PD-AAL-901 9310621 (5)

AID-1350-1X (7-71)

PIO/T

DEPARTMENT OF STATE
AGENCY FOR
INTERNATIONAL DEVELOPMENT

PROJECT IMPLEMENTATION ORDER/TECHNICAL SERVICES

1. Cooperating Country: TA/BUREAU 3117502

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2. PIO/T No. 931-11-130-621 73

3. [X] Original or Amendment No. 9p

4. Project/Activity No. and Title: Improvement of Winter Wheat for DCs, based on Hybridization of Spring x Winter Forms

DISTRIBUTION

5. Appropriation Symbol: 72-11X1023

6.A. Allotment Symbol and Charge: 402-31-099-00-22-51

6.B. Funds Allotted to: [X] A.I.D./W [ ] Mission

7. Obligation Status: [X] Administrative Reservation [ ] Implementing Document

8. Funding Period (Mo., Day, Yr.) From 9/15/76 To 9/14/78 CR

9.A. Services to Start (Mo., Day, Yr.) Between 9/15/76 and

9.B. Completion date of Services (Mo., Day, Yr.) 9/14/79

10.A. Type of Action: [X] A.I.D. Contract [ ] Cooperating Country Contract [ ] Participating Agency Service Agreement [ ] Other

10.B. Authorized Agent: AID/W

Estimated Financing $1.00=		(1) Previous Total	(2) Increase	(3) Decrease	(4) Total to Date
11. Maximum A.I.D. Financing	A. Dollars		629,000		629,000
	B. U.S.-Owned Local Currency				
12. Cooperating Country Contributions	A. Counterpart				
	B. Other				

FUNDS RESERVED BY 7/14/76

13. Mission References

14. Instructions to Authorized Agent

SER/CM is authorized to negotiate a three year contract with Oregon State University to conduct research services specified in block 19 and attachment A. The total cost for the life of the contract shall not exceed the approved level of $943,000. Any increase of this amount must receive prior approval from TA/AGR and TA/PPU. This PIO/T provides incremental funding for the first two years ending on or about 9/14/78. The balance of funding is subject to availability of funds.

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/CP, E. Leng Earl R. Leng Date: 5/24/76
TA/AGR, G. Baird Date: 5/27/76

B. Funds for the services requested are available
TA/PPU/PPA, C. Molfetta Date: 6/4

C. The scope of work lies within the purview of the initiating and approved Agency Programs
TA/AGR, L. Hesser Date: 5/27/76

D.
TA/PPU/PPA, M. Mozynski MEM Date: 6/29

E.
TA/AGR, R. Holmes by Date: 6/4/76

F.
TA/RES, M. Rechcigl Date: 6-14-76

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 Gunning
Title: Chief, TA/PPU/PPA

18. Date of Signature 7/1/76

GPO 867-266

AID 1350-1X (9-70) PIO/T	Cooperating Country TA/BUREAU	PIO/T No.	Page 2 of 5 Pages
	Project Activity No. and Title Improvement of Winter Wheat for DCs, based on Hybridization of Spring x Winter Forms		

SCOPE OF WORK

19. Scope of Technical Services

A. Objective for which the Technical Services are to be Used: To utilize linkages between CIMMYT, U.S. institutions and agencies in DCs to expand the interbreeding of winter wheats and spring wheats to develop better winter wheat varieties and additional genetic variability for use in the CIMMYT led spring wheat improvement program.

B. Description

The proposed project will: develop and maintain a germplasm bank of superior winter wheat cultivars for hybridization; create greater genetic diversity for improvement of winter and spring type wheats; improve nutritional quality in winter wheat; apply suitable selection pressures to identify superior winter wheat germplasm with improved yield and adaptation; disseminate early generation breeding stocks to selected DC cooperators for further selection; distribute superior agronomic lines and fixed varieties to all cooperators; determine those attributes necessary in winter wheat cultivars to insure soil erosion control, productivity and stability in concert with improved dryland cultural practices; train scientists from DCs who have responsibility for adaptive research; and establish new relationships and expand existing ones between DC agencies and institutions, U.S. universities, USDA, USAID Missions, CIMMYT, FAO, foundations and international centers.

C. Technicians

(a) No. Number	(b) Professional Field	(c) Grade and Salary	(d) Duration of Assignment (Man Months)
	Technical personnel and non-professionals		122 each yr.

(2) Duty Post and Duration of Technicians' Services

Oregon State University and outlying research stations

(3) Language requirements

N/A

(4) Access to Classified Information

N/A

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(5) Dependents [ ] Will [X] Will Not Be Permitted to Accompany Technician

D. Financing of Technical Services

(1) By AID - $ 501,500 (2) By Cooperating Country

20. Equipment and Supplies (Related to the services described in Block 19 and to be procured outside the Cooperating Country by the supplier of these services)

A. (1) Quantity (2) Description

	(3) Estimated Cost 1st Year	2nd Year	(4) Special Instructions
Equipment	$60,000	$15,000	
Materials and Supplies	25,000	27,500	

B. Financing of Equipment and Supplies
(1) By AID - $127,500 (2) By Cooperating Country -

21. Special Provisions

☒ A. This PIO/T is subject to AID (contracting) (PASA implementation) regulations.

☒ B. Except as specifically authorized by AID, or when local hire is authorized under the terms of a contract with a U.S. Supplier, services authorized under this PIO/T must be obtained from U.S. sources.

☒ C. Except as specifically authorized by AID/W, the purchase of commodities authorized under this PIO/T will be limited to the U.S. under Geographic Code 000.

☒ D. Other (specify): Special Provisions: Prior to making visits to DCs, contractor will review plans with TA/AGR. He will keep USAID Missions fully informed of proposed visits, ask them to provide information they wish regarding timing and content of visits, and will inform Missions of consultation visits. Copies of trip reports will be provided to TA/AGR Project Manager.

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)

As provided in Guidelines for Preparation and Submission of Reports to Centrally-Funded Contractors, dated July 14, 1975.

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

Information useful to contractors can be found in the [illegible] documentation concerning winter wheat activities at CIMMYT and the University of Nebraska/AID contract on Improved Nutritional Quality of Wheat.

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

A. Relationships and Responsibilities

N/A

B. Cooperating Country Liaison Official

N/A

C. AID Liaison Officials

Dr. Earl Long
Dr. Guy Baird
Dr. Leon Hesser

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AID 1350-1X (9-73) PIO/T	Cooperating Country TA/BUREAU	PIO/T No.	Page 5 of 5 Pages
	Project/Activity No. and Title Improvement of Winter Wheat for DCs, based on Hybridization of Spring x Winter Forms		

LOGISTIC SUPPORT

25. Provisions for Logistic Support A. Specific Items (Insert "X" in applicable column at right. If entry needs qualification, insert asterisk and explain below in C. "Comments")	IN KIND SUPPLIED BY		FROM LOCAL CURRENCY SUPPLIED BY		TO BE PROVIDED OR ARRANGED BY CONTRACTOR
	AID	COOPERATING COUNTRY	AID	COOPERATING COUNTRY	
(1) Office Space	X (For GCI consultants)				
(2) Office Equipment					
(3) Housing and Utilities					
(4) Furniture					
(5) Household Equipment (Stoves, Refrig., etc.)					
(6) Transportation in Cooperating Country	X (as available)				
(7) Transportation To and From Country					
(8) Interpreter Services (personnel)					
(9) Medical Facilities					
(10) Vehicles (other 3)					
(11) Travel Arrangements (airline)					
Other: (specify) (12)					
(13)					
(14)					
(15)					

B. Additional Facilities Available from Other Sources

☐ APO ☐ PX ☐ COMMISSARY

☐ OTHER (specify, e.g., duty free entry, tax exemption)

A close working relationship and partnership will be instituted involving CIMMYT, GCI and the ongoing AID centrally funded wheat improvement project at the University of Nebraska.

Linkages and exchange of information and breeding materials already exist between the Nebraska project and this proposed activity and CIMMYT.

C. Comments

CIMMYT has strongly urged the establishment and support of this proposed activity since they believe the winter x spring crossing program is vital to success of their spring wheat breeding operations.

Contractor will exchange information and breeding materials with U.S. institutions having winter or spring wheat breeding programs -- Arizona, California, Colorado, Indiana, Kansas, Minnesota, New York, North Carolina, Oklahoma, Texas and Washington being the most important.

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ATTACHMENT A — PIO/ , Oregon State University Wheat Improvement

Work Plan -- For first Two Years

1. Germplasm Bank

1976-77 --- Exchange superior varieties and advanced lines with major winter wheat breeding centers. Catalog information from place of origin on yield potential, combining ability and other important characters. Begin recording of local observations. Begin computer compilation of identifying characteristics and major traits useful in selection.

1977-78 --- Continue acquisition of new materials. Continue cataloging of information and recording of local observations. Reach full scale computerized recording of characteristics. Produce and distribute computer print-out of data recorded to date.

2. Genetic Diversity

1967-77 --- Evaluate material produced in Mexico in 1976 crossing season. Make new winter x spring crosses at CIMMYT facility, Toluca, Mexico. Share F1 seed of these crosses between CIMMYT and Oregon. Make [illegible] crosses in Oregon with F1 material produced in 1976. Evaluate and select segregating materials from previous crosses under Oregon conditions. Assist in CIMMYT evaluation and selection in winter crop at Obregon, Mexico.

1977-78 --- Repeat above cycle. Add new material obtained through germplasm bank activities.

3. Incorporation of Superior Nutritional Properties

1976-77 --- Cross selected winter x spring F1 progenies to high protein and high lysine cultivars selected by University of Nebraska.

1977-78 --- Continue crossing as above. Screen F2 progenies from 1976-77 crosses, send seed of selected lines to University of Nebraska for chemical analysis. Selected material from analysis will be returned to Oregon for further screening, and also sent to CIMMYT for inclusion in the spring wheat breeding program.

4. Selection Pressures

1976-77 --- Segregating progenies derived from crosses previously made will be screened at three test sites. These sites will be selected to encompass a wide range of climates and soil

conditions. Selection of progenies will be based on performance at all three sites, to insure wide adaptation.

1977-78 --- Continue selection as in 1976-77 at same three sites. Distribute superior selections to other cooperators for testing.

5. Early Generation Breeding Stocks

1976-77 --- Populations derived from bulking superior F2 selections will be planted at the three major Oregon test sites and in selected developing countries where active winter wheat breeding programs are in operation. Data on population performance will be returned to OSU for analysis. Populations showing superiority for desired characters will be utilized in new breeding cycles. Beginning with the F3 generation, selections showing superior agronomic traits will be evaluated for gluten strength by the Pelshenke Test and only those lines with acceptable gluten characteristics will be retained for further selection.

1977-78 --- Continue development and early generation testing as above.

6. International Screening Nurseries

1976-77 --- Superior selections developed through the above procedures will be tested (usually in the F4 or F5 generation) in the International Winter x Spring Wheat Screening Nursery (IWSWSN). Three years of IWSWSN trials have been completed in previous work. In 1976-77, it is expected that about 70 trials will be conducted in at least 40 countries. Cooperators will grow the trials, record yields and other agronomic data, and return data field books to OSU. Printed copies of the results will be distributed to all cooperators by mid-February of the year following the test. Superior F5 and F6 lines identified from screening in the IWSWSN will be placed in an International Winter x Spring Wheat Performance Trial, to be conducted under this project. Agronomic data will be collected for at least two years and over a wide range of environments. Outstanding lines identified will be entered in the IWWPN conducted by the University of Nebraska, to check their suitability for release as varieties.

1977-78 --- Continue screening trials as above. Add or delete cooperating sites in accordance with indicated needs. Continue to advance superior selections through the trial system.

7. Variety x Management Interaction Studies

1976-77 --- Selections and established varieties will be compared under different systems of soil and water management. One of these systems will be early seeding on residual moisture. Characters to be studied will include:

a. ability to emerge rapidly in warm, relatively dry soil;

b. wind-resistant plant types;

c. conservative moisture requirement;

d. satisfactory levels of winter hardiness;

e. greater resistance to pathogens; and

f. yielding ability.

1977-78 --- Continue studies as above, changing varieties under study as evidence on performance is developed.

8. Training (both years)

Students from developing countries, who plan to work in wheat improvement, will be trained in the program. Emphasis will [illegible] selection of [illegible] to be directly applicable to problems of the student's home area. Close contact will be maintained by OSU staff with the various developing countries to insure that appropriate training is given. Young Ph.D.s from developing countries will be employed as postdoctorates to receive further research experience.

9. Development of Linkages

1976-77 --- Close working cooperation, including exchange of materials and information, will be established with the University of Nebraska centrace wheat research program. The existing cooperation with CIMMYT will be maintained. Frequent visits between institutions will be made to avoid duplication of effort and to facilitate exchange of material and information. Project staff will visit IWSWSN sites.

Project personnel will assist in organizing and conduct of international or regional wheat workshops and conferences, as mutually agreed among agencies concerned.

1977-78 --- Linkages developed will be strengthened and new developing country cooperators added as appropriate. Other activities indicated above will be continued.

Budget

	First Year		Second Year		To Project Completion FY 79	Total Estimated Life of Project Cost
	Est. Cost		Est. Cost			
INPUTS	M/M	$(000)	M/M	$(000)	$(000)	$(000)
1. Salaries	122	103.5	122	[illegible]	123	341
2. Fringe Benefits	78	12.5	78	[illegible]	15	41.5
3. Indirect Costs (45.52%)	122	47.0	122	[illegible]	56	154.5
4. International Travel		20		[illegible]	24	66
5. Domestic Travel		10		[illegible]	12	33
6. Equipment		60		[illegible]	0	75
7. Materials & Supplies		25		[illegible]	30	82.5
8. Field site expense		15		[illegible]	18	49.5
9. Other direct costs		26		[illegible]	31	84.5
0. Publications		5		[illegible]	6	16.5
Total Cost by Inputs		324		[illegible]	315	944
OUTPUTS						
1. Germplasm Bank		16.2		[illegible]	15.75	47.2
2. Genetic diversity		81.0		[illegible]	78.75	236.0
3. Nutritional properties		16.2		[illegible]	15.75	47.2
4. Selection pressures		48.6		[illegible]	47.25	141.6
5. Breeding stocks		32.4		[illegible]	31.50	94.4
6. Screening nurseries		64.8		[illegible]	63.00	188.8
7. Management interactions		32.4		[illegible]	31.50	94.4
8. Training		16.2		[illegible]	15.75	47.2
9. Linkage development		16.2		[illegible]	15.75	47.2
Total costs by Outputs		324		[illegible]	315	944

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RESEARCH PROJECT STATEMENT

Improvement of Winter and Facultative Wheat for Developing Countries, Based on Hybridization of Spring x Winter Forms

AID Ref 1.6

Project Number: 931-0621.11

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RESEARCH PROJECT STATEMENT

I. Project Summary

Project Title:	Improvement of Winter and Facultative Wheat for Developing Countries, Based on Hybridization of Spring X Winter Forms
New or Extension:	Extension
Contractor:	Oregon State University (Cooperation with International Maize and Wheat Improvement Center - CIMMYT and the International Center for Agricultural Research in the Dry Areas - ICARDA)
Principal Investigators:	Dr. Warren E. Kronstad, Professor Dr. Willis L. McCuistion, Associate Professor
Duration:	October 1, 1979 - September 30, 1982
Total Estimated Cost:	$1,311,923
Funding by Fiscal Years:	FY 1979-80 $415,782 FY 1980-81 $433,616 FY 1981-82 $462,525
Project Manager:	Robert I. Jackson
Prior Funding:	Funding from September 30, 1976 - September 30, 1979 - $943,000

Summary Narrative Statement. The continuation of this project on hybridizing spring x winter wheat is a means of increasing genetic veritability in order to penetrate the apparent yield plateau. The results gained to date from the international nurseries generated by CIMMYT concentrating on spring wheat and OSU focusing on winter or facultative types, clearly suggest that the systematic exchange of genetic materials through hybridization of winter and spring type wheats has resulted in new genetic combinations. Such recombinations have been shown to be superior to cultivars with mainly spring or winter parentage in terms of disease resistance, vigor, adaptability and grain yield. Furthermore, by taking advantage of the nutritional lines identified by the University of Nebraska, materials sent to LDCs in the screening nurseries are not only superior for various agronomic traits but some also have elevated nutritional properties.

The winter x spring concept of increasing genetic variability to improve both winter and spring wheats was developed by CIMMYT. During the past few years, there has been a strengthening of the mutual research activities between CIMMYT and OSU coupled with existing linkages with the program at the University of Nebraska. As superior nutritional strains of wheat are identified and different genetic sources of high protein emerge from the Nebraska project, they are incorporated into the winter x spring program. The winter wheat germ plasm developed in Oregon has then the advantage of including superior nutritional properties in addition to the desired agronomic traits. A similar situation exists for spring type wheats developed through the CIMMYT program.

The spring habit is retained while transferring only the desired attributes from the winter wheat parent. After subsequent evaluation and selection, the advanced lines are disseminated through the existing international nurseries coordinated by CIMMYT to the spring wheat growing LDC programs. The earlier maturity and different disease complexes enable scientists from OSU to collect valuable agronomic information from the plots in Mexico just prior to the crossing season in Oregon, thus providing an additional dimension in determining the most productive crosses to make.

As a continuation of current research efforts, this project extension proposes to: 1) accumulate and maintain a genetic pool of wheat cultivars; 2) intercross spring and winter wheats; 3) incorporate superior nutritional properties; 4) insure wide adaption by selecting lines grown under climatic conditions; 5) provide LDCs with the screening nurseries; 6) train young scientists and technicians in cereal breeding and production.

II. Background and Accomplishments

Oregon State University has been engaged in winter wheat improvement for nearly 75 years. Its association with CIMMYT originated ten years ago when scientists from OSU, working under a USAID contract, introduced the semi-dwarf spring type wheats developed by CIMMYT in Mexico into the coastal areas of Turkey. With the subsequent development of the Wheat Research and Training Center by Turkey by the Rockefeller Foundation, a close association between CIMMYT and OSU scientists was established. The OSU team was supported by a USAID grant to develop a package of cultural practices to increase winter wheat production under dryland conditions. Further linkages between these three agencies have been developed through the identification of young, dedicated scientists from many LDCs for graduate training in cereal breeding at OSU. From these associations the various agencies became aware of the potential benefits each could derive from an integrated endeavor to achieve a degree of excellence in wheat improvement with emphasis on small farms which are marginally productive due to environmental stressed conditions.

The winter x spring concept of increasing genetic variability to improve both winter and spring wheats was developed by the late Dr. Rupert, a Rockefeller Foundation scientist assigned to CIMMYT. The initial program was based in Chile and subsequently moved to Davis, California. When it became apparent that the environmental conditions in Oregon were more similar to the winter wheat growing conditions observed in the LDCs and with the associations already established between CIMMYT and OSU, the program was transferred to Oregon in 1971. It was hoped that CIMMYT in Mexico would handle the spring wheat improvement phase while the Turkish national program and OSU would concentrate on the winter dimension. Because of a number of factors, the Turkish program was not able to provide an international scope to the program. As a result, CIMMYT, lacking the sustained support from Turkey and realizing it could not conduct a full international winter wheat program from Mexico, sought a greater involvement by OSU, requesting that it become the center of operation for winter wheat improvement

With this strengthening of the mutual research activities between CIMMYT and OSU coupled with the already existing linkages with the program at the University of Nebraska, a very positive and complementary total wheat improvement program has been created.

The current winter x spring program takes advantage of the vastly different environmental conditions and disease complexes observed between Oregon and Mexico. The first crosses are made in Toluca, Mexico in May where the vernalization and day-length requirements for winter wheat cultivars can be satisfied, thereby providing the opportunity to nick with spring type wheats. Thus the problem which has historically isolated winter and spring wheats is avoided. Resulting F1 seed is divided and planted in October at Ciudad Obregon, Mexico and Corvallis, Oregon. The F1 material at Ciudad Obregon is integrated into the spring wheat improvement program by top and double crossing to spring type material.

In Oregon, the winter x spring F1 material is top and double crossed back to winter type wheats. In conducting subsequent evaluations, three major testing sites are utilized for screening segregating populations. These include: The Hyslop Agronomy Farm near Corvallis (1000 mm rainfall), Pendleton Experimental Site (500 mm rainfall), and the Sherman Experiment Station (250 mm rainfall). These sites not only provide varying degrees of moisture stress, but also allow selection of winterhardy lines and those resistant to the major diseases observed in the winter wheat producing regions of the world.[1/] In addition, the Sherman Experiment Station allows for selection under summer fallow management systems. This is very critical in dryland areas like the Anatolian Plateau in Turkey which typifies dryland wheat-producing areas in most LDCs. A significant input to the dryland wheat production effort is the awarding of a 211(d) grant by USAID to OSU, thereby strengthening the expertise in dryland agriculture production. This will benefit the breeding program as well since the management system is so vital

1/ To insure adequate levels of leaf and stem rust infection, all segregating winter populations are also grwon in Toluca, Mexico where artifical inoculations are practiced to identify resistant genotypes.

in developing suitable varieties or germ plasm. Further resources in the area of weed control in both dryland and high rainfall areas can be obtained through the cooperative effort between the breeding program and the International Plant Protection Center (IPPC) also funded by USAID and based at OSU.

When considering the three diverse testing sites, it should be noted that through the "material flow" system, the germ plasm in the course of development is alternated and/or simultaneously subjected to various environmental stresses. Thus, successful lines have favorable responses to a full range of requirements. This approach has been the key to the wide adaptation of the materials developed in Mexico for spring wheat. Wheat breeders in Oregon are in a unique position to do the same thing for winter wheats. Nowhere in the United States and few places in the world can such an ideal situation be found for evaluating germ plasm under the many different environmental stresses within such a short distance.

Two hundred and fifty winter and facultative lines representing the F4, F5 and F6 generations are included in the International Winter X Spring Wheat Screening Nursery (IWSWSN) along with suitable check varieties. This nursery is currently sent from Oregon to 48 different countries representing 97 breeding programs. Elite lines identified in Oregon through yearly visits by CIMMYT scientists, along with the screening nursery, are sent back to Mexico for recycling, thus providing additional germ plasm for the spring wheat improvement program. To some of the same LDCs, outstanding early generation populations are also sent, particularly where specific limiting factors have been identified such as aluminum toxicity in Brazil. In 1978, 100 selected F2 populations were sent to 28 cooperators. In addition, crossing blocks and specific cultivars which exhibit desired attributes are sent upon request.

Accomplishments have included: 1) The systematic crossing between winter and spring wheat cultivars has greatly increased the genetic potential for both winter and spring wheats. The most promising lines now emerging in the CIMMYT program for the improvement of spring wheats have resulted from winter x spring crosses. A similar situation exists for winter wheats in Oregon. 2) The growing conditions observed in Mexico at the Toluca site have permitted the extensive crossing of winter and spring wheat cultivars. 3) The different environmental conditions, disease complexes and growing season observed between Mexico and Oregon have permitted a very efficient program to be conducted for the improvement of both winter and spring wheats. 4) Research activity at the University of Nebraska has identified superior nutritional material and provided a significant linkage to the winter x spring wheat improvement program.

The IWSWSN has served as an effective means of distributing useful germ plasm to all country programs. Data returned by over 70 percent of the cooperators indicate that scientists in developed as well as developing countries are making extensive use of the lines in the screening nurseries either through further hybridization or as direct varietal releases. A few specific examples are as follows:

Afghanistan. Approximately 15 winter x spring breeding lines have been selected each year from the screening nurseries for advancement into yield trials. This germ plasm is especially well adapted to the regions of Kabul and similar high altitudes. The Afghan scientists are hopeful that one of these selections can be multiplied for release.

Algeria. The earlier winter x spring cultivars from OSU are well adapted to the high plateau regions of Setif, Tiaret and Siada in Algeria. The climatic conditions are very similar to those at the Sherman station in eastern Oregon. Selections are being advanced from segregating populations and the IWSWSN.

Argentina. Several selections from the winter x spring program have expressed good disease resistance and contain sufficient frost tolerance and/or winter hardiness for the region of Bordenave, near Buenos Aires.

