CIMMYT Report on Wheat Improvement

1985-86

CIMMYT Report on Wheat Improvement

1985-86

The International Maize and Wheat Improvement Center (CIMMYT) is an internationally funded, nonprofit scientific research and training organization. Headquartered in Mexico, the Center is engaged in a worldwide research program for maize, wheat, and triticale, with emphasis on food production in developing countries. It is one of 13 nonprofit international agricultural research and training centers supported by the Consultative Group on International Agricultural Research (CGIAR), which is sponsored by the Food and Agriculture Organization (FAO) of the United Nations, the International Bank for Reconstruction and Development (World Bank), and the United Nations Development Programme (UNDP). Donors to the CGIAR system are a combined group of 40 donor countries, international and regional organizations, and private foundations.

CIMMYT receives core support through the CGIAR from a number of sources, including the international aid agencies of Australia, Austria, Brazil, Canada, China, Denmark, Federal Republic of Germany, Finland, France, India, Ireland, Italy, Japan, Mexico, the Netherlands, Norway, the Philippines, Spain, Switzerland, the United Kingdom, and the USA, and from the European Economic Commission, Ford Foundation, Inter-American Development Bank, OPEC Fund for International Development, UNDP, and World Bank. CIMMYT also receives non-CGIAR extra-core support from Belgium, the International Development Research Centre, the Rockefeller Foundation, and many of the core donors listed above.

Responsibility for this publication rests solely with CIMMYT.

Correct Citation: CIMMYT Report on Wheat Improvement 1985-86. 1988. Mexico, D.F.: CIMMYT.

ISSN 0304-54-39

On the cover: Improvement of spring wheats from winter x spring crosses is a well established fact. Since there is no scientific reason why winter wheats should not benefit to the same extent from winter x spring crosses, this effort is receiving major emphasis in the newly established Turkey/CIMMYT Collaborative Project for winter wheat. The cover photo shows winter wheat lines receiving supplemental lighting in Ciudad Obregon, Sonora, so that it will flower concurrently with spring wheat lines in nearby plots, thus permitting crosses between these two gene pools. (Photo by Gene Hettel).

Germplasm Bank

H.A. Sencer

Introduction

CIMMYT's wheat germplasm bank program was started in October 1981. The bank's physical facilities became operational at the end of 1983.

Base collection—The base collection of the bank consists of bread wheat, durum wheat, triticale, and barley entries with desirable characters and both spring- and winter-type growth habits. The international screening and yield nurseries, spring and winter crossing blocks, primary triticales, progenitors, and interspecific and intergeneric crosses are the sources of the base collection. Advanced lines from CIMMYT nurseries, commercial varieties of the cooperators and progenitors identified and utilized by CIMMYT form the base collection. They are selected on the basis of their superior characteristics and included in the nurseries which provide introductions to the base collection.

In 1982, about 5500 bread wheat, durum wheat, and triticale entries from the base collection were evaluated for resistance to leaf, stem, and stripe rusts; septoria tritici blotch, and fusarium leaf blight at Ciudad Obregon, Toluca, Patzcuaro, and Rio Bravo in Mexico; about 2700 barley entries were evaluated at El Batan for resistance to leaf and stem rusts, fusarium and helminthosporium in cooperation with the pathology program. In 1983, about 3000 barley entries from the base collection were evaluated for the leaf rust resistance at Cd. Obregon, Mexico. The same year two pilot disease evaluation nurseries, consisting of 383 bread wheat and 210 durum wheat entries from the base collection, were sent to the cooperators in disease "hot spots" around the world.

By the end of 1984, the bank's base collection was brought up-to-date in seed introduction, increase/rejuvenation, morpho-agronomic evaluation, and storage of materials with a spring-type of growth habit. At the end of 1986, the base collection contained 26,175 entries (Table 1).

