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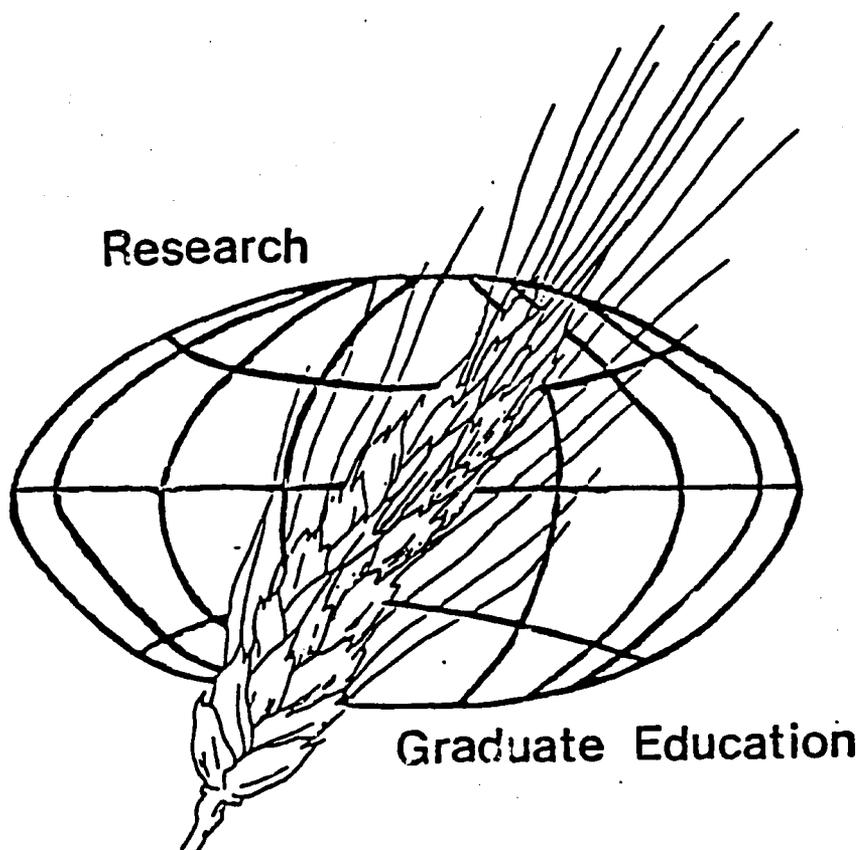
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IMPROVEMENT OF WINTER WHEAT FOR
DEVELOPING COUNTRIES BASED ON
HYBRIDIZATION OF SPRING X WINTER FORMS

PROJECT REVIEW

July 8-11, 1980



Oregon State University

Contract AID/ta-c-1352

SUMMARY STATEMENT

The materials compiled for this review represent accomplishments and changes that have taken place since the 1978 USAID review. With the extension of the contract last October 1, two additional activities have been added to complement the spring x winter hybridization segment. These are the graduate training program and the in-country training program. The graduate training program had been previously funded by the Rockefeller Foundation.

In developing a rather intensive itinerary for the review it is hoped that the total breadth of the program can be effectively presented. This requires that the various experimental sites be visited. The stage of development of the wheat is excellent at all locations to evaluate the various selection pressures being applied to the germ plasm. There will also be an opportunity to interact with various wheat producers with regard to their feelings about this international program and Oregon State University's participation. Time has also been provided for the review team to meet with the OSU administration. On Thursday evening there will also be an opportunity to visit informally with the graduate students and staff with their families at an international picnic.

PROJECT REVIEW

**Improvement of Winter Wheat for Developing Countries,
Based on Hybridization of Spring X Winter Forms**

Contract AID/ta-c-1352-Research

July 0-11, 1980

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A. Project Statement

Statistical

Contractor:	Oregon State University Corvallis, Oregon 97331
Principal Investigators:	Dr. Warren E. Kronstad Professor, Plant Breeding and Genetics
	Dr. Willis L. McCuiston Associate Professor, Plant Breeding and Genetics
	Dr. Fred A. Cholick Research Associate, Plant Breeding and Genetics
Duration:	September 30, 1979-September 30, 1982
Total Estimated Cost:	\$1,311,923
Funding by Fiscal Year:	FY 79-80 \$415,782 FY 80-81 \$433,616 FY 81-82 \$462,525

Personnel

ADMINISTRATION

Robert MacVicar President, Oregon State University
 John Byrne Dean of Research and Acting Dean of the Graduate School
 Ernest Briskey Dean of the School of Agriculture
 John Davis Director, Agricultural Experiment Station
 Wilson Foote Associate Director, Agricultural Experiment Station
 Dale Moss Head, Crop Science Department

DOMESTIC AND INTERNATIONAL CEREAL BREEDING AND GENETICS PROGRAM

-2-

		% Financial Contribution			FTE on Breeding and Genetics Program
		OSU	AID	SEA	
Warren Kronstad	Professor-Project Leader	1.00			.50
Willis McCuiston	Associate Professor-International Outreach		1.00		1.00
Fred Cholick	Research Associate-WXS Program		1.00		1.00
Mary Boulger	Instructor, Barley and Wheat Breeding	1.00			.10
Nan Scott	Instructor, Data Processing	1.00			.50
Patrick Hensleigh	Research Assistant-Field Operations	1.00			.30
Colleen Mork	Research Assistant-Seed Distribution		1.00		1.00
Tom Fairweather	Research Assistant-Field Operations		1.00		1.00
Rebecca White	Research Assistant-Grain Quality Analysis		1.00		1.00
Ann Corey	Research Assistant-Barley and Wheat Breeding	1.00			.05
Kathleen Klahn	Administrative Assistant-Budgets, Accounting	.50	.50		.50
Carol Anderer	Secretary-Correspondence, Seed Shipments		1.00		1.00
Dave Altman	Graduate Research Assistant		.50		.50
John Frederickson	Graduate Research Assistant		.50		.50
Yahyaoui Amor	Graduate Research Assistant		.50		.50
Byung Choi	Graduate Research Assistant		.15		.15
COOPERATORS					
Bob Metzger	Professor (USDA), Cytogenetics, Triticale			1.00	.20
Floyd Bolton	Associate Professor, Dryland Agriculture		1.00		.75
Chuck Rhode	Professor, Cereal Breeding - Pendleton	1.00			.10
Mathias Kolding	Senior Instruction, Triticale and Barley	1.00			.20

B. Plan of Work

5%

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.

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 principle investigator.

2. Genetic Diversity

15%

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 result in superior germ plasm.

3. Incorporation of Superior Nutritional Properties

5%

Selected F1 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

15%

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 accommodate 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 six 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 at 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

10%

The F1 top and double 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 F2's 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 inaccessible 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 F5 and F6 generations.

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 evaluated 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

20%

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 eight 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 Eight IWSWSNs, 1973-1979.

<u>IWSWSN Nurs. No.</u>	<u>No. of Entries</u>	<u>No. of Cooperators</u>	<u>No. of Countries</u>	<u>Crop Season</u>
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
7	250	96	48	1979-80
8	250	94	49	1980-81

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 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

15%

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.

Thesis 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 programs proposed in this contract address 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 contract renewal three assistantships are identified for the 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

5%

Communication and cooperation between agencies and programs throughout the world forms the cornerstone of success in an international wheat improvement program. (see App. Table 3)

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

5%

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.

C. Results and Accomplishments Since the 1978 Project Review

1. Publications Since 1978

a. Journal articles:

Camargo, C. E. O., W. E. Kronstad and R. J. Metzger. 1979. Parent-progeny regression estimates and associations of different height levels with aluminum toxicity and grain yield in wheat. In press. Crop Sci.

Camargo, C. E. O., W. E. Kronstad and R. J. Metzger. 1980. Heritability estimates and associations of different height levels with aluminum toxicity and grain yield in wheat. Manuscript in progress.

Keim, D. L. and W. E. Kronstad. 1978. Drought resistance and dryland adaptation in winter wheat. Crop Sci. 19:574-579.

Keim, D. L. and W. E. Kronstad. 1979. Drought response of winter wheat cultivars grown under field stress conditions. Accepted for publication. Crop Sci.

Kronstad, W. E., W. L. McCuistion, M. L. Swearingen and C. O. Qualset. 1978. Crop selection for specific residue management systems in Crop Residue Management Systems. American Society of Agronomy. Madison, Wisconsin.

Roberts, D. D., W. E. Kronstad and A. Haunold. 1980. Genetic variability and association of maturity, yield and quality characteristics of female hops (Humulus lupulus L.). In press. #291-79 Crop Sci.

Scott, N. H., W. E. Kronstad and W. L. McCuistion. 1978. An electronic weighing and data processing system for field use in a small grain breeding program. Crop Sci. 19:574-579.

Sears, R. G., W. E. Kronstad and R. J. Metzger. 1980. Inheritance of dwarf and semidwarf plant height in barley. Accepted for publication. Crop Sci.

b. Germplasm and nursery results:

Oregon State University Cereal Team. 1978.
Results of the Fifth International Winter X Spring Wheat
Screening Nursery
OSU-CIMMYT-USAID

Oregon State University Cereal Team. 1979.
Results of the Sixth International Winter X Spring Wheat
Screening Nursery
OSU-CIMMYT-USAID

Oregon State University Cereal Team. 1978
Wheat Cultivar Abbreviations (Winter and Spring)
Oregon Agricultural Experiment Station

c. Presentations and proceedings:

- Appleby, A. P. 1980. Weed control in rainfed wheat. Presented at the 3rd International Wheat Conference. Madrid, Spain. Manuscript to be published in the proceedings.
- Kronstad, W. E. 1980. The Turkish experience in increasing food production in arid and semi-arid lands. Invitational paper. Manuscript to be published in proceedings of the International Food Symposium. Kuwait.
- McCuistion, W. L., W. E. Kronstad, F. A. Cholick and N. H. Scott. 1980. The international winter x spring wheat research and graduate training programs. Presented at the 3rd International Wheat Conference. Madrid, Spain. Manuscript to be published in the proceedings.
- Moss, D. N. 1980. Physiology - role in future wheat improvement. Presented at the 3rd International Wheat Conference. Madrid, Spain. Manuscript to be published in proceedings.
- Petpisit, V. and W. E. Kronstad. 1980. Use of general combining ability estimates to predict progeny performance for grain yield in wheat. Presented at the 3rd International Wheat Conference. Madrid, Spain. Manuscript to be published in proceedings.
- Scott, N. H. and W. E. Kronstad. 1980. The computer - an agronomist's assistant. Presented at the 3rd International Wheat Conference. Madrid, Spain. Manuscript to be published in proceedings.
- Whorl, D., W. Nelson, N. H. Scott, A. Klatt. 1980. Performance of CIMMYT wheat germplasm in optimal and sub-optimal production environments. Presented at the 3rd International Wheat Conference. Madrid, Spain. Manuscript to be published in the proceedings.

d. Theses:

- Alexander, W. L. 1980. A study of methods of parental evaluation using testers to predict subsequent progeny performance in winter wheat. Ph.D. Thesis.
- Brajcich, P. 1980. Estimates of heterosis for five agronomic traits in selected winter x spring and winter x winter wheat crosses. M.S. Thesis.
- Camargo, C. E. O. 1978. Differential response and inheritance to aluminum toxicity, heritability estimates and associations of different height levels with aluminum toxicity, grain yield and other agronomic characteristics in wheat. Ph.D. Thesis.

