# SCREENING SWEETPOTATO (*IPOMOEA BATATAS* L.) FOR DROUGHT TOLERANCE AND HIGH Β-CAROTENE CONTENT IN MOZAMBIQUE

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## BACKGROUND

Sweetpotato (*Ipomoea batatas,* L.) is one of the most important food sources and an option for rural income generation in Mozambique. The crop is produced mainly by small-scale farmers under rain fed conditions. Drought is the most important abiotic stress in Mozambique (Gomes et al., 2005). It affects yield and yield components, and conservation of planting material in-situ for the next growing season (Demagante *et al*. 1989).

The objective of the study was to identify sweetpotato genotypes tolerant to drought, particularly orange-fleshed genotypes, to be used as new parental material in the breeding programs.

## MATERIALS AND METHODS

Forty eight genotypes (12 landraces, 23 introduced clones and 13 national breeding lines) were evaluated in field trials conducted at Umbeluzi Research Station.

Gross and net plot sizes were 7.2 and 6 m², respectively. The inter- and intra-row spacing was 90 and 30 cm, respectively. The experiment was conducted using three replications, α-design with split-plots.

The **Genotypes** in each plot constituted the whole-plot treatment factor and Irrigation **treatment was** the sub-plot treatment factor.The factor treatment were three irrigation levels, namely: (i) no stress (plants irrigated from planting up to the 120th DAP), (ii) moderate stress, plants irrigated until 60 days after planting (DAP), and (iii) severe stress, plants irrigated until 30 DAP.The soil moisture was monitored using a tensiometer. The following data were recorded for each net plot: survival%, aboveground biomass, root *yield, total* biomass *production*, dry *matter* and *β-carotene content (βC was* estimated using the standard colour chart).