Active collection—The active collection of the bank consists of various species of wheat, triticale, barley and *Aegilops* with known or unknown characteristics for crop improvement and both spring- and winter-type growth habits. The national cooperators (both gene banks and improvement programs) and CIMMYT regional and base

H. Ayla Sencer, curator of the wheat germplasm bank, checks inventory in the storage facility.

program nurseries are the sources of the active collection. Land races and wild species, advanced lines, and selections from land races and wild species form the active collection. They are introduced for screening and selected by CIMMYT programs (regional and headquarters) on the basis of desirable characteristics. They are of a semi-improved or unimproved nature.

The relatively small active collection, consisting of potential germplasm entries from past (1969-81) breeding nurseries, was inherited by the bank in 1981. The active collection was enlarged as of 1982 by introductions of various natures. Parental collections and potential germplasm material were received from the CIMMYT outreach programs. Collections of primitive land races and wild species, originating from Turkey, Ethiopia, Pakistan, China, etc. were introduced upon request from the breeding programs, to be screened for stress tolerance and disease resistance. Entire sets of *Triticum aestivum* materials with a spring-type of growth habit were introduced from the national small grains collection (NSGC) of the USDA.

Over 2000 entries from the active collection of the bank were grown at El Batan during the winter season of 1983-84 for seed increase/rejuvenation and morpho-agronomic evaluation, while they were being screened for other characteristics by the breeding programs. By the end of 1986, the active collection contained 35,182 entries (Table 1).

Information management—The information management of the bank has been manual since its initiation. Elimination of duplicated entries, preparation of books, labels, bags, and updating of information were all handled manually. Towards the end of 1984, entry of part of the introduction data (names, pedigrees and origins) to the computer was started and the process of complete computerization was continued in 1985-86.

The activities of the bank, during the period of 1981-1986 are summarized in Table 1.

Seed Introduction

The number of new entries added to the inventories of the bank in 1985-1986 totaled 13,786; 6,668 to the base collection and 7,118 to the active collection, respectively (Table 2). The new entries added to the base collection originated from different nurseries of the bread wheat, durum wheat, triticale, barley, and basic germplasm development programs.

The new entries added to the active collection consisted of wheat materials from Winnipeg, Canada; durum wheat entries with a spring-type growth habit from the NSGC of the USDA; wheats originating from Ethiopia; wheats with a winter-type of growth habit from the Italian gene bank; wheats from the Japanese gene bank; wheats from CIMMYT's programs in Turkey, Portugal, Chile, Ecuador, and Brazil; and wheats from Australia and Morocco.

Seed Increase/ Rejuvenation

More than 17,000 entries were increased, rejuvenated, and evaluated in 1985-86 (Table 2). A seed increase/rejuvenation nursery of 3508 winter-type entries of bread wheat, durum wheat, triticale, barley, and introductions from the base and active collections, was grown at Cuauhtemoc, Mexico, during the 1984-1985 winter season. Due to late frost and flowering time, generally insufficient quantities of seed (less than 500 grams of seed per entry) were harvested.

During the 1985-1986 winter season, a seed increase/ rejuvenation and evaluation nursery of 9519 spring-type entries of bread wheat, durum wheat, triticale, and barley from the base and various species from the active collection was grown at Cd. Obregon. This nursery contained approximately 5000 and 2000 new introductions from the base and active collections, respectively; 1500 entries for seed increase; and 1000 entries for rejuvenation purposes originating from the base collection.

Also during the 1985-1986 winter-season, another seed increase/ rejuvenation and evaluation nursery of 3983 wheat entries, sent by CIMMYT program in Portugal consisting of breeding lines, was grown at El Batan. Since germination of most of the entries under field conditions was impossible, another set of these seeds was germinated in the laboratory with treatment to break dormancy and provoke germination. Only 510 entries could be germinated.

Seed Storage

The seeds of 11,141 entries (Table 2), harvested from the seed increase/rejuvenation nurseries, were processed (cleaned and dried) and stored in three sets (for long- and medium-term storage and distribution) at CIMMYT. A fourth set was prepared for long term-storage at the USDA National Seed Storage Laboratory (NSSL).

