BREEDING FOR CASSAVA MOSAIC DISEASE RESISTANCE

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INTRODUCTION

PREVALENCE OF CASSAVA MOSAIC DISEASE HAS RESULTED: IN REDUCED YIELD

IN TAMIL NADU: REDUCED STARCH TURN OVER.

IN KERALA: OBLITERATION OF VARIETAL CHARACTERS&VARIETIES BECOME EXTINCT

REDUCED VEGETATIVE GROWTH LEADING TO SHORTAGE OF PLANTING MATERIAL.

DISEASE SEVERITY MORE IN RAINFED AREAS & DROUGHT PRONE AREAS. LESS SYMPTOM EXPRESSION SEEN IN SOME HILLY AREAS OF TAMIL NADU : IN KADAMBUR FOREST, ERODE Dist.

Severe symptom expression (CMD) in H226

Symptom free plants of H 165 in Kadambur, Erode

MATERIALS AND METHODS

- Repeated field screening done in different seasons and locations.
- Graft testing done with susceptible symptom expressingstalk _ for confirmation of resistance.
- Field evaluation of MNga -1 For direct utilization: Repeated over different seasons & locations.
- Hybridization varieties with MNga -1

Varieties involved in crosses with MNga-1

Sree Rekha, Sree Jaya, CI- 848, CO -2, Sree Prabha, Sree Vijaya, CI-742, Ambakadan.

Graft testing of Mnga-1 & *M. Caerulescens*

MATERIALS AND METHODS

- EVALUATON OF F1 LINES AND SELECTION
- CLONAL EVALUATION&SELECTION
- CLONAL MULTIPLICATION &REPLICATED TRIALS
- FARMER,S PARTICIPATORY EVALUATION
- ALL INDIA MULTI LOCATION TRIALS
- GENETIC ENHANCEMENT OF CMD RESISTANT GENE
- BACK CROSS BREEDING,SELFING&OP. PROGENY
- STUDIES ON INHERITANCE OF CMD RESISTANCE
- INTERSPECIFIC HIBRIDIZATON-WILD GENES
- .TRUE SEED PROGRAMME -RAPID SELECTION

SELECTION CRITERIA USED

DISEASE RESISTENCE

RESISTANT – R

MODERATELY RESISTANT

WITH RECOVERING SYMPTOM } RV & RV+

SUSCEPTIBLE S

DISEASE RECOVERY SYMPTOM

SELECTION CRITERIA

Tuber Yield, Starch Content, Tuber Shape (Top Priority)

Culinary Quality, Tuber Flesh Colour - (White &Yellow)

rind pealability, purple/pink rind (Market preference).

- Starch content measured instantly based on specific gravity method (factory method).

Later confirmed by chemical methods.

Evaluation trials : Design : RBD, Replications :3

Plot size : 25 plants

Measuring starch of tuber using Specific Gravity Method (Factory Method -FPR Programme.)

Farmers participatory evaluation

FOR SELECTION OF LOCATION SPECIFIC VARIETIES.

RESULT

*MNga -1 selected as resistant variety (germplasm introduction)

proposed for release in irrigated plains (Tamil Nadu)- Sree Padmanabha.

Field screening of varieties for CMD incidence.(1998-99).

- Sree Sahya- 24.8 % -(6-46.7)
- Sree Vijaya -18.5- % (8-28.5)
- Sree Prakash-35.1 % (20.6-50.0)
- Sree Visakham-31.6 % (2.6-66.9)
- Sree Harsha-18.6 %
- H 226-27.7 % (15.6-39.8)
- H 165-28.5 % (2.5-48.3)
- H 97-31.3 % (1.4-45.9)
- MNga1-0.3 % (0-1.0)

MNga-1: yield & tuber characters.

- Yield : 23.1-34.2 t/ha
- Dry matter :30.6 -37.4
- Starch :23.5-28.2 %
- Cyanogen : 36.5-40 /ug/100gm
- Culinary quality : well cooked, non bitter, tasty.

MNga-1:(TMS 30001) Distinguishing Features

- Resistant to Cassava Mosaic Disease- confirmed through field screening, graft testing and progeny studies.
- Preferred by farmers for its CMD – resistant character in OFT-conducted in various districts in Kerala and Tamil Nadu.
- Observed as free from Tuber rot even in cent percent soil moisture for prolonged period. (Papyreddipatty, Dharmapuri dist.)
- Reported as resistant to Cassava Bacterial Blight. (CBB) - IITA, Nigeria.
- Susceptible to drought, spidermites and white fly.

