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Pearl Millet Breeding in West Africa – Steps Towards Higher Productivity and Nutritional Value

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Abstract

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is the most important staple crop for smallholder farmers in drylands of West Africa (WA) due to its high drought and heat tolerance. In future, these farmers will need more productive and more nutritious pearl millet varieties to combat hunger and hidden hunger in the region. To meet this challenge, we conducted three different, large multi-location trials, to evaluate the WA pearl millet genetic diversity for agro-morphological and grain quality traits, to determine the potential hybrid superiority over open-pollinated cultivars, and to develop complementary breeding strategies that lead to better performance, stability and grain micronutrient content.

Characterisation of a broad collection of 360 WA pearl millet landraces identified wide ranges for agro-morphological traits such as yield, flowering time, panicle length, etc., indicating tremendous diversity and the usefulness of germplasm exchange among national breeding programs. Grain iron and zinc contents showed significant genetic variation in a set of 72 WA landraces and moderate-to-high heritability (h^2=0.70 for iron, h^2=0.53 for zinc), which emphasises a high potential for biofortification breeding. In a multi-location trial evaluating 100 population hybrids and their 20 parental populations, population hybrids showed grain yield superiority of on average 16.7 % compared to their parental populations (ranging from -26 to 73 %), reflecting the great potential of hybrid breeding to increase pearl millet productivity. To achieve the required yield stability and robustness, genetically heterogeneous hybrid types should be preferred. Due to high genetic admixture among WA pearl millets, heterotic grouping, which is the basis of efficient hybrid breeding, is not feasible based on "naturally" distinct groups, thus combining ability studies are required, followed by a systematic development of heterotic groups. To facilitate the establishment of a male parent pool exhibiting fertility restoration, we identified molecular markers for male-fertility restoration in the A4 cytoplasmic male-sterility system in pearl millet. Such a system is required for economic hybrid seed production. The feasibility of hybrid seed production by WA farmer seed cooperatives has been demonstrated for sorghum in Mali. A similar approach should be followed for pearl millet, to facilitate smallholder farmers' access to the superior hybrid seed.

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