

FORAGE SEED FARMER FIELD SCHOOL (FS-FFS)

Training Curriculum



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General Introduction

The Forage Seed Farmer Field School (FS-FFS) is an approach to intensive promotion of forage seed production. It is an adaptation of the participatory and interactive learning approach first developed by FAO in South East Asia in 1989, as a way for smallholder rice farmers to learn IPM practices in their paddy fields. The methodology and guidelines for implementation of the FS-FFS has been adapted from ILRI's Livestock Farmer Field Schools developed and piloted in collaboration with Veterinaires Sans Frontiers Belgium (VSF-B) in 2006 in northern Kenya.

The overall objective of the FS-FFS is to motivate and provide technical inputs to farmers to help them cultivate improved forages for their dairy livestock. For the facilitators, the guidelines provide information about generic tools and processes integral to the FFS approach as well as technical information about various forage crops suitable for local contexts and agro-climatic conditions.

The facilitators' training is an important first step in the establishment of the FS-FFS. The objectives of the training of facilitators include –

- Understanding the basic principles and core activities of the FFS approach
- Developing the skills to facilitate FS-FFS
- Understand how to incorporate technical information in the FS-FFS
- Learning how to set up and run a FS-FFS

Typically, the facilitators training to be acquainted with the content to make it easier for them deliver to the farmers. This would allow them to ask for clarification where needed. Under ideal situation is good to have a minimum of 8-10 participants for each facilitators training course but with COVID 19 restrictions, this could be adapted to what is practical. The facilitators should ideally be from the project area, well respected by farmers and have a dynamic and confident personality. It is also useful to include 1-2 technical experts – who will provide technical backstopping and support during the FS-FFS in the course.

Training content will include at least a field visit to have hands-on experience, and to practice conducting FS-FFS sessions.

A METHODOLOGY AND IMPLEMENTATION

A1 FFS overview and FS-FFS principles

- schools without walls;
- building on local knowledge – merging traditional knowledge with new information helps adoption
 - o what forages farmers have experience with, and are there new forages with better attributes
- uses experiential learning techniques rather than telling them what to do
 - o Posing questions to encourage farmers think about the topic in question
- A group size of 15-20 meet regularly over a season to make observations related to forage cultivation
- Provides a platform for farmers can come together and test options (even after projects end)

Key Principles of FS-FFS

- o learning by doing
- o learner-led study
- o learning from mistakes
- o learn how to learn
- o problem posing and problem solving
- o the fodder plot is the learning ground
- o facilitation – not teaching
- o unity is strength
- o every FFS is unique
- o each FFS follows a systematic training process

A2 FS-FFS Core activities – repeated in each session

- (a) Comparative experiments
 - Why experimentation?
 - Which type of experiments can be set up based on farmers’ problems based on field experiences? (identifying and prioritizing problems/ solutions)
 - What to analyze? (determine parameters to monitor progress; who will observe? When?)

⇒ Participatory evaluation- individual farmer scoring

- Sharing results and learning

(b) Ecosystem analysis

- Concept farm of ecosystem - components, ecological relationships,
- Why ecosystem analysis is needed?
- How to analyze the ecosystem? (unit/ steps/ format)

E.g. for farmers to understand the interdependence of the crops within a farm. May touch on usage e.g. use of residues

(c) Topic of the Day (to introduce new technical information)

- What is topic of the day? Why is it important?
- How to identify topic of the day? (by demand/ arises from observations/ common issue/...)
- How to present the topic of the day? (brainstorm/ discussion/ presentation/...)

(d) Group dynamics (exercises)

- Concept group dynamics in FFS context
- Purpose (relaxing/ energizing, enhance participation, strengthen learning, team building, levelling expectations, solve conflicts)
- Points to watch
 - ⇒ Ground rules e.g. Respect each other view, phones on silent mode, keeping time etc.

(e) Participatory monitoring/ assessment of progress

- Define goals
- Select what to monitor
- Decide how monitor (plan)
- Tools (Participatory evaluation i.e. farmer criteria/attributes looked for in forages)

B TRAINING MODULES (Technical)

B1 Participatory learning and facilitation

B2 Team building, group dynamics

B3 Technical topics

The technical module are based on seasons and chronological stages of forage production i.e. from selection to utilization.

