Cover crops

Target group: Farmers

Definition (1)**:**

Cover crops are fast growing plants which are sown in the time between the main cash crops as part of the crop rotation. Cover crops are grown during fallow periods, between harvest and planting of commercial crops, utilizing the residual soil moisture. Their growth is interrupted either before the next crop is sown, or after sowing the next crop, but before competition between the two crops starts.

Various crop alternatives can be used as vegetative cover: Grains, legumes, root crops and oil crops.

Usage for:

- **Protecting** the soil (e.g. of erosion and drying out / evaporation), when it does not have a crop (1).
- Providing an additional source of **organic matter** to improve soil structure (1).
- Recycling **nutrients** (especially P and K) and mobilizing them in the soil profile in order to make them more readily available to the following crops (1).
- **Legumes** increase available nitrogen (1)
- Can solve **compaction** problems (1)
- Can be used for livestock fodder (1)
- Provide "**biological tillage**" of the soil; the roots of some crops, especially cruciferous crops (1)
- Control **weed** growth (1)
- Repel soil borne **pests** (1)
- Utilizing easily **leached** nutrients (especially N) (1)
- In particular, the introduction of legumes (e.g. mucuna) into the crop rotation as cover and catch crop tends to suppress the incidence of Striga (parasite) (2).
- Groundcover management can have highly beneficial effects on soil surface conditions, SOM content, soil structure, porosity, aeration and bulk density. Improvements in these properties influence infiltration rates, water storage potential and water availability to plants. (2)
- Higher yields due to reduced on-farm erosion and reduced nutrient leaching May conflict with using cropland for grazing in mixed crop-livestock system Reduced variability due to increased soil fertility, water holding capacity (2)

Example (2)

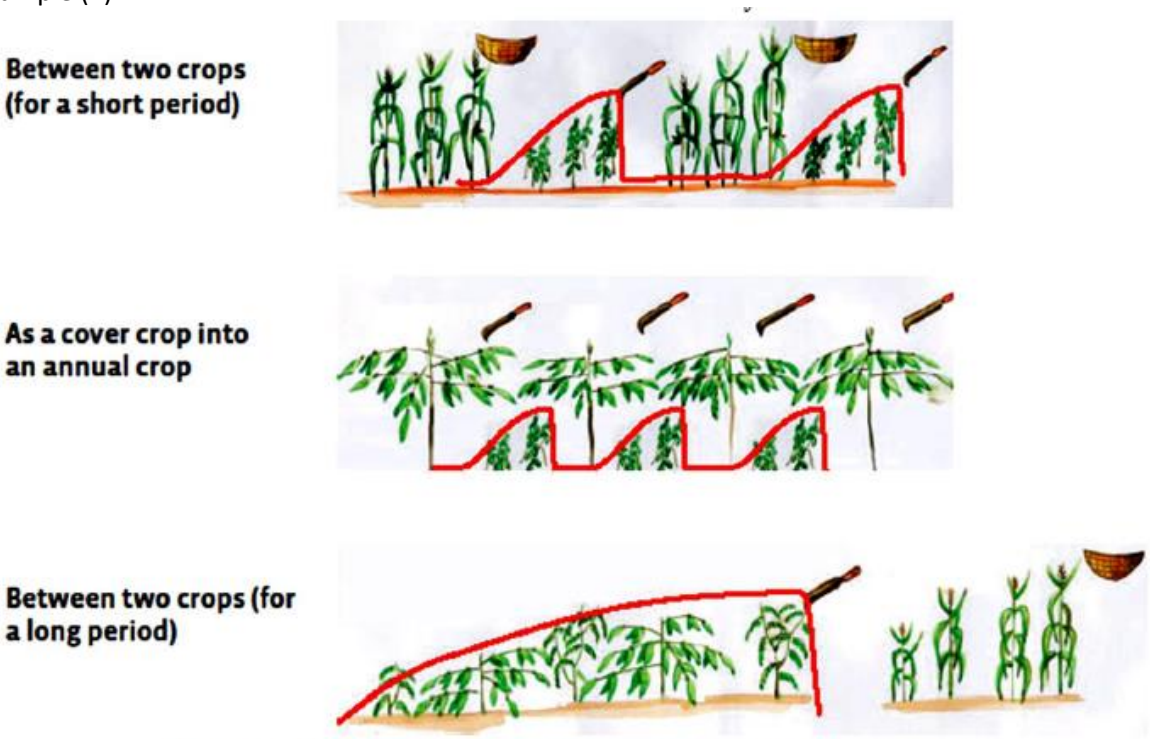

FIGURE 6-8 - 3 POSSIBILITIES OF INTEGRATING GREEN MANURES INTO THE CROP ROTATION

Challenges (1)**:**

- Require a higher level of management (1)
- Decomposition of cover crops can lead to a deficit of nitrogen at the beginning of the growing period (1)
- Control the cover crop sufficiently, so that it doesn't turn into a weed (1)