AICRP Trials : IET Ca 99. Yield (t/ha) - 3 years

Varieties	2001-'02	2002-'03	2003-'04
CI-848	15.80	38.13	31.86
Sree Rekha	15.80	39.93	30.46
Sree Prabha	15.6	31.23	41.26
CI-850	14.90	27.67	35.13
MNga-1	**16.9**	**35.93**	**35.26**
H-282	17.21	19.27	17.9
H-152	19.3	29.23	20.7
H-740	20.90	34.03	27.4

AICRP Trials:IET Ca99(contd.)

Varieties	2001-02	2002-03	2003-04
PDP- 1	-	19.10	14.6
IGT- 1	-	20.80	20.23
IGT- 2	-	37.40	32.3
IGT-3	-	16.23	20.16
CO-3	18.10	39.37	37.2
CI-849	21.10	30.53	26.76
CD (0.05)	**2.10**	**9.89**	**5.443**

OFT in Tamil Nadu plains : 2004-'05

Lines	LI yield	L1 starch	L2 yield	L2 starch	L3 yield	L3 starch	L4 yield	L4 starch	L5 yield	L5 starch	L6 starch
✓5-3	44.00	29.2	31.25	31.2	15.00	30.2	24.00	31.5	48.75	26.0	26.0
✓4-2	39.63	32.0	31.25	31.2	12.5	31.5	24.5	30.5	22.05	24.8	"
✓6-6	53.25	29.6	-	-	12.5	29.8	23.25	32.0	-	-	"
2-14	46.86	27.3	-	-	15.00	28.2	30.38	28.6	-	-	"
✓MNga 1	24.63	23.8	-	-	12.5	25.4	20.38	24.8	25.00	18.5	"
✓H-152	26.63	29.2	-	-	17.5	27.4	29.88	28.5	-	-	"
✓H740	29.75	28.7	-	-	13.75	27.0	19.63	28.0	-	-	"

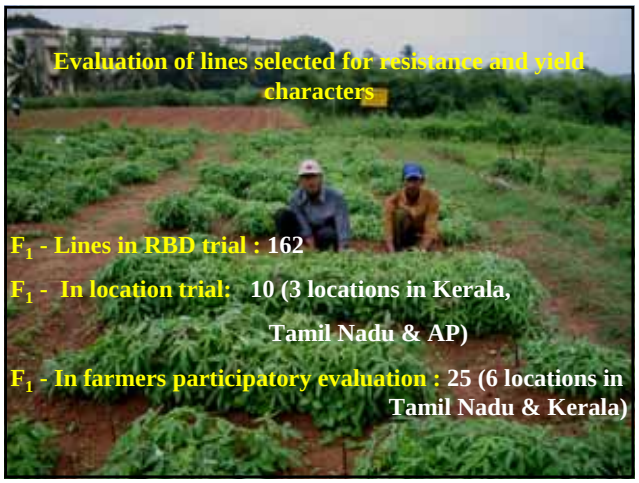
Mnga-1-Belukurichi, Namakkal

Mnga-1 at PR Patty, Dharmapuri

Mnga-1 at SPAC, Erode.

PROGENIES EVALUATED IN FIELD : SEEDLING & CLONAL

First Filial Generation	: 7,500 seedlings 162 selected
Back cross- 1 generation	: 185 Lines evaluated
Selfed generation	: 17 lines evaluated
Open pollinated (Half sib Generation) :	120 lines evaluated
Total lines evaluated	: 484



IET 1 : Evaluation trial of CMD resistant lines.

