally-good" alternative food would be determined in consultation with nutritionists at KSU, Pakistan Agricultural University and

ii. Costs of food ingredients and for processing would be ascertained from published sources in Pakistan and Morocco, augmented by interviews with government and university statisticians and with a limited number of vendors and processors.

b. Outline feasible programs for distribution of the improved food and the alternative food to various sectors of the population. Associated information and demonstration activities will be considered also.

Separate programs will be considered for urban, village and rural sectors. The institutional feeding sector will also be examined (schools, hospitals, orphanages, and the army).

i. Obtain information about traditional food markets and food buying and preparation practices from published studies, interviews and with economists and people in the food trade, and visits to a few city and village markets.

c. Estimate the price-elasticity for nutritionally enriched food to ascertain the percent of increased cost that would be absorbed by the population at various socio-economic levels (1) at present, and (2) at the end of an educational campaign. These estimates will furnish a basis for arriving at the amount of subsidy that might be required for a program of a given size.

In view of the short-range nature of the study, price-elasticities would have to be obtained from secondary sources supplemented by limited field interviews.

d. Project the proportion of the population within each sector that might use the improved food at the end of 1, 5 and 10 year periods assuming (1) consumer to pay added cost due to enrichment, (2) public absorption of half the added cost, (3) public absorption of all the added cost. Project consequences of program growth in terms of (1) aggregate costs, (2) growth in associated staff and costs to operate the program, and (3) aggregate quantities and costs of food additives used and proportion of these that would be imported.

3. Tentative target dates for completion of sub-projects.

a. Basic development should be completed on

Bolillos	-	June 1973
Cookies	-	October 1973
Tortillas	-	October 1973
Noodles	-	March 1974

b. The basic evaluation scheme should be completed within six months following extension. Thereafter it will be a matter of evaluating products and countries on a selected priority basis.

c. The following are targets for evaluation of protein resource materials.

Full-fat soy flour	June 1973
Extruded whole soybean flour	October 1973
Sunflower flour	October 1973
Fish protein concentrate (additional sources if necessary)	March 1974
Sesame flour	March 1975
Rapeseed flour	March 1975
Triticale	March 1975

Some work is currently in progress on all of the above.

d. Economic studies of protein concentrates from legumes--June 1973.

e. Additional nutritional data will be obtained as needed throughout the two-year period on a priority order suggested by A.I.D.

f. In all respects, this will be the predominate effort into which the preceding objectives will be structured and ordered as the program develops. Based upon what we now know, we would anticipate tests being completed by the following times:

Morocco	-	June 1973
Pakistan	-	September 1973
India	-	September 1973
Philippines	-	September 1973
Taiwan	-	September 1973
Mexico	-	September 1973
Ceylon	-	January 1974
Korea	-	January 1974
Ethiopia	-	March 1974
Peru	-	March 1974
Guatemala	-	March 1974
Venezuela	-	March 1974
Turkey	-	June 1974
Colombia	-	June 1974

The target dates on the last countries on the list are highly dependent on the effort and emphasis placed on priorities by A.I.D.

## 6. Research Methodology

The research methodology used in this project will be largely the traditional experimental scientific approach i.e. concepts for improving the nutritive value of cereal products will be tested experimentally by making test products and evaluating those products physically, chemically

and organoleptically. Those products which show promise will be examined further using commercial-style market research techniques with emphasis on determining the potential for reaching low-income persons, especially preschool children, with supplementary nutrients.

#### 7. Research Competence

The Food and Feed Grain Institute at Kansas State University is uniquely suited to conduct the research and development programs under this research program. The Institute is founded on an interdisciplinary systems approach to research and development on grain and grain products. The historic dependence on the State of Kansas on grains resulted in the establishment and continued support of training and research into all aspects of grain handling, processing and marketing.

The feed manufacturing, milling, and baking industries have provided facilities and equipment worth approximately 3 million dollars which make possible large scale production of many grain products. The versatility of these facilities are complemented by well equipped biochemical, microbiological, and nutritional laboratories.

Milling and processing facilities include scale equipment for wheat and other similar grains, and pilot scale and micro-milling equipment for corn, grain, sorghum, rice and pulses. A \$400,000 feed processing facility has just been completed which includes equipment for extrusion cooking, drying, and cooling of various types of fortified food blends for child and family feeding programs.