- Harrabi, M. 1978. Estimates of genetic variance and heterosis in F1 winter x spring barley crosses (Hordeum vulgare). M.S. Thesis.
- Lovato, C. 1978. Nitrate reductase activity in leaves and its relationship to nitrogen yield in four spring barley cultivars. Ph.D. Thesis.
- Oakley, S. R. 1980. Estimates of heterosis in winter/winter, winter/spring and spring/spring crosses of barley. M.S. Thesis.
- Petpisit, V. 1980. Progeny tests for predicting grain yield and selected agronomic traits in single, three-way and double crosses in wheat. Ph.D. Thesis.
- Schumaker, K. S. 1980. Evaluation of four quality factors in a selected winter X spring wheat cross. M.S. Thesis.
- Sears, R. G. 1979. Identification, inheritance and association of different dwarfing sources and gibberellic acid insensitivity in barley. Ph.D. Thesis.
- Valencia-Villarreal, J. A. 1980. Competitive effect for grain yield of four cultivars in pure and mixed populations in wheat. Ph.D. Thesis.

2. Participation in meetings

**5th Regional Cereal Workshop. Algiers, Algeria. May 5-9, 1979.
Attended by W. L. McCuistion.**

**Symposium/Workshop. Concepts and Philosophy of International
Testing. CIMMYT, El Batan, Mexico. August 14-19, 1979.
Attended by W. L. McCuistion.**

**Barley Yellow Dwarf Virus Workshop. CIMMYT, Mexico City, Mexico.
January 15-16, 1980. Attended by F. A. Cholick.**

**Hard Red Winter Wheat Workers Conference - Winter Survival.
Ft. Collins, Colorado. February 12-14, 1980. Attended by
F. A. Cholick.**

**Long Term Planning Conference. CIMMYT, Mexico City, Mexico.
April 9-13, 1980. Attended by W. E. Kronstad.**

**International Food Symposium. Al Kuwait, Kuwait. May 19-23, 1980.
Attended by W. E. Kronstad.**

**Meeting to coordinate activities of Oregon State University, International
Maize and Wheat Improvement Center (CIMMYT), International Center
for Agricultural Research in Dryland Areas (ICARDA), and the
Government of Turkey. Ankara, Turkey. May 14-16, 1980. Attended
by W. E. Kronstad and N. H. Scott.**

**3rd International Wheat Conference. Madrid, Spain. May 22-26, 1980.
Attended by W. E. Kronstad, W. L. McCuistion, A. P. Appleby,
D. N. Moss, and N. H. Scott**

3. Country Program Reviews

Dr. Willis L. McCuiston traveled extensively during the period of May 3 to July 10, 1979 visiting more than 200 scientists and 35 research institutes in 16 countries. Most of these scientists are cooperators with OSU evaluating the International Screening Nursery, yield trial and segregating populations. It was also a privilege to visit with 20 former OSU students and trainees, each assuming responsible positions in cereal research and administration in their respective countries. Brief comments will be made for each of the locations visited.

Algiers, Algeria. The fifth North African and Middle East Workshop was held in Algiers from May 5-9, 1980. There were approximately 250 delegates from 25 countries attending the workshop and field tours. Most of the OSU cooperators from this geographic region were present at the workshop. It was specially meaningful for Dr. McCuiston to attend this workshop to interact with the large number of research scientists, many with whom he has been associated throughout the five workshops beginning in 1969. There were many excellent formal presentations and the session chairman presented summaries for each of the major disciplines. These will be published as proceeding by CIMMYT.

One day was spent with the Algerian cereal staff and CIMMYT visitors reviewing the central research area of Oued Smar just outside of the city of Algiers. A number of resistant cultivars to Septoria tritici were requested and received for evaluation in Oregon.

Setif, Algeria. The low rainfall coupled with strong winds, low winter temperatures, intermittent snow and occasional late frost present a challenge to cereal improvement at this location on the high plateau. Several winter x spring selections, exhibiting long vegetative and short reproductive cycles similar to the local variety Mahon Demais, are performing well in yield trials. Low rainfall and late frost caused drought stress and head sterility throughout the nurseries, however there were promising selections of bread and durum wheat.

Kef, Tunisia. Dr. Abderrazak Daaloul, a former MS and Ph.D. student at OSU, is director of the Ecole Supérieure des Grande Culture at Kef and also directs cereal research. Approximately 70 lines from the 5th IWSWSN were advanced to yield trials and the best of these will be further advanced this year. Unseasonable warm winds and a dry winter caused general drought stress throughout Tunisia and wheat production will be reduced. In spite of the stress conditions, some of the winter x spring germplasm looked better than the local cultivars.

Tunis, Tunisia. A days visit to the accelerated cereal project and the INRAT (National Institute for Agricultural Research in Tunisia) provided an opportunity to interact with many old friends and colleagues. Mr. Moncef Harrabi, a former MS student at OSU, reviewed his barley breeding program and expressed the need for more resistance for scald and powdery mildew from the OSU barley program. A collection of germ-plasm is presently being sent to Tunisia.

Benghazik, Libya. Although meetings had been arranged with Mr. Ben Said, Director of the Cereal Project in Tripoli, and the research team at Al Marj Station in Benghazi, neither party met me upon arrival at the airports and it was impossible to reach them by telephone. After trying to call for an afternoon and morning and failing to find transportation from Benghazi to the Al Marj station (more than 100 kilometers), it was necessary to leave Libya without contacting the cooperators.

Thessaloniki, Greece. Dr. E. Skorda, Director of the cereal program, provided an excellent opportunity to review the entire cereal improvement program at the main station, a branch station and several farmer's fields. The Mexican varieties Yecora, Jupateco and Siete Cerros were winterkilled or sterilized by late frost and the area was replanted in the spring. The Greek varieties having Italian parents were more cold tolerant and survived the late spring frosts. Some of the winter x spring lines were also well adapted. The Greek scientists desire spring wheat maturity not more than seven days later than the variety Lerma Rojo, however, they must have some winterhardiness and frost tolerance. True winter wheats are much too late for the normal rainfall distribution and have shriveled grain. The major disease problems for wheat are stem rust and powdery mildew. CIMMYT spring wheats are generally resistant to stem rust but susceptible to powdery mildew. Race changes are common with both diseases. There is also a general problem in the major cereal growing regions, specifically noted weeds were wild oats and poppy.

Amman, Jordan. An extensive tour in Jordan permitted visits to the university cereal breeding and production trials as well as to the major outlying research stations where research is conducted by the Ministry research and extension staff. Jordan has experienced an extremely dry year (260 mm total - 400 mm normal at Amman) with hot winds during late winter followed by cold temperatures. Some of the winter x spring lines with Yamhill and Aurora parentage were as early and performed as well as the best adapted varieties. Drought stress in the Amman region forced early heading and small spike size was general for bread and durum wheat, barley and triticale. In the farmer demonstrations, conducted by Dr. Bill Bray, ICARDA, the durum wheats developed better than the barleys and both were better than the bread wheats and triticales used in the studies. Dr. Ghosheh, plant breeder in the Ministry of Agriculture, states that this is the normal situation

under stress conditions. A wheat-fallow rotation is being practiced on the Durhala Station 80 kms south of Amman. In comparative trials of rotation and continuous wheat, durum wheat yields on the rotation plots will more than double yields on the continuous wheat plots and the potential should be two tons per hectare with 274 mm rainfall. The Shobak Station, located on a high plateau (1500 m altitude) approximately 200 kms south of Amman had excellent early plant development with 300 mm rainfall prior to April. During the first two weeks of April continuous hot, dry winds burned the vegetation just prior to heading stage. Equal damage was observed in both spring and winter nurseries. The locally developed durum wheat variety, Dier alla 2 performed the best under these stress conditions.

Douma (Damascus), Syria. The Douma station near Damascus is primarily involved in seed multiplication of cereals and some research trials in wheat and grain legumes. This station is directed by the Syrian Ministry of Agriculture with consulting support from ICARDA staff.

Aleppo, Syria (ICARDA). The three and one-half days spent interacting with the ICARDA administrative and technical staff in the office and field was very beneficial. There was opportunity to review, in detail, the bread and durum wheat, barley and triticale programs. Dr. Mohamed Mekni from Tunisia and Tom Rauch former student at OSU, were both doing good jobs directing the barley and durum wheat programs respectively. Mr. Owen Brough, Associate Director of ICARDA, suggests closer linkage with OSU for development of winter cereals where applicable throughout the Middle East and North Africa. Their specific interest at present is the Anatolian region of Turkey. A large collection of new winter and spring germplasm was requested and received from ICARDA. Origins of this germplasm were Turkey, Iran, Kenya, Ethiopia, China, Algeria and Portugal.

Diyarbakir, Turkey. The director of the Diyarbakir station and cereal breeder, Mr. Ertug Firat and the production agronomist, Mr. Selman Aktan, both former OSU students, have developed an excellent cereal research program for South Eastern Turkey. Although this region is primarily devoted to durum wheat production, there are many well adapted spring and winter x spring cultivars of bread wheat in yield trials that could be released for production. The Mexican bread wheat variety Penjamo 62 is being grown on land not planted to durum wheat. Since Turkey now exports wheat they are becoming more interested in producing good quality bread wheats for foreign markets. The agronomic trials were designed to study interactions of varieties, rates of seeding, dates of seeding and rates and times of application of nitrogen fertilizers. Mr. Aktan has also implemented studies of moisture conservation using different rotation systems.

Ankara, Turkey. Cooperation has been very close for a number of years between the OSU cereal staff and the Turkey Research and Training Center located in Ankara. All of the major cereal research stations also have one to several staff members trained at OSU. The plant breeder,

production agronomist and weed control specialist at Ankara are all former OSU students and have aggressive research programs at the Haymana station. Support staff from Rockefeller Foundation, CIMMYT and OSU helped the national scientists develop an aggressive cereal breeding and production program which is now being directed by local staff. A large segment of the winter wheat program is composed of winter x spring germplasm developed at OSU and at three stations in Turkey.

Eskisehir, Turkey. A well qualified staff of scientists are directing the winter cereal program at this location. The main emphasis for varietal improvement is concentrated in bread wheat and winter barley. The program is divided into research for irrigated and rainfed conditions and the winter x spring germplasm is being screened in both environments. Two leading scientists from Tolbuhin, Bulgaria accompanied me on the round trip from Ankara and during the field visit.

Izmir, Turkey. The plant breeder and plant pathology at this spring cereal research station are former OSU students. There was opportunity to observe most of the international nurseries, local trials and seed multiplications with these two scientists and Mesut Kanbertay, recently selected to receive a Rockefeller Foundation scholarship for study at OSU. The IWSWSN from OSU is being screened at Izmir for sources of resistance to stem, leaf, stripe rust and Septoria tritici. Natural infections of all these diseases are common at this location and some of them are also spread by artificial inoculation.

Edirne, Turkey. The director of the Edirne station is a former OSU student and the plant breeder, Necati Hazar has received a Rockefeller Foundation scholarship to attend OSU next year. The climatic conditions at this location are very similar to Corvallis and many of the winter x winter and winter x spring cultivars from Oregon are among the highest yielding entries in yield trials. Several of these cultivars have been multiplied, named and released for commercial production. The major disease problems are stripe rust, powdery mildew, *Cercospora* and bunt.

A large collection of requested cultivars have been sent from each of the Turkey research stations.

Novi Sad, Yugoslavia. The visit with Dr. Borojevic and his staff is always pleasant and informative. All of the daylight hours were spent at the research station and state farms observing collections, crossing block, screening nurseries, segregating populations, yield trials and seed increases. Two Mexican spring wheat varieties, Siete Cerros and Tobari have been crossed extensively with the local Novi Sad winter varieties. Several of these crosses look very promising. A large collection of cultivars was requested having winterhardiness, dwarf genes, earliness, resistance to leaf rust, stem rust, powdery mildew, Italian origin and the best advanced lines.

Zagreb, Yugoslavia. There are three wheat breeders working semi-independently on semi-dwarf, high yielding cultivars, drought tolerant and high altitude cultivars and large ramified head types. There is a great deal of overlap and lack of coordination in the programs. The OSU winter x spring germplasm performs well in the Zagreb region. The major disease is stem rust and several of the local resistant cultivars were requested for inclusion in the OSU program. A visiting scientist Dr. Alexia Alexiavia, from Moldavia, Russia also receives the winter x spring nursery and reported that several entries are being utilized in their breeding program.

