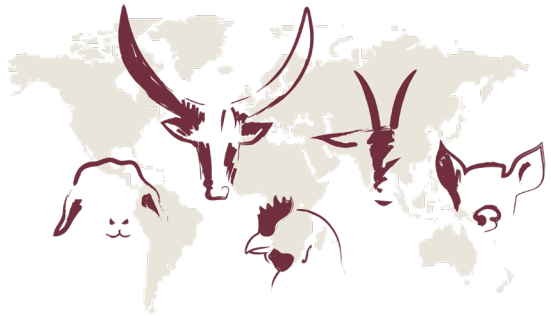

Better lives through livestock

Integrated Forage Production Methods in the Ethiopian Highlands

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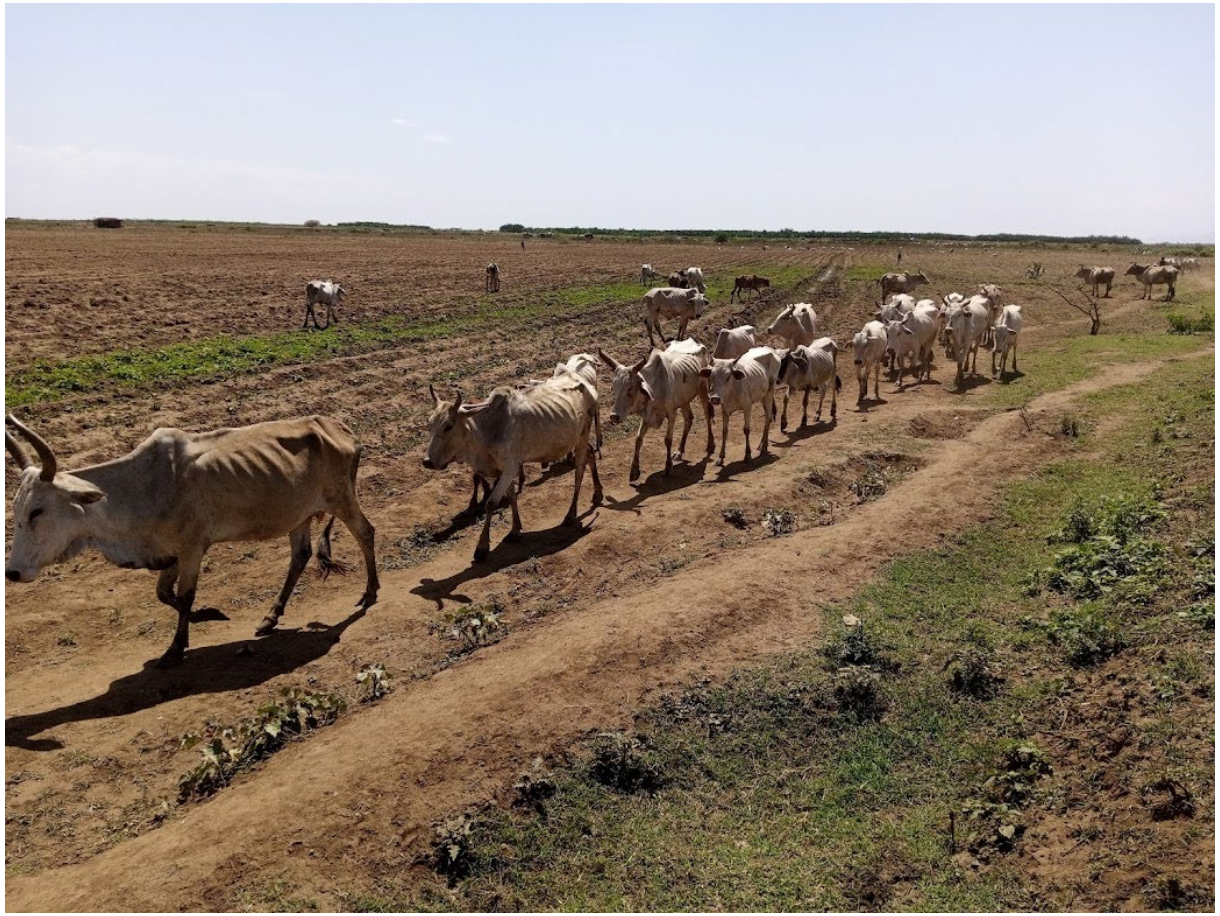
Introduction

Feed shortage is the main constraint for livestock production

Feed is inadequate and poor in quality

- Grazing lands are shrinking and degraded
- Crop residues – have on-site and off-site competing uses, are poor in quality
- Concentrate feeds are high in price and not accessible

Cultivated forages are potential options to increase feed availability and quality and transform livestock production.