Sl. No.	Lines	Starch percentage	Mean Tuber yield	Resistance To CMD.
1	CMR- 1	27.7	34.5t/ha	RV
2	CMR-2	27.9	27.5 t/ha	RV +
3	CMR-3	28.8	29.7 t/ha	RV
4	CMR-4	24.7	47.1 t/ha	RV
5	CMR-5	24.7	19.0 t/ha	RV
6	CMR-6	24.4	32.0 t/ha	RV +
7	CMR-8	21.8	51.9 t/ha	RV+
8	CMR-9	23.0	38.3 t/ha	R
9	MNga- 1	21.1	37.4 t/ha	R
10	Sree Vijaya	21.1	27.1 t/ha	S

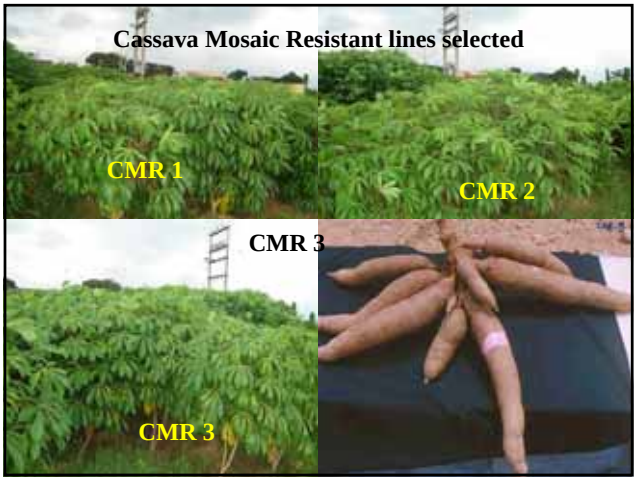
CD 0.5 = 11. 85

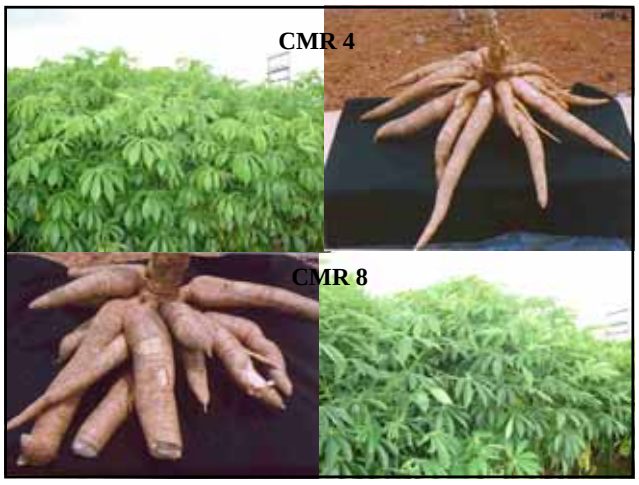
R= No symptom expressing, RV+ symptom expressing but recovers completely
RV = symptom expressing but shows partial recovery.

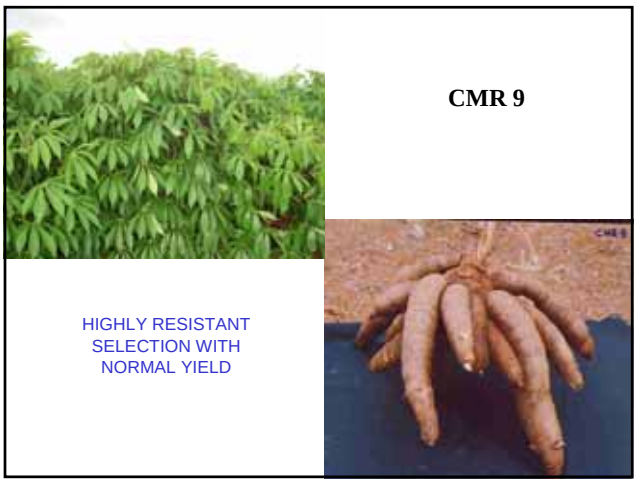
IET 2: Evaluation trial of CMD resistant lines.

Sl.No.	Lines	Starch percentage	Mean Tuber yield	Resistance To CMD.
1	CMR- 14	22.0	46.7	RV +
2	CMR-15	28.2	31.5	RV
3	CMR-16	21.9	40.6	RV
4	CMR-17	21.1	41.3	RV +
5	CMR-18	24.0	51.4	RV +
6	CMR-19	16.6	42.5	RV
7	CMR-20	25.2	23.5	R
8	CMR-21	26.5	40.7	RV
9	CMR-22	21.0	44.2	RV
10	CMR-23	23.2	32.6	RV +
11	CMR-24	26.0	25.9	R
12	MNga- 1	23.0	28.9	R
13	Sree Vijaya	24.0	25.7	S

