*Uganda Journal of Agricultural Sciences*, 2000, 5:8-11
ISSN 1026-0919


# Improvement of local cassava germplasm in Uganda

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## Abstract

**Use of local varieties in cassava germplasm improvement has been intensified in the recent past as farmers demand for resistant types of their local varieties. This seems to indicate that recently released varieties may be lacking certain unique characteristics for which farmers selected and maintained the local varieties. During the evolution of the local varieties, there were hardly any biotic stresses on cassava and therefore, farmers did not consider this in their selection criteria. As a result, most, if not all local varieties, are susceptible to most of the important diseases and pests of cassava. Therefore, considerable breeding efforts have centred around improvement of such local cassava varieties for disease and pest resistance. Sources of resistance have been mainly the Tropical Manihot Series(TMS lines). Though it has been difficult to get resistant progeny from local cassava female parents, one successful clone yielded a resistant clone, 95/SE-0087 from a local female pareut (Bao) and an improved male parent, TMS 60142 (Nase 1). The clone 95/SE-0087 yields up to 24 tons/ha. It is sweet with good architectural characteristics, a low cyanogenic potential, good resistance to bacterial blight, cassava green mite and has so far uot shown any symptoms of mosaic.**

**Key words:** Cassava, germplasm, Uganda.

## Introduction

Cassava is an important food crop grown all over Uganda and recent trends indicate that it will soon be the most important staple in the country replacing bananas. Cassava was introduced in Uganda as early as 1862 (Langlands, 1972) and since then it spread and gained popularity among farmers and consumers. The major reasons for the fast adoption of the crop were: (i) the ability of the crop to yield well even under marginal conditions where other crops can hardly give yield. (This ability was specially demonstrated during the droughts of 1931 and 1941 when it was essential to maintain local food production (Jameson, 1964)). (ii) the ability of the crop to store long in the soil and therefore its use as a famine reserve crop.

### Evolution of landraces

When cassava was introduced in Uganda, farmers used to grow it and store it in the soil, only turning to it under conditions of food shortages. The long period it was left growing enabled the crop to flower and seed. Being an outcrossing crop and highly heterozygous, a lot of variation emerged as seed sprouted into seedlings. Whenever the farmers harvested their crop, they also harvested the seedlings and whatever was appealing to them was kept through generations by cloning. The major route for the spread of cassava has been farmer to farmer diffusion. Those good clones that had high stability and adaptability spread to many parts of the country to the extent that their origin cannot be traced.

### Importance of landraces

Farmers selected cassava plants in their fields basing on unique characteristics that suited their preferences. These included underground storability, taste and compatibility with other crops in intercropping systems. During the early days of the recent mosaic pandemic re-mobilisation of local landraces particularly Ebwanateraka to affected areas served as a short term solution to the problems of food shortages that could otherwise have had more serious implications. What is very apparent to have been neglected in farmers' selection criteria is resistance to diseases and pests either because they were not important at the time or the crop itself was considered of low value compared to other crops.

The recent mosaic pandemic that devastated cassava in the North and Eastern parts led to serious genetic erosion as farmers abandoned cultivation of their local varieties that had succumbed to the disease for the improved tolerant/resistant varieties from the research system. Following the reduction of the disease pressure in the environment, interactions with farmers both formally and informally have indicated the need to restore or improve local varieties. It is therefore very obvious that the new varieties lack some of the unique characteristics for which farmers selected and maintained landraces.

**Approach to improvement of local varieties**

In response to the above demands, the cassava breeding programme at Namulonge initiated a hybridisation project in order to introgress disease/pest resistance genes into local landraces. Particular attention was paid to Ebwanateraka and Bao because these were highly adaptable and acceptable by farmers. The strategy of this project has been development of genotypes from local varieties with resistance to prevalent biological and environmental stresses. Other objectives of this project include: development of varieties with high yields especially in terms of dry matter content per unit area per unit time, improvement of root quality with respect to the different consumption practices among farmers, improvement of plant architecture suitable for different cropping systems and stability and adaptability across environments.

Earlier efforts to improve local varieties in E. Africa centred upon the use of *Manihot glaziovii*, a wild species of cassava. However, this was a long process that involved backcrossing to recover root qualities. All the same success was recorded with the development of the TMS series that have since then featured prominently in many African cassava breeding programmes (Ssemakula *et al*, 1997).

The Uganda breeding program has utilised the TMS series as males and the local varieties as females in an introgression block. Seed is collected of both cross and open pollination, planted and evaluated at seedling and subsequent clonal levels. This follows the breeding and selection scheme shown in Figure 1. This process has experienced difficulties similar to those faced by earlier programmes to improve local varieties in E. Africa.

