A Study Guide for Livelihood Farmer Field Schools

Sustainable Livelihood Development Project in the Mau Complex

March 2010

Kenya Forest Service & United Nations Food and Agriculture Organization
About This Study Guide

This Study Guide has been prepared for Livelihood Farmer Field Schools (LFFS) under TCP Sustainable Livelihood Development in the Mau Forest Complex. Each activity or enterprise represents a learning package, which consists of the objectives, materials, possible layout, procedure and questions to discuss.

Most of the learning options are designed in combination with income generating or livelihood supporting activities to attract farmers' interests in participation.

The group members are expected to select their LFFS learning enterprise from this Activity Catalogue and develop learning plan after conducting “Learning Expectation Session”. Please, read the menu carefully and discuss among the members which option might be most appropriate enterprises in your area and worth trying through LFFS. This catalogue is supposed to help members to discover some possible solutions for livelihood improvement and environment conservation.

The guideline emphasis is on self guiding as it is written in simple straight forward language for both technical staff as well as the farmer facilitators. The implementation of this guideline shall go along way in improving the performance of different groups and shall greatly provide diversity of options for the farmer field schools not only in the project area but in other areas as well.

11th March, 2010

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1. Wood Lots for Timber

Objectives
In this trial you will compare the performance of two timber species planted with agricultural crops at a moderate spacing and crop yields during the first one or two years.

Material
Implements for land preparation and cultivation, supply of maize/sorghum/millet seeds, seedlings of species 1 and species 2 as chosen by the group, sticks, tape measure, ruler, string, note books and pencil.

Layout

Procedures
1. