THE CASE FOR AN INTEGRATED MANAGEMENT OF CASSAVA MOSAIC DISEASE IN UGANDA

[1]Alicai, T., [1]Sserubombwe, W., [1]Omongo, C.A., [2]Gibson, R.W., [1]Bua, A., [1]Otim-Nape, G.W., [2]Colvin, J and [2]Thresh, J.M.

[1]Namulonge Agricultural & Animal Production Research Institute, P.O. Box 7084, Kampala, Uganda. email: casug@naro-ug.org

[2]Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB, UK

CASSAVA MOSAIC DISEASE (CMD) & CONTROL

Cassava mosaic disease (CMD) occurs throughout Africa where cassava is grown. It is the most important constraint to cassava production on the continent. Losses are serious, up to 100% especially under epidemic conditions and control measures are necessary.

Measures to control CMD include;

- Phytosanitation - effectiveness depends on overall rate of spread, inoculum pressure & intensity of cassava cultivation
- Cultural practices - feasibility relies on cropping practices, wind patterns & land tenure systems
- Resistant varieties - most effective control measure but resistant varieties often do not have tuberous root qualities desired by farmers.

BENEFITS OF RESISTANT VARITIES IN THE MANAGEMENT OF CMD

Studies were conducted to investigate the progress of CMD, recovery (loss of symptoms), reversion (production of CMD-free plants by cuttings from diseased plants) and symptom expression after ratooning in five resistant varieties and one susceptible cultivar (Bao). The following observations were made;

- Generally low cumulative and final incidences in resistant varieties (Fig. 1). Highly resistant varieties (Nase 3 and 4) had final incidences of <20%, while that in the moderately resistant Nase 2, 9 & 11 had up to 35% CMD incidence. Total infection occurred in Bao by 9 months after planting (MAP).
- Low rate of spread among resistant varieties, asymptotic disease levels were only attained after 9 MAP. The least area under disease progress curve (AUDPC) was in Nase 4 and the largest in Bao.

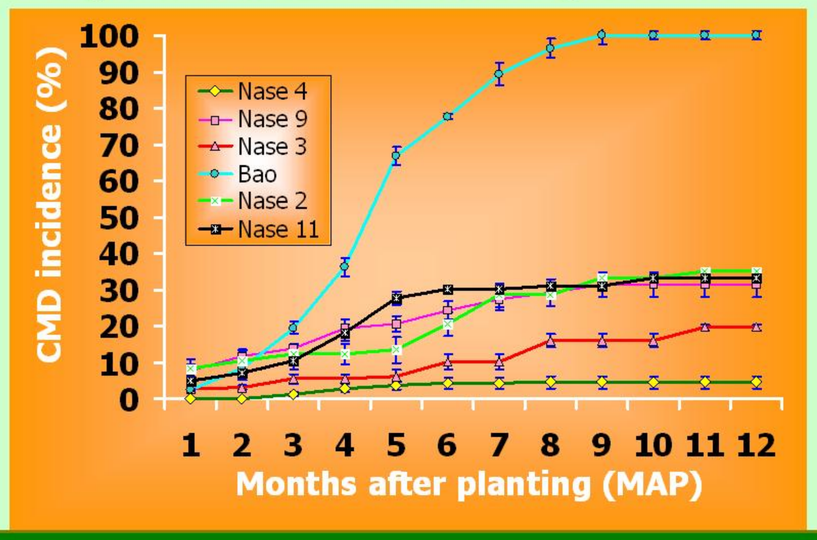

Fig. 1: Progress of cassava mosaic disease among five cultivars of cassava

Table 1: Extent of reversion in progeny plants of cuttings from symptomless and symptom-bearing (diseased) branches of recovered plants & recovery in plants grown from recovered and non-recovered (diseased) parent plants

Variety (VAR)	Health status (HTH) of branch/shoot	Reversion (%)	*Mean*	Health status of parent plant	Recovery (%)	*Mean*
Nase 4	Diseased	50.3	**64.5**	Diseased	57.9	**75.7**
	Symptomless	78.7		Recovered	93.4	
Nase 9	Diseased	28.3	**51.0**	Diseased	38.1	**48.5**
	Symptomless	73.6		Recovered	58.8	
Nase 2	Diseased	24.6	**47.7**	Diseased	80.4	**88.7**
	Symptomless	70.7		Recovered	96.9	
Nase 11	Diseased	23.9	**49.4**	Diseased	73.5	**83.2**
	Symptomless	74.8		Recovered	92.9	
$LSD_{.05}$	VAR	8.4			9.7	
	HTH	5.3			6.1	
P	VAR	0.004			<0.001	
	HTH	<0.001			<0.001	
	VAR x HTH	0.025			0.002	

