Improved Varieties of Banana for the African Highlands

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Summary

Production of bananas in the Great Lakes region has stagnated. For example in Uganda, yields are as low as 5 30 t ha-1 year-1 compared to a potential 70 t. Banana bunch weights have dropped from 60 kg to 10 kg or even less. In large part this is because traditionally cultivated varieties of the East African Highland bananas are susceptible to several pests and diseases. Declining soil fertility and drought further undermine production. Low banana yields result in food shortages that place dependent communities at risk of hunger. Introduction of high-yielding, disease resistant hybrids forms an integral part of technology packages to improve productivity. Through conventionally breeding, a range of improved varieties were developed that are less susceptible to black leaf streak and resistant to nematodes and bunchy top disease. Cultivating improved varieties reduces the risk of die-off in plantations.

Technical Description

Breeding pipelines for cooking banana is enhanced as more high yielding and pest and disease resistant hybrids become available. Early field evaluation processes are accelerated by improving pollination and increasing the number of crosses made. A major breakthrough is the ‘NARITA’ hybrid line obtained by crossing the East African Highland Banana (EAHB, AAA group) with a wild variety (Calcutta 4, AA group). Hybrids are then selected for culinary quality, color, aroma, taste, mouthfeel, and texture. Building upon the NARITA success, the Tanzania Official Seed Certification Institute has registered four Tariban cooking banana hybrids.

Uses

The recommended hybrid varieties in Tanzania are TARIBAN1 through 4. Clean swords of these varieties are available from the Tanzania Agriculture Research Institute. Tissue culture plantlets are available from designated private laboratories in Tanzania. In Uganda, the National Banana Research Program of NARO in Kawanda maintains hybrid cooking banana varieties at on-station fields. They are accessible through NARO and domestic private enterprises. In Rwanda, evaluations show that NARITA hybrid and Mpologoma perform well at sites with varying altitude, soil fertility and rainfall. In DR Congo, traditional cultivars of cooking banana dominate but hybrid lines derived from NARITA are undergoing field evaluation.

Composition

Improved hybrid varieties have a compact bunch with more fruit, as well as heavier and larger fruit than traditional cultivars. Tall banana plants are normally vulnerable to wind damage but TARIBAN2 is particularly sturdy. The TARIBAN cultivars produce pronounced swords and few suckers except for TARIBAN3.

Means of application

Conventional breeding of banana involves the crossing of edible varieties with wild seeded bananas. New molecular techniques assist in this approach. Resistance against nematodes is acquired by inserting foreign genes through a bacterial vector. Early field evaluation consists of monitoring single plants among large populations of hybrids, while preliminary yield trials assess entire rows of clonal hybrids. Climate and soil conditions have strong influences on the suitability of varieties so performance evaluation of banana hybrids must be done at multiple contrasting locations to ascertain performance, adaptability, and stability. This way specific or broadly adapted cultivars can be selected and commercially multiplied. Trials conducted over two production cycles provide reliable information at reduced costs. For example, TARIBAN varieties have been developed by testing of 27 hybrids in three sites over four. The final selection of prospective “Matooke” hybrids is guided by a product profile that includes host plant resistance to BLS, culinary acceptability, and bunch weight significantly higher than the standard local check. For obtaining satisfactory production, clean planting materials must be used alongside with balanced nutrient inputs and optimal spacing and stand management.

Agroecologies	Highlands, Humid forest, Moist savanna.
Regions	Africa South of Sahara.
Developed in Countries	Burundi, Cameroon, Democratic Republic of the Congo, Ethiopia, Kenya, Malawi, Rwanda, Somalia, South Sudan, Tanzania, Uganda.
Available in	Burundi, Cameroon, Democratic Republic of the Congo, Ethiopia, Kenya, Malawi, Rwanda, South Sudan, Tanzania, Uganda.
Solution Forms	Genetics.
Solution Applications	Improved variety.

Agricultural Commodities	Banana/Plantain.
Target Beneficiaries	Small-scale farmers, Commercial farmers.

Commercialization

Commercialization Category

Commercially available

Startup Requirements

Starter materials of disease resistant high-yielding varieties have been successfully distributed via farmer associations and NGOs in many countries for widespread nursery propagation of plantlets. Promoting hybrid banana among small-scale farmers requires information campaign about its nutritional benefits and easy access to quality planting material. This involves: 1) Identifying appropriate cultivars for specific climatic conditions, stand management, production targets, and market demands, 2) Awareness raising with multipliers, farmers and food processors about the benefits of new disease resistant high-yielding varieties, 3) Establishing local hubs for training on macro-propagation of healthy plantlets and good agronomic practices, and 4) Distributing clean material for multiplication.