Well equipped baking laboratories with facilities for all phases of baking, cooking and frying on large, small and micro-scale are available.

The laboratories are equipped for all types of cereal chemistry and physical dough testing analysis. Instrumentation is available for rapid, nondestructive analysis of protein content by neutron activation analysis and for moisture and lipid content by nuclear magnetic resonance. Two automatic amino acid analyzers are also located within the facility.

Facilities are available for small animal and human nutrition studies and for organoleptic quality and taste panel evaluations. Statistical and computer services are also available.

The faculty of the Food and Feed Grain Institute includes food scientists, cereal chemists, biochemists, chemists, microbiologists, nutritionists, milling engineers, chemical engineers, agricultural engineers and economists.

The faculty, facilities and training programs of the Institute are unique and are recognized worldwide as the only University program of its

kind. This uniqueness has led to a large role in international activities. Many leaders in the grain processing industries around the world have been trained at Kansas State. The experience gained from the current A.I.D. contract in processing and evaluating the nutritional and functional property contributions of selected protein concentrates to cereal based foods will prove invaluable for carrying out the objectives of this project continuation. Several research projects on protein concentrates or high protein foods from oilseeds and other crops are concurrently underway in the Institute sponsored by U.S. food companies.

Economists experienced in grain and grain product marketing and in sectoral analysis on the faculty are available to provide economic analysis and assist in economic studies.

Dr. William J. Hoover, Director of the Food and Feed Grain Institute, will continue to serve as the principal investigator and to devote approximately two-tenths of his time to the program. The faculty who have served on this project during the five year program will continue to serve during the extended period (Dr. Jean Caul, Dr. Charles Deyoe, Professor Eugene Farrell, Dr. Beth Fryer, Dr. John Johnson, Dr. Donald Parrish, Dr. C. C. Tsen, Professor Arlin Ward). They devote approximately one-tenth of their time to the program although none of the salaries of these professors has been charged to the project. Dr. Robert Robinson devotes about eight-tenths of his time to the project. During the period of extension Dr. Joseph Scoville will devote approximately one-half time to the project and Dr. Leonard Schruben and Dr. Floyd Niernberger will contribute limited time as needed in the economic evaluations.

#### 8. Contribution to Institution Building

It is anticipated that considerable involvement of LDC research organizations will occur during the two year period, however, it is not now possible to accurately predict the rate of program development and thus involvement by any country or particular group. Part of the inherent value of this project will be to stimulate such involvement.

#### 9. Utilization Plans

This project is especially designed to emphasize utilization of results. In particular the utilization of the work to develop methods for fortifying leavened bread with vegetable protein will be emphasized as outlined above in Section 5. Additionally the Office of Nutrition has developed a coordinated plan to promote implementation of KSU technology which will draw on the resources of USDA (PASA), LIFE and the American Association of Cereal Chemists, and the LDC Food Grant Program as administered by TA/N. These various resources will be united with KSU with the specific objective of establishing one or more pilot projects in LDCs in which oilseed protein fortified leavened bread will be manufactured and distributed as a commercial product.

Additionally KSU will continue to emphasize utilization of cereal fortification technology in Pakistan and Morocco as provided in the earlier phase of the project, and to promote use of KSU-developed soy fortified wheat flour in Title II and other nutrition-oriented welfare programs.

#### 10. Budget Analysis

The estimated total cost for the two years would be \$300,000 with \$150,000 expended in each of the two years. The Kansas Agricultural Experiment Station will contribute the salaries of all faculty involved except those specified in the budget support detail.

Roughly 15% of the budgeted salaries will be devoted to the economic evaluations during the period. This does not properly reflect the effort on the economic aspects, however, because a number of Kansas State University faculty will devote effort to the project as they have in the past without being charged to the budget of the project. Dr. Leonard Schruben and Dr. Floyd Niernberger, of the Department of Economics, will give assistance.

A good deal of supplemental and cooperative economic efforts have been and will continue to be made by A.I.D. field personnel and by representatives of the FAS marketing cooperator agencies.

Budget details are given in Appendix B.

#### 11. Internal and External Reviews

Contract AID/csd 1586 was reviewed intensively on February 18, 1972 by a committee made up of Dr. Harold Wilcke, Chairman, John Rader for James Blume, Varnum Ludington (absent), and Robert Muscat (absent). In general the Committee was very favorably impressed with the way the project had been conducted and commended the KSU staff on their work (see Appendix A).

