

Doubled-up legume technology: Boosting land productivity by cultivating two grain legumes with different growth habits



Photo: Jonathan Odhong/IITA

Introduction

Farmers are used to intercropping 2 or more crops in their fields, and usually this involves maize and groundnut or cowpea. The reasons for intercropping are many, including:

- to get more crops if land is limited
- some crops are considered too minor to occupy land on their own
- to diversify income sources on farms

Intercropping 2 legumes that have different growth habits is a relatively new practice. It is an approach that takes advantage of beneficial interactions between the 2 legume crops. Successful doubled-up legume intercropping systems mostly involve pigeonpea. It has been established that pigeonpea grows very slowly for the first 2 months after planting.

The doubled-up legume technology

- Pigeon pea can be intercropped with either groundnuts or soyabeans, without too much competition for water, nutrients and sunlight
- Pigeonpea only starts rapid growth when either soyabean or groundnuts are approaching maturity
- Groundnuts or soyabean mature first in about 4 months and are harvested in the month of May.
- After this pigeonpea continues to grow as a sole crop, forms pods, and will be harvested later
- This way we 'double' crops and 'double' soil fertility benefits as both legume crops add fertility to the soil
- Thus the farmer successfully doubles up the output of his or her farm with an extra-legume to supplement household nutrition and for earning extra income.

Soyabean-pigeonpea doubled-up cropping



Photo: Kathy Lopez/ IITA

Step 1: Plant soyabean first

- Remember to use rhizobia inoculants if you are using varieties that require inoculation (see how to grow soyabean guidelines for details)
- Soyabeans need moist soil for germination. They must not be dry planted and should not be planted until it is clear that the rainy season has properly started (plant after a few days of rainfall!).
- Make ridges that are 75 cm apart, just as for maize, so that the normal ridging system is not disrupted by the production of soyabeans. Avoid ridges wider than 75 cm as this is wasting our precious land
- Plant soyabean on 2 shallow farrows (3 cm deep at most) that can be made with a stick on each side of the ridge. Two rows per ridge (instead of only one) ensure high plant population > 250,000 plants per hectare. This results in good soyabean yields.
- Within a row, drop (sprinkle) the soyabean seeds at about 5-8 cm apart. These seeds must be planted no more than 3 cm deep, otherwise germination will not be good.
- About 90 kg of seed is required to plant one hectare (about 35 kg per acre). For varieties with small seeds, less quantities of seed will be required

- A farmer planting 30 x 40 field size requires only 10 kg soyabean seed
- Weeding should be done at least 2 times, especially early in the season. Soyabeans have ability to shade out other plants, so high soyabean population is helpful in control of weeds.

Step 2: Plant pigeonpea on the same day

- On the ridges already planted with soyabean, plant 3 pigeonpea seeds per planting station at 90 cm spacing. This results in about 44,000 plants/ha
- This single row of pigeonpea must be at the center (top) of the ridge
- Only 8 kg pigeonpea seed is required to plant 1 ha of a soyabean/pigeonpea doubled up system
- A farmer planting 30 x 40 field size requires only 1 kg pigeonpea seed
- In this intercrop, soyabeans are harvested earlier, and then the pigeonpea remains as the only crop in the field
- Pigeonpea contributes to next year's crop (usually maize) through the large amount of pigeonpea leaves that fall as it matures thereby adding organic mulch that enriches soil fertility

Groundnut-pigeonpea doubled-up cropping



Step 1: Plant groundnut first

- If maximum yields are to be realized, groundnuts must be planted early, with the first effective rains - a delay in planting will cause a marked drop in yield
- Make ridges that are 75 cm apart (just as for maize and soyabean), so that the normal ridging system is not disrupted by the production of groundnuts. Avoid ridges wider than 75 cm as this is wasting of your precious land
- Plant 2 rows of groundnut on either side of each ridge, at about 5-8 cm depth. Too shallow planting will result in patchy germination as the surface soil can dry out if there is no further rainfall after planting. Too deep planting will delay germination
- Within each row, plant groundnut seeds at 10-15 cm apart. Double rows on each ridge and using this seed spacing will ensure high plant populations (> 200,000 plants/ha), and good harvests
- Seed requirements per hectare range from 80-100 kg, depending on the groundnut variety and seed size
- A farmer planting 30 x 40 field size requires only 10 kg groundnut seed

- Keep fields weed-free by early weeding and pulling off late weeds by hand from the field

Step 2: Plant pigeonpea on the same day

- On the ridges already planted with groundnuts, plant 3/4 pigeonpea seeds per planting station at 90 cm spacing. This results in about 44,000 plants/ha
- This single row of pigeonpea must be at the center (top) of the ridge
- A farmer planting 30 x 40 field size requires only 1 kg pigeonpea seed
- In this intercrop, groundnuts are harvested earlier, and then the pigeonpea remains as the only crop in the field
- The benefit of the pigeonpea to next year's crop on that field (usually maize) is due to the large amount of pigeonpea leaves that fall to the ground as the crop matures and adds a lot of organic mulch that enriches soil fertility

Fertilizer management in doubled-up legume systems

- When a doubled-up intercropping of soyabean or groundnut is grown in rotation with a crop that had received NPK fertilizer the previous season, there is no need to apply any fertilizer that year
- On poor soils apply a 50 kg bag of NPK (23:21:0) fertilizer per hectare at planting. This will supply some nutrients (especially phosphorus) for the 'small factories' on the roots to work better. We call this process biological nitrogen fixation. Please read guidelines on soyabean and groundnut production for more details on this subject
- There is no need to apply UREA fertilizer on doubled-up legumes in your field. These are magic crops manufacturing their own UREA. Save your urea for maize that desperately needs it!



Groundnut



Soyabean



Soyabean

Harvesting and residue management

- Harvest pigeonpea when pods are brown and sometimes when they produce a rattling sound upon shaking.
- At maturity, there will be a carpet of pigeonpea leaves on the ground. This is the magic. The factories in the soil have done a great job. They have made the crop produce a lot of leaves (as well as protein rich grain for food).
- The leaves on the ground will be UREA fertilizer for the next crop. Next season; please make sure you **plant maize on this plot**. You will require less fertilizer
- So **never burn these residues** - you will be burning a good source of enriching your soil
- Wise farmers never burn crop residues - they also use residues to produce more manure through composting



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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