Summary of weekly technical information- Scheduling

Week	Topics
1.	<p>Introduction</p> <ul style="list-style-type: none"> - What is forage cultivation? <ul style="list-style-type: none"> o Important especially where livestock are kept as a business <ul style="list-style-type: none"> ▪ Milk, meat, breeding stock e.g. heifers - What are the benefits of growing forages? <ul style="list-style-type: none"> o Cheaper than buying for milk production o Control and use quality forage you are sure of. Some forages in the market are of poor quality o Manure and leftovers – composted to plough back nutrients to the soil o Ecosystem services i.e. control soil erosion, legumes fix free nitrogen into the soil thus fertility - What are the characteristics and nutrition value of different forages? <ul style="list-style-type: none"> o Grasses versus legumes o Leaves more nutrient than stems o Stage of harvest
2.	<p>Selection of forages to grow on farm</p> <ul style="list-style-type: none"> o Revisit why grow forages on farm? o Adaptability, quality and yields o What is limiting on the farm i.e. basal or supplemental feeds - An idea of fodder budgeting/planning to know the deficit within your farm guided by the land available and number of animals you are keeping - What do you look at, to decide what to grow? <ul style="list-style-type: none"> o Remember grasses to legumes feeding ratio is 70:30. I.e. 7 parts of grasses to 3 parts of legumes. Thus more than double amount of grass would be required compared to legumes for your cattle
3.	<p>Land preparation</p> <ul style="list-style-type: none"> - When should you prepare the seedbed? - What modes of land preparation exist in your area? - Why do we need to prepare seedbed? - Does size of the seed has implication on the seedbed you should prepare? - What is the difference between seedbed and nursery? - Why and when would you need to have a nursery? - What should you do in a farm with obnoxious weeds? e.g. couch grass
4.	<p>Planting/sowing</p> <ul style="list-style-type: none"> - When should you plant/sow the forage seeds? Is it different for the seedbed and nursery? <ul style="list-style-type: none"> o Nursery may need to be establish a month before beginning of the rainy season to be ready for transplanting when season starts - What do I need to observe during planting? E.g., is seed rates the same for all forage types? Spacing? Depth of sowing? <ul style="list-style-type: none"> o Vary depending on the forage types - Soil fertility – application of manure, fertilizer

	<ul style="list-style-type: none"> ○ Forage mine nutrients from the soil and need to plough back especially under cut-and-carry unlike in grazing where faeces and urine get back to the pastures
5.	Planting/sowing- continued with examples
6.	<p>Managing forage crop</p> <ul style="list-style-type: none"> - What does managing forage crop entail? <ul style="list-style-type: none"> ○ Attending your forage farm regularly to check on e.g. germination, weeds, pest and diseases, and know what you should do when you identify positive cases of these. ○ E.g. weeding, pest and disease control, gapping - When should you harvest your forage? How do you tell when you should harvest? <ul style="list-style-type: none"> ○ What happens if you harvest early or much later than expected? - What should I do if I have excess forage than I can use at a certain time? - During dry season, how can I cope? Irrigation if possible?- especially where there is fodder market
7.	<p>Forage harvesting</p> <ul style="list-style-type: none"> - How should I harvest? Does the cutting stubble height matter? <ul style="list-style-type: none"> ○ Perennials and annuals - Harvesting on use demand i.e. as required by the animals in the farm - What are implications for perennial and annual <ul style="list-style-type: none"> ○ Perennials will produce regrowth that would require management as discussed earlier ○ Annuals will need to be planted/sown again
8.	<p>Utilization and conservation</p> <ul style="list-style-type: none"> - In what form should the forages be fed to cattle? <ul style="list-style-type: none"> ○ Green chop, dried hay ○ Processing i.e. chopping what is the importance - What amount is enough for a cow per day? <ul style="list-style-type: none"> ○ Rule of thumb- feed ad libitum ○ Water and minerals ad libitum i.e available always for the animal to consume at will - Why conserve and how? <ul style="list-style-type: none"> ○ Conserve excess, otherwise no need to conserve if no enough for the animals at the prevailing moment. ○ Hay, silage

Week 1 - Introduction

By the end of the week, the farmers should be able to understand

- # What is forage cultivation
- # What are the benefits of growing forages
- # What are the characteristics and nutrition value of different forages

Introducing a concept by posing to the farmers on what they think, captures their attention and give their reflections

- ⇒ Like any other crop, forage cultivation is growing forages with the basic purpose of feeding to livestock for productivity
- ⇒ Then, these forages should have the advantage of increasing the livestock productivity
- ⇒ Important especially where livestock are kept as a business
 - Milk, meat, breeding stock e.g. heifers

Engage the farmers by asking them what applies to them and get a consensus

Why should a farmer grow forages are there any benefits? *Get farmers reflections*

Benefits could include as below but farmers could add from their reflections

- ⇒ Cheaper than buying for either milk or meat production
- ⇒ Control and use forage whose quality you know. Some forages in the market are of poor quality
- ⇒ Manure and leftovers – composted to plough back nutrients to the soil
- ⇒ Ecosystem services i.e. control soil erosion, legumes fix free nitrogen into the soil thus fertility
- ⇒ Growing forages could be source of income- selling to farmers with livestock