Brazil. Two different wheat research programs in southern Brazil are selecting the winter x spring germ plasm for resistance and tolerance to a number of important diseases and soil problems; i.e., aluminum toxicity caused by low soil pH similar to the conditions in western Oregon.

Chile. Dr. I. Ramirez (Santiago), Mr. J. Acevedo (Tumunco) and Mrs. L. Aguayo (Chillan) each have several winter x spring wheat cultivars in yield trials. These cultivars exhibit good disease resistance and/or intermediate-to-high levels of winterhardiness.

India. Dr. Sivaminathan, Director General - ICAR, and Dr. M.V. Rao, Coordinator, All-India Wheat Coordinated Program have requested and received winter x spring wheat germ plasm for the major research centers in the Himalaya mountains. They are selecting facultative types with sufficient winterhardiness and earliness for the available moisture provided by the annual monsoon.

Iran. The scientists at the Karaj plant breeding center have selected three cultivars which are now in the second year of yield testing and under preliminary increase. Major emphasis for the winter and winter x spring wheat programs has now been moved to the Tabriz site in the mountains of northern Iran. The 5th IWSWSN was planted for the first time at this site in the fall of 1977.

Jordan. Over 50 advanced lines from the IWSWSN have been included in yield trials and five of these lines are also under preliminary multiplication at Amman, Jordan. These lines are of intermediate maturity and have expressed a sufficient level of frost tolerance.

Mexico. The CIMMYT program is using winter wheat varieties and advanced lines from the OSU winter x spring program as parents in the development of new Winter x Spring F1 single crosses at the Ciudad Obregon site and at Toluca in northern and southern Mexico, respectively. The diverse locations in Mexico provide ideal conditions to screen the germ plasm for resistance to stem rust, leaf rust, and stripe rust. Equally diverse sites in Oregon provide optimum conditions to identify resistance to stripe rust, septoria, powdery mildew, barley yellow dwarf, and the foot rots.

Nepal. Several selections from the IWSWSN have performed well in the Kathmandu regions and have been included in the national trials.

Pakistan. Promising IWSWSN lines are being evaluated in yield trials at Quetta (western Pakistan) and the hill areas in northern Pakistan.

South Africa. The similarity in climate, soils and production problems of South Africa and Oregon has stimulated a desire to exchange germ plasm. The IWSWSN and F2 bulk populations are presently being evaluated at Bethlehem. One of their scientists has visited the program to select germ plasm and learn more about management of a plant breeding program. Severe attack of stem rust in South Africa will provide OSU with valuable information as to the best sources of resistance for incorporation into new hybrid combinations.

Spain and Portugal. Both Spain and Portugal are positive about the winter segregants from winter x spring F2 populations and selections from the IWSWSNs. The nurseries are being observed in the northern areas of both countries.

Syria. Close linkage has been established with ICARDA. Dr. J. Srivastava has requested and received the F2 bulk populations (250 entries) and the IWSWSN for selection in the zones of lower winter temperatures.

Tunisia. A number of cultivars from OSU are doing well in the higher altitudes of western Tunisia where late frost and occasional freezing temperatures occur. This is a region where production of spring wheats is frequently damaged by frost.

Turkey. Very close linkages with the Turkey wheat program and OSU for several years has provided winter x spring germ plasm to all winter and intermediate wheat zones. Both OSU and CIMMYT provided teams of scientists to develop a nationally coordinated wheat research program and winter x spring germ plasm has also been disseminated from the Turkey program.

Korea. The desire for earliness to facilitate double cropping with either rice or soybeans is a major breeding objective. Two advanced lines which look extremely promising and will be released as new varieties are Suweon #215 and #216. These lines resulted from the cross Strampelli/69D-3607/Jokwang. The parent 69D-3607 was a selection they obtained from the 1st IWSWSN. In addition, 12 lines from the IWSWSN are being used extensively for mildew resistance and 10 lines for stem rust resistance.

There is a definite potential for increasing yield levels in many LDCs. When yields of lines in the screening nursery are compared to the yield of the local check grown in the same trial, several spring x winter lines exceed the local check significantly.

Graduate training is an area that has benefited greatly from the spring x winter program. Many young scientists from LDCs who received their training at OSU have now returned to their country programs where they are assuming leadership roles and are making significant contributions in the area of wheat improvement. Many are now cooperators in the IWSWSN and return complete and extremely useful data annually.

Many theses problems have been a direct spin-off of the spring x winter program. Factors effecting emergence and stand establishment have been studied. Earliness and winterhardiness in winter x spring crosses have been evaluated as well as the inheritance and association of earliness and grain yield. A study is currently underway of vernalization and photo period responses as related to earliness in wheat. Also in progress is an evaluation of breeding methods in certain spring x winter populations.

One important measure of the effectiveness of the program has been in the linkages established. Because of the prominance and worldwide reputation of the program based at OSU, many scientists from all over the world come to Oregon to interact with OSU staff and graduate students and to make selections in the breeding material for their country programs. Young trainees who have completed a course of study at CIMMYT frequently spend time observing and interacting in the program at OSU before returning home. This exposure has proved a definite benefit as it has increased the completeness and accuracy of the data returned from these country programs.

The program has been effective in establishing lines of communication and germ plasm exchange with countries such as the People's Republic of China and the USSR where political considerations had previously made such an exchange possible.

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An International Symposium on Rainfed Agriculture in Semi-Arid Regions. April, 1977. University of California, Riverside. Participant, Dr. W. L. McCuistion.

Regional Barley and Wheat Workshop. Amman, Jordan. April, 1977. Presentation on the OSU W & S Wheat Program by Dr. W. L. McCuistion. "The OSU International Nursery Program".

International Agricultural Development Service organizational meetings. Airlie House - Warrenton, Virginia. June, 1977. Presentation on Cereal Production in North Africa by Dr. W. L. McCuistion.

The Fifth International Wheat Genetics Symposium. February-March, 1978. Presentation by Dr. W. L. McCuistion. "Development in the W X S Wheat Program during the Past Six Years."

Conferencia Regional de Cereales. CIMMYT-INIAP-CIDA. May, 1978. Quito, Ecuador. Presentation by Dr. W. E. Kronstad. "The International W X S Wheat Research and Graduate Training Programs at OSU."

National Academy of Science Wheat Studies delegation exchange with People's Republic of China. Dr. W. E. Kronstad presented four seminars on various aspects of wheat breeding and genetics.

Country Program Reviews

The People's Republic of China. Dr. W. E. Kronstad was a member of a Wheat Delegation reviewing the national wheat program during the months of May and June, 1976.

Jordan. The national wheat program of Jordan. Dr. W. L. McCuistion reviewed the national and university programs during and following the Regional Barley and Wheat Workshop during April, 1977.

Syria. Review of planned research sites and offices of ICARDA - Aleppo, Syria. Dr. W. L. McCuistion toured the research sites and interacted with new staff members to discuss future coordination of regional and international nurseries.

Iran. The wheat research team at the Karaj Plant Breeding Center spent four days with Dr. W. L. McCuistion reviewing the present field goals. They are relying on strong support from the new winter wheat station established by ICARDA at Tabriz, Iran.

Afghanistan. Representatives of the Ministry of Agriculture, the Agricultural University at Kabul and the Food and Agricultural Officer of USAID provided complete support to Dr. W.L. McCuistion in reviewing their present wheat research. They also requested suggestions on future direction of the national research program. The overlapping visit of Dr. F. Zillinsky with Dr. McCuistion allowed additional discussions on coordination of international nurseries.

India. The visit of Dr. W.L. McCuistion with Dr. M.V. Rao, Coordinator of the All-India Wheat Coordinated Program permitted time to develop a detailed outline of India's requirements for winter wheats in the northern Himalaya mountains.

Pakistan. An extensive field tour was arranged for Dr. McCuistion by Dr. M. Tahir, the newly appointed National Wheat Coordinator. The winter wheat nurseries will be grown in western and northern Pakistan.

Korea. The Korean Ministry of Agriculture invited Dr. W.E. Kronstad to participate as a team member in reviewing the National Wheat Research Program. The team members prepared a summary report providing suggested modifications and additions to the existing program.

III. Research Purpose and Expected Products

A. Project Goal

To assure that LDCs, where winter wheat is a major food grain, can obtain and effectively take advantage of the latest improved winter wheat varieties and technologies suitable for increasing yields of high quality grain, especially on small farms and in environmental conditions which now are marginally productive.

B. Research Objectives

The major objectives of this project are as follows:

1. Develop, evaluate for superior agronomic traits and maintain a germ plasm bank of superior winter wheat cultivars for hybridization.

2. Create greater genetic diversity for the improvement of winter and spring type wheats.

3. Improve nutritional quality in winter wheat by making crosses to lines with known superior nutritional properties.

4. Apply suitable selection pressures to identify superior winter wheat germ plasm with improved yield adaptation and disease resistance.

5. Disseminate early generation breeding stocks to selected LDC cooperators for further selection under their local conditions for specific adaptation requirements.

6. Distribute superior agronomic lines and fixed varieties to all cooperators through the IWSWSN with LDCs receiving first consideration.

7. Determine those attributes necessary in winter wheat cultivars to insure maximum soil erosion control, productivity and stability in concert with improved dryland cultural practices.

8. Train dedicated young scientists who will have prime responsibility for adaptive research in their LDC institutions.

9. Establish new relationships and expand those already existing between LDC agencies and institutions, U.S. universities, USDA-SEA, USAID missions, the Rockefeller Foundation, CIMMYT, FAO and other international and regional plant breeding centers.

10. Conduct in-country (LDCs) training and seminar programs in cooperation with USAID missions and CIMMYT and ICARDA research staff in selected countries.

C. Description

In order to continue current research toward meeting the overall objective in the spring x winter wheat hybridization project, the contractor will perform the following services:

1. Germ Plasm Bank

In order to make crosses directed toward specific objectives, it is necessary to accumulate and maintain a working genetic pool made up of superior winter wheat cultivars which cover a wide range of adaptability. Through the network of cooperation that has already been formed between LDC agencies and institutions, U.S. universities, USDA-SEA, USAID missions, the Rockefeller Foundation, CIMMYT, FAO and other international and regional plant breeding centers, superior varieties and advanced lines are being exchanged. Information from the country of origin as well as local observations concerning combining ability, yield potential, adaptation, resistance to various diseases, and responses to other limiting factors will be catalogued. Utilizing the computer to record and cross reference such information a data bank will be compiled to give the plant breeder ready access to the names of varieties or lines which can be effectively utilized in crosses directed toward a particular goal. From this winter germ plasm bank the winter crossing block for both CIMMYT, where the single crosses are made, and Oregon for top crossing will be developed.

This collection is now being further enriched by the exchange of germ plasm with the People's Republic of China which was facilitated by recent visits by CIMMYT staff and OSU principal investigator.

2. Genetic Diversity

There is a concern that future improvement in yield levels and adaptability will be only minor if scientists are limited to the use of existing germ plasm and are restricted to intracrossing in the spring or winter types.

However, results have shown that a much greater genetic diversity can be achieved through the intercrossing of the two types. Spring wheat parental sources are carefully chosen to incorporate important characters such as a wide maturity range, head fertility, agronomic type, new dwarf genes, and genes for disease resistance not available in the winter wheats. The winter wheat parents provide new genetic sources for winterhardiness, frost and drought tolerance, yield potential and stability, shattering resistance, bread making quality and different types of disease resistance not presently available in spring wheats. Results from the international nurseries developed by both CIMMYT and OSU have clearly demonstrated that products from spring x winter crosses do represent superior germ plasm.

3. Incorporation of Superior Nutritional Properties

Selected F_1 populations resulting from spring x winter single crosses made in Mexico are top and double crossed in Oregon to high protein cultivars previously identified by the University of Nebraska. Lines with exceptional nutritional properties are identified and evaluated under the diversified selection pressures in subsequent generations to insure that lines with enriched nutritional properties will have wide adaptation. Prior to entry into the IWSWSN, selected lines are further evaluated by the quality laboratory recently established at the Hyslop Agronomy Farm located near the OSU campus for improved nutritional properties. This information, along with the agronomic data obtained in Oregon will be provided to the scientists in the LDCs receiving the IWSWSN seed. With this background information, scientists in the LDCs can more effectively identify promising lines.

4. Selection Pressures

Specific climatic conditions and those factors which limit winter wheat production in the LDCs can be found somewhere within the State of Oregon. There are over 400 different soil types varying from strongly basic to strongly acidic. Winter temperatures in coastal areas are mild enough to accomodate the growing of fall-sown spring wheats, but in eastern Oregon are severe enough to require a moderate level of winterhardiness. The rainfall pattern is predominantly a mediterranean type with annual amounts varying from less than 250 mm to over 1000 mm. In the dryland areas, drought resistance is an important consideration and the development of cultivars in relation to an exacting management system is required. Every major disease attacking winter wheat is present with the exception of stem rust, thus, all early generation material is also sent to Toluca, Mexico where it can be effectively screened for stem rust resistance. Data already obtained from the entries.

in the first five IWSWSNs also suggest that many of the physiological races of major diseases present in LDCs are found in Oregon.

To insure wide adaptation, superior progeny from segregating populations are grown and selected simultaneously in all four sites. Due to the large environmental differences observed between sites, the resulting germ plasm is exposed to many of the limiting factors common to winter wheat areas of the world. It should be noted that advanced lines which have been selected for their yield potential under Oregon conditions do in fact have wide adaptation as evidenced by their superior performance across locations in the LDCs.

5. Early Generation Breeding Stocks

The F1 top and double cross populations are selected on an individual plant basis using the pedigree method. In addition, superior populations are bulked following plant selection and sufficient seed is available for further testing as F2s at a number of locations. Each F2 bulked population is planted at the three major Oregon experimental sites. The remaining seed is disseminated to selected LDCs where facilities and staff are available for further selection under local conditions.

Cooperators in areas with particular problems consistently limiting wheat production, such as special types of winter killing, late spring frosts, drought conditions, specific disease attacks, etc., will be asked to assist in screening additional genetic material for resistance to those limiting factors. Providing these early generation stocks is extremely important to the cooperator and can also benefit the OSU and CIMMYT programs as data are returned indicating the best populations under unique conditions. Programs in developed countries, particularly in eastern Europe, are not only providing useful agronomic data as a result of growing the IWSWSN, but are also providing valuable germ plasm for incorporation into the winter x spring program. As a consequence of this exchange, superior germ plasm previously inaccessable is now finding its way into the LDCs.

When early generation quality screening is used along with agronomic and pathological selection, a higher percentage of the lines have desirable quality in the advanced generations. The wheat quality evaluation of lines starts with the F4 individual selections (seed from F3 selected plants) and is continued through the F5 and F6 generations. Quality considerations involve nutritional properties rather than end product use factors.

In making winter x spring crosses, tremendous variability in gluten strength results due to the wide variation in germ plasm. Following harvest, seed of all selected plants are first tested for grain type and only those with plump kernels are maintained. Advanced generation material is then evaluated for gluten strength using a mixograph. Only lines with acceptable gluten strength in keeping with hard or soft wheat types are retained for further evaluation.

6. Screening Nurseries

Selections from preliminary yield trials at the three Oregon sites are advanced to the IWSWSN for evaluation in many winter wheat areas. In Table 1 is presented the number of entries, cooperators and countries receiving the six IWSWSNs that have been distributed to date. With the identification of additional nursery sites in the People's Republic of China, and the mountainous regions of northern India, all the major winter or facultative wheat growing areas are covered.

TABLE 1. TOTAL NUMBERS OF ENTRIES, COOPERATORS AND COUNTRIES RECEIVING THE SIX IWSWSNs, 1973-1979

IWSWSN NURS. NO.	NO. OF ENTRIES	NO. OF COOPERATORS	NO. OF COUNTRIES	CROP SEASON
1	360	38	24	1973-74
2	450	52	30	1974-75
3	448	63	33	1975-76
4	250	69	40	1976-77
5	250	80	46	1977-78
6	250	97	48	1978-79

Return of the experimental data following harvest is essential for proper evaluation of the material. Response from cooperators thus far has been very encouraging. Personal contact through visits to different cooperators will improve the quality and amount of data returned. Receipt of all data is requested prior to the end of the year in which the nursery is grown. The data are completely summarized by computer and superior lines are identified. A printed copy of the results is returned to the cooperator by mid-February of the following year. This provides the cooperators with the complete summary of data from all locations prior to their crossing period. This summary is also a valuable tool for OSU and CIMMYT in planning their crosses for new hybrid combinations.

Advanced lines with proven general adaptation from the IWSWSN or with special attributes will make up the new International Winter X Spring Replicated Yield Trial. This nursery will complement the IWSWSN and will be sent to a limited number of cooperators with emphasis on those LDCs which cannot take full advantage of the screening nursery due to limited breeding programs.

7. Variety X Management Interaction

Since the majority of the winter wheat production in the LDCs is under limited rainfall conditions, a management system to conserve moisture must be employed if successful yield levels are to be obtained. The summer fallow system of the Pacific Northwest has been modified and successfully introduced into Turkey. Experience has shown that if maximum production is to be achieved, varieties must be developed in keeping with the particular system. Furthermore, such a variety x management interaction is even more critical in preventing or reducing soil erosion either by wind or water. With the awarding of the 211(d) grant to OSU for strengthening dryland agriculture production technology, it is possible to utilize this resource in the breeding program in a complementary fashion.

One cultural practice which has been clearly identified as being significant in dryland management systems is that of seeding early in residual moisture. This not only results in higher yield levels, but is a major deterrent to soil erosion. However, if this practice is to be effective, cultivars must be developed which have certain attributes not found in existing varieties. These involve factors which influence stand establishment including rapid emergence in warm, relatively dry soils, semi-erect seedlings having a proper balance of tillers and leaves to lessen damage by wind, improved winterhardiness, varieties that efficiently use limited water supplies, greater ability to compete with weeds, emergence through compact, residue covered soil and greater resistance to pathogens.

In the winter wheat producing LDCs, the need for developing cultivars in keeping with management systems to reduce soil erosion either by wind or water cannot be overstated. These areas have already lost a substantial amount of an irreplaceable resource base which they can ill afford in terms of present food needs to say nothing of future requirements.

8. Training

The ongoing cereal research program at OSU provides a faculty and staff concerned with extending scientific knowledge and dedicated to the training of young people.

The scope and size of the winter x spring hybridization program is ideal for training qualified young scientists and technicians in cereal breeding and production. The program has been developed to provide an educational base for those young people who will be expected to assume leadership roles in their respective national programs. The students work directly in the winter x spring research project receiving assigned responsibilities, thus becoming familiar with all practical aspects of wheat breeding. They learn to disseminate information by being exposed to the philosophy and techniques employed in extension systems. That there is dignity in getting one's hands dirty is another important learning experience. The students are expected to assume leadership roles and discuss their phase of the program with visiting scientists and with farmers during field days.

Theses problems for students from LDCs are selected in keeping with their personal interests and with regard to the type of research experience which will be most beneficial upon their return home. Some students currently enrolled in the program are completing their course work at OSU and doing their research in cooperation with CIMMYT and at the International Rice Research Institute.

A positive result of the program has been the lasting relationships which have developed between LDC students and the faculty and staff at OSU. Contacts are maintained through a quarterly newsletter and, in some instances, faculty members are able to visit programs in various countries and assist in developing objectives. Such visits not only reinforce the young scientist's confidence in himself, but frequently road blocks can be removed by visiting with government officials in the particular country. Several graduates of the program are now cooperators in the winter x spring research effort in their respective countries. The in-country training program proposed in this renewal request addresses itself to this need for continuation of the backup support for the LDC scientists.

There are a substantial number of gifted young people, from the U.S. many of whom are former Peace Corps volunteers, who want to become involved in international programs. Unfortunately, there is very little support for such people in terms of assistantships. In this proposed renewal three assistantships are identified for U.S. students with interest in international agriculture. The need for well trained scientists for international assignments is very acute. This aspect of the winter/spring program addresses itself to this need.

9. Linkages

Communication and cooperation between agencies and programs throughout the world forms the cornerstone of success in an international wheat improvement program.

Genetic stocks, experimental lines, and research information are exchanged with other organizations engaged in international activities, such as CIMMYT, FAO, The Rockefeller Foundation, the University of Nebraska and Michigan State University to insure rapid progress in the improvement of winter wheat.

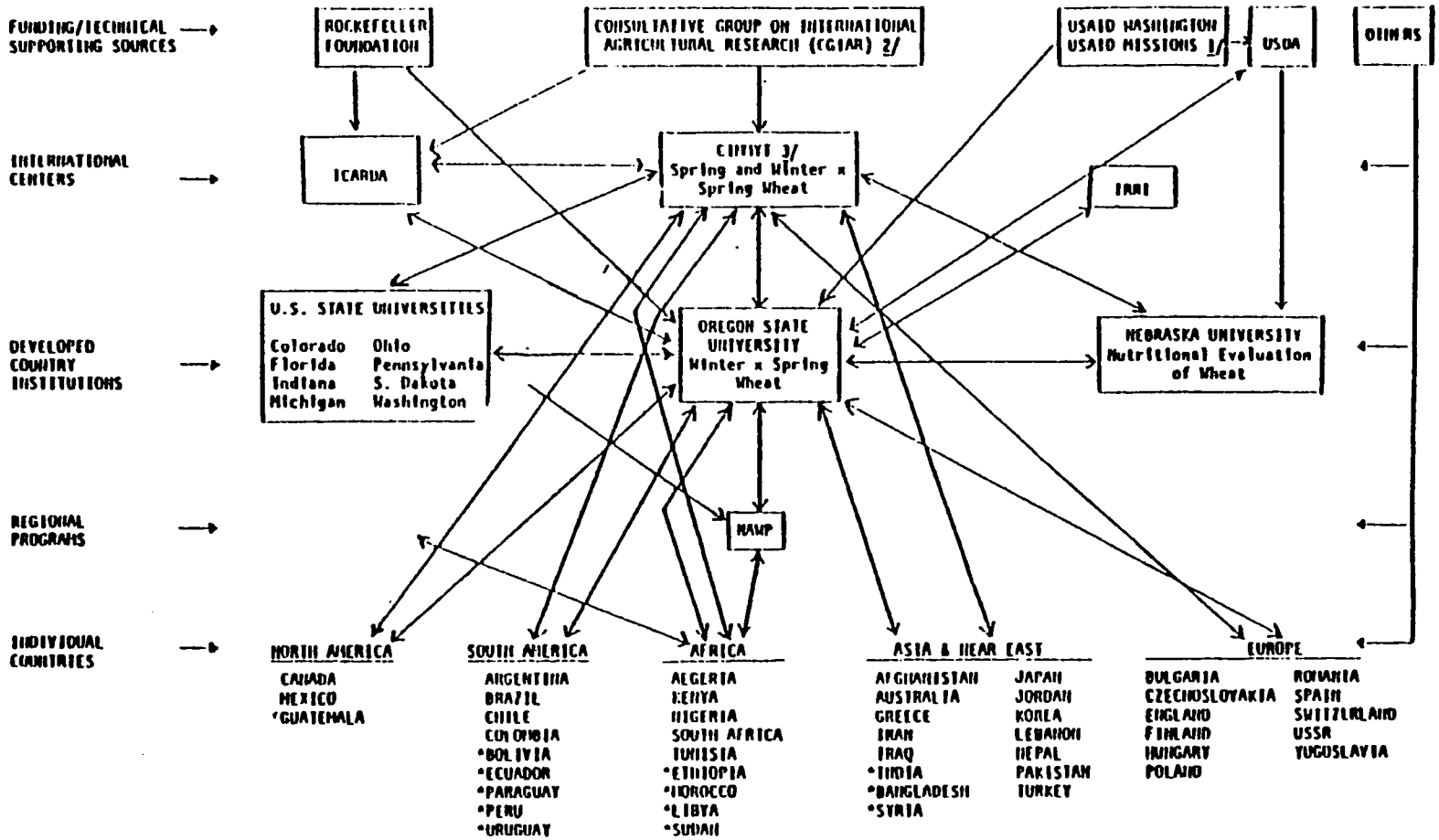
Visits between institutions and cooperators are made to avoid duplication of effort and to coordinate the exchange of material and information. Personal contact through visits to countries where the IWSWSN is being grown will improve the quality and amount of data returned.