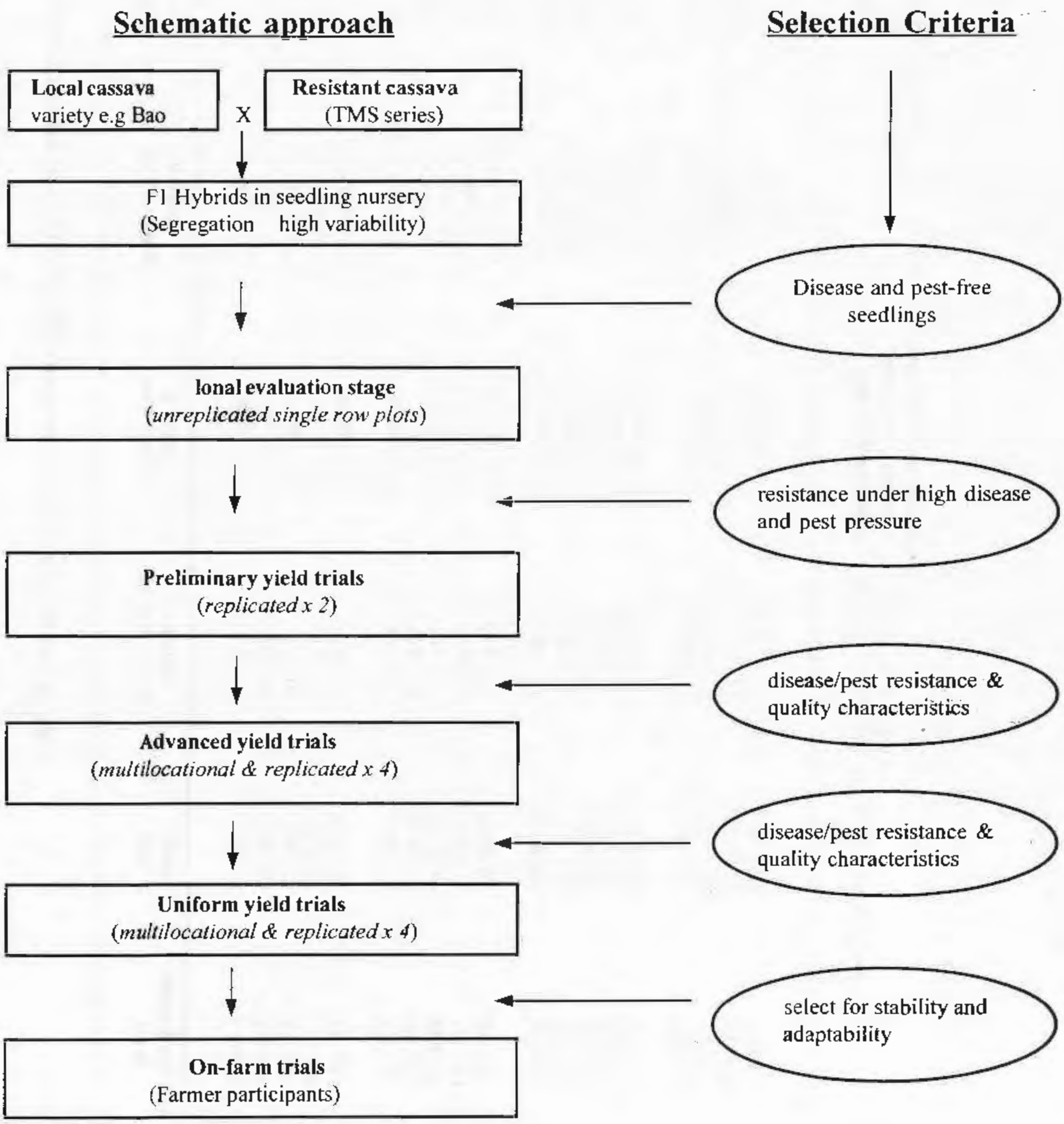


**Fig. 1: Breeding and selection scheme for resistance to cassava pests and diseases**

Table 1. Performance of selected cassava clones at advanced yield trial stage planted at Serere and Ngetta 97/98