The specific recommendations of the committee have been incorporated into the work at KSU and into the proposed contract extension. In particular the recommendation that "there be some attempt to expand utilization of this information to other countries" has been adopted and emphasis has been placed on introduction of protein fortified leavened bread in additional countries through collaboration with USDA, LIFE and other organizations.

The proposal for extension was reviewed by RIGC on September 21. RIGC required additional information, including the following:

A. A more complete description of what has been accomplished and what is planned in the way of overseas testing of newly-developed products, both for acceptability and economic feasibility;

B. An assessment of the importance of leavened vs unleavened bread;

C. An assessment of the feasibility of developing an indigenous soy and chick pea production in Morocco and Pakistan;

D. An analysis of the proposed staffing pattern to determine the relative importance of economics and technology;

E. Some description of specific research targets on a time-phased basis.

These questions have been addressed by Dr. Hoover and staff. The project statement has been modified in accordance with RIGC concerns.

## 12. Evaluation

The Office of Nutrition considers this research project as having the highest priority and recommends that the project be extended for an additional two year period at a funding level of \$150,000 per year.

The RIGC at its 11/10/72 meeting recommended that the project be terminated at the conclusion of this two year extension.

### Attachments:

Appendix A

Appendix B

Minutes of a Meeting to Review the Kansas State  
Project on Improving the Nutritive Value of Cereal  
Based Foods - Sponsored by AID

The meeting was held in the conference room in the State Department building. Present were Dr. Bill Hoover of Kansas State; Dr. Erwin Hornstein, AID; Dr. Kahn, AID; Dr. Crosley, USDA; John Raber; and H. L. Wilcke. Dr. Hoover reported that the work had progressed to the point where soy flour with the additive had been sent to a baker in Morocco, and that the baker was quite enthusiastic about the results of the fortification of typical Moroccan bread with the soy flour. This baker is willing to engage in a field trial and arrangements were made to have 30,000 pounds of soy flour shipped to Morocco, but because of certain policies within the Food for Peace Program, this has not yet been implemented. It is anticipated that approval will be forthcoming quite soon. In the work of Kansas State, fortification of Cous-Cous with chickpeas and horse beans at a 10% level and soybeans at a 12% level have been quite successful. However, it was learned in Morocco that Cous-Cous is not as widely distributed as supposed and that, therefore, the trials will be conducted with Moroccan bread rather than with the Cous-Cous. This is sound reasoning because the bread is consumed by all classes of the population of Morocco and the Cous-Cous is not. Nor is it consumed as regularly. When the field trial is set up in cooperation with this baker, the product will be monitored for acceptability only. No attempt will be made to measure the effects of improved nutrition on the health or stature of the people. This would be the subject of another test completely. There is no university in Morocco so it was not possible to set up a collaborative trial with the university. The research group is found in

the Ministry of Agriculture. They seemed quite interested. There are thirty-three flour milling companies in Morocco and most of them are quite modern. There is an association of millers and it seems that if this type of fortification is acceptable and is used in Morocco, the best point for blending will be by these flour millers. It will be coordinated by the government.

An economic and feasibility study is badly needed to determine whether additional beans or soybeans can be grown in Morocco profitably. At the present time there is quite a sizeable production of beans, that is, the chickpeas and horse beans, but they are all consumed in the normal channels of trade at the present time. Therefore, any use of these commodities to fortify bread would be simply substituting the method of consumption, which would not be a practical thing to do. Therefore, a study needs to be made on economics of increasing the production of soybeans or other edible legumes. Arrangements had been made to conduct an acceptability test in West Pakistan and the plan was developed in September of 1971. However, because of the disruption due to the war, nothing further had been heard until recently and it is now assumed that the test will be set up in the very near future. There is no commercial interest to this time in this type of fortification in Pakistan, but they have excellent university facilities and staff in food technology and it is planned to collaborate with the university to conduct the acceptability test in Pakistan. Chickpeas and soy are the protein additives chosen for the work in West Pakistan.

There was considerable discussion on the type of test that should be used to evaluate the proteins at Kansas State. It was suggested that PER might

not be too acceptable and that NPU or the Hegsted method be used instead. It was agreed that this question would be submitted to the Technical Advisory Committee for their decision on the type of test that should be used. Included in this discussion also was the biological value determination. This was advocated quite strongly. It was agreed that the following recommendations should be made for the work which will progress in 1972.

