Non-conventional Breeding Methods

by

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Non-conventional breeding methods accelerate plant breeding and significantly broaden the utilizable gene pool. The methods include:

A. Embryo culture

Post sexual incompatibility between similar, distant or unrelated species, which limits the ability of conventional plant breeders to widen genetic variability in a given plant species, was overcome with the development of embryo culture technique (Brar and Khush 1994). Abortion of embryos at different stages of development is a characteristic feature of wide crosses. Incompatibility between the embryos and the endosperm is a common problem which results in the abortion of hybrid embryos. To prevent this from happening, the hybrid embryos are removed from the endosperm before they abort and are nurtured in a defined nutrient medium to enable them to grow into seedlings (Brar and Khush, 1994).

The technique has been used to produce interspecific hybrids of various plants including those of rice. Wild *Oryza* species are important reservoir of useful genes for resistance to diseases, insect pests, tolerance to abioitc stresses, and quality traits. Through embryo rescue many of these important traits have been transferred to elite breeding lines of rice (Brar and Khush, 1994, Brar et al. 1996). Several intergeneric hybrids have also been produced by embryo rescue in cereals (*Triticum x Hordeum, Triticum x Elymus* (Brar and Khush, 1994). The level of introgression was low however.

B. Somatic Hybridization

Fusion of somatic cells is involved in this technique (Kung 1993). At first, the cell walls and middle lamella are digested by cellulase and pectinase, respectively, before the resulting protoplasts are allowed to fuse. Then, the somatic hybrid cell is induced to regenerate a complete plant. Somatic hybrid plants have been successfully formed in 2 tobacco species (Carlson et al. 1972) and 2 petunia species (Power et al. 1980). Hopes were high that this technique could allow unlimited genetic exchange. Nonetheless, success of interspecific and intergeneric protoplast fusion was limited because of the difficulty of regenerating a complete plant from the fused protoplasts.

C. Anther Culture

The technique consists of culturing anthers on solid or liquid medium, resulting in the formation of either calli or embryoids and eventually haploid plants (Brar and Khush 1994). Through colchicine application, the chromosome number of regenerated haploid plants is doubled, producing dihaploid (DH lines). Compared to conventional breeding which would take 6 to 7 generations to form homozygotes, anther culture technique develops true breeding lines in one generation from heterozygous parents and thus shortens the breeding cycle of new varieties. Recessive mutations are also expressed in the same generation thereby increasing the efficiency of selection.

Anther culture had been successfully used to develop improved varieties of wheat, rice, and tobacco (Brar and Khush, 1995). In China, Xin Xiu was the first anther culture-derived commercial variety of rice released for high yield (Zhang 1992). In the Philippines, the first *indica/indica* F1 anther culture-derived material IR51500-AC11-1 or PSBRc 50 (Bicol) developed at the International Rice Research Institute was released for their salt tolerance (Senadhira eta l. 1995). The ability to form haploids through anther culture, however, is genotype dependent and, those, that are able to exhibit low frequency of regenerated haploid plants. High frequency of albino plants is also a frequent problem in anther culture.