

Development and deployment of climate resilient wheat varieties to ensure food security in Africa

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Wheat production in the CWANA and SSA regions is significantly affected by abiotic (heat, drought) and biotic (rusts, septoria, etc) stresses. The wheat breeding program at ICARDA develops high yielding wheat genotypes with resistances to these major stresses using classical and molecular approaches. A modified shuttle breeding program involving two cycles of elite x elite crosses (simple crosses, F1top crosses while increasing F1s) and two cycles in the field (winter and summer seasons) at Merchouch station (Morocco) and Kulumsa station (Ethiopia) has been deployed. Such breeding schemes takes only 4 years from crossing to distribution of elite genotypes to national programs. Genomic selection is applied for stage 1 trials at F6. Elite genotypes at F7 are evaluated across key locations: Wadmedani (Sudan) for heat tolerance, Merchouch (Morocco) for drought tolerance, Sids (Egypt) and Terbol (Lebanon) for yield potential and Kulumsa (Ethiopia) for resistance to diseases (rusts, septoria). Yield levels of the top yielding elite spring bread wheat genotypes ranged up to 6t/ha at Wadmedani station of Sudan under extreme heat stress, 7t/ha at Merchouch station of Morocco under terminal moisture stress (260 -300 mm) and 11 t/ha at Sids station in Egypt under optimum conditions. Significant MTAs have been identified for heat and drought tolerance, resistance to rusts and septoria, and nutritional qualities including iron, Zinc and selenium concentration in the elite spring bread wheat genotypes. Pedigree analysis showed that resistance sources for heat and drought tolerance in such elite wheat germplasm were introgressed from synthetic wheats and wild relatives mainly *T. dicoccoides*. Annually, ICARDA distributes more than 400 elite spring bread wheat genotypes to its partners through international nurseries. In the last 10 years alone, more than 70 bread wheat varieties of ICARDA origin have been released by National Agricultural Research System (NARS) in the CWANA and SSA regions. Deployment of heat tolerant wheat varieties have been carried out in SSA and significant impact has been achieved in Ethiopia, Sudan and Nigeria. The heat tolerant irrigated wheat production in Ethiopia started 5 years ago and has reached 1 million ha in 2023 with average productivity of 4 t/ha. Establishment of innovation plat forms (IP), cluster farming, strong partnership among stake holders such as national/regional governments, extension departments, national and CGIAR research centres, donors (CGIAR, AfDB, Agri-Banks), farmer unions and private sector miller's associations, etc. was instrumental for achieving such a big milestone and setting the beginning of green revolution in Ethiopia. Deployment of such approach at scale could potentially transform wheat production and ensure food security in Africa.