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Grain yield and quality trait responses of Bambara groundnut (*Vigna subterranea* (L.) Verdc) to drought stress

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Abstract

Bambara groundnut (BG) is an underutilised legume crop with the potential to provide a nutritious food in drought-prone areas. It is valued for its protein and oil content, which contribute to dietary energy and essential fatty acids. This bean is prepared by boiling, roasting, or processed into flour. It is a climate-resilient crop but research is needed to determine drought effects on its oil and protein content, as these are its exceptional nutritional qualities. The experiment was carried out at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, in the derived savanna agroecological zone, with slightly acidic sandy-loam soil. We investigated the effects of drought on the grain yield, seed oil and protein content of BG. Ten accessions of Nigerian origin with similar flowering times were evaluated in a field trial under two water treatments; well-watered (WW) and drought-stressed (DS) using a split-plot design with three replicates. The split plot treatments in the DS plot had different watering based on different plant growth stages; vegetative, flowering, and pod-filling. All DS treatments were watered three times weekly until they reached the designated growth stage, at which point drought stress was imposed by withholding irrigation for 21 days. Thereafter, normal watering resumed and maintained until plant senescence. The WW treatment received water three times weekly until plant senescence. Irrigation was applied to achieve field saturation, with soil moisture monitored using a Hydrosense II probe in both WW and DS plots. Plants were harvested, weighed and analyzed for oil and protein. All data were subjected to ANOVA and correlation analysis. Grain yield reduced in the DS vegetative (13.8 %) and flowering (23.0 %) treatments. Drought stress significantly increased protein content in the vegetative (7.8 %) and pod filling (26.5 %) stages and had no significant effect on seed oil content. Grain yield had a significant negative correlation with seed oil content but not with seed protein content. Accessions TVSu-2, TVSu-8, TVSu-2094, and TVSu-2089 showed great yield potential, while TVSu-2093, TVSu-2090, and TVSu-2091 combined low to moderate grain yield with high seed protein and oil content and may be good sources of germplasm for improvement programs.

Keywords: Bambara groundnut, critical stage of water stress, drought stress, grain yield, oil and protein content