What attributes/characteristics and nutrition value of forages? Before answering that question, make the following facts

- ⇒ Nutrients and some minerals come from the forages the cattle eat
- ⇒ Nutrient include energy and protein, just like humans would require
- ⇒ Grasses provide more energy, but still has some protein while forage legumes provide more of proteins

What can influence the level of nutrient in a forage? Pose this to the farmers as it engages them

- ⇒ Leaves have more nutrient than stems. Therefore forages with more leaves than stems are better

- ⇒ Stage of harvest harvesting the forage. Younger forages have more nutrients but less dry matter than over grown forages that are more fibrous
- ⇒ Thus, important to use forage at the right stage not too young nor when it is overgrown

Therefore, the higher the level of energy or protein, the better the nutrition value of forage

Table 1. Examples of forage grass nutrient levels

Forage type	Protein (%)	Gross Energy (MJ/kg DM)
Napier grass	9.7	17
Rhodes grass	9	18
Brachiaria-hybrid	17	15

Source: Feedipedia

Note:

- ✓ Allow farmers to ask questions and note them; also keep the register of the farmer's in attendance and their mobile contacts
- ✓ Remember to allow for breaks and group dynamics as may deem fit

Week 2 – Selection of forages to grow on-farm

By the end of the week, the farmers should be able to understand

- # not all forages fit everywhere
- # Difference between perennial and annual forages

Selection of forages to grow on farm

⇒ Revisit/ recap lightly on reasons why grow forages

Selecting forages

- ⇒ Generally, there are forages adapted to warm areas (tropical) and those adapted to cold areas (temperate).
- ⇒ As a farmer, you should be able to tell what isn't enough on your farm. Is it grasses that provide more energy or legumes that provide proteins, or both? Usually both are in short supply.
- ⇒ Depending on the number of animals you have, how many months in a year can the forage you have cover your animals?
- ⇒ This enables to have a fodder budget/planning and know the deficit you should aim to bridge
- ⇒ Do you want to plant forages that will occupy the portion of land for several years (perennial) or that you harvest one off and can dedicate the land to another crop?
- ⇒ To move further you need to understand the climate of the area your farm is located. Does it have cold temperatures that cause frostbite to crops or not? Areas with frostbites would require temperate forages, otherwise can use tropical forages.

Table 2. Climate of different areas in Kenya

Climate zone	Areas in Kenya
Semi-arid	Northern Kenya, Parts of eastern
Warm, wet , medium altitude	Taita Hills, Meru, Embu, Kirinyaga, Muranga, Kiambu and Nyeri districts in eastern and central Kenya. In western Kenya, the region covers Bungoma, Kakamega, Busia, Siaya, Kisumu, Kisii and South Nyanza districts.
Cool wet medium altitude	Trans-Nzoia, Nandi, Kericho, Kisii and Narok districts, Nyandarua, upper Kiambu, Nyeri, Kirinyaga, Muranga, Embu and Meru districts in Central Kenya
Cold, wet high altitude	Mau Narok in the Rift Valley, the upper Cherangani hills and upper Mt. Elgon in Western Kenya, and the upper Nyandarua, Nyeri, Kiambu, and Aberdare Range in Central Kenya

Climatic zone	Forage Grasses/tubers (examples)	Forage Legumes (Examples)
Semi-arid Elevation of 1000-1800 meters and Receives less than 650mm of rainfall yearly	<ul style="list-style-type: none"> → Enteropogon macrostachyus → Cenchrus ciliaris → Eragrostis superba → Sorghum 	<ul style="list-style-type: none"> → Lablab
Warm, Wet , Medium Altitude Elevation 1200 -1850 meters Receives 1000 -2500 mm r/f annually	<ul style="list-style-type: none"> → Brachiaria → Napier grass → Panicum → Oats → Rhodes grass → Sorghum 	<ul style="list-style-type: none"> → Lablab → Calliandra → Desmodium → Leucaena → Cowpea → Sun hemp/ Crotalaria
Cool, Wet, Medium Altitude Elevation 1850 -2400 meters Receives 1000 -2500 mm r/f annually	<ul style="list-style-type: none"> → Brachiaria → Napier grass → Panicum → Rhodes grass → Fodder sorghum → Dual purpose sweet potato vines → Turnips → Chicory 	<ul style="list-style-type: none"> → Desmodium → Lucerne → Lablab → Crotalaria
Cold Wet, High Altitude Elevation 2400 -3000 meters Receives 1000 – 2500 mm r/f annually	<ul style="list-style-type: none"> → Oats → Ryegrass → Turnips 	<ul style="list-style-type: none"> → Vetch → Lupin → Lucerne

