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Improvement of Grain Crops

It was a sunny day in late March on a field of irrigated land located in the Sonora desert of northwest Mexico. The wheat stems were heavy with grain. They would be harvested in about 2 weeks. On closer examination, it was evident that the field of several hundred hectares was subdivided into thousands of experimental plots. Thousands of varieties of wheat were being tested, some for yield, others for resistance to disease.

This beautiful scene was viewed by an international group of visitors during Presentation Week at the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT). This is the organization whose progenitors developed the wheats that played a major role in the Green Revolution. Today, CIMMYT is a nerve center of an international network of scientists located in more than 100 countries. When superior varieties of wheat are produced either in Mexico or elsewhere they are tested in as many as 250 locations around the world. When a new mutant form of a pathogen is detected within the cooperating countries, the news is spread and seed from resistant varieties is multiplied. The varieties of wheat being grown in Sonora represent only a small fraction of the germ plasm that is available. In reserve in wheat banks are more than 90,000 entries.

To facilitate its work, CIMMYT has several stations located in different climatic zones of Mexico. It is possible to expedite development of new lines of wheat by obtaining two harvests per year, one at Sonora and another in the highlands near Mexico City. The existence of stations in diverse environments also facilitates development of lines capable of thriving under comparatively adverse conditions.

Other programs designed to foster better yields from marginal lands include a form of genetic engineering. That is, wheat is being crossed with wild grasses that can grow under very unfavorable conditions, such as in seawater. Earlier, in Manitoba, a cross of rye and wheat was made, called triticale. Varieties of triticale now yield as well as or better than the best wheat and they can withstand a more harsh environment, such as the acid soils and aluminum toxicity of the lateritic soils of the Cerrado of Brazil. An intensive breeding and selection program is yielding varieties suited to this type of soil. The Cerrado includes 200 million hectares of land with adequate rainfall and tillable soil. In a decade the Cerrado will probably be producing significant quantities of grain. In addition, success in the Cerrado might speed development of other areas of the tropics where similar conditions prevail.

The maize program at CIMMYT is receiving an effort comparable to that devoted to wheat and triticale. Maize can be grown under a broader set of environmental conditions than wheat and it is particularly adapted to the tropics. Wild types have been growing in many parts of this hemisphere. More than 10,000 lines have been placed in maize banks. An intensive breeding program is creating higher yielding varieties. Norman Borlaug, the Nobel Laureate who has specialized in developing strains of wheat, believes that in 5 to 10 years production of maize will outstrip wheat production worldwide. Maize has the additional advantage of yielding about 50 percent more grain per hectare than wheat in many localities. A factor that may speed the adoption of maize is the development of a more nutritious variety. About a decade ago, the availability of a high-lysine, high-tryptophan line was announced. However, the plants then available were deficient in yield and disease resistance. Patient work over a decade at CIMMYT has led to varieties that are nutritionally balanced and also high yielding and disease resistant.

In addition to maintaining the basis for a response to threats of crop failure due to disease and to improving prospects for additional food, CIMMYT maintains a training program for agriculturists from many countries. Total annual cost of all these efforts is $20 million, only a fraction of which comes from the U.S. government. Seldom has so modest a sum produced such significant results.—PHILIP H. ABELSON