OSU will assist and participate in national and international workshops and conferences in cooperation with the above mentioned agencies. Furthermore, upon request and funding by USAID missions OSU scientists will provide inputs to LDCs to strengthen national cereal research programs as a part of the proposed in-country training program.

10. In-Country (LDCs) Training and Seminar Programs

There is a need to relate to specific country programs regarding all aspects of cereal production. In concert with USAID Missions, in-depth reviews in the form of seminars and discussion groups will be held involving LDC staff graduates, national scientists and selected resource people. These sessions will focus on research needs of specific countries and will not be conducted in the broad format of an international conference where overall general country papers dominate the proceedings. The in-country training programs may involve several days to several weeks, depending on the needs and availability of resources of individual countries. Included with formal presentations will be also on-site visits to the major research institutes within the countries to review research programs and priorities. All aspects of cereal research will be discussed including breeding, production, economics and extension practices. Target countries will be identified based on the various USAID Mission and CIMMYT outreach staff requests. Such a program would not only acquaint the spring x winter staff with the needs of individual countries, but it would also reinforce the national scientists in terms of program development and establish closer linkages between the spring x winter program and LDC activities. It would also serve as a means of identifying prospective students for the graduate training program.

Table 2



1/ AID IS SHOWN APART IN ORDER TO INDICATE FUNDING LINKAGES TO U.S. RESEARCH INSTITUTIONS. AID ALSO CONTRIBUTES THROUGH BILATERAL ARRANGEMENTS TO INDIVIDUAL COUNTRY PROGRAMS. OTHER DONOR MEMBERS OF CGIAR HAVE CORRESPONDING ADDITIONAL FUNDING LINKAGES.

2/ THE DONOR MEMBERS SUPPORTING CIMMYT ARE CGIAR, FORD FOUNDATION, ROCKEFELLER FOUNDATION, GERMANY, UNDP AND IBRD. OTHER CGIAR DONORS INCLUDE BELGIUM, DENMARK, FRANCE, JAPAN, KELLOGG FOUNDATION, NETHERLANDS, NORWAY, SWEDEN, SWITZERLAND, UNITED KINGDOM. ALL CGIAR MEMBERS ARE POTENTIAL FINANCERS OF OPERATING LINKAGES WITHIN THE NETWORK.

3/ THE LINKS BETWEEN CIMMYT AND THE INDIVIDUAL COUNTRIES TAKE THE FORM OF INFORMATION AND MATERIALS EXCHANGE, THE CONDUCT OF SEMINARS AND WORKSHOPS, COOPERATIVE RESEARCH PROJECTS, ADVISORY SERVICES AND TRAINING.

* FUTURE COOPERATORS

IV. Significance and Rationale for the Research

Problems of world hunger and malnutrition in developing countries are becoming more intense as a result of food deficits and population growth. Despite some optimistic reports for specific countries and with world food production increasing about 2.7 percent per year, the rate of production growth for cereals in developing countries actually decreased from 2.50 percent per year for the overall period 1960-1974 to 1.69 for the last eight years of this period. 2/

Famines in the LDCs will be even more acute in the future because food production is unstable and resources are poorly organized and virtually indeveloped. The urgency of the situation is underlined by the fact that world food production must reach 6.6 billion metric tons by 2015 to feed the additional four billion people. This feat must be accomplished in only 40 years, whereas, it took 10,000 years (to 1974) to reach an annual production of 3.27 billion tons of food.

In the final analysis, only the LDCs can provide the answers to their food problems. These countries must develop and sustain their own technological research and educational capabilities to prevent major famine. The magnitude and diversity of resources needed to implement and sustain a comprehensive program to increase food production in the LDCs requires the experience, expertise and facilities which are available at various international centers, USAIDs, foundations, FAO-SEA, and U.S. universities. However, to be effective, linkages among these agencies and LDCs must be established through a multitude of efforts or missions. One such cooperative effort has been achieved through the development of the Spring X Winter Wheat Research and Training Project. A.I.D., the Rockefeller Foundation, CIMMYT, ICARDA, OSU are contributing their expertise in using wheat improvement as the vehicle to develop meaningful and responsive agricultural programs in certain LDCs. Such a program takes advantage of the importance of cereal grains and provides a model to increase total food production. The underlying foundation of the program is the development and dissemination of improved wheat germ plasm with relevant training and extension activities welded together to provide an effective delivery system within the LDCs.

Wheat is the most widely adapted and most efficient source of both calories and protein among the major food crops. That wheat can effectively serve as a model for adaptation of new technology was clearly demonstrated with the development and distribution of semi-dwarf, day-length insensitive spring type wheat and rice cultivars in the 1960s which gave rise to the so-called "Green Revolution". Unfortunately, improvements have been much less spectacular in the major cereal producing regions where winter or facultative type wheats are required and various environmental stresses are more severe.

2/ Meeting Food Needs in the Developing World, International Food Policy Research Inst., Research Report No. 1, February 1976.

As a result, millions of hectares are still devoted to a subsistence level of wheat culture, particularly in the winter-rainfall, summer-drought areas of the Middle East, North Africa, Northern Asia, certain Latin and South American countries and in such countries as the People's Republic of China where 80 percent of the total wheat acreage (28 million hectares) is of the winter type. Due to the vastness of these areas, and the lack of stability of yield, modest and consistent improvements in yield levels would result in substantial increases in world food production.

It now appears that yield plateaus have been reached in many of the major crop species including wheat. With the development of such outstanding wheat varieties as Centurk, Bezostaia, Gaines and Hyslop among the winter types and varieties from the 8156 cross (Siete Cerros) and Anza representing the spring types, additional breakthroughs in yield and adaptation have not materialized in wheat in recent years. A much greater degree of genetic diversity must be created within both winter and spring type wheats if this apparent "yield plateau" is to be penetrated.

It should also be emphasized that the Spring x Winter Research Project serves as an excellent format for the training of gifted young people from LDCs. It is in this area that the real solution to world food problems will be found. A significant factor in the dramatic increase in wheat production in Turkey was the program developed by USAID, OSU, the Rockefeller Foundation and CIMMYT which provided not only the necessary technology and delivery system, but left in place a group of well-trained scientists to continue the program. These scientists are the key to the continuity of this program. The lack of trained people in the LDCs remains at the most critical need. In response OSU has accepted the commitment to maintain a strong, relevant graduate training program to complement the Spring x Winter Research program.

There is also a need for stronger linkages to be established between research and training institutions in LDCs and programs such as the winter x spring project. Such linkages could be achieved and strengthened by developing in-service training programs for specific LDCs. This might involve an in-depth review of all aspects of cereal production within a country using the combined expertise of USAID personnel, CIMMYT, ICARDA and OSU. Seminars, on-site visitations to various research projects, and meetings with appropriate government officials might provide not only the necessary institutional building incentives, but also reinforce the confidences of the scientists including follow up contract with previous OSU and other university graduates.

V. Plans to Coordinate and Link Research

Approximately 98.0 percent of the food is produced on the land with cereal grains contributing the largest segment (41.0 percent of the total). In terms of metric tons, wheat, followed by rice, maize and barley, are the most important. Wheat is also the most widely cultivated of all cereal crops in the world occupying about 17 percent of the total cultivated land. Under the direction of CIMMYT,

the major thrust of the Green Revolution has been on spring wheats, and therefore, confined to the subtropical zones. An important statistic that is often overlooked, however, is that winter wheats occupy 66 percent of the total world wheat acreage. Also of importance is the fact that 75 percent of the acreage is fall-sown. Both wheats with true spring habit and facultative types are fall-sown when possible to take advantage of a longer growing season.

The present local varieties being grown in the LDCs are generally tall, late and low yielding because they do not have the genetic potential to respond even under optimum growing conditions. Introduced varieties with higher yield potential often lack seed quality, disease and insect resistance, winter-hardiness, or other adaptation to climatic conditions. A large acreage within each of the LDCs belongs to small farmers working in marginally productive areas where yearly yield levels are totally dependent on the environment. If these farmers are to benefit from improved technology, the institutions of selected LDCs with major responsibility for adaptive research and extension of wheat improvement to the rural populations must be strengthen The training of dedicated young scientists in conjunction with providing them access to superior germ plasm is the most direct means of accomplishing this objective.

Through OSU's distribution of the IWSWSN, a worldwide network of cooperators has been formed which insures that the LDCs can obtain and effectively take advantage of the widely adapted materials developed through the combined efforts of OSU and CIMMYT.

The 6th IWSWSN is currently being evaluated in most of the major winter wheat growing areas of the world. Additionally, selected F2 populations have been sent to those countries with the scientific personnel necessary to use such materials. The close linkage of OSU with international and national research organizations will accelerate the efforts to produce and distribute new improved advanced lines and varieties for use in the LDCs.

The winter wheat improvement program at OSU is closely aligned with the spring wheat program conducted by CIMMYT in Mexico and their various outreach activities. Both programs are production oriented and utilize the same breeding procedures. The unique geographic locations, easy travel between programs, and complementary environmental stresses maximize the progress achieved in the winter x spring program for the benefit of both winter and spring wheat production areas in the LDCs.

The International Center of Agricultural Research for Dry Areas (ICARDA) has also joined OSU and CIMMYT in the development and screening of germ plasm. The International Rice Research Institute (IRRI) is also participating by assisting in graduate training.

The two programs currently funded by USAID at OSU, which include a 211(d) grant for development of expertise in dryland agriculture production and the International Plant Protection Center (IPPC) for weed control, will be valuable assets to the winter x spring program. The combined thrusts of these three programs will be to develop improved varieties and a package of cultural practices to protect the existing natural resources while improving the quality of life by maximizing winter wheat production in the LDCs.

Linkages in addition to germ plasm exchange have also been established with several institutes in developing and LDCs as follows:

1) The Government of Tunisia Accelerated Cereal Project - Tunis, Tunisia

2) The Turkey Wheat Research and Training Center - Ankara, Turkey.

3) The Wheat Research Program at the University of Jordan - Amman, Jordan

4) IDGC - The Algerian Institute for Development of Cereal Production and Companion Crops - Algiers, Algeria

5) The Agricultural Research Council for the Government of Pakistan - Islamabad, Pakistan

6) The Ministry of Agriculture and Irrigation - Kabul, Afghanistan

7) The All-India Wheat Coordinated Program - New Delhi, India

8) Wheat and Barley Research Institute - Suweon, Korea

9) Institute de Investig. Agropec - Casilla, Santiago, Chile

10) Programa de Cereales, Universidad Nacional Agraria-
Lima, Peru

11) Organization of the National Agricultural Research Institute-
~~Quito, Ecuador~~

VI. Plan To Facilitate Utilization of Research Results

The six aspects for facilitating the utilization of the results are: (1) The IWSWSN made up of superior lines is an excellent way to disseminate germ plasm which is being used effectively by the LDCs. The screening nursery also serves as a worldwide surveillance nursery for the identification of new insect and disease problems and in surfacing new sources of resistance. (2) Results from the first five screening nurseries suggest that the germ plasm selected in Oregon retains the desired attributes when grown in the LDCs. These nurseries have also demonstrated the major limiting factors to increased production for specific countries such as certain diseases, soil problems, and earliness. (3) The positive response of cooperators and the overwhelming requests for the nurseries give a very strong indication of the value placed on the winter x spring program by the scientists in the LDCs. Not only is the nursery providing a mechansim for the exchange of germ plasm and information, but in concert with the University of Nebraska program and CIMMYT, it has opened up lines of communication between the winter and spring wheat breeders throughout the world. (4) The program has a built-in means of verifying how extensive the germ plasm is being used in LDC programs and this has reflected very positive results. (5) Through the use of the computer and the development of a useful format for summarization of data at OSU, results of each IWSWSN have been returned to the cooperators during the same year and prior to their crossing season. (6) The strong breeding program has provided an ideal milieu within which to train students from the LDCs at the graduate level. Currently 30 foreign students and 14 U.S. students with an interest in international agriculture have been, or are now participating in this research program. Many have returned home after completing the M.S. or Ph.D. degree and are now cooperators in the winter x spring program in their respective countries. It is apparent that without the program strength as background, the university's ability to train young, dedicated scientists from the developing countries would be only partially effective.

VII. Management Considerations

Because of the cross-linkages involved in this research, as already outlined in Section V, careful consideration has been given to the management of the contract. The past experience has shown that management has performed in a very satisfactory manner in carrying out the previous contracts.

The two principal investigators are very much respected and have worldwide reputations as foremost wheat breeders. They have had extensive experience which includes field research, technical assistance, teaching and advising to policy makers of government agencies and major foundations.

VIII. Technical Review

Among the major food crops, wheat is the most widely adapted and the most efficient source of both calories and protein. With the introduction of the semi-dwarf, day-length insensitive characters into agronomically desirable spring type wheats, progress made in wheat improvement has resulted in a substantial increase in the world food supply. Of particular significance is that as the result of day-length insensitivity, wheat is now a major food crop in many of the subtropical Less Developed Countries (LDCs) rather than remaining solely a crop restricted to the temperate zones. Furthermore, this technological breakthrough has been largely independent of farm size as increased yield levels have benefited both the large and small farmer. Unfortunately, improvements have been much less spectacular in winter type wheats which are generally grown under less productive environments. As a result, millions of hectares, particularly in the winter-rainfall, summer-drought areas of the Middle East, North Africa, Northern Asia and certain Latin and South American countries, are still devoted to a subsistence level of winter wheat culture. Due to the vastness of these areas, and the lack of stability in production, modest and consistent improvements in yield levels would result in substantial increases in food production. In order to improve the quality of life for the people inhabiting these now marginal areas, there is a pressing need for the development and dissemination of superior varieties and the improvement of production technology. This would lessen the gap in wheat production between the more favorable spring growing areas and the less favored sites growing winter wheat.

There is a concern that with the development of such outstanding semi-dwarf varieties as Gaines and Hyslop among the winter types and varieties from the 8156 cross (Siete Cerros) and Anza representing spring types, future yield and adaptation breakthroughs will be difficult utilizing existing germ plasm. Much of the success of the semi-dwarf varieties arose from the crosses made between diverse germ plasm sources. It is apparent that a much greater degree of genetic diversity must be created within both winter and spring type wheats if further major improvements are to be made. There is solid evidence that such diversity can be achieved by the intercrossing of winter and spring type wheats. Historically such crosses were only attempted when the plant breeder was desperate for a new source of disease resistance or some other attribute not found within the particular type he was developing. This reluctance was in part the result of difficulties in crossing due to the vernalization required by winter type wheats. As a consequence, spring and winter wheats have diverged from one another in an evolutionary fashion. It is noteworthy that several of the major breakthroughs in wheat breeding, such as the variety Thatcher, resulted from winter x spring crosses. Even the semi-dwarf spring wheats originally developed in Mexico obtain their short stature from the dwarfing source found in Norin 10-Brevor 14, a winter type wheat.

The results gained by CIMMYT and the winter wheat project conducted by OSU indicate that new genetic combinations resulting from the systematic crossing of winter x spring types are superior to either the winter or spring parent. In addition to greater vigor and wider adaptation, desirable characteristics lacking in one group can be transferred from the other. Such factors as good sources of stripe rust and drought resistance found in winter wheat can be transferred into spring types while spring varieties can contribute superior sources of stem rust resistance and early maturity (Table 3).

TABLE 3. SELECTED AGRONOMIC CHARACTERISTICS OF EACH WHEAT GROUP THOUGHT DESIRABLE FOR INTERCROSSING.

WINTER WHEATS	SPRING WHEATS
Winterhardiness	Early Maturity
Frost Tolerance	Agronomic Type
Dwarf Source	Dwarf Sources
Drought Resistance	Yield Potential
Yield Potential	Yield Stability
Yield Stability	Light Insensitivity
Shattering Resistance	Spike Fertility
Quality	Stem Rust Resistance
Stripe Rust Resistance	Yellow Dwarf Virus Resistance
Mildew Resistance	Septoria Resistance
Leaf Rust Resistance	Leaf Rust Resistance
Root Rot Resistance (Cercosporella, Ophiobolus, Fusarium, etc.)	
Yellow Dwarf Virus Resistance	

The cooperative program between CIMMYT and OSU is providing the necessary genetic diversity to substantially improve both winter and spring wheats and in currently making such germ plasm available to the scientists in the LDCs through international screening nurseries.

IX. Research Project Design and Methods

A. Germ Plasm Bank

Approximately 5000 winter wheat cultivars have been evaluated for their agronomic worth. These lines were obtained from every major winter wheat producing area in the world and represent mainly advanced materials from the more progressive breeding programs. Nearly 200 new entries are received each year and evaluated in the miscellaneous crossing block. The most promising genotypes are then advanced to the main crossing block the following year for hybridization in the top crossing program in Oregon and for the single crosses made in Mexico. Information is catalogued on such factors as yield potential, combining ability, disease reactions and other important agronomic properties. Those lines found to be superior for various desired traits are made available to the cooperators upon request. By 1979 an information sheet will be made available to all the cooperators identifying the attributes of each of the more promising lines.

Approximately 200 new entries are received each year from nearly all the major winter wheat breeding programs. For the past two years collections have also been received from the People's Republic of China. Since earliness is a major factor needed in many parts of the world, 75 of the very earliest maturing lines from the collection in Suweon, Korea are being sent for use by Oregon this year. Particularly promising lines for earliness and winterhardiness have been obtained from the USSR, Yugoslavia, Romania and Turkey. Sources for aluminum tolerance have been obtained from Brazil. Materials from Argentina and South Africa are being obtained as new sources of stem rust resistance. It should also be noted that the high protein and high lysine screening nursery from Nebraska is grown each year and utilized in the crossing program.

B. Genetic Diversity

Data from the 97 cooperators currently receiving the screening nursery suggest that the concept of creating greater genetic diversity through the systematic crossing of winter x spring wheat cultivars is valid. Thirty percent of the advanced lines currently being increased at CIMMYT originated from winter x spring crosses. These not only represent some of the best spring cultivars but when it is realized that the winter x spring program has only been underway since 1972, it is most impressive. Similar observations have been made in Oregon when progeny from the winter x spring program are compared with strict winter x winter crosses.

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C. Incorporation of Superior Nutritional Properties

The most promising lines in the high protein, high lysine screening nursery from the University of Nebraska have been used in top crosses. The nutritional information provided by the University of Nebraska and local agronomic evaluation is utilized in making the desired crosses. Selected progeny from such crosses were to be sent to Nebraska for subsequent screening; however, with the reduction in the Nebraska program, this phase of the program will be carried at Oregon State University in the new Quality Laboratory.

D. Selection Pressures

The simultaneous selection within segregating populations across three diverse testing sites has been positive in developing lines with wide adaptation. Certainly the results returned from the screening nurseries substantiate that most limiting factors in developing countries can be found at the three testing sites in Oregon. Leaf and stem rust epidemics are an exception; therefore, in addition to the three sites in Oregon, all the winter segregating populations are also grown at Toluca, Mexico where they are artificially inoculated and meaningful selection can be carried out.

E. Early Generation Breeding Stocks

In addition to the IWSWSN, selected F2 and later generation populations which have special attributes are sent to selected developing countries. For example, populations where short stature has been combined with different sources of aluminum tolerance have been sent to Brazil for their evaluation or selection. Early generation materials exhibiting extreme earliness have been sent to Korea. Such materials can be effectively utilized in developing countries where positive breeding programs are being conducted. This has the benefit of providing elite materials much earlier to these programs rather than waiting until the F5 or F6 generation when such material might reach them through the screening nursery. It should be noted that early generation materials selected in the various developing countries are then recycled through the winter x spring program.

F. Screening Nurseries

The 7th IWSWSN is made up of 250 lines from F4, F5, and F6 populations and is being distributed to 97 cooperators representing 48 different countries where winter or facultative wheat is being grown. Testing sites have now been identified in the People's Republic of China, Northern India ~~and~~ Bangladesh, thus expanding coverage to all of the major winter wheat producing areas of the world.

Lines in the screening nursery have been selected over a wide range of environments within the state of Oregon. Many are selected with strengths in certain problem areas known to exist in the LDCs such as specific disease resistance, earliness and drought tolerance. Some lines are useful to the cooperators as germ plasm to be incorporated in crosses with local adapted varieties. On the other hand, several countries including Iran, Jordan, Turkey and Afghanistan have indicated that they are increasing several lines from the screening nursery for direct varietal release.

In an effort to provide the most beneficial data summary, the IWSWSN is sent six months earlier to cooperators in the southern hemisphere so that all data on the current screening nursery can be returned in time for inclusion in the annual summary. Such a practice will provide a more complete picture of the performance of lines across a wide range of environments.

Testing sites have been divided into three rainfall zones: Low (<400 mm), intermediate (400-650 mm), and high (>650 mm and irrigated sites) in an effort to better summarize data and pinpoint lines which are most suitable to a specific area.

After harvest, cooperators return data to Oregon where they are coded and keypunched for analysis by computer. Data are accepted for inclusion in the current summary up until January 30. Data received after that time are included as an addendum in the following year's summary.

The computer facilitates the handling of thousands of bits of information on the 250 lines in the screening nursery. A complete catalog of all data received for each line is printed, enabling the cooperator to view the performance of a particular line across a wide range of environments and growing conditions. Utilizing weighted scores obtained by ranking all of the lines for nine agronomic traits, the best 25 lines are identified and results printed for each location. Subsequently, the best 25 lines over all location reporting are identified for yield potential, earliness, winter-hardiness, stripe rust, leaf rust, stem rust, septoria, and powdery mildew. Therefore, lines are identified with strengths in these areas so the cooperator can make use of them in his breeding

program. Finally, based on weighted scores from all locations reporting in the low, intermediate, and high rainfall zones, a table is printed of the 25 lines in each rainfall zone which exhibited adaptation for particular areas and may be useful to the cooperator either for reselection or direct release.

By the first of March, the summarization is complete and printed in book form. It is in the hands of the cooperators prior to the subsequent crossing season so they may make the most effective use of the information. Because of the timely return of the data, there has been an excellent response from the cooperators. Approximately 70 percent of all those who receive the nursery return data to be included in the summary. This is of extreme importance and serves to increase the value and usefulness of the summary. It should be noted that the summary books are available to those other than just cooperators who might be interested in specific germ plasm.

G. Variety X Management Interaction

Under dryland wheat production moisture conservation is a critical factor. Through the development of various management practices, successful winter wheat production has been accomplished with 200 mm of annual rainfall. It is very apparent that to maximize grain yield under such conditions, new cultivars must be developed in keeping with specific management systems. At the Sherman Branch Experiment Station germ plasm is being evaluated under such practices as mold board plowing, stubble mulching, minimum and no tillage. Important plant attributes such as germination and emergence under low moisture and high temperature conditions and other factors associated with stand establishment are being evaluated.

With the minimum and no tillage practices, erosion control is the main consideration. Wheat cultivars have been identified that germinate under lower moisture conditions and higher soil temperatures, emerge rapidly, and have a spreading growth habit and prolific root branching patterns for holding the soil. Adequate levels of winterhardiness and increased spring vigor have also been observed. Greater problems with pathogens and insects can be anticipated; therefore, more work must be completed to identify specific problems and find tolerance or resistance to these limiting factors. With the existing genetic variability it is possible to develop cultivars with the desired attributes to fit into management systems which can help to control wind and water erosion. This will be an important feature of the winter x spring program when making future crosses.

H. Training

An integral part of the winter x spring wheat research program at OSU is a graduate training program where young scientists can receive appropriate training leading to M.S. and Ph.D. degrees. The program has been developed to provide an educational base for those young people who will be expected to assume leadership roles in their respective national programs.

A student who first joins the program is assigned responsibility on the research project. As a result, students become familiar with the practical aspects of the research program through actual participation. He is expected to take the leadership and discuss phases of the program with visiting scientists and with farmers during field days. The importance of the team approach to research is stressed and the student has the opportunity to participate as a team member. As the individual progresses through the program, the research effort will turn toward the M.S. or Ph.D. thesis problem which often, its very nature, is more specific than the work on the cereal research program. Theses problems are selected in keeping with the student's interest and with regard to the type of research experience which will be most beneficial upon his return home. A program has been developed where, under certain circumstances a student may complete his academic work at OSU and conduct his thesis research at one of the international centers. Currently three Ph.D. students are doing their theses research in Mexico with the assistance of CIMMYT scientists. Another student is working on a thesis project in rice at the International Rice Research Institute in the Philippines.