Grasses to legumes feeding ratio is 70:30. I.e. 7 parts of grasses to 3 parts of legumes. This means, more than double amount of grass would be required compared to legumes for your cattle on daily basis

Note:

- ✓ *Allow farmers to ask questions and note them; also keep the register of the farmer's in attendance and their mobile contacts*
- ✓ *Remember to allow for breaks and group dynamics as may deem fit*

Week 3 – Land preparation

By the end of the week, the farmers should be able to understand

- # Importance of land preparation
- # Relationship of land preparation and size of the seed

Ideally, land preparation should be done well before the start of rains

- ⇒ This allows to eradicate the weeds and get them dry up
- ⇒ Where there are notorious weeds like couch grass spraying herbicide to eradicate is possible before ploughing the land might be advisable
- ⇒ Ploughing the land makes the soil loose and will be easier for the roots to penetrate as well as improve water absorption
- ⇒ The land preparation essentially refers to seedbed that could run to envisioned land to establish a crop. Therefore a seedbed can be less than an acre or as much as 1000 acres or more
- ⇒ The crop planted in a seedbed does not require transplanting. It will grow to desired maturity from the seedbed
- ⇒ A nursery is a small unit of 1 m width but can run to any desired length. This is required to raise seedlings, which are later transplanted into seedbed.
- ⇒ The reason for nursery is for crops whose seedlings require ‘Tender love and Care’ at the initial stages i.e. watering, pest and disease control
- ⇒ Ideally, nursery establishment well before start of rains for seedlings to be ready to transplant once the rains begin is preferable. Some forage seeds could require nursery rather than planting in seedbed directly e.g. Brachiaria, Calliandra
- ⇒ The size of the seed determines the kind of seedbed to prepare
- ⇒ As the rule of thumb, the smaller the seed the finer the soil tilth in a seedbed should be
- ⇒ Tiny seeds are not buried under the soil for more than a centimeter, hence the need for fine soil tilth.
- ⇒ In addition, fine soil would enhance seed-soil contact required for proper germination and establishment, which can’t happen in seedbed with big soil clods

Pose to the farmers the mode of seedbed/land preparation that exist in their locality

Land/seedbed preparation fall under one of the categories

- Machinery- e.g. tractor ploughing and harrowing

- Draft animals –e.g. oxen ploughing
- Human labor using hoe and jembes



Prepared seedbeds by machinery. Note, in the first photo the soil tilth is not fine especially the big soil clods at the fore. The second photo the land has been ploughed and harrowed and would be good for tiny seeds

Note:

- ✓ *Allow farmers to ask questions and note them; also keep the register of the farmer's in attendance and their mobile contacts*
- ✓ *Remember to allow for breaks and group dynamics as may deem fit*

Week 4 – Planting/sowing

By the end of the week, the farmers should be able to understand

- # Different forages have different Seedrates and spacing
 - # Forage seeds planting depth
-
- ⇒ Planting of forages should happen after the onset of rains. For germination and establishment to happen seeds require
 - Enough soil moisture- Should have rained for 3 consecutive days before sowing. Most seeds do not survive in water logged soils and therefore well-draining seedbed is good i.e. that does not encourage water logging
 - Warmth- if it rains too much for several days, the temperature in the soil drops and germination will not be good
 - ⇒ Make the necessary furrows or hills depending on the forage being sown/planted
 - ⇒ For good establishment after germination, phosphorus is good for the roots that will be essential in drawing water and nutrients from the soil.
 - ⇒ Therefore, apply fertilizer with phosphorus or use well-composted farmyard manure before putting the seeds to ensures especially for the farmyard manure does not place tiny seeds for more than a cm below.
 - ⇒ Place the seeds/seedlings/splits at the recommended seedrates or spacing and there after cover with soil
 - ⇒ For the tiny seeds remember to apply soil that does not cover the seeds for more than a centimeter
 - ⇒ To ensure the seed get good contact with the soil, compact the soil on top lightly with feet.