1. Acceptability testing programs in Morocco and Pakistan both should be completed. In addition, there should be a study made of the economics and the market and distribution possibilities of this type of fortified material in both these countries. In other words, can they be produced economically within the countries, and are there proper channels for distribution and for handling the fortification process.
2. It was agreed that the nutrient availability test development, that is, the effects of processing and natural versus synthetic nutrients, should be minimized.
3. Nitrogen balance studies on protein fortified products should not be conducted.
4. The studies on processing of protein concentrates from legumes should be continued, but at a low level not to exceed 10% of the effort.
5. The acceptability, that is organoleptic and digestive problems with developed products, should rate a low priority.
6. Some other protein resource materials should be evaluated in order that there will be information if and when they become

practical or plentiful in certain areas of the world. This would include fish protein concentrate, triticale, sunflower seed, rapeseed and perhaps others.

7. Some studies should be made of products such as cookies which are used quite commonly for small children and these studies should be based on traditional eating habits. The method of fortification and the problems involved should be worked out.
8. There should be some attempt to expand utilization of this information of other countries. This would be accomplished largely by USDA and AID staff work, but the Kansas group would be available for consultation and help.

The consensus of opinion was that this is a well conducted project, and that the results are now available which should be used in developing countries. The goal is to produce a 12% protein in the consumable product and this can be accomplished with indigenous materials in most cases. Thus, there is hope that this type of information will lead to production of products within the countries instead of depending entirely on Food for Peace programs. Dr. Hoover and his staff deserve commendation for the work they have done in carrying this project forward.

Harold L. Wilcke

3/1/72

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## Appendix B

<u>Category</u>	<u>Budget</u>	
	<u>July 1, 1973 to June 30, 1974</u>	<u>July 1, 1974 to June 30, 1975</u>
Salaries	\$ 82,520	\$ 87,471
Consultant fees	2,000	2,000
Equipment and books	10,000	3,000
Expendable equipment and supplies	6,000	6,000
Travel and subsistence	10,000	10,000
Publication costs	1,000	1,000
Other direct costs	1,594	1,429
Indirect costs (44.7% of salaries)	<u>36,886</u>	<u>39,100</u>
TOTAL	\$150,000	\$150,000

Statements Supportive of Proposed BudgetSalaries

<u>Personnel</u>	<u>Title</u>	<u>Percent of Time</u>	<u>Annual Salary</u>
Dr. Robert J. Robinson	Associate Professor	80	\$15,300
Dr. Joseph Scoville	Professor	50	21,780
Cathy Mojibian	Research Assistant	100	6,060
Karen Penner	Research Assistant	50	6,060
Merlene Ryan	Research Assistant	50	5,100
Phyllis Pinkston	Research Assistant	100	5,640
Phyllis Faulk	Secretary	100	6,948
Doris Hickey	Ag. Lab Tech. I	100	4,836

In addition, six one-half time graduate research assistants will be employed. Their rate of pay averages \$4,000 per year for a one-half time appointment.

Consultant fees

To facilitate response to LDC or AID requests for research assistance the use of consultants is anticipated. Twenty man-days per year at a fee rate of \$100 per day is covered in the budget.

#### Nonexpendable equipment

Pilot scale equipment for production of cookies, crackers, and fried dough products are needed. This includes: cookie and biscuit rotary molders and dies (\$3,500); cookie wire depositor (\$2,500); cracker dough lapper (\$1,000); frier (automatic) for fried dough products including dough cutters (\$3,000).

#### Expendable equipment and supplies

This budget item will cover expenditures primarily for grain, oilseeds, pulses and other raw materials as well as for chemical and expendable laboratory reagents and supplies.

#### Travel and subsistence

Travel is anticipated, both domestic and international, to be at the request of AID staff to assist in developmental programs in applied nutrition and to report and disseminate results. Field studies will be necessary for the economic evaluations and for in-country product trials. Such trips should be of no more than three week duration.

#### Publication costs

This expenditure would cover the cost of page charges and reprints of technical articles resulting from the project. No special bulletins or brochures would be developed or charged to the contract.

#### Other direct costs

The costs include direct cost items chargeable to the contract but not covered in other budget categories.

#### Indirect costs

The overhead rate at Kansas State University is currently set at 44.7% of the salary component of the budget.