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## Strategies for enhancing productivity and resilience of pearl millet in stress environments of Rajasthan, India

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### Abstract

Pearl millet is valued for its nutrient-rich grain for human consumption and its green fodder and dry stover for livestock and forms the basis of livelihood and nutritional security in arid and semi-arid regions of South Asia and sub-Saharan Africa (SSA). Its cultivation is largely concentrated in India, Niger, Sudan, Nigeria, Mali, Burkina Faso and Chad and is challenged by abiotic and biotic stresses. The purpose of this article is to consider the impact of research strategies in pearl millet improvement targeting stress-prone Rajasthan state of India and then to assess relevance of these strategies for western and central Africa where pearl millet is cultivated in similar agro-climatic conditions. Strategies to enhance the productivity in stress environments have centred on development of new cultivars (largely hybrids with niches areas for open-pollinated varieties) with higher production potential and built-in resistance to diseases. Strategic use of genetic resources from India and SSA remain the key points in breeding of diverse hybrids and open-pollinated cultivars. A large number of cultivars have been developed and deployed in Rajasthan during last four decades leading to productivity increase from 254 kg ha<sup>-1</sup> in 1980 to 892 kg ha<sup>-1</sup> in 2019. Adoption of improved cultivars in highly risk-prone arid regions of India highlights their significant role in raising crop productivity even in marginal areas. These results have great significance to justify similar investment in research and development efforts and policy intervention in pearl millet for SSA.

Given pearl millet becoming more vulnerable to ever changing climatic conditions, enhancing its resilience to drought remains the key issue. Understanding pearl millet response to drought and dissection of drought tolerance physiology and phenology has helped in identifying target traits for manipulation in breeding for drought tolerance. The role of adapted germplasm has been emphasised. Hybridisation of adapted landraces with selected elite genetic material has been found effective to amalgamate stress adaptation and high productivity. Recent advancements in high-throughput phenotyping and genotyping platforms have made it more realistic to apply markers-assisted selection in breeding programmes targeting drought tolerance.

**Keywords:** Adaptation, breeding, cultivars, drought, pearl millet