

# Pack #109, Item 2

# Type: Backgrounder

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**Backgrounder: Using permanent soil cover in conservation agriculture**

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***Why is this subject important to listeners?***

Because farmers who are interested in maintaining permanent soil cover should know:

* How covering the soil contributes to soil health.
* The various methods of maintaining soil cover.
* The types of crops and crop residues best used to cover the soil.
* The amount of soil cover required. (Conservation agriculture recommends that at least 30 percent of land be covered with crop residues.)
* The proportion of crop residues to feed to livestock and the proportion to leave on the soil.
* That planting cover crops with main crops reduces the risk of crop failure.

***What are some key facts?***

* Covering the soil reduced the number of weed seeds and suppresses weed growth.
* Covering the soil reduces erosion in the top layer of fertile soil.
* Maintaining soil cover conserves soil moisture, especially in dry regions.
* The two sources of vegetation for maintaining soil cover are cover crops and mulch from crop residues.
* For small-scale farmers, it is recommended to use cover crops that can also act as sources of food.
* Maintaining soil cover increases soil fertility and levels of organic matter in the soil. Cover crops can provide up to 50 tonnes per hectare of organic material.
* Cover crops provide a supplementary source of income to main crops.
* Using leguminous cover crops like mucuna, sun hemp, and lablab beans can reduce the use of chemical fertilizers by 60-80% without lowering yields.
* To control erosion, farmers should maintain 30% soil cover after harvest.

***What are the big challenges of maintaining permanent soil cover?***

* In semi-arid regions, poor rains reduce the growth of some cover crops.
* Domestic use of crop residues for roofing or as livestock fodder can make it difficult for some farmers to maintain permanent soil cover for the whole year.
* Pests and diseases can affect some cover crops, thereby leaving the soil bare.
* Rodents like rats and moles feed on some cover crops.
* Some types of termites attack cover crops, though most types of termites are beneficial, since they break down crop residues into organic matter.
* Accidental fires can destroy soil cover that consists of dry crop residues.

***Gender aspects of maintaining permanent soil cover***

* In Ethiopia, women spend more time and walk longer distances searching for livestock feed when crop residues are used as mulch to cover the soil.
* In Tanzania, men and women small-scale farmers both prefer cover crops that are also food sources and improve soil fertility.
* In Tanzania, women small-scale farmers prefer cover crops because they reduce weed growth, which reduces weeding time, while men prefer cover crops from which they can earn income by selling them in markets.
* Across Africa, cover cropping can reduce the weeding workload for women.

***Permanent soil cover and climate change***

* Permanent soil cover increases soil health, and healthy soils store the carbon that causes climate change.
* Permanent soil cover is normally associated with reduced or zero tillage. Tillage causes carbon to be released to the atmosphere as carbon dioxide.
* Badly managed soils release carbon dioxide into the atmosphere, contributing to climate change.
* Restoring degraded soils and adopting soil conservation practices reduces the emission of greenhouse gases such as carbon dioxide and nitrous oxide that contribute to climate change.

*For further information, see documents 1, 2, 3, 5, and 8.*

***Key information about maintaining permanent soil cover***

1. **Choosing cover crops**

Cover crops provide soil cover and improve soil fertility, while some provide food for humans and feed for livestock. Some cover crops are grown in dry seasons to cover bare soil, while others are intercropped with the main crop during the growing season.

*Before planting cover crops, consider the following:*

* Cover crops should not interfere with the growth of the main crop.
* Choose cover crops that grow well in your region’s climate.
* In dry regions where water is scarce, cover crops need to be drought resilient, such as cowpeas, lablab bean, *desmodium*, pigeon pea, lucerne, and velvet bean.
* Grow cover crops with multiple benefits, for example, medicinal benefits, food for humans and fodder for livestock, and fuel for domestic use.
* Choose cover crops based on the quantity and quality of mulch they provide.
* Where farmlands are close to grazing areas, select cover crops that animals don’t eat, for example, jackbean and sun hemp.
* As cover crops, legumes decompose quicker than grasses, which means that the main crop uses nutrients from legumes more quickly.
* If the main crops are cassava, late-maturing millet, or sorghum, the best cover crops to plant are quick-growing, early-maturing legumes that cover the soil quickly, such as cowpeas, groundnuts, or beans.
* If the main crops are maize, early-maturing millet, or sorghum, the best cover crops are slow-growing, late-maturing legumes that cover the soil and produce after the harvest of the main crop, such as pigeon pea, lablab, and late-maturing cowpeas.