Production Costs

Breeding of improved banana varieties in the laboratory and greenhouse and testing their performance under field conditions requires significant long-term investment that must be funded by the public sector and donors. A switch to resistant varieties involves the purchase of new planting material which ranges between US $290 and $1,000 per hectare. Recommended inputs of animal manure and synthetic fertilizer for increasing yield and plant health cost US $670 to $3,300 per hectare. Labour costs to plant, manage and harvest plantations amount between US $700 and $1,300 per hectare.

Customer Segmentation

Subsistence and commercial banana producers can benefit from disease resistant varieties, especially in disease infested areas including. Scaling this technology also involves national research and extension systems, private companies, traders, and food processors.

Potential Profitability

Improved cultivars have greater bunch weigh and annual yield than common cultivars which results in higher food security and income for farmers. By example, the average bunch weight of TARIBAN varieties across different regions in Tanzania ranges from 26.5

to 34.2 kg, with total yields ranging from 16.0 to 20.3 t ha-1 per year, which is 68% - 117% higher than the traditional variety. Depending on the variety, management and yield, net annual profits from improved bananas will amount between US $1,200 and $9,500 per hectare in the first cycle and are between US $1,900 and $15,000 per hectare in ratoon cycles.

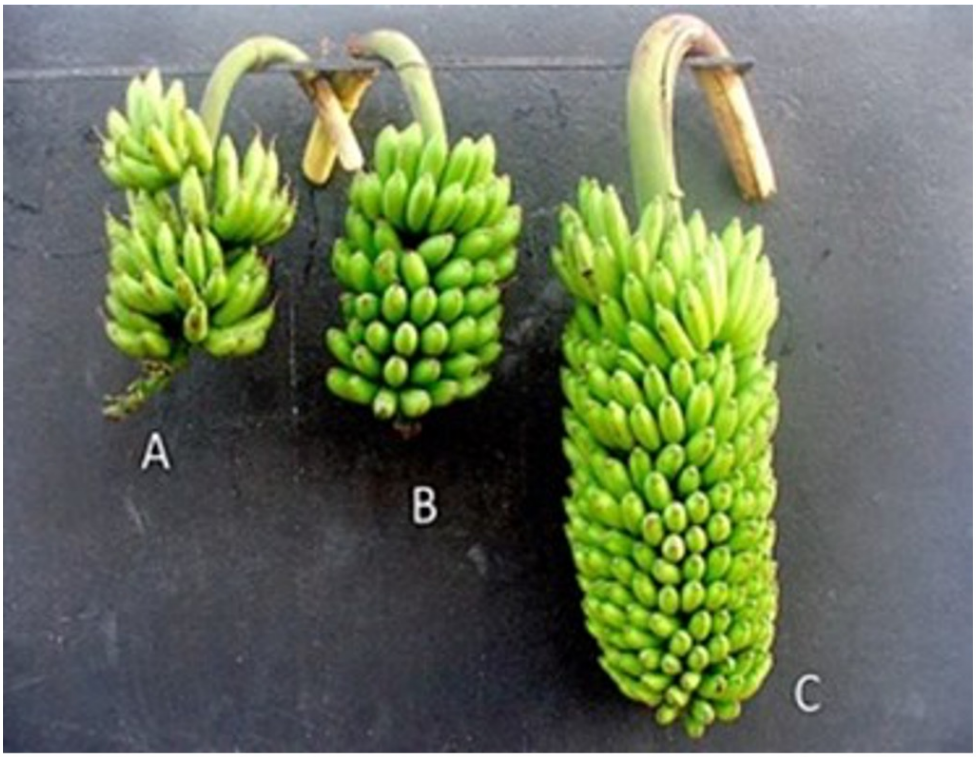
Licensing Requirements

Compliance with regulations on seed systems and plant health policies is required in many cases.