Learning Objectives

- Understand contributions of integrated cultivated forage production for intensification of mixed crop-livestock system and adaptation and mitigation of effects of the changing climate.
- Describe integrated forage production methods including their strength and drawbacks.
- Identify suitable forage growing niches for their effective integration in the smallholder system
- Provide information to end users (livestock keepers and feed producers) on potential options of producing forages and properly managing natural resources.

Why integrated forage cultivation?

- Economize the use of scarce resources
  - Land
  - Inputs such as fertilizer
  - Labour
- Intensify forage production through integration with food crops cultivation
- Improve soil fertility through legume forage intercropping
- Increase land productivity and environmental sustainability

Integrated forage production methods

- Under-sowing and intercropping
- Rotational (Sequential) cropping, Relay cropping
- Hedge row intercropping / Alley farming
- Backyard forage production
- Strip forage planting/establishment
- Over-sowing/enrichment planting on grazing areas and enclosure areas
- Multipurpose forage production- feed and pest management

1. Under-sowing and Inter-cropping

Under sowing and intercropping are methods in which two or more crops usually cereals and legumes grown simultaneously in the same field and growing season.

Advantages:

- No extra land required
- Maintain soil fertility and reduced erosion
- Produce additional quality forage
- Improves feeding value of crop residues
- Provide variety of returns
- Increases efficiency with which scarce resources are used

1. Under-sowing and Inter-cropping

Under-sowing

- Under-sowing involves the planting of crops (forage legumes) into another crop after the main crop is established

Intercropping

- Intercropping is a modification of under-sowing, which is useful in areas where row planting is common. The legumes intercropped in two or three rows at the same time as or after the main crop.
- The forage species are under-sown with crops such as maize, sorghum, barley, wheat or plantation crops (e.g. coffee).

1. Under-sowing and Inter-cropping

Important considerations during intercropping and under-sowing:

- Selection of species
- Easiness for establishment
- Compatibility in rate of growth, height, maturity, nutrient and water requirement, tolerance to different climatic conditions such as frost, drought, water logging
- Herbage yield and nitrogen fixing ability
- Harvesting and utilization
- Persistence and reseeding ability for perennial legumes to be continued as permanent pasture

Examples

- Dolichos, cowpea and vetch under sown in maize, sorghum and millet fields
- Clovers and vetch under-sown in wheat and barley
- *Desmodium* under-sown in coffee and other plantations
- Oat intercropped in faba bean fields in southern Ethiopia

Dolichos under-sown in maize

Faba bean/oat intercropping

Vetch under-sown in maize

2) Sequential (Rotational) Cropping, Relay Cropping

Sequential or rotational cropping is planting different crops in sequence or in rotation one after the other, usually legume crops/forage plants following cereals.

Relay cropping is a sort of sequential cropping but usually the following crop is planted before the preceding crop is harvested or immediately after harvest.

Relay cropping is practiced:

- During establishment of perennial pastures
- In areas with residual moisture.
- To control plant pests, weeds and diseases
- In areas with poor soil fertility

