

3. Implementing intercropping or rotation cropping systems

Decisions to make:

1. Crop rotation or intercropping?
2. Suitable crops / crop combinations?
3. Do the crops selected fit within the cropping season or crop calendar?

Crop rotation or intercropping

The decision to adopt cereals-legumes **intercropping, or rotation** depends on:

1. What type of crop: Cash crop, staple food crop, a crop that provides more grains or residues for livestock feed?
2. How much land is available to accommodate rotations? Many smallholders who own less than 1 ha land prefer intercropping of cereal and legumes to meet dietary household needs.
3. If a farmer is aiming for the high yields of legume, usually as a cash crop, then rotations provide a better assurance of higher productivity.

Examples:

- In South Africa (SA), common beans are produced as a cash crop and rotations are preferred to intercropping. Soybeans and cowpeas may be grown as sole crops in rotation with maize as farmers often have large farm sizes in SA.
 - Maize yield increases from rotations under conservation agriculture ranged in between 30 and 50% in Malawi.
 - However, intercrops tend to perform well under high rainfall and high soil fertility conditions. Very low rainfall may cause moisture stress to both intercropped crops thereby compromising yields.
 - In Malawi and Ethiopia farmers prefer intercrops as they have smaller farm sizes of less than 1 ha.
4. The planting configuration and density in intercrops vary depending on agro-ecology or the seasonal rainfall (see also choosing appropriate cereals and legumes).
 - In 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 used for a sole legume crop.
 - An intercropped legume does not get as much light due to the shading effects of the cereal and so certain planting configurations such as double row, back to back and strip cropping which can help the legume gain access to more light.

5. The time of planting of cereals and legumes in an intercrop system is an important factor to consider when planning intercropping. 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 to reduce competition. For slow growing legumes such as pigeon pea, cowpea and common beans, it is best to plant them at the same time with maize or other similar cereal (see also crop calendar).

Choosing appropriate cereals and legumes

The choice of cereals and legumes for intercropping and rotation also depends on farmer needs (food security or cash crops), climatic conditions and soil types (Table 2.1).

- Maize does well on well-drained soils with high fertility and sub-humid to humid climates and rainfall of about 800 to 1400 mm. Maize is also widely grown in semi-arid to arid regions with rainfall below 600mm. The high rainfall (>1200 mm per season) and hot environments result in faster growth of crops thus farmers can use high plant densities along with high fertilizer application rates whereas low plant density is recommended for areas with low rainfall (<600mm).
- The use of legumes as intercrop often causes moisture stress, therefore, higher rainfall conditions are ideal for intercrops.

Table 3.1 Typical climatic and soil requirements for various cereals and legumes.

Crop type	Crop	Seasonal rainfall	Optimum Soil characteristics	Temperature	Growing period	Remarks
Cereals	Maize	800-1200	Well drained fertile soil pH 5.5-6.5	18-32 °C	80-150 days	An important crop in ESA New drought tolerant varieties available
	Sorghum	300-800	Well drained, deep loamy textured soils pH 5.5-8.5	25-30°C	110-130 days	Drought tolerant and suitable for semi-arid conditions
	Finger Millet	500-1000	Fertile and well drained soils pH 5.0-8.2	11-27°C		Drought tolerant and suitable for semi-arid conditions
	Pearl millet	250-700	Light well drained loamy soils, and low pH (4-5) tolerant	23-30°C	70-100 days	Susceptible to waterlogging but can tolerant infertile soils

Legumes	Common beans	400-650	Well drained loamy soils 5.8 to 6.5	18-24 °C	80-115 days	
	Cowpea	400-900	Well-drained, sandy loam to clay loam soils 5.8-6.5	20-30 °C	80-120 days	Susceptible to aphid attack and needs frequent use of insecticides
	Ground-nut	500-1200	Well-drained, light sandy loams, pH 6.0-7.0	18-33°C	100-180 days	Heavy soils make harvesting difficult. Calcium requirement is high.
	Soybeans	500-900	Deep well drained medium to heavy textured soils with high fertility, pH 6.0-6.5	15-25°C	110-140 days	Does well with rhizobia inoculation
	Pigeon pea	600-1400	Well drained light or heavy textured soils, pH 6.0-7.0	18-30°C	120-180 days	Deep rooted and drought tolerant

Crop calendar

The Crop Calendar provides information on planting, sowing and harvesting periods of locally adapted crops in specific agro-ecological zones. This helps to identify the most suitable cropping combinations. A crop calendar for a maize - soybean intercrop system applied in Malawi and South Africa is presented in Figure 3.1.

The key issue is to ensure both crops are established and mature within the rainy season. It is also clear that the cropping season dependent on the onset and end of the rainy season which determines the length of the crop growing period.

However, crops that grow on residual moisture such as pigeon pea can be relayed in such a way that the peak water demand period for maize will not coincide with that of pigeon pea. Pigeon pea matures after maize and can be harvested as late as July in Southern Africa if livestock (such as goats and cattle) can be kept away from the crop.

Figure 3.1 A typical crop calendar for Malawi and Free State of South Africa

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Figure 3.1 A typical crop calendar for Ethiopia

Crop	Activity	Ju l	Au g	Se p	Oc t	No v	De c	Ja n	Fe b	Ma r	Ap r	Ma y	Ju n
	Rainfall	x	x	x								x	x
Maize	Land preparatio n								x	x	x		
	planting											x	
	Weeding	x	x	x									x
	Harvesting					x							
Commo n Bean	Land preparatio n									x	x		
	planting											x	x
	Weeding	x	x										
	Harvesting			x	x								