

## Development of Component Lines (CMS, Maintainer and Restorer lines) and their Maintenance Using Diversed Cytosources of Rice

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### Abstract

The practice of hybridization has greatly contributed to the increase in crop productivity. A major component that exploits heterosis in crops is the cytoplasmic male sterility (CMS)/nucleus-controlled fertility restoration (*Rf*) system. The development and use of hybrid rice varieties on commercial scale utilizing male sterility and fertility restoration system has proved to be one of the mile stones in the history of rice improvement. Pollen sterility status of 148 exotic lines have been assessed and crossed with established known maintainer lines viz. BRR11B. Based on pollen male sterility status of the *F<sub>1</sub>* lines, 20 lines were assessed for pollen and spikelet fertility. The *F<sub>1</sub>* lines were assessed through judgement of pollen and spikelet fertility of *F<sub>1</sub>* lines. The results showed that all the *F<sub>1</sub>* lines were sterile except BRR11B which was fertile. The fertility restoration genes were cloned from the *F<sub>1</sub>* lines and found to be *urf13* gene. The results indicated that the *urf13* gene is present in all the *F<sub>1</sub>* lines except BRR11B.

**Keywords:** Pollen; Spikelet; Fertility; Sterility; Fertility restoration; CMS line; Maintainer line; Synthesized

### Introduction

The development and use of hybrid rice varieties on commercial scale utilizing male sterility and fertility restoration system has proved to be one of the mile stones in the history of rice improvement. The hybrid rice technology now in operation, aims at yield increment through higher exploitable heterosis levels [1]. In hybrid rice technology most usually two sterility systems i.e., CMS and EGMS are used for commercial seed production. In three line system of hybrid rice variety development system, three lines, A, B and R are required. A line is the cytoplasm-genetic male sterile line where the male sterility is jointly controlled by recessive nuclear gene and sterile cytoplasm. B-line is isogenic line of A-line, only difference in male sterility and fertility. R-line possesses fertility restoration gene [2]. A commercial A-line is characterized by the absence of pollen grains or rudimentary pollens, agronomically superiority, stable sterility, wide regeneration spectrum, abortive anther and highly synchronized [3]. B line is the maintainer line characterized by normal anthers, functional pollens and seed setting on selfing. While normal anthers, functional pollens, abundant pollen producing capacity, strong restoring ability, good combining ability, high out crossing rate, and genetically diverse from CMS line [4,5] are the main characteristics of R-line. It is 30 years since the first commercial release of hybrid rice. Plant cytoplasmic male sterility (CMS), a maternally inherited trait that prevents plants from producing functional pollen, has been identified in many higher plants, including rice, cotton, maize, and sorghum. CMS restorer systems have been widely exploited to produce hybrids that outperform their inbred parents in yield, biomass, or other traits. CMS is usually attributed to an unusual chimeric gene in the mitochondrial genome. In many cases, a nuclear-encoded fertility restorer gene (Rf) can restore fertility of the cytoplasmic male-sterile plants. Therefore, the CMS/Rf system is an ideal model for dissecting the interaction between mitochondrial and

nuclear genomes. A variety of mechanisms of fertility restoration by the Rf genes have been reported for different CMS systems. T-urf13, a mitochondrial gene encoding a 13 kDa protein, has been detected only in maize carrying T male-sterile cytoplasm. The first restorer allele cloned, the maize *urf13* gene, does not affect the expression of *urf13* and

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frequency of restorer lines in Chinese rice germplasm was found very high as compared to local rice genotypes. Thus the above mentioned genotypes having restorer genes may be utilized as a good reservoir of restorer genes for development of efficient restorer lines. Abeysekera