Skopje, Yugoslavia. There are two breeders at this high altitude station in Southern Yugoslavia, one working with bread wheat and the other with durum wheat and barley. This location has the only durum wheat program in the country and winter malting barley is important in this region. The research program is small.

Tolbuhin, Bulgaria. This research center in Eastern Bulgaria has 30 scientists working on cereals, sunflowers and field beans. It is the largest and most aggressive of all institutes in Eastern Europe. Disease resistance breeding is concentrated primarily for powdery mildew, stem and leaf rust and Fusarium root rot. A number of selections from earlier winter x spring nurseries are being evaluated in yield trials. There is a good range of maturity in the program from Roussalka to cultivars seven days later than Bezostaja. The major dwarfing source is Bezostaja dwarf. A collection of cultivars was sent from Tolbuhin to OSU.

Fundelea, Romania. Fundelea is a large central research center servicing breeders with germplasm at seven addition stations. Bezostaja was the major wheat variety in production until 1971 but was replaced by the Romanian varieties Iulia, Ceres, and Dacia. The major diseases are powdery mildew and the three rusts. This station has one of the few winter durum wheat breeding programs. The request for specific germplasm was channeled through CIMMYT since Dr. R. G. Anderson had already established a method of exchange with the Ministry of Agriculture.

Szeged, Hungary. The cereal research program at Szeged is smaller than many others in Eastern Europe, however, a number of well adapted and resistant varieties designated "GK" have been released for the southern region of Hungary. A great deal of emphasis is placed on breeding for resistance to powdery mildew, leaf rust and Fusarium root rot. The pathologist, Dr. Mesterhazy, is culturing and inoculating the germplasm with Fusarium culmorum and F. graminearum screening for resistance sources that the breeders can incorporate into their programs. The fifth IWSWSN had been divided into a winter and spring planting, offering an opportunity to separate the entries into winter, facultative and spring growth habit.

Martonvasar, Hungary. The major emphasis at the Martonvasar institute is to incorporate into present adapted cultivars additional dwarfing genes, winterhardiness and resistance to powdery mildew and stem rust. The GK varieties from Szeged and varieties from Yugoslavia are too winter tender to be grown commercially in central and northern Hungary. Several Martonvasar varieties (MV) are averaging more than six tons/hectare in commercial production. A collection of these cultivars has been sent to OSU. There was also opportunity to attend the farmers' field day at the institute, seed farms and state farms.

Bucany, Czechoslovakia. The Bucany research center is small in size and total staff. The breeding program places major emphasis on improving winterhardiness and resistance to powdery mildew, stem and yellow rust. This center, as do most of those in Eastern Europe, draws heavily on germplasm from Russia. Heavy snow cover is common for most of the winter and snow mold is a problem.

Krakow, Poland. There was opportunity to visit three research centers in the Krakow region. The work on race identification at IHAR (Krakow Breeding Institute) was most impressive. A large collection of germplasm has been screened using the major races of powdery mildew, stripe, leaf and stem rust. A number of generally resistant cultivars have been identified for each disease. These cultivars have been requested but have not yet been received.

Laski, Poland. A dynamic breeding program is being conducted by Dr. Wolski for bread wheat, triticale and rye. This program is supplying varieties for most of Poland and some area in each of the neighboring countries. The most important variety at present is Grana. The breeding program stresses increased winterhardiness, reduction of plant height and resistance to powdery mildew, Septoria nodorum, leaf and stem rust. There is a direct correlation of intensity of powdery mildew and reduction of yield. Use of Bayleton to control mildew will significantly increase yield. A collection of germplasm was sent to OSU. Several selections from earlier OSU F₂ winter x spring populations have been advanced to yield trials.

Zurich, Switzerland. The winter wheat variety Zenith released by the Zurich cereal institute in 1968 is still occupying the major cereal area in Eastern Switzerland. The government milling industry requires only red seeded varieties and quality standards are high. It is difficult to transfer the hard red winter wheat quality from U. S. varieties to locally adapted cultivars. Many of the winter x spring cultivars are high yielding but lack the desired quality. The institute has a highly automated and extensive quality laboratory being operated by a well qualified staff.

Nyon, Switzerland. The cereal research institute at Nyon, near Geneva, concentrates their breeding efforts mainly on developing cultivars of bread wheat and triticale resistant to Septoria nodorum, stem and leaf rust. A small research site in the low range of the Alp

mountains is used to screen for resistance to Septoria nodorum. A heavy epidemic of this disease is assured every year with natural and artificial infection. A collection of germplasm is being sent to OSU.

Clermont-Ferrand, France. The Clermont-Ferrand research institute is located in the mountains of South Central France and winterhardness is an important factor in the breeding program. Major emphasis is also placed on breeding for resistance to Cercospora root rot. A concerted effort is also being made to increase protein content and quality. Germplasm was requested specifically for resistance to Cercospora.

Versaille, France. The central research station for France (INRA) is located at Versailles outside of Paris. Cereal breeding is concentrated primarily on winter, spring and hybrid wheat and some research on triticale. The French National Institutes are primarily involved in addressing problems of basic research and the development of genetic material for use by private breeding firms who in turn develop and release new varieties. Climatic conditions during the past winter provided an excellent screening of the sixth IWSWSN for winterhardness and resistance to stripe rust.

Momont Freres, Inc., France. The private company of the Momont brothers located near Lille in Northern France has been operating for more than 100 years. Earlier contact with this firm and correspondence indicating very promising selections from winter x spring F2 populations prompted a short visit to observe their cereal breeding efforts. Several short statured and stripe rust resistant selections from this germplasm are promising in advanced yield trials. Requested germplasm is being sent to OSU.

Cambridge, England. The two days of interaction with the cereal staff at Cambridge was very profitable. Time permitted observation of the winter and spring programs of bread wheat, triticale and barley. Drs. Bingham, Blackman and McCuiston evaluated the sixth IWSWSN for stripe rust and found many good sources of resistance. It was also possible to observe the breeding populations for the doctoral thesis of Mostefa Laabassi, an Algerian student and former colleague. A collection of germplasm is being sent to OSU.

More than 2500 new introductions have already been received at OSU from this trip and more are expected.

Dr. Warren Kronstad and Mrs. Nan Scott visited the following countries during May, 1980. They were accompanied in Yugoslavia and Turkey by Drs. Floyd Bolton and Arnold Appleby.

England. Researchers visited the Plant Breeding Institute at Cambridge where new quality analysis techniques were discussed as well as new screening techniques for Cercosporia. A number of selections were requested to be incorporated into the germplasm pool at Oregon State University.

France. The winter wheat program of CACBA, a private plant breeding farm was visited. Notes were taken on the spring x winter material from Oregon. Mildew and septoria infections were good. Selections from promising French lines were requested and will be sent to OSU after harvest.

Tunisia. The wheat program was reviewed at Le Kef, Beja, and Sbiba. Several crosses of winter x spring material are showing good promise for the region. The feasibility of a dryland agricultural program patterned after the Turkey program was discussed for Central Tunisia.

Yugoslavia. The winter wheat programs at Novi Sad and Zagreb were visited. Promising material was noted and seed will be sent to OSU for incorporation into the winter x spring program, particularly winterhardy types and those showing good resistance to powdery mildew.

Turkey. The cereal programs at Ankara and Izmir were visited. Linkages were strengthened with the national program. All of the spring x winter F₄ and F₅ populations will be screened at Ankara for adaptation to dryland conditions and at Izmir for reaction to the three rusts, mildew, septoria and smut. This information will prove very useful in developing germplasm more widely adapted to the growing conditions of the LDC's.

W. L. McCusick participated in the Madrid Wheat Conference post-symposium tour from May 26 to June 3 to Southern Spain, Elvas, Portugal and Northern Morocco. Following are general impressions of the programs in each country.

Spain. The three INIA experiment stations visited were El Encin (south of Madrid), Merida and Jerez. The El Encin station is the only one crossing and selecting segregating populations. After discussion with the national scientists conducting the bread wheat, durum wheat and barley programs, it appears that the cereal improvement efforts at these three sites are mainly involved in screening nurseries provided by various international agencies. The only nursery planted at Merida was provided by a private French company and the cultivars were poorly adapted. The germplasm at Jerez consisted of 95% CIMMYT and 5% ICARDA nurseries. Some of the CIMMYT bread and durum wheats are performing well.

Portugal. The Elvas Station is well managed and impressive to visit. The germplasm was almost strictly spring bread and durum wheat barley and triticale. There were many interesting advanced lines from local and international nursery germplasm.

Morocco. The Fez research station in North Central Morocco is primarily devoted to seed multiplication, however, some small screening nurseries were being evaluated for disease resistance. The Merchouche Station, south of Rabat, is also used primarily for seed multiplication. Some breeding material is being evaluated by staff from the University of Rabat and INRA (National Institute of Agricultural Research). Two Moroccan scientists are also conducting cereal research trials at the institute site at the edge of the city of Rabat. It would seem most feasible to concentrate the major cereal research at the Merchouche Station which has adequate land area and is more typical of the cereal production region.

4. Linkages

On May 13 and 14 a meeting was held in Ankara, Turkey between representatives of CIMMYT, ICARDA, OSU, and the Government of Turkey. The nature of the meeting was to provide greater complementarity of the efforts of each group to the needs of the region. It was agreed that CIMMYT would continue to provide cereal germ plasm with emphasis on spring wheat, OSU would contribute winter and facultative wheat germ plasm in addition to providing graduate training in various aspects of cereal production and ICARDA would work on winter barley and winter durum wheat. The winter wheat program in Turkey will be expanded to evaluate F4 and F5 populations developed in the winter x spring program in Oregon.

An agreement has been signed between the National Institute for Agricultural Research (INIA) - Mexico and the School of Agriculture - OSU for the exchange of germ plasm, students and faculties involving several disciplines and crops. This agreement is the direct result of the cooperative winter x spring wheat program between OSU and CIMMYT which has made use of the CIANO Experiment Station in Obregon, Mexico. This station is under the direction of INIA.

Linkages involving the winter x spring program are provided in Appendix Table 3. In addition to the various agencies and centers, OSU is currently providing the screening nursery annually to 48 countries and 110 breeding programs. The only major winter wheat producing country not involved in this network is the People's Republic of China. However, limited germ plasm is now being shared with this country as well. With Dr. Wang from the National Research Center in Peiking spending a year at OSU, it is hoped that a greater exchange of information and germ plasm will be forthcoming in the near future.

5. Evaluation of Effectiveness of Program

Cooperating country programs throughout the developing and developed world continue to request and receive wheat germ plasm in the forms of screening nurseries, crossing blocks, segregating populations and specified cultivars. Continuing communication through correspondence, data returned for the IWSWSN, and our personal visits to their institutes and their visits to OSU have served to identify many spring x winter cultivars for further hybridization or as direct varietal releases. Some of these cultivars from specified countries are listed on the following pages.

Spring X Winter cultivars from OSU International Program in
advanced trials and/or released as varieties

Country	Station	Cultivar	Sel. No.	Status of advancement
Tunisia	Kef	67 selections from screening nurseries		15 and 52 selections in second and third yield trials
Algeria	Setif	ANZA/3/PI62/NAR59//HYS	(10/79)	Advanced yield trials (These cultivars have long vegetative cycle and shorter reproductive to maturity cycle being well adapted to low moisture and drought stress).
		CNO//BB/GLL/3/BHR	(161/79)	
		P101/ANZA	(38/79)	
		ANZA/4/SK/2*CD//LR/3/HYS	(11/79)	
		BEZ/ERA	(27/79)	
		BEZ//TOB/8156	(25/79)	
Greece	Thessaloniki	ANZA/3/PI62/NAR59//HYS	(10/79)	Advanced yield trials, R-LR, MR-SR ^{1/}
		SPD//EDCH/PT	(46/79)	Advanced yield trials, R-LR, R-PM
		TAST/5/CI17800/BZA/4/MD/MCM/EX/3/ AF/MY	(183/79)	Advanced yield trials, R-LR, R-SR
		ALBA/GNS//FN/SN64	(193/79)	Advanced yield trials, R-LR, R-PM
		INIA//SMB/HN4	(8/79)	Advanced yield trials
		GLL/4/SK/2*CD//LR/3/HYS	(199/79)	Advanced yield trials
Jordan	Amman & Irbed	LOH1/DIRK/4/SU92/CI13645/3/BC/ CI13232//INIA		Advanced trials, R-Drought Stress
Jordan	Amman	BEZ/TOB		Advanced trials, R-Drought Stress
Syria	Aleppo	P101/ANZA (3sib lines) 30 selections > 150% of local check	(164-184/79)	Advanced trials, HY, R-YR, R-PS Advanced trials, HY, R-YR, R-PS

^{1/}R = Resistance
LR = Leaf Rust
SR = Stem Rust

PM = Powdery Mildew
HY = High Yield
YR = Yellow Rust

PS = Pseudomonas
GdST - Good Seed Type
E = Early

SD = Semi Dwarf
GdWH = Good Winter Hardiness

Argentina	Buenos Aires	GNS/LP	(111/79)	Advanced yield trials
		SPN/SN64	(151/79)	Advanced yield trials
		P101/ANZA	(169-175/79)	Advanced yield trials
		ALBA/GNS//FN/SN64	(193/79)	Advanced yield trials
Pakistan	Quetta	ANZA/4/VIL29/VG8881//INIA/3/55-1744/ DRC	(12/79)	Advanced yield trials
		PCH/3/KT54A/N10B//KT54B/4/NAR	(96/79)	Advanced yield trials
		JAR//GNS/LP	(126/79)	Advanced yield trials
		HYS/IBIS	(127/79)	Advanced yield trials
		FN/3*TH//K58/2*N/3/MY54/N10B/4/WRM/ 5/SDY	(198/79)	Advanced yield trials
		SN64/HN4//REX/3/7C	(138/79)	Advanced yield trials
		HYS//DRC*2/7C	(144-45/79)	Advanced yield trials
		S X W F ₃ Bulk 8	(159/79)	Advanced yield trials
		P101/ANZA	(165-184/79)	Advanced yield trials
		ALBA/GNS//FN/SN64	(190/79)	Advanced yield trials
		Netherlands	Vanderhave	F ₃ Bulk 14 (OR772)
OREG SEL 773 (MYT42)				Advanced yeild trial
6720//BB/NOR/3/70-228/YMH				Possible varietal release
SPN//MCD/CAMA				Possible varietal release
Chile	Santiago Temuco Chillian	Each station reports observing several winter X spring cultivars in advanced yield tests. These cultivars exhibit good levels of winter hardiness and disease resistance.		
Afghanistan	Kabul Herat	Both locations are testing a number of spring X winter cultivars in advanced yield trials. Several have been suggested for release for the cereal regions at higher altitudes.		
Brazil	Passo Fundo Pelotas Campinas	These three major cereal research centers have selected a number of winter X spring wheat cultivars having resistance and/or tolerance to a number of important diseases and soil problems.		

Turkey	Diyarbakir	PMF/LFN CLE/ND AN/NAI/3/SU92/CI13645//INIA GLL/4/SK/2*CD/LR/3/HYS ANZA/4/SK/2*CD/LR/3/HYS	(119/79) (185/79) (195/79) (199/79) (41/79)	Advanced trials, HY, GdST Advanced trials Advanced trials Advanced trials Crossing block GdST, E, SD
Turkey	Ankara	NOR67/2/CD/P101//DRC SDY/BEZ HD832/ON//BB/3/BEZ/PI178383/4/ODIN (SW072//H47) CLLF//N10B/P14//P101 HYS/PI178210 (SW072/H414)		Crossing block & yield trials, R-LR, R-SR Advanced yield trials Advanced yield trails, HY, GdR Advanced yield trials, HY, GdR Advanced yield trials, HY, GdR
Turkey	Edirne	HYS S/7C HYS S/7C (sister) CD/P101//DRC/HYS YMH/HYS Bhr/CZHO		New variety: Kirkpinar 79 New variety: Trakya New variety: Edirne New variety: Taskan New variety: ENEZ
-27- Turkey	Ankara	ND/P101*2		New variety: ATAGUN
Turkey	Eskisehir	DIGA//MY48/MY54//BB5 55-1744/MEX 67 SU92/CI13645//PMG M374/SX S311 A51/3/EDCH/PTG//N1220/4/LFN CLLF/HYS		Crossing block & yield trial, R-3 rusts Crossing block & yield trial, R-3 rusts
Turkey	Izmir	YMH/TOB INIA//SMB/HN4 BEZ/ERA	(53/79) (8/79) (26/79)	Crossing block, R-3 rusts Crossing block, R-3 rusts Crossing block, R-3 rusts
Yugoslavia	Novi Sad	BEZ/NAD//KZM CLLF/BEZ/3/SU92/CI13645//NAI	(28/79) (48/79)	Yield trials Yield trials

Yugoslavia	NoviSad	CLEO/PCH SPD/SN64	(110/79) (149/79)	Yield trials Yield trials
Yugoslavia	Skopje	II62-61/3/1453/ODIN//CI13431 CLLF/BEZ/3/SU92/CI13645//NAI	(47/79) (48/79)	Advanced yield trials Advanced yield trials
Yugoslavia	Zagreb	NOR67/3/CD/P101//DRC/4/YMH SN64/SS2 YMH/TOB D6301/NAI/3/DIGA//MD*2/FN CLLF/PCH//P101/VOGAF BEZ/ERA/4/SU92/3/TH*6/KF//LEE*6/KF BEZ/ERA/4/SU92/3/TH*6/KF//LEE*6/KF (sib) NOR/6720//BEZ ANZA/3/PI/NAR//HYS	(427/75) (367/75) (384/75) (346/76) (106/77) (26/76) (27/76) (207/78) (197/79)	Multiplication, possible release Multiplication, possible release Advanced yield trial Advanced yield trial Advanced yield trial Advanced yield trial Advanced yield trial Advanced yield trial Advanced yield trial
Bulgaria	Tolbuhin	50+ selections from previous screening nurseries		(Cultivars R-rusts & PM) Entered in 1st, 2nd, & 3rd year trials
Romania	Fundelea	BEZ/NAD//KZM PCH/3/KT54A/N10B//KT54B/4/NAR ALBA/GNS//FN/SN64 II58-57/ODZI (sisters)	(28/79) (96/79) (193/79) (206-210/79)	Advanced yield trial, GdR Advanced yield trial, R-PM, GdWH Advanced yield trial, GdWH Advanced yield trial, GdWH
Hungary	Szeged	N10//P14/1453/3/P101/ODIN TOP/YMH II58-57/ODZI	(30/79) (45/79) (209/79)	Yield trials, GdWH Yield trials Yield trials
Czechoslovakia	Bucany	GNS/LP/3/ART*5/AA//TF/BULG86 II62-61/3/1453/ODIN//CI13431 JAR//GNS/LP	(14/79) (47/79) (126/79)	Yield trials Yield trials Yield trials
Poland	Krakow	SMB/HN4 HBGN/HN4 P101/ANZA (9 sibs) ALBA/GNS//FN/SN64 (4 sibs) II58-57/ODZI	(89/79) (84/79) (164-184/79) (186-194/79) (209-10/79)	Yield trials Yield trials Yield trials Yield trials Yield trials

Poland	Laski	HBN/HN4	(84-5/79)	Yield trials
		SMB/HN4	(86-9/79)	Yield trials
		II62-61/3/1453/ODIN//CI13431	(47/79)	Yield trials, HY
		GNS/LP	(111/79)	Yield trials
		II58-57/ODZI	(209/79)	Advanced yield trials, HY
		CFN/3/1453/ODIN//CI13431		Advanced yield trials, GdWH
Switzerland	Zurich	AN//SN64/SS2	(24/78)	Advanced yield trials, GdR
		CLLF/BEZ//BEZ/ERA	(28/78)	Advanced yield trials, GdR
		HK/38MA//LOH1/DIRK	(31-2/78)	Advanced yield trials, GdR
		ANZA/SDY	(35/78)	Advanced yield trials, GdR
		AU/ANZA	(36-7/78)	Advanced yield trials, GdR
		INIA//SMB/HN4	(48-54/78)	Advanced yield trials, GdR
		II58-54/3/FN/CNN//IDEF	(69-70/78)	Advanced yield trials, GdR
		ALBA/GNS//FN/SN64	(71-72/78)	Advanced yield trials, GdR
		CLLF/PCH//P101/VOGAF	(82-86/78)	Advanced yield trials, GdR
		BEZ//TOB/8156	(105-6/78)	Advanced yield trials, GdR
France	Versaille	P101/ANZA (3 sibs)	(57,62,67/79)	Yield trials, HY, GdR, GdWH
		ANZA/4/VIL29/VG8881//INIA/3/55-1744		
		/DRC	(78-81/79)	Yield trials
		CLLF/PCH//P101/VOGAF	(84-6/79)	Yield trials
		CLLF*2/PCH	(206/79)	Yield trials
		NOR/6720//BEZ	(207/79)	Yield trials
		BEZ/TOB	(209/79)	Yield trials
		DIBO//HQ/NAI	(210/79)	Yield trials
YMH/HYS//RPR/YMH	(219/79)	Yield trials		
England	Cambridge	LEDA/3/7C/CNO//CAL	(55/79)	Yield trials, R-YR, R-PM
		BEZ/ERA	(194/79)	Yield trials
		DIBO*/II50-18//DIBO/LFN	(193/79)	Yield trials
		INIA//SMB/HN4	(53/79)	Yield trials
		II58-57/3/FN/CNN//IDEF	(70/79)	Yield trials
		LOH1/DIRK/4/SU92/CI13645/3/BC/CI13232// INIA	(188/79)	Yield trials
Australia	Melbourne	LOH1/DIRK/4/SU92/CI13645/3/BC/CI13231	(188/79)	Advanced yield trials
		FN//T/TH/3/3*CLLF/4/ANZA	(237/79)	Advanced yield trials

6. Plans for In-Country (LDCs) Training and Seminar Programs

There is a need to relate to specific country programs regarding all aspects of cereal production. Funding provided by USAID will permit in-depth reviews in the form of seminars and discussion groups involving LDC national scientists, selected OSU staff, other selected resource people, USAID mission representatives and selected CIMMYT staff. The in-country training and seminar programs may involve several days to several weeks, depending of the needs and availability of resources in individual countries. The general guidelines will be two days of formal presentations, primarily by national scientists, reviewing the past history, present status, and future goals of cereal research in their countries. All aspects of cereal research will be discussed including breeding, pathology, production, economics and extension practices. Following the presentations will be on-site visits to major research institutes within the countries to review research programs and priorities. A final one day session will be designed to reinforce present objectives and suggest additional research plans. When feasible, meetings will also be scheduled with high level administration such as the directors of research institutes, universities and the ministry of agriculture. The goal will be to strongly support a coordinated cereal program conducted by the national scientists and establish closer linkages between the spring x winter program and LDC activities. This type of program will also serve as a means of identifying prospective students for the graduate training program.