**Methods of planting cover crops**

* **Intercropping:** In intercropping, cover crops grow at the same time as the main crop. With intercropping, there is a risk of the cover crop interfering with the growth of the main crop, so it is important to choose the right combinations of crops. Cover crops and main crops that can be intercropped together in dry environments include maize-pigeon pea, maize-lablab, sorghum-pigeon pea, and cassava-cowpea. In wetter environments, maize can be intercropped with legumes like beans, cowpea, and mucuna, but this should be avoided in dry environments.
* **Relay cropping:** In relay cropping, the cover crop is planted either when the main crop is being weeded at about four weeks after planting, or before the main crop is harvested.
* **Sequential cropping:** In sequential cropping, farmers plant a cover crop after they harvest the main crop. This is only possible in regions with enough moisture to sustain a second crop.

**How to plant cover crops**

* Use narrow spacing of cover crop seeds in sequential cropping, and wider spacing for intercropping. In drier regions, wider spacing of cover crops is recommended to prevent them from competing with main crops for moisture.
* In sequential planting, plant cover crops with large seeds like maize, beans, squash, and pumpkin with a hoe, jab planter, or an animal-drawn planter.
* The number of seeds per hole depends on the moisture available. Farmers should sow fewer seeds per hole in dry regions.

**Basic cover crop management**

* **Rotation:** Rotate between new varieties of cover crops every season to reduce the chances of pest and disease outbreaks.
* **Planting:** When intercropping or relay cropping a cover crop, ensure the spacing is wide enough so that the cover crop doesn’t interfere with main crop growth, or compete for moisture in drier regions.
* **Weeding:** Cover crops need to be weeded at least once before they are established enough to cover the soil and suppress weeds.
* **Pest and disease management:** Use biopesticides or safer chemical pesticides against pests and diseases that attack cover crops, and plant pest and disease-resistant crops and crop varieties.
* **Harvesting:** Before slashing cover crops to make mulch, harvest the seeds and store them for future plantings. The seeds can also be sold or serve as food sources for humans and livestock.
* **Seed storage:** Dispose of damaged cover crop seeds. Then dry and treat the good seeds with a biopesticide that is less toxic to humans and the environment. Store seeds for planting in non-airtight or slightly opened bags, or in well-ventilated containers.
* **Spacing:** The number of **s**eeds to plant per square metre varies between cover crops. For each square metre, plant 3-4 lablab seeds, 4-5 seeds of tall pigeon pea, 8-10 seeds of dwarf pigeon pea, 5-6 seeds for vining cowpea, 10-20 seeds of bush cowpea, and 2-3 seeds of velvet bean.

*For further information, see documents 1 and 5.*

1. **Mulching**

Mulching covers the soil with crop residues from main crops and cover crops, as well as prunings from trees and shrubs. In arid areas during dry seasons, these prunings cover bare soil and create a humid environment that allows farmers to plant cover crops.

Planting or retaining trees and shrubs in the field reduces soil erosion, improves soil structure, reduces soil compaction, shades the soil, and creates windbreaks that reduce evaporation and retain soil moisture.

**Sources of mulch**

* **Leguminous shrubs:** These fix nitrogen in the soil and improve soil fertility. Their leaves and twigs act as mulch to cover the soil. Shrubs like Calliandra, Leucaena, Tephrosia, Crotalaria, Sesbania, and Gliricidia add nitrogen to the soil as they cover it. Though they add nutrients to the soil, legume crop residues decompose quickly when used as mulch. To make legume mulch last longer, mix it with grass species.
* **Trees:** Leguminous trees like Faidherbia albida, *Grevillea robusta*, and *Prosopis juliflora* have leaves and twigs that improve soil fertility and cover the soil. Woody residues from cotton plants can also be used to cover the soil.
* **Living fences:** Farmers can use tree species like Gliricidia, Grevillea, Ziziphus, and Cassia as windbreaks to stop soil moisture from evaporating. These species can also be pruned to provide fodder for livestock and mulch to cover the soil.