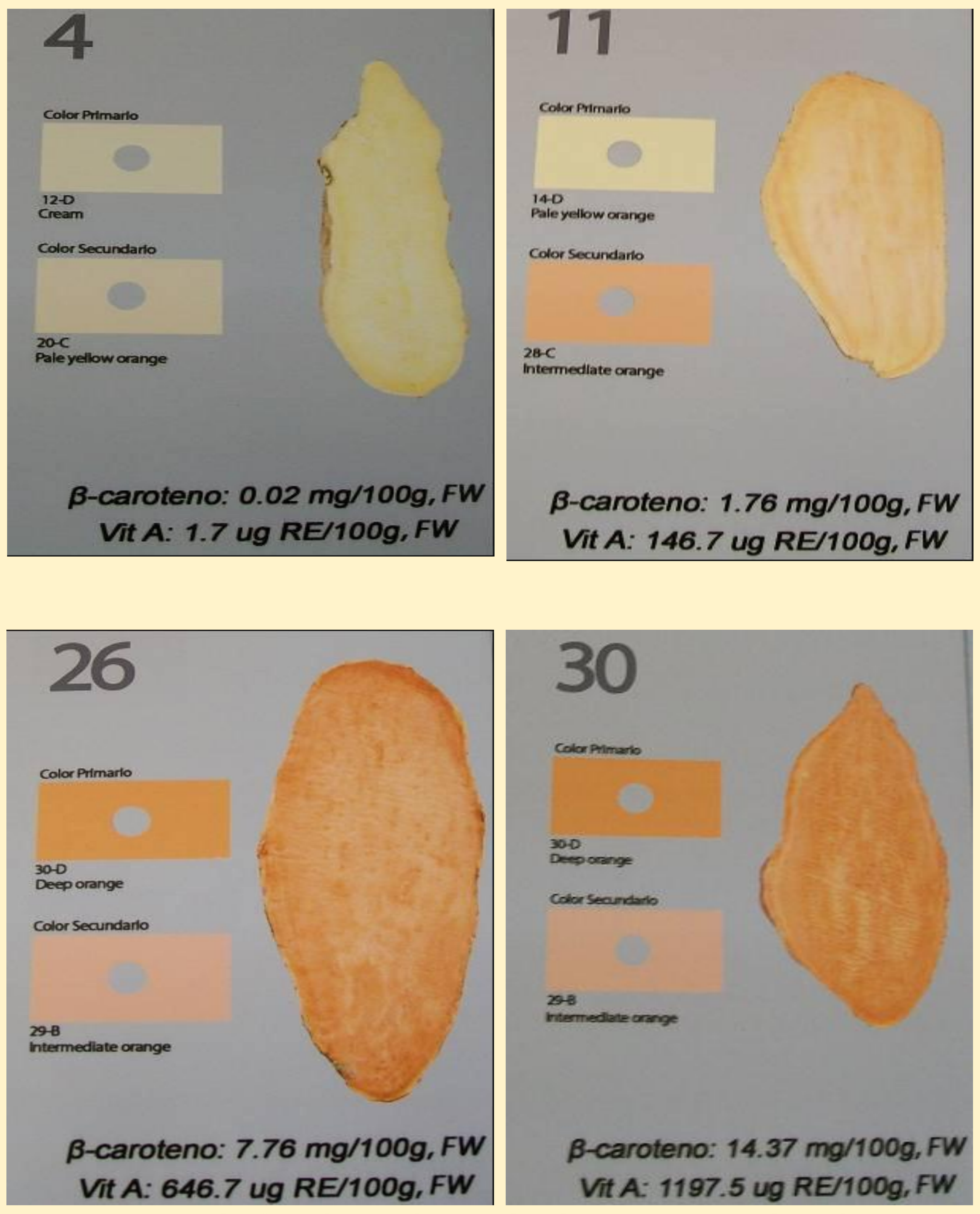


Figure 2.1: Examples from the Royal Horticultural Society (RHS) Colour Chart for estimating β-carotene content in sweetpotato

## RESULTS

*From ANOVA, Genotypes were significant for all traits. Irrigation levels were not only significant for aboveground biomass. T*he Genotype x Irrigation interaction was only significant for total root yield, the response patterns of the 48 Genotypes across Irrigation levels were not similar *(Table 1)*.

**Table 1: F-statistics of genotypes, irrigation levels and genotypes x irrigation level interaction for five traits of 48 sweetpotato genotypes exposed to 3 irrigation levels**

| Treatment factor | Genotype | Irrigation Levels | Genotype x Irrigation Levels |
|---|---|---|---|
| Survival % | 2.88** | 30.39** | 1.13 ns |
| Aboveground biomass (t ha$^{-1}$) | 11.29*** | 6.69 ns | 1.23 ns |
| Total root yield (t ha$^{-1}$) | 12.04*** | 18.48*** | 1.57*** |
| Total fresh biomass (t ha$^{-1}$) | 8.98*** | 11.09*** | 1.21 ns |
| β-carotene (mg 100 g$^{-1}$) | 27.47*** | 10.75* | 0.92 ns |
| Dry matter content (%) | 2.06 *** | 0.29 *** | 1.07 ns |

* Significant at the 0.05 probability level; ** Significant at the 0.01 probability level; *** Significant at the 0.001 probability level; ns - Not significant

Total root yield of the 48 Genotypes was generally very low under all Irrigation levels, ranging from: 0.00 to 8.17 t ha$^{-1}$ under severe stress; 0.14 to 13.56 t ha$^{-1}$ under moderate stress; and 0.24 to 19.22 t ha$^{-1}$ under nonstress conditions. MUSG0608-33, MUSG0623-9, MUSG0609-47, MUSG0616-18 and 199062.1 recorded the highest yields under nonstress, moderate and severe stress Irrigation levels, respectively. Villamayor Jr (1987) reported that high yielding genotypes under nonstress conditions also produced high yields under stress conditions (Table 2).

The yields of K118, Tainung64, Chulamete, Jonathan-Nairobi, Xihetamakote and Nhacutse4 were only slightly higher under nonstress conditions compared to moderate and severe stress conditions indicating a limited response to available water by these Genotypes (Table 3.5). Demagante *et al*. (1989) also found that root yield in some genotypes did not increase in response to increased irrigation.

In contrast, NASPOT, Ukerewe, Canassumana, MUSG0606-2, MUSG0615-36, MUSG0622-60, Gabagaba and Cordner recorded higher yields with increasing Irrigation levels (table 2).

MUSG0608-33, Lo323, Jonathan-Nairobi, 199062.1, Tainung64, MUSG0616-18, MUSG0623-9, MUSG0609-47 and Atacana had their highest yield under severe stress. Conversely, under moderate stress, Lo323 and Jonathan-Nairobi recorded their lowest yield (Table 2).