Brachiaria forage establishment – Example #1

Three approaches can apply for Brachiaria as stipulated below

1. Seeds directly	2. Transplanting	3. Using splits
<ul style="list-style-type: none"> ✓ Seed rate is 8 kg/ha = 3.2 kg/acre (a) Make shallow holes at 30cm apart between hills/hole and 45 cm between rows <ul style="list-style-type: none"> – Apply NPK or DAP fertilizer at 200 kg/ha = 80kg/acre – Place 4-5 seeds per hole i.e. pinch with two fingers – The seeds should not be buried beyond 2 cm depth (b) Broadcasting method (Increase seed rate slightly i.e. 10%) <ul style="list-style-type: none"> – Disadvantage- loose soil contact – Seed distribution may be skewed 	<ul style="list-style-type: none"> ✓ Seeds put in a nursery then transplanted. <ul style="list-style-type: none"> – Nursery should be set earlier (a month) before start of the season, and is possible to irrigate – Spacing: 30 cm x 45 cm – Transplant 2-3 seedlings per hole/hill – Trim leaves at the top and apply manure or inorganic fertilizer <p style="text-align: center;"><i>Nursery</i></p> <ul style="list-style-type: none"> • Similar to carrots nursery • Why nursery? Easy to take care i.e. management to get seedlings including: watering, weeding, pest control • Establish before rains such that seedlings are ready to transplant when rains set in <p style="text-align: center;"><i>How do you make a nursery?</i></p> <ul style="list-style-type: none"> • Prepare fine soil in a width of 1m and allow the length to be as long as seeds you have • Preferable to add manure and incorporate in the soil • 1m width allow you to work on the nursery without stepping inside on either side along the length • Make shallow drills of 1-2 cm deep and 10cm apart • Provide shade to minimize loss of soil moisture 	<ul style="list-style-type: none"> ✓ Brachiaria can also be established from Splits <ul style="list-style-type: none"> – Land preparation is already described – Planting splits should be done after rains and the soil is wet enough (2-3 days of raining) – Spacing :- 30cm x 45cm – Disadvantage: is laborious as splits are bulky, especially if extensive piece of land is to be planted

Note: Brachiaria is perennial, once established and with good management, the stand can go for more than 10 years.

However, Brachiaria does not perform under cold and frost prone areas

✓ *Allow farmers to ask questions and note them; also keep the register of the farmer's in attendance and their mobile contacts*

✓ *Remember to allow for breaks and group dynamics as may deem fit*

Week 5 – Planting/sowing continued---

Panicum forage sowing- Example #2

⇒ *Using seeds*

- Panicum establishes very well from seed compared to Brachiaria. Panicum seeds are more tiny than those of Brachiaria
- Seed-rate 2-3kg/ha or 0.8-1.2kg/acre
- Spacing drill (furrow) at 50cm apart or
- Broadcast possible but mix with dry soil/sand for better spread.
 - Down side of broadcasting is more seed is required, and the seeds end up not well covered by soil coupled with poor seed-soil contact. Seeds not covered are prone to eating by birds
- At planting apply phosphorus at 40 kg N/ha or 36 kg N/acre and Nitrogen at 50kg/ha

⇒ *Using Splits*

- Space at 50cm x 50cm
- And apply fertilization as above

⇒ Topdressing annually at 200 - 400 kg/ha/year (80 -160kg/acre/year)

⇒ *Panicum* requires more fertile soils than *Brachiaria*

⇒ *Note Panicums are perennials, once established and with good management, the crop can go for more than 10 years. Panicums do not thrive in cold and frost prone areas*



Farmers making furrows to plant Panicum via seeds

Fodder Sorghum sowing – example #3

- ⇒ Seed rate is 3 kg/acre
- ⇒ Sorghum seeds are also small, but not as those of Panicum
- ⇒ Drill/ furrows at 75cm apart
- ⇒ Soils of at least medium fertility are necessary
- ⇒ Use fertilizer rate at 50 kg/acre- phosphorus
- ⇒ Thin the plants when they are 15cm high to 10 cm intra plant
- ⇒ Sorghum is more drought tolerant

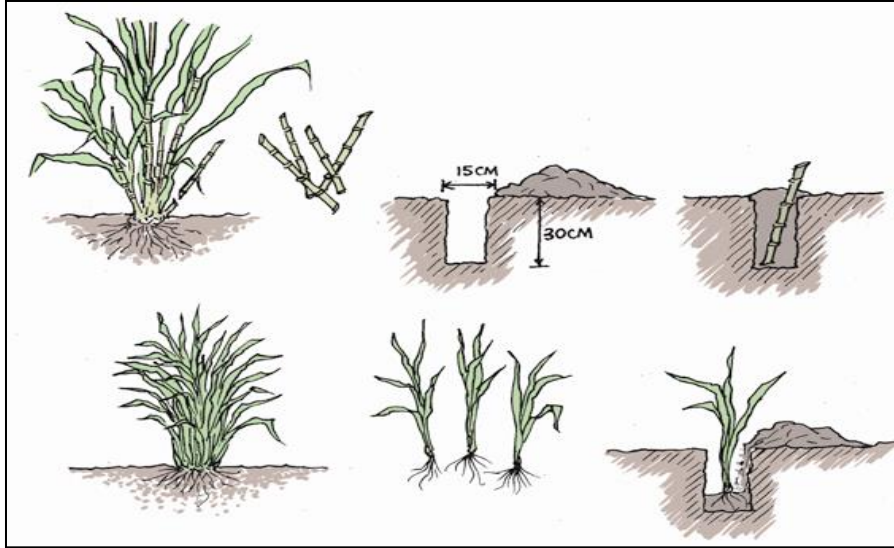


Fodder sorghum at dough stage and ready for making silage

Note, unlike Brachiaria or Panicum, sorghum is more of an annual crop. Although first and second ratoons are possible, the yields are much lower

