Multi-Crop production system Intercropping Strategies for Banana and Plantain

Improved system production for better yield

Banana with common bean understory (Credit: B. Dhed'a)

International Institute of Tropical Agriculture (IITA)
Godfrey Taulya

Intercropping, growing bananas or plantains alongside other plants, offers farmers numerous benefits but also poses challenges like nutrient competition, disease spread, and careful handling during planting and harvesting to avoid root damage.

This technology is TAAT1 validated.

5·7 Scaling readiness: idea maturity 5/9; level of use 7/9

Gender assessment 4

Climate impact 7

Problem

- Competition for nutrients and water
- Weed proliferation
- Soil degradation and erosion
- Vulnerability to pests and diseases
- Dependency on external inputs
- Susceptibility to extreme weather
- Loss of biodiversity

Solution

- Allows for early yields before banana crops, while suppressing weeds.
- Canopies and roots protect against soil erosion.
- Legume intercrops provide nitrogen through biological fixation.
- Biomass from intercrops serves as mulch and organic nutrients.
- Intercropping diversifies farmers' income sources.
- Reduces disease spread, Enhances soil health.
- Strengthens food systems' resilience....

Key points to design your project

To integrate Intercropping Strategies for Banana and Plantain into your project, follow these steps:

1. Educate farmers about the benefits, emphasizing increased productivity and reduced chemical use.
2. Provide tailored extension support for variety selection and best practices.
3. Facilitate seed production and ensure accessibility of inputs.
4. Allocate funds for training and ongoing support.
5. Develop communication materials to promote adoption.
6. Establish partnerships with farmers.
7. Consider integrating with other complementary technologies for optimal results.

IP

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Technology originally documented by

ProPAS

Commodities

Banana/Plantain

Sustainable Development Goals

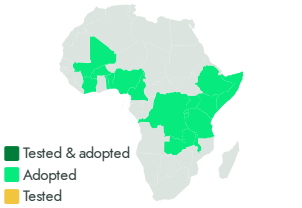
Categories

Production, Practices, Weed management, Soil fertility

Best used with

- Biofortified Beans for Improved Nutrition ›
- Orange-Fleshed Sweet Potato (High provitamin A) ›
- Disease resistant cassava varieties ›
- New rice for Africa varieties ›

Tested/adopted in



Where it can be used

This technology can be used in the colored agro-ecological zones.

Specialty Fertilizers and Local Blending for Banana and Plantain

Fertilize for Success: Banana & Plantain Boost

The technology of Specialty Fertilizers and Local Blending for Banana and Plantain involves creating tailored fertilizer blends to enhance banana and plantain yield in Sub-Saharan Africa. It adapts to soil characteristics, improves crop resilience, and increases productivity and nutritional value. It's a cost-effective solution for farmers.

International Institute of Tropical Agriculture (IITA)
Godfrey Taulya

This technology is TAAT1 validated.

8·9 Scaling readiness: idea maturity 8/9; level of use 9/9

Gender assessment 4

Climate impact 7

Problem

- **Nutrient Deficiency**: Poor soil nutrients lead to low crop yields.
- **Environmental Stresses**: Crops are vulnerable to drought, pests, and diseases.
- **Climate Change**: Drought due to climate change affects crop health and productivity.

Solution

- **Nutrient Supply**: Provides balanced nutrients, improving crop growth and yield.
- **Crop Resilience**: Strengthens crop resilience to environmental stresses.
- **Climate Adaptability**: Helps crops withstand impacts of climate change.

Key points to design your project

The Specialty Fertilizers and Local Blending for Banana and Plantain technology contributes to several Sustainable Development Goals (SDGs) by improving crop yields, promoting gender equality, and having a positive impact on the climate. It enhances productivity and resilience of crops, contributing to zero hunger and economic growth.

To implement this technology:

- Identify potential partners
- Launch an awareness campaign and training programs,
- Develop the right blends of fertilizer and leverage the manufacturer's distribution network,
- Set up demonstration plots,
- Establish a feedback mechanism, and regularly monitor and evaluate the impact of the technology.

