The role of plant breeding in sustainable food production under the threat of climate change

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The world is grappling with a steady decline of non-renewable resources that are essential for agricultural production, such as water, fossil fuels, land and other raw materials. Furthermore, crop production is threatened by climate change-induced abiotic and biotic stresses. As the world population continues to grow, there is a need to ensure food security by sustainably producing more food under unfavourable climatic conditions with ever-dwindling natural resources. Plant breeding can play an important role in buffering crop production systems against the vagaries of climate by producing climate-smart varieties that are more resilient to harsh environments while using limited resources efficiently. However, conventional breeding takes ~10-12 years to complete the entire breeding cycle (from the selection of parental genotypes to the registration of new varieties). These long generation times impede the ability of breeders to develop new adapted cultivars swiftly in response to farmers' immediate needs. The advent of new plant breeding methods, such as the use of “omics” technologies, phenotyping platforms and the recent development of speed breeding protocols for many crops, can be harnessed to overcome some of these challenges. These new technologies offer an opportunity to increase the efficiency of plant breeding pipelines and shorten the breeding cycle to ensure early variety release and more flexibility in responding to farmer needs. Although clear benefits are achievable, integration of these technologies will require infrastructure development as well as skills training of plant breeders to translate them into tangible benefits that will contribute to sustainable food production.