Improved Varieties of Plantain for Tropical Lowlands

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Summary

Plantain is the third most important food crop after yam and cassava in much of Central and West Africa. The major producing countries are Cameroon (4.5 million t), Ghana (4 million t), Nigeria (3.2 million t), and Ivory Coast (1.6 million t). Black leaf streak disease is the greatest production constraint with yield losses ranging from 33% to 50% or more. Weevils and nematodes undermine yields by destroying the corm and root system. Population growth reduces fallow intervals and soil fertility. The devastating effects of diseases and pests on plantain production spurred development of resistant hybrids. Improvement of plantains also focused on high productivity, drought resilience and preferred cooking traits. Varieties of improved plantain now exist that are adapted to diverse climatic and production conditions.

Technical Description

Breeding for host plant resistance to diseases and pests is the most appropriate control strategy since chemical control is expensive and environmentally hazardous. Most of varieties of the hybrid line “PITA” were produced by crossing a female with increased fertility (AAA group) and the wild banana (Calcutta 4). On-farm research in Cameroon, Ivory Coast and Nigeria shows that mixing disease resistant plantain hybrids with local cultivars reduces black leaf streak pressure on the susceptible local cultivars, raising the number of functional leaves at flowering and increasing fruit yield. This strategy preserves genetic diversity while providing farmers access to high-yielding resistant hybrids. It must be noted that while plantain hybrids offer prospective for enhancing yield and resistance, they do not have the same cooking properties of preferred landraces and therefore can only be used for specific preparations.

Uses

Specific varieties of the high-yielding and black leaf streak resistant hybrid PITA line have been selected for different countries. PITA 4, PITA 14, PITA 17, and PITA 18 perform best growing areas in Nigeria, while PITA 23 and 27 are suitable for Cameroon. Another plantain hybrid, called PITA 3, is popular among growers in Ivory Coast and has also been adopted in Mali and Burkina Faso. The variety FHIA 21, bred from a Honduran high-yielding and black leaf streak resistant line, is massively propagated, and distributed to farmers in Benin, Burkina Faso, Ivory Coast and Togo by the West Africa Agricultural

Productivity (WAAAP) program. The PITA hybrids have moderate resistance to nematodes so must be cultivated on plot with low infestation.

Composition

Traditional varieties of plantain in West Africa include Big Ebanga, Orishele, Afoto and Agnirin which are resistant to nematodes but susceptible to black leaf streak. Farmer preferences are also guided by height, with shorter statured (<3m) varieties requiring no staking, being less vulnerable wind and allowing easier harvest. Taller statured plantains (4-5m), on the other hand, prevent theft of bunches which can account for substantial preharvest losses. All varieties can be boiled, mashed, or fried for use in local dishes.

Means of application

Plantains are typically grown in smaller gardens with application of manure and household refuse that ensures continuous high productivity for many years. They are also produced in fields under shifting cultivation and bush fallow with low or no input of organic fertilizer causing bunch yields to decline rapidly after the first production cycle due to disease pressure and poor management practices. The major harvest in West-Africa occurs in the dry season spanning the months of December through March, when most other starchy staples are in short supply, but bunches of fruit are produced throughout the year.

Agroecologies	Humid forest, Moist savanna.
Regions	Africa South of Sahara.
Developed in Countries	Burkina Faso, Cameroon, Democratic Republic of the Congo, Ghana, Ivory Coast, Mali, Nigeria, Togo, Zambia.
Available in	Burkina Faso, Cameroon, Democratic Republic of the Congo, Ghana, Ivory Coast, Mali, Nigeria, Togo, Zambia.
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

Promoting improved plantain varieties among 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 plantain 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. New planting material requires US $290 to $1,000 per hectare with a minimum $1,400 needed for production inputs and labor.

Customer Segmentation

Subsistence and commercial plantain producers can benefit from high-yielding and disease resistant varieties, especially areas with extensive cultivation and pest infestation. Scaling this technology also involves national research and extension systems, private companies, traders, and food processors.

Potential Profitability

Improved varieties typically provide 3 to 4 kg greater bunch weights than traditional ones. Nematode and weevil damage is about 25% to 34% less in hybrids, resulting in extended stands. Benefit to cost advantages in varietal investment are about 5:1.

Licensing Requirements

Once improved varieties are purchased, there are no further licensing requirements from plantation improvement.

Innovation as Public Good

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

Solution Images



Effect of black leaf streak on plantain; susceptible variety, left and resistant variety, right (Credit: Alvarez et al. 2015)



Sika Plantain (Credit: B. Dhed'a)

Institutions

Accompanying Solutions

In-Vitro Tissue Culture Propagation

Propagation of Disease-Cleaned Suckers