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Reverse Breeding: A Novel Plant Breeding Approach

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Abstract

One of the most sought-after goals in plant breeding is reverse breeding, which is an unique plant breeding approach designed to directly establish parental lines for any heterozygous plant. Through engineered meiosis in reverse genes, reverse breeding produces completely complementing homozygous parental lines with a proven track record. The final product of this procedure is an F, hybrid, and the reverse breeding end product will be similar to parental lines obtained through traditional breeding. In the future, this technology will supplant the old way of seed production.

Keywords: Conventional, Engineered meiosis, F1 hybrid, Seed Production

Introduction

Reverse breeding is a unique breeding approach that uses genetic alteration to facilitate F, hybrid breeding by suppressing meiotic recombination in order to create F, hybrids again. In several crops, hybrid vigour is required to develop high-yielding cultivars (Chen, 2010). Reverse breeding is a technique that begins with an exceptional heterozygous line and ends with homozygous parental lines. This innovative approach addresses the problem of complicated heterozygous fixing. Driks*et al.* (2009) proposed this, although it has yet to be marketed. Reverse breeding allows breeders to develop hybrids in a fraction of the time it takes with traditional methods. Because any heterozygous plant may now be economically grown, this unique plant breeding approach has an obvious benefit over previous techniques Re synthesis of a suitable parental line was used to exploit it. The underlying idea behind another method known as near reverse breeding was to create diploid spores through partial segregation and recombination, and then choose complementary fertile selfing lines in the progeny using double haploid technology (Van Dun *et al.*, 2008).

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Reverse Breeding Procedures

- Starting with a heterozygous organism.
- Allows haploid cells to be produced by the beginning organism.
- It is possible to create homozygous organisms from haploid cells.
- Choosing the organism with the specified chromosomal set.
- Create heterozygous organisms by crossing homozygous organisms created using this procedure.

Principle

This method relies on eliminating meiotic crossing over to reduce genetic recombination in the selected heterozygote. Male or female spores obtained from such plants contain a combination of non-recombinant parental chromosomes that can be cultured *in vitro* to generate homozygous double haploid plant.

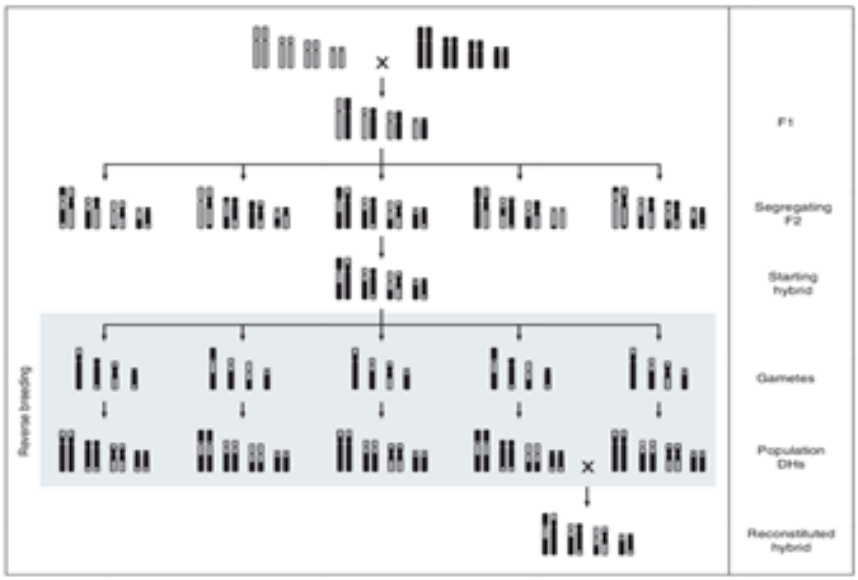

Fig – 1 Reverse Breeding can be used to fix unknown heterozygotes. Crossing two homozygous parents (grey and black bars) create a heterozygous F1 . When selfed , F1 produces a segregating F2 population. A starting hybrid of unknown genetic constitution is selected for its desirable characteristics and subjected to the two steps of Reverse Breeding (grey box).

The Use of Reverse Breeding

CMS lines are transferred by reverse breeding. From a homozygous CMSA line, reverse brooding was used to establish a maintainer line (B line). Seed propagated variants

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are produced through reverse breeding. Species that are now commercially multiplied by vegetative propagation in hybrid crops, Reverse breeding is utilized to boost seed yield. As a result, reverse breeding can yield extremely useful information. An investigation on the nature of heterotic effects, when breeding on a single chromosome, reverse breeding is used.

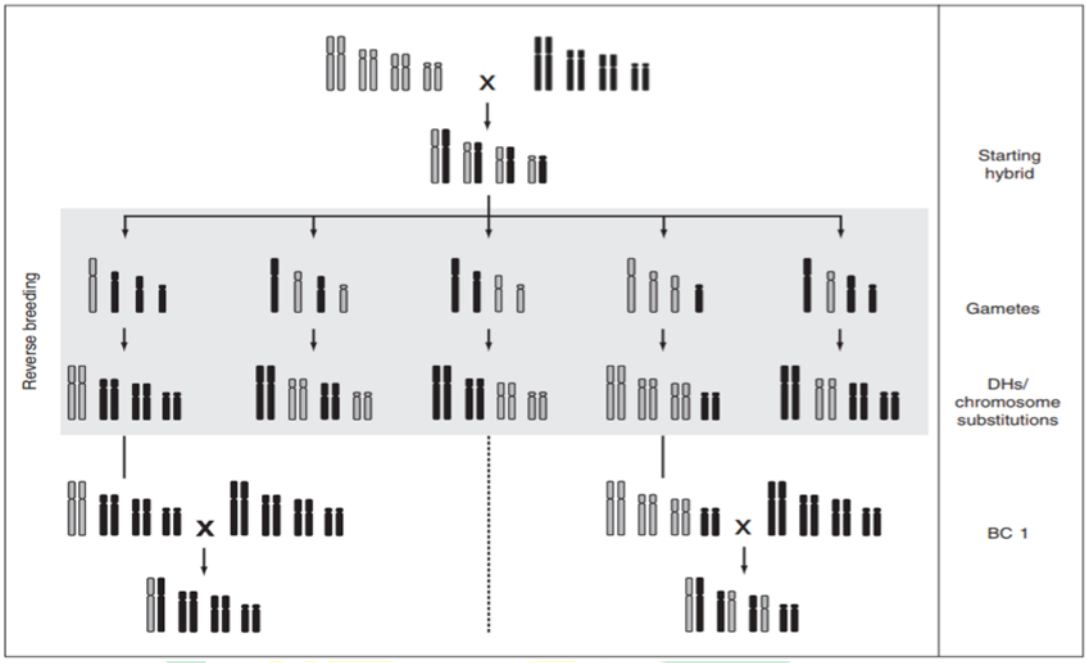

Fig – 2 Reverse Breeding can be used as Advanced Breeding tool. Application of Reverse Breeding leads to population of double haploids.

Reverse Breeding's Limitations

Reverse breeding is confined to crops where double haploid technology is widely used, such as cucumber, onion, sugar beet, maize, sorghum, pea, *etc*. This method is only applicable to crops with a haploid chromosome number of 12 or less, as well as spores that can be regenerated into double plants.

Conclusion

Reverse breeding is a unique breeding method that slows down the brooding process while increasing the deconstruction of complicated genotypes into homozygous parental lines, allowing these lines to be improved further.

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