

Perenniality-Potential and challenges for future sustainable crop production

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Abstract

The most drought resistant among the five most important cereal crops, and a key dual-use (grain and biomass) crop in regions containing some of the world's most degraded soils, sorghum has inherent climate resilience that is likely to become more important under environmental conditions that are projected by many climate change models. The importance of sorghum might be further elevated by the development of productive genotypes that increase the extent and duration of soil cover beyond those of conventional annual crops, mitigating or even reversing losses of ecological capital through multiple crops from single plantings. Rich genetic and genomic resources have been developed to link *Sorghum* phenotypic diversity to its molecular basis, and in particular the genus has become a model for dissecting the molecular control of perenniality. Nature has made *Sorghum* perennial at least twice, and crosses between wild perennials and cultivated sorghums show the feasibility of developing genotypes with varying degrees of investment in perenniality while still providing harvestable food, feed, sugar and/or cellulose. Genetic analysis of progeny from these crosses is revealing the hereditary basis of traits related to ratooning and perenniality and providing diagnostic DNA markers. One perennial *Sorghum* species has adapted to continents and latitudes far beyond the reach of its progenitors, surviving stresses year after year that are only periodically experienced by conventional (annual) sorghum, and may also harbor novel alleles that may mitigate production challenges in conventional annual sorghums.

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