6 ton/ha
yield increase

IP
Open source / open access

Technology originally documented by

ProPAS

Commodities

Banana/Plantain

Sustainable Development Goals

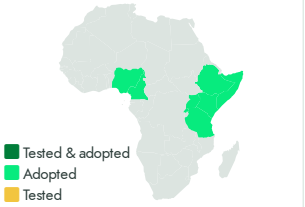
Categories

Production, Inputs, Fertilizer

Best used with

- Improved Varieties of Plantain for Tropical Lowlands ›
- Improved Varieties of Banana for the African Highlands ›

Tested/adopted in



Where it can be used

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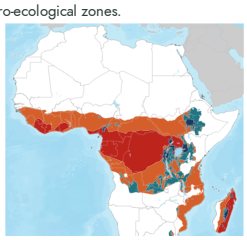
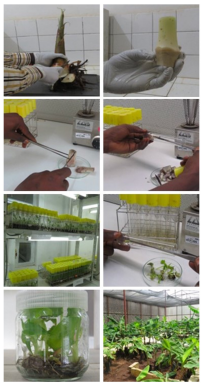


In-Vitro Banana Tissue Culture Propagation

A rapid quality plantlets delivery technology for banana

In-Vitro Tissue Culture Propagation involves a series of steps including initiation, multiplication, shooting and rooting, and hardening, all performed in controlled, sterile laboratory conditions to produce disease-free banana and plantain plantlets.



Steps of in-vitro tissue culture micro propagation: a) Removal of sheaths, b) Separated corm, c) Desinfection and segmentation of corm, d) Transferal to sterile tubes with growth media tubes, e) Culturing in climatized chamber, f and g) Transferal of propagules for proliferation of shoots by subculturing in jar, and h) Nursing of plantlets in screenhouse (Credit: B. Dhed'a)

International Institute of Tropical Agriculture (IITA)
Amah Delphine

This technology is TAAT1 validated.

8•8 Scaling readiness: idea maturity 8/9; level of use 8/9

Gender assessment 4

Climate impact 7

Problem

- Traditional crops were more susceptible to extreme weather conditions, leading to significant crop damage and reduced yields.
- Traditional propagation methods were more susceptible to diseases, resulting in widespread outbreaks
- Natural disasters and disease outbreaks often led to slow recovery in agricultural systems

Solution

- In vitro micro-propagation eliminates all pests and diseases except for viruses.
- TC plants have the benefits of uniformity and fast propagation of large numbers of plantlets.
- These advantages enable marketing and more rapid recovery from broad-scale damage such as disease outbreak and extreme weather.

Key points to design your project

The adoption of in-vitro propagation technology offers a significant opportunity to enhance banana and plantain production while reducing losses from pests and diseases. To integrate this technology into your project, consider steps such as

- Business planning and market analysis, securing financing for equipment acquisition,
- Staff training on handling and quality control,
- Farmer awareness campaigns on planting and propagation of tissue culture (TC) plantlets,
- Additionally, explore partnerships with agricultural research institutes and government agencies to promote widespread adoption and improvement of banana and plantain production nationwide.

Cost: $$$ **1,3 USD**
Per plantlets

ROI: $$$ **40 %**
Profit

3000 Tissue Culture plantlets
A nursery business can produce 3,000 TC plantlets per cycle

IP
No formal IP rights

Technology from
ProPAS

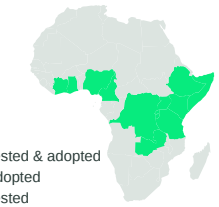
Commodities
Banana/Plantain

Sustainable Development Goals
2 ZERO HUNGER
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Categories
Production, Practices,
Pest control (excluding weeds),
Yield improvement

Best used with
- Improved Varieties of Plantain for Tropical Lowlands ›
- Improved Varieties of Banana for the African Highlands ›
- Propagation of Banana and Plantain Disease-Cleaned Suckers ›

Tested/adopted in



Where it can be used
This technology can be used in the colored agro-ecological zones.