Napier grass planting- example #4

- ⇒ Napier grass does not produce viable seeds hence is propagated vegetatively
- ⇒ Napier does not perform well in cold and frost prone areas
- ⇒ It can grow from sea level up to 2000 meters above sea level
- ⇒ Planting can be done from splits and canes
- ⇒ Make holes of about 15 cm diameter and go up to 30cm deep



- ⇒ If using canes make sure two nodes are below the soil surface
- ⇒ Fertilization- Use phosphorus fertilizer e.g. DAP (100 kg/acre) or manure at planting- depending on availability e.g. 2 spades/hill

Note:

- ✓ *Allow farmers to ask questions and note them; also keep the register of the farmer's in attendance and their mobile contacts*
- ✓ *Remember to allow for breaks and group dynamics as may deem fit*

Week 6 – Managing forage crops

By the end of the week, the farmers should be able to understand

- # What key management practices/what they should do after sowing/planting
- # Understand some major pest and disease challenges in forages
- # Importance of maintaining soil fertility in forage fields

⇒ What does managing forage crop entail?

- Attending your forage farm regularly to check on e.g. germination, weeds, pest and diseases, and know what you should do when you identify positive cases of these.
 - If the germination is poor in some portions, the farmer should gap the empty spaces by planting/sowing again.
 - If opportunistic weeds establish quickly, uproot otherwise spray selective herbicides to kill broad leaf weeds if the forage crop planted is a grass.
 - If serious pest and/or disease are noted, report to livestock officer in your area and ask for advice. You may be advised which pesticide/fungicide to apply

⇒ After harvest, for perennial forages is important to fertilize the fields again. Use of nitrogenous fertilizer will be good for regrowth e.g. nitrogenous inorganic fertilizer should be at 80 - 160kg/acre/year.

⇒ You can use inorganic fertilizer (Urea, CAN) or cattle manure.



⇒ Apply the inorganic manure after weeding and when the soil is adequately wet after rains otherwise nitrogen is volatile and will be lost to the atmosphere

⇒ Manure should not be applied on top of the weeded field as nitrogen will equally be lost into the atmosphere

⇒ Instead, dig up shallow furrows between rows of the forage, apply the manure and cover back with the soil. Roots will access the nitrogen and other nutrients via roots in the soil

Note: Forages especially perennials mine nutrients from the soil over time, and there is need to get back the nutrients especially under cut-and-carry unlike in grazing where feces and urine get back to the pastures. Otherwise, the forage yields will progressively dwindle

⇒ For a long time forages have had no major pests or diseases but currently some diseases have been observed for example Napier grass is affected by smut and stunt disease and spider mites in Brachiaria hybrids

Smut – Affects Napier grass	Stunt - Affects Napier grass
<ul style="list-style-type: none">• Smut reported first 1998 – has spread• Reduce harvestable yield• Infection spread- planting material, farm tools, manure-feeding infected material, Mechanically• <i>Remedy</i>- use tolerant cultivars: Kakamega I & II	<ul style="list-style-type: none">• Stunt reported first 2004- Has spread• Reduce harvestable yield• Infection spread- Insect vector (tiny hoppers)• <i>Remedy</i>- Use tolerant cultivar: Ouma and South Africa I and II•
	

- ⇒ Spider mites in Brachiaria hybrids are very tiny reddish mites that reside on the underside of the leaves and very difficult to identify them unless if you look keenly and closely.
- ⇒ They actually feed from the nutritious Brachiaria hybrid and what you observe from a distance is the affected leaves turn yellowish then brownish as if being scotched.
- ⇒ If you start to observe this in the field harvest the crop and allow the cattle to eat if they accept it.
- ⇒ Mites will appear more during dry season and once rains fall they disappears.

- ⇒ Spraying water on the underside (abaxial) leaf surfaces makes them disappear.
- ⇒ The good thing is that Brachiaria is perennial and you will still get another crop. So is advisable once you see signs of the pest to harvest and get another crop

Spider mite attack in Mulato II Brachiaria hybrid



Note:

- ✓ *Allow farmers to ask questions and note them; also keep the register of the farmer's in attendance and their mobile contacts*
- ✓ *Remember to allow for breaks and group dynamics as may deem fit*

Week 7 – forage harvesting

By the end of the week farmers should understand

- # When to harvest forage
- # How to harvest forage especially

⇒ When should I harvest my forage?

