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EVALUATION OF CASSAVA VARIETIES FOR YIELD AND ADAPTABILITY IN ZIMBABWE

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ABSTRACT

Cassava *(Manihot esculenta)* is becoming an important household food security crop especially in the drier areas of Zimbabwe. Cassava, however, performs differently under various soil and climatic conditions. To address this problem, eighteen newly introduced cassava varieties namely, M 86/00106, I92/0326, 92^{B}/0006, I92/0057, XM7, I91/02324, TME1, I92/0067, I4(2)1443, I63397, XM6, I92/0342, I4(2)1425, TME2, I30001, 91/0282, I00142, I91/02327; and two local accessions (Rushinga White and Smart farmer) were evaluated under rainfed conditions, without fertilisation during the 2000/2001 and 2002/2003 cropping seasons. From the study, M86/00106, I920326, 92^{B}/006, I920057 and XM7 showed stable yields across the two environments, even though yields were slightly higher in NR 11. Mean yield of the six best performing-improved varieties was 14.4 t ha^{-1}, 26% higher than 10.70 t ha^{-1}, mean of the local accessions. The study also showed that cassava will produce acceptable yields even under sub-optimal conditions. There were no significant disease incidence recorded in both sites and on all varieties.

Key Words: *Manihot esculenta*, marketable yield, mealybug

RÉSUMÉ

Le manioc *(Manihot esculenta)* est devenu une plante importante pour la sécurité alimentaire des ménages, spécialement dans les zones sèches du Zimbabwe. Cependant, la performance du manioc varie avec les conditions climatiques. Pour résourdre ce problème, 18 nouvelles variétés de manioc étaient introduites comprennant M86/00106, I92/0326, 92B/0006, I92/0057, XM7, I91/02324, TME1, I92/0067, I4(2)1443, I63398, XM6, I92/0342, I4(2)1425, TME2, I30001, 91/0282, I00142, I91/02327 et deux variétés locales Rushinda blanc et le smart fermier étaient évaluées dans des conditions pluvieuses, sans engrais pendant les saisons culturales 2000/2001 et 2002/2003. L'étude montra que M86/00106, I920326, 92B/006, I920057 et XM7 avaient des rendements stables à travers les deux environnements, même si les rendements étaient légèrement supérieurs dans NR11. La moyenne de six plus performantes variétés améliorées étaient 14.4 t ha^{-1}, 26% plus élévé que le 10.70 t ha^{-1} moyenne des variétés locales. L'étude montra aussi que le manioc peut produire des rendements acceptables même sous des conditions sub-optimales. L'incidence de la maladie n'a pas été significative dans les deux sites et pour toutes les variétés.

Mots Clés: *Manihot esculenta*, rendement vendable, virus farineux

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is gaining recognition in Zimbabwe mainly because of the change in climatic pattern, economic production of the crop and favourable policy environment (Mahungu, 1998). Hence, the need to introduce and develop germplasm adapted to the semi-arid areas. The crop is slowly catching up with the 'maize culture', mainly because of its ability to tolerate drought and produce stable yields in low fertility soils, thereby making a significant contribution towards household food security and cash income.

Zimbabwe was often referred to as a success story in terms of food security (Angberg,1997). However, the country is currently in a state of food insecurity both at national and household levels, following the recurrent natural disasters (floods and drought) that hit the country in the past few years. The production of the staple crop, maize *(Zea mays)*, has declined with yields being less than a tonne per hectare (Muza *et al.*,1998) due to the fact that costs for farm inputs such as fertilisers are beyond the reach of smallholder farmers. The most plausable strategy therefore is crop diversification, but also cultivation of alternative low input crops such as cassava, which can tolerate the stressful conditions.

Traditionally, cassava was grown and consumed in rural areas with mixed populations of immigrants from Mozambique, Zambia and Malawi (Angberg, 1997). This trend, however, is changing with Zimbabweans appreciating the role of cassava as a starch source at household level. Communities in Mutoko, Chiredzi, Zvishavane have gone a step further into processing flour and livestock feeds as non-Governmental Organisations (NGOs) move into the areas with promotion activities. Cassava could also find a niche in the dairy development projects, brewing industry, starch and bakery industries.