A pilot study was conducted in 1985 to find out if there were any significant differences in viability among the same entries stored at different times under different storage conditions. Data analysis indicated that a majority of the bread wheats had 96-99% viability, the durum wheats 90-95% viability, the triticales 90-99% viability, and the barleys 90-99% viability.

Viability tests for more than 28,000 entries (Table 2) were conducted with one replicate, 100 seeds per entry. The tests were repeated with four replications, 100 seeds each, for those entries which showed less than 80% viability.

Seed Distribution

More than 29,000 entries were distributed from the bank upon request from CIMMYT breeding programs and cooperators (Table 2). There were 46 and 43 independent dispatches from the bank in 1985 and 1986, respectively. Quantities varied from 5 to 500 g.

The largest dispatches in 1985 were sent to programs in Japan, Chile, and China and to the CIMMYT Wide Crosses Program and, in 1986 to programs in Japan, China, India, and Kenya (CIMMYT regional) and to the durum wheat (CIMMYT base) program.

Evaluation

Morpho-agronomic characteristics, taxonomic identification, and growth habit of about 3500 entries sown at Cuauhtemoc during the 1984-1985 winter season and of about 9500 entries sown at Obregon during the 1985-1986 winter season were determined.

In addition, the infection types of both leaf and stem rusts were determined for about 3000 entries from the active collection during the 1985-86 Yaqui Valley winter season. Hexaploid wheats and *Triticum carthlicum* with resistant reactions were passed to the bread wheat and wide crosses programs, respectively. Assistance was provided for morpho-agronomic evaluation as well as determination of taxonomic identification, growth habit, and leaf and stem rust resistance in a nursery of 6000 wheat entries (mostly single-plant collections) which were collected in Turkey and grown at Yaqui Valley by Dr. R.J. Metzger, during the 1985-86 season.

Information

As in previous years, elimination of duplicated entries, preparation of field books, distribution lists, bags and labels, and updating of information were carried out manually.

Entries of introduction data (names, pedigrees, and origins) to the computer were continued and data from a total of 104,167 entries were entered in 1985 and 1986 (Table 2). Correction and updating of data were not done in 1986.

During the second half of 1986, the distribution lists and nursery books of the bank were printed by the computer for the first time.

To provide relevant information, requested along with the seed, disease data were retrieved manually for over 800 entries which were sent to CIMMYT's East Africa Program based in Kenya. In turn, up-to-date disease data are expected from Kenya.

Disease data for more than 17,000 entries of bread wheat, durum wheat, and barley were copied from the CIMMYT wheat international nurseries reports and sent to Japan, along with the entire duplicate sets of bread wheats, durum wheats, and barleys from the bank's base collection.

Seed Health

The seed shipments from the bank in 1985 and 1986 were treated with a mixture of chemicals recommended by the Seed Health Unit.

Towards the end of 1986, an investigation to find out the effectiveness of deep freezing as a quarantine measure for the germplasm bank material was started jointly with the Seed Health Unit.

Table 1. CIMMYT's wheat germplasm bank activities (no. of entries) in 1981-1986

	Seed Intro.	Seed Increase Rej., Eval.	Seed Storage			Viability Tests	Seed Distr.	No. of Entries
			Base CIMMYT	Base NSSL[a]	Active CIMMYT			
Bread Wheat	11512	13572	10188	9998	11851	8517	15741	23081
Durum Wheat	4824	6439	4738	4701	6139	4084	5332	13533
Triticale	5375	6539	5412	5382	5699	3728	1677	11860
Barley	4837	10061	4931	4801	6498	4130	5410	13231
Interspecific crosses	2561	1236	906	894	906	114	-	5004
Introductions	26654	9726	-	-	4089	-	11154	41478
Total	55763	47573	26175	25776	35182	20573	39314	108187