The scientific approach, integrity in reporting data and dedication are stressed. It is equally important that the student learn to disseminate information, therefore, he is exposed to the philosophy and techniques of extension systems. Furthermore, he comes to realize that there is dignity in getting his hands dirty as he works beside faculty members in the field.

A positive result of the program has been the lasting relationships which have developed between the former students and the faculty and staff. Contacts are maintained through a quarterly newsletter and, in some instances, faculty members are able to visit various countries and assist in developing programs. Such visits not only reinforce the young scientist's confidence in himself, but frequently road blocks can be removed by visiting with government officials either in the particular country or while the officials are touring the United States.

If a solution is to found to population-food supply problems, it will be only after there is a sufficient number of highly motivated young scientists with the desired level of training to make the necessary contributions. It will not be possible for any country or organization to provide enough support to the developing countries to solve the food problem. The goal should be the strengthening of the national programs which can only be achieved if there is enough expertise in a given country to get the job done. The need for strong training programs at the M.S. and Ph.D. levels to complement the training received at the various centers such as CIMMYT must receive top priority for this is the ground work upon which to build strong national programs that can meet existing and future requirements for food. The graduate training program at OSU addresses itself to this need.

AID 1020-2011-78

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: Improvement of Winter Wheat for Developing Countries, Based on Hybridization of Spring x Winter Forms

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To increase quantity and nutritional value of food crops in developing countries.	Measures of Goal Achievement: 1. Significant increase in per capita production of major food crops in LDCs. 2. Improvement of nutritional quality of major LDC food crops.	1. Official production and population statistics (FAO, Foreign Agricultural Service estimates). 2. Nutritional quality surveys in LDCs.	Assumptions for achieving goal targets: 1. LDCs will actively attempt to expand food crop production. 2. Nutritional quality can be improved without major constraints on yield.
Project Purpose: To make available to LDCs high-yielding, nutritious varieties of wheat with multiple resistance to moisture and temperature stresses, diseases and insects, together with improved practices for their cultivation.	Conditions that will indicate purpose has been achieved: End of project status. 1. New, superior varieties available to farmers in LDCs. 2. Research and development activities in wheat effectively assumed by LDC agencies and international institutions and linked by communications network.	1. Publication and reports of LDC governmental agencies; on-site inspections of seed supply. 2. On-site inspection and review by AID/W personnel and consultants.	Assumptions for achieving purpose: 1. Solutions can be found to major constraints. 2. Agriculture extension services are able and willing to promote proven practices. 3. LDC research institutions develop adequate capabilities.
Outputs: 1. Identification of superior germ plasm. 2. Incorporation of desirable traits into broadly-adapted varieties suitable for LDC use. 3. Evaluation of improved varieties and practices in LDCs. 4. Training of LDC personnel in wheat research. 5. Establishment of effective linkages with LDC agencies.	Magnitude of Outputs: 1. Not quantifiable. 2. At least 2 superior varieties for each major agroclimatic region. 3. At least 1 test location in each major winter wheat growing LDC. 4. Total of 20 LDC trainees completing training. 5. Linkages with 2 international centers and at least 10 LDC institutions.	1. Reports by contractor. 2. Reports by contractor, USAIDs, LDC cooperators, and international agencies. 3. Same. 4. Contractor reports. 5. Contractor reports, communications and reports from LDCs and international agencies.	Assumptions for achieving outputs: 1. LDCs and USAIDs will seek technical assistance; research funds will be available. 2. Cooperation of LDCs. 3. Interest and resources exist in LDCs. 4. Collaboration of international institutions. 5. Sufficient interest among LDCs and qualified personnel.
Inputs: 1. AID/W provides financial support and project guidance. 2. Contractor provides qualified personnel and backstopping facilities. 3. Participating personnel and cooperation provided by 1) LDCs, 2) USAIDs, and 3) international organizations.	1. AID/W funding at approximately $425,000/year. 2. 24 worker months/year technical personnel; adequate laboratory facilities; 10 or more acres field research area. 3. Not directly quantifiable.	1. AID/W records. 2. Contractor reports, on-site inspections. 3. USAID reports, on-site verification.	Assumptions for providing inputs: 1. AID/W funding will be available on schedule and in quantity agreed upon. 2. Contractor will have necessary qualified personnel; university facilities will be available to project. 3. International organizations, USAIDs, and LDCs will have personnel and resources to support

X. Overall Cost Estimates

Duration: From October 1, 1979 through September 30, 1982.

Organization: Crop Science Department, Oregon State University

Principal Investigator: Warren E. Kronstad

A. SALARIES AND WAGES [1]	1979-80	1980-81	1981-82
1. Kronstad[2] (Professor .50)	-	-	-
2. McCuistion (Associate Prof. 1.00)	30,000	32,100	34,347
3. Metzger[2] (Plant Geneticist,SEA .10)	-	-	-
4. Research Associate	22,000	23,540	25,188
5. Technician (Field Operations 1.00)	16,000	17,120	18,318
6. Technician (Quality Laboratory 1.00)	15,000	16,050	17,173
7. Technician (Graduate Training and Field Operations 1.00)	13,000	13,910	14,884
8. Technician (Seed distribution-Computer aid 1.00)	13,000	13,910	14,884
9. Administrative Assistant (.50)	5,250	5,617	6,010
10. Secretary (1.00)	9,130	9.769	10,453
11. Hourly Wages [3]	20,000	21,400	22,878
12. OPE (19%, 20%, 20%, Retirement, Social Security)	27,242	30,683	32,827
SUBTOTAL 1	170,662	184,099	196,962
B. TRAVEL AND SUBSISTENCE			
1. International	10,000	11,000	12,000
2. Domestic	10,000	11,000	12,000
SUBTOTAL II	20,000	22,000	24,000
C. RESEARCH OPERATIONS SUPPORT			
1. Capital Equipment[4] (see page 35)	11,220	-	-
2. Maintenance of Equipment	1,750	1,750	1,750
3. Experimental Site Preparation & Care	10,000	10,500	11,000
4. Freight&Mailing for Nurseries	18,000	18,500	19,000
5. Computer Costs	3,000	3,300	4,000
6. Supplies (see page 36)	20,000	20,500	21,000
7. Publications	5,000	5,500	6,000
SUBTOTAL III	68;970	60,050	62,750

	1979-80	1980-81	1981-82
D. GRADUATE TRAINING PROGRAM			
1. Three Graduate Assistantships[5] (.50 each)	13,500	14,445	15,456
2. Thesis Research Support[6] (10 M.S. and Ph.D. students)	15,000	16,000	17,000
3. Travel and Subsistence	2,500	3,000	3,500
SUBTOTAL IV	31,000	33,445	35,956
E. COUNTRY TRAINING IN LDCs			
1. Travel and Subsistence	20,000	21,000	22,000
2. Local Committee Expenses	2,000	2,500	3,000
3. Publications	500	500	500
SUBTOTAL V	22,500	24,000	25,500
TOTAL DIRECT COSTS	313,132	323,594	345,168
INDIRECT COSTS (34% of TDC excluding equipment)	102,650	110,022	117,357
GRAND TOTAL	415,782	433,616	462,525
Three-Year Total		$1,311,923	

[1]An increase of 7% has been allowed for each succeeding year's budget; howeve actual salary adjustments will be based on university-wide adjustments.

[2]Salary contributed to OSU or SEA.

[3]Represents approximately 7,300 man hours.

[4]Non-recurring expenses.

[5]For U. S. students interested in international agriculture.

[6]Graduate stipends to be paid by sponsoring institution or government.

Proposed Budget by Inputs ($000)

Inputs	1980	1981	1982
Salaries and Wages	171	184	197
Travel & Subsistence	20	22	24
Research Operations Support	69	60	63
Graduate Training	31	33	36
Training in LDCs	22	24	25
Indirect Costs	103	110	117
TOTAL	416	433	462

EQUIPMENT LIST FOR 1979-80

1.	Flat Bed Trailer	$3,500
2.	Tape - 300 feet and 100 m ($150 each)	300
3.	Two Plant Threshers ($1,100 each)	2,360
4.	Two Seed Cleaners ($280 each)	560
5.	Suzue Binder	2,500
6.	Shelving and Storage Facilities	2,000
	TOTAL	$11,220

SUPPLY LIST	1979-80	1980-81	1981-82
1. Fertilizer and Chemicals	5,400	5,900	5,900
2. Field Planting and Harvest	7,300	7,300	7,300
3. Seed Preparation and Shipment	4,300	4,300	4,300
4. Computer Supplies	1,000	1,000	1,000
5. Office Supplies	2,000	2,000	2,000
TOTAL	$20,000	$20,500	$21,000

XI. Reporting Plans

An annual substantive report covering the status of the work, indicating progress made during the year, and outlining plans for the ensuing period will be submitted to the AID project manager. An annual review will be held if deemed necessary by the AID project manager.

Scientific reports and manuscripts will be prepared and presented at various symposia, conferences and professional meetings. In addition to departmental reviews of publications, the investigators will allow a pre-publication review by AID. Therefore each of the proposed publications will be submitted to the DSB/AGR/FCP Senior Agronomist (one copy) and to the Contracting Officer (one copy) no later than the date of their submission to the publisher.

XII. Initial Environmental Examination

The activities of this project fall into the area described in environmental procedure regulations paragraph 216.2(c) "Analysis, studies, academic or investigative research, workshops and meetings." These classes of activities will not normally require the filing of an Environmental Impact Statement or the pareparation of an Environmental Assessment. It is possible that an output of this project will be a set of procedures, guidelines or research results which when used would require such as assessment. However, the project itself only proposes research and directly supportive activities. Under these guidelines, this activity clearly qualified for a Negative Determination at the time when a threshold decision is determined.

XIII. Women in Development

It is the goal of this project to encourage the widest possible participation of wheat workers, broadly defined, in the design and implementation of problem solving in wheat production, protection and use. The current research contract, AID/TA/C-1352, employs women professionals in the Department of Agronomy actively supporting the research work. A continuation of these strategies under this proposed research project is assumed. Overall program requirements to advance knowledge in human nutrition in the development of wheat foods adapted to specific cultures and their acceptance in LDC diets hold great promise for the increased utilization of women in those areas where they have traditionally played a major contributing role.

Oregon State University has an aggressive affirmative action program to assure opportunities of employment for qualified personnel, including minorities and females, in compliance with Title IX. Oregon State University has an officer responsible for program implementation.

ENVIRONMENTAL THRESHOLD DECISION

TO: DAA, DS/FN, Tony Babb

THRU: DS/PO, Robert Simpson

FROM: DS/AGR, Dean F. Peterson

SUBJECT: Environmental Threshold Decision

Project Title: Improvement of Winter and Facultative Wheat for DCs Based on Hybridization of Spring x Winter Forms

Project Number: 931-17-130-621

Project Manager: Robert I. Jackson

REFERENCE: Initial Environmental Examination (IEE) contained in the Research Project Statement page 37

dated January 8, 1979.

On the basis of the Initial Environmental Examination (IEE) referenced above and attached to this memorandum I recommend that you make the following decision.

X 1. The proposed agency action is not a major Federal action which will have a significant effect on the human environment.

_____ 2. The proposed agency action is a major Federal action which will have a significant effect on the human environment, and:

_____ a. An Environmental Assessment is required; or

_____ b. An Environmental Impact Statement is required.

The cost of and schedule for this requirement is fully described in the referenced document.

_____ 3. Our environmental examination is not complete. We will submit the analysis no later than _____ with our recommendation for an environmental threshold decision.

Approved: _____

Disapproved: _____

Date: _____

Clearances:
DS/AGR/FCP: KMByergo _____ Date _____
DS/AGR, MMozynski _____ Date: _____

March 6, 1979

MEMORANDUM TO: See Distribution

FROM: DS/AGR, John R. Wilson

SUBJECT: DSB Project Review of DS/AGR's projects

On March 9, 1979 in Room 206 RPC at 2:00 pm the following projects will be reviewed:

- Spring Winter Wheat
- Seed Program and Industry
- Weed Control Utilization

These projects were reviewed by the Technical-Program Committee for Agricultur (TPCA) sub-committee on Crop Production Technology on March 2, 1979. The minutes of this review are attached to each of the project papers for your information. The subcommittee recommended that the projects be approved for funding. There were certain issues raised at that time and these are covered in the attached minutes with the actions that DS/AGR project managers will take to resolve the issues.

DS/AGR is preparing an action memorandum to the Regional Bureau Assistant Administrators to establish the TPCA as the official committee to review and recommend approval of DS/AGR projects. The membership of the TPCA is shown on the attached distribution. The Regional Bureau and PPC members will have the delegated authority to clear for their respective Bureaus. However, until this committee has been delegated the authority to speak for the Regional Bureaus and PPC, DSB will continue to use the DSB project Review Committee to review and recommend approval of DS/AGR's projects.

MAR 7 1979

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : See Distribution

THRU : DS/AGR, J. R. Wilson

DATE: March 6, 1979

FROM : DS/AGR/FCP, Drs. G. F. Warren and John M. Yohe

SUBJECT: Notes on the TPCA Crops Subcommittee Review of the Spring-Winter Wheat, Seed Program and Industry Development, and Weed Control Utilization Projects

The review was held March 2, 1979 and was attended by the following:

NE/TECH/AD, VLateef
ASIA/TR/ARD, DMitchell
LAC/DR/RD, BAllen
AFR/DR/ARD, BWhittle
AFR/DR/ARD, DGates
DS/PO/RES, MRechcigl
DS/PO, PGage
DS/AGR/FCP, Keith M. Byergo
DS/AGR/FCP, GFWarren
DS/AGR/FCP, JMYohe.

The projects were reviewed by the following criteria:

a. Technical soundness and project design,

b. Relevance to regional bureau needs,

c. Anticipated future requirements for field support, and for the results of the research, and

d. Relevance to the future requirements of the LDCs.

The projects, as reviewed by the subcommittee, are discussed as follows:

I. <u>Winter-Spring Wheat Hybridization Research Project, Oregon State University</u>

The subcommittee felt that it was a good proposal, technically sound, and well written. There were three issues which were discussed. These were:

Issue One - The concept of transferring some of the research being conducted at Oregon State University to one or more sites in host countries.

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It was pointed out in the discussion that on this type of project, where large numbers of hybridization crosses are being made, that it is not desirable to decentralize this phase of the activity. It is more appropriate to distribute segregating genetic material for adaptation to LDC sites. This is the activity that is being done at present. Note was taken that the project management should be aware of the need to work as extensively in host country programs as possible.

Issue Two - Training at Oregon - is it adequate to meet LDC training needs?

It was pointed out by AFR/DR that Dr. Warren Kronstadt, the Principal Investigator, is an excellent researcher and teacher. He has an excellent rapport with all students. He trains them in field work techniques and in the philosophy that a plant breeder's place is in the field working with his plants. The feeling was that the training to be received would be relevant in that Dr. Kronstadt stressed the practical field application aspects.

Issue Three - What is USDA's role?

The discussion centered around the idea of how this work would be coordinated with USDA. It was felt that the outputs of a program such as this should be made available to USDA in its outreach to China, etc.

It was pointed out that USDA will be assuming responsibility for the high protein nurseries at the University of Nebraska and that there would be plenty of opportunity for interface with USDA.

II. Seed Program and Industry Development, Mississippi State University.

It was pointed out that this program has been well received and heavily used, especially by Latin American countries. There was discussion on how to involve other countries and it was agreed that, in consultation with AGR regional bureau representatives, an airgram would be prepared to send to all missions giving information on services available under this project.

The possible need for more seed technology research was discussed. It was pointed out that a great deal of research is conducted at Mississippi State and other U. S. and foreign locations on non-A.I.D. funds which are sufficient to supply the information needed for technical assistance.

There was discussion of the need to obtain measurements of the effect of seed technology assistance on the small farmer. Seed technology is only one component of the total technological package needed in LDCs. How does it relate to other inputs and what is its impact? Attention to these questions need to be given in the future.

The project was approved by consensus.

III. Weed Control Utilization, Oregon State University.

There was considerable discussion on the need to make this project worldwide in scope. It has been oriented heavily to Latin America in the past and more recently to Southeast Asia. Recently, the aquatic weed subproject has involved several countries in Africa and Asia. However, it was emphasized that there should be much more activity in these areas and the Near East in view of widespread, serious weed problems.

An airgram sent to all missions in January brought only two new requests. It was agreed that Dr. Warren would consult with representatives of the regional bureaus and send new airgrams to the missions with emphasis on project staff competence on dryland and aquatic weed control. The availability of the staff for surveys of weed problems, consultation on approaches to control, and training programs are to be included.

There was discussion also on the need to obtain clear evidence of the impact of the project on yield increases, improved farm income, or other positive effects on the small farmer.

The project was approved by consensus.

One other agenda item was added. This was in reference to an action taken by the Joint Research Committee of the BIFAD at their February 13-14, 1979 meeting. The JRC wanted to know if A.I.D. wanted to send out a telegram on the upcoming Peanut CRSP to get mission views before the planning process started. The subcommittee recommended definitely that this would be an excellent approach for ground floor input from the missions and passed this recommendation on to the TPCA for their approval.

DS/PO made the observation that this was the most effective review they had sat in on. There was technical review, as related to relevance to the mission's program, ways were discussed on how to make programs more relevant to mission needs, and there was a true atmosphere of constructive critique and constructive measures for improving programs.

Distribution:

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A PROPOSAL TO:

The United States Agency for International Development (USAID)
Washington, D.C.

FROM

Oregon State University (OSU)
Corvallis, Oregon

WITH
THE FULL SUPPORT OF THE

International Maize and Wheat Improvement Center (CIMMYT
Mexico City, Mexico

FOR

A. SUPPORT OF A COLLABORATIVE OREGON STATE UNIVERSITY - CIMMYT PROGRAM FOR THE IMPROVEMENT OF WINTER WHEATS FOR THE DEVELOPING COUNTRIES, BASED PRIMARILY ON A WINTER X SPRING WHEAT HYBRIDIZATION APPROACH.

B. SUPPORT OF GRADUATE TRAINING FACILITIES TO PROVIDE FOR THE DEVELOPMENT OF SCIENTIFIC PERSONNEL TO MAN THE PROGRAMS OF THE DEVELOPING NATIONS.

A. Winter X Spring Wheat Research Program

1. Improving Winter Wheats for the Developing Countries

Background - Oregon State University has been engaged in winter wheat improvement for nearly 75 years. Its associations with CIMMYT originated several years ago when the University provided a training ground for CIMMYT-identified, young scientists of developing countries. Closer associations developed when CIMMYT assigned two of its scientists to the Rockefeller-Foundation-financed program of assistance to the Turkish National Wheat Program. In this capacity they collaborated closely with O.S.U.-assigned scientists financed under a USAID contract and the direction of Dr. W. E. Kronstad.

As a result of this close collaboration in the Turkish Program, CIMMYT decided to move the late Dr. Joseph Rupert from the University of California to the Oregon State University Wheat Program. Dr. Rupert, a Rockefeller Foundation scientist assigned to CIMMYT, was primarily concerned with the development of new materials from crosses between winter and spring wheat varieties. The very promising results arising from his earlier work caused CIMMYT to increase its interest in this field, and their program was greatly expanded in 1972 following Dr. Rupert's untimely death.

This series of interactions resulted in an informal agreement between O.S.U. and CIMMYT, whereby, CIMMYT undertook to make a large number of winter x spring wheat crosses in Mexico at their Toluca Valley site and supply a portion of the F1 seeds of all crosses to O.S.U. The University, on its part, undertook to develop winter germ plasm through further crossing of the F1 to winter varieties or winter x winter

F1's. Exploitation of the material was accomplished through joint efforts with the Turkish National Program.

CIMMYT directed its improvement toward the spring wheat types by making crosses to spring varieties. This material has been fully integrated into its regular spring wheat program.

The principal countries of the developing world which are served by the winter wheat program include the higher areas of Turkey, Iraq, Iran, Afghanistan, Pakistan, India, South Korea and Algeria and certain regions of Japan, Argentina and Chile. In addition, strong ties have been established with the programs in countries of Eastern Europe. Linkages with China are likely to be established in the near future.

In the developed countries, materials have been supplied wherever winter wheats are grown. Requests have been increasing rapidly and every effort is being made to respond insofar as facilities will allow.

In the initial stages of the program, the distribution of materials was shared between O.S.U. and the Turkish National Program. In the current year, the Turkish Program was unable to provide the necessary manpower assistance to prepare and distribute nurseries and these are being sent by O.S.U. alone.

CIMMYT, lacking the sustained support form Turkey and realizing it could not conduct a full international winter wheat program from Mexico, sought the assistance of O.S.U., asking that it become the base of operation for winter wheat improvement. O.S.U. welcomed the opportunity to assist the developing countries, provided supporting funds could be found to finance the expansion of its existing winter wheat program.

It is in this context that the present grant is being requested.

2. Why is the Winter X Spring Hybridization Program of Importance?

Over the past two decades, advances have been made in both winter and spring wheats, leading to such outstanding varieties as Gaines and Hyslop among the winter types, and varieties of the cross 8156 and Anza in the spring types. As a result of the introduction of dwarf habit and the evolution of the semi-dwarf group of varieties, a major jump in yields and adaptation was achieved. Following this breakthrough, slow steady advances were made primarily through greater protection from diseases. Large increases in yield similar to those earlier achieved with the development of semi-dwarf varieties have been rare.

Much of the success of the semi-dwarf varieties arose from the crosses made between diverse germ plasm sources. In the case of winter x spring crosses, we have a classic case of the intermingling of unlike germ plasm. Because of the difficulties attendant on crossing between winter and spring varieties (vernalization, nicking, etc.), breeders in the past were reluctant to make crosses between these groups and they were only infrequently attempted.

The spring wheats and winter wheats have therefore diverged from one another in an evolutionary fashion, and different genetic combinations have been selected. It is noteworthy that several of the world's leading varieties such as Thatcher were derived from winter x spring crosses.

By crossing between these groups, one can expect to create new constellations of characteristics from which significant increases in yield may be made. Further, disease resistance, maturity factors etc. can be transferred from winter to spring and spring to winter.

It has been heartening to note from some of the earlier lines

selected from winter x spring crosses, this theory is being borne out by "results". Yields appear to be considerably higher, disease resistance is being transferred, and maturities suitable for use in different rotations are becoming available.

3. Why is Oregon State a Suitable Center for Winter Wheat Improvement?

Oregon possesses within its boundaries climatic conditions which essentially represent all of the winter wheat areas of the developing countries. Winterhardiness developed in Oregon is adequate for virtually all similar areas. Good disease screening is available. There are conditions under which selection can be made for drought resistance.

To select for these characteristics, three regional research centers are utilized: Hyslop Agronomy Farm near the University site with 1000 mm of rainfall, Pendleton Experiment Station with 400 mm of rainfall, and the Sherman Experiment Station with 250 mm of winter rainfall. At the latter station, selection can be made under a summer fallow system thereby providing an evaluation of variety x management system interactions which is so critical for such dryland areas as the Anatolian Plateau of Turkey. Further, through a "materials-flow" system, the germ plasm in the course of development is alternated and/or simultaniously subjected to the different conditions of the several sites in order to insure that successful lines have wide adaptation to the full range of requirements.

It was on the basis of these similarities of climate that USAID officials wisely supported the OSU involvement in the Turkish National Program at an earlier date. With the growth and experience that has developed at OSU, the University is now in a strong position to provide this vital service to the winter wheat producing countries.

4. The International Distribution of Winter X Spring Wheat Germ Plasm

In 1974, 1034 lines selected from the three experimental sites in Oregon mentioned above, were sent in a uniform screening nursery to some 27 countries totalling 40 different breeding programs. During the current year, increased requests resulted in a distribution of 60 sets of the International Winter X Spring Wheat Screening Nursery (IWSWSN) to 38 countries. Additionally, selected F1, F2, and F3 populations have been sent to those countries with the scientific personnel necessary to use such materials. In the last year the results from these tests were circulated back to the cooperators very rapidly through the use of computer services.