Improved Varieties of Plantain for Tropical Lowlands

Better Plantain Varieties for Thriving Farmers

The "Improved Varieties of Plantain for Tropical Lowlands" makes stronger and healthier plantains that can resist diseases and pests. It does this by mixing different kinds of plantains to create new varieties. These special plantains grow well in different climates and have more leaves and fruits.

This technology is TAAT1 validated.

8•8 Scaling readiness: idea maturity 8/9; level of use 8/9

Gender assessment 3

Climate impact 7

Problem

- Black leaf streak disease causing significant yield losses ranging from 33% to 50%.
- Weevils and nematodes undermining corm and root systems.
- Declining soil fertility due to poor management practices.

Solution

- This technology aims to combat black leaf streak disease, weevils, and nematodes.
- Focus on high productivity and drought resilience to mitigate yield losses.
- Emphasis on preferred cooking traits to meet consumer preferences.
- Adaptation to diverse climatic and production conditions.

Key points to design your project

The adoption of improved plantain varieties offers significant benefits for food security and income in disease-prone areas with fluctuating climates. Here's a concise summary:

Key Activities:

- **Selecting suitable cultivars** based on climate, management, production goals, and market needs.
- **Educating stakeholders**—multipliers, farmers, processors—about the advantages like disease resistance and higher yields.
- **Creating training hubs** for seed multipliers and farmers on propagation techniques and best farming practices.

A dedicated team of trainers should be engaged to provide comprehensive training and support during the project implementation. The budget should cover the costs for training sessions and post-training assistance.

290—1000 USD
Planting material/ha

ROI: $$ **500 %**
Benefit to cost advantages starts from the second cycle harvest onwards

1400 USD
Production inputs and labor per ha

IP
Open source / open access

International Institute of Tropical Agriculture (IITA)
Moses Nyine

Technology originally documented by

ProPAS

Commodities

Banana/Plantain

Sustainable Development Goals

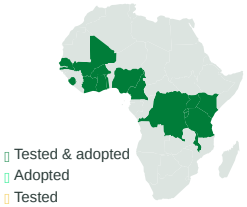
Categories

Production, Improved varieties, Disease resistance, Insect resistance, + 0 more

Best used with

- In-Vitro Tissue Culture Propagation ›
- Propagation of Disease-Cleaned Suckers ›

Tested/adopted in

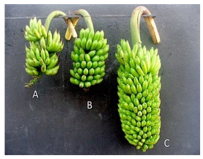


Where it can be used

This technology can be used in the colored agro-ecological zones.

Improved Varieties of Banana for the African Highlands

Cultivate superior banana varieties for abundant yields and enhanced food security.



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

The NARITA technology is a improved varieties for banana. NARITA hybrids are selected for their culinary quality, color, aroma, taste, texture, and mouthfeel. This technology enables the production of high-yielding bananas resistant to diseases and pests.

This technology is TAAT1 validated.

8·8 Scaling readiness: idea maturity 8/9; level of use 8/9

Gender assessment 4

Climate impact 7

Problem

- Low Banana Yields of Traditional varieties: 5-30 tons per hectare
- Traditionnal varieties are susceptible to Pests and Diseases (black leaf streak, nematodes, and bunchy top disease)
- Inadequate soil fertility hampers banana production, posing a challenge for traditional varieties

Solution

- NARITA offers disease-resistant hybrids can yield up to 70 tons per hectare
- These varieties are specifically bred to resist black leaf streaks, nematodes, and bunchy top disease
- Disease-resistant hybrids exhibit greater resilience in nutrient-depleted soils

Key points to design your project

The adoption of NARITA banana technology offers opportunities to improve banana cultivation practices, especially in areas affected by diseases. To integrate NARITA technology into your project, consider activities such as:

- Identifying suitable cultivars, raising awareness among stakeholders, establishing local training hubs, and distributing clean planting materials.
- Collaboration with breeders and research institutions is essential to develop tailored NARITA banana varieties.
- Additionally, estimating costs for technology adoption, including inputs and labor, is crucial for project planning.