Several countries suggested for a review are Peru, the People's Republic of China, Chile and Tunisia. Presently we are planning an in-country review in Peru in the spring of 1981. The major cereal area of 300,000 hectares is located in the Sierra area and the major crops are corn, potatoes, spring wheat and barley. In 1973, the cereal research program at the University of Agriculture of La Molina initiated a winter cereal improvement program in the Altiplano (high plateau) region of southeastern Peru. There is a potential area of approximately three million hectares for winter cereals in Peru; however, the program is concentrating on only one million hectares at present. An even larger area exists on the same plateau in western Bolivia. The winter x spring germ plasm from OSU has shown good adaptation in this high plateau region. Winter and facultative barley cultivars have been selected and advanced for use by farmers of the region. Preliminary plans have been developed with Dr. M. Romero-Loli, director of the university cereal research program and valuable suggestions and support are being provided by Miss Luz Gomez, a colleague of Dr. Romero presently studying toward a Master of Science degree in cereal breeding at Oregon State University.

D. APPENDIX

Appendix Table 1. Experimental Sites

The diversity of environments found in Oregon simulate conditions in most winter wheat growing areas of the world, making Oregon an ideal outdoor laboratory for screening material destined for other parts of the world.

Hyslop Agronomy Farm, Corvallis

Hyslop Agronomy Farm, one of the three major screening sites, has an average rainfall of 1000 mm per year and an elevation of 68 meters. The soil is an acidic (5.3-5.5 pH) Woodburn silt loam. The mild wet winters and cool springs offer ideal infection courts for the fungal leaf diseases such as stripe rust, septoria and powdery mildew. Take-all, a root rotting disease, and the aphid transmitted barley yellow-dwarf virus are also factors that limit yield in wheat in the Willamette Valley.

Pendleton

At the Pendleton screening site, with an average rainfall of 500 mm, the primary cropping patterns involve a wheat pea rotation. Bush beans can also be grown in rotation if irrigation is available. Here the elevation is 452 meters, soil pH is 6.5 and the primary soil type is Walla Walla silt loam. Pendleton is very similar to Ankara, Turkey in climate and rainfall patterns.

Stripe rust and *Cercospora* (a foot-rot known as straw-breaker or eyespot) are major diseases that limit production. Depending upon the year, selection for leaf rust and powdery mildew resistance can also be accomplished at this site. In cooperation with Dr. Robert Metzger, USDA-SEA, all the promising lines are screened for smut resistance on the Pendleton Experiment Station.

Hermiston, a site near Pendleton, provides excellent screening for barley yellow-dwarf virus, greenbug resistance and various root and mineral stresses associated with very sandy soils. This area has recently come under cultivation with the advent of circle irrigation. The green foliage resulting from continuous cropping under the circles provides a home for hosts of insects including the oat bird cherry aphid, a carrier of barley yellow-dwarf virus.

Sherman Experiment Station

The third major screening area is the dryland site of the Sherman County Experiment Station. Because of the low rainfall (250 mm) in this area, a wheat-fallow system of management is practiced. In this area, which is similar to the Anatolian plateau of Turkey, management and variety interactions are very important. Stand establishment and erosion control are the major areas where breeding and management converge. In order to prevent

erosion, stands should be established early; consequently, lines that germinate under high soil temperatures and low moisture must be developed. Concurrent with stand establishment, drought tolerance and shattering resistance are major selection criteria in this area. Early lines, which escape the moisture stress, and those lines which are most efficient water users can be evaluated at this experimental site. Dry winds are a constant factor at this location exerting strong selection pressure for shattering resistance.

Other Experimental Sites

Besides these major screening sites, elite material and specific problem studies are grown in other areas of the state.

Madras and Ontario are high-production, relatively disease free irrigated areas where yield potential can be assessed. In the former area, the major crops are alfalfa, potatoes, peppermint and cereals. The latter area produces sugar beets, onions, peppermint, potatoes and cereals.

There are two high elevation sites: Burns (1413 meters) and Klamath Falls (1225 meters). Burns, on the high desert of Eastern Oregon, provides good and consistent testing for winterhardness. In Klamath Falls, where the major crops are barley, potatoes, alfalfa and pasture, there are no guaranteed frostfree days. Breeding material is screened for frost tolerance at this site.

The acid soils on the slopes of the Willamette Valley approximate the soil problems of areas like Southern Brazil. On these hillsides screening for aluminum and manganese tolerance is carried out.

Appendix Table 2. Former and Current Graduate Students in the Cereal Research Project

NAME	COUNTRY	SUPPORT	DEGREE	YEAR	THESIS TITLE	CURRENT POSITION
Mapangada Ganapathy	India	Self	PhD	1968	Influence of Population Density on Light Interception and Grain Yield Involving Wheat Hybrids	Plant breeding, India
Surinder Kuman Saini	India	Self	PhD	1968	Influence of Plant Densities on Gene Action Estimates and Associations in Seven Winter Wheat Parents and Their F2 Progeny	Teaching in USA
Don Jones	USA	Self	PhD	1969	Influence of Chelating Agents on Cytological Crossing-Over and Genetic Recombination in <u>Zea mays</u>	Assistant Professor of Biology, Centralia Junior College, Centralia, Wa.
Charles Ihrke	USA	NASA	PhD	1970	Influence of Chelating Agents on Genetic Recombination in <u>Zea Mays</u>	Chairman Biology Science Division, University of Wisconsin - Green Bay
Clarence Peterson	USA	ARS	PhD	1970	Genotype x Environment Interaction in Winter Wheat F1 Progeny	SEA-USDA Winter Wheat Breeder, Washington State University, Pullman, Wa.
Terd Charoenwatana	Thailand	Self	PhD	1971	Evaluation of Three Methods of Selection in Relation to Yield Stability in Winter Wheat	Department Head of Agronomy, Khon Kaen University, Thailand.
Mohamed Chemli	Tunisia	USAID	MS	1972	Effect of Row Spacings, Seeding Rates and Nitrogen Fertilizer Rates on the Agronomic Performance of Yamhill and Hyslop Wheat	FAO - Extension Service

NAME	COUNTRY	SUPPORT	DEGREE	YEAR	THESIS TITLE	CURRENT POSITION
James Helm	USA	OSU	PhD	1972	Chemical and Genetic Evaluation of High Lysine and Protein in Selected Barley Crosses	Director of Agricultural Program for Alberta Canada
Maximino Alcala	Mexico	Rockefeller	PhD	1973	Evaluation of Parental Performance for Grain Yield in Two Populations of Wheat	Seed Distribution/ International Nurseries CIMMYT, Mexico.
Ali Bayraktar	Turkey	Rockefeller	MS	1973	Inheritance of Plant Height in Barley	Instructor, Research and Wheat Improvement, Roseworthy College, Australia
Polat Solen	Turkey	Rockefeller	MS	1973	Heritability Estimates and Associations for Protein Content and Grain Yield Involving Four Winter Wheat Crosses	Spring Wheat Coordinator and Breeder, Izmir, Turkey
Abderrazak Daaloul	Tunisia	USAID	MS	1972	Evaluation of Early Generation Testing in a Diallel Cross Involving Four Winter Wheat Cultivars	Director Agricultural College, El Kef, Tunisia
			PhD	1974	Genetic and Environmental Factors Influencing the Effectiveness of Early Generation Selection in a Diallel Cross Involving Four Winter Wheat Cultivars	

NAME	COUNTRY	SUPPORT	DEGREE	YEAR	THESIS TITLE	CURRENT POSITION
Cevdet Dutlu	Turkey	Rockefeller	MS	1974	Physiologic Races of Stripe Rust of Wheat in the Pacific Northwest	Plant Pathologist, Izmir, Turkey
Don Keim	USA	OSU	PhD	1974	Adaptability of Winter Wheat Cultivars to Dryland Conditions and Their Response to Water Stress	Associate Professor and Wheat Breeder, South Dakota State University, Brookings
Krisda Samphantharak	Thailand	OSU	PhD	1974	Nitrate Reductase Activity and Inheritance of Grain Protein in Six Barley Cultivars	Sorghum Breeder, Kasetsart University, Bangkok, Thailand
Mengu Guler	Turkey	USAID	MS	1975	Yield and Other Agronomic Characters of Winter Wheat Cultivars as Affected by Five Seeding Rates and Three Environmental Conditions	Dryland Wheat Research Ankara, Turkey
Erdogan Indelen	Turkey	Rockefeller	MS	1975	Performance of Five Winter Wheat Cultivars When Grown in Composite and Pure Stand Populations Under Different Environmental Stresses	Station Director, Erdine, Turkey
Jose Luis Maya	Mexico	Rockefeller	PhD	1975	Combining Ability and Associations of Agronomic Traits Involving Three Sources of Dwarfism in Wheat	Wheat Breeder, INIA - Mexico

NAME	COUNTRY	SUPPORT	DEGREE YEAR	THESIS TITLE	CURRENT POSITION
Don Roberts	USA	ARS	PhD 1975	Genetic Variability and Associations Between Agronomic and Quality Characteristics in Twenty-nine Female Genotypes of Hops	SEA-USDA, Mint Breeder Oregon State University Corvallis, Oregon
Selman Aktan	Mexico	USAID	MS 1976	Nitrate Nitrogen Accumulation in the Soil Profile During a Fallow-Wheat Rotation	Dryland Wheat Production Research, Diyarbakir, Turkey
Nedret Duratan	Tureky	Rockefeller	MS 1976	Effect of Timing and Rate of Metribuzin on Wheat and Barley Cultivars and Italian Rye Grass	Weed Control Specialist Ankara, Turkey
Alpaslan Pehlivanurk	Turkey	Rockefeller	MS 1976	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	Assistant Director of Agriculture, Ankara, Turkey
Kamil Yakar	Turkey	Rockefeller	MS 1976	Association and Inheritance of Earliness and Winterhardiness in Four Winter x Spring Wheat Crosses	Winter Wheat Breeder for Turkey, Ankara, Turkey
Michele Abi-Antune	Lebanon	Rockefeller	PhD 1977	Competitive Stress as it Influences the Components of Yield in Winter Wheat	Teaching and Research American University, Beirut, Lebanon

NAME	COUNTRY	SUPPORT	DEGREE	YEAR	THESIS TITLE	CURRENT POSITION
Mike Conway	USA	Self	MS	1977	The Relationship Between ATP and Early Germination in Winter Wheat	Completing PhD at the University of Minnesota.
Alfonso Lopez	Mexico	Rockefeller	PhD	1977	Inheritance of Aluminium Tolerance from the Rye and Wheat Parentage in Triticale	Research and Breeding at the University of Santio, Mexico.
Cesar Martinez	Colombia	Rockefeller	PhD	1977	Inheritance and Mode of Action of Aluminium Toxicity in Rice	Director of Rice Research, Colombia
Mohammed Vahabian	Iran	Ford-CIMMYT	PhD	1977	Factors Influencing Stand Establishment of Winter Wheat Under Dryland Conditions	Under Secretary of Agriculture - Iran
Ertug Firat	Turkey	Rockefeller	MS	1978	Inheritance and Association of Earliness and Grain Yield in Four Winter X Spring Wheat Crosses	Station Director and Wheat Breeder, Diyarbakir, Turkey
Moncef Harrabi	Tunisia	Rockefeller	MS	1978	Estimates of Genetic Variance and Heterosis in Winter X Spring Barley Crosses	Completing PhD at Montana State University
Vichien Petpisit	Thailand	Rockefeller	PhD	1978	Progeny Tests for Predicting Grain Yield and Selected Agronomic Traits in Single, Three-way and Double Crosses in Wheat	Director of Rice Research, Southern Thailand

