Tropentag 2022
September 14-16, 2022
Conference on International Research on Food Security, Natural Resource Management and Rural Development
organised by the Czech University of Life Sciences, Prague, Czech Republic

# Phenotyping the banana biodiversity to identify climate smart varieties with optimal market potential in Africa and Europe

Elyeza Bakaze[a], Rockefeller Erima[b], W.A. Okurut[c], Priver Namanya Bwesigye[d]

a National Agricultural Research Organization (NARO), National Banana Research Program, Uganda
b National Agricultural Research Organization (NARO), National Banana Research Program
c National Agricultural Research Organization (NARO), National Banana Research Program
d National Agricultural Research Organization (NARO), National Banana Research Program

## Introduction

Global warming due to climate change presents a challenge to agricultural industry. The productivity banana depends on climatic conditions mainly temperature and water as drivers of crop growth. Banana is a major staple food crop to more than 25million rural and urban Ugandans and 400 million people in the world (www.fao.org/faostat/). It is an important source of income for many small and medium-scale producers that needs only limited inputs to ensure a harvest. However, banana farming entirely depends on received rainfall to provide soil moisture for banana production. As a result, extreme weather condition such as drought negatively affects production and consequently livelihoods of those who depend on bananas. Majority of cultivated East African highland banana varieties are susceptible to moisture stress as a result of drought leading to reduced yield potential and up to 65% yields loss (Van Asten et al., 2011). Intensifying banana production in a sustainable way (without expanding land use and considering biotic and abiotic pressure) means introducing suitable varieties that are resilient to the effects of climate change and remain high-yielding. The project, therefore, aims at sustainably improve banana production and productivity with climate-smart bananas. This would be achieved through; 1) the diversity search in the released hybrids and already existing banana varieties to identify those preferred by stakeholders of the banana value chain. 2) Evaluation/ profiling of the potential selected banana cultivars for drought tolerance. 3) Train banana stakeholders on sustainability banana production. Trainings on good agronomic practices, Youth managed seed nurseries and formation cooperatives is an incentive towards sustained income and food security. Evaluation of drought resilience under field conditions, will contribute to intensifying sustainable banana production, maximizing land and labour use amidst biotic and abiotic pressure - hence the climate smart banana cultivars.

Moreover this project offers an opportunity to meet the objectives of UN standard development goal (SDG) of improving food and nutrition security (SDG 2), reduce on poverty (SDG 1), and enhance adaptation to climate change (SDG 13) at local scales. Also, the project align well to the Uganda Third National Development Plan (NDPIII) objective four “Enhance productivity and wellbeing of Population”. Nevertheless, the project supports Government Parish Development Modal (PDM) that encourages farmers and other value chain actors to increase production of area-based commodity, pillar 1; production, Processing and Marketing. Likewise, the project proposed mobilizing farmers into groups to enhance participation and ownership of introduced

technology, a strategy that directly fit one of the sixth component of PDM pillar 3; Community organization and pillar 7; "Mind Set Change, Community Mobilization And Cross".

## Material and Methods

The study was conducted in three districts of Uganda in the cattle corridors; Sembabule, Ntugamo and Isingiro characterized with drought Figure 1. A survey conducted to explore the genetic diversity of preferred banana varieties by stockholders along the banana value chain. A pre-tested questionnaire was used to assess the effect of drought on the household. Evaluating, selecting and promoting elite banana varieties for drought tolerance is an incentive towards sustained income and food security. Therefore, banana hybrids recently released by NARO; Kabana-6H, NAROban-3, NAROban-4, and NAROban-5 whose yield is above 50 ton/ha/yr with preferred sensory attributes, resistant to pests and diseases were evaluated on 20 farmer managed fields for drought tolerance. This was coupled with training stakeholders on good banana agronomic practices.


Figure 1: Drought prone areas in Uganda for testing banana hybrids

## Results and Discussion

A survey conducted in drought prone district of Sembabule, Isingiro and Ntungamo a long the cattle corridor, identified improved hybrids, such as FHIA 17 as resilient to drought while matooke variety Mpologoma (Musa AAA-EA) was worst hit by drought. Also found was 18% of 526 farmers, suffered food and income insecurity, and loss of livestock during drought. Figure 2. Established stakeholders' perception about drought, and its effects on banana farmers and traders The coping strategy reported was a reduction in the number of meals per day, something that compromise their health and productivity in terms of labor. Evaluated hybrids; Kabana-6H, NAROban-3, NAROban-4, and NAROban-5 on 20 farmer managed plots for drought resilience under field conditions, showed NAROban-5 is more resilient to drought. However, a conclusive assessment will be made after at least 3 cycles of drought exposure. Currently the plants have gone through one cycle.

