

CIMMYT
COLLABORATIVE RESEARCH ACTIVITIES
(Present Work and Future Needs)

(May 9, 1980)



CENTRO INTERNACIONAL DE MEJORAMIENTO DE MAIZ Y TRIGO

INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER

México

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INTRODUCTION

CIMMYT COLLABORATIVE RESEARCH ACTIVITIES 1979-80

CIMMYT continues to direct its research towards the solution of applied "production-oriented problems" applicable to wide scale use in strengthening national research and production programs in developing countries. These applied research programs occasionally are limited by more complex problems requiring the application of specialized research techniques, equipment, or knowledge for their solution.

CIMMYT believes that this type of research is best undertaken in collaboration with scientists in "centers of excellence", in universities, and in government and private research laboratories in both developed and developing countries of the world.

Apart from the collaborative research arrangements, CIMMYT maintains contacts with a wide range of such centers throughout the world. These contacts help to ensure that new research results of a basic or applied nature that are of potential value to scientists or farmers in other countries are studied and adopted for further research and adaptation, if appropriate. This procedure keeps CIMMYT staff abreast of new research developments and helps to maintain the interchange of ideas between the scientists of both types of organizations, also enabling CIMMYT scientists to provide personal information conduits between scientists in technically developed countries and those in developing countries and vice-versa.

CIMMYT has, at present, a number of collaborative research agreements in progress. Most, but not all, of these arrangements are financed by special grants. Both present collaboration activities and future needs are covered in this document. The report discusses: (1) activities of the CIMMYT Wheat Program, (2) the Maize Program and (3) Collaborative Activities involving both programs.

WHEAT PROGRAM

Collaborative Research Activities

PRESENT
COLLABORATION

May 9, 1980

**CIMMYT COLLABORATIVE RESEARCH ACTIVITIES
WHEAT PROGRAM**

Collaborating Country	Scientific Focus	Institution	Brief Description of Proposed Activity
Argentina	Breeding & Germ-plasm Development	Argentina National Agricultural Institute	A shuttle breeding effort between the various programs in Argentina and CIMMYT in Mexico to speed up the development of high yielding, disease resistant varieties adapted to the conditions of the Argentine.
	Breeding & Germ-plasm Development		An aggressive program to select forage triticales is being conducted and CIMMYT is furnishing most of the germplasm.
Australia		University of Sydney	Study of CIMMYT wheat multilines to identify stem rust resistance genes.
Brazil	Breeding & Germ-plasm Development	EMBRAPA FECOTRIGO	A shuttle breeding effort with Brazil to obtain high yielding wheats with tolerance to high levels of aluminum.
Canada	Cytology	University of Manitoba, with the Plant Breeding Institute, Cambridge, England	Investigating the heterochromatin content of rye chromosomes and its relationship to seed shriveling in triticales; seeking to develop and identify triticale lines with reduced heterochromatin in one or more of the rye chromosomes.
	Breeding & Germ-plasm Development	University of Guelph	Development of winter type triticales.
Canada	Cytology	University of Manitoba	Origin and consequence of chromosome malfunction in Triticale.

Netherlands & Israel		IPO and Univ. of Tel- Aviv	IPO and Univ. of Tel Aviv work in Israel to screen germplasm for better Septoria resistance.
The Netherlands	Pathology	Institute of Phy- topathological Re- search (IPO)	Virulence identification of strips rust collections and regional phy- topathological workshops in as- sociation with disease surveillance network operating from Morocco to India.
	Pathology	IPO	Identifying stripe rust races from collections around the world and as- sisting in the identification of lines with excellent resistance to the stripe rust.
Sweden	Genetics	Institute of Genetics Svalov and Univ. of Lund	Research on hexaploid and octaploid triticales.
Syria	Breeding & Germ- plasm Improvement	ICARDA	CIMMYT cooperates with the winter cereals program. In 1980, CIMMYT will assign a wheat breeder to ICARDA, stationed at Aleppo, Syria.
Turkey Syria U.S.A.	Breeding & Germ- plasm Improvement	Turkey National Wheat Program, ICARDA and Oregon State Univ.	Cooperating in the development of winter wheats and wheats with cold tolerance for winter and facultative wheat regions of the world.
United Kingdom (and Canada)	Cytology	The Plant Breeding Institute, Cambridge, Univ. of Manitoba, Winnipeg	Working with the seed shriveling pro- blem in triticale and its possible relationship to the heterochromatin content of the rye chromosomes.