**Preparing mulch**

* Before making mulch from harvested crop residues, slash, break, or pull stalks to kill any living plants remaining.
* Add mulch to your field by cutting up stalks and laying them on the ground to cover the soil.
* Legume residues decompose faster than cereal stalks, thereby releasing their nutrients faster for use by crops in the following season.
* If you want to cover your soil for a longer period, mix residues of grass species with legume residues.

**Precautions when mulching with plant materials**

* Using striga or couch grass for mulching interferes with the growth of cereal crops like maize, causing them to wither and be stunted.
* Couch grass harbours pests and diseases that can spread to the main crop. After uprooting it, destroy couch grass by soaking it in water in a covered bucket for four weeks. Place a brick or stone on top of the couch grass to suffocate it until its roots are dead. Alternatively, place couch grass on a surface where it can’t grow, such as a metal sheet or concrete, until its roots and stems wither.
* When mulching, avoid using weeds that have flowered as their seeds may grow and interfere with main crops.

*For further information, see documents 1, 2, 4, 7, and 9.*

***Where can I find other resources on this topic?***

*Documents*

1. IIRR and ACT. 2005. *Conservation agriculture: A manual for farmers and extension workers in Africa*, chapter 1, 24 pages. International Institute of Rural Reconstruction, Nairobi; African Conservation Tillage Network, Harare. Downloadable at <http://www.act-africa.org/content.php?com=5&com2=20&com3=38&com4=106&com5=#.WpwtiOjwaUk> (1.10 MB).
2. Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), 2015. *Case studies on gender mainstreaming in the SIMLESA Programme.*<http://www.asareca.org/sites/default/files/publications/Lowres_ASARECA_SIMLESA_case_studies_Ver12.pdf>(26.9 MB).
3. Bunch, Roland, 2012. *Restoring the Soil: A Guide for Using Green Manure/Cover Crops to Improve the Food Security of Smallholder Farmers.* <http://www.fao.org/ag/ca/ca-publications/restoring_the_soil.pdf> (1.16 MB).
4. Conservation Farming Unit, undated, *Residue Retention and Mulching in CF.* <https://conservationagriculture.org/uploads/pdf/RESIDUE_RETENTION_VERSUS_MULCHING_-_7.2012.pdf> (3.22 MB).
5. IIRR and ACT. 2005. *Conservation agriculture: A manual for farmers and extension workers in Africa*, chapter 5, 22 pages. International Institute of Rural Reconstruction, Nairobi; African Conservation Tillage Network, Harare. Downloadable at <http://www.act-africa.org/content.php?com=5&com2=20&com3=38&com4=106&com5=#.WpwtiOjwaUk> (405 KB)
6. IIRR and ACT. 2005. *Conservation agriculture: A manual for farmers and extension workers in Africa*, chapter 6, 14 pages. International Institute of Rural Reconstruction, Nairobi; African Conservation Tillage Network, Harare. Downloadable at <http://www.act-africa.org/content.php?com=5&com2=20&com3=38&com4=106&com5=#.WpwtiOjwaUk> (401 KB)
7. Food and Agriculture Organization, 2011. *Green manure/cover crops and crop rotation in Conservation Agriculture on Small Farms.* <http://www.fao.org/docrep/014/i2190e/i2190e00.pdf> (1.63 MB).
8. Food and Agriculture Organization, 2015. *Soils help to combat and adapt to climate change by playing a key role in the carbon cycle.* <http://www.fao.org/3/a-i4737e.pdf> (491 KB)
9. Ask Organic, undated. *Composting Perennial Weeds.*<http://www.askorganic.co.uk/composting/perennial%20weeds.pdf>(432KB)

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