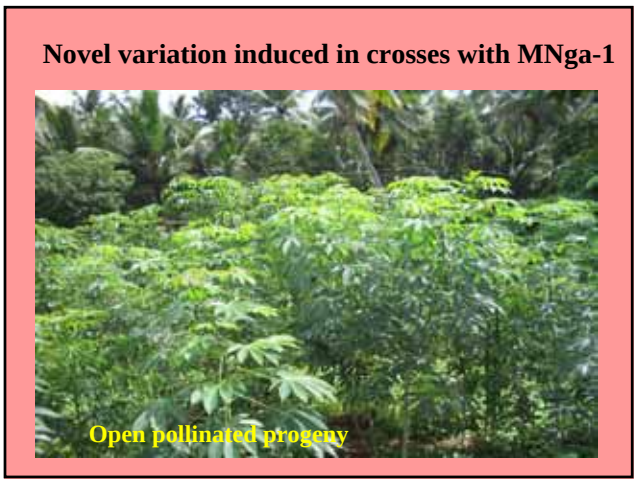
CD 0.5 = 10.44




CMR 4
CMR 8


CMR 9
HIGHLY RESISTANT
SELECTION WITH
NORMAL YIELD


CMR LINES IN SANKAGIRI


Novel variation induced in crosses with MNga-1
Open pollinated progeny

Genetics of CMD resistance in Mnga-1

Mapping population CO2 X MNga-1

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141 F_1 progenies

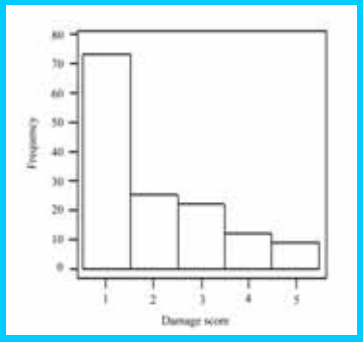
Susceptible lines : 68

Resistant lines : 73

CMD resistance segregation ratio = 1:1

CMD resistance controled by single dominant gene

Frequency distribution disease in the F1 progeny : Phenotypic score



1-Symptomless plant

5-Severe CMD symptom

Frequency distribution of phenotypic values of CMD resistant F_1 mapping population

Enhancement of CMD resistance through pyramiding of genes.

- Fifty percent gene expression in first Filial generation was found enhanced to 70 to 89% in selfed, open pollinated and backcrossed generation of selection made from Mnga-1 crosses.
- 374 lines selected based resistance and tuber characters planted for clonal evaluation in 2005-06

Interspecific hybridization for cassava mosaic resistance

- H. 99/14 - 3 - BC line with *M. glaziovii* genome.
- CMD resistant & High Yielding (> 50t/ha)

Leaf yield : 6kg/plant
No. of leaves : 2529
Tuber Dry matter :42.46
Tuber protein :2.9%

High Leaf retention
Ten times higher than top branchin
Three times higher than spreading
Canopy spread : 2.1m

Interspecific hybridization for protein enrichment *M. esculenta* x *M. tristis*

TRUE SEED PROGRAMME:

- Rapid multiplication of cassava lines having disease resistance and yield attributes in traditional and new areas using true seeds
- Minimizing progeny variation using a male sterile line (Ambakadan) in pollination block planted in mixed rows with the disease resistant line Mnga-1
- Seedlings and clones evaluated in diverse environment for selection of potential lines suitable to the location
- Realization of location specific lines within minimum time spent for selection and multiplication

Ambakadan OP seedling tubers at different location

CTCRI | Peddapuram

Conclusion and future prospects

- **Strength: of the programme is the genetic variations created using a potential donor parent MNga-1 (TMS 30001) thanks to IITA, Nigeria and CIAT, Cali, Colombia. Our Strength lies also in the enthusiastic farmers.**
- **Weakness: lack of MAS (Marker assisted Selection) methods for rapid selection process. HRD (Human Resource Development) to be increased along with funding to quicken the results of selection and multiplication.**

Conclusion and future prospects

- **Opportunity: is there in the production of more varieties with CMD resistance,root yield high starch, nutrient content and industrial qualities along with culinary traits. There is pressing demand for new varieties from farmers, industrialists and traders.**
- **Threat: natural appearance of new strains of virus is the major threat. Fresh genes, or gene combination are to be developed from exotic, or pathogen derived or from wild source.**