The local varieties being grown are sweet, but low yielding and late maturing, and planting material has been cited as the major limiting factor to cassava production (Mahungu, 1998). In an effort to address the problem of planting material availability, the Southern Africa Root Crops Research Network/International Institute of Tropical Agriculture (SARRNET/IITA) embarked on a multiplication and distribution programme for cassava and sweetpotato *(Ipomea batatus)* planting material in 1998 (Kasele, 1999). This led to an increase in the area under production of the crops. About 316 clones of cassava were introduced in Zimbabwe in the form of certified tissue culture plantlets from IITA in 1998 and established in the field in August 1998 (Kasele, 2000). These were harvested 15 months after planting from which 18 cultivars were selected for participatory evaluation.

According to Mba and Dixon (1995), cassava exhibits different growth behaviours at different locations due to climatic and soil factors. New varieties, therefore, have to be evaluated for their adaptability to various agro-ecological zones. It was on this basis that the trial was conducted to evaluate the introduced cassava genotypes for yield and dry matter content, disease tolerance and adaptability in NR II and IV of Zimbabwe.

MATERIALS AND METHODS

The trial was conducted at two locations, namely, at Panmure Experiment Station (NR IIb) and Mutoko (NR IV). Panmure site has moderately deep reddish brown clay loam soils. Rainfall is fairly high with a mean of 209mm^{-1}month in the 2000/01 and 77mm month^{-1} in the 2001/02 seasons. Mutoko site was a farmer-led germplasm evaluation where a site was identified in a farmer's field and the farmer took responsibility for the maintenance of the plot. The soils here are coarse-grained sands with essentially ferrallitic characteristics.

The experiment was laid out in a randomised complete block design with three replications. Plot size was 8 m x 6 m. Spacing between plants was 1 m x 1 m.

Eighteen cultivars with cyanogenic potential ranging from 1.64 - 5.08 mg HCN/100 g fresh weight of roots were provided by IITA and two local accessions (Smart farmer, and Rushinga White) used as checks were established for participatory evaluation and selection by farmers. The 20 clones were planted on 11 January, 2001 in Mutoko and 31 January, 2001 at Panmure Station. No fertiliser or supplementary irrigation were applied. Root and yield components were recorded at harvesting. Analyses of variance (ANOVA) was used to test for significant differences between treatments and means were compared using the Least Significance Difference test (Steel *et al.*, 1997).

RESULTS AND DISCUSSION

Root yield. There was significant (P<0.1) variation in the number of roots produced by different varieties (Table 1). Plants grown at Panmure had a significant higher number of roots per plant than the plants grown in Mutoko. I4(2)1425 and 91/02822 produced the highest number of roots per plant.

There was a significant difference in root yield and this was largely influenced by varietal effects (Fig. 1). Yield ranged between 2.7 and 12.9 t ha^{-1} in NR IV (Mutoko), and 6.67 and 21.3 t ha^{-1} in NR II (Panmure). One variety, M86/00106, outyielded both checks (Rushinga White and Smart farmer) at both locations, while four other varieties out-yielded Smart farmer only. Generally, yields were higher at Panmure than in Mutoko because the former lies in a higher rainfall area than the latter. Also, the clay loam soils at Panmure Station are more fertile than the sandy soils on-farm in Mutoko (Muza *et al.*, 1998). Different environmental conditions can, therefore, induce marked changes in the general pattern; growth and development of cassava, and storage root number (Hunt *et al.*, 1997)

Dry matter content. There was significant difference in the dry matter content (P=0.05) with 91/02822 expressing the highest DM content of 46%. All the varieties expressed high dry matter content (>40%) except for one of the checks, Smart farmer which had 37%.

There is a shift in the paradigm factor and root yield alone is not sufficient to justify the production of a particular variety (Mahungu, 1998). Dry matter content among other factors becomes a critical factor.

