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The Green Manure/Cover Crop approach in RAMA-BC

Green Manure is intercropping maize (or cassava) with cover crops that fix nitrogen. This improves the health of the soil; increases organic matter and fertility; retains more moisture in the soil and helps control weeds¹. The quality of nitrogen fixed by plants is superior and more efficiently used than nitrogen from chemical fertilisers, which require transformation into a usable form first². The crops used for green manure are pulses such as pigeon peas, cowpeas, mung beans, lablab beans, and jack beans. The aim here is to improve productivity, especially maize productivity. Other advantages of healthy soils are crops that are more resistant to pests and diseases as well as being more nutritious. We may achieve this by doing the following:

- ✓ Not ploughing and practicing minimal soil disturbance (including chemical disturbance (herbicides, pesticides, inorganic fertilisers))
- ✓ Covering at the soil surface for as long as possible (to avoid drying out the soil and interrupting microbial activity)
- ✓ Practicing crop rotation /intercropping (always have living roots in the soil that feed bacteria and fungi – sharing nutrients like phosphorous and magnesium with plants)
- ✓ Integration, where possible of animals in the system

In order to have a clear understanding of how to organize cover crops on the farm, we must distinguish between 'anchor' and 'secondary' cover crops:

Definition: An 'anchor' crop is a cover crop such as pigeon pea, or lablab beans, or jack beans that is intercropped with a 'main' crop (usually maize or cassava). An 'anchor' crop has a long cycle and covers the soil for at least 300 days. Just one 'anchor' crop should be intercropped with the 'main' crop at a time. A 'secondary' crop is a crop such as cowpea or mung beans, which has a shorter cycle (75-90 days). To avoid competition, we should just have one 'secondary' crop, with one 'anchor' crop. These 3 crops ('main' + 'anchor' + 'secondary') don't compete, but act as fillers in the initial stages of crop growth at the start of the season, so that the soil is covered for as long as possible. To summarize as an example, an intercrop could be as follows: 1 'main' crop (maize) + 1 'anchor' crop (example pigeon pea) + 1 'secondary' crop (example cowpea).



Jack bean intercropped with maize

Summary of possible Cover Crops: Jackbean

Jack bean can fix 100-240 kg of Nitrogen per year/ha. Jack bean can be intercropped simultaneously with maize or used as a crop rotation. As a rotating crop, jack bean can be used as a *sequential* cover crop following soya, sesame and common beans after they bear their first pods and before the end of the rainy season. As a sequential crop,

¹ Including pests like Fall Army Worm and other persistent weeds like nutgrass and (*Cyperus* spp) e witchweed (*striga*)

² The process of converting inorganic nitrates into a bio available form requires energy and water from the plants

jack bean can be sown in March or April - its tolerance to drought will allow it to complete its cycle in 5-6 months, before the next rainy season. In this way jack bean will keep the soil covered.

Jack bean is recommended for degraded soils that need rehabilitation. Jack bean, being less palatable to animals, can also be used to cover the soil in places where ruminants usually invade and eat the existing crops in the field.

When sowing the *main* crop - maize, sow jack bean - as the *anchor* crop, simultaneously with the maize and between maize lines that are 75 cm apart and 30 cm between plants, resulting in a cover of 3-5 plants per square metre. The same density should be followed when using jack bean sequentially with soya or common bean, sowing jack bean with residual humidity/just before the rains cease.

Pigeon Pea

Pigeon pea is a bushy legume crop with a cycle of up to 3 years, that can be ratooned annually before each maize season. In addition to fertilizing the soil, pigeon pea is a nutritious human food. Another advantage of bushes or agroforestry tree intercrops is the phenomenon of bio irrigation³.

When intercropped with maize, the pigeon pea plant is pruned in the second year at a height of 30 cm (favouring maize) or at a height of 60 cm (favouring pigeon pea). Pigeon pea fertilizes the soil by fixing 60-120 kg of Nitrogen per hectare/year.

When sowing the *main* crop, such as maize, sow pigeon peas - *anchor* crop, at the same time as the maize, between the maize lines, at 75 cm between rows and 30 cm between plants, resulting a cover of 3-5 plants per square metre.



Pigeon pea with maize

If at pigeon pea harvest the whole plant is cut and threshed, sow jack bean between plants whilst the pigeon peas are beginning to pod, but before the end of the rain season, so as to keep the soil covered.

Lab lab

Lablab bean is an annual cover crop that can be used as a maize intercrop or used as a crop rotation. Lablab improves soil fertility by fixing between 60 to 140 kg/ ha/year of nitrogen.



Lab lab with maize

Sown between the maize lines, lablab climbs over the maize plant and pods following the maize harvest, and continues to cover the soil until it dies, often because of the lack of moisture.

With maize, as *main* crop, sow lablab, as an *anchor* crop, between the rows of maize at a spacing of 75 cm between rows and 30 cm between plants, with a cover crop density of 3-5 plants per square metre. Lablab has its limitations: It is prone to being eaten by animals and dies off when the soil dries out.

³ During photosynthesis, plant with deep roots transport water from the soil to the leaves, at night when photosynthesis ceases, water continues to be transported from the depths of the soil and is released through rootlets close to the soil surface, thus 'irrigating' other plants with more shallow root systems



Cowpea with maize

Cowpeas

Cowpeas fix between 40 to 60 kg of Nitrogen/ ha/year. This crop is very resistant to drought. Cowpeas can be used as food and as a cash crop.

Sow cowpeas 15 days after maize, as a *secondary* crop, at 75 cm between rows and 30 cm between plants. Cowpeas can be sown together with other '*anchor*' cover crops, such as jackbean or pigeon peas, as they have a short cycle of 60-75 days, reducing the risk of competition.



Mung bean

Mung beans

Mung beans can be intercropped with other cover crops, such as jack bean or pigeon pea, as a *secondary* crop, with their short cycle of 60-75 days, reducing the risk of competition. It deposits 40 to 60 kg of Nitrogen /ha/year

Mung bean is sown 15 days after sowing maize 75 cm between rows and 60 cm between plants.

In summary: intercropping and cover crops can be managed as follows:

- ✓ Maize x pigeon pea planted simultaneously (pigeon pea pruned in the 2nd year and resown in the 3rd year) – (can include cowpea and a secondary crop and sown 15 days after maize)
- ✓ Maize x jack bean planted simultaneously
- ✓ Maize x lablab planted simultaneously
- ✓ Soya x jack bean (jack bean sown after formation of the soya bean pods, when there is still soil moisture)
- ✓ Common Beans x jack bean (jack bean sown after formation of beans pods when there is still soil moisture)