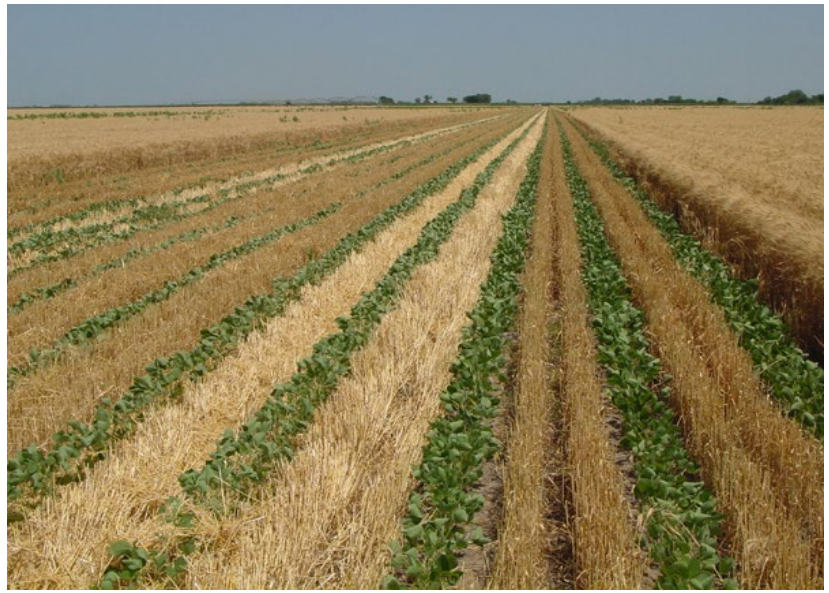


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Table 1. Estimated amount of N fixed by different forage legumes

No	Legume	Forage yield t/ha	N fixed kg/ha
1	*Trifolium steudneri*	4.72	44.7
2	*Trifolium steudneri*	3.19	40.4
3	*Vicia dasycarpa*	7.11	163
4	*Vicia atropurperous*	5.23	103.6
5	*Lablab purpureus*	9.49	214.6
6	*Lablab purpureus*	8.15	140.1
7	*Medicago scutellata*	6.8	121.9
8	*Medicago trancatula*	6.46	108.5
9	*Chamaecytisus palmensis*		100

Source: Haque and Lupwayi, 2000

3) Hedge-row intercropping or alley cropping

It is an agroforestry practice in which browse trees or shrubs are planted as hedgerows in crop fields or other parts of the cropping areas.

Hedge-row practice is integrated in the farming system to:

- Control soil erosion and improve soil physico-chemical properties
- Use forage biomass for animal feed/mulching-soil management
- Improve crop productivity that grow in between the alleys
- Enhance sustainable use of the land resources

Challenges:

- Poor adoption of the practice
- Competition for water and nutrients
- Free grazing system

4) Backyard forage production

Backyard forage production is the growing of forages around the residential areas, compounds and along the fence lines.

- Soils in backyards are usually fertile and this supports forage species to be productive.
- The practice engages women and youth meaningfully.
- It enhances application of a cut and carry system.
- Free grazing and browsing is a challenge for forages not to perform well in backyards.

4) Backyard forage production

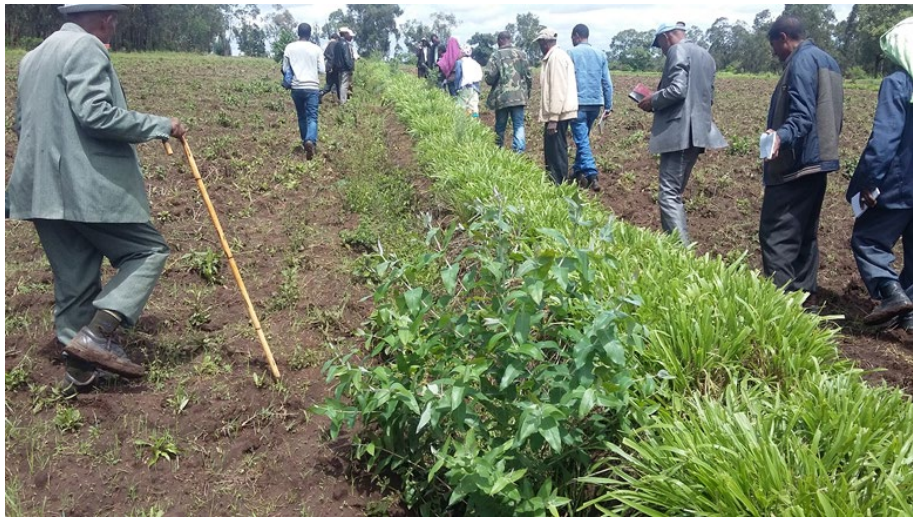
- To maximize efficiency of land utilization the forage crops could be planted or grown
  - Along the fence lines as hedges (usually forage trees)
  - They can be intercropped or under sown with existing perennial backyard crops
  - It is also possible to grow forages on plots in the garden
- Backyard forage crops also improve soil fertility, used as shelter and source of fuel wood
- Leucaena, Sesbania, Tagasaste, Erythrina, Pigeon pea, Napier grass, Alfalfa, Fodder beet are commonly used backyard forages

5) Forage strip establishment

- Forage strips are narrow lines of forage established between arable crops.

