

# Morphological and agronomic basis of vine survival in sweetpotato in drought-prone areas of Mozambique

**Drought is the most threatening factor to sweetpotato production in Mozambique (Fig. 1). We have identified five released varieties which can give more than 10 sprouts per root after 3 to 4 months of storage in sand. This is a key trait for assuring permanent adoption.**



Fig. 1 Variety Resist- Moz drying up one month into the dry season at the testing sites (credit G. Makunde)

## ➤ What is the problem?

In areas with long dry seasons (>4 months), non-availability of planting material at the beginning of the planting season is the major constraint to attaining desired levels of sweetpotato production. Most farmers save their own "seed" in Mozambique, but less than 40% of sweetpotato farmers can retain sufficient quantities of vines for planting in the following season.

## ➤ What do breeders want to achieve?

Breeders need to provide varieties which can withstand dry season. Traditionally, many farmers leave a few roots in the ground which sprout with the next rains but are often affected by weevils and disease. The Triple S (Storage in Sand and Sprouting) technology is a new approach in which at harvest health roots are healthy stored in layers of sand and then planted out in a protected nursery bed 6-8 weeks prior to the expected onset of the rains, where they sprout. Thus, breeders should assess whether roots can still sprout after three to five months of storage in sand. This could

ensure adequate availability of pest-free planting material at the start of the rainy season (Fig. 2).

## ➤ What was our approach?

We tested 37 varieties in total, classified by distinct types shown by different colours:

- 17 varieties released in Mozambique
- 1 clone from the Mozambique breeding program being considered for release
- 7 local landraces collected in Mozambique
- 5 promising clones from other African countries
- 1 genotype from the USA
- 6 from CIP headquarters in Peru

All 37 were evaluated for vine survival and sprouting abilities at three sites in 2015 and 2016: Gurué in Central Mozambique; Umbeluzi and Nwalate in Southern Mozambique. There were three treatments set at each location with different harvesting times; 5, 9 and 11 months after planting. Single row plots, each 4 m long, were assigned to each genotype following a randomized complete block design with two replications. A row-to-row distance of 0.9 m and a plant-to-plant spacing of 0.3 m was maintained. To estimate traits that relate to plant vigor, vine length and stem diameter were measured at four months after planting at all locations. A total of 10 small to medium-sized roots were selected at all locations at five month's harvest. The selected storage roots were stored in dry sand at Nwalate (Fig. 3) and Gurué, following the Triple S (approach of layering dry cool sand alternating with health roots in a bucket). Six of the stored roots were drawn in early November in 2015 and 2016 and planted in a seed nursery at Umbeluzi, Nwalate and Gurué to assess ability to sprout (Fig. 4). The remaining four roots were sent to the quality laboratory for analysis. Data on the number of sprouts at 4 weeks and length of the vines at 5 weeks were recorded. The collected data were analyzed using SAS 1996.





**Fig 2** Farmers receiving vines at the start of the rainy season in Maputo Province 2016 (credit A. Naico)



**Fig 3** Preparation for storage of small to medium sized roots in sand after harvesting at Nwalate (credit G. Makunde)

### ➤ What did we learn?<sup>1</sup>

- Variety, environments and year affected the expression of two important characteristics for vine survival - vine length and stem diameter.
- Vine length was longest in landrace variety, **Xiadla-xakau** and shortest in a breeding clone ready for release, **Margarete**.
- **Resisto-Moz** had the thinnest stem (2.8 mm) and **Margarete** had the thickest (5.2 mm).
- Variety and environments affected the number of sprouts germinating from each planted root.
- The number of sprouts germinating from each planted root was not influenced by the year of planting.
- The released variety **Esther** had the highest number of sprouts per root, 16; while the farmer variety **Nhacoongo 1** had 2, the lowest.
- The best top five sprouting varieties were **Esther**, **Caelan**, **Delvia**, **Alisha** and **Ivone**, with more than 10 sprouts per root at four weeks after planting.
- Sprouting is affected by the relationship between starch and simple sugars (%) in the stored roots after four months in sand storage. Varieties with low starch and high glucose and sucrose levels sprouted earlier than the others.
- Varieties with sprouts longer than 75 cm at six weeks after planting were **Tacna**, **Alisha**, **Caelan**, **Xitsekele**, **Bita** and **Cordner**. These were ready for harvest and normal planting.
- The most drought sensitive varieties were **Resisto-Moz** and **Nhacoongo 1**. They could not survive until 9 months after planting. The two are spreading-type varieties with the thinnest average stem diameter of 2.8 and 3.1 mm, respectively.

- Short, but erect and thick-stemmed genotypes had a better survival rate to prolonged dry spells than spreading or thin-stemmed types.
  - Vine length and stem diameter are heritable characteristics, with above 50% heritability.
- Overall, sprouting ability, vine length and diameter as well as branching ability offer possible avenues to create a sustainable seed system in sweetpotato and these traits should be targeted in breeding programs.

### ➤ What are the next steps?

The best varieties which combine three traits important for vine survival are: **Caelan** and **Alisha**, both released varieties. **Caelan** had an average of 15 and **Alisha** had 11 sprouts per root, four weeks after planting and sprouts lengths of 79 and 87 cm at five weeks of sprouting, respectively. Both varieties are thick stemmed. We intend to popularize the sand, storage, and sprouting technique, known as Triple S, in the drought-prone provinces of Maputo, Gaza and Inhambane in collaboration with dissemination projects in the country. The breeding program in Mozambique will begin including sprouting ability in sand as one of its selection criteria for drought-prone areas.



**Fig 4** Improved variety Melinda, the first genotype to sprout at Umbeluzi one week after seeding (credit G. Makunde)

<sup>1</sup> The color of the mentioned variety matches the type color shown in the previous section.

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