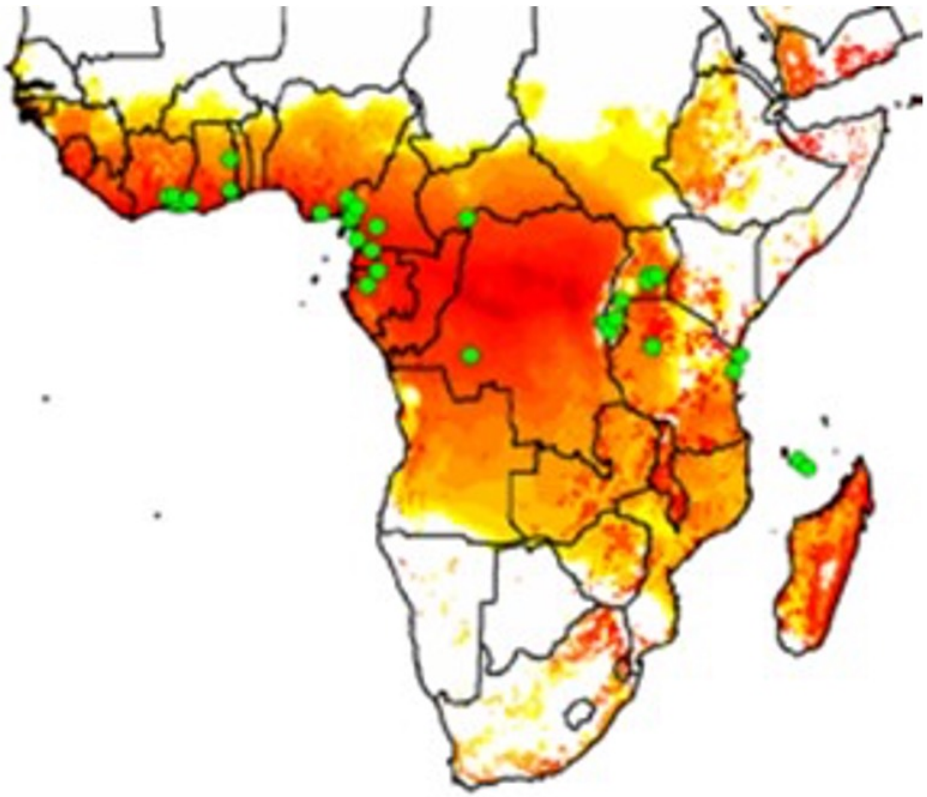
Innovation as Public Good

Farmers, NGOs, and private enterprises have the right to multiply hybrid banana varieties without royalty since these cultivars are a Regional Public Good.

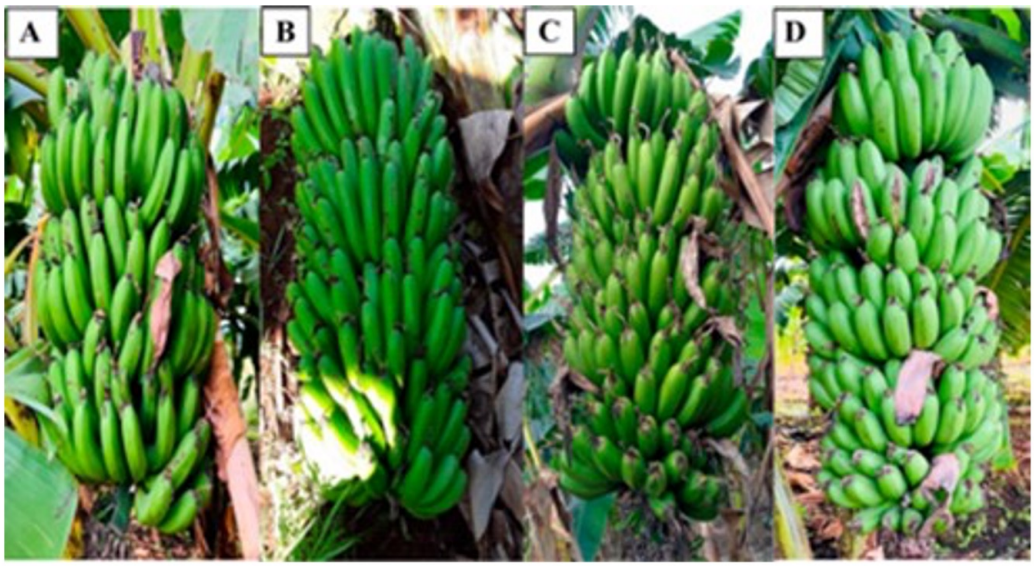
Solution Images



Progressive gain in bunch weight of cooking banana through selective breeding, A: grandparent, B: parent, and C: hybrid



Potential occurrence of black leaf streak disease; highest in red areas, lowest in yellow areas (Credit: Yonow et al. 2019)



Bunches of new Matooke cooking banana cultivars, A to D = TARIBAN 1 to 4 (Credit: Madalla et al. 2022)

Institutions

Accompanying Solutions

In-Vitro Tissue Culture Propagation

Propagation of Disease-Cleaned Suckers