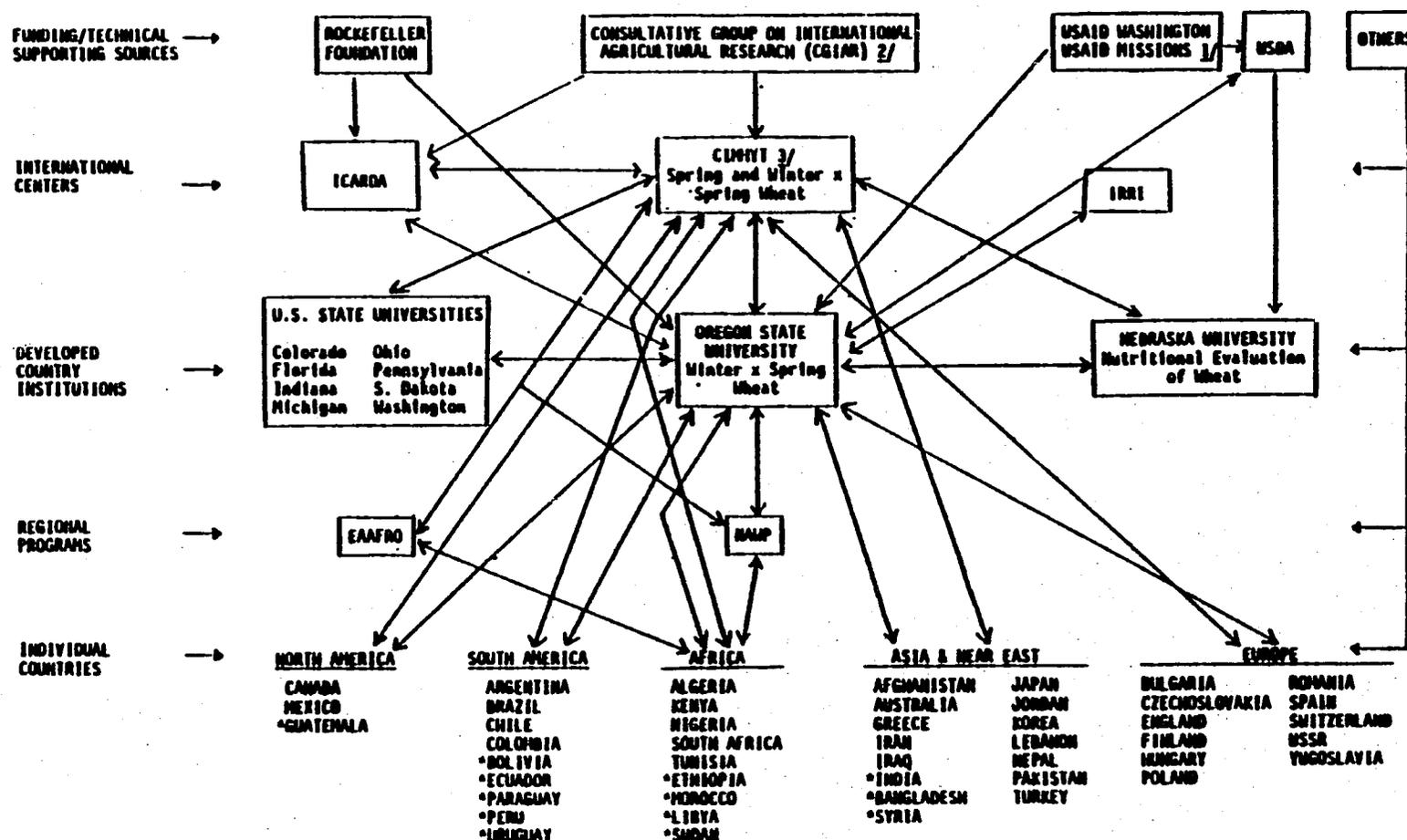
NAME	COUNTRY	SUPPORT	DEGREE	YEAR	THESIS TITLE	CURRENT POSITION
Carlos Camargo	Brazil	USAID	PhD	1979	Differential Response and Inheritance to Aluminum Toxicity, Heritability Estimates and Associations of Different Height Levels with Aluminum Toxicity, Grain Yield and Other Agronomic Characteristics in Wheat	Wheat Breeding and Research, University of Campinas, Brazil
Claudio Lovato	Brazil	Brazil	PhD	1979	Nitrate Reductase Activity in Leaves and Its Relationship to Nitrogen Yield in Four Spring Barley Cultivars	Sweet Corn Breeder, Brazil
Rollin Sears	USA	OSU	PhD	1979	Identification, Inheritance and Association of Different Dwarfing Sources and Gibberellic Acid Insensitivity in Barley	Assistant Professor, Wheat Breeder, Kansas State University, Manhattan, Kansas
Larry Alexander	USA	OSU	PhD	1980	A Study of Methods of Parental Evaluation Using Testers to Predict Subsequent Progeny Performance in Winter Wheat	Post Doctorate Corn Breeding, North Dakota State University, Fargo, North Dakota
Steven Oakley	USA	OSU	MS	1980	Inheritance of Yield Components and Other Characters in Four Winter and Four Spring Barley Cultivars	Completing PhD at University of Arkansas

NAME	COUNTRY	SUPPORT	DEGREE	YEAR	THESIS TITLE	CURRENT POSITION
Karen Schumaker	USA	OSU	MS	1980	Evaluation of Four Quality Factors in a Selected Winter X Spring Wheat Cross	Instructor, Principia College, Elsah, Illinois
Antonio Valencia	Mexico	Mexico	PhD	1980	Competitive Effect for Grain Yield of Four Cultivars in Pure and Mixed Populations in Wheat	Wheat Breeder, INIA, Cd. Obregon, Mexico
David Altman	USA	USAID	MS		The Effects of Foliar Applied Nitrogen on the Protein Content of Winter Wheat	
Nadjib Benacef	Algeria	CIMMYT	MS		Effect of Row Spacing, Date and Rate of Seeding on Yield of Five Winter Wheat Cultivars	
Mary Boulger	USA	OSU	MS		Root Development of Winter Wheat on Acid Soil as Affected by Lime and Phosphorus	Barley Breeding, Oregon State University Corvallis, Oregon
Pedro Brajcich	Mexico	Rockefeller	PhD		Combining Ability Analysis in Winter X Spring Wheat Crosses	
Byung Han Choi	Korea	Ford	MS		Vernalization and Photo-period Responses as Related to Earliness in Winter Wheat	

NAME	COUNTRY	SUPPORT	DEGREE YEAR	THESIS TITLE	CURRENT POSITION
Leonardo Corral	Ecuador	Ecuador	PhD	Combining Ability Effects in Single, Three and Four Way Crosses in Winter Wheat	
Federico Cuevas	Dominican Republic	Rockefeller	PhD	The Inheritance and Properties of Ratooning in Rice	
Ali Osman Ekse	Turkey	Rockefeller	MS	Gametocide Studies in Winter Wheat	
John Frederickson	USA	USAID	PhD	Recurrent Selection for Heading Date in Winter Wheat	
Micheal Glenn	USA	Rockefeller	PhD	Nitrogen - Moisture Balance in the Soil for Optimum Grain Yield in Winter Wheat Under Dryland Production Conditions	
Necati Hazar	Turkey	Rockefeller	MS	Early Generation Evaluation of Quality Characteristics in Wheat	
Mesut Kanbertay	Turkey	Rockefeller	MS	The Inheritance of Common Bunt Resistance	
James Mareck	USA	OSU	PhD	Two Aspects of Recurrent Selection in Spring Barley	
Jesus Martinez	Mexico	Mexico	PhD	Quality Characteristics of Winter X Spring Wheat Crosses	
Hwang Kee Min	Korea	Korea	MS	The Relationship Between Earliness and Yield and Yield Components	

NAME	COUNTRY	SUPPORT	DEGREE YEAR	THESIS TITLE	CURRENT POSITION
Guillermo Ortiz	Mexico	Rockefeller	PhD	Evaluation of the Pedigree, Modified Bulk and Bulk Selection Methods in Winter X Spring Wheat Populations	
Huseyin Senel	Turkey	Rockefeller	MS	Dryland Wheat Production	
Jaime Tola	Equador	Rockefeller	PhD	The Inheritance of Barley Yellow Dwarf Resistance in Winter Wheat	
Luz Gomez Pando	Peru	CIMMYT	MS	The Effects of Nitrogen on Grain Yield and Protein in Winter Wheat and Barley	
Yahyaoui Amor	Tunisia	USAID	MS	Interaction Between Various Herbicides and Winter Wheat Cultivars	

APPENDIX TABLE 3. Flow Diagram of Linkages



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 FINANCIERS 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

APPENDIX 4 - Contributions by the Agricultural Experiment Station and the Oregon Wheat Commission.

Currently the total cost in conducting the winter x spring program is being provided by the USAID contract supplemented by funds and facilities contributed through Oregon State University and the Oregon Wheat Commission. Research funds obtained from the Oregon Wheat Commission are the result of the farmers taxing themselves one cent per bushel for all wheat sold.

Oregon State University, in addition to such items as office space, greenhouses, various laboratories and the computer center, is providing salary dollars for Dr. Kronstad, Mary Boulger, Nan Scott, Patrick Hensleigh, Ann Corey, and Kathleen Klahn. The university also just completed an \$88,000 laboratory to facilitate the winter x spring program on the Hyslop Agronomy Farm. This laboratory was furnished from state appropriations. Included in this facility is a quality laboratory which will allow for an efficient evaluation of nutritional properties being incorporated into the germ plasm.

The Oregon Wheat Commission has contributed \$27,000 for the purchase of equipment for quality evaluation in direct support of the winter x spring program. Their funds, along with Oregon State University's, are also contributing substantially to the operating budget for such items as part time employees, travel to experiment stations, and purchase of supplies.

Appendix 5.

VISITORS TO THE CEREAL PROJECT

July 1979 - June 1980

<u>Visitor</u>	<u>Country</u>	<u>Position</u>
Mr. Kayihan Korhut	Turkey - CIMMYT	Short term trainee
Mr. Ben Saad	Algeria - CIMMYT	" " "
Mr. Mohamed Kamil	Algeria - CIMMYT	" " "
Mr. Larbi Larbi	Algeria - CIMMYT	" " "
Miss Kay Hamilton	U. of Wisconsin, USA	" " "
Dr. Valer Botezan	Breeder - Romania	" " "
Dr. Dan Atsmon	Weizman Inst., Israel	Long term trainee
Dr. Hanli Wang	People's Rep. of China	" " "
Mr. Jean Bernard Dubois	Nyon, Switzerland	" " "
Mr. Wan-sik Ahn	Korean Wheat Research Center	" " "
Mr. Eui-Byung Youn	Korean Wheat Research Center	" " "
Mr. Duck-Yong Suh	Korean Wheat Research Center	" " "
Mr. Frank Triverio	ENSA - France	" " "
Mr. Jean Pierre Rossett	Cargill, France	Visiting Scientist
Mr. Jack Mertin	CIMMYT - Mexico, Publications	" "
Dr. Jesse Dubin	CIMMYT, Triticale Program	" "
Dr. Joachim Lange	Breeder - Hamburg, Germany	" "
Dr. Peter Meredith	Breeder - New Zealand	" "
Dr. R. Glenn Anderson	CIMMYT - Mexico	" "
Dr. Norman Borlaug	CIMMYT - Mexico	" "
Eng. Dan Serbu	Dir., Min. of Ag - Fundelea, Romania	" "
Dr. Nicolai Gumanuc	Tech Dir. - Fundelea, Romania	" "
Dr. Octavian Lesniuc	Counselor, International Relations - Romania	" "
Mr. J. M. Bann	Seed Company - Kent, England	" "
Mr. Robert Fenton	Seed Company - Kent, England	" "
Mr. David Humphries	Seed Company - Kent, England	" "
Mr. Michael Rousset	Breeder - Clermont-Ferrand, France	" "
Mr. Ryuichi Ishii	Fac. of Ag, U. of Tokyo, Bunko-ku, Tokyo	" "
Professor Murata	Fac. of Ag, U. of Tokyo, Bunko-ku Tokyo	" "
Dr. Ishihara	Fac. of Ag, U. of Tokyo, Bunko-ku Tokyo	" "
Dr. Swindle	ICRISAT - Hyderabad, India	" "
Dr. Andrej Aniol	Plant Breeding & Acclimation Inst., Warsaw, Poland	" "
Dr. Larry Gusta	U. of Saskatchewan, Saskatoon, Canada	" "

