Combination of empirical and trait-based approaches for breeding drought tolerance in groundnut (*Arachis hypogaea* L.)

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Breeding groundnut varieties that combine improved pod yield under water-deficit stress, and enhanced water use efficiency (WUE) is an important strategy to overcome the challenges in water-limited conditions. SPAD chlorophyll meter reading (SCMR) and specific leaf area (SLA) are the two important traits associated with WUE. SCMR is simple, non-destructive and robust method. Maintaining high chlorophyll density under water stress conditions is associated with high WUE in groundnut, and SCMR measures green colour intensity associated with chlorophyll density. A RIL population (280) was evaluated during 2015/16 under well-watered (WW) and water-deficit stress (WS) for yield parameters and SCMR. Pod yield is independent of SCMR (R2=0.003), suggesting the importance of simultaneous selection for both these traits in breeding programs. For breeding varieties suitable for water-stress conditions, measuring both pod yield under stress and WUE through its surrogate SCMR are useful. In Africa and Asia, groundnut is largely a rainfed crop. The frequency of drought is variable, and every year is not a drought year. Therefore, the commercial groundnut varieties should perform well under normal rainfall years, and have less yield penalty during drought years. The approach of measuring pod yield penalty under water-deficit stress compared to WW condition is a useful selection criterion in breeding programs, wherein the lines with minimum yield penalty are selected. Such a selection criteria enable selection of genotypes that perform well under normal seasons and have less yield penalty during drought seasons. In this paper, we discuss progress in groundnut breeding at ICRISAT using these two approaches.

Molecular breeding tools improved drought tolerant groundnut variety for resistance to foliar fungal diseases

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A largely rainfed crop in India, drought tolerance, particularly mid- and end-season tolerance, is a key trait in groundnut varieties. A combination of both empirical and trait-based approaches was used in breeding programs of ICAR and ICRISAT, resulting in release of few tolerant varieties that have superior pod yield under drought stress and/or have enhanced water-use-efficiency. There is a need to breed varieties with drought tolerance, disease resistance and quality traits that suit different production ecologies as well as meet the needs of the farmers, consumers and industries. ICRISAT has released an early-maturing (90-95 d) and drought- tolerant variety ICGV 91114 for the drought-prone Ananthapur district of Andhra Pradesh, India, where about 0.7 m ha area is under groundnut cultivation and has low (300 mm) and erratic (30-40 rainy days) rainfall. On-farm studies conducted with ICGV 91114 during 2008-10 showed 30% reduction in yield variability over the years. Following screening in hot-spots of both rust and LLS disease during 2014 rainy season, a total of 27 introgression lines derived from ICGV 91114 were selected and advanced for evaluation in multi-location trials at six locations in 2015 under rainfed conditions. Based on the pod yield under rainfed conditions and disease resistance, three superior introgression lines (ICGV 14410, ICGV 13189, ICGV 14421) were proposed for the first-ever NILs trial (near-isogenic lines trial) along with eight others conducted under All India Coordinated Research Project on Groundnut (AICRP-G) at national level.