Time frame (3)**:**

- use for at least one, better two years
- first year: slowly decomposing cover crops (high C/N ratio)
- second year: legumes
- Later for livestock fodder

Important criteria for growing cover crops

- **Which** of the available **cover crops** is the most appropriate? (3)
- **Time of sowing**. Many species show dormancy (=*is a period in an organism's life cycle when growth and development are temporarily stopped*) or photoperiodism (=*the developmental responses of plants to the relative lengths of the light and dark periods*). This means that the production of biomass depends on the period of the year in which the plant is sown. Seeding should be done in the proper season. In order not to jeopardize the following crops, a good planning of the cover crops is necessary (3)
- Cover crops can be **sown** either using direct seeding or broadcast over the stubble of the last crop, possibly using a tree trunk, knife-roller, disc harrow (*see the explanation above*) used as roller with the discs set at a disc angle close to 0° or chains for putting the seeds into contact with the soil. Some species, like hairy vetch, have the ability to reseed themselves. (3)
- **Seed quality:** like in commercial crops, the seeds or planting material of cover crops need to be of high quality and free of pathogens to avoid failure through low quality seeds. (3)

- Soil management: for seeding of the cover crop **no land preparation** is needed (3)
- A **proper spacing / density** of the cover crop is important in order to create a rapid covering of the surface to protect the soil from rain and sun and to suppress the weeds (3)
- Whether the cover crop needs a lot of **water**, and if this will be available (3).
- If it is possible to control the cover crop sufficiently, so that it doesn't turn into a **weed** (3).
- Where **no-till** is used without cover crops and with herbicides to manage weeds, the effects on nitrogen uptake and reduced leaching, as well as on yields, may be less evident (2).

Methods: Push-Pull on the example of Desmodium and Napiergrass (4)

The Push-Pull method is an excellent example of eco function intensification as an integrated production system. It uses the combination of a cover crop and a trap crop to prevent stem borers and the striga parasite in maize.

The left side is the Push-Pull field

Desmodium is planted to repel the stem borer and also to attract the natural enemies of the pest. Its root exudates stop the growth of striga which is a parasitic weed of maize.
Napier grass is planted outside of the field as a trap crop for the stem borer. The desmodium repels (Push) the pests from the maize and the Napier grass attracts (Pull) the stem borers out of the field to lay their eggs in it in instead of the maize. The sharp silica hairs on the Napier grass kill the stem borer larvae when they hatch to break the life cycle and reduce pest numbers.

The desmodium, suppresses weeds, adds nitrogen, conserves the soil, repels pests and provides high protein stock feed

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High yields are not the only benefits. The system does not need synthetic nitrogen as desmodium is a legume and fixes nitrogen. Soil erosion is prevented due to a permanent ground cover. Very significantly the system provides quality fodder for stock.
The border of Napier grass is systematically strip harvested to provide fresh fodder for livestock. Livestock can also graze down the field after the maize is harvested. Many Push-Pull farmers will integrate a dairy cow into the system and sell the milk that is surplus to their family needs as a regular source of income.

Methods: Insectary plants (4)

Dust interferes with predatory insects' ability to locate hosts and can lead to outbreaks of pests like spider mites. Planting insectary plants as windbreaks and ground covers will reduce dust.

Cover crops as pasture cropping and in Horticulture (4)

Pasture cropping and cover cropping in horticulture

Onions grown in rye grass (Lolium sp.)

The rye grass is mowed down as short as possible. The onions are seeded into small ploughed strips. The grass is regularly mowed with a side throw lawn mower. The mowed grass clippings act as a mulch to suppress weeds and conserver water. The discarded roots of the rye grass are broken down by micro-organisms to provide a range of complete nutrients to the cash crop.