United Kingdom

Pathology
(2 projects)

Commonwealth
Mycological
Institute
Dept. of Agriculture
and Fisheries for
Scotland.

Identification of Triticale diseases.

Genetics

The Plant Breeding
Institute,
Cambridge

Hormonal and genetic basis of dwarfing
in wheat.

Cytology

Plant Breeding
Institute,
Cambridge

Cytology of Triticale.

Physiology

Univ. of Reading

Physiology in wheat -- effect of
day-length and temperature on the
development of the apical meristem.

Physiology

Wye College

Hormonal and genetic basis of dwarf-
ing in wheat.

U.S.A.

Breeding & Germ-
plasm Improvement

Oregon State Univ.

An extensive research effort involving
winter wheats and spring x winter
wheats for many regions of the
world. CIMMYT co-sponsors the distribu-
tion of the International Winter x Spring
Wheat Screening Nursery (IWSWSN). Also
working with triticales, especially winter
types, with extensive programs in agro-
nomic research and weed control.

Breeding &
Germplasm
Development

Alabama A. and M
University

Germplasm and scientific backup for
spring triticale breeding program.

Univ. of Nebraska

Sponsors, with CIMMYT, the Int'l Winter
Wheat Performance Nursery (IWPN), a
yield trial designed to evaluate winter
wheats around the world.

U.S.A. (Contd.)	Breeding & Germ-plasm Development	Oregon State Univ.	Development of winter types from winter x spring crosses of wheat and triticale.
	Pathology	Montana State Univ.	Pathology of barley diseases.
	Cereal Technology	Texas Technical University	Industrial uses of Triticale.
U.S.A.	Breeding & Germ-plasm	Kansas State Univ.	Crosses between plant genera using immunosuppressant drugs to break down incompatibility barriers.
	Physiology and Breeding	Washington State University	Development of laboratory screening techniques for selecting resistance to aluminum toxicity.
Federal Republic of Germany	Breeding & Germ-plasm Development	Freie University West Berlin	New primary Triticale and tetraploid Triticale.
	Breeding & Germ-plasm Improvement	University of Hohenheim	Development of fertile, short-strawed, high yielding rye inbreds (Triticale).
Yugoslavia	Pathology	Novi Sad Faculty of Agriculture	Identification of leaf rust races from around the world.
Zambia	Pathology	Zambia, National Research Institute	Screening in Zambia for better <u>Helminthosporium</u> resistance.

WHEAT PROGRAM
Collaborative Research Activities

FUTURE
COLLABORATION

May 9, 1980

(FUTURE PROGRAMS)

A screening program to identify lines with better resistance to Fusarium head scab.

To enhance the participation of the Ste-Foy and the Univ. of Manitoba in the BYDV project.

A cooperative program to identify material with better resistance to the various root rot diseases of cereals.

A cooperative program to develop very early spring and winter wheats ideally suited for the rotations in China and in other countries of SE Asia.

Need for better stem rust resistance in durums better Septoria resistance in bread wheats and durums, and Rhynchosporium resistance in barley.

A screening program to identify materials resistant to Helminthosporium.

Cooperation in the development of resistance to Barley Yellow Dwarf Virus (BYDV) in wheat, barley and triticale.

Need for a screening program to identify wheats with better tolerance to high temperatures.

Need to screen existing germplasm, including the world collection, of bread wheat durums, triticales and barley to identify better sources of BYDV resistance. To incorporate this resistance into high yielding widely adapted wheat, triticale, and barley varieties and distribute the resistant lines around the world where BYDV is a problem.

Collaboration in CIMMYT's wide cross program to incorporate from other species better levels of resistance to Helminthosporium, Fusarium, BYVD, and drought. Need also to attempt to transfer the high lysine gene from barley to wheat.

Need various countries to assist in screening barley materials for better resistance to Helminthosporium spp.

Need for a chemical gameticide to allow recurrent selection in the wheat and barley programs to provide greater "gene mixing." And thus greater genetic variability in the basic breeding gene pools.

