



Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

Improving crop adaptation to climate change through strategic crossing of stress adaptive traits

M. Reynolds, G. Molero, M. Tattaris, CM Cossani, P. Alderman, S. Sukumaran

CIMMYT, Mexico

Abstract Crossing programs based on phenomics have resulted in a new generation of drought adapted wheat lines based on strategic crossing of complementary physiological traits (PT) that have been included in CIMMYT's international distribution system since 2010. New PT lines have shown superior performance over conventional material in most international environments. For example, in the 17th SAWYT the average yield of PT lines was larger than the group of conventionally bred lines at 75% of international sites. This ongoing effort has involved broadening the genetic base of conventional wheat gene pools through extensive use of genetic resources, including landraces and products of inter-specific hybridization with members of the Triticeae tribe. One of the prerequisites for successful application of phenomics in breeding is the establishment of reliable screening tools and platforms that can precisely measure expression of physiological traits in realistic field environments. Genetic gains associated with selection for canopy temperature and spectral water indices have shown that such remotely sensed traits can serve as proxies that reliably estimate water relations characteristics impacting on yield. The first aerial remote sensing platforms for large scale genetic resource screening was developed at CIMMYT in Mexico and more than half of the accessions of the World Wheat Collection have been screened. These high throughput field phenotyping tools have application in gene discovery and QTL for both drought and heat adaptive traits have been identified on 4 different chromosomes of the Seri/Babax RILs population, showing for the first time a common genetic basis for these key abiotic stresses. Similarly the phenology-controlled 'Wheat Association Mapping Initiative' panel has been used for gene discovery work. To define the best constellation of traits for application in breeding -and determine priorities for genetic understanding- it is necessary to develop conceptual models of adaptive traits that highlight wheat's genetic limitations under water limitation; pre-breeding serves as a practical tool to test different models.

© 2015 The Authors. Published by Elsevier B.V This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

Keywords: Physiology, breeding, phenomics, remote sensing