		Visiting Scientist
Dr. Robert Redden	IITA - Ibadan, Nigeria	"
Dr. E. M. Matheson	Deputy Dir., ICARDA - Tabriz, Iran	"
Visiting Exchange Group	People's Republic of China	"
Mr. Oliver Lauboyer	CACBA - Cedex, France	"
Mr. M. Bonnemaizon	CACBA - Cedex, France	"
Mr. Paul Marko	Training, CIMMYT - Mexico	"
Dr. S. Rajaram	Wheat Breeding, CIMMYT - Mexico	"
Dr. Bent Skovmand	Triticale Breeding, CIMMYT - Mexico	"
Dr. Frank Zillinsky	Triticale Breeding, CIMMYT - Mexico	"
Dr. Enrique Rodriquez	Barley Breeding, CIMMYT - Mexico	"
Dr. Santiago Fuentz	Pathology, CIMMYT - Mexico	"
Dr. Enrique Torrez	Pathology, CIMMYT - Mexico	"
Dr. Eva Villegas	Quality Lab, CIMMYT - Mexico	"
Mr. Peter Portmann	Barley Breeder - S. Perth, Australia	"
Dr. Ralph Richardson	Rockefeller Foundation - New York	"
Dr. Russ Larson	Dean of Ag, Pennsylvania State U.	"
Dr. Dwight Finfrock	Rockefeller Foundation Consultant - Turkey	"
Dr. Glenn Pound	Dean of Ag, U. of Wisconsin	"
3 Egyptian Scientists	Ministry of Ag & Cereal Research - Egypt	"
Dr. Slavko Borojevic	Breeder - Novi Sad, Yugoslavia	"
Dr. Z. Martinic	Breeder - Zagreb, Yugoslavia	"
Mr. Guy Thiebaut	Breeder - Clays-Luck, France	"
Mr. Walter Nelson	Breeder, CIMMYT - Mexico	"
Dr. James MacKey	Breeder - Uppsala, Sweden	"
Mr. Rachid Sayoud	Pathology - Setif, Algeria finished M.S. at U. of Minnesota	"
Dr. Bryan Whan	Geneticist - Victoria, Australia	"
Dr. Ernesto Samayoa	Dir., CIANO - Cd. Obregon, Mexico	"
Mr. Fernando Durazo	Pres. PATRONATO - Sonora Station, Mexico	"
Dr. James Helm	Breeder - Alberta, Canada	"
Dr. M. Romero-Loli	Breeder, La Malina - Lima, Peru	"
Dr. George Varughese	Breeder, Regional Coordinator, CIMMYT - Portugal	"
Mr. Moncef Harrabi	Breeder - Tunis, Tunisia	"
	Ph.D. student, Montana	"
Dr. T. Wolski	Breeder - Laski, Poland	"

Appendix Table 6. Names, Positions and Addresses of Those Involved in the USAID Review

Robert W. MacVicar
President
Oregon State University
Corvallis, OR 97331

John Byrne
Dean of Research
Oregon State University

Wilson Foote
Associate Director
Agricultural Experiment Station
Oregon State University

Ed Hardin
Acting Department Head
Crop Science Department
Oregon State University

Warren E. Kronstad
Professor of Agronomy
Crop Science Department
Oregon State University

Willis McCuiston
Associate Professor
Crop Science Department
Oregon State University

Wesley Grilley
Executive Secretary
Oregon Wheat Growers League
P. O. Box 400
Pendleton, OR 97801

Bob Witters
Associate Director
Agricultural Experiment Station
Oregon State University

John Cuthbert
President, Oregon Wheat League
P. O. Box 400
Pendleton, OR 97801
(and 15 members of the Wheat League)

Frank Tubbs
Chairman, Oregon Wheat Commission
P. O. Box 400
Pendleton, OR 97801
(and 5 committee members)

Robert Metzger
Professor of Cytogenetics
USDA-SEA
Crop Science Department
Oregon State University

Fred Cholick
Research Associate
Crop Science Department
Oregon State University

Nan Scott
Instructor
Crop Science Department
Oregon State University

Mary Boulger
Instructor
Crop Science Department
Oregon State University

Tom Fairweather
Research Assistant
Crop Science Department
Oregon State University

Colleen Mork
Research Assistant
Crop Science Department
Oregon State University

Patrick Hensleigh
Research Assistant
Crop Science Department
Oregon State University

Tad Miller
Past President
Oregon Wheat Growers League
P. O. Box 400
Pendleton, OR 97801

Don Thompson
2nd Vice President
Oregon Wheat Growers League
Moro, OR 97039

Del Smith
Sherman Branch Experiment Station
Foreman
Moro, OR 97039

Larry Kaseberg
Wheat Representative to Experiment
Station Advisory Committee and
Past President of Oregon Wheat League
Star Route
Wasco, OR 97065

Ray Almarez
SEA Area Regional Director
Columbia Basin Agricultural Experiment
Station
Pendleton, OR 97801

Bob Ramig
SEA
Columbia Basin Agricultural Experiment
Station
Pendleton, OR 97801

Steve Lund
Superintendent
Columbia Basin Agricultural Experiment
Station
Pendleton, OR 97801

Mat Kolding
Cereal Breeder
Columbia Basin Agricultural Experiment
Station
P. O. Box 370
Pendleton, OR 97801

Ivan Packard
Executive Secretary
Oregon Wheat Commission
P. O. Box 400
Pendleton, OR 97801

Wren Case
Oregon Wheat Commission
Pendleton, OR 97801

Bill Hulse
Former Chairman
Oregon Wheat Commission
Pendleton, OR 97801

Bill Jaeger
Oregon Wheat Commission
Pendleton, OR 97801

Glenn Christensen
Former President
Oregon Wheat League
Pendleton, OR 97801

Dick Skiles
Former President
Oregon Wheat League
Pendleton, OR 97801

Allen Pinkerton
Former President
Oregon Wheat League
Pendleton, OR 97801

Don Thompson
President, Oregon Wheat Growers
League
Pendleton, OR 97801

Appendix Table 7. Additional Germplasm Sent to Various Locations in 1980

Distribution of F2 Bulk Populations

<u>Cooperator</u>	<u>Country</u>
Dr. L.J.M. Noulard	Belgium
Dr. Kosta Gatzov	Bulgaria
Mr. P. Auriau	France
Dr. Malik & Mr. Mir	India
Dr. C. Camargo	Brazil
Dr. V. Almanza	Colombia
Mr. M. A. Noory	Afghanistan
Dr. Pakendorf	South Africa
Mrs. Ho	Canada
Mr. John Bingham	England
Dir. Jean Roussineau	France
Dr. Aristeo Acosta-UAAAN	Mexico
Dr. R. K. Rai	The Netherlands
Dr. G. Halloran	Australia
Dr. Sung Ho Bae	Korea
Dr. A. Vallencia-CIANO	Mexico
Dr. Martinic	Yugoslavia
Mr. J. Acevedo	Chile
Dir., I.D.G.C	Algeria
Dr. Daaloul	Tunisia
Dr. Fossati	Switzerland
Dir., Wheat Res. Center	Turkey
Dir., Food & Ag Div.	Nepal
Dr. B. Valer	Romania

Additional International Seed Shipments

<u>Cooperator</u>	<u>Country</u>
Dr. M. Vahabian	Iran
Dr. M. Jalalyar	Afghanistan
Mr. Mir	India (Kashmir)
Dr. Jesse Dubin	Ecuador
Mr. Sisforaggera	Italy
Dr. M. Grant	Canada
Dr. J. Helm	Canada
Mr. Mellado	Chile
Dr. J. Lange	Germany
Dr. A. T. Pugsley	Australia
Mr. C. van Deventer	South Africa
Dir., CIMMYT	Mexico
Dr. B. Goht	Sweden
Dr. D. Atsmon	Israel
Dr. M. Loli	Peru
Dr. Rodrigez	Mexico
Dr. T. Ruebenbauer	Poland
Dr. Rocha	Brazil
Dr. M. Tahir	Pakistan
Mr. E. Beratto	Chile
Dr. S. Tomosoric	Zagreb
Mr. M. Harrabi	Tunisia
Dr. Botezan	Romania
Mr. J.G. Bowman	England
Dir., Research Station	Turkey
Mr. Marion Ford	Morocco (USAID)
Mr. G. Thiebaut	France
Mr. S. Sunderwirth	France
Dr. Sanchez	Spain
Mr. I. Angelor	Yugoslavia
Dr. Govedarov	Bulgaria
Dr. Balla	Hungary
Dr. Indelen	Turkey
Mr. Comeau	Canada
Mr. P. Portman	Australia
Mr. G. Hollamby	Australia
Mr. Leturque	France

Spring X Winter Yield Trials

<u>Cooperator</u>	<u>Country</u>
Dir., E.E.A. Inta	Argentina
Dr. I. Ramirez	Chile
Mr. T. C. Nel	South Africa
Mr. P. Auriau	France
Dr. Sung Ho Bae	Korea
Dr. S. Rajaram	Mexico
Dr. J. Brykszynski	Poland
Dr. N. Saulescu	Romania
Dir., Wheat Research Center	Turkey
Dr. Z. Martinic	Yugoslavia
Dr. E. Smith	Oklahoma, USA

Appendix Table 8. List of Cooperators

1980

8th IWSWSN
(Northern Hemisphere)

AFGHANISTAN

Mr. M. A. Noory
President of Agriculture Research
Ministry of Agriculture and Irrigation
Kabul, AFGHANISTAN

Port of Entry: Kabul

Mr. M. A. Noory
President of Agriculture Research
Ministry of Agriculture and Irrigation
Kabul, AFGHANISTAN

Attn: Widukhan-Herat, AFGHANISTAN

Port of Entry: Kabul

ALGERIA

Dr. Lounes Hachemi
I.D.G.C./CIMMYT
B.P. 16
El Harrach/Alger, ALGERIE

Port of Entry: Algiers

BELGIUM

Dr. L. J. M. Noulard, Director
Estacion de Amelioration de
Grandes Cultures
5800 Gembloux, BELGIUM

Port of Entry: Brussels

BULGARIA

Dr. Ivan Govedarov
Institute for Wheat and Sunflower
Tolbouhin, BULGARIA

Port of Entry: Sofia

CHINA

Chinese Academy of Agricultural and
Forestry Sciences
Pekin, People's Republic of China

Attn: Director Fang

Port of Entry: Peking

CANADA

Dr. Denis Bastien, Wheat Breeder
Station de Recherches Agricoles
3230, rue Dicotte, C.P. 70
Saint Hyacinthe, Quebec
CANADA J2S 2M2

Port of Entry: Quebec

Dr. James H. Helm
LaCombe, Alberta, CANADA TOC 150

Port of Entry: Edmonton

Dr. Leslie A. Hunt
Dept. of Crop Science
Ontario Agricultural College
University of Guelph
Guelph, Ontario, CANADA

Port of Entry: Toronto

CZECHOSLAVAKIA

Dr. B. Kabrt
Breeding and Research Station
919 28 Bucany
CZECHOSLAVAKIA

Port of Entry: Bratislava

DENMARK

Pajbjergfonden
Pajbjerggarden
Grindsnabevej 25-Dyngby
8300 Odder, DENMARK

Port of Entry: Unknown

ENGLAND

Dr. John Bingham
Plant Breeding Institute
Maris Lane, Trumpington
Cambridge, ENGLAND CB 22 LQ

Port of Entry: London

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FINLAND

Dr. R. Manner, Director
State Plant Breeding Institute
31600 Jokioinen, FINLAND

Port of Entry: Helsinki

Dr. Zoltan Barabas
Cereal Research Institute
6701 Szeged, P.O.B. 391
HUNGARY

Port of Entry: Budapest

FRANCE

Mr. P. Auriau
Genetique des Plantes
Etoile de Choisy
Route de St-Cyr 78000
Versailles, FRANCE