- Reversion ranged from 47% to 65% and was greater in symptomless branches of plants that had at least partially recovered (Table 1)
- High mean recovery levels were recorded in resistant varieties, ranging from 49% to 89%. Plants with recovered progenitors showed greater recovery than those with non-recovered parents (Table 1)
- Ratooning resulted in dramatic increases in CMD severity. At 12 months after ratooning, severity levels were generally greater than that at the end of the preceding season before ratooning.

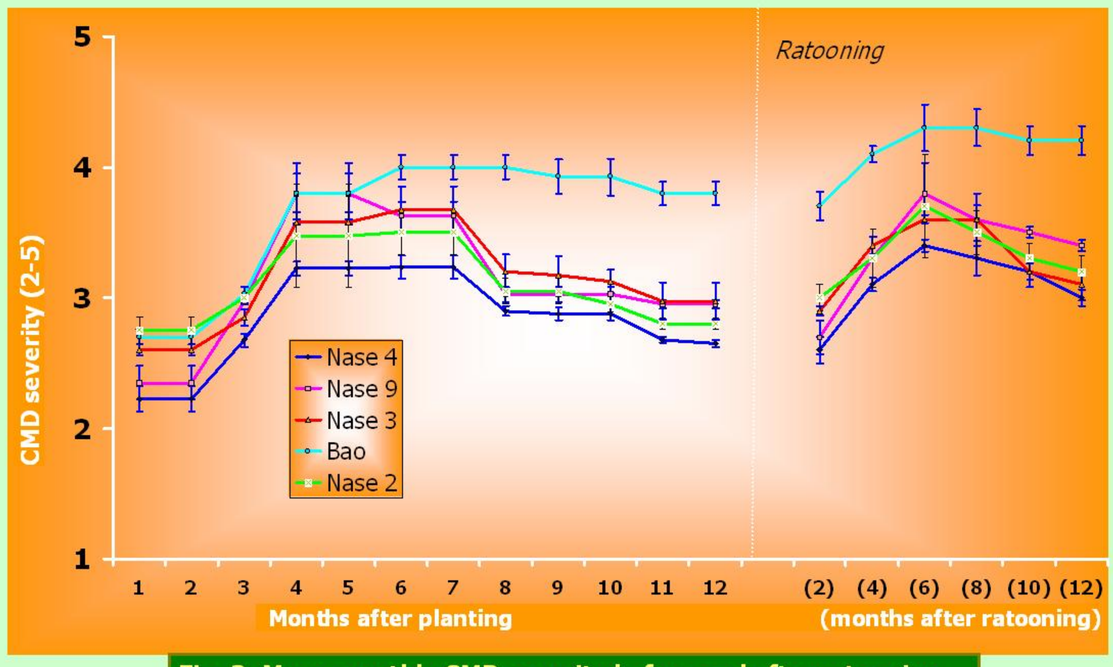

Fig. 2: Mean monthly CMD severity before and after ratooning

Symptoms of CMD on a local susceptible cultivar

Severe reduction in yield due to CMD

Recovered plant of CMD-resistant Nase 9

RELEVANCE OF INTEGRATED MANAGEMENT OF CMD

Resistant varieties exhibited low final CMD incidences, reversion and recovery. This has the net effect of greatly improving the health of the same stock of cassava. However, ratooning resulted in more severe symptoms in re-growth of previously diseased plants compared to severity in the original generation. This may have the effect of increasing virus concentration in plants, thus amount of virus in a location, resulting in placing nearby plants of susceptible cultivars at increased risk of infection. Ratooning may also have the effect of selecting for more virulent forms of cassava mosaic begomoviruses (CMBs)

Host resistance factors may be influencing the balance of CMBs. A related study noted cultivar differences in the proportions of mild and severe CMD, with common occurrence of severe CMD ('yellow mosaic') among resistant varieties.

Although recovery and reversion on their own can make huge contributions to CMD management, host plant resistance should be used together with phytosanitation and cultural control options to increase the effectiveness of CMD control. Combining the management practices can generate interactive effects that give better control than using only one practice.

Acknowledgments: IDRC, Gatsby Charitable Foundation, DFID (CPP), Rockefeller Foundation, Government of Uganda, Natural Resources Institute (NRI)