

The Importance of Crop Rotations

What is a crop rotation?

A crop rotation is a series of different crops planted in the same field following a defined order (i.e. maize-cotton-sunnhemp or maize-soyabeans). Monoculture is the repeated planting of the same crop in the same field year after year.

What problems occur with monocultures?

In monocultures, increases in crop-specific pests and diseases are often observed over time. Continuously growing the same crop will tend to exploit the same soil root zone which can lead to a decrease in available nutrients for plant growth and to a decrease in root development.

What are the advantages of crop rotations?

- ✓ Many crops may have positive effects on succeeding crops in the rotation, leading to greater production overall.
- ✓ Rotations are used to reduce pests and diseases in the cropping system and to control weeds by including smothering crop species (e.g. cowpeas) or green manure cover crops.
- ✓ Rotations may also give benefits in terms of improved soil quality (more or deeper roots; root exudates), better distribution of nutrients in the soil profile (deep-rooted crops bring up nutrients from below) and to increased biological activity.
- ✓ Through rotations, peak labour times may be reduced and labour better distributed throughout the year, if planting and harvest times are different.
- ✓ Crop rotations may decrease risk as bad seasons, or bad parts of a season, may affect some crops more than others.
- ✓ Crop rotations can balance the production of residues by alternating crops that produce few and/or short-lived residues with crops that produce a lot of durable residues.

However, above all the rotation needs to address the needs of the farmer, whether it be for cash income or subsistence.

Some important facts about crop rotations

- Positive effects of rotations and negative effects of monocultures are more marked in CA than in conventional systems.
- Many of the benefits of crop rotations are not completely understood and often cannot be predicted: rotations need to be tested in the field.
- Under CA, rotations will often be better than a monoculture even if legumes are not included in the rotation.



Photo: Christian Thierfelder

An example of a successful rotation for some parts of Southern Africa: Three phases of a maize-cotton-cowpea rotation (from top to bottom). Maize is a grain crop which generates residues in the rotation. Cotton is a deep rooting cash crop that generates cash income. Cowpea is a legume cash crop that adds some fertility to the system (nitrogen fixation), although part of the additional nitrogen is taken off by the grain.

- However, the best economic returns from rotations can be expected if legumes are included, because of the nitrogen they add to the system.
- Rotations are not sufficient to maintain crop productivity – extracted nutrients have to be replaced by fertilizers and/or manure.
- The most effective rotations combine crops with different growth strategies (deep rooting versus shallow rooting; nutrient accumulating versus nutrient depleting; water accumulating versus water consuming etc.).
- It is important to rotate different species, and especially species that have different pests and diseases.

What are green manure cover crops?

Green manure cover crops (gmcc's) are mainly planted to provide cover, nitrogen and smother weeds. They are often cut down before they reach maturity. They can be planted as inter-crops, relay crops or, as sole crops. Gmcc's are not primarily planted as income generating crops (i.e. for grain production).

What are the benefits of green manure cover crops?

The benefits of gmcc's are the effective control of weeds (smothering), the additional biomass produced when no other crop is able to grow and the nitrogen fixation if leguminous crops are used. Different gmcc's have different strengths in weed control and nitrogen fixation. Common gmcc's in Southern Africa are: velvet beans (*Mucuna pruriens*); lablab (*Lablab purpureus*); sunnhemp (*Crotalaria juncea*), *Crotalaria grahamiana*, *Tephrosia vogelii* and others.



Photo: Christian Thierfelder

Sunnhemp may be used as a green manure cover crop in rotation with maize – the maize crop benefits from N-fixation, weed control and high residue amounts.

When is it useful to plant gmcc's?

It is useful to plant cover crops when there is enough residual moisture available to grow the gmcc (but not to produce a marketable crop), when there is a free period between crops, when it is necessary to rebuild degraded soils or when producing a cash crop is not profitable or is too risky.

Green manure cover crops: Important considerations:

Before considering gmcc's, it is important to know the effects of a gmcc on the succeeding crop (positive or negative), the interactions between the cover and the main crop, the effect on weed populations, the ability to break pest and disease cycles, the expected returns (in terms of nitrogen) and how fast the residues will decompose. The cost of production of the gmcc and difficulty of producing seed are also of prime importance.