Port of Entry: Orly (Paris)

Mr. Michel Rousset
Charge de Recherches a l' I.N.R.A.
Station d' Amelioration des Plantes
Domaine de Crouelle
63 100 Clermont-Ferrand-FRANCE

Port of Entry: Unknown

INDIA

Dr. M.V. Rao
I.A.R.I.
Cummings Laboratory
New Delhi 12, INDIA

Attn: Mr. G.N. Mir
AND

Attn: Dr. S.K. Malik

Port of Entry: New Delhi

IRAN

Dr. Mohamed Vahabian
Karaj Plant Breeding Center
Karaj, IRAN

Port of Entry: Tehran

GERMANY

Dr. Joachim Lange
2000 Hamburg 19
Osterstrasse 71
WEST GERMANY

Port of Entry: Hamburg

IRAQ

General Committee for Applied Research
Cereal Department
Abu-Ghraib, Baghdad, IRAQ

Port of Entry: Baghdad

GREECE

Dr. E. A. Skorda
Cereal Institute
Thessaloniki, GREECE

Port of Entry: Thessaloniki

ISRAEL

HUNGARY

Dr. Laszlo Balla
Agricultural Research Institute
Hungarian Academy of Sciences
Martonvasar, HUNGARY

Port of Entry: Budapest

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JAPAN

Mr. Yukio Ozeki, Head
Regional Wheat Breeding Lab
Kitami Prefectural Agri. Exp. Sta.
Kunnepu, Tokoro-gun
Hokkaido, JAPAN

Port of Entry: Otaru

JORDAN

Dr. Mahmud Duwayri
Faculty of Agriculture
University of Jordan
Amman, JORDAN

Port of Entry: Amman

Mr. Zulkifl Ghosheh, Director
Agricultural Research Division
P.O. Box 226
Amman, JORDAN

Port of Entry: Amman

KOREA

Dr. Chang Hwan Cho, Director
Wheat and Barley Res. Institute
Office of Rural Development
Suweon, KOREA

Port of Entry: Unknown

LEBANON

Dr. A. Alameddine
Regional Field Food Crops
Improvement Officer
UNDP, P.O. Box 3216
Beirut, LEBANON

Port of Entry: Beirut

LIBYA

Chairman of Agricultural Res. Center
P.O. Box 2480
Tripoli, LIBYA

Attn: Dr. Jamal Fuad/
Mr. Soliman el-Sebai

Port of Entry: Tripoli

MEXICO

Dr. S. Rajaram (2 sets -- one for CIMMYT
CIMMYT and one for Jose Luis
Maya, CIANO)

Apdo. Postal 6-641
Londres 40, MEXICO 6, D.F.

Port of Entry: Mexico City

NEPAL

Dr. A. N. Bhattarai
National Wheat Development Program
Bhairahwa Agriculture Farm
Bhairahwa, NEPAL

Port of Entry: Kathmandu

PAKISTAN

Dr. Homer M. Hepworth
c/o LAPSA
P.O. Box 1237
Islamabad, PAKISTAN

Port of Entry: Karachi

POLAND

Dr. J. Brykzynski
Laski, p. 05-660
Warka, POLAND

Port of Entry: Warsaw

Dr. Tadeuse Ruebenbauer
Prof. at the Agricultural College
Cracow
Kracow ul Urzednicza 58 m. 9
POLAND

Port of Entry: Cracow

ROMANIA

Dr. N. Saulescu, Wheat Breeder
I.C.C.P.T. Fundulea
Laborator Ameliorare Griu
Comuna FUNDULEA-Judet ILFOV-8264
ROMANIA

Port of Entry: Bucharest

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SPAIN

Dr. Jose M. Vallejo
I.N.I.A.
Av. Puerta de Hierro s/n
Madrid, SPAIN
(Send seed through CIMMYT)

SWITZERLAND

Dr. F. Weilenmann
Swiss Federal Res. Sta. for
Agronomy
8046 Zurich
Rechenholzstrasse 191/211
SWITZERLAND

Port of Entry: Zurich

Dr. A. Fossati
Station Federal de Recherches
Agronomiques
De Changins
CH1260 Nyon, SWITZERLAND

Port of Entry:

SYRIA

Dr. J. P. Srivastava
Cereal Improvement Programme Leader
ICARDA
P.O. Box 5466
Aleppo, SYRIA

Port of Entry: Aleppo

TUNISIA

Dr. Abderrazak Daaloul
Ecole Superieure des Grandes
Cultures du Kef
Kef, TUNISIE

Port of Entry: Unknown

TURKEY

Turkish Winter Cereal Project
c/o Agricultural Attache
U.S. Embassy, Ankara
APO NY 98254

(Send 7 sets - address list attached)

Port of Entry: Ankara

USSR

Dr. V. G. Gulyayev
Agricultural Institute of Central
Non-Chernozem Zone
P.O. Nemichinovka, Odzintsovsky Rayon
Moskovskaya-Oblast, U.S.S.R.

Port of Entry: Moscow

Dr. Yuri M. Puchkov
Wheat Breeding Department
Krasnodar Lukyanenko
Research Institute of Agriculture
350012 Krasnodar, U.S.S.R.

Port of Entry: Moscow

Dr. Aleksey A. Sozinov, Director
All-Union Institute for Breeding
and Genetics
Odessa, 270036, U.S.S.R.

Port of Entry: Odessa

YUGOSLAVIA

Dr. S. Borojevic
Institute of Agricultural Research
Novisad, Maksime
Gorkog 30, YUGOSLAVIA

Port of Entry: Belgrade

Mr. Ivan Angelov
Zemjodelski Institut
Skopje, Macedonal, YUGOSLAVIA

Port of Entry: Belgrade

Dr. Z. Martinic J.
Faculty of Agriculture
P.O. Box 1009
Yu-41001
Zagreb, YUGOSLAVIA

Port of Entry: Zagreb

YEMEN ARAB REPUBLIC

M. M. Elghouri
Central Agri. Res. Project
TAIZ
P.O. Box 4788
UNDP - SANAA'
YEMEN ARAB REPUBLIC

Port of Entry: SANAA'

8th IWSWSN
(Northern Hemisphere)

U.S.A.

Dr. J. R. Welsh
Department of Agronomy
Colorado State University
Fort Collins, COLORADO 80521

Dr. E. H. Everson
Dept. of Crop & Soil Sciences
Michigan State University
East Lansing, MICHIGAN 48823

Dr. V. A. Johnson
Agronomy Department
University of Nebraska
Lincoln, NEBRASKA 68503

Dr. Howard N. Lafever
Professor, Dept. of Agronomy
Ohio Agric. Res. & Development Center
Wooster, OHIO 44691

Dr. C. F. Konzak
Dept. of Agronomy and Soils
Washington State University
Pullman, WA 99163 (spring-planted)

Dr. Clarence Peterson
Dept. of Agronomy and Soils
Washington State University
Pullman, WA 99163

Dr. Don Keim
Plant Science Department
South Dakota State University
Brookings, SOUTH DAKOTA 57006

Dr. Jerry W. Johnson
University of Georgia
Georgia Experiment Station
Experiment, GEORGIA 30212

Dr. Allan Taylor
Plant and Soils Department
Montana State University
Bozeman, MONTANA 54715

Dr. Ed Smith
Department of Agronomy
Oklahoma State University
Stillwater, OKLAHOMA 74074

Dr. Louis Anzalone
Department of Plant Pathology
The Louisiana State University
College of Agriculture
Baton Rouge, LOUISIANA 70803

Dr. Elmer Heyne
Department of Agronomy
Kansas State University
Manhattan, KANSAS 66506

8th IWSWSN
(Southern Hemisphere)

ARGENTINA

Director
E.E.A. INTA
Bordenave
Buenos Aires, ARGENTINA
Attn: Ing. Santiago Garbini
Port of Entry: Buenos Aires

Jorge E. Nisi
Inta Marcos Juarez
CCHO 21 Cordoba, ARGENTINA
Port of Entry: Unknown

AUSTRALIA

Dr. M. A. Kahn
Agricultural Research Institute
Department of Agriculture
Wagga Wagga, N.S.W. 2650
AUSTRALIA
Port of Entry: Unknown

Mr. G. J. Hollamby
Roseworthy Agricultural College
Roseworthy, South Australia
AUSTRALIA 5371
Port of Entry: Unknown

BRAZIL

Dr. Milton Rocha
Universidad Federal de Pelotas
96100 Pelotas - R.G. Sul
BRAZIL

Port of Entry: Porto Alegre

Eng. Agr. Ottoni de Sousa Rosa
EMBRAPA - C.N.P. Trigo
Caixa Postal 569
99.100 - Passo Fundo
RS - BRAZIL

Port of Entry: Porto Alegre

Dr. Carlos Camargo
Instituto Agronomico
Caixa Postal - 28
Campinas, S. Paulo
C.E.P. - 13100 BRAZIL

Port of Entry:

CHILE

Dr. Ignacio Ramirez
Institute de Investig. Agropec.
Casilla 5427
Santiago, CHILE

Port of Entry: Santiago

Mr. Juan Acevedo
Estacion Experimental Carillanca
Temuco, CHILE

Port of Entry: Unknown

Mrs. Lily Aguayo
Estacion Experimental Quilmapu
Casilla 426
Chillan, CHILE

Port of Entry: Unknown

COLOMBIA

Dr. Mario Zapata
C.N.I.A. Tibaitata
Bogota, COLOMBIA

Port of Entry: Bogota

Dr. D. Varela Almanza
Instituto Colombiano Agropecuario
Tibaitata, Bogota D.E., COLOMBIA

Port of Entry: Bogota

ECUADOR

Dr. Jesse Dubin (send two sets)
INIAP
Box 2600, Quito
ECUADOR

Port of Entry: Quito

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NEW ZEALAND

Director
Crop Research Division
Dept. of Scientific and
Industrial Research
Private Bag
Christchurch, NEW ZEALAND

Attn: J. P. Malcolm

Port of Entry: Unknown

PERU

Marino Romero Loli
Universidad Agraria
Apartado 456
Lima, PERU

(Need import permit)

Port of Entry: Lima

SOUTH AFRICA

Director, Crops and Pastures
c/o Plant Introduction Officer
Private Bag X179
Pretoria, 0001
SOUTH AFRICA

Port of Entry: Johannesburg

URUGUAY

Ing. Irene Gatti de Leon
Centro de Investigaciones
Agrícolas "Alberto Boerger"
Estacion Experimental La Estanzuela
Colonia, URUGUAY

(Need import permit)

Port of Entry: Colonia

TURKISH IWSWSN COOPERATORS

A. E. Firat
Güney Dogu Anadolu
Bolge Ziraî Arastirma Enstitüsü
P.K. 72
Diyarbakir, TURKEY

Erdogen Indelen
Ziraî Arastirma Enstitüsü
Edirne, TURKEY

B. Yilmaz
Doguanadolu Bolge Ziraî
Arastirma Enstitüsü
Erzurum, TURKEY

E. Karma
Ziraî Arastirma Enstitüsü
Eskisehir, TURKEY

Dr. H. Alpargun
Marmara-Trakya Bolge Ziraî
Arastirma Enstitüsü
Yesilkoy - Istanbul, TURKEY

P. Solen
Bolge Ziraî Arastirma Enstitüsü
Menemen - Izmir, TURKEY

Mr. Metin Arican
Ziraî Arastirma Enstitüsü
Mudurlugu
Adapazari, TURKEY

Director
Wheat Research and Training Center
P. K. 226
Ankara, TURKEY

OREGON LOCATIONS

Winter

Hyslop
Moro
Rugg
Hermiston (2 sets)
Flora
Squaw Butte

Spring-Planted

Hyslop
Klamath Falls