| Clone | Mean yield (tons/ha) | Mean CMDI (6 MAP) | Mean CMDS (6 MAP) | Mean CBB (6 MAP) | Mean CGM (6 MAP) | Raw taste | HCN (mg/kg dry wt) |
|---|---|---|---|---|---|---|---|
| 95/SE-0050 | 28.11±7.13 | 14.92±5.89 | 1.75±0.25 | 1.87±0.35 | 1.12±0.12 | 1.50±0.33 | 234±47 |
| 95/SE-0290b | 16.58±2.83 | 0.00±0.00 | 1.00±0.00 | 1.75±0.37 | 1.25±0.16 | 2.00±0.33 | 395±56 |
| 95/SE-0160 | 21.94±3.85 | 89.83±6.00 | 3.00±0.00 | 1.75±0.37 | 1.25±0.16 | 1.12±0.12 | 461±45 |
| 95/SE-0412 | 11.16±2.71 | 22.22±12.24 | 2.00±0.38 | 1.62±0.32 | 1.12±0.12 | 1.62±0.32 | 241±45 |
| 95/SE-0348 | 5.91±0.78 | 2.08±2.08 | 1.33±0.33 | 1.50±0.34 | 1.17±0.17 | 1.00±0.00 | 243±34 |
| 95/SE-0290a | 14.92±5.25 | 53.12±15.26 | 2.62±0.37 | 1.62±0.26 | 1.50±0.33 | 2.00±0.26 | 570±45 |
| 95/SE-0055 | 12.32±3.55 | 6.80±4.86 | 1.43±0.30 | 1.50±0.22 | 1.86±0.34 | 1.67±0.42 | 263±56 |
| 95/SE-0126 | 9.61±1.96 | 29.07±15.29 | 2.00±0.45 | 1.50±0.22 | 1.17±0.17 | 1.40±0.40 | 258±45 |
| 95/SE-0094 | 21.94±2.51 | 0.00±0.00 | 1.00±0.00 | 1.87±0.29 | 1.37±0.26 | 2.37±0.32 | 192±34 |
| 95/SE-0245 | 8.83±2.61 | 44.17±10.91 | 2.50±0.34 | 1.55±0.34 | 2.00±0.36 | 1.60±0.40 | 297±41 |
| 95/SE-0312 | 12.68±2.85 | 7.14±7.14 | 1.29±0.29 | 1.57±0.30 | 1.14±0.14 | 2.00±0.45 | 595±87 |
| 95/SE-0230 | 16.67±2.74 | 23.04±10.74 | 1.87±0.35 | 1.75±0.31 | 1.25±0.16 | 1.75±0.31 | 507±67 |
| 95/SE-0044 | 30.12±3.25 | 35.36±10.37 | 4.50±1.50 | 2.12±0.35 | 1.62±0.26 | 1.00±0.00 | 240±34 |
| SS4 (check) | 24.62±4.21 | 15.84±12.21 | 1.87±0.61 | 2.75±0,92 | 2.00±0.27 | 1.25±0.16 | 258±41 |
| 95/SE-0087* | 24.21±3.89 | 0.00 ±0.00 | 1.00±0.00 | 1.75±0.31 | 1.12±0.12 | 1.37±0.26 | 232±43 |
| 95/SE-0253 | 23.19±4.17 | 41.09±16.25 | 2.43±0.43 | 1.42±0.20 | 1.14±0.14 | 2.50±1.22 | 269±32 |
| 95/SE-0088 | 21.06±2.12 | 2.50±2.50 | 1.25±0.25 | 1.75±0.31 | 1.75±0.31 | 1.57±0.30 | 163±27 |
| 95/SE-0356 | 19.13±3.81 | 62.19±10.60 | 3.00±0.00 | 1.75±0.31 | 1.37±0.26 | 1.75±0.25 | 344±18 |
| Nase 2 (check) | 18.11±2.22 | 48.29±12.56 | 2.75±0.25 | 1.87±0.35 | 1.50±0.19 | 1.75±0.31 | 166±21 |

CMDI=mosaic disease incidence(%) * Bao x Nase 1 cross
CMDS=mosaic disease severity (1-no symptoms± 5-very severe symptoms)
CBB=cassava bacterial blight (1-no symptoms± 5-very severe symptoms)
CGM=cassava green mite (1-no symptoms± 5-very severe symptoms)
Raw taste 1=sweet± 2=slightly bitter± 3=bitter
MAP=months after planting

Table 1 shows the performance of selected cassava clones at an advanced yield trial stage planted at two locations. With the selection criteria adopted, only 5 clones from table 1 were promising and were selected. These are : 95 / SE-0050, 95/SE-0055, 95/SE-0094, 95/SE-0088 and 95/SE-0087. Other clones were not selected either because they had low yield (less than 12 tons/ha), had a cassava mosaic disease (CMD) incidence of more than 30 %, a CMD severity score of more than 2.5, a taste score of up to 2.0 or a cyanogenic potential of up to 300mg HCN/kg dry weight. From the table, it is evident that CMD is still the major biotic constraint being addressed. Originally what hindered progress in the improvement of local varieties was the lack of genetic variability for resistance to diseases and pests especially CMD. Also, a close association between taste, yield, cyanogenic potential and resistance to CMD has been reported by Ssemakula et al 1997. Many highly disease resistant cassava varieties always tend to have bitter taste and high cyanogenic potential, a combination that makes breeding for resistance, good taste and low cyanogenic potential almost incompatible objectives. With the close access to a large germplasm pool from the International Institute of Tropical Agriculture, a lot of variability has been exploited in order to improve the Ugandan local germplasm. A number of cassava clones with high resistance to pests / diseases and low cyanogenic potential have been identified and are being used as male parents for improving local varieties.

Recording success has not been very easy as seedlings from local varieties have in most cases been as susceptible to diseases and pests as their female parents (locals). On the other hand, seedlings from reciprocal crosses very often been resistant but with unacceptable cyanogenic potential. Recently, however, a progeny of Bao (female) and Nase 1 (male) has shown a high level of resistance to mosaic disease. This clone (95/SE-0087) is sweet, with a low cyanogenic potential and yields higher than Nase 2, a check variety that has been used in evaluating it. Table 1 shows its performance relative to others in an Advanced Yield trial. The clone has petiole and stem colours like those of Bao but sometimes branches lower than Bao.

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