The positive response of cooperators and the overwhelming requests for the nurseries gives a very strong indication of the value placed on the winter x spring crossing program. It is providing a source of wide genetic variation for the wheat breeding programs world-wide. The nurseries provide a mechanism for the exchange of germ plasm and information and has opened up lines of communication between the winter wheat breeders which will assist them in their improvement work.

The strength of the breeding program provides an ideal milieu within which training at the graduate level can be conducted. Oregon State University feels that without this program strength as background, their ability to train young scientists from the developing countries would be only partially effective.

B. Training Program

An integrated part of the winter x spring hybridization program is a graduate training program where young scientists and technicians can obtain M.S. and Ph.D. degrees in cereal breeding and production. The program has been developed to provide an educational base for those young people who will be expected to assume leadership roles or to become engaged in their respective national programs.

Care is taken that sufficient flexibility is permitted in developing the students' academic program and thesis research to provide a meaningful experience without sacrificing the standard or quality of education.

A student who first joins the program is assigned responsibility on the domestic research project. As a result, the student becomes familiar with the practical aspects of a breeding program through actual participation. He is expected to take the leadership and discuss his phase of the program with visiting scientists and with farmers during field days. The importance of the team approach to research is stressed and the student has the opportunity to participate as a team member. As the individual progresses through the program, the research effort will turn toward the M.S. or Ph.D. thesis problem which often, by its very nature, is more specific than the work on the breeding program. Thesis problems are selected in keeping with the student's interest and with regard to the type of research experience which will be most beneficial upon his returning home. A program has been developed where, under certain circumstances, a student may complete his academic work at Oregon State University and return home to conduct his thesis research. Dr. Bill Wright, Director of the Wheat Research and Training Center at Ankara, Turkey, is a member of the Graduate Faculty at Oregon

State University and can direct thesis problems in Turkey. Also the facilities and staff of CIMMYT have provided a similar input in Mexico.

Since Oregon State University has an ongoing cereal research program, faculty and staff are available who are not only concerned with extending our scientific knowledge, but who are also very dedicated to the training of young people. The post doctorate position has proven to be a very positive asset to the total program. Individuals in these positions not only assist students in their graduate studies, but also free the faculty for other responsibilities in the total international program. It provides an excellent opportunity for young Ph.D.'s to gain an understanding and an appreciation for international work.

Emphasis is placed on developing leadership and a professional attitude during a student's program. The scientific approach, integrity in reporting data and dedication are stressed. It is equally important that the student learn to disseminate information; therefore, he is exposed to the philosophy and techniques of extension systems. Futhermore, he comes to realize that there is dignity in getting his hands dirty as he works beside faculty members in the field.

A positive result of the program has been the lasting relationships which have developed between the former students and the faculty and staff. Contacts are maintained through a quarterly newsletter and, in some instances, faculty members are able to visit programs in various countries and assist in developing programs. Such visits not only reinforce the young scientist's confidence in himself, but frequently road-blocks can be removed by visiting with government officials either in the particular country or while the officials are touring the United States.

If a solution is to be found to population-food supply problems, it will be only after there is a sufficient number of highly motivated young scientists with the desired level of training to make the necessary contributions. It will not be possible for any country or organization to provide enough support to the developing countries to solve the food problem. The goal should be the strengthening of the national programs which can only be achieved if there is enough expertise in a given country to get the job done. The need for strong training programs at the M.S. and Ph.D. levels to complement the training received at the various centers such as CIMMYT must receive top priority for this is the ground-work upon which to build strong national programs that can meet existing and future requirements for food. The graduate training program at Oregon State University addresses itself to this need.

In Table I, a list of the former and present students is provided with some additional data for each. Currently nineteen students have received either M.S. or Ph.D. degrees in this program representing ten different countries.

TABLE I. Former and Current Graduate Students in the Cereal Research Project.

Name	Country	Support	Degree	Thesis Title
Michele Abi-Antune	Lebanon	Rockefeller	Ph.D.	Competitive Stress as it Influences the Components of Yield in Winter Wheat
Selman Aktan	Turkey	USAID	M.S.	Nitrate Nitrogen Accumulation in the Soil Profile During a Fallow-Wheat Rotation
Maximino Alcala	Mexico	Rockefeller	Ph.D.*	Evaluation of Parental Performance for Grain Yield in Two Populations of Wheat (Triticum aestivum Vill., Host)
Ali Bayraktar	Turkey	Rockefeller	M.S.*	Inheritance of Plant Height in Barley (Hordeum vulgare L. Emed. LAM)
Pedro Brajcich	Mexico	Rockefeller	Ph.D.	Combining Ability Analysis in Winter X Spring Crosses
Mary Boulger	U.S.A.	OSU Exp. Sta.	M.S.	Relationship Between ATP and Early Germination in Barley
Carlos Camargo	Brazil	USAID	Ph.D.	Aluminium Toxicity in Winter Wheat
Terd Charoenwatana	Thailand	Self	Ph.D.*	Evaluation of Three Methods of Selection in Relation to Yield and Yield Stability in Winter Wheat
Mohamed Chemli	Tunisia	USAID	M.S.*	Effect of Row Spacings, Seeding Rates and Nitrogen Fertilizer Rates on the Agronomic Performance of Yamhill and Hyslop Wheat
Mike Conway	USA	Self	M.S.	The Relationship Between ATP and Early Germination in Wheat
Abderrazak Daaloul	Tunisia	USAID	M.S.*	Evaluation of Early Generation Testing in a Diallel Cross Involving Four Winter Wheat Cultivars
			Ph.D.*	Genetic and Environmental Factors Influencing the Effectiveness of Early Generation Selection in a Diallel Cross Involving Four Winter Wheat Cultivars
Mapangada C. Ganapathy	India	Self	Ph.D.*	Influence of Population Density on Light Interception and Grain Yield Involving Wheat Hybrids

TABLE I. Continued

Name	Country	Support	Degree	Thesis Title
Mengu Guler	Turkey	USAID	M.S.*	Yield and Other Agronomic Characters of Winter Wheat Cultivars as Affected by Five Seeding Rates and Three Different Environmental Conditions
James Henry Helm	U.S.A.	OSU Exp. Sta.	Ph.D.*	Chemical and Genetic Evaluation of High Lysine and Protein in Selected Barley Crosses
Charles Albert Ihrke	U.S.A.	NASA	Ph.D.*	Influence of Chelating Agents on Genetic Recombination in *Zea mays* L.
Erdogan Indelen	Turkey	Rockefeller	M.S.*	Relationship of Composite Versus Pure Line Cultivars with Regard to Grain Yield in Winter Wheat
Don Jones	U.S.A.	Self	Ph.D.*	Influence of Chelating Agents on Cytological Crossing Over and Genetic Recombination in *Zea mays* L.
Don Keim	U.S.A.	OSU Exp. Sta.	Ph.D.*	Drought Resistance in Winter Wheat
Alfonso Lopez	Mexico	Rockefeller	Ph.D.	The Inheritance of Aluminium Tolerance From the Rye and Wheat Parantage in Triticale
Claudio Lovato	Brazil	B. Govt.	Ph.D.	Inheritance of Tolerance by Wheat Cultivars to Magnesium Toxicity
Cesar Martinez	Colombia	Rockefeller	Ph.D.	Study Involving the Inheritance and Mode of Action of Aluminium Toxicity in Rice**
Jose Luis Maya	Mexico	Rockefeller	Ph.D.*	Breeding Potential of Various Sources of Dwarfism in Wheat
Alpaslan Pehlivanturk	Turkey	Rockefeller	M.S.	Effect of Soil Temperature, Seeding Date, and Straw Mulch on the Plant Development and Grain Yield in Two Winter Wheat and Two Winter Barley Cultivars
Clarence Peterson	U.S.A.	ARS	Ph.D.*	Genotype-Environment Interaction in Winter Wheat F1 Progeny

TABLE I. Continued

Name	Country	Support	Degree	Thesis Title
Don Roberts	USA	ARS	Ph.D.*	Inheritance of Disease Resistance in Hops
Rollin Sears	USA	OSU Exp. Sta.	Ph.D.	Improvement of Nutritional Properties in Winter Barley
Surinder Kuman Saini	India	Self	Ph.D.*	Influence of Plant Densities on Gene Action Estimates and Associations in Seven Winter Wheat Parents and Their F2 Progeny
Krisda Samphantharak	Thailand	OSU Exp. Sta.	Ph.D.*	Nitrate Reductase Activity and Inheritance of Grain Protein in Six Barley Cultivars
Polat Solen	Turkey	Rockefeller	M.S.*	Heritability Estimates and Associations for Protein Content and Grain Yield Involving Four Winter Wheat Crosses
Mohammed Vahabian	Iran	Ford-CIMMYT	Ph.D.	Factors Influencing Stand Establishment of Winter Wheat under Dryland Conditions
Kamil Yakar	Turkey	Rockefeller	M.S.	Earliness and Winter-Hardiness in Winter X Spring Crosses

*Degree has been completed

**Thesis research to be conducted at CIAT in cooperation with Drs. Jerry Grant and Peter Jennings.

PROPOSED BUDGET

A. Winter X Spring Wheat Research Program

In Table II, a proposed budget is provided for the Winter X Spring Wheat Research Program. Salary dollars are requested for Dr. McCuistion, one post doctorate, two field technicians, one computer technician and a full-time secretary. The hourly wage item involves the hiring of part time help to assist in planting, crossing, and harvesting material. The OPE figure is a payroll expense to cover retirement, social security and industrial accident insurance. Dr. Kronstad's salary on a quarter time basis will be contributed by Oregon State University.

Funds for international and domestic travel for Drs. McCuistion and Kronstad are requested to provide them with the opportunity to visit those involved in cereal research programs in the cooperating countries. Travel funds will also be utilized for the post doctorate position to work in Mexico. Domestic travel will support the on-going program in Oregon.

Under Research Operations Support, $75,000 is requested for capital equipment expenditures which would be a nonrecurring expenditure. Items to be purchased include plot and head threshers, planters, tractor and trailer, seed cleaners, and items of equipment necessary to maintain an acceptable summer fallow system. Additional funds are requested for the maintenance and up-keep of this equipment. Expenses to be incurred in off-station land rental and preparation are included in the proposed budget. Freight and mailing costs are incurred in the sending of the screening nurseries and germ plasm to the cooperating countries. Also included would be the cost of mailing the summarized data for the screening nurseries to the cooperators. The collection, summary, and analysis of

data is included in the computer costs. Materials purchased under supplies include fertilizer, pesticides, sacks, labels, and other items necessary for conducting the research operation.

B. Training Program

Under the Training Program, Table III, a post doctorate, two technicians, a half-time secretarial position, and hourly wage funds are requested along with OPE costs. Oregon State University will provide the funding for one quarter of Dr. Kronstad's salary under this program. Dr. Floyd Bolton will be budgeted half-time on this program from Oregon State University funds.

Funds to cover thesis related travel are requested along with off-station land rental and preparation costs. Thesis data analysis is covered under computer costs. Materials purchased under supplies would include fertilizer, pesticides, chemicals, labels and other items needed for thesis research.

It is estimated that up to twelve graduate students representing both breeding and production phases can be accommodated at this level of support.

Contributions by Oregon State University to the Total Program

It is understood that Oregon State University will provide plant materials, modern greenhouses, growth chambers, a computer center and accessibility to laboratories for work in physiology, pathology, cytogenetics and soils. In addition, the University will build two field laboratories to meet the needs of this program on the Hyslop Agronomy Farm and the Pendleton Experiment Station. Administrative costs will be covered by the overhead item, a figure to be agreed upon in keeping with the policies of the University and USAID.

TABLE II. Five Year Summary of Proposed Budget for Winter X Spring Wheat Research Program for the Period July 1, 1976 - June 30, 1981.

	1976-1977	1977-1978[1]	1978-1979[1]	1979-1980[1]	1980-1981[1]	Five Year Total
I. Winter X Spring Wheat Research Program						
A. Salaries and Wages						
1. McCuistion	$25,000					
2. Post Doctorate	15,500					
3. Two Technicians (Field Research)	21,000					
4. Technician (Computer & Research)	12,000					
5. Secretary	7,500					
6. Hourly Wages	30,000					
7. OPE (15% for Retirement, Social Security, etc.)	16,650					
8. Overhead	?[2]					
Sub Total A	$128,000[3]	$141,000	$155,000	$171,000	$188,000	$783,000
B. Travel						
1. International	$15,000					
2. Domestic	7,000					
Sub Total B	$22,000	$24,000	$26,000	$29,000	$32,000	$133,000
C. Research Operations Support						
1. Capital Equipment Expenditures	$75,000[4]					
2. Maintenance of Equipment	2,000					
3. Off Station Land Rental and Preparation Costs	10,000					
4. Freight and Mailing for Nurseries	10,000					
5. Computer Costs	5,000					
6. Supplies	35,000					
Sub Total C	$137,000	$68,000	$75,000	$83,000	$91,000	$454,000
Sub Total Part I.	$287,000	$233,000	$256,000	$283,000	$311,000	$1,370,000
Contingency[5]	$21,000	$23,000	$26,000	$28,000	$31,000	$129,000
Total Part I.	$308,000	$256,000	$282,000	$311,000	$342,000	$1,499,000[2]

[1] An increase of 10% has been allowed for each succeeding year's budget.
[2] Overhead figure to be established in keeping with University and USAID policies. Totals will be adjusted accordingly
[3] All Sub-Totals and Totals have been rounded to nearest $1,000.
[4] Nonrecurring expenditures
[5] Because of uncertain economic conditions, a 10% contingency figure is requested (rounded to nearest $1,000).

TABLE III. Five Year Summary of Proposed Budget for the Training Program for the Period July 1, 1976 - June 30, 1981.

	1976-1977	1977-1978[1]	1978-1979[1]	1979-1980[1]	1980-1981[1]	Five Year Total
II. Training Program						
A. Salaries and Wages						
1. Post Doctorate	$15,500					
2. Two Technicians	21,000					
3. Secretary (1/2 time)	3,800					
4. Hourly Wages	10,000					
5. OPE (15% for Retirement, Social Security, etc.)	7,545					
Sub Total A	$58,000[2]	$64,000	$70,000	$77,000	$85,000	$354,000
B. Travel						
1. Thesis Related Travel	$5,000					
Sub Total B	$5,000	$6,000	$6,000	$7,000	$7,000	$31,000
C. Thesis Research Support						
1. Off Station Land Rental and Preparation Costs	$5,000					
2. Computer Costs	1,000					
3. Supplies	$10,000					
Sub Total C	$16,000	$18,000	$20,000	$22,000	$24,000	$100,000
Sub Total Part II.	$79,000	$88,000	$96,000	$106,000	$116,000	$485,000
Contingency[3]	$8,000	$9,000	$10,000	$11,000	$12,000	$50,000
Total Part II.	$87,000	$97,000	$106,000	$117,000	$128,000	$535,000

[1] An increase of 10% has been allowed for each succeeding year's budget.
[2] All Sub-Totals and Totals have been rounded to nearest $1,000.
[3] Because of uncertain economic conditions, a 10% contingency figure is requested (rounded to nearest $1,000).

TABLE IV. Five Year Summary of Proposed Budget for the Winter X Spring Wheat Research Program and the Training Program for the Period July 1, 1976 - June 30, 1981.

	1976-1977	1977-1978[1]	1978-1979[1]	1979-1980[1]	1980-1981[1]	Five Year Total
Total Part I.	$308,000	$256,000	$282,000	$311,000	$342,000	$1,499,000[2]
Total Part II.	$87,000	$97,000	$106,000	$117,000	$128,000	$535,000
GRAND TOTAL	$395,000	$353,000	$388,000	$428,000	$470,000	$2,034,000

[1]An increase of 10% has been allowed for each succeeding year's budget.

[2]Overhead figure to be established in keeping with University and USAID policies. Totals will be adjusted accordingly.

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SUMMARY OF RAC RECOMMENDATIONS TO A.I.D.

PROPOSALS REVIEWED AT THE MAY 24-25, 1976 MEETING

1. Effect of Protein-Calorie Interventions on Human Growth Retardation and Mortality Rates (New) - Institute of Nutrition of Central America and Panama (INCAP). Duration of project, 5 years; estimated cost, $2,288,020; authorization requested for 3 years, $1,500,000. Schweigert, Carter, Linder, Montgomery.*

   Recommendation: That Phase I of the Project be approved for a period of 18 months in an amount approximating $650,000 with the provision that RAC suggestions concerning design, food sources, data analysis, etc., be considered. It is understood that AID staff will utilize advice from RAC member consultation during Phase I, and any proposed extension will require RAC review and action.

2. The Determinants of Developing Country Irrigation Project Problems: A Multifactor Analysis for Improved System Operation and Performance (New) - Cornell University. Duration of project, 3 years; estimated cost, $280,000. D. Peterson, Heady, M. Peterson, Wittnebert.

   Recommendation: That AID staff consider suggestions of the RAC and present a revised proposal at the October (RAC) meeting.

3. Improvement of Winter Wheat for Developing Countries, Based on Hybridization of Spring and Winter Forms (New) - Oregon State University. Duration of project, 3 years; estimated cost, $943,000. M. Peterson, Ludington, D. Peterson, Whitney. 2-621

   Recommendation: That the project be approved with the provisions that (a) objectives be identified more specifically and (b) AID staff review the budget request for appropriate reductions in the total funding.

RAC review subcommittee; chairman underscored.

7. Socio-Economic Analysis of Environmental Health Problems (New) - Resources for the Future. Duration of project, 18 months; estimated cost, $128,042. Heady, Adams, Carter, D. Peterson.

Recommendation: That AID (a) provide limited funds for Dr. Rosenfield to continue her schistosomiasis transmission simulation model applications to data available through WHO in Geneva, and (b) request Resources for the Future to develop a more comprehensive project proposal including complete cost-benefit analyses of schistosomiasis transmission simulation models.

8. The Relationship Between Trade Strategies and Employment Growth (Expansion) - National Bureau of Economic Research. Duration of extension, 15 months; estimated additional cost, $93,169. Heady, Anderson, Montgomery, Wittnebert.

Recommendation: That the budget and time period be extended as requested.

Research on Hemoprotozoal Diseases of Food Producing Livestock in LDCs (Augmentation) - Texas A&M University. Duration of project, 3 years; approved May 1975 at an estimated cost of $1,185,000; estimated additional cost, $75,000. Schweigert, Adams, Connell, Wishik.

Recommendation: That the project augmentation be approved as requested.

World Fertility Survey (Extension) - International Statistical Institute. Duration of extension, 3 years, 3 months; estimated additional cost, $7,500,000. Montgomery, Anderson, Connell, Wishik.

Recommendation: That the project extension be approved for support as proposed.

Enhancement of Lactational Infertility and Infant Nutrition (New) - Johns Hopkins University. Duration of project, 3 years; estimated cost, $986,164. Wishik, Carter, Connell, Linder.

Recommendation:

1. Studies in Phase I in Baltimore be approved with particular focus on thyroid-related side effects encompassing (a) a new immunobiossay test for TRH in human milk, (b) testing for TRH and T4 in blood of women receiving OTRH, (c) testing for elevation of basal prolactin level, (d) assessing ovarian steroid hormone activity, (e) measurement of spontaneous TRH and T4 levels among lactating women, and (f) standarization of laboratory procedures for field trials; and exclusion of nutrition and metabolism studies with corresponding reduction in budget.

2. Budgetary provision be made for possible later field phase in Bangladesh, but not in Chile, including attention to the thyroid question among undernourished women.

3. Prior to initiation of Phase II a revised proposal and budget be prepared on the basis of Phase I results and reviewed by RAC.

4. AID obtain independent consultation on estimation of the potential demographic impact of the proposed method under different levels of effectiveness and practice, and try to obtain results for reporting at the time of RAC review of the Phase II proposal.

931062(9)
PD-AAL-901

PARIS (ORI)

Res. pk 9p

Date: JAN 2 1976

MEMORANDUM FOR: Members of the Research and Development Committee

FROM: TA/PPU, Carl R. Fritz

SUBJECT: Approved Project Identification Document

Attached is a copy of a Project Identification Document (PID) which has been approved by the Assistant Administrator for Technical Assistance for project design and the drafting of a Project Paper (PP):

Project Title: Improvement of Winter Wheat-KPA #2

Project Number: 931-~~17-130-621~~ 17-130-0621

Initial FY: 1977

Responsible Office: TA/AGR

If you have any comments, questions or issues which you would like to see addressed in the PP, please send them directly to the responsible office listed above with a copy to TA/PPU. They should be received by that office within ~~two weeks~~/one month, so that the comments can be addressed by the drafter.

The draft PP will be submitted to the Research and Development Committee for review and comment. However, we encourage your comments as early in the design process as feasible so that the project can be responsive to Agency concerns.

Attachment: a/s

cc: TA Technical Office

MEMORANDUM.

DATE: December 11, 1975

TO : AA/TA, Mr. Curtis Farrar

FROM : TA/PPU, John N. Canning

SUBJECT: PID Clearance

Project Title: Improvement of Winter Wheat-KPA ~~#2~~ 1637

Begins FY 197 7

1. The PID complies with the following AA/TA instructions if the appropriate block is checked. Otherwise, comments are attached.

   [ ] a. Main points of Program Guidance #3 covered. See Attachment.

   [ ] b. AA/TA budget review comments have been incorporated or adequately appealed in the narrative. See Attachment.

   [ ] c. Proposed funding is within limits described in TA Bureau FY 76/77 Program Submission to PPC and/or as amended by current OYB. See Attachment.

   [x] d. Dates of PP development, approval and project initiation are realistic and consistent with the Program Submission.

[ ] 2. This PID has been in TA/PPU and staff work is incomplete because of [ ] TA/PPU work pressure, or [ ] Tech office work pressure. We recommend you return the PID for further review prior to your final decision.

3. We recommend the following action:

   [x] a. Approval

   [ ] (1) subject to _____

   [ ] b. Disapproval or delay for reasons specified in attached.

4. AA/TA Action

   [x] Approved KR

   [ ] Subject to _____

   [ ] Disapproved

Curtis Farrar
Signature

12/15/75
Date

December 11, 1975

Title: Improvement of Winter Wheat - KPA #2

This project proposal was not considered at AA/TA review of July 8, 1975, therefore, blocks 1(a), (b) and (c) are not applicable.

The proposal was recently reviewed by the AA/TA who has given his verbal approval for the concept proposed. If the research project proves to be successful it could have an important impact on wheat production in cold climate areas. This in essence would extend the "Green Revolution" to larger areas of the globe.

Due to potential impact of this proposal in world food production, the AA/TA has agreed to delay other approved activities for FY 1977 to provide funds for this proposal.

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IDENTIFICATION DOCUMENT FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE ("X" appropriate box)
[x] Original [ ] Change [ ] Add [ ] Delete

PID

DOCUMENT CODE 1

2. COUNTRY/ENTITY
Interregional-Research-KPA 2

3. DOCUMENT REVISION NUMBER

4. PROJECT NUMBER
931-11130-G11

5. BUREAU
a. Symbol: TAB
b. Code: 6

6. PROPOSED NEXT DOCUMENT
a. [ ] PRP [x] PP b. DATE mo. 02 yr. 76

7. PROJECT TITLE - SHORT (stay within brackets)
Dr. Earl Leng, Project Manager
[Improvement of Winter Wheat
Oregon State University, Proposed]

8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION
a. INITIAL FY 77 b. FINAL FY 81

9. ESTIMATED COST (life of project)
($000 or equivalent, $1 =) 1.8 million

FUNDING SOURCE	AMOUNT
a. AID APPROPRIATED	1,800
b. OTHER U.S.	
c. HOST GOVERNMENT	
d. OTHER DONOR(S)	
TOTAL	1,800

10. ESTIMATED COSTS/AID APPROPRIATED FUNDS ($000)

a. Appropriation (Alpha Code)	b. Primary Purpose Code	c. Primary Tech. Code	FIRST YEAR FY 77 d. Grant	FIRST YEAR FY 77 e. Loan	ALL YEARS f. Grant	ALL YEARS g. Loan
			700		1,800	
		TOTAL	700		1,800	

11. OTHER U.S. ($000)

a. FUNDING SOURCE	b. FIRST YEAR	c. ALL YEARS
TOTAL		

12. SECONDARY TECHNICAL CODES (maximum six codes of three positions each)

13. SPECIAL CONCERNS CODE (maximum six codes of four positions each)

14. SECONDARY PURPOSE CODE

15. PROJECT GOAL (stay within brackets)

[To improve the production of basic food supplies in LDCs where winter wheat is an important food grain.]

