

## Implementing cereal legume rotations or intercrops for Sustainable Agricultural Intensification (SAI) in East and Southern Africa

**Lead partner:** CIMMYT

**Prepared by:** CIMMYT and NIBIO

**Other partners involved:** HU, UoM, SFHC, ARC

**Objective:** To highlight and share technical factors important for implementing cereal-legume rotations and intercrops for sustainable agricultural intensification in East and Southern Africa

### 1. Cereal legume Crop Rotations

Crop rotation is the practice of growing different crops in the same area in a special sequence over seasons to maintain healthy and fertile soils. Special sequencing of selected crops for rotations is decided upon the need to suppress diseases, erosion control and improvements in crop yields and diversify sources of food or feed. Common crop rotations in cereal-legume systems include maize-followed by common beans, soyabeans, groundnuts or cowpea (Giller, 2001). These combinations are generally considered as sustainable ways of agricultural intensification.

#### Advantages

- Improved soil fertility from nitrogen fixation by legumes
- Improved soil structure and reduced erosion and run-off is often minimized
- Increased biomass from varied root structures
- Suppression of pests and diseases : different crops may break the life cycle of attacking pests
- Mitigating climate change through increased soil carbon and reduction of greenhouse gas emissions
- Soil health through macro and micro fauna is improved
- Increased crop yields especially in conservation agriculture systems

#### Disadvantages

- Rotations can effectively be implemented by farmers with adequate land sizes. When land constrained, farmers tend to monocrop staple cereal crops such as maize or sorghum.
- Rotations involving legumes require access to scarce legume seeds which may also be too expensive
- The risk of losing an entire crop in a rotation
- The need to stick to a defined crop sequence even when the other crop is not financially rewarding

### 2. Cereal legume Intercrops

Intercropping refers to the inter-planting of different types of crops in the same piece of land. These crops usually include a mix of cereals such as maize, sorghum or finger millets, with legume such as cowpea, common beans and groundnuts. Crops that are intercropped may be planted at the same time or at different times so that one matures before the other, a practice also sometimes referred to as relay cropping.

#### Advantages

- Diversification of soil flora and fauna
- Increased water infiltration through channels created by diverse roots structures.
- Growing different crops diversifies sources of food. This also provides insurance against failure of crops in very dry or very wet years and contributes to increased food and feed outputs for human and livestock.
- Intercropping gives additional yield income/unit area than sole cropping and often higher biomass
- Improved soil cover and thereby reduced susceptibility to runoff and erosion
- Weeds are smothered by the high biomass levels in intercrops

#### Disadvantages

- Initially yield decreases of the individual component crops compared to sole crops as the increased cropping density causes more competition for water, light and nutrients
- Mechanization can be difficult in intercropped systems and so planting and weeding may need to be done by manual methods
- May require more basal fertilizer since the crop density is higher
- Harvesting can be difficult as the crops may interfere with each other

### 3. Factors to consider in deciding to use intercrops or rotations

The decision to go for intercrops or rotations of cereals and legumes depends on several factors such as

1. *What is the objective of the farmer?* Cash crop, food security or producing extra livestock feed?

2. *The availability of adequate land* to accommodate rotations. In many countries of sub-Saharan Africa, farmers with less than 1 ha of land prefer intercrops as they need to grow the staple cereal in the same place every year while legumes provide an important source of protein.

3. *If farmers seek to achieve high yields from a legume crop*, usually as a cash crop, then rotations provide a better assurance of higher productivity from the legume crop. For example in South Africa, common beans is produced as a cash crop and rotations are preferred to intercrops. In Mozambique, soybeans and cowpeas may be grown as sole crops in rotation with maize as farmers often have land in abundance. Yield increases from maize using rotations under conservation agriculture have been found to range between 30 and 50% in Malawi and Mozambique (Nyagumbo et al., 2016).

4. *The time of planting of cereals and legumes in an intercrop system* is an important factor to consider when planning to use intercrops. Usually cereals and legumes are planted at the same time but for fast growing legumes such as mucuna and sunnhemp, it is best to delay or relay them for up to two weeks in order to reduce competition with the cereal crop. For slow growers such as pigeon pea, cowpea and common beans, it is best to plant them at the same time as maize or some other similar cereal.

5. *The planting configuration and density of intercrops* also varies depending on agro-ecology or the seasonal rainfall expected in an area. For high rainfall areas the planting density of cereals may be the same as for sole crop planting while the legume planting density is reduced to about half the density that would normally be used for a sole legume crop. Planting legumes on rows between maize is often preferred if the farmer does not use a mechanical weeder such as an ox-drawn cultivator.

The incorporation of legumes in cereal maize based systems either as intercrops or rotations thus provides an important and effective strategy towards sustainable agricultural intensification in smallholder farming systems of SSA (Thierfelder et al., 2012).



#### InnovAfrica experiences

Farmers in Mzimba and Dedza districts of Malawi who took part in InnovAfrica's farmer led field experiments in 2017/18 echoed various yield and other benefits from the experiments, such as:

- Increased diversity and intensification of crops (many crops in small area) >> improved food security
- Planting configuration for pigeon pea and sorghum worked very well because both crops have improved drought tolerance. They were not affected by the prolonged dry spells during the last season (2017/18)
- Maize / pigeonpea and maize / groundnut intercrops were also very good in terms of yield for both crops and very popular combination with farmers.

#### References

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**Further contacts:** Email: i.nyagumbo@cgiar.org