- This varies depending on the forage species under consideration
- The aim is to harvest when optimal nutrient are available in the forage and, that is digestible for the animals to access the beneficial nutrients
- For forage grasses that flower, the optimal nutrient content is usually when flowering sets in
- If forages are harvested too early the quality may be better but the dry matter content will be considerably low, in the reverse if harvesting is delayed, there may be more dry matter/biomass but the quality will have declined and also the digestibility will be low as the forage develops fibers that are not easily digested by the cattle
- Harvesting perennial forages in time gives room for regrowth soonest that will also produce be of quality when harvested at the right stage

⇒ Does the cutting height from the soil level matter?

- This is called stubble height and it matters
- Cutting forage at the soil level is not advisable, but at 5–10 cm above the soil
- This encourages the grasses to recuperate/regenerate quickly without first having to produce completely new tillers at take some time. This means the regrowth herbage takes shorter time
- Other reason, the forage will persist longer i.e. longevity
- Some annuals that are weak perennials e.g. fodder oat may also be able to produce some 1st and 2nd ratoon and cutting the at the mentioned stubble height is advisable

⇒ At farm level, harvesting is dictated by use demand i.e. as required by the animals in the farm and the reason why is good to plant enough forages to avoid harvesting forage when has not reached the recommended stage

⇒ During dry season, forages do not grow well and where possible irrigation helps to keep the growth going and get harvestable crop. This may be helpful especially where fodder market exist for continuous supply

Brachiaria harvesting

- ⇒ Under cut and carry and with good rains harvesting at 6 weeks (40-45 days) intervals is feasible
- ⇒ Ideally, when after flowering the forage quality start to drop. As such , harvest when flowering starts to set in
- ⇒ Cut slightly (5-10cm) above the ground i.e. stubble height as discussed before



***Panicum* harvesting**

- ⇒ Under cut and carry and with good rains harvesting at 6 weeks (40-45 days) intervals is feasible
- ⇒ Cut slightly (5-10cm) above the ground i.e. stubble height
- ⇒ Top dress with organic fertilizer (farmyard manure) or use inorganic Nitrogenous inorganic fertilizer (80 -160kg/acre/year)

Sorghum harvesting

- ⇒ Sorghum can take 7–8 months to dough stage, the stage best for use or making silage
- ⇒ Sorghum produces panicles and seeds produce milk when at dough stage
- ⇒ Sorghum is high yielding and can produce 28–40 tons/acre of silage material when harvested at dough stage

Napier harvesting

- ⇒ Harvest at 3ft (~1m) height or waist height as usually Napier grass does not flower easily
- ⇒ Leave a stubble height of 5-10 cm for fast regrowth
- ⇒ Napier grass produces high biomass of up to 18 - 40 t DM/Ha especially when put under irrigation



Lablab harvesting

- ✓ Lablab is an annual but if harvested leaving a stubble of 30 cm is possible to harvest 1st and 2nd ratoon but with reduced yield (weak perennial)
- ✓ Seasonal yields of 2 t/ha leaf or 4 t/ha stem and leaf are common in sub-humid sub-tropics

Note:

- ✓ *Allow farmers to ask questions and note them; also keep the register of the farmer's in attendance and their mobile contacts*
- ✓ *Remember to allow for breaks and group dynamics as may deem fit*

Week 8 – Utilization and conservation

Brachiaria utilization and conservation

- ✓ *Brachiaria*, provides the basal roughage for energy and protein to some extent
- ✓ Feed as green chop after wilting, wilting increases the dry matter which is key for animal intake
- ✓ Chopping to small pieces e.g. 1 inch size, assist to reduce the cow selecting for the leaves only and you get more intake
- ✓ Luckily, when harvested at the right stage (40-45 days) *Brachiaria* stems are soft and the cow can eat everything even without chopping
- ✓ A mature cow can take daily 3% of its live body weight of Dry Matter.
- ✓ If a cow weighs 400 kg, then would require 12 kg DM/day
- ✓ If fed fresh/wilted to get the 12 kg DM, the animal would take equivalent of ~80 kg fresh (fresh has ~85% water)
- ✓ If fed from hay the cow would take ~14 kg of *Brachiaria* hay (hay has ~15% water)
- ✓ As rule of thumb, the feeding trough should not be empty
- ✓ Remember to provide clean drinking water *adlibitum* i.e. without limit
- ✓ In the tropics, *Brachiaria* can easily be conserved as hay which is easier for smallholder farmers, but can also be made into silage

