

# CMD Resistance Breeding in Cassava and Management Strategy

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**C**assava (*Manihot esculenta* Crantz) woody shrub of spurge family belongs to Euphorbiaceae which are described by lactiferous vessels made out of secretory cells. They commonly called cassava, manioc, yucca etc. Although it is a perineal plant, it is extensively cultivated in both tropical and subtropical regions as annual crop for its edible starchy tuberous root.

Cassava is the fifth important starchy staple food crop after rice, wheat, maize and potato. They are predominantly consumed in the boiled form and also used for making starch, sago, animal feed and as a raw material industrial product. It is a staple food for more than 800 million people in the world; the production is about 315 MT from 30 mha. The origin of cassava was from Brazil, and South America. Even though it is from the South America it moved to Africa, during 16th and 17th century. Mainly Easter side and Western side, later 18th century it came to Sri Lanka, then it reached India. In India, cassava is mainly grown in southern states viz. Kerala, Tamil Nadu,

Andhra Pradesh and Maharashtra. In Kerala, it is used for consumption purpose, whereas in Tamil Nadu and Andhra Pradesh it is grown for industrial production of starch and sago. Cassava cultivation, India ranks first in productivity - 36t/ha and in production ranks ninth position.

## Cassava mosaic disease (CMD)

Cassava mosaic disease is a major constraint to cassava production in Africa and India. Yield losses estimates in susceptible cultivars can be as high as 90% and can be up to \$2.7 billion USD. Therefore, losses due to CMD have an immediate impact on the food supply and threaten food security and the livelihoods of rapidly growing population (FAO, 2014). CMD is mainly spread by infected cuttings and transmitted by the whitefly (*Bemisia tabaci*). CMD is caused by a complex of at least 11 Cassava mosaic begomoviruses worldwide, of which nine occur in Africa and two are found in the Indian subcontinent namely, Indian Cassava Mosaic Disease (ICMV) & Sri Lankan Cassava Mosaic Disease (SLCMV).

## CMD Symptoms

CMD causes two characteristic symptoms of green and yellow mosaic patterns in leaves. Plants affected by green mosaic have leaves with contrasting sectors of dark and light green tissue. But yellow mosaics are much more conspicuous, as they have leaves with contrasting areas of normal green and yellow tissues. Moreover, these chlorotic areas expand to other parts of the leaf lamina leading to rupturing of the tissues and distortion of leaves. Severe chlorosis is often associated with premature leaf abscission, a characteristic S-shaped curvature of the petioles of the remaining leaves and an obvious decrease in vegetative

growth and yield of tuberous roots. The most severely affected plants are so stunted virtually with no yield of roots and stems not suitable for further propagation.



**CMD resistant plant**



**CMD susceptible plant**



**Whiteflies on the leaf**

Cassava is mainly propagated through stem cuttings and CMD is mainly spread by infected cuttings and transmitted by the whitefly. Breeding for varieties that are CMD resistance is major aim in cassava breeding programmes.

## CMD Resistance Breeding:

CMD is one of the main constraints that hamper cassava production.

Breeding for varieties that are CMD resistant is a major aim in cassava breeding programmes. However, the use of the conventional approach has its limitations, including a lengthy growth cycle and a low multiplic-



**Sree Padmanabha**



**Sree Reksha**



**Sree Suvarna**



**Sree Sakthi**



**Sree Kaveri**

**CMD resistant cassava varieties released from ICAR-CTCRI**

ation rate of planting materials. To increase breeding efficiency as well as genetic gain of traits, using molecular markers can be used to screen and identify resistant genotypes. The deployment of host plant resistance, the use of resistant varieties is the most sustainable solution because it decreases disease-related production losses as well as the inoculum source for whitefly, which is known to be the disease vector. All these viruses are transmitted by the whitefly, to an extent of 5 per cent only. But wide spread of this disease is due to virus infected planting material.

The use of resistant varieties and the supply of healthy planting materials is an effective strategy to mitigate the impact of the disease. Resistant varieties can significantly reduce yields losses and the source of inoculum of the virus in the field. The first CMD-resistant varieties, developed by IITA in Nigeria, were hybrids obtained with *M. glaziovii*, found in Brazil, which conferred CMD resistance.

At ICAR-CTCRI, Thiruvananthapuram, cassava cultivar MNga-1 and wild *M. caerulescens* were identified as resistant to ICMV. MNga-1 is a breeding line from IITA, Nigeria, released as Sree Padmanabha during 2006. Since 2001, more intensive resistance breeding programme was undertaken through inter-varietal and interspecific hybridization programmes. In inter-varietal hybridization programme, MNga-1 was used as a donor for ICMV resistance and crosses were made with released varieties and promising selections from indigenous germplasm.

During 2008, received CMD resistant cassava clones from CIAT, Colombia and used for developing new hybrid lines and inbreeding lines. From these hybrid lines, four CMD resistant clones were released from ICAR

- CTCRI, Thiruvananthapuram and the details of the CMD resistant varieties are given below,

**Sree Padmanabha:** This variety yields 38.0 t ha<sup>-1</sup>. This is the first CMD resistant cassava variety developed by ICAR-CTCRI. Tubers have 25.8% starch, 38.2µg/100g cyanogen with excellent cooking quality. It shows cupping of leaves under drought conditions. Tubers are long cylindrical with silvery white skin colour, tuber rind and flesh colour white, tuber neck absent.

**Sree Reksha:** It yields 45-50 t ha<sup>-1</sup>. It is completely resistant to cassava mosaic disease caused by both Indian cassava mosaic virus and Sri Lankan cassava mosaic virus. It is also tolerant to post-harvest physiological deterioration. It has medium starch (27-31%) and low sugar (1.10%) content. It is suitable for planting in rainfed and irrigated conditions.

**Sree Sakthi:** It yields around 45-50 t ha<sup>-1</sup>. It is completely resistant to cassava mosaic disease caused by both Indian cassava mosaic virus and Sri Lankan cassava mosaic virus. It is also tolerant to post-harvest physiological deterioration. It has high starch content of 29% (range: 26-32%) and is an industrial variety.

**Sree Suvarna:** The average yield of this variety is 45-50 t ha<sup>-1</sup>. It has medium starch, 25-27% and is completely resistant to cassava mosaic disease caused by both Indian cassava mosaic virus and Sri Lankan cassava mosaic virus.

**Sree Kaveri:** This variety yields about 50 t ha<sup>-1</sup>. It is an Inbred developed from pre-breeding line, completely resistant to cassava mosaic disease, drought tolerant, N and K efficient variety, suitable for the States of Kerala, Tamil Nadu and Andhra Pradesh for industrial purpose.