



**1**  
MODULE

**2**  
MODULE

**3**  
MODULE

**4**  
MODULE

**5**  
MODULE

# Conservation agriculture modular approach

- Module 1: Concept, Principles and Practices
- Module 2: Land Preparation
- **Module 3: Soil Cover**
- Module 4: Soil Health and Fertility
- Module 5: Weed Control



## Characteristics of bare soil

- Prone to erosion
- Very high soil temperatures
- Accelerated evaporation
- Lack of organic matter
- Little or no soil life

The sum of the above characteristics is **poor soil productivity**





“A good farmer gives her soil some cover; only a healthy soil can produce a good crop.”



## Two main types of soil cover



Living plant material –  
crops and cover crops



Mulch or dead plant material –  
crop residues and pruning from trees



## What are cover crops?



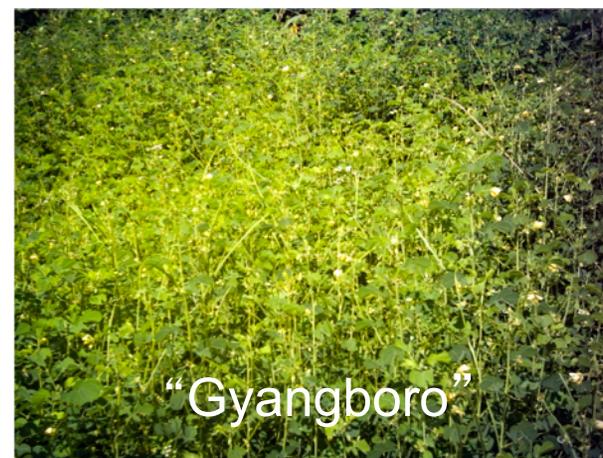
Crops grown to cover the area between rows of commercial crops



Crops grown to cover the whole field when no commercial crop is growing



## What cover crops are available in your area?





## Benefits of cover crops

- Protect the soil against high temperatures
- Minimize erosion
- Add organic matter to the soil
- Control weeds
- Promote soil life
- May reduce compaction problems
- Increase porosity and internal drainage



## ‘Green manure crops’ vs. ‘cover crops’

### **Green Manure Crops**

- Mainly legumes
- Mainly for addition of nitrogen to the soil
- Incorporated into the soil at certain growth stages

### **Cover Crops**

- Species from different plant families
  - e.g. grasses, legumes, etc.
- Grown for specific plant attributes
- Grown to cover soil and feed soil organisms
- Little market value
  - Compared to commercial crops



## Considerations before choosing a cover crop

**Cover crops may feature multiple benefits, for example:**

- Compatibility with cropping systems
- Time of sowing and length of growth cycle
- Ease of management
- Amount of water required and / or drought resistance
- Probability of becoming a weed



## How to manage cover crops

For long-term soil cover from dead mulch, kill by using:

- Knife roller
- Chain
- Herbicide

For immediate decomposition to release nutrients, kill by:

- Slashing
- Mowing



## Time to kill the cover crops

Important to know when to kill, as:

- Most species can regenerate when interrupted prematurely
- Mature seeds can germinate and cause problems as weeds
- Most cover crop species at full flower = maximum accumulation of biomass
  - Legumes - first pod formed; however, not yet matured
  - Grains - milky stage
  - Woody species (e.g. *Cajanus*) - just before flowering because of wood development



## Time of sowing the commercial crop

The period between:

- The slashing / management of the cover crop, and
- The seeding of the commercial crop
- Defines the **production level of the crop**

Related to:

- Allelopathy, and
- Nitrogen immobilization



## Time of sowing the commercial crop

For direct seeding over the cover crop, allow:

- 8–12 days for cover crop; low-to-medium carbon:nitrogen ratio
  - Carbon:nitrogen ratio of 12–22
  - e.g. legumes
- 12 - 20 days for cover crop; high carbon:nitrogen ratio
  - Carbon:nitrogen ratio of > 24
  - e.g. grasses



## Consequences of poorly-managed residue

### Properly Managed

- Adds organic matter to the soil
- Retains carbon in the soil
- Buffers soil pH & facilitates availability of nutrients
- Captures rainfall
- Reduces evaporation & increases soil moisture content

### Poorly Managed

- Provokes uneven drying of soil
- Interferes with seeding and fertilizing activities
- Hinders the emergence of crop seedlings
- Allows weed species to emerge



## Two major threats to soil cover in Africa



Over grazing



Bush fire

How can we reduce their effects?



## Challenges for maintaining soil cover

- **Semi-arid areas**
  - Minimal rain
    - Crops, shrubs and trees produce less residue
  - Utilized for feed, fuel and wood (for building)
    - Difficult to maintain soil cover for the entire year
    - Best to depend on crop residue and tree/ shrub prunings as the main source of soil cover
- **Pests and disease**
  - May attack the cover crop requiring special attention
  - Fire is utilized to destroy pests and disease
    - Rotate crops – versus burning - to control pests and disease
    - Consider using pesticides, if necessary



## Challenges for maintaining soil cover

- Rats
  - A dense crop cover may attract rats; rats attack crops
    - Prior to planting, slash the live cover crop as close to the ground as possible
    - Bait and / or traps may be used
    - Rotate crops to:
      - Interrupt rats' food supply
      - Disturb rats' living conditions



# Challenges for maintaining soil cover

- Termites
  - Soil cover attracts termites
    - Termites are important
      - Break down plant material on the surface; carry it into the soil, adding organic matter
      - As a result, soil is aerated
      - Infiltration is improved
    - Most termites are beneficial
      - Some attack crops by eating the stem or damaging the grain
      - Timing is harvest
      - Trick termites by leaving plant material (mulch) on the surface; termites then attack this versus crop itself



# Challenges for maintaining soil cover

- Fire
  - Bushfires or uncontrolled fires can spread into a CA field and destroy its soil cover
    - Leave a buffer zone around the field
    - Once CA is more practiced, burning will be minimized
    - Education and bylaws will help reduce damage by fire



## Challenges for maintaining soil cover

- Livestock
  - Uncontrolled grazing destroys soil cover
    - Keep animals out by:
      - Planting living fences
      - Spraying field boundaries with cattle urine
      - Planting cover crops not eaten by cattle
    - Create “community-agreed upon” grazing area and fodder production



## Understanding the conservation agriculture system



Farmers who do not yet understand the importance of adequate mulch coverage DO NOT yet understand the conservation agriculture system.



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CENTRE FOR NO-TILL AGRICULTURE

**3**  
MODULE

# Discussion