**Introduction**

*Megathyrsus maximus* (Jaq.) B.K. Simon & S.W.L. Jacobs (Syn. *Panicum maximum* Jacq.), plays an essential role in livestock production systems in the tropics. This pasture is widely used in extensive production systems, silvopastoral systems (tropical America), and cut-and-carry systems (Africa). This perennial and apomictic grass has important characteristics such as very leafy, high quality feed, high production potential, suited to grazing and cutting, drought tolerant, and early season growth in some lines.

**The challenge**

Despite being considered as an excellent alternative, some factors challenge the performance of *Mm* commercially:

1. **climate change puts at risk their potential production through worsening of drought periods;**
2. **evolution and adaptation of pests and diseases, which can become increasingly unpredictable.**

Thus, there is a need to search for superior hybrids with more potential for mitigation and adaptation to climate change.

**Alliance Bioversity-CIAT Genebank**

The genebank of the Alliance preserves a large number (563 accessions) of *Mm* accessions, collected and introduced mostly from Africa [genebank.ciat.cgiar.org]. A big proportion of these accessions have been agronomically characterized and genotypes with desirable traits such as drought tolerance (Atlas, Centenario, Colonião, Mombasa, Sêmpre Verde, Tobità), high biological nitrification inhibition (BNI potential Tobità), high nutritional value (*CIAT* 16035 c.v. BRS Zuri) and tolerance of low soil pH and high Al+++ (*CIAT* 26900 c.v. Vencedor and hybrid Centerario; Usberti, 1986) have been identified.

**Our approach**

The *Mm* breeding program at the Alliance pursues a product profile focused on pyramiding in one unique product, the good attributes of quality and biomass currently available in commercial varieties, but adding value through additional traits like adaptation to climate change with tolerance to drought and low fertility conditions.

Furthermore, *Mm* has the potential to contribute to the mitigation of climate change in two ways. Firstly, by means of carbon dioxide fixation since *Mm* follows the C₃ photosynthetic pathway, which is considered more efficient in *CO₂* fixation due to higher photosynthetic rates. Secondly, through BNI, a phenomenon that enables a drastic reduction of nitrification through root exudation of biological inhibitors.

Taking into account these considerations and adding that the Alliance’s breeders have a large experience in genetic improvement of grasses (*Urochloa*), we aim to describe the first steps followed by Forage Breeding Team at Alliance in their effort to build a new breeding program in *Megathyrsus maximus*.

**Current status**

Pursuing the exploitation of heterosis, the *Mm* breeding program at the Alliance started in 2016 following simultaneously two breeding schemes: i) Recurrent Selection based on Specific Combining Ability (RS-SCA), and ii) Reciprocal Recurrent selection (RRS). In both breeding schemes the aim is to accumulate heterotic effects over cycles having two separated heterotic pools. However, the schemes differ in the number of populations for improvement. While RS-SCA aims to improve one unique breeding pool (females) maintaining the male tester always fixed, the RRS (widespread in Maize breeding) improves both female and male pools simultaneously. Based on quantitative genetics principles, the RS-SCA should deliver higher genetic gains in the short term but in the long term, RRC could double the genetic gains in comparison with RS-SCA. In order to test and profit from that assumption, the breeder at the Alliance decided to partition the investment and follow both strategies simultaneously as we will describe as follows.

**References**


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