Panicum utilization and conservation

- ✓ *Panicum* like *Brachiaria*, provide the basal roughage for energy and protein to some extent
- ✓ Feed as green chop after wilting. Chopping assist to reduce the cow selecting for the leaves only as already mentioned above
- ✓ As for *Brachiaria* or any basal diet, a mature cow can take daily 3% of its live body weight of Dry Matter.
- ✓ If a cow weighs 350 kg, then would require 10.5 kg DM/day
- ✓ If fed fresh/wilted to get the 10.5 kg DM, the animal would take equivalent of ~70 kg fresh (fresh has ~85% water)
- ✓ If fed from hay the cow would take ~12.5 kg of hay (hay has ~15% water)
- ✓ As rule of thumb, the feeding trough should not be empty
- ✓ Remember to provide clean drinking water *adlibitum*
- ✓ *Panicum* can easily be conserved as hay as opposed to silage

***Sorghum* utilization and conservation**

- ✓ Sorghum can be fed as green chop or as silage
- ✓ It should be noted that sorghum contains prussic acid which could kill the cow
- ✓ As a remedy, when feeding fresh allow proper wilting for up to 3 days and the acid level will go down
- ✓ Since sorghum is succulent, silage is the most feasible for conservation
- ✓ Making Sorghum silage also handles the prussic acid making it edible to the cows with no possibility of death
- ✓ Feeding levels as in Panicum and Brachiaria applies

***Napier* utilization and conservation**

- ✓ Napier grass Crude Protein level- (8 -10%)
- ✓ Feed Napier grass as green chop (wilt) or conserved as silage as Napier grass is succulent and not easy to dry and make hay.
- ✓ Feeding levels as in Panicum, Brachiaria and sorghum applies

***Lablab* utilization and conservation**

- ✓ Lablab is a legume and thus used for supplementation – protein source and is therefore not a basal diet
- ✓ Feeding should constitute of up to 30% of daily basal diet, otherwise contribute to bloating due to high levels of nitrogen
- ✓ Leaf has CP content of 21-38%, commonly about 26%. Much lower for stem (7-20%). Grain contains 20-28% CP. Digestibility ranges from 55-76%, commonly >60% (leaves). Grain high in vitamins A, B and C
- ✓ For conservation, it is easier to dry and make hay

Annex 1 Sources of forage seeds in Kenya

	Stockist	Forage stocked		Price Range/kg	Contact
1	Advantage crops/Tropical seeds	Bracharia varieties	Mulato II	4600	0704236777
			Cayman	5000	
			Cobra	5500	
2	Pannar Seeds/Elgon Kenya	Yellow Maize		325	0728601260
3	Hygrotech Solutions	Sorghum	Cow Candy	450	0722205148
		Lucerne		2000	
4	Royal Seed	Lucerne		2636	0800720250
5	KALRO – Lanet & Ol Joro Orok	Purple Vetch	<i>Vicia</i> spp	600	
6	KALRO – Ol Joro Orok	Lupin	<i>Lupinus angustifolius</i>	200	
7	Kenya Seeds & Simlaw	Lucerne	<i>Medicago sativa</i>	2,190	0722205144
		Desmodium		5,685	
		Boma Rhodes	<i>Chloris gayana</i>	950	
		Elmba Rhodes	<i>Chloris gayana</i>	950	
		Sudan grass		115	
		Columbus grass		115	
		Bracharia	<i>Molato II</i>	3500	
		Fodder sorghum	<i>Sorghum bicolor</i>	300	
		Maize (silage)		195	
		Sunflower		200	
Oat	<i>Avena sativa</i>	115			
8	Ikinyukia farmers group (Njabini)	Common vetch	Vetch (<i>Vicia sativa</i>)	2,000	0724492456
		Lupin	<i>Lupinus angustifolius</i>	1,000	
		Barley	<i>Hordeum vulgare</i> L	100	
		Sorghum	<i>Sorghum bicolor</i>	1,000	
9	Amiran Kenya	<i>Mulato</i>	Brachiaria varieties	5848	0719 095000
		<i>Cayman</i>		6464	
10	Leldet Kenya Ltd	Fodder sorghum	(E6518)	300 (2 kg)	
11	Coopers Kenya	Lucerne		2700/kg	

		Purple Vetch		1400/kg	0722209840
12	SPEN Youth Group	Yellow Maize		350	0712 515 285
		Desmodium		8000	
		Lucerne		5000	
		Calliandra		3000	
		Lupin		1000	
		Tree Lucerne		4000	
		Lucerne		2500	
		Sesbania		3000	
		Boma Rhodes		1000	
		Oat		5000	