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Reverse Breeding

Satyam Pathak, Manoj Tiwari and Ashim Debnath*

Dept. of Genetics & Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh (224 229), India

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Corresponding Author
Ashim Debnath
e-mail: ashimdebnathdmr@gmail.com

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E-mail: *bioticapublications@gmail.com*

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Abstract

Reverse breeding is a novel plant breeding technique design to directly produce parental lines for any heterozygous plant, one of the most striven after goals in plant breeding. Reverse breeding generates perfectly complimenting homozygous parental lines through engineered meiosis in reverse genes with proven record. In this technique the end product is a F_1 hybrid and the end product of reverse breeding will be similar to parental lines obtained through conventional breeding. This method will replace the traditional method of seed production in future.

Introduction

Reverse breeding is a novel breeding technique that makes use of genetic modification to facilitate breeding of F_1 hybrid by suppression of meiotic recombination to again reproduce F_1. Hybrid vigor is essential to produce high-yielding varieties in many crops (Chen, 2010). Reverse breeding starts with an elite heterozygous line and aims at the generation of homozygous parental lines. This new technique meets the challenge of fixation of complex heterozygous. This was proposed by Driks *et al*. (2009), but yet has not been commercialized. Reverse breeding allows breeder to produce hybrid in such a short time than conventional techniques. This novel plant breeding approach offers clear advantage over existing techniques due to the fact that in principle any heterozygous plant can now be commercially exploited through re-synthesis of suitable parental line. Another method called near reverse breeding, the basic idea was to obtain diploid spores with partial segregation and recombination, and then double haploid technology was used to select complimentary fertile selfing lines in the offsprings (Van Dun *et al.,* 2008).

Steps in Reverse Breeding

- Providing a heterozygous starting organism.
- Allows the starting organism to produce haploid cells.
- Creating homozygous organism from the haploid cell does obtain.
- Selecting the organism having the desired set of chromosome.
- Reconstitute heterozygous by crossing homozygous organism produced through this method.

Principle

This method is based on reducing genetic recombination in the selected heterozygote by eliminating meiotic crossing over, male or female spores obtained from such plant contain combination of non-recombinant parental chromosome which can be cultured in vitro to generate

homozygous double haploid plant.

Application of Reverse Breeding

- Reverse breeding is used for transfer of CMS lines.
- Reverse breeding is used to produce a maintainer line (B line) from a homozygous CMS A line.
- Reverse breeding provides seed propagated varieties in species that now are commercially multiplied by vegetative propagation technique.
- Reverse breeding is used to improve seed production in hybrid crops.
- Reverse breeding can as such provide highly valuable insights into the nature of heterotic effects.
- Reverse breeding is used for breeding on single chromosome level.

Limitation of Reverse Breeding

- Development of reverse breeding is limited to those crops where double haploid technology is common in practice, *E.g.*, cucumber, onion, sugarbeet, maize, sorghum, pea, *etc*.
- This technique is limited to crop with a haploid chromosome number of 12 or less and a where spores can be regenerated into double haploids.

Conclusion

Reverse breeding is a novel breeding approach which accelerates the breeding process and increases the available genetic combinations. It helps in controlling deconstruction of complex genotypes into homozygous parental lines and allows further improvement of these lines by classical breeding methods.

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