

Developing drought and heat tolerant wheat germplasm and its utilisation for the drylands of Central and West Asia and North Africa

The ICARDA/CIMMYT Wheat Improvement Program (ICWIP)
International Center for Agricultural Research in the Dry Areas (ICARDA)
International Maize and Wheat Improvement Center (CIMMYT)

Country/Region:	Algeria, Sudan, Syria, Jordan, and Iran
German participation:	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)
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Initial situation

The sustainability of wheat production in Central and West Asia and North Africa (CWANA) requires new cultivars with higher yield potential and improved water use efficiency. The ICARDA-CIMMYT Wheat Improvement Program (ICWIP) will make use of the combined expertise to advance drought and heat tolerance in durum and bread wheat for the drylands of the Central and West Asia and North Africa countries.

Approach of the project

Fast, cost effective and easy-to-measure physiological traits such as canopy temperature and early ground cover were selected from the conceptual model developed by the International Maize and Wheat Improvement Center (CIMMYT). Canopy temperature is a surrogate of root mass at depth and increased water extrac-

tion capacity from the soil, and therefore contributes to improve yield under drought and heat. Fast early ground cover prevents water loss during the initial stages of development and as such has important contributions to grain yield under stress.



Major results achieved

Several agronomic traits were measured including days to heading, days to maturity, grain filling duration and thousand kernel weight in bread wheat. Drought and heat responses in a bread wheat mapping population of 169 lines derived from the cross *Seri/Babax*, developed at CIMMYT, was characterized in Egypt (Shandaweel), Iran (Ahwaz and Darab), Sudan (Dongola and Medani), Mexico (Obregon), and Syria (Tel Hadya). Mainly Iranian and Egyptian sites were characterized by terminal heat stress during the grain filling period, while Medani-Sudan showed permanent heat stress across the entire wheat cycle. Shandaweel and Dongola showed the

highest yields and these two environments were highly correlated whereas Ahwaz, Medani, Obregon and Tel Hadya showed the lowest yields.



In durum wheat the study aimed at identifying chromosomal regions/markers affecting grain yield expression under drought condition. A population of 114 F₈ recombinant inbred lines (RILs) was derived from a cross between Omrabi 5 (more drought tolerant) and Belikh 2 (less drought tolerant). Phenotypic data of the RILs and parental lines were measured for sixteen morphological traits in Jordan and Syria. For performance under drought conditions, six RILs showed superior mean performance compared to the drought tolerant cultivar Omrabi5 (released as UmQais in Jordan) for grain yield trait. In addition, 15 MrbBlk-RILs showed superior mean performance compared to Belikh 2 for all the

stress-physiological traits studied at both developmental stages (Zadok's scale 45 and 70). A genetic map is being developed for the RIL population.

Expected impact

One important delivery from this project was to identify in each environment, the physiological traits that best correlate with grain yield in bread wheat. Canopy temperature, early ground cover and grain filling duration in almost all environments tested, had important contributions to final grain yield. These traits can be easily used for parental characterization in strategic breeding programs and introgressed into superior varieties.

The testing at large scale of promising durum genotypes at farmers' fields in Algeria showed that the Lahn/Cham1-2003 is the most promising line and is considered for release in 2010.

Collaborating institutions

Agricultural Research Centre (ARC), Sudan; Institut National de la Recherche Agronomique (INRA), Algeria; Maru Agricultural Research Station, Jordan; Shandaweel Research Station, Egypt; Seed Production and Improvement Center of Iran

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