

Doubled-up legume technology

Boosting land productivity by intercropping two grain legumes with different growth habits



The doubled-up legume technology entails intercropping two grain legumes, exploiting the opportunity presented by different/complementary growth habits and plant architecture. The most successful doubled-up legume involves pigeonpea intercropped with groundnut in an additive design.

Photo credit: Jim Richards

Key messages

- Strategies are required to address low household protein consumption, enhance food security during the hungry season, and restore soil fertility of degraded cropped lands.
- Pigeonpea can be intercropped with groundnut and with minimal competition for water, nutrients, and sunlight; two grain crops are harvested.
- This legume-legume intercrop “doubles” grain and “doubles” soil fertility benefits as both crops add fertility to the soil through their leafy biomass components that must be returned to the soil.
- The diversified grain legume production on small farms leads to positive nutrition outcomes, and makes it possible for poor farmers to participate in income-generating output markets.

The issue

In poor farming communities that access and use little chemical fertilizers, one of the key ecological production objectives is to lower the need for fertilizers through

the use of legumes that build soil fertility, while also producing grain crops rich in nutrients for improved diets. Malnutrition remains high in rural Malawi especially for young children. Meat products are scarce, hence intensification of grain legumes is a plausible pathway that results in achieving multiple development goals.

Farm sizes have shrunk over the years due to sub-divisions within families. The average farm size in central Malawi currently is 0.7 ha. This calls for innovations that increase land productivity if the production of the staple maize as well as grain legumes is to be met in the future. New innovative intercropping systems are part of the solution.

Intercropping is growing two or more crops together in order to capture beneficial interactions while minimizing competition among the companion crops. Finding two complementary grain legumes that are compatible in an intercrop system accelerates soil fertility build-up while also bringing benefits of diversified grain crops produced

on the same area. This is critical as the combination enables very small farms to diversify crop production. This intercrop system is called the “doubled-up” legume technology because benefits are double legume grain and double soil fertility inputs from residues of the two legumes. Groundnut-pigeonpea intercropping is the most successful doubled-up system thanks to the two crops’ contrasting structures and maturity dates. The initial growth of pigeonpea is very slow, with rapid growth and pod formation only occurring when groundnut has already matured and been harvested.

Findings

- The early maturity pigeonpea variety successfully produced seed earlier in July with minimal conflict with livestock. In mixed crop-livestock systems, crops that mature late after the rainy season are at risk of being destroyed by freely grazing goats and cattle.
- The pigeonpea-groundnut intercropping system resulted in grain yields of groundnut that were comparable to productivity in sole cropping (Table 1). Pigeonpea was a bonus crop, providing fuelwood, food, and soil fertility.

Table 1: Grain yields of pigeonpea and groundnut grown as sole crops or as a doubled-up technology

Cropping system	Grain yield (kg/ha)	LER
Sole groundnut	1650	1.48
Intercropped groundnut	1330	
Sole pigeonpea	950	1.48
Intercropped pigeonpea	640	

*The land equivalency ratio (LER) is a measure of land productivity, and a number > 1 indicates that intercropping is advantageous. This number is obtained using yields of intercropped crops using this equation:

$$LER = (intercrop1/pure\ crop\ 1) + (intercrop2/pure\ crop2)$$

The LER of 1.48 in Table 1 indicates that 1.48 ha of land is needed to grow pure stands of each crop compared to only 1 ha when both crops are grown in a doubled-up system. For small farms, this technology offers a huge opportunity for increasing land productivity and maintaining diversified crop production.

Recommendations

- Up to 1 million households situated in pigeonpea and groundnut growing agroecologies in Malawi will benefit from this technology.
- This is a sustainable system that contributes to multiple development objectives (nutrition, natural resource management, income).
- Malawi extension system and development partners need to be supported to disseminate and support adoption of this technology.
- Farmers must be concurrently supported to acquire knowledge on local level value addition and processing their grain legumes for increased local consumption.

Methodology

Africa RISING research teams carried out multi-location experiments on farmers’ fields in four sites of Dedza and Ntcheu districts, in central Malawi. Improved crop varieties and innovative crop combinations were tested at “mother trial” sites, and concurrently evaluated by experimenting farmers on “baby trials”.

This research was undertaken between 2013 and 2015. The team worked with local extension officers and farmers to co-establish experiments that were termed “mother trials” and in turn farmers used components of the mother trials to establish their own simple and easy to follow “baby trials” (Fig. 1). This mother and baby trial approach accelerated knowledge gains for a range of sustainable intensification technologies, for which the doubled-up technology is a component. As part of the learning process, farmers in different learning groups collectively evaluated trials at different stages during the growing seasons, and were also involved in determinations of yields at harvest time.

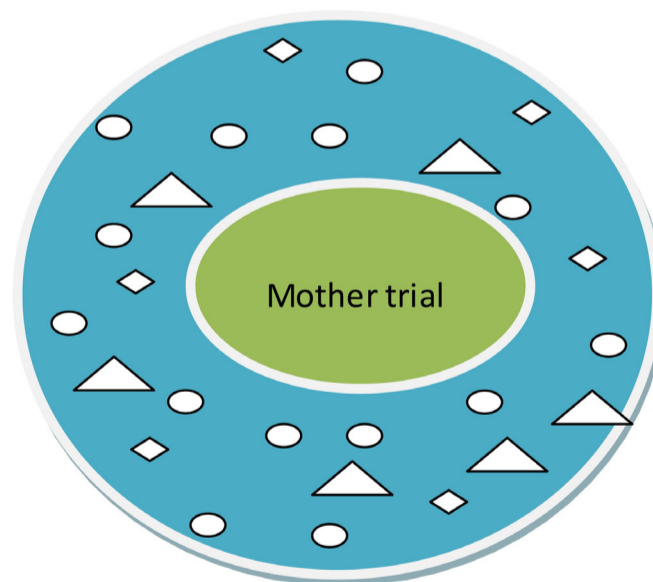


Figure 1: A mother trial is a nucleus/platform for co-learning for a group comprising at least 60 baby trial farmers all within her “blue” sphere of influence. Different shapes of “babies” depict diversity of farmers.



The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government’s Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation and impact assessment.

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