Adaptability. From Figure 1, seven varieties (M 86/00106, I92/0326, 92^B/0006, I63397, XM6, I4(2)1425 and I 91/02327) performed well in NR II and seven varieties (M 86/00106, Rushinga white, I92/0326, 92^B/0006, I92/0057, XM7 and Smart farmer) performed well in NR IV. These varieties would still need to be subjected to similar

TABLE 1. Root attributes of low cyanide cassava varieties (means over two seasons, 2000/2001 and 2001/2002)

Variety	Mutoko		Panmure site		
	Marketable root yield	Root $plant^{-1}$	Marketable root yield	Root $plant^{-1}$	Dry matter (%)
M 86/00106	12.5	7	10.1	5	40.5
Rushinga white	7.5	5	6.4	5	44.7
I92/0326	16.9	6	7.8	4	41.2
92^B/0006	17.5	4	6.9	5	43.9
I92/0057	6.7	6	6.2	5	45.4
XM7	4.1	5	5.8	5	40.8
Smart farmer	8.1	4	6.0	5	37.1
I91/02324	7.6	5	5.6	2	43.0
TME1	12.3	6	5.7	3	43.6
I92/0067	12.7	7	6.5	4	43.9
I4(2)1443	9.8	6	4.9	4	37.3
I63397	17.6	4	4.9	2	44.5
XM6	13.1	6	5.2	4	44
I92/0342	7.5	6	4.3	4	41.5
I 4(2)1425	17.8	8	5.0	4	42.2
TME2	13.6	3	3.8	4	44.6
I30001	8.7	5	4.7	4	42.8
91/02822	7.5	8	4.0	2	46.0
I00142	11.3	3	2.1	2	40.5
I91/02327	17.2	5	2.0	2	43.4
CV (%)					
LSD (0.10)	7.1	ns	ns	ns	4.28

*ns = Mean values within a column are not significantly different at P≤0.05

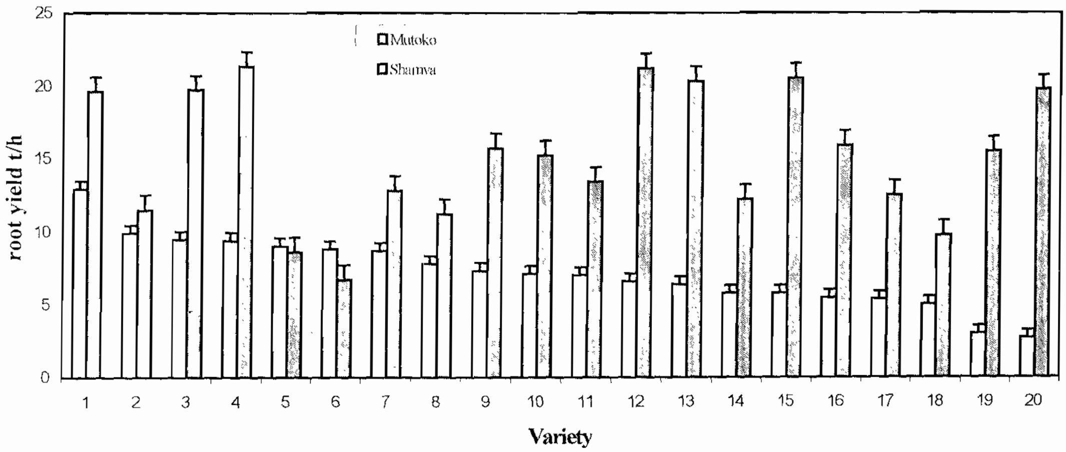

Figure 1. Fresh root yield of low cyanide cassava varieties (means over two seasons, 2000/01 and 2001/02).

environments for verification of performance. However, three varieties I 92/0057, XM7 and one check, (Rushinga White) exhibited some stability in both environments. This probably suggests that these varieties have a high adaptability.

CONCLUSION

This study has revealed that the improved varieties are higher yielders than their local counterparts. XM7, is preferred for sweet taste and I92/0057 for stability. All the other varieties still need further evaluation in other similar environments.

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