

# Effect of Cassava Mosaic Virus on Yield of Cassava

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## ABSTRACT

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Yield reductions of cassava infected with cassava mosaic virus under field conditions ranged from 24 to 75%. There was a strong correlation between disease severity and yield loss. Incorporation of yield loss assessments in evaluation of varieties for mosaic resistance would seem advisable in view of these results.

Mosaic of cassava (*Manihot esculenta* Crantz), caused by the cassava mosaic virus (CMV), occurs throughout Africa and has been reported recently from India (7). The virus is transmitted by the whitefly *Bemisia tabaci* Genn. Considerable work has been done on the virus (2,3), virus-vector relationships (4,8), and on breeding for resistance (6). There is, however, comparatively little information on the effect of CMV on yield of cassava. The work reported here was carried out to measure yield losses caused by cassava mosaic.

## MATERIALS AND METHODS

The experiment was conducted at Kikambala, Kenya, at an altitude of 15 m, using cassava varieties Kibandameno, 46106/27, 5315/40, 5317/21, and 5318/34. Kibandameno, a local variety, is grown extensively on the coastal areas of Kenya and is susceptible to CMV. 46106/27, which is recommended for the low-altitude areas of Kenya, is grown in varying extents outside the research stations and is moderately susceptible to CMV. 5315/40 and 5317/21, which are resistant to CMV, and 5318/34, which is highly resistant, are restricted to research stations.

Thirty-two cuttings of each variety were graft-inoculated using CMV-infected Kibandameno rootstocks. Severity of leaf symptoms on newly

formed shoots was assessed on a 1-5 scale (9). Scion tops were then cut just above the graft union and planted in the field, along with a corresponding number of mosaic-free cuttings of each variety. All cuttings were planted during the long-rains growing season and thus received the same conditions as commercial crops. Plantings were made at a standard spacing of 1 m between and within rows. Treatments were arranged in a randomized complete block design with four replicates. The plots were surrounded by two guard rows of mosaic-free cassava variety 5546/156 planted at the same spacing.

The experimental area was sprayed weekly with dimethoate 40% EC to control *B. tabaci*. Symptom development in plants was followed in the field (9). Plants were harvested in 12 mo, and fresh root weight was determined for each plant.

## RESULTS AND DISCUSSION

Observations on symptom development

before and after field transplanting showed that the resistant varieties "out-grew" symptoms (Table 1). Old leaves were shed during the dry season, and new leaves on 5315/40, 5317/21, and 5318/34 remained symptomless until harvest time. Only partial recovery was observed on moderately susceptible 46106/27.

Yields were reduced 23.9% for the highly resistant variety, 40.7-44.2% for the resistant varieties, 70% for the moderately susceptible variety, and 74.7% for the susceptible variety (Table 1). Mean reduction in yield for all varieties was 50.7%. Differences in yields between mosaic-free and mosaic-diseased plants were significant ( $P < 0.05$ ), as were differences among susceptible and resistant varieties. Disease severity and yield loss were highly correlated ( $r = 0.884$ ). No movement of CMV from diseased to healthy plants was observed.

Yield losses of 24 and 75% for resistant and susceptible varieties, respectively, were directly related to disease severity and were similar to those reported from other countries (1,5,10). Yields of resistant varieties were more than double those of susceptible and moderately susceptible varieties. However, lack of persistence of leaf symptoms in resistant varieties and yield losses even when there were no apparent symptoms suggest that varietal evaluations for resistance should include yield comparisons of CMV-

Table 1. Reduction in yield of cassava varieties infected with cassava mosaic virus

Variety	Leaf symptoms <sup>a</sup>		Mean fresh root wt (kg/plant) <sup>b</sup>		Reduction (%)
	Before transplanting	After transplanting	Diseased	Healthy	
5318/34 (HR) <sup>c</sup>	4	1	3.79 y	4.98 y	23.9 <sup>ad</sup>
5315/40 (R)	4	1	2.83 y	5.07 y	44.2 <sup>**</sup>
5317/21 (R)	4	1	2.80 y	4.72 xy	40.7 <sup>*</sup>
46106/27 (MS)	5	3	1.33 x	4.45 xy	70.1 <sup>**</sup>
Kibandameno (S)	5	5	1.00 x	3.95 x	74.7 <sup>**</sup>
Mean	...	...	2.35	4.63	50.7

<sup>a</sup> Rated on a scale of 1-5: 1 = no symptoms; 2 = mild mosaic; 3 = severe mosaic with mild distortion of lower leaflets; 4 = severe mosaic plus severe distortion of two-thirds of leaflets; and 5 = severe mosaic, severe distortion of more than two-thirds of leaflets, and reduced leaf size.

<sup>b</sup> Data are averages for 32 plants per treatment. Numbers in each column followed by the same letter are not significantly different ( $P = 0.05$ ) according to Duncan's multiple range test.

<sup>c</sup> HR = highly resistant, R = resistant, MS = moderately susceptible, and S = susceptible to CMV.

<sup>d</sup> \* = Significant ( $P = 0.05$ ) within variety; \*\* = significant ( $P < 0.01$ ) within variety.

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infected and healthy plants of the same variety.

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