Green Manure

CCARDESA
Centre for Coordination of Agricultural Research and Development for Southern Africa

Technical Brief 02

Green manure (otherwise known as cover crops), is a climate smart fertiliser process that involves growing plants (mainly legumes) and distributing uprooted or sown crop-parts to wither and cover soil. It provides soil coverage to enhance biological, physical and chemical properties of soil while mitigating soil erosion, supressing weed growth, adding biomass to soils, improving soil structures, promoting biological soil preparation, and reducing pests, diseases and weed growth. These functions can increase economic return, reduce the need for herbicides and pesticides, while increasing productivity and potentially the quality of crops. It can also increase soil nitrogen, improve soil fertility, conserve soil humidity and reduce fertiliser costs. Green manure also has low management costs, presents good conservation characteristics, and improves biodiversity. Green manure is a feasible and sustainable option for farmers to improve soil quality and productivity, depending on local context and availability of different leguminous plants that best fit for farmers' cropping systems. Examples of leguminous plants that can be used in southern Africa include: Mucuna *(Mucuna pruriens);* Sunhemp *(Crotalaria juncea),* Lab-lab *(Lablab purpureus)*; Pigeon pea *(Cajanus cajan);* Cowpea *(Vigna unguiculata)* and Butterfly pea *(Clitoria ternatea).* Green manure has climate smart benefits as contributes to sustainable maintenance of agricultural production without the use of chemical fertilisers and depending upon the cover crop can contribute to adaptation of agricultural practices to climate change. Furthermore, coverage of soil with additional plant material can assist with carbon sequestration in soil. Not only does growing a secondary green manure crop provide a soil amendment benefit, but the crop can also be used as fodder for livestock. As the most common green manure plants are legumes, the pods and seeds can be fed to livestock while leaving the crop residue to perform the cover crop function in in the fields.

MOST SUITABLE AGRO-ECOLOGICAL CONDITIONS

Value chain

- Maize
- Sorghum
- Rice
- Livestock
- Other

Soil texture

- Light
- Medium
- Heavy

Climatic zone

- Arid
- Semi-arid
- Sub-humid
- Humid

Water source

- Rainfed
- Partly irrigated
- Irrigated

Annual average rainfall (mm)

- < 250
- 250 - 500
- 500 - 750
- 750 - 1000
- 1000 - 1500
- > 1500

Topography

- Flat to gentle slope (0 – 5 %)
- Moderate to rolling slope (6 – 15 %)
- Hilly slope (16 – 30 %)
- Steep slope (> 30 %)

MOST APPROPRIATE CONDITIONS AND REQUIRED INPUTS

Farming system

Does it require collective action

- Yes
- No

Characteristics

- Subsistence
- Commercial Small
- Commercial Medium
- Commercial Large

Farm size (ha)

- < 2
- 2 to 5
- 5 to 10
- > 10

Mechanisation

- Manual
- Animal
- Mechanised

Human resources

Labour intensity – level of effort

- Low (household)
- Medium (seasonal)
- High (outside labour)

Gender/youth smart (low investment/low labour requirements)