Perennial horticulture
Planting winter growing groundcovers such as vetch is a way of capturing the sunlight and rainfall not used by the crop to improve the farming systems. The cover crops can add nitrogen and carbon and provide valuable mulch for water conservation is the drier and hotter summer months. In tropical climates the groundcovers can do the same and provide mulch for the drier winter months. There is the added advantage that they protect the soil from erosion during the intense tropical downpours and prevent nutrient leaching by taking up the nutrients in the biomass. These nutrients are released to the cash crop when the cover crop is cut down at the beginning of the dry season.

Most commonly used species (3)**:**

Legumes adapted to humid lowlands:
English name: Centro, butterfly pea, Black gram, Tropical kudzu

Legumes adapted to fire:
English name: Centro, butterfly pea, --, Glycine, Siratro

Legumes adapted to cold conditions:
English name: butterfly pea, Greenleaf desmodium, --, Glycine, Lotononis, Lucerne, Phasey bean, Clover

Legumes adapted to frequently flooded or inundated areas:
English name: Lotononis, Phasey bean, Tropical kudzu, Dalrymplar vigna, Rice bean

Legumes that tolerate drought:
English name: Pigeon pea, --, Jack bean - sword bean, butterfly pea, --, Silverleaf desmosium, Lablab bean, Glycine, Archer axillaris, Common stylo, tropical lucerne, Caribbean stylo, pencil flower, Townsville stylo, wild lucerne, Mucuna, velvet bean, Cowpea

Legumes adapted to shade:
English name: Horse groundnut, Calapo, Jack bean, sword bean, --, Leucaena, Tropical kudzu, White clover

Legumes adapted to fertile soils:
English name: Glycine, Lucerne, Mucuna, Velvet bean Mucuna, Clover, Common vetch, Hairy vetch

Legumes adapted to medium fertile soils:
English name: Centro, butterfly pea, Siratro, White lupin, Blue lupin, Grass pea, chickling pea, Sunn-hemp

Legumes and other species tolerant to low soil fertility:
English name: Pigeon pea, Calapo, Jack bean, sword bean, Centro, butterfly pea, Desmodium, Leucaena, Birdsfoot trefoil, Yellow lupin, Siratro, Stylo, Black mucuna, Hairy vetch, Cowpea, Zornia, Italian ryegrass, Pink serradella, bird's foot, Rye, Corn spurry, spurry

Cover crops for compacted soils (2)
Some ‘pioneer’ crops, such as pigeon peas, lupine, jack-beans (canavalia) or radish, can break subsoil compactions if, for example, they are planted in the crop rotation or intercropped as green manure cover crops.

The cost (5)
Using cover crops from a fertilization point of view are economically comparable to using other types of fertilisation.
Consider the additional labour and seed cost - for sowing as well as for mulching (or treatment) before the new cash crop.
The Nitrogen-fixing potential of a legouminous cover crop can be compared with the cost of any other organic or N fertilizer which would have to be bought instead. In case of winter pea in tempreate zones the cost is comparable or, depending on seed cost, even lower to the cost of commercial organic fertilizer or slurry application. (acc. FiBL)

However, considering the additional benefits (see above), a well-chosen and managed cover crop has more monetary benefits in the long term (…)

Example (1)**:**

A dense cover crop (hairy vetch - Vicia villosa) will provide good soil cover. This is one important criterion to be considered in cover crop selection. (S. Vaneph).

Example 2 (3)**:**

Cowpea (Vigna unguiculata, French: Niébé) is an important grain legume throughout the tropics and subtropics. It has some properties which make it an ideal cover crop:
· It is drought tolerant and can grow with very little water
· It can fix nitrogen and grows even in very poor soils
· It is shade-tolerant and therefore compatible as an intercrop
· It yields eatable grains and can be used as an animal fodder rich in protein
· It is quite resistant to pest attack
Subsistence farmers in sub-Saharan Africa usually intercrop cowpea in maize, sorghum, millet and cassava.
Other legumes used as cover crops are **alfalfa** (Medicago sativa), **crimson clover** (Trifolium incarnatum), **Faba beans** (Vicia faba) and **hairy vetch** (Vicia vellosa).
Some cover crops are used to improve the soil structure and to add organic matter to the soil; examples of **non-legumes crops** used for this purpose include **barley** (Hordeum vulgare), **buckwheat** (Fagopyron esculentum), **oats** (Avena sativa), **annual rye** (Lolium multiflorum), **winter wheat** (Triticum aestivum).

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