**Table 2: Total root yields (t/ha) of 48 genotypes exposed to three irrigation levels**

| Genotypes | Severe stress | Moderate stress | Non-stress | Genotypes | Severe stress | Moderate stress | Non-stress |
|---|---|---|---|---|---|---|---|
| Xitsekele | 0.06 | 0.72 | 1.06 | MUSG0614-24 | 0.89 | 3.11 | 3.67 |
| ADMARC | 1.17 | 2.00 | 3.17 | MUSG0608-61 | 1.44 | 2.39 | 7.50 |
| MGCl01 | 0.33 | 1.28 | 2.56 | MUSG0606-02 | 0.72 | 5.00 | 10.94 |
| Xiadlaxakau | 0.78 | 3.39 | 5.94 | Tainung64 | 6.33 | 7.67 | 17.28 |
| Manhissane | 1.72 | 2.06 | 4.23 | MUSG0610-51 | 1.17 | 2.17 | 3.94 |
| Canassumana | 3.94 | 2.61 | 5.11 | Chulamete | 2.17 | 2.10 | 3.06 |
| Tacna | 0.11 | 1.94 | 2.17 | Jonathan-Nairobi | 6.67 | 6.50 | 7.67 |
| NASPOT | 0.78 | 2.83 | 7.56 | LO323 | 6.78 | 3.49 | 9.89 |
| Resisto | 0.33 | 1.94 | 3.11 | Resisto-Nairobi | 1.06 | 3.28 | 6.94 |
| Jonathan | 0.11 | 1.78 | 3.00 | MUSG0615-36 | 1.89 | 7.72 | 17.33 |
| Carrot-C | 0.22 | 0.45 | 1.56 | MUSG0608-33 | 8.17 | 13.56 | 19.22 |
| K135 | 0.06 | 0.17 | 0.24 | MUSG0622-60 | 0.94 | 9.22 | 14.72 |
| Gueri | 0.22 | 0.40 | 2.40 | MUSG0614-22 | 3.61 | 4.78 | 9.67 |
| Zambezi | 0.39 | 0.39 | 2.06 | Gabagaba | 1.56 | 6.06 | 8.33 |
| Ukerewe | 0.22 | 4.06 | 7.28 | Ligodo | 0.11 | 1.72 | 5.00 |
| Mayai | 0.22 | 0.72 | 2.50 | Cordner | 2.06 | 4.10 | 11.44 |
| K566632 | 0.22 | 1.06 | 1.17 | Xihetamakote | 0.11 | 0.65 | 0.94 |
| K118 | 0.00 | 0.14 | 0.33 | Nhacutse4 | 1.67 | 1.39 | 2.18 |
| Ejumula | 0.50 | 1.16 | 2.11 | Atacana | 3.06 | 2.33 | 6.22 |
| Pipi | 0.33 | 2.83 | 5.11 | UNK-Malawi | 0.11 | 0.44 | 1.78 |
| 199062.1 | 6.39 | 9.50 | 12.94 | Cincominutos | 0.56 | 1.35 | 2.50 |
| MUSG0609-47 | 4.28 | 9.11 | 14.89 | **Mean** | **1.84** | **3.56** | **6.43** |
| MUSG0616-18 | 4.61 | 10.22 | 13.61 | **Min.** | **0.00** | **0.14** | **0.24** |
| CN 1448-49 | 0.28 | 2.39 | 2.67 | **Max.** | **8.17** | **13.56** | **19.22** |
| MUSG0623-09 | 4.50 | 10.44 | 16.89 | **$LSD_{0.05}$** | **4.33** | **4.02** | **5.99** |
| MUSG0610-45 | 1.17 | 3.67 | 4.33 | **C.V. (%)** | **62.53** | **76.01** | **75.76** |
| Beauregard | 4.33 | 4.50 | 10.22 | | | | |

## CONCLUSIONS

The effect of drought stress on total root yield depended on both the degree of stress and on the stage of growth at which the stress occurred.

The highest yields under nonstress and stress conditions were: MUSG0608-33, MUSG0623-9, MUSG0609-47, MUSG0616-18; these Genotypes could be used to increase yield under both irrigated and non-irrigated conditions.

The highest yielding Genotypes under nonstress conditions: MUSG0615-36, Tainung64, MUSG0622-60; these Genotypes could be used to improve yield under nonstress or irrigated conditions.

The highest yielding genotypes under severe stress were: Lo323, Jonathan-Nairobi, Atacana; these genotypes could be used to improve yield under stress conditions.

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## REFERENCES

- Demagante, A.L., Opefia, G.B. and Vander Zaag, P., 1989. Influence of soil moisture on sweetpotato (*Ipomoea Batatas* L. Lam) growth and yield. Manila (Phlippines). CIP Southeast Asia and the Pacific Region Office. Pp 131-144.
- Gomes, F., Carr, M.K.V., and Squire, G.R., 2005. Effects of water availability and vine harvesting frequency on the productivity of sweetpotato in southern Mozambique. IV. Radiation interception, dry matter production and partitioning. *Experimental Agriculture*, 41: 93-108.
- Villamayor Jr, F.C., 1987. Evaluation of root crop varieties adapted to drought conditions. Visayas State College of Agriculture. Philippine Root Crop Research and Training center. Annual Report 1986. Pp 32-34.