- Yes
- No

Financial resources

Initial investment

- Low
- Medium
- High

Maintenance Costs

- Low
- Medium
- High

Access to finance capital or credit required

- Yes
- No

Enabling Environment

Extension support

- Yes
- No

Access to inputs

- Yes
- No

Market access

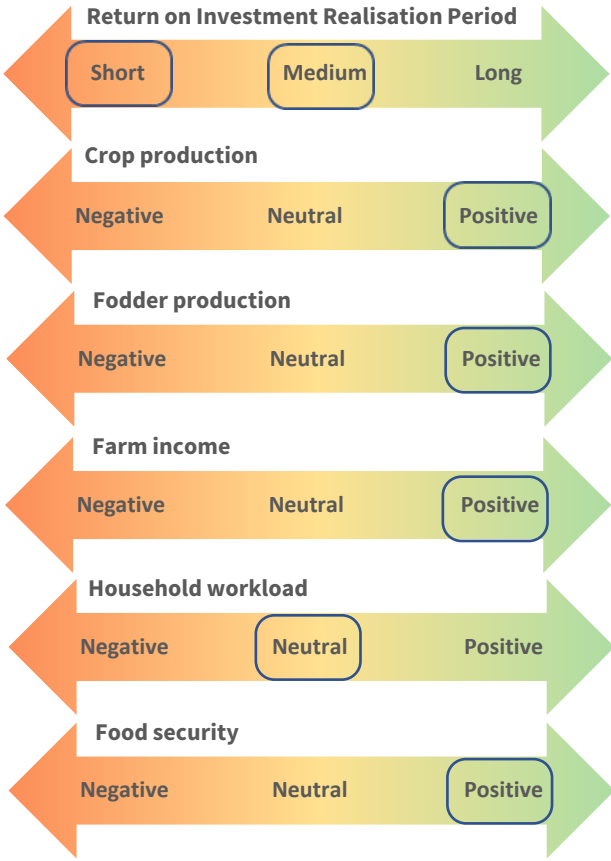
- Yes
- No

The purpose of this technical brief is to guide where this **practice, technology or strategy** could be applied. It may be applicable in other circumstances, but this brief focuses on where it is possibly **most suitable**. Content is general, and should be contextualised depending upon locality. The brief provides an overview, details of appropriate agroecological characteristics, appropriate conditions and inputs, possible outcomes and impacts, how the **practice, technology or strategy** should be applied, potential benefits and drawbacks, and provides suggestions for further reading in terms of CCARDESA materials and other sources, including those used to develop this technical brief.

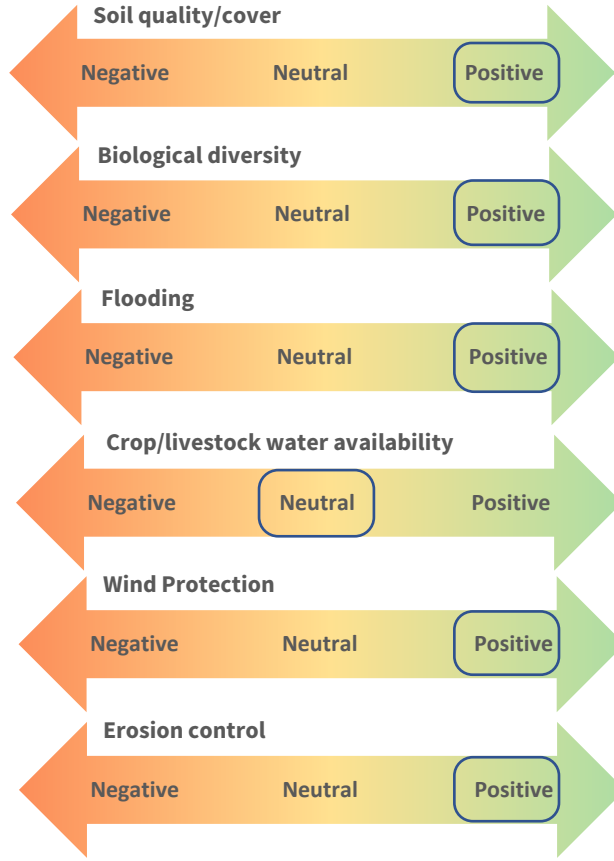
CCARDESA is a subsidiary of SADC, coordinating and harmonising agricultural research and development in Southern Africa.
*This **Technical Brief** is part of a series of materials designed to support **Knowledge Products on climate smart agriculture** available here: www.ccardesa.org/saaiks-knowledge-hub*

POSSIBLE IMPACT/OUTCOMES

Socio-Economic Impacts Positive or Negative



Ecological Impacts Positive or Negative



These descriptors indicate whether the practice, technology or strategy has a positive, neutral , or negative impact or outcome
Those with no box are deemed not-applicable

TECHNICAL APPLICATION

To effectively apply a green manure approach, the following should be considered::

- **Step 1:** Select legumes that grow well under local conditions and in local soils. Green manure crops should be resilient and require few crop management practices. A thorough investigation should be made to ensure that green manure crops are appropriate for the local conditions in terms of rainfall, climate, soil pH and texture, and salt tolerance.
- **Step 2:** Identify the appropriate time for planting the green manure crop to ensure growth, but not impacting the primary crop. Especially if the secondary crop is a climber/creeper. Main crop may need to be mature before planting the manure crop, as if a creeper, it may outcompete or constraint growth of maize or sorghum plants.
- **Step 3:** If seeking to enrich soil properties, the farmer must allow crop residue to remain in the soil longer. This is particularly relevant with multiple uses – e.g. soil amendments and livestock fodder. In these cases, pods can be harvested for fodder, and the remaining plant residue left in the field to cover the soil.
- **Step 4:** Crop planting should be alley cropped between the primary crop rows, allowing management of the primary and secondary crops, also reducing the competition between the primary and the secondary crop. If the secondary crop also has pest management properties, it may be beneficial to consider boundary planting.
- **Step 5:** When harvesting the secondary crop, the farmer should consider leaving the residue in the ground. If it is uprooted, it should left on the soil surface. A common mistake is to remove it from the field and accumulate it in one location, missing the benefits of cover-crops, and exposing the residue to decay.

