Intercropping Strategies for Banana and Plantain

Solution Holder is **Godfrey Taulya** and can be contacted through **g.taulya@cgiar.org**

Summary

There are several advantages and disadvantages from intercropping bananas or plantains with other crops. Intercropping with annual field crops allows for early harvests months before banana yields, and in the process suppress weeds within the plantation. Intercrop canopies and roots protected against soil erosion. Legume intercrops provide nitrogen through biological fixation. Biomass from the intercrops may be applied as mulches and sources of organic nutrients. The disadvantages of intercropping include below- and aboveground competition for nutrients and water, the potential introduction and spread of diseases, and damage to banana roots from soil disturbance during planting and harvest of companion crops. A common practice is to intercrop with annuals during the first year of plantation establishment; another is to grow bananas with shade tolerant perennial crops such as coffee or cacao. A third option is to grow bananas with agroforestry trees that provide poles that support banana stalks and fruit.

Technical Description

Intercropping involves the production of two or more crops simultaneously on the same land. It serves as insurance against crop failure due to abnormal weather conditions. In the case of banana and plantain, it is possible to establish a multi-story system where crops with different canopy heights are established. Intercropping of bananas with other crops is common soil fertility improvement practice. Trees such as mangos and papaya may be established within banana plantations as sources of fruit and to serve as windbreaks. Root systems of banana and plantain are delicate and require fertile soil to allow sufficient water and nutrient uptake and guarantee anchorage and sucker production. The residues of companion crops may provide this need. Understory intercropping makes it possible to achieve a high level of land, nutrient and water use efficiency due to synergistic effects between the two different crops. Mixing of crops also reduces the infestation rate of weeds, pests and diseases on farmer fields which benefits the productivity of both and slows down the spread of organisms that are harmful to agriculture. Inorganic fertilizers are used very efficiently in mixed cropping systems greater diversity in root structure results in greater capture. One difficulty with intercropping however is that some field operations become more complicated, confounding mechanization and herbicide application.

Uses

Integration of other crops is suitable for all banana and plantain growing areas in Sub-Saharan Africa, and is particularly advantageous under low soil fertility and moisture availability. Intercropping legumes contributes to strengthening the climate resilience of food systems and the communities that draw income from them. Understories of younger plantations may be intercropped with food crops such as groundnut, sweet potato or bush bean. Choice of the understory depends agro-ecological conditions, marketing opportunity, and food preferences. Maize intercrops are often considered harmful because of competition. It is best that young plantations be intercropped with plants that cover the soil quickly to protect soils. Older plantations with more complete canopies benefit from shade tolerant intercrops.

Composition

The type of crop grown in the understory of banana or plantain stands can be chosen by farmers in line with agro-ecological conditions, marketing opportunity, production needs, and eating habits. Improved varieties of both crops that are well adapted to specific conditions in growing areas should be used to achieve maximal benefits. Bananas and plantains must be intercropped with crops that cover the soil very quickly and for a long time until the foliage protect the soils. Legumes and cocoyam offer these advantages and provide fast income to the farmer faster. The most common intercropping practices across the Ituri and North-Kivu provinces of DR Congo are banana-bean, banana-bean-taro, banana-maize-bean and banana-coffee intercrops, whereas plantain-maize, plantain-maize-rice, plantain-maize-casava, plantain-casava, plantain-casava-rice and plantain-rice, in Tshopo Province.

Means of application

For intercropping, the two crops can be planted simultaneously or in relay, so their growth and harvest are aligned with farmer conditions and needs. Different layouts can be used with the associated crops planted on alternating rows, in strips of 2-3 rows or randomly positioned. Common bean should be inoculated with an elite strain of N-fixing microorganisms to maximize biological N fixation and in some cases, this must be complemented with N fertilizer application at the right time and placement to improve soil fertility status. Access to seed of improved varieties as well as together with careful extension on the use of inoculants.

Agroecologies	Highlands, Humid forest, Moist savanna.
Regions	Africa South of Sahara.
Developed in Countries	Zambia, Uganda, Togo, Tanzania, Somalia, Rwanda, Nigeria, Mali, Malawi, Kenya, Ivory Coast, Ghana, Ethiopia, Democratic Republic of the Congo, Cameroon, Burundi, Burkina Faso, Benin.

Available in	Zambia, Uganda, Togo, Tanzania, Somalia, Rwanda, Nigeria, Mali, Malawi, Kenya, Ivory Coast, Ghana, Ethiopia, Democratic Republic of the Congo, Cameroon, Burundi, Burkina Faso, Benin.
Solution Forms	Management.
Solution Applications	Soil fertility management, Soil/land conservation.
Agricultural Commodities	Banana/Plantain.
Target Beneficiaries	Small-scale farmers, Commercial farmers.

Commercialization

Commercialization Category

Commercially available

Startup Requirements

Understory intercropping of banana and plantain is a traditional practice in Africa that has been improved by researchers and extension agencies. Different mechanisms contributed to this, including awareness creation about its nutritional and income benefits, farmer collective action, and the development of more effective marketing mechanisms and value-added cottage industries. Successfully promoting the integration of banana and plantain with other crops relies on 1) Education of farmers about its benefits for agricultural intensification and diversification, and savings on fertilizer use, 2) Extension support on varietal selection and good agronomic practices under local contexts, 3) Multiplication of high quality seed by community or private enterprises, and 4) Access to low-cost plant propagules, fertilizers and other needed production inputs from local suppliers.

Production Costs

Intercropping systems have greater start-up costs for seed and fertilizers than monocrop cultures. Their yields, however, are greater as is input use and organic recycling efficiency. Intercropping systems usually have greater planting density than monocrop cultures and thus bear greater cost of seed and fertilizer per hectare. Yield-scaled costs of inorganic fertilizer application are considerably lower thanks to greater use efficiency through crop association and savings on N input by biological fixation of legumes.

Customer Segmentation

Intercropping with banana and plantain is attractive to small-scale and commercial farmers alike. Small-scale farmers are particularly attracted to this practice because it allows households to grow more and a greater variety of food within their smallholdings. Commercial farmers are less attracted to intercropping because of the increased complexity and labor requirement of complex intercropping although banana-coffee and banana-coconut intercropping at a large scale has shown to offer economic advantages.

Potential Profitability

Studies in DR Congo suggest that understory intercropping provides about 2.2 ton ha-1 of additional food harvest per year. Growing banana and coffee together increases crop revenue by more than 50% compared to monocrops of both. In many cases the advantages to smallholders diminishes with time because the canopy development of banana increasing shades their desired companion field crops. Banana and coffee systems are more diverse, reduce risk and provide food throughout the year. Bananas mature first, providing harvest and income before coffee becomes productive. Bananas provide shade to coffee and compete less than other crops for water during drought.

Licensing Requirements

No commercial or environmental licenses are needed to practice intercropping.

Innovation as Public Good

Knowhow for intercropping banana and plantain plantations is regarded as a Regional Public Good disseminated by IITA, ICRAF and many local extension agencies.

Solution Images



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







Complex banana intercropping systems where banana is the understory of coconut (left); banana is grown beneath oil palm with a cacao understory (center); and a multi-story garden that includes palms, spices and banana (right)

Institutions

Accompanying Solutions

Biofortified Beans for Improved Nutrition

Orange-Fleshed Sweet Potato (High provitamin A)

Disease resistant cassava varieties

New rice for Africa (NERICA varieties)