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Natural and Anthropogenic Factors Affecting Gene Flow in Crop Sorghum and their Implications in Ensuring Varietal Integrity

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Abstract

Ensuring varietal integrity is vital in achieving durable stability of introgressed traits and desirable agronomic qualities of improved crop varieties. The integrity of a variety depends on its purity and stability of heritable characteristics. Erosion of varietal integrity is mainly caused by gene flow through migration of individuals (*e.g.* seeds) or gametes (*e.g.* pollen). Presented here are results of a multi-approach based study to understand the effects of natural and human mediated factors affecting gene flow in sorghum [*Sorghum bicolor* (L.) Moench]. Outcrossing rates and pollen dispersal distances of landraces and modern varieties from Sudan and Kenya were analyzed. Further, simultaneous characterisation using molecular markers (microsatellite) of populations of several varieties from contrasting agro-eco-systems, Western Kenya and Eastern Sudan were done. On average, the Sudanese cultivars used in this study had higher outcrossing rates than those from Kenya (18.5 and 4.5 %, respectively). Pollen dispersal decreased drastically with increase in distance. Maximum dispersal distance was 200 m based on a mathematical modelling of the data. Microsatellite characterisation of *in situ* collected varieties revealed the impact of different seed systems and farming practices on their genetic structure. Differently named varieties from Western Kenya, particularly landraces were not resolved using the microsatellite data while those from Sudan were genetically well differentiated. Despite the high outcrossing rates of the samples from Sudan, the high genetic differentiation suggests that farmers' practices and seed systems play an important role. Indeed, it emerged from interviews with the farmers that varietal isolation is commonly practised in Sudan but rare in Kenya, due to small field sizes. Furthermore, the study shows that formal seed sector is more active in Sudan than in Kenya as far as sorghum is concerned. Finally, this study provides recommendations for maintenance of varietal integrity of improved varieties under diverse farming and seed management systems.

Keywords: Gene flow, microsatellites, outcrossing rates, pollen dispersal, seed systems, sorghum, varietal integrity