16. PROJECT PURPOSE(S) (stay within brackets)

[To assure that LDCs where winter wheat is a major food grain can obtain and effectively take advantage of the latest improved winter wheat varieties and technologies suitable for increasing yields of high-quality grain, especially on small farms and in environmental conditions which now are marginally productive.]

17. PLANNING RESOURCE REQUIREMENTS (staff/funds)

18. ORIGINATING OFFICE CLEARANCE

Signature: Ben F. Lewis

Title: Director
Office of Agriculture
Bureau for Technical Assistance

Date Signed: mo. 12 day 10 yr. 75

19. Date Received in AID/W, or For AID/W Documents, Date of Distribution
mo. day yr.

I. Summary of the Problem and Proposed Response.

Problem: Substantial improvement in world food supply has resulted from the successful introduction of high yielding, semidwarf wheats in many wheat growing countries. This improvement has been greatest in areas growing spring wheat under irrigation. Although the same techniques have been applied to winter wheats, the development of varieties suitable to low rainfall areas and other marginally productive environmental conditions has not been as effective. Thus, the gap in wheat production between the more favorable environmental areas and the less favored sites is widening. Millions of acres, particularly in the winter-rainfall, summer-drought areas of the Middle East, are still devoted to subsistence level winter wheat culture. There is a pressing need for better varieties and improved production technologies in these areas.

a. Proposed Solution. This project proposes to utilize linkages between CIMMYT, U. S. institutions, and agencies in developing countries to expand the interbreeding of winter wheats and spring wheats, with the aim of developing 1) significantly better winter wheat varieties and 2) additional genetic variability for use in the CIMMYT-led spring wheat improvement programs.

   No environmental problems are expected to arise. No change in energy requirements or source is directly contemplated; research on certain field practices could conceivably lead to energy conservation. In some involved countries, women are cultivators and their situation should be improved by more effective practices.

b. State of the Art. Progress in wheat improvement, particularly the development of high-yielding semidwarf spring wheat, was a fundamental basis of the "Green Revolution" in the mid-1960s. The initial breakthrough resulted from the introduction of the dwarfing, erect-leaved trait into agronomically desirable types, and the subsequent selection of varieties highly responsive to favorable growing conditions. Subsequent improvements have been much less spectacular, and improvement in winter wheats has generally not been as marked as that in the spring forms. Types adapted to rigorous environmental conditions have not been improved sufficiently to bring about major increases in wheat production in such areas.

   Evolutionary divergence, resulting from difficulties in hybridizing the two forms, have led to wide germ plasm variability between the spring wheats as one group and the winter wheats as another.

By crossing the two groups, new genetic combinations can be created which bring the hope of developing new varieties with characteristics superior to those of either parental form. Several of the most widely adapted varieties have been developed through winter x spring crossing.

There is good evidence that, in addition to the vigor expected from wide hybridization, desirable characteristics lacking in one group can be transferred from the other group. Outstanding characters of this nature include drougth resistance (found in winter wheats, desired in spring types) and early maturity with high yield (found in spring types, desired in winter wheat).

The wheat improvement program of CIMMYT is principally oriented to the development of better spring types, but is heavily dependent on cooperation with an area where winter types are adapted, to insure the availability of winter x spring crossing programs. No world center for winter wheat improvement has been established, although the protein quality improvement program at the University of Nebraska has functioned to some extent as a coordinating center for worldwide testing of improved winter types. Adequate support of improvement programs in winter wheat and of the spring x winter crossing aspect of CIMMYT's program appear to require the development of an effective winter wheat program aimed at LDC needs.

c. Brief Project Description.

L) Expected outputs. These will include:

(a) Improved, broadly adapted winter wheat varieties suitable for use on small farms in LDCs.

(b) Breeding stocks useful for further manipulation in country LDC wheat improvement programs.

(c) More diverse genetic material for use in CIMMYT's wheat improvement programs.

(d) Well trained LDC personnel, capable of conducting successful wheat improvement programs.

(e) Establishment of improved linkages between U. S. institutions, CIMMYT and other international centers, and LDC agencies and institutions.

2) Technical and physical resources required.

(a) Three or four professionally qualified wheat improvement specialists, with interest and experience in wheat improvement for LDCs.

(b) Support staff of technicians, assistants, and part-time workers.

(c) Adequate field and laboratory facilities for testing performance under a variety of environmental conditions and for measuring quality.

(d) Special equipment for field and laboratory operations in wheat improvement.

3) Expected disbursement period.

The project is planned to begin about October 15, 1976 (FY 77 funding) and to extend for a period of 5 years.

d. Major Assumptions. Major assumptions pertinent to project success are 1) staffing with highly competent, development oriented personnel, 2) selection of LDC participating countries where both real problems and appropriate institutions exist, 3) active cooperation among all participating agencies, including the appropriate international centers (principally CIMMYT).

e. Realistic Alternatives.

1) CIMMYT could undertake this work from it's core budget or seek other support. This alternative has been considered, but has the disadvantage that CIMMYT's available locations in Mexico are not in a winter wheat zone. Thus CIMMYT would have to establish a branch station, at considerable expense, in another geographic location.

2) This activity could be made part of ongoing centrally funded research on wheat protein content and quality. However, the existing project would have to be restructured and substantial additional funds and staff would be required. This probably would overtax the resources of the present contractor.

f. Beneficiaries. The major direct beneficiaries will be institutions of selected LDCs with prime responsibility for adaptive research and extension of wheat improvement to the rural population. Primary indirect beneficiaries will be the farmers themselves, and particularly the smaller and poorer farmers who are generally not now reached by improved technology. Ultimately, the entire consuming population dependent on wheat as a major cereal food grain will be benefited.

g. Environmental Problems. No environmental problems are expected from the proposed research activities nor from adoption of the improved practices. As disease and insect resistant varieties are put to use, pesticide use should decline. Also, improved varieties will give better ground cover and thus crowd out weeds, reducing demand for herbicides.

h. Energy Considerations. No major change in energy requirements is expected as a direct result of the project, except for energy savings per unit of production which could result from adoption of improved practices.

i. Spread Effect. If this project is successful, it would be expected to have two important spread effects. The first of these would be in individual LDCs, where success of this project should increase the effectiveness of technology adoption with winter wheat. Second, it could provide a model for cooperation between international centers and other research institutions, for the joint solution of basic problems in agricultural development.

II. Financial Requirements and Plans.

a. The best estimate of project cost is 1.8 million for a five-year period. The cost for the first two years (initial fiscal year commitment) is estimated at $700,000.

b. Funding is expected to start in FY 77. Project activities could begin approximately October 15, 1976.

c. This will be a contracted, centrally-funded research project.

III. Development of the Project.

a. Information appears to be available in sufficient scope and quantity to enable formulation of the detailed project. Feasibility of the project and its specific orientation to various LDCs will be determined in consultation with the regional bureaus.

b. The next document planned is a PP to be submitted before February 1, 1976.

c. Consultant services are expected to be required. Regular AID consultants are expected to be available.

d. The major responsibility for preparing the PP will be with TA/AGR/CP. Consultation with relevant U. S. institutions, CIMMYT, regional bureaus, and other TAB offices will be accomplished. The time requirements for AID personnel outside the sponsoring office are estimated to be less than five man days.

IV. Issues of a Policy or Programmatic Nature.

The principal issues related to this project are:

a. Realistic time framework. A five-year duration would be sufficient to expect initial results, but a need for continuation of the activity is likely to extend over an additional 10 to 15 years.

b. The relative importance of winter wheat and the indicated level of centrally-funded AID effort on its improvement require consideration and definition. In this connection, the important complementarity for CIMMYT's spring wheat program warrants consideration.

c. Linkage relations between CIMMYT, U. S. institutions, and LDC agencies may be unfavorably affected unless adequate attention is given to structure of this project and it's linkages. It is recommended that special consultation with existing centrally funded wheat project personnel (University of Nebraska) be accomplished at an early stage of PP preparation.

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COST REIMBURSEMENT CONTRACT WITH AN EDUCATIONAL INSTITUTION

AGENCY FOR INTERNATIONAL DEVELOPMENT NEGOTIATED CONTRACT NO. AID/ta-C-1352

NEGOTIATED PURSUANT TO THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED, AND EXECUTIVE ORDER 11223	TOTAL ESTIMATED CONTRACT COST (943,000 AID) $974,018 (See Articles V and VI)
CONTRACT FOR: Improvement of Winter Wheat for DCs based on Hybridization of Spring & Winter Forms	CONTRACTOR (Name and Address) Oregon State University
PROJECT NO: 931-17-130-621-73	NAME P. O. Box 1086
ISSUING OFFICE (Name and Address) Central Operations Division Office of Contract Management Agency for International Development Washington, D.C. 20523	STREET ADDRESS Corvallis, Oregon 97330
	CITY, STATE, AND ZIP CODE
ADMINISTRATION BY CM/COD/TAB	COGNIZANT SCIENTIFIC TECHNICAL OFFICE TA/AGR
MAIL VOUCHERS (Original and 3 copies) TO: Office of Financial Management Agency for International Development Washington, D.C. 20523	ACCOUNTING AND APPROPRIATION DATA PIO/T NO. 3117302 APPROPRIATION NO. 72-11X1023 ALLOTMENT NO. 402-31-000-00-22-51
EFFECTIVE DATE September 30, 1976	ESTIMATED COMPLETION DATE September 29, 1979

BEST AVAILABLE COPY

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 Oregon with its principal office in Corvallis, agree that the Contractor will 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 11 pages, the General Provisions (Form AID 1420-23C), dated 7-1-75, as revised, and Additional General Provisions (Form AID 1420-23D) dated 7-1-75, as revised.

NAME OF CONTRACTOR Oregon State University	UNITED STATES OF AMERICA AGENCY FOR INTERNATIONAL DEVELOPMENT
BY (Signature of authorized individual)	BY (Signature of Contracting Officer)
TYPED OR PRINTED NAME Hugh E. Jeffery, Jr.	TYPED OR PRINTED NAME V. C. Perelli
TITLE Director of Business Affairs	CONTRACTING OFFICER
DATE September 24, 1976	DATE SEP 28 1976

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 - Negotiated Overhead Rates

Article VIII - Special Provision

Article IX - Alterations in Contract

GENERAL PROVISIONS

The General Provisions applicable to this contract consist of form AID 1420-23C entitled "General Provisions - Cost Reimbursement Contract with an Educational Institution," dated 7-1-75, which, as revised, includes provisions 1 through 40, and form AID 1420-23D entitled "Additional General Provisions - Cost Reimbursement Contract with an Educational Institution," dated 7-1-75, which, as revised, includes provisions 1 through 18.

ARTICLE I. STATEMENT OF WORK

A. Objective

For a period hereinafter set forth in the Schedule, the Contractor shall render technical services to utilize linkages between CIMMYT, U.S. institutions and agencies in DCs to expand the interbreeding of winter wheats and spring wheats to develop better winter wheat varieties and additional genetic variability for use in the CIMMYT-led spring wheat improvement program. The Contractor will: develop and maintain a germplasm bank of superior winter wheat cultivars for hybridization; create greater genetic diversity for improvement of winter and spring type wheats; improve nutritional quality in winter wheat; apply suitable selection pressures to identify superior winter wheat germplasm with improved yield and adaptation; disseminate early generation breeding stocks to selected DC cooperators for further selection; distribute superior agronomic lines and fixed varieties to all cooperators; determine those attributes necessary in winter wheat cultivars to insure soil erosion control, productivity and stability in concert wtih improved dryland cultural practices; train scientists from DCs who have responsibility for adaptive research; and establish new relationships and expand existing ones between DC agencies and institutions, U.S. universities, USDA, USAID Missions, CIMMYT, FAO, foundations and international centers.

B. Work Plan

1. Germplasm Bank

1976-77 -- Exchange superior varieties and advanced lines with major winter wheat breeding centers. Catalog information from place of origin on yield potential, combining ability and other important characters. Begin recording of local observations. Begin computer compilation

of identifying characteristics and major traits useful in selection.

1977-79 -- Continue acquisition of new materials. Continue cataloging of information and recording of local observations. Reach full scale computerized recording of characteristics. Produce and distribute computer print-out of data recorded to date.

2. Genetic Diversity

1967-77 -- Evaluate material produced in Mexico in 1976 crossing season. Make new winter x spring crosses at CIMMYT facility, Toluca, Mexico. Share F1 seed of these crosses between CIMMYT and Contractor. Make top crosses and double crosses in Oregon with F1 material produced in 1976. Evaluate and select segregating materials from previous crosses under Oregon conditions. Assist in CIMMYT evaluation and selection in winter crop at Obregon, Mexico.

1977-79 -- Repeat above cycle. Add new material obtained through germplasm bank activities.

3. Incorporation of Superior Nutritional Properties

1976-77 -- Cross selected winter x spring F1 progenies to high protein and high lysine cultivars selected by University of Nebraska.

1977-79 -- Continue crossing as above. Screen F2 progenies from 1976-77 crosses, send seed of selected lines to University of Nebraska for chemical analysis. Selected material from analysis will be returned to Oregon for further screening, and also sent to CIMMYT for inclusion in the spring wheat breeding program.

4. Selection Pressures

1976-77 -- Segregating progenies derived from crosses previously made will be screened at three test sites. These sites will be selected to encompass a wide range of climates and soil conditions. Selection of

progenies will be based on performance at all three sites, to insure wide adaptation.

1977-79 -- Continue selection as in 1976-77 at same three sites. Distribute superior selections to other cooperators for testing.

5. Early Generation Breeding Stocks

1976-77 -- Populations derived from bulking superior F2 selections will be planted at the three major Oregon test sites and in selected developing countries where active winter wheat breeding programs are in operation. Data on population performance will be returned to OSU for analysis. Populations showing superiority for desired characters will be utilized in new breeding cycles. Beginning with the F3 generation, selections showing superior agronomic traits will be evaluated for gluten strength by the Pelshenke Test and only those lines with acceptable gluten characteristics will be retained for further selection.

1977-79 -- Continue development and early generation testing as above.

6. International Screening Nurseries

1976-77 -- Superior selections developed through the above procedures will be tested (usually in the F4 or F5 generation) in the International Winter x Spring Wheat Screening Nursery (IWSWSN). Three years of IWSWSN trials have been completed in previous work. In 1976-77, it is expected that about 70 trials will be conducted in at least 40 countrie Cooperators will grow the trials, record yields and other agronomic data, and return data field books to OSU. Printed copies of the results will be distributed to all cooperators by mid-February of the year following the test. Superior F5 and F6 lines identified from screening in the IWSWSN will be placed in an International Winter x Spring Wheat Performance

Trial, to be conducted under this project. Agronomic data will be collected for at least two years and over a wide range of environments. Outstanding lines identified will be entered in the IWWPN conducted by the University of Nebraska, to check their suitability for release as varieties.

1977-79 -- Continue screening trials as above. Add or delete cooperating sites in accordance with indicated needs. Continue to advance superior selections through the trial system.

7. Variety x Management Interaction Studies

1976-77 -- Selections and established varieties will be compared under different systems of soil and water management. One of these systems will be early seeding on residual moisture. Characters to be studied will include:

a. ability to emerge rapidly in warm, relatively dry soil;

b. wind-resistant plant types;

c. conservative moisture requirement;

d. satisfactory levels of winter hardiness;

e. greater resistance to pathogens: and

f. yielding ability.

1977-79 -- Continue studies as above, changing varieties under study as evidence on performance is developed.

8. Training

In conjunction with research under this contract, the Contractor is authorized to provide training in wheat research techniques and methodology to students from developing countries, at no cost to A.I.D. for such training, except as may be separately authorized and funded. Trainees from developing countries may be employed as technicians, graduate research assistants, or post-doctoral research associates on contract activities, if they have the necessary professional qualifications.

9. Development of Linkages

1976-77 -- Close working cooperation, including exchange of materials and information, will be established with the University of Nebraska contract wheat research program. The existing cooperation with CIMMYT will be maintained. Frequent visits between institutions will be made to avoid duplication of effort and to facilitate exchange of material and information. Project staff will visit IWSWSN sites.

Contractor will exchange information and breeding materials with U.S. institutions having winter or spring wheat breeding programs.

Project personnel will assist in organizing and conduct of international or regional wheat workshops and conferences, as mutually agreed among agencies concerned.

1977-79 -- Linkages developed will be strengthened and new developing country cooperators added as appropriate. Other activities indicated above will be continued.

ARTICLE II. KEY PERSONNEL

A. The key person which the Contractor shall furnish for the performance of this contract is the following:

Dr. W. Kronstad, Principal Investigator

B. The person specified above is considered to be essential to the work being performed hereunder. Prior to making any change in the key person, 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 approved 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 in the Operational Plan. If A.I.D. 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 propose 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 September 30, 1976, and the estimated completion date of work, including final report(s), under this Contract is September 29, 1979.

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 aritcle of the Schedule entitled "Budget," if applicable.	$629,000
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.	$314,000 995
C. Contractor's Contribution	$ 31,018
Total Estimated Contract Cost	$974,018

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."

Contractor agrees to contribute an amount equal to $31,018 which costs would otherwise be allowable in accordance with Subpart 1-15.3 of

the Federal Procurement Regulations.

ARTICLE VI. BUDGET

Line Item No.	Funds Available FR:9/15/76 TO:9/14/78	Estimated Additional Cost to Completion FR:9/15/78 TO:9/14/79	Total Estimated Contract Cost
1. Salaries & Wages	$207,450	$114,780	$322,230
2. Fringe Benefits	33,192	18,365	51,557
3. Overhead	167,180	94,601	261,781
4. Travel & Transportation	54,000	31,300	85,300
5. Equipment & Materials	129,800	47,050	176,850
6. Other Direct Costs	48,300	28,000	76,300
Grand Total	*$639,922	**$334,096	$974,018

The total funds available and authorized to be expended by the Contractor during the period indicated is $629,000 (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 Line Item amounts as reasonably necessary for the performance of the work.

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.

*Contractor's contribution	$10,922
**Contractor's contribution	20,096
Total Contractor's Contribution	$31,018

the Federal Procurement Regulations.

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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.

*Contractor's contribution	$10,922
**Contractor's contribution	20,096
Total Contractor's Contribution	$31,018

ARTICLE VII. NEGOTIATED OVERHEAD RATES

Establishment of Predetermined Indirect Cost Rates

Pursuant to the provisions of the clause of the General Provisions of this Contract entitled "Negotiated Overhead Rates", a rate or rates shall be established for each of the Contractor's accounting periods during the term of the Contract. The rate for the initial period shall be as set forth below:

	Rate	Base	Period
On Campus	39.5%	*Total Direct Costs	FR: 8/15/76 TO: 6/30/77

*Excluding equipment and subcontracts

Predetermined indirect cost rates for subsequent periods shall be established in accordance with the terms of the "Negotiated Overhead Rates - Predetermined" clause of this Contract.

ARTICLE VIII. SPECIAL PROVISION

Prior to making any visits to developing countries, the contractor will review his plans with TA/AGR. He 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. He will make his own appointments and logistic 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 IX. ALTERATIONS IN CONTRACT

The following modifications are made to the General Provisions of this Contract:

A. Delete General Provision Nos. 7, 8, and 14 in their entirety and in lieu thereof substitute the attachments hereto which are made a part

hereof.

B. Delete Additional General Provision Nos. 3 and 4 in their entirety and in lieu thereof substitute the attachments hereto which are made a part hereof.

C. Add General Provision Nos. 39 and 40 attached hereto.

D. 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.

After approval of the proposed international travel, the Contractor shall provide the cognizant USAID mission advance notification, with a copy tothe Contracting Officer, of the arrival date and flight identifications of AID financed travellers.

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

E. Delete Additional General Provision No. 16 in its entirety.

9310621 (11)
PD-AAL-901

(2)

ENVIRONMENTAL THRESHOLD DECISION

TO: AA/TA, Mr. Curtis Farrar

THRU: TA/PPU, John Gunn

FROM: TA/AGR, Leon F. Hesser

SUBJECT: Environmental Threshold Decision

Project Title: Spring x Winter Wheat
Project #: 931-17-130-621-73
Project Manager: Earl Leng
REFERENCE: Initial Environmental Examination (IEE) contained in Project Statement, p. 21 dated April 2, 1976

On the basis of the Initial Environmental/Examination (IEE) referenced above and attached to this memorandum I recommend that you make the following decision.

XXX 1. The proposed agency action is not a major Federal action which will have a significant effect on the human environment.

_____ 2. The proposed agency action is a major Federal action which will have a significant effect on the human environment, and:

_____ a. An Environmental Assessment is required; or

_____ b. An Environmental Impact Statement is required.

The cost of and schedule for this requirement is fully described in the referenced document.

_____ 3. Our environmental examination is not complete. We will submit the analysis no later than _____ with our recommendation for an environmental threshold decision.

Approved: for C Farrar

Disapproved: _____

Date: DEC 3 1976

Improvement of Winter Wheat for Developing Countries, Based on Hybridization of Spring and Winter Forms (New) - Oregon State University. Duration of project, 3 years; estimated cost, $943,000.

This project reinforces existing cooperative research on improving wheat varieties for LDCs where winter wheat is important. Hybridization of winter spring types will result in improvement of both types by expanding their genetic base. Such hybridization requires integration of field experimentation between winter wheat and spring wheat areas to allow for selection of appropriate characteristics.

This project, strongly supported by CIMMYT and built on AID and Rockefeller Foundation support of Oregon State work in Turkey and elsewhere, provides integration of winter and spring wheat zone breeding programs at Oregon and CIMMYT, respectively. It is tightly linked with the University of Nebraska wheat protein improvement project, and utilizes the International Winter/Spring Wheat Screening Nursery, which provides a working network with LDCs for exchange of breeding materials and research information.

The R&DC reviewed and approved this project on March 24, 1976.

931062 (2)
a-62 PD-AAC-901

Proposal submitted to the May 24-25, 1976 RAC

29p

PROJECT STATEMENT

A. PROJECT SUMMARY.

1. Statistical

Project Title:	Improvement of Winter Wheat for Developing Countries, based on Hybridization of Spring x Winter Forms
New or Extension:	New
Contractor:	Oregon State University (cooperation with CIMMYT and with University of Nebraska contract research project)
Principal Investigators:	Dr. Warren E. Kronstad, Professor Dr. Willis L. McCuistion, Research Associate
Duration:	September 30, 1976 - September 30, 1979
Total Estimated Cost:	$943,000
Funding by Fiscal Years:	FY 76 $324,000 FY 77 305,000 FY 78 314,000
Project Manager:	Earl R. Leng

2. Narrative Summary

This is a proposal to reinforce existing cooperative wheat research work aimed at improvement of this crop for developing countries, with the important new objective of utilizing winter x spring crossing and rigorous selection to develop superior new varieties and breeding stocks for developing countries where winter wheat is an important food grain.

CIMMYT and Oregon State University have developed a close working cooperation in wheat improvement, utilizing hybridization between spring and winter forms as the starting point. CIMMYT utilizes the resulting materials in it's spring wheat improvement program; OSU has been involved with USAID-supported country programs in Turkey and Jordan which have included some selection of improved winter wheats.

Since the USAID program in Turkey is being concluded, it is now proposed to utilize the existing cooperative resources and to strengthen the program, particularly for the objective of developing winter wheats better suited to developing country conditions. Also, a full working partnership will be instituted involving CIMMYT, OSU, and the ongoing AID centrally funded wheat improvement project at the University of Nebraska.