[a] National Seed Storage Laboratory, Fort Collins, Colorado

Table 2. CIMMYT's wheat germplasm bank activities (no. of entries) in 1985-1986

Crop	New Entries	Seed Increase/ Rej., Eval.	Seed Storage	Viability Tests	Seed Distribution	No. of Entries
Bread Wheat	2311	3613	3400	10526	12310	19061
Durum Wheat	886	1902	1875	5166	4480	13533
Triticale	1146	1981	1861	5394	128	11860
Barley	465	1155	1125	4912	4503	13231
Interspecific Crosses	1860	812	791	905	-	5004
CIMMYT Wheat Int.	7118	7547	2089	1462	7827	41478
Total	13786	17010	11141	28365	29248	104167

Wheat Program Personnel

(Dec. 31, 1986)

CIMMYT Headquarters

Director—Byrd C. Curtis, USA
Associate Director—Arthur R. Klatt, USA
Senior Consultant—Norman E. Borlaug, USA

Improvement Programs

Bread Wheat—Sanjaya Rajaram, India
Wolfgang H. Pfeiffer, West Germany
Ravi P. Singh, India
Osman S. Abdalla, Sudan

Durum Wheat—Pedro Brajcich G., Mexico

Triticale—George Varughese, India

Support Programs

Agronomy—Matthew A. McMahon, Ireland
Kenneth D. Sayre, USA

Germplasm Bank—H. Ayla Sencer, Turkey

Germplasm Development—Ricardo Rodríguez R., Mexico

Industrial Quality—Arnoldo Amaya C., Mexico
Roberto Javier Peña, Mexico

Information Services—Eugene P. Hettel, USA

International Testing—Maximino Alcalá S., Mexico

Pathology— Girma Bekele, Ethiopia
Lucy Gilchrist S., Chile
J.M. Prescott, USA
Peter A. Burnett, New Zealand
Monica Mezzalama, Italy
Elizabeth J. Warham, UK

Training—Reynaldo Villareal, the Philippines

Wide Crosses—A. Mujeeb-Kazi, USA

Regional Programs

Andean—Paul Fox, Australia
Patrick C. Wall, Ireland
(based in Quito, Ecuador)

East/Southern Africa—Enrique Torres, Colombia
Douglas G. Tanner, Canada
Daniel Danial, The Netherlands
(based in Nairobi, Kenya)

North and West Africa and the Iberian Peninsula— Santiago Fuentes F., Mexico (based in Lisbon, Portugal)

South Asia—H. Jesse Dubin, USA (based in Kathmandu, Nepal)

Southeast Asia—Christoph E. Mann, West Germany
David A. Saunders, Australia
(based in Bangkok, Thailand)

Southern Cone of South America— Man Mohan Kohli, India
L.T. van Beuningen, The Netherlands
(based in Asunción, Paraguay)

Bilateral Programs

Bangladesh— Larry Butler, USA (based in Dhaka)

Pakistan— Peter R. Hobbs, UK (based in Islamabad)

Peru— Gregorio Vázquez G., Mexico (based in Lima)

Turkey—Bent Skovmand, Denmark (based in Ankara)

Joint Collaborative Projects

CIMMYT/ICARDA Bread Wheat Improvement Project— Guillermo Ortiz F., Mexico (based in Aleppo, Syria)

CIMMYT/ICARDA Durum Wheat Improvement Project— Miloudi Nachit, W. Germany (based in Aleppo, Syria)

Turkey/CIMMYT Winter Wheat Project— Hans-Joachim Braun, W. Germany
Eugene E. Saari, USA
(based in Ankara)

Postdoctoral Fellows

Robert Asiedu, Ghana
Thomas G. Barker, USA
Mark A. Bell, Australia
Daniel J. Davidson, USA
William R. Raun, USA
Maarten van Ginkel, The Netherlands

ISSN 0304-54-39

Centro Internacional de Mejoramiento de Maíz y Trigo
International Maize and Wheat Improvement Center
Lisboa 27, Apartado Postal 6-641, 06600 México, D.F. México