Introgression of drought tolerance traits into adapted Kenyan chickpea varieties using marker assisted backcrossing (MABC)

Kosgei AJ[1], *,Kimurto PK[2], Gaur PM[3], YeboahMA[4], Offei SK[5], Danquah EY[5], Muriuki RW[2], Thudi M[3] , Varshney RK[3]

[1]Machakos University, Machakos, Kenya
[2]EgertonUniversity, Njoro, Kenya
[3]International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Patancheru, India
[4]The World Vegetable Center (AVDRC), Messa Yaoundé, Cameroon
[5]West Africa Centre for Crop Improvement (WACCI), University of Ghana, Legon, Ghana
* E-mail: songj.aliz@gmail.com

Drought is the major constraint causing considerable yield reduction in chickpea. Roots play a critical role in enhancing drought tolerance. The main objective of the study was to introgress drought tolerant root traits into Kenyan chickpea varieties through marker assisted breeding (MABC). Eight simple sequence repeat (SSR) markers, linked to quantitative trait loci (QTL) for root and yield traits, were used to screen the parents at ICRISAT, India. In addition, 1144 single nucleotide polymorphic markers (SNPs) were also used in genotyping these parents at Legume Genomics Center, United Kingdom. Crosses were made between two selected varieties, ICCV 92944 (*Chania Desi II*) and ICCV 00108 (*LDT 068*) and *'QTL-hotspot'* donor parent ICC 4958 that has extensive rooting system. Polymorphic SSR and SNP markers were used to select progenies with root QTL at F1, BC1F1 and BC2F1 that were later advanced to BC2F3. The BC2F3 populations were evaluated for root traits at Egerton University in randomized complete block design with two replications in pot experiment. The BC2F3 families were significantly different for root dry weight (RDW), shoot dry weight (SDW), total plant dry weight (PDW) and root to shoot dry weight (R/S) ratio (R/S) for *Chania Desi II* x ICC 4958 and R/S for *LDT 068* x ICC 4958. These lineshad significantly improved root traits compared the recurrent parents. MABC is aneffective and efficient method of introgressing complex drought tolerant traits which leads to improvement in yield especially under drought conditions.

Breeding grapevine for an efficient use of water by lowering night-time transpiration

Coupel-Ledru A[1], Lebon E[1], Christophe A[1], Gallo A[1], Gago P[2], Pantin F[3], Doligez A[1], Simonneau T[1]*

[1]INRA, Montpellier, F-34060, France
[2]MBG-CSIC, 36143 Pontevedra, Spain
[3]Montpellier SupAgro, Montpellier, F-34060, France
*E-mail: audecoupel.ledru@yahoo.fr

In the face of increasing water scarcity, breeding for higher transpiration efficiency (TE), that is, the biomass produced per unit of water transpired, has become crucial. This could be achieved by reducing plant transpiration through a better closure of the stomatal pores at the leaf surface. However, this strategy generally also lowers growth, as stomatal opening is necessary for the capture of atmospheric CO2 that feeds daytime photosynthesis. Here, we considered the reduction in transpiration rate at night (En), when photosynthesis is inactive, as a possible strategy to limit water use without altering growth. We carried out a genetic analysis for En and TE in grapevine, a major crop in drought-prone areas. A 3 year experiment was conducted on the F1 progeny from a cross between Syrah and Grenache cultivars using a phenotyping platform coupled to a controlled-environment chamber, under well-watered and moderate soil water deficit scenarios. High genetic variability was found for En and 5 QTLs were detected. An experiment was also performed outdoors which confirmed the significance of this genetic variability. We further highlighted a major role of residual stomatal opening at night and a minor, yet significant contribution of the cuticle in determining this genetic variability. Strikingly, 4 of the QTLs detected for En co-localized with QTLs for TE. Moreover, genotypes with favourable alleles on these common QTLs exhibited reduced En without altered growth. These original results (Coupel-Ledru et al., PNAS, 2016) open new horizons for breeding crops with lower water loss at night for higher TE.