This proposal has the strong endorsement of CIMMYT, which regards the proposed work as essential to the success of it's spring wheat improvement program.

B. RESEARCH PURPOSE AND EXPECTED PRODUCTS.

1. Purpose

This project proposes to utilize linkages between CIMMYT, U. S. institutions, and agencies in developing countries to expand the interbreeding of winter wheats and spring wheats, with the aim of developing 1) significantly better winter wheat varieties and 2) additional genetic variability for use in the CIMMYT-led spring wheat improvement programs.

2. Objectives and Expected Products

The major objectives of the proposed project are to:

(a) Develop and maintain a germplasm bank of superior winter wheat cultivars for hybridization.

(b) Create greater genetic diversity for the improvement of winter and spring type wheats.

(c) Improve nutritional properties in winter wheat by making crosses to lines identified by the University of Nebraska.

(d) Apply suitable selection pressures to identify superior winter wheat germplasm with improved yield and adaptation.

(e) Disseminate early generation breeding stocks to selected developing country cooperators for further selection under their local conditions.

(f) Distribute superior agronomic lines and fixed varieties to all cooperators through the IWSWSN.

IWSWSN - International Winter x spring wheat screening nursery

(g) Determine those attributes necessary in winter wheat cultivars to insure maximum soil erosion control, productivity and stability in concert with improved dryland cultural practices.

(h) Train scientists from developing countries who will have prime responsibility for adaptive research in their own institutions.

(i) Establish new relationships and expand those already existing between developing country agencies and institutions, U. S. universities, USDA, USAID missions, the Rockefeller Foundation, CIMMYT, FAO, and other international and regional plant breeding centers.

C. SIGNIFICANCE AND RATIONALE FOR THE RESEARCH.

1. The Development Problem

Wheat is the most widely cultivated cereal crop in the world, occupying about 17 per cent of the total cultivated land. With rice, it is one of the two most important direct sources of human food.

The "Green Revolution" was principally based on improved varieties of rice and of spring wheat developed in programs oriented toward problems of food deficit areas. CIMMYT has continued the improvement of spring wheat, partly through a crossing program involving spring x winter crosses, but no broad scale program has been developed specifically for the improvement of winter wheats for most developing country areas.

The present local winter wheat varieties being grown in the developing countries are generally tall, late and low yielding because they do not have the genetic potential to respond even under optimum growing conditions. Introduced varieties with higher yield potential often lack seed quality, disease and insect resistance, winter hardiness, or other adaptations to climatic conditions. A large acreage within each of the developing countries belongs to small farmers working in marginally productive areas where yearly yield levels are totally dependent on the environment. If the farmers are to benefit from improved technology, the institutions of selected developing countries with major responsibility for adaptive research and extension of wheat improvement to the rural population must be strengthened.

Success of future spring wheat improvement work is considered by CIMMYT scientists to be dependent on continuing, effective operation of a winter x spring wheat crossing program and

subsequent selection. In their judgment, this can be most effectively achieved through cooperation with a strong U. S. institution located in an area with appropriate climate.

2. State-of-the-Art

Substantial improvement in world food supply has resulted from the successful introduction of high yielding, semidwarf wheats in many wheat growing countries. This improvement has been greatest in areas growing spring wheat under irrigation. Although the same techniques have been applied to winter wheats, the development of varieties suitable to low rainfall areas and other marginally productive environmental conditions has not been as effective. Thus, the gap in wheat production between the more favorable environmental areas and the less favored sites is widening. Millions of acres, particularly in the winter-rainfall, summer-drought areas of the Middle East, are still devoted to subsistence level winter wheat culture.

Types adapted to rigorous environmental conditions have not been improved sufficiently to bring about major increases in wheat production in such areas.

Evolutionary divergence, resulting from difficulties in hybridizing the two forms, have led to wide germplasm variability between the spring wheats as one group and the winter wheats as another. By crossing the two groups, new genetic combinations can be created which bring the hope of developing new varieties with characteristics superior to those of either parental form. Several of the most widely adapted varieties have been developed through winter x spring crossing.

There is good evidence that, in addition to the vigor expected from wide hybridization, desirable characteristics lacking in one group can be transferred from the other group. Outstanding characters of this nature include resistance to stripe and drought (found in winter wheats, desired in spring types) and early maturity with high yield (found in spring types, desired in winter wheat).

The wheat improvement program of CIMMYT is principally oriented to the development of better spring types, but is heavily dependent on cooperation with an area where winter types are adapted, to insure the availability of winter x spring crossing programs. No center for winter wheat improvement has been established, although the protein quality improvement program at the University of Nebraska has functioned to some extent as a coordinating center

for worldwide testing of improved winter types. Adequate support of improvement programs in winter wheat and of the spring x winter crossing aspect of CIMMYT's program appear to require the development of an effective winter wheat program aimed at developing countries needs.

D. PLANS TO DEVELOP LINKAGES AND TO FACILITATE UTILIZATION OF RESEARCH RESULTS.

1. Other Centrally-Funded AID Activities

The chief related activity is the University of Nebraska program on wheat improvement which places special emphasis on nutritional quality. Linkages and exchange of information and breeding materials already exist between the Nebraska project and the proposed activity. The present proposal has been developed by consultation with the University of Nebraska, and care has been taken to insure close working cooperation without unnecessary duplication of efforts.

2. Developing Country Institutions and Activities

Germplasm and breeding materials will be furnished to any developing country's institution or agency which desires them. The International Winter x Spring Wheat Screening Nursery (IWSWSN), which already is established, will provide working linkages and exchange of breeding materials and information with every developing country which is interested in winter wheat improvement or in the winter x spring breeding material. Particular close relations will be maintained with Turkey, which has been the site of field testing for several years. USAIDs in winter wheat growing countries will be encouraged to utilize contractor's expertise in whatever ways are considered appropriate.

3. International Research Centers and Networks

An especially close relationship will be maintained with the wheat program at CIMMYT. In fact, CIMMYT has strongly urged the establishment and support of the proposed activity since they feel the winter x spring crossing program is vital to success of their spring wheat breeding operations. Contractor will also cooperate in training programs involving CIMMYT trainees. Close cooperation with ALAD and its successor institute ICARDA is planned, although events in the ICARDA area of operations may delay active cooperation for a time. The proposed program will be a key element of the international wheat research network (see network chart, page 7).

4. Other Funding Agencies

Rockefeller Foundation supported the establishment of this program and will continue to support a closely related training activity. USDA-ARS has a related program at the same location, and ARS staff will cooperate in the conduct of the proposed research.

5. Other U. S. Institutions

In addition to the special cooperation with the University of Nebraska's AID-funded wheat program, information and breeding materials will be exchanged with all the U. S. institutions having winter or spring wheat breeding programs. The most important of these include the agricultural experiment stations of Arizona, California, Colorado, Indiana, Kansas, Minnesota, New York, North Carolina, Oklahoma, Texas, and Washington.

6. Special Utilization Plans

The IWSWSN is expected to continue as a particularly effective means of exchanging genetic stocks, breeding material and research information.

Visits between institutions and cooperators will be used to avoid duplication of effort and to coordinate the exchange of material and information. Personal contact through visits to countries where the IWSWSN is being grown will improve the quality and amount of data returned.

Contractor will assist and participate in national and international workshops and conferences in cooperation with the above mentioned agencies. Furthermore, upon request and funding by USAID missions, OSU scientists will provide inputs to developing countries to strengthen national cereal research programs.

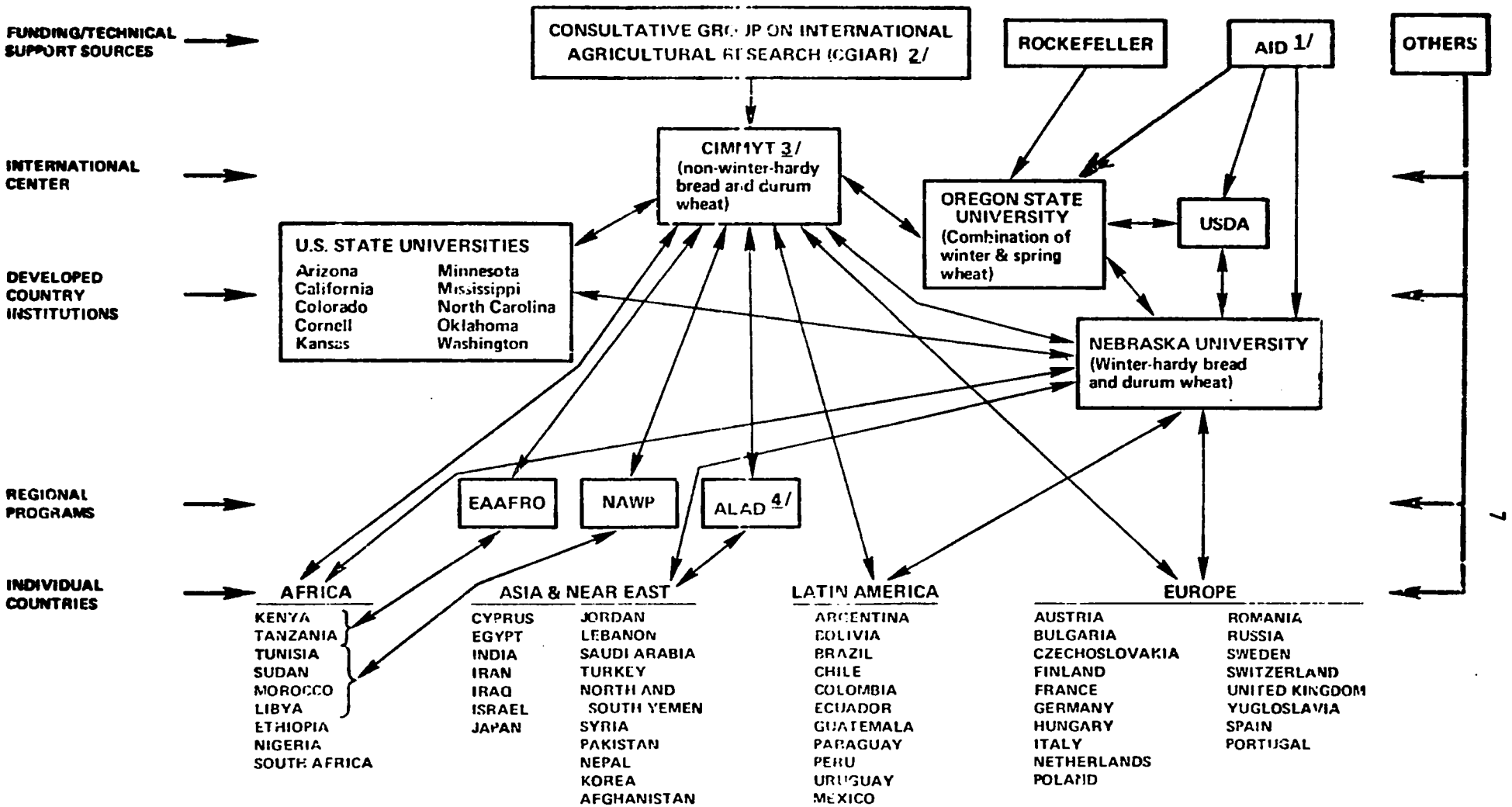
Research results will be published in appropriate reports, bulletins, and scientific journals.

E. MANAGEMENT CONSIDERATIONS.

No unusual management problems are expected to arise in connection with this project. It is similar in concept and design to other centrally funded crop improvement research projects.

Noncontract funded inputs will be substantial. These will include approximately six- worker/months effort by one of the principal investigators, cooperation by other staff members, office and laboratory facilities, some equipment, and extensive field facilities.

INTERNATIONAL WHEAT RESEARCH NETWORK



1/ AID IS SHOWN APART IN ORDER TO INDICATE FUNDING LINKAGES TO U.S. RESEARCH INSTITUTIONS. AID ALSO CONTRIBUTES THROUGH BILATERAL ARRANGEMENTS TO INDIVIDUAL COUNTRY PROGRAMS. OTHER DONOR MEMBERS OF CGIAR HAVE CORRESPONDING ADDITIONAL FUNDING LINKAGES.

2/ THE DONOR MEMBERS SUPPORTING CIMMYT ARE CGIAR, FORD FOUNDATION, ROCKEFELLER FOUNDATION, GERMANY, UNDP AND IBRD. OTHER CGIAR DONORS INCLUDE BELGIUM, DENMARK, FRANCE, JAPAN, KELLOGG FOUNDATION, NETHERLANDS, NORWAY, SWEDEN, SWITZERLAND, UNITED KINGDOM. ALL CGIAR MEMBERS ARE POTENTIAL FINANCERS OF OPERATING LINKAGES WITHIN THE NETWORK.

3/ THE LINKS BETWEEN CIMMYT AND THE INDIVIDUAL COUNTRIES TAKE THE FORM OF INFORMATION AND MATERIALS EXCHANGE, THE CONDUCT OF SEMINARS AND WORKSHOPS, COOPERATIVE RESEARCH PROJECTS, ADVISORY SERVICES AND TRAINING.

4/ ALAD ALSO SERVES SEVERAL AFRICAN COUNTRIES.

Coordination with wheat research under contract with the University of Nebraska and at CIMMYT will be accomplished by frequent communications and meetings. AID project management staff will actively participate in these coordination activities.

It is expected that this will be a sole source procurement project since the research proposal was unsolicited and since the expected contractor has predominant capability for conduct of the proposed activities.

F. PROJECT BACKGROUND DESCRIPTION.

OSU has been engaged in winter wheat improvement for nearly 75 years. It's association with CIMMYT originated in 1966 when scientists from OSU working under a USAID contract, introduced the semidwarf spring type wheats developed by CIMMYT in Mexico into the coastal areas of Turkey. With the subsequent development of the Wheat Research and Training Center in Turkey by the Rockefeller Foundation, a close association between CIMMYT and OSU scientists was established. The OSU team was supported by a USAID grant to develop a package of cultural practices to increase winter wheat production under dryland conditions. Further linkages between these three institutions have been developed through the identification of young scientists from the developing countries for graduate training in cereal breeding at OSU. From these associations the various agencies became aware of the potential benefits each could derive from an integrated endeavor to achieve a degree of excellence in wheat improvement with emphasis on small farms which are marginally productive due to environmental conditions.

The winter and spring concept of increasing genetic variability to improve both winter and spring wheats was developed by the late Dr. Rupert, a Rockefeller Foundation scientist assigned to CIMMYT. The initial program was based in Chile and subsequently moved to Davis, California. When it became apparent that the environmental conditions in Oregon were more similar to the winter wheat growing conditions observed in the developing countries and with the associations already established between CIMMYT and OSU, the program was transferred to Oregon in 1971. It was on the basis of similarities of climate that USAID supported the OSU involvement in the Turkish National Program at an earlier date. It had been hoped that CIMMYT in Mexico would handle the spring wheat improvement phase while the Turkish National Program and OSU would concentrate on the winter dimension. Unfortunately, the Turkish program was not able to provide an international scope to the program. As a result, CIMMYT, lacking the sustained support from Turkey and realizing it could not conduct a full international winter wheat program from Mexico has sought a greater involvement by OSU, requesting that it become a center of operation for winter wheat improvement.

With this strengthening of the mutual research activities between CIMMYT and OSU coupled with the already existing linkages with the protein quality program at the University of Nebraska, a positive and complementary total wheat improvement program can be created. As superior nutritional strains of wheat are identified and different genetic sources of high protein emerge from the Nebraska project, they will be incorporated into the winter x spring program. The winter wheat germplasm will then include superior nutritional properties in addition to the desired agronomic traits. A similar situation will exist for spring type wheats developed through the CIMMYT program.

The winter x spring program takes advantage of the vastly different environmental conditions and disease complexes observed between Oregon and Mexico. The first crosses are made in Toluca, Mexico in May, where the vernalization and day length requirements for winter wheat cultivars can be satisfied, thereby providing the opportunity to "nick" with spring type wheats.

Thus, the problem which has previously isolated winter and spring wheats is avoided. Resulting F1 seed is divided and planted in October at CIANO in Obregon, Mexico and Corvallis, Oregon. The F1 material at CIANO is integrated into the spring wheat improvement program by top and double crossing in spring type material. Thus, the spring habit is retained while transferring only the desired attributes from the winter wheat parent. After subsequent evaluation and selection, the advanced lines are disseminated throughout the existing international nurseries coordinated by CIMMYT to the spring wheat growing developing country programs. Due to the earlier maturity and different disease complexes, scientists from OSU can collect valuable agronomic information from the plots in Mexico just prior to the crossing season in Oregon, providing an additional dimension for deciding on the most productive crosses.

In Oregon, the winter x spring F1 seed is top and double crossed back to winter type wheats. In conducting subsequent evaluations, three major testing sites are utilized for screening segregating populations. These include: The Hyslop Agronomy Farm near Corvallis (1000 mm rainfall), Pendleton Experimental Site (400 mm rainfall), and the Sherman Experiment Station (250 mm rainfall). These sites not only provide varying degrees of moisture stress, but also allow selection of winter hardy lines and those resistant to the major diseases observed in the winter wheat producing regions of the world. In addition, the Sherman Experiment Station allows for selection under summer fallow management systems. This is critical in dryland areas like the Anatolian Plateau in Turkey which typifies dryland wheat producing areas in most developing countries. A significant input to the dryland wheat production effort is the recent

awarding of an AID 211(d) grant to OSU, thereby strengthening the expertise in dryland agriculture production. This will benefit the breeding program as well since the management system is so vital in developing suitable varieties or germplasm. Further resources in the area of weed control in both dryland and high rainfall areas can be obtained through the cooperative effort between the breeding program and the IPPC (International Plant Protection Center) also funded by AID and based at OSU.

When considering the three diverse testing sites, it should be noted that through the "material flow" system, the germplasm in the course of development is alternated and/or simultaneously subjected to various environmental stresses. Thus, successful lines will have favorable responses to a full range of requirements. This approach has been the key to the wide adaptation of the materials developed in Mexico for spring wheat. Wheat breeders in Oregon are in a unique position in being able to do the same thing for winter wheats. Nowhere else in the United States and few places in the world would such an ideal situation be found.

From 400 to 600 lines representing the F5 and F6 generations are included each year in the IWSWSN along with suitable check varieties. This nursery is currently being sent from Oregon to 65 breeding programs in 40 different countries. Elite lines identified in Oregon, along with the screening nursery, are sent back to Mexico for recycling, thus providing additional germplasm for the spring wheat improvement program. To some of the same countries, outstanding early generation populations are also sent, particularly where specific limiting factors have been identified such as aluminum toxicity in Brazil.

Accomplishments have included:

1. The systematic crossing between winter and spring wheat cultivars has greatly increased the genetic potential for both winter and spring wheats. The most promising lines now emerging in the CIMMYT program for the improvement of spring wheats have resulted from winter x spring crosses. A similar situation exists for winter wheats in Oregon.

2. The growing conditions observed in Mexico at the Toluca site have permitted the extensive crossing of winter and spring wheat cultivars.

3. The different environmental conditions, disease complexes and growing season observed between Mexico and Oregon have permitted a very efficient program to be conducted for the improvement of both winter and spring wheats.

4. Research activity at the University of Nebraska has identified superior nutritional material and provided significant linkage to the winter x spring wheat improvement program.

5. Through the use of the computer and the development of a useful format for summarization of data at OSU, results of the first IWSWSN have been returned to the cooperators prior to their crossing season.

6. The IWSWSN made up of superior lines is an excellent way to disseminate germplasm which is being used effectively by the developing countries.

7. Results from the first two screening nurseries suggest that the germplasm selected in Oregon retains the desired attributes when grown in the developing countries.

8. The positive response of cooperators and the overwhelming requests for the nurseries give a very strong indication of the value placed on the winter x spring program by the scientists in the developing countries. Not only is the nursery provided a mechanism for the exchange of germplasm and information, but in concert with the University of Nebraska program and CIMMYT, it has opened up lines of communication between the winter and spring wheat breeders throughout the world.

Furthermore, the strength of the breeding program has provided an ideal milieu within which to train students from the developing countries at the graduate level. Currently 25 developing country students have been, or are now participating in this research program. Many have returned home after completing the M.S. or Ph.D. degree and are now the cooperators in the winter x spring program in their respective countries. It is apparent that without the program strength as background, the university's ability to train young, dedicated scientists from the developing countries would be only partially effective.

G. PROJECT DESIGN AND METHODS.

1. Germplasm Bank 5%

In order to make crosses directed toward specific objectives, it is necessary to accumulate and maintain a working genetic pool made up of superior winter wheat cultivars which cover a wide range of adaptability. Through the network of cooperation that has already been formed between developing country agencies and institutions, U. S. universities, USDA, USAID missions, the Rockefeller Foundation, CIMMYT, FAO and other international and regional plant breeding centers, superior varieties and advanced lines will be exchanged. Information from the country of origin as well as local observations concerning combining ability, yield

potential, adaptation, resistance to various diseases, and responses to other limiting factors will be catalogued. Utilizing the computer to record and cross reference such information, a data bank will be compiled to give the plant breeder ready access to the names of varieties or lines which can be effectively utilized in crosses directed toward a particular goal.

2. Genetic Diversity 25%

There is a concern that future improvements in yield levels and adaptability will be only minor if scientists are limited to the use of existing germplasm and are restricted to intracrossing in the spring or winter types. However, results have shown that a much greater genetic diversity can be achieved through the intercrossing of the two types. The CIMMYT field staff will make the initial winter x spring single cross combinations at Toluca, Mexico. Spring wheat parental sources will be carefully chosen to incorporate important characters such as a wide maturity range, head fertility, agronomic type, new dwarf genes, and genes for disease resistance not available in the winter wheats. The winter wheat parents will provide new genetic sources for winter hardiness, frost and drought tolerance, yield potential and stability, shattering resistance, bread making quality and different types of disease resistance not presently available in spring wheats. F1 seed of these single crosses will be equally divided between CIMMYT and OSU. CIMMYT will utilize these F1 populations in subsequent top and double crosses with spring type wheats. Conversely, with emphasis on winter wheat improvement, OSU will make top and double crosses to superior winter types. Plants in the segregating populations will have diverse genotypes capable of adapting to a range of environments and limiting factors.

Through mutual agreement with CIMMYT, OSU has become a base of operation for winter wheat improvement; however, both the spring and winter wheat improvement programs are closely correlated and a wealth of beneficial information can be obtained through close cooperation. Prior to the crossing season in Oregon, OSU scientists visit Obregon, Mexico where the F1 population concerning agronomic type, fertility and disease reactions to be used in matching winter parents to the same F1s during the subsequent crossing season in Oregon. Scientists from CIMMYT routinely visit OSU before harvest to select plants from segregating populations which have desirable characteristics needed to improve spring wheats. These populations are incorporated into CIMMYT's program and are utilized in generating new genetic combinations.

3. Incorporation of Superior Nutritional Properties 5%

Selected F1 populations resulting from spring x winter single crosses made in Mexico will be top and double crossed in Oregon to high protein cultivars identified by the University

of Nebraska. After preliminary screening at OSU, superior F2 progeny will be sent to the University of Nebraska for further testing. Lines with exceptional nutritional properties will be identified and returned to Oregon where diversified selection pressures will be applied in subsequent generations to insure that lines with enriched nutritional properties will have wide adaptation. By combining desired agronomic traits with improved nutritional properties, scientists in the developing countries will have a better opportunity of obtaining improved nutrition when selecting for yield and adaptation. This avoids the difficulty frequently encountered in the developing countries where chemical analyses are impossible to obtain.

4. Selection Pressures 15%

Specific climatic conditions and those factors which limit winter wheat production in the developing countries can be found somewhere within the boundaries of the State of Oregon. There are over 400 different soil types varying from strongly basic to strongly acid in reaction. Winter temperatures in coastal areas are mild enough to accommodate the growing of of fall sown wheats; but in eastern Oregon are so severe as to require a high degree of winter hardiness. The rainfall pattern is predominantly a mediterranean type with annual amounts varying from less than 250 mm to over 1000 mm. In the dryland areas, drought resistance is an important consideration and the development of cultivars in relation to an exacting management system is required. Every major disease attacking winter wheat is present with the exception of stem rust. Resistance to this disease can be effectively identified in Mexico as a part of the winter x spring program. Data already obtained from the entries in the first and second IWSWSN also suggest that many of the different physiological races of major diseases present in developing countries are found in Oregon.