Cost: $$$ **290—1000 USD**
per hectare for planting material.

68—117 %
Yield increased

670—3300 USD
per hectare for inputs

700—1300 USD
per hectare for labor

IP
Open source / open access

Tanzania Agricultural Research Institute
Mpoki Shimwale

Technology originally documented by

ProPAS

Commodities

Banana/Plantain

Sustainable Development Goals

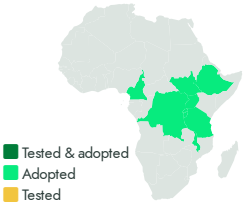
Categories

Production, Improved varieties, Disease resistance, Yield improvement

Best used with

- In-Vitro Tissue Culture Propagation ›
- Propagation of Disease-Cleaned Suckers ›

Tested/adopted in



Where it can be used

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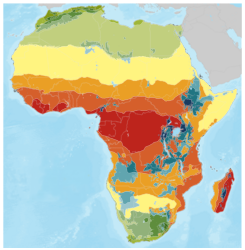


Banana Peels as Feed and Organic Resource

From Waste to Resource

Banana and plantain peels offer a sustainable solution to waste disposal, serving as valuable resources for animal feed, soil input, and cooking ingredients. Proper processing detoxifies the peels, making them suitable for consumption by animals and contributing to waste reduction in regions where plantains and cooking bananas are common.

An industrial green banana peeler able to processes 600 units per hour

International Institute of Tropical Agriculture (IITA)
John Derera

This technology is TAAT1 validated.

7•8 Scaling readiness: idea maturity 7/9; level of use 8/9

Gender assessment 3

Climate impact 7

Problem

- Waste accumulation due to the disposal of banana and plantain peels.
- Concerns regarding the chemical composition and nutrient ratios of the peels, especially when used as animal feed.
- Difficulty in removing peels from green bananas and plantains, leading to inefficiencies in processing.
- Restrictions on using raw peels in poultry feed due to the presence of anti-nutritional compounds like tannins and oxalate.
- Challenges in effectively utilizing peels, such as feed refusal due to high tannin content and the need for proper processing techniques to detoxify peels.

Solution

- Banana and plantain peels are valuable components in livestock and poultry diets.
- Dried peels contain essential nutrients like potassium, phosphorus, iron, calcium, magnesium, and sodium.
- Utilizing peels reduces waste accumulation and promotes sustainable resource management.
- Treated and composted peels serve as beneficial organic inputs for soil improvement.
- Green peels provide an energy source in animal diets due to their carbohydrate content.
- Fresh peels with high moisture content help animals stay hydrated.
- In smaller quantities, peels find use in cooking, water purification, and manufacturing beauty and health products.

Key points to design your project

- Technology utilizes banana and plantain peels for animal feed and compost.
- Enhances food security and promotes sustainable resource management.
- Improves soil health, aids carbon sequestration, and supports climate resilience.
- Steps to incorporate technology include understanding nutrient composition, sourcing machinery, and marketing products.
- Costs vary for machinery, with single belt peelers at USD 3500 and larger multi-channel machines at USD16,000.
- Consider delivery expenses and collaborate with agricultural institutions for widespread adoption.

Cost: $$$ **3,500 USD**

A single belt 0.37 kWatt peeler

16,000 USD

Larger multi-channel 2.0 kWatt machines

IP

Open source / open access

Technology from

ProPAS

Commodities

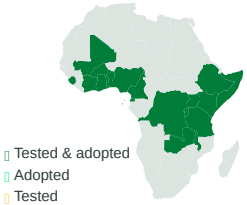
Banana/Plantain

Sustainable Development Goals

Categories

Pre-production, Practices, Post-harvest management

Tested/adopted in



Where it can be used

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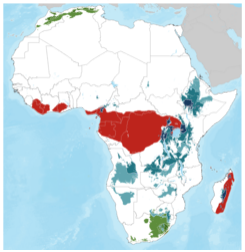


Target groups

Breeders

Induced Ripening of Banana for Increased Marketability and Storage

Ripening Solutions for Quality and Efficiency

The Induced Ripening of Banana for Increased Marketability and Storage technology is a method designed to enhance the ripening process of bananas, specifically dessert bananas, to ensure they are market-ready and have an extended shelf life. In this process, bananas are artificially ripened using various chemical agents, most notably ethylene gas.