It has several uses:

- They provide forage for cut and carry
- They prevent soil erosion
- They provide wood for fuel and
- shelter belts if tree legumes are used
- They improve soil fertility



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5) Forage strip establishment

Types of forage strip establishment:

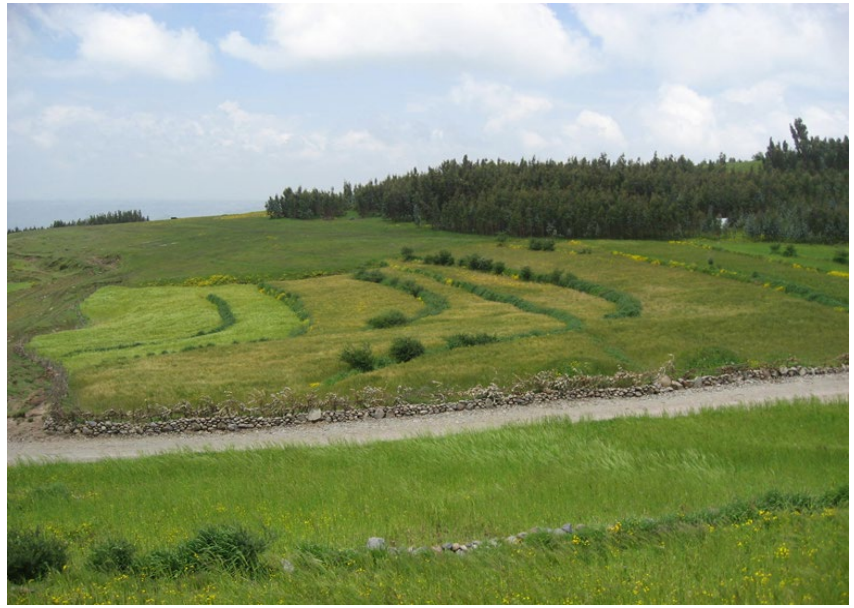
- Forage on bunds and terrace walls. These strips can be either in arable areas or in stock exclusion zones
- Forages planted on contour strips without bunds or terraces
- A sort of alley farming, this is where tree or shrub legumes are planted in parallel rows in crop growing areas
- Forage planted as shelter belts around crop plots

6) Forage production in fragile/ degraded sites

- They could be planted on sloppy areas to rehabilitate eroded gullies

It has several uses:

- They provide forage for cut and carry
- They prevent soil erosion
- They provide wood for fuel and shelter
- They improve soil fertility



7) Over-sowing on grazing and stock exclusion areas

- Over - sowing is the rehabilitation of degraded natural or cultivated grazing land by sowing suitable forage crops to produce forage

- Forage crops could also be over-sown on stock exclusion areas, usually for rehabilitation of degraded lands. The forage will be used as cut and carry or hay

- Different grass and legume forage species could be used for over-sowing

- In the highlands: ***Vetches*** *showed better performance*

  In the low and warmer areas: ***Siratero, Desmodium, Stylo*** *are doing well*

8) Forage production through integrated pest management – Push and Pull technology

- **Stem-borers** – are one of the major pests of maize. The parasitic weed ***Striga hermonthica*** is also an important maize pest. - Losses to stem-borers can reach 15-40%.

Adult moth of stem borer

Maize stem borer

Striga

Cropping strategy (Habitat management)

- **Maize – as main crop**
- **Napier grass – on field borders**
  - Adult moths (stem-borers) attracted by the chemicals emitted from grasses – therefore the napier grass provide the **pull**
  - The Napier grass once attacked, it defends by secreting a sticky substance which physically traps the pest
- **Desmodium – intercropped**
  - Desmodium emits chemicals that **push** the stem-borers
  - Desmodium also helps to reduce the growth of striga

Benefits

- Effect of stem-borer and striga on maize crop is minimized
- High quality forage from napier grass and *Desmodium* is produced
- Soil fertility is improved through nitrogen fixation of *Desmodium*
- Increase the overall efficiency of land productivity

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