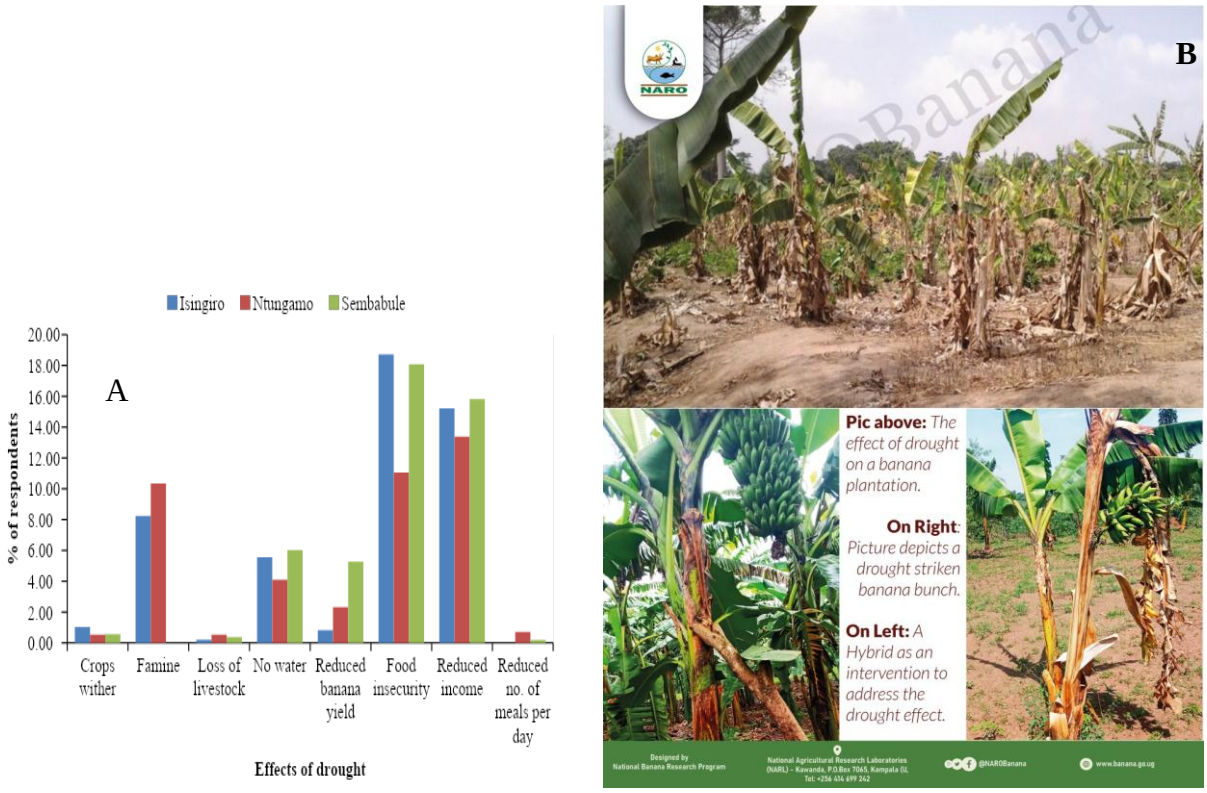


Figure 2; shows the effects of drought on: A; family households, B; plantation and proposed intervention using elite banana hybrids

## Conclusions and Outlook

Intensifying banana production in a sustainable way (without expanding land use and considering biotic and abiotic pressure) means introducing suitable varieties that are respecting the local environment. This is best achieved through a science-based selection. Indeed, a better land use and agricultural resilience is possible by selecting and introducing climate smart cultivars (cultivated varieties that are tolerant to climate change). Therefore, the project's interventions with cooking banana hybrids: Kabana-6H, NAROban-3, NAROban-4, and NAROban-5, identified on the basis of robustness and resilience to erratic rainfall, pest, and disease is equivalent to climate smart banana.

Nonetheless, the ability of bananas to grow in wide range of agro-ecological zones, i.e. 38% of the total arable land of Uganda and its perennial nature, invariably guarantees food and income security to smallholder families that form the majority of Uganda's population. Unlike the known agricultural ecosystem that deplete soil organic carbon, banana restores it. Moreover, bananas because of their leaf area are able to sequestrate higher (87 Mg ha-1) carbon than Eucalyptus woodlot (55 Mg ha-1), tea (69 Mg ha-1) and natural forest 68 Mg ha-1) (Kamusingize et al., 2018). Promoting Climate smart banana in the drought-prone areas will mean increased yields per unit area and improved agro-ecosystem through locking more carbon into soil (soil organic carbon).

**References**

Kamusingize, Daphine, Jackson Mwanjalolo Majaliwa, Everline Komutunga, Kephas Nowakunda, Priver Namanya, und Jerome Kubiriba. 2018. „Allometric relationships and carbon content for biomass-carbon estimation of East African Highland Bananas ( Musa spp . AAA-EAHB ) cv . Kibuzi , Nakitembe , Enyeru and Nakinyika“. *African Journal of Agricultural Research* 13(36):1865–73. doi: 10.5897/AJAR2016.11960.

Van Asten PJA, Fermont AM, Taulya G (2011a) Drought is a major yield loss factor for rainfed East African highland banana. Agric Water Manag 98:541–552. https://doi.org/10.1016/j.agwat.2010.10.005]

www.fao.org/faostat/