Unless local examples are available, small test plots should be used to test different cover crops to determine which is the most appropriate, and if necessary, demonstrate value to farmers and communities. As the secondary (green manure) crop is not a direct cash-crop, you may need to ensure expectations are measured. It may take several years to develop enough green manure crop to contribute to crop production; hence, crop production has to fit around existing cash/subsistence crops. Furthermore, benefits may not be realised within a single planting season., e.g. Nitrogen may only be available in the soil in the subsequent season.

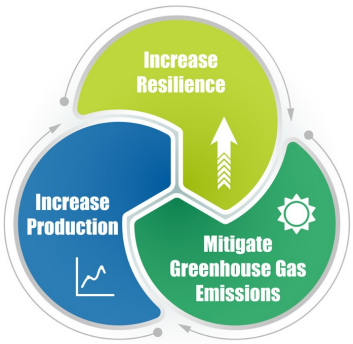
CLIMATE SMART AGRICULTURE OUTCOME(S)

Reflecting how this **practice, technology or strategy** contributes to Climate Smart Agriculture outcomes

Green manure can maintain or increase agricultural productivity through improved soils.

Adjustment of practices to include cover crops allows farmers to diversify crop types, and produce their own fertilisers.

Reduction in carbon released from soil.



SUMMARY/KEY ISSUES

Benefits

- Green Manure is a non-tillage method that promotes soil fertility through enhancement of soil organic content. In doing so, it mitigates erosion, maintains soil humidity, and promotes biological activity.
- Many green manure plants can be used to feed livestock if there is an excess
- Green manure cover crops also make organic matter to apply – compost requires work and time to develop, whereas this approach sees it added immediately.
- Cover crops can reduce weed competition by shading soil.
- If using legumes, they can thrive in poor quality soils.
- Cover crops such as Cow pea can also be used for animal and human consumption.

Drawbacks

- Require access to seedbanks for legumes and other viable cover crops
- May require the testing of crops in test plots prior to implementation.
- If so, community action may be required to test varieties and make decisions.
- Farmers may require more land to plant the same amount of the main crop, as they need to be intercropped with the cover crop. This can be unattractive to some farmers.

REFERENCE MATERIAL

CCARDESA Related Content

- CCARDESA 2019. KP06 Climate Smart Soil Amendment Options for Maize and Sorghum. Gaborone, Botswana.
- CCARDESA 2019. KP07 Climate Smart Planting Options for Maize and Sorghum. Gaborone, Botswana.
- CCARDESA 2019. KP08 Climate Smart Land Preparation Options. Gaborone, Botswana.
- CCARDESA 2019. Technical Brief 7. Intercropping. Gaborone, Botswana
- CCARDESA 2019. Technical Brief 8. Relay Cropping. Gaborone, Botswana

Additional Information

- Bunch, Roland 2012. Restoring the soil: a guide for using green manure/cover crops to improve the food security for smallholder farmers. Canadian Food grains Bank, Winnipeg, Canada
- EMNZ 2015. Green Manure Crops and the Benefits. New Zealand.
- ECHO Community Staff 2017. Selecting Legumes as Green Manure/Cover Crops. ECHO Best Practice Notes BPN #7.
- Food and Agriculture Organisation of the United Nations (FAO) 2011. Green manure/cover crops and crop rotation in Conservation Agriculture on small farms. Rome.
- Food First 2016. Green Manure Crops in Africa: A Report from the Field. Policy Brief No. 20.
- Motis 2016. A "2:4:2" Maize/Legume Intercropping Pattern. ECHO Development Notes Issue 133.
- Odhiambo, J. (2011). Potential use of green manure legume cover crops in smallholder maize production systems in Limpopo province, South Africa. African Journal of Agricultural Research. 6

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