MAIZE PROGRAM

Collaborative Research Activities

PRESENT

COLLABORATION

May 9, 1980

CIMMYT COLLABORATIVE RESEARCH ACTIVITIES
MAIZE PROGRAM

Collaborating Country	Scientific Focus	Institution	Brief Description of Proposed Activity
Andean Countries (Colombia, Ecuador, Peru, Bolivia)	Breeding and Germplasm Improvement	National Maize Programs	Introduction of Quality Protein into Floury maize.
Canada	Tissue Culture	Prairie Regional Laboratory	Studies of callus formation in maize and sorghum crosses.
Mexico	Cytology	Univ. Chapingo	Cytology and tissue culture.
Thailand	Pathology	Kasetsart Uni- versity	Studies of maize downy mildew and associated development of techniques for selection of resistant populations.
United Kingdom	Entomology	Tropical Products Institute	Evaluation of maize grain samples for reaction to grain storage insects.
U.S.A.	Genetics	Purdue Univer- sity	Utilization of various endosperm mutants in development of quality protein maize.
	Breeding & Germplasm Development	University of Illinois	Identification of lines giving high crossability between maize and tripsacum. Cytogenetic studies of resulting segregates.
	Entomology	Cornell Univer- sity	Development of CIMMYT maize pop- ulations with resistance to European Corn Borer and study of nature of resistance.
U.S.A.	Physiology	Cornell University	Development of maize populations with broad adaptation to environ- ments of widely different day length and study of mechanisms involved.

U.S.A. (Cont.)

Wide Crosses/
Cytology

University of
Massachusetts

Techniques of identifying mitotic
chromosomes of crosses between
maize/tripsacum and maize/sorghum.

Wide Crosses/
Tissue Culture

University of
Minnesota

Plant regeneration from maize
callus and techniques for hybrid
embryo culture.

Wide Crosses

Univ. of Illinois

Identification of genotypes of
superior crossability.

Pfizer, Connecticut

Improvement of tissue culture tech-
nique and biochemical identification
of hybrids.

USDA
Athens, Georgia

Production of wide hybrids and im-
provement of alien pollen growth.
Biochemical investigation for
identification of growth promoters
and/or inhibitors in alien styles.

West Germany

Breeding and
Germplasm Im-
provement

University of Giessen

Development of very early matur-
ing cold tolerant maize.

MAIZE PROGRAM

Collaborative Research Activities

FUTURE
COLLABORATION

May 9, 1980

(PROPOSED ACTIVITIES)

Investigations of:

- 1) The mode of resistance in maize for Fall Army Worm; to Sugar Cane Borer, and other insects.
- 2) The factors that make it possible for some progeny to survive and yield better than do others under heavy moisture stress.
- 3) The determinents of tropical maize plant efficiency.
- 4) Why N-grain ratio is lower in the tropics.
- 5) Why O_2 maize dries down more slowly after physiological maturity.
- 6) Why O_2 dry matter accumulation shuts off sooner than its normal counter-part.
- 7) Chromosome transfer location etc. in those progenies of wide crosses that are advanced sufficiently to have ample seed and to have shown a change that is useful and assumed to have come from alien germplasm.
- 8) CIMMYT system of selection vs. traditional use of model etc. in selection to study breeding efficiency methodology.
- 9) Limitation to high grain stover ration. Where or what in the biological system is misdirecting the photosynthate?

10) Further nutritional studies with quality hard endosperm protein maize.

11) Nutritional value of bread from wheat flour extended with o_2 flour.

12) (If resistance to ear rot is obtained) what is giving the resistance and its compound that influences the nutritional quality especially in the highlands?

13) What enzymes or other factors accounts for the growth capability of highland maize? Lowland material can be brought up to the highland, but taking highland material to the lowland does not work. Why?

COLLABORATIVE RESEARCH ACTIVITIES INVOLVING BOTH

MAIZE AND WHEAT PROGRAMS

PRESENT COLLABORATION

NUTRITIONAL QUALITY

During 1979 some of the most promising maize, wheat, triticale and barley materials were evaluated for nutritional quality by rat feeding tests. The different Institutions that have been collaborating with CIMMYT in the biological evaluation of advanced materials are: Instituto de Nutrición de Centro América y Panamá (INCAP), Guatemala; the National Institute of Animal Science (NIAS), Denmark; the Instituto Nacional de Investigaciones Pecuarias (INIP), México; and the Instituto Nacional de la Nutrición (INN), México.

Special biochemical studies of protein fractionation are carried out at the Department of Grain Science and Industry at Kansas State University and industrial evaluation is going to be performed on some maize materials at the Instituto Nacional de Investigaciones Agrícolas.

COLLABORATION INVOLVING BOTH

THE

WHEAT AND MAIZE PROGRAMS

Future Collaborative Needs

Cellular Biology

Generation of hybrid plants from callus of embryo or other plant tissue to provide more hybrids for crossing and other experimentation.

Cellular Biology

More effective techniques and media are needed for producing hybrid callus material and as an effective means of stimulating plant growth from the styles.