To insure wide adaptation, superior progeny from segregating populations identified at one experimental site will be subsequently tested at the other two locations. Due to the large environmental differences observed between sites, the resulting germplasm will be exposed to many of the limiting factors common to winter wheat areas of the world. It should be noted that advanced lines which have been selected for their yield potential under Oregon conditions do in fact have wide adaptation in the developing countries.

5. Early Generation Breeding Stocks 10%

The F1 top and double crossed populations are selected on an individual plant basis using the pedigree method. In addition, superior populations are bulked following plant selection and sufficient seed is available for further resting as F2s at a number of locations. Each F2 bulked population is planted at the 3 major Oregon Experimental Stations. The remaining seed is disseminated to selected developing countries where facilities and staff are available for further selection under local conditions.

Cooperators in areas with particular problems consistently limiting wheat production, such as special types of winter killing, late spring frosts, drought conditions, specific disease attack, etc., will be asked to assist in screening additional genetic material for resistance to those characters. Provision of these early generation stocks is extremely important to the cooperator and can also benefit the OSU and CIMMYT programs as data are returned indicating the best populations under unique conditions.

When early generation quality screening is used along with agronomic and pathological selection, a higher percentage of the lines have desirable quality in the advanced generations. The wheat quality evaluation of lines starts with the F3 individual selections (seed from F2 selected plants) and is continued through the F4 and F5 generations.

In making winter x spring crosses tremendous variability in gluten strength results due to the wide variation in germplasm. Following harvest, seed of all selected plants are first tested for grain type and only those with plump kernels are maintained. These individual plant samples are then evaluated for gluten strength by the Pelshenke Test. CIMMYT has proven this test to be a very satisfactory screening method for separating strong, intermediate, and weak gluten types. Only lines with acceptable gluten strength in keeping with hard or soft wheat types are retained for further evaluation. Visible kernel characteristics reflecting the gluten strength would be a major asset to the breeder in the developing countries.

6. Screening Nurseries 20%

Selections from preliminary yield trials at all Oregon locations, based on yield performance, agronomic traits and disease reactions, are advanced to the IWSWSN for evaluation in many winter

wheat areas. Distribution of the second IWSWSN covered 40 cooperators in 28 different countries. During the current year, the third IWSWSN for the 1975-76 crop season was sent to 65 cooperators in 40 countries. Some additional nursery sites such as the People's Republic of China, Northern India and the mountainous region of Bangladesh must be arranged to complete coverage of all the major winter wheat growing areas.

Return of the experimental data following harvest is essential for proper evaluation of the material. Personal contact through visits to different cooperators will improve the quality and amount of data returned. Receipt of all data is requested prior to the end of the year in which the nursery is grown. The data is completely summarized by computer and superior lines identified. A printed copy of the results is returned to the cooperator by mid-February of the following year. This provides the cooperator with complete data prior to the crossing period allowing use of superior lines in new combinations. This summary is a valuable tool for OSU and CIMMYT in planning their crossing list of new hybrid combinations.

Superior F5 and F6 lines with good general adaptation which have been screened through the IWSWSN will be placed in a new International Winter x Spring Wheat Yield Trial to be distributed by OSU. Agronomic data will be accumulated on such lines covering several crop years and a wide range of environments. This data will then be used to select superior lines for release as varieties to be submitted to the IWWPN distributed by the University of Nebraska.

7. Variety x Management Interaction 10%

Since the majority of the winter wheat production in the developing countries is under limited rainfall conditions, a management system to conserve moisture must be employed if successful yield levels are to be obtained. The summer fallow system evolved in the Pacific Northwest has been successfully introduced into Turkey and Jordan. Experience has shown that if maximum production is to be achieved, varieties must be developed in keeping with the particular system. Furthermore, such an interaction is even more critical in preventing or reducing soil erosion either by wind or water, which has long been a major problem plaguing areas of winter wheat production.

One cultural practice which has been clearly identified as being significant in dryland management systems is that of seeding early in residual moisture. This not only results in higher yield levels, but is a major deterent to soil erosion. However, if this practice is to be effective, cultivars must be developed which have certain desired attributes not found in existing varieties. These involve factors which influence stand establishment, including rapid emergence in warm, relatively dry soils, semierect seedlings having a proper balance of tillers and leaves to lessen damage by wind, improved winter hardiness, varieties that conservatively use limited water supplies, greater ability to compete with weeds,emergence through compact, residue covered soil, and greater resistance to pathogens.

In the winter wheat producing developing countries, the need for developing cultivars in keeping with management systems to reduce soil erosion either by wind or water cannot be overstated. These areas have already lost a substantial amount of an irreplaceable resource base which they can ill afford in terms of present food needs to say nothing of future requirements.

8. Training 5%

The scope and size of the winter x spring hybridization program will be ideal for training qualified scientists and technicians in cereal breeding and production. The program has been developed to provide an educational base for those young people who will be expected to assume leadership roles in their respective national programs. The students will work directly in the winter x spring research program receiving assigned responsibilities. They will thus become familiar with all practical aspects of wheat breeding. They learn to disseminate information by being exposed to the philosophy and techniques employed in extension systems. The students are expected to assume leadership roles and discuss their phase of the program with visiting scientists and with farmers during field days.

Thesis problems for students from developing countries will be selected in keeping with their personal interests and with regard to the type of research experience which will be most beneficial upon their return home. Under certain circumstances, a student may complete his academic work and return

home to conduct his thesis research. This is possible provided that a well qualified scientist, approved by the graduate faculty, is available to direct the student's thesis work in his home country. Examples of this arrangement presently exist in Turkey and Mexico.

The postdoctorate positions will be a considerable asset to the total program. Individuals in these positions not only assist students in their graduate studies, but also free the faculty for other responsibilities in the total international program. Such experience provides an excellent opportunity for young Ph.D.s to gain an understanding and an appreciation for international work.

9. Linkages 5%

Communication and cooperation between agencies and programs throughout the world form the cornerstone of success in an international wheat improvement program.

This project already has well developed linkages with USDA, other U. S. universities, and international and regional research institutes including CIMMYT, ICARDA, the Wheat Research and Training Center in Ankara, Turkey, and African and central and South American programs. The existing active cooperation with CIMMYT will be further strengthened, and closer coordination will be effected with the University of Nebraska's contract project.

H. WORK PLANS FIRST TWO YEARS.

1. Germplasm Bank

1976-77 --- Exchange superior varieties and advanced lines with major winter wheat breeding centers. Catalog information from place of origin on yield potential, combining ability and other important characters. Begin recording of local observations. Begin computer compilation of identifying characteristics and major traits useful in selection.

1977-78 --- Continue acquisition of new materials. Continue cataloging of information and recording of local observations. Reach full scale computerized recording of characteristics. Produce and distribute computer print-out of data recorded to date.

2. Genetic Diversity

1967-77 --- Evaluate material produced in Mexico in 1976 crossing season. Make new winter x spring crosses at CIMMYT facility, Toluca, Mexico. Share F1 seed of these crosses between CIMMYT AND CONTRACTOR. Make top crosses and double crosses in Oregon with F1 material produced in 1976. Evaluate and select segregating materials from previous crosses under Oregon conditions. Assist in CIMMYT evaluation and selection in winter crop at Obregon, Mexico.

1977-78 --- Repeat above cycle. Add new material obtained through germplasm bank activities.

3. Incorporation of Superior Nutritional Properties

1976-77 --- Cross selected winter x spring F1 progenies to high protein and high lysine cultivars selected by University of Nebraska.

1977-78 --- Continue crossing as above. Screen F2 progenies from 1976-77 crosses, send seed of selected lines to University of Nebraska for chemical analysis. Selected material from analysis will be returned to Oregon for further screening, and also sent to CIMMYT for inclusion in the spring wheat breeding program.

4. Selection Pressures

1976-77 --- Segregating progenies derived from crosses previously made will be screened at three test sites. These sites will be selected to encompass a wide range of climates and soil conditions. Selection of progenies will be based on performance at all three sites, to insure wide adaptation.

1977-78 --- Continue selection as in 1976-77 at same three sites. Distribute superior selections to other cooperators for testing (see below).

5. Early Generation Breeding Stocks

1976-77 --- Populations derived from bulking superior F2 selections will be planted at the three major Oregon test sites and in selected developing countries where active winter wheat breeding programs are in operation. Data on population performance will be returned to OSU for analysis. Populations showing superiority for desired characters will be utilized in

new breeding cycles. Beginning with the F3 generation, selections showing superior agronomic traits will be evaluated for gluten strength by the Pelshenke Test and only those lines with acceptable gluten characteristics will be retained for further selection.

1977-78 --- Continue development and early generation testing as above.

6. International Screening Nurseries

1976-77 --- Superior selections developed through the above procedures will be tested (usually in the F4 or F5 generation) in the International Winter x Spring Wheat Screening Nursery (IWSWSN). Three years of IWSWSN trials have been completed in previous work. In 1976-77, it is expected that about 70 trials will be conducted in at least 40 countries. Cooperators will grow the trials, record yields and other agronomic data, and return data field books to OSU. Printed copies of the results will be distributed to all cooperators by mid-February of the year following the test. Superior F5 and F6 lines identified from screening in the IWSWSN will be placed in an International Winter x Spring Wheat Performance Trial, to be conducted under this project. Agronomic data will be collected for at least two years and over a wide range of environments. Outstanding lines identified will be entered in the IWWPN conducted by the University of Nebraska, to check their suitability for release as varieties.

1977-78 --- Continue screening trials as above. Add or delete cooperating sites in accordance with indicated needs. Continue to advance superior selections through the trial system.

7. Variety x Management Interaction Studies

1976-78 --- Selections and established varieties will be compared under different systems of soil and water management. One of these systems will be early seeding on residual moisture. Characters to be studied will include:

a. ability to emerge rapidly in warm, relatively dry soil;

b. wind-resistant plant types;

c. conservative moisture requirement;

d. satisfactory levels of winter hardiness;

e. greater resistance to pathogens; and

f. yielding ability.

1977-78 --- Continue studies as above, changing varieties under study as evidence on performance is developed.

8. Training (both years)

Students from developing countries, who plan to work in wheat improvement, will be trained in the program. Emphasis will be placed on selection of research topics directly applicable to problems of the student's home area. Close contact will be maintained by OSU staff with the various developing countries to insure that appropriate training is given. Young Ph.D.s from developing countries will be employed as postdoctorates to receive further research experience.

9. Development of Linkages

1976-77 --- Close working cooperation, including exchange of materials and information, will be established with the University of Nebraska contract wheat research program. The existing cooperation with CIMMYT will be maintained. Frequent visits between institutions will be made to avoid duplication of effort and to facilitate exchange of material and information. Project staff will visit IWSWSN sites.

Project personnel will assist in organizing and conduct of international or regional wheat workshops and conferences, as mutually agreed among agencies concerned.

1977-78 --- Linkages developed will be strengthened and new developing country cooperators added as appropriate. Other activities indicated above will be continued.

I. GENERAL APPRAISAL.

This project has been given top level priority by the Crop Production Division and Office of Agriculture. In addition to the need for developing improved winter wheat varieties for developing countries, the strong support provided to the CIMMYT wheat program is considered essential to the success of further spring wheat improvement.

The proposing institution has a strong staff with excellent experience in developing countries. Field facilities are outstanding, particularly in regard to the range of soil and climatic conditions which are available within the state.

The proposal is sound in design and cost estimates are appropriate to the level of effort intended. The three-year time framework proposed for the initial project is recognized as too brief to reach full results, and it should be anticipated that extension would be desirable if progress is made as expected.

A detailed review of the project should be conducted at the end of the second project year, to assess progress and to determine the need for possible extension.

J. ENVIRONMENTAL CONSIDERATIONS.

No environmental problems are expected for the proposed research activities nor from adoption of the recommended practices. Improved cultural practices, new plant types, new sources of disease resistance, and better adaptation may reduce the use of pesticides and herbicides. As cultural practices and adapted varieties are introduced, soil erosion due to wind and water should be substantially curtailed.

WORK PLAN - CONTRACT BUDGET AND LIFE-OF-PROJECT COST ESTIMATE

	First Two Fiscal Years FY 77 Est. Cost		FY 788 Est. Cost		To Project Completion FY 79	Total Estimated Life of Project Cost
INPUTS	M/M	$(000)	M/M	$(000)	$(000)	$(000)
1. Salaries	122	103.5	122	114.5	123	341
2. Fringe Benefits	78	12.5	78	14.0	15	41.5
3. Indirect Costs (45.52%)	122	47.0	122	51.5	56	154.5
4. International Travel		20		22	24	66
5. Domestic Travel		10		11	12	33
6. Equipment		60		15	0	75
7. Materials & Supplies		25		27.5	30	82.5
8. Field site expense		15		16.5	18	49.5
9. Other direct costs		26		27.5	31	84.5
0. Publications		5		5.5	6	16.5
Total Cost by Inputs		324		305	315	944
OUTPUTS						
1. Germplasm Bank		16.2		15.25	15.75	47.2
2. Genetic diversity		81.0		76.25	78.75	236.0
3. Nutritional properties		16.2		15.25	15.75	47.2
4. Selection pressures		48.6		45.75	47.25	141.6
5. Breeding stocks		32.4		30.50	31.50	94.4
6. Screening nurseries		64.8		61.00	63.00	188.8
7. Management interactions		32.4		30.50	31.50	94.4
8. Training		16.2		15.25	15.75	47.2
9. Linkage development		16.2		15.25	15.75	47.2
Total costs by Outputs		324		305	315	944

AID [illegible]

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 76 to FY 78
Total U. S. Funding _____
Date Prepared: _____

Project Title & Number: Improvement of Winter Wheat for Developing Countries Based on Hybridization of Sping x Winter Forms

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To increase quantity and nutritional value of food crops in developing countries.	Measures of Goal Achievement: 1. Significant increase in per capita production of major food crops in LDCs. 2. Improvement of nutritional quality of major LDC food crops.	1. Official production and population satistics (FAO, Foreign Agricultural Service estimates). 2. Nutritional quality surveys in LDCs.	Assumptions for achieving goal targets: 1. LDCs will actively attempt to expand food crop production. 2. Nutritional quality can be improved without major constraints on yield.
Project Purpose: To make available to LDCs high-yielding, nutritious varieties of wheat with multiple resistance to moisture and temperature stresses, diseases and insects, together with improved practices for their cultivation.	Conditions that will indicate purpose has been achieved: End of project status. 1. New, superior varieties available to farmers in LDCs. 2. Research and development activities in wheat effectively assumed by LDC agencies and international institutions and linked by communications network.	1. Publication and reports of LDC governmental agencies; on-site inspections of seed supply. 2. On-site inspection and review by AID/W personnel and consultants.	Assumptions for achieving purpose: 1. Solutions can be found to major constraints. 2. Agriculture extension services are able and willing to promote proven practices. 3. LDC research institutions develop adequate capabilities.
Outputs: 1. Identification of superior germ plasm. 2. Incorporation of desirable traits into broadly-adapted varieties suitable for LDC use. 3. Evaluation of improved varieties and practices in LDCs. 4. Training of LDC personnel in wheat research. 5. Establishment of effective linkages with LDC agencies.	Magnitude of Outputs: 1. Not quantifiable. 2. At least 2 superior varieties for each major agroclimatic region. 3. At least 1 test location in each major winter wheat growing LDC. 4. Total of 10 LDC trainees completing training. 5. Linkages with 2 international centers and at least 5 LDC institutions.	1. Reports by contractor. 2. Reports by contractor, USAIDs, LDC cooperators, and international agencies. 3. Same. 4. Contractor reports. 5. Contractor reports, communications and reports from LDCs and international agencies.	Assumptions for achieving outputs: 1. LDCs and USAIDs will request technical assistance; research findings will be available. 2. Cooperation of LDCs. 3. Interest and resources exist in LDCs. 4. Collaboration of international institutions. 5. Sufficient interest among LDCs and qualified personnel.
Inputs: 1. AID/W provides financial support and project guidance. 2. Contractor provides qualified personnel and backstopping facilities. 3. Participating personnel and cooperation provided by 1) LDCs, 2) USAIDs, and 3) international organizations.	Implementation Target (Type and Quantity) 1. AID/W funding at approximately $310,000/year. 2. 24 worker months/year technical personnel; adequate laboratory facilities; 10 or more acres field research area. 3. Not directly quantifiable.	1. AID/W records. 2. Contractor reports, on-site inspections. 3. USAID reports, on-site verification.	Assumptions for providing inputs: 1. AID/W funding will be available on schedule and in quantity agreed upon. 2. Contractor will have necessary qualified personnel; university facilities will be available to project. 3. International organizations, USAIDs, and LDCs will have personnel and resources to support this activity.

RESEARCH AND DEVELOPMENT COMMITTEE

Minutes of March 24, 1976 Meeting

Project: Improvement of Winter Wheat for Developing Countries, based on Hybridization of Spring and Winter Forms (New), 3 years $943,000.

Contractor: Oregon State University

Project Manager: Earl R. Leng, TA/AGR

Dr. Leng reported that a training component was originally proposed as part of an integrated project. Although omitted from this research proposal, it is a desirable component which could be provided through some other channel.

The LA Bureau, G. A. Breitenbach, was complimentary on the scientific merits of the project and its presentation, but voiced considerable concern that the work would not address LDC problems. They expressed opposition on the issue that very few LDC's grow winter wheat and CIMMYT is generously supported by AID.

Dr. Long, AA/TA, pointed out there are two major questions in this issue: (1) How important is winter wheat to developing countries? (2) How important to spring wheat improvement is hybridization with winter wheat?

The Africa Bureau, W. Leake, indicated use of winter wheat is limited in Africa. However, they accept Dr. Norman Borlaug's, CIMMYT, advice on the use of winter wheat in the improvement of spring wheat and will favor the project on this basis.

Dr. Leng reported that CIMMYT strongly endorses the project, and previous work in this area was funded from AID/Turkey and the Rockefeller Foundation. Acknowledging Dr. Borlaug's support for this work, Dr. Breitenbach asked why the Rockefeller Foundation was terminating their involvement. Dr. Long responded that the Foundation was making a major reduction in their foreign commitment and much of their agricultural work is being terminated.

Because CIMMYT is involved and vitally concerned, Robert Birnberg, NE/DP, and others asked why the project is not funded through them. Dr. Long reported this had been considered, but CIMMYT preferred that AID administer the project. Management through AID he emphasized will provide direct opportunity for coordination with the Nebraska wheat project.

Motion: That the project be approved

Moved by John Rixse and seconded

Vote: Aye 6, Nay 0, LA Bureau abstained

Proj. No. 9310621
PR

5/24-25/76

Improvement of Winter Wheat for Developing Countries, Based on Hybridization of Spring and Winter Forms - Oregon State University

Dr. Maurice Peterson, Chairman of the Subcommittee composed of Mr. Ludington, Dr. D. Peterson, and Dr. Whitney reviewed the project as follows. Dr. Peterson commented first on the relationship between AID plant breeding research projects and those of the International Centers, and noted that this project has a general objective similar to the Nebraska project. The program is proposed for three years with an estimated cost of $943,000, but it is recognized that it will require 6 to 10 years to accomplish the objectives as envisioned. The proposal is to carry out hybridization between winter and spring wheats, which can be done effectively, in order to transfer desirable plant, disease, and seed characteristics between the two gene pools for the improvement of both. Four issues should be considered.

1) The project describes an activity focused on improved varieties without giving specific goals. The procedure is not new as essentially every important winter wheat variety in the U. S. includes spring wheat germ plasm. There is no disagreement that wheat breeders should cross the two types, but this activity alone is a questionable basis for a major project of this magnitude. 2) The underdeveloped countries have very limited acreage of winter wheats, thus there is a significant question as to who will primarily benefit from the project. 3) There is a question of alternative support. AID is providing operational support to CIMMYT and is supporting the Nebraska wheat project. The USDA is supporting wheat research in Oregon

and the Rockefeller Foundation is also supporting a training program there. This request is presumably to replace the R. F. research funding plus more. 4) Is the justification sufficient for the level of funding? Dr. M. Peterson said that while the project would be useful, his own responses to these questions would not give it a very high priority and he suggested that a more modest proposal for funding would be appropriate until AID reaches a consensus as to how plant breeding projects will be handled.

Dr. D. Peterson said the network chart helped him to focus on the total wheat breeding picture. It is clear that this procedure will bring the two gene pools together and also that the U. S. will benefit. There is no question about the competence of the Oregon staff or the suitability of the climatic spectrum there for this work. He raised the question of whether wheat breeders need to continue broadening the genetic base or do more fine tuning for specific country environments. Also he asked if the breeders at CIMMYT, Nebraska, and Oregon had a broad enough base of LDC problem information to have optimally designed the project.

Dr. Whitney noted that CIMMYT had requested this project as a continuation or expansion of an ongoing program. He pointed out that the 3 Oregon test centers have maritime climates in summer with all appropriate benefits. However, many varieties developed out of Oregon are not adapted to the continental U. S. Great Plains environments. He asked where the 40 country nurseries were located and if the issue was hard red or hard white winter wheats. He indicated the graduate training program is of continuing importance.

Mr. Ludington endorsed Dr. M. Peterson's comments and emphasized the question as to where winter wheat was important in the LDCs and if barley and triticale were competing with it.

Dr. Schweigert said he was apprehensive as to the precision of what the project was about and emphasized the research objective question. Dr. M. Peterson pointed out that the breeding materials may be more valuable than information developed. He noted that from among 24 MS and PhD's trained previously, only one paper had been published.

Dr. Ehrenreich asked how this effort would dovetail into our U.S. National effort, and indicated there may be much duplication of effort especially in the fine tuning efforts. Dr. Smuckler indicated there was some indication of this relationship in the network diagram. Dr. D. Peterson indicated fine tuning of the basic genetics in relation to climate was needed instead of in the field experimentation.

Dr. Hesser, TA/AGR, commenting on AID philosophy in relation to the International Centers, said they lack new input resources due to their limited size and that the U. S. and others can fill this need. He acknowledged that it is nore general than most AID projects, but does provide an internationally oriented staff which would otherwise probably be dissipated. It fits the Title XII model, but it is still too early to develop it in that form. Elements of the project are worthy of support, he said, and AID is interested in the benefits to both spring and winter wheats for the LDCs.

Dr. Leng, TA/AGR, spoke to the various technical questions. In North Africa, he said, it is difficult to differentiate between the spring and winter wheats in many areas. One can estimate there are 15 to 20 million hectares of winter wheat in the LDCs. CIMMYT has made it quite clear that hybridization needs to be done on a massive scale as a base for their program, and while they could sponsor the Oregon project they definitely prefer that AID do this and manage it directly. He confirmed that there is mostly development in this research and development project. Nurseries do include developed as well as lesser developed countries and perhaps should be funded some other way. However, more is obtained than is given in this effort.

The basic goal is improved varieties and the general variety has a definite place in material development for LDCs which can then do their own fine tuning. As an example he pointed out that India took amber out of a mixture sent there and developed it as their variety. If you are choosing one state, he said, Oregon would be the most beneficial for AID recipient countries. He also pointed out that AID did resist taking over the graduate training program, and Oregon then went to Rockefeller Foundation for this support.

He explained that the large travel budget results from the full team traveling to Mexico for nursery work each year, and visits to the international nurseries. The publication budget is large due to the cost of publishing the extensive nursery results. Dr. Long emphasized

that cost of publication should definitely not stand in the way of dissemination of information.

Dr. M. Peterson asked what other crop priorities were being considered and if this project would affect them. Dr. Leng reported that two sorghum projects would be submitted for extension, a new pearl millet project would be proposed, and other projects were being scrutinized. Dr. Hesser said funding of this proposal would not impair newly envisioned projects through FY-78.

Motion: That the project be approved with the provisions that (a) objectives be identified more specifically and (b) AID staff review the budget request for appropriate reductions in the total funding.

Moved by Dr. M. Peterson and seconded by Dr. Whitney

Vote: Unanimous approval