Industrial ripening chamber with refrigeration and gas control (Credit: Nilkamal)

International Institute of Tropical Agriculture (IITA)
Patchimaporn Udomkun

Technology originally documented by

ProPAS

Commodities

Banana/Plantain

Sustainable Development Goals

This technology is TAAT1 validated.

8•8 Scaling readiness: idea maturity 8/9; level of use 8/9

Gender assessment 4

Climate impact 4 1

Problem

- Bananas, especially plantains, suffer significant post-harvest losses due to transportation damage and spoilage.
- Traditional ripening methods, such as wrapping banana bunches with green leaves, are time-consuming and result in non-uniform ripening.
- Consumers prefer ready-to-eat bananas, and fruit sellers need a consistent supply of ripe fruit to meet this demand.

Solution

- Artificial ripening with ethylene gas ensures that bananas are ready for the market, reducing the risk of post-harvest losses.
- The technology allows for the acceleration or slowing down of the ripening process based on market demand, optimizing the supply chain.
- The technology meets consumer demand for ready-to-eat bananas, benefiting both fruit growers and sellers.

Key points to design your project

The technology of induced ripening offers cost-effective solutions for enhancing the marketability and storage of bananas, empowering farmers and aiding in poverty alleviation. Steps to integrate this technology include:

- Conducting market assessments, developing a business plan,
- Allocating resources for training and support,
- Collaborating with agricultural institutions.

Cost: $$$ **3,500 USD**

Constructing artisanal chambers

17,000 USD

Industrial semi-automated ripening chambers of 5 tones of banana

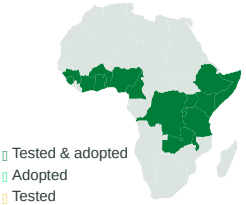
IP

Trademark

Categories

Prevention & storage, Equipment, Post-harvest handling

Tested/adopted in



Where it can be used

This technology can be used in the colored agro-ecological zones.

Target groups

Farmers, Sellers

Propagation of Banana and Plantain Disease-Cleaned Suckers

Propagate Success with Clean Suckers

Macro-propagation involves two techniques: field-based (decapitation) and detached corm (beds). It ensures disease-free seedlings, promoting uniform growth and stress resistance. Clean knives and hardened sprouts are vital for success.

Complete decapitation with excised meristem (top) and sprouting suckers (bottom)

International Institute of Tropical Agriculture (IITA)
Amah Delphine

This technology is TAAT1 validated.

8•8 Scaling readiness: idea maturity 8/9; level of use 8/9

Gender assessment 4

Climate impact 7

Problem

- Natural regeneration often results in contaminated banana and plantain planting materials, harming productivity and lifespan.
- Traditional methods result in non-uniform growth, affecting the overall efficiency of banana and plantain cultivation.
- Conventional methods may lead to stress-prone plantlets, negatively impacting their adaptation and performance in the field.

Solution

- Macro-propagation ensures the production of banana and plantain seedlings free from pests and diseases, promoting healthier and more resilient crops.
- Macro-propagation contributes to increased productivity and prolonged lifespan of banana and plantain plants .
- This technique reduces financial barriers by offering a low-cost method of obtaining disease-free seedlings
- Macro-propagation ensures more uniform growth of banana and plantain seedlings.

Key points to design your project

The adoption of Propagation of Disease-Cleaned Suckers technology presents an opportunity to enhance banana and plantain production. To integrate this technology into your project, consider the following steps:

- Ensure access to disease-free suckers for banana and plantain farmers at affordable prices.
- Educate farmers about the benefits of using disease-cleaned suckers and encourage their adoption of this technology.
- Provide training and certification to farmers on proper sucker selection and planting techniques to maximize yield.
- Collaborate with agricultural extension services to disseminate information and support the implementation of disease-cleaned sucker propagation.

Cost: $$$ **1500 USD per 8000 plantlets**

Nusery four months maintenance

ROI: $$$ **725—1050 USD**

Net profit per cycle

340 USD

2,500 plantlets shade house

2,300 USD

Cost of chamber of 8,000 plantlets

IP

Open source / open access

Technology from

ProPAS

Commodities

Banana/Plantain

Sustainable Development Goals

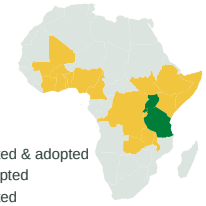
Categories

Production, Practices, Seed system

Best used with

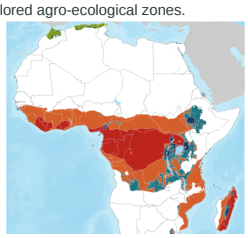
- Improved Varieties of Plantain for Tropical Lowlands ›
- Improved Varieties of Banana for the African Highlands ›

Tested/adopted in



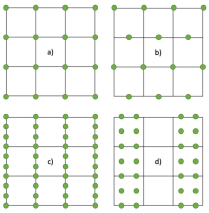
Where it can be used

This technology can be used in the colored agro-ecological zones.



Spacing and Stand Management in Banana and Plantain

Optimized Spacing, Maximum Yield



Planting layouts: a) square, b) triangular, c) single row, and d) paired row

This technology optimizes banana and plantain plant spacing to boost yield, considering factors like plant variety, climate, and soil fertility. It uses various planting systems and may require herbicide use and stem base “earthing-up” in windy areas.

International Institute of Tropical Agriculture (IITA)
Godfrey Taulya

This technology is TAAT1 validated.

8•9 Scaling readiness: idea maturity 8/9; level of use 9/9

Gender assessment 3

Climate impact 7

Problem

- High plant densities cause uneven growth, delayed maturity, and increased labor.
- Low densities lead to weed competition and yield variability.
- Unmanaged stands accumulate pests and diseases.
- Insufficient wind protection damages plants.

Solution

- Proper spacing promotes uniform growth, reduces labor, and optimizes yield.
- Adequate spacing minimizes resource competition and maximizes sunlight exposure.
- Square block planting provides wind protection.
- Spacing aids in weed management and pest/disease control.

Key points to design your project

The Spacing and Stand Management technology in Banana and Plantain farming boosts yield and mitigates climate impact, aiding both small-scale and large-scale producers. It contributes to SDGs 2 (Zero Hunger) and 13 (Climate Action) by maximizing yield and improving resource efficiency.

For successful implementation in Africa, the following steps are crucial:

- Engaging stakeholders
- Training farmers
- Setting up demonstration plots
- Providing support services
- Conducting regular monitoring and evaluation

The cost of training varies based on several factors. It’s advisable to reach out to the technology provider or a local agricultural extension service for detailed information.

100 t/ha/year

Dwarf Cavendish planted at 2500 to 4400 plants per ha

IP

Open source / open access

Technology originally documented by

ProPAS

Commodities

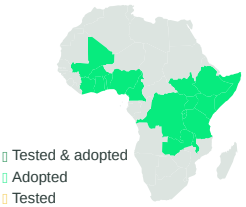
Banana/Plantain

Sustainable Development Goals

Categories

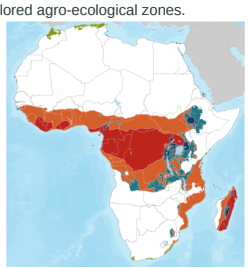
Production, Practices, Yield improvement

Tested/adopted in



Where it can be used

This technology can be used in the colored agro-ecological zones.



Target groups

Farmers