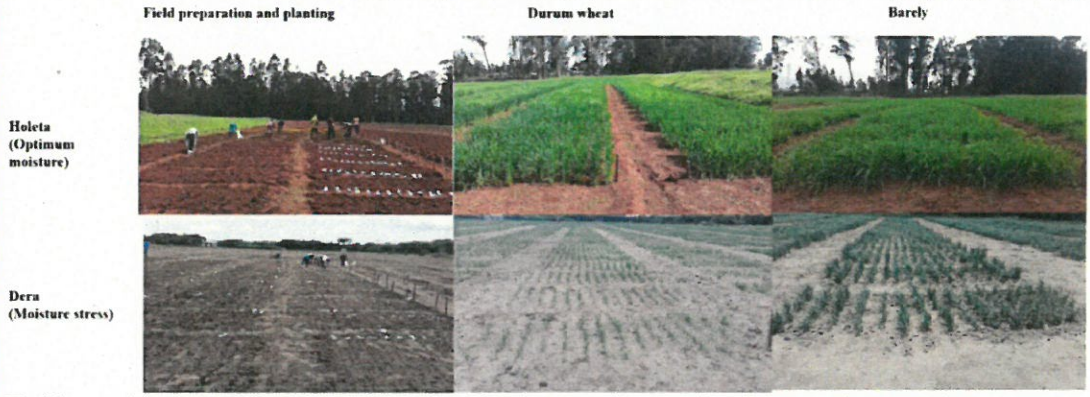
Bundesministerium
für Ernährung
und Landwirtschaft

Project Acronym: Genome wide association studies to improve drought stress tolerance in Ethiopian durum wheat (Triticum durum) and barley (Hordeum vulgare) accessions

country/countries	Germany, Ethiopia
funding agency	Federal Ministry of Food and Agriculture - BMEL
project management	Federal Office for Agriculture and Food - BLE
project coordinator	Prof- Dr. Frank Ordon
project partner(s)	Ethiopian Institute of Agricultural Research, Holetta Biotechnology Laboratory, P O Box 2003, Addis Abada, Ethiopia

project budget	**395.032,38 €**
project duration	01.01.2014 - 31.12.2019
key words	Barley, durum wheat, drought stress tolerance, yield, ethiopian accessions
background	Globally drought is a serious abiotic stress factor challenging wheat and barley production and quality. In Ethiopia, wheat and barley production is completely dependent on rainfed. Therefore, drought stress tolerance is an important breeding goal in Ethiopia.
objective	• Identifying genetic diversity for drought stress tolerance of durum wheat and barley accessions from Ethiopian landrace collections • Identifying genomic regions or genes involved in drought stress response in barley and durum wheat using genome wide association studies (GWAS) • Starting marker based breeding program to introgress drought stress tolerance in adapted Ethiopian barley and wheat cultivars
results	Field experiments of Ethiopian durum wheat and barley accessions were conducted in Ethiopia at four locations for three growing seasons from 2016-2018. The locations were Melkassa and Dera representing natural drought conditions and Holetta and Debre Zeit representing optimum moisture conditions. Based on the results of the field trials 196 each of durum wheat and barley accessions were selected for climate chamber experiments. Analysis of variance revealed significant ($p<0.001$) difference between accessions for grain yield in field and growth chambers, indicating huge genotypic variation. Overall, drought significantly reduced grain yield and other traits. Those traits that had positive correlation with grain yield in both environments, stressed and non-stressed may contribute to select genotypes for both environments.

	By genome wide association studies (GWAS) one quantitative trait locus (QTL) on chromosome 3H in barley was observed associated to yield in field and climate chamber drought stress conditions. For durum wheat one interesting QTL was identified on chromosome 3B at 423 Mb for grain yield under drought stress in field conditions. This region is already described to be involved in drought response and may be an interesting candidate for further analyses. The genes or genomic regions, which were identified may - after validation - contribute to marker assisted selection for drought stress tolerance in wheat and barley breeding.
recommendations	Due to climate change drought is gaining rising importance in crop production and crop quality. Thus, conservation of potential genetic resources and genomic dissection of crop accessions is becoming important. Hence, GWAS is a state of the art approach to identify associations for abiotic stress tolerance, such as drought. Additionally, genotypes, which harbor QTL involved in drought stress tolerance, should be included in the national breeding system and evaluated on multiple environmental conditions.
photos	 Field experiments preparation and planting, for durum wheat and barley at optimum moisture (Holeta) and drought stress (Dera) conditions during 2018 growing season.  Ethiopian barley accessions grown in climate chamber experiment under control (70% Soil water capacity) and drought stress conditions (20% soil water capacity).