Inbred-parent–based cassava hybrids promise enhanced efficiency and resilience

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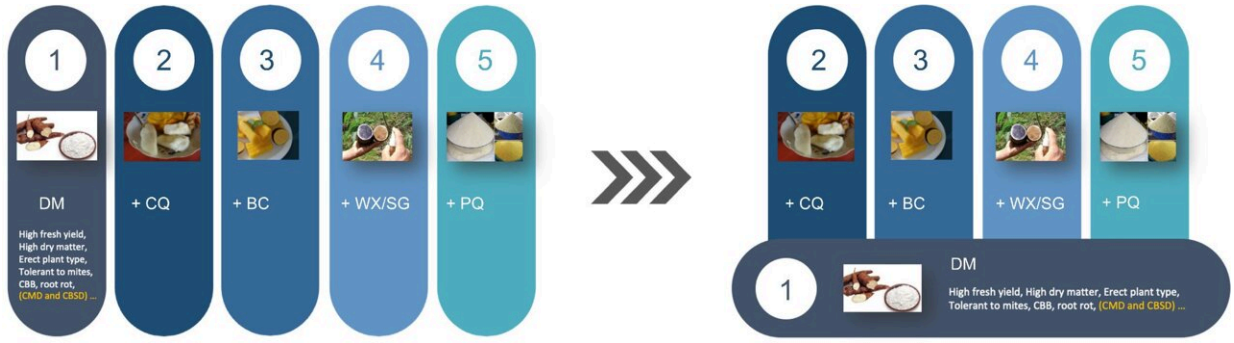

Credit: *Tropical Plants* (2024). DOI: 10.48130/tp-0024-0024

A research team has proposed inbred-parent–based hybrid cassava breeding to overcome the challenges of heterozygous parent use, aiming to transform cassava breeding by purging deleterious mutations and utilizing heterosis. This approach leverages self-compatibility, flower-inducing, and doubled haploid technologies, coupled with genomics advancements.

By understanding inbreeding depression, developing inbred or doubled haploid parents, purging genetic load, and creating heterotic pools, this innovative strategy promises efficient, cost-effective, and accelerated cassava breeding, enhancing adaptability and resilience to contribute significantly to ending hunger and reducing poverty.

Cassava is a vital crop for food security and income in tropical regions, valued for its climate resilience and productivity. Despite its importance, cassava research has lagged, with recent advancements through the NextGen Cassava breeding investment focusing on genomics-assisted breeding. However, challenges remain due to the need for crossing heterozygous parents, leading to high genetic loads.

A study published in *Tropical Plants* on 22 May 2024, proposes inbred-parent–based hybrid cassava breeding, aiming to improve predictive breeding accuracy and accelerate the development of desirable cassava varieties.

The authors initially presented the significance of inbred-parent–based hybrid breeding, emphasizing its advantages for cassava, which is crucial for carbohydrate production in the tropics. Cassava has significant advantages over corn in staple carbohydrate production in the tropics, and inbred-parent–based hybrid cassava breeding paves the way for sustainable and resilient cassava production by enhancing efficiency, adaptability, and cost-effectiveness, ultimately making a substantial contribution to ending hunger and reducing poverty during the climate crisis.

Subsequently, the researchers highlighted two pain points associated with conventional recurrent selection for new variety development: the high cost of yield trialing and the prolonged duration of the breeding process. The inbreeding depression related to heterozygous parents makes it impossible to integrate essential traits via backcrossing.

To address this, they proposed an innovative approach—inbred-parent–based hybrid cassava breeding, aiming to transform cassava breeding by implementing backcrossing-based trait introgression, effectively purging deleterious mutations, and systematically exploring and utilizing heterosis. In addition, the feasibility of inbred-parent-based

hybrid breeding in cassava was analyzed.

Cassava is self-compatible, which is a fundamental requirement for inbred-parent–based hybrid breeding. In addition, advances in flower-inducing technology, DH technology, genomics advancements, and the global network have provided tools for achieving efficient, precise, and accelerated inbred-parent–based hybrid breeding.

Finally, the researchers proposed four essential areas to concentrate on for the initial phase, including inbreeding depression, developing inbred or doubled haploid parents, purging genetic load, and creating heterotic pools.

According to the study's lead researcher, Xiaofei Zhang, "Through collective efforts and global collaboration, inbred-parent–based hybrid cassava breeding will transform cassava breeding and production, ensuring resilience and adaptability to significantly contribute to ending hunger and reducing poverty during the climate crisis."

In summary, genomics-assisted breeding has improved cassava selection, but heterozygous parents hinder efficient trait introgression. This study proposes inbred-parent-based hybrid breeding, leveraging self-compatibility, flower-inducing, and doubled haploid technologies, alongside genomics advancements.

This approach promises to enhance cassava breeding efficiency, adaptability, and cost-effectiveness, significantly contributing to food security and poverty reduction during climate change.

More information: Xiaofei Zhang et al, Towards transforming cassava breeding: harnessing inbred-parent-based hybrid breeding strategies, *Tropical Plants* (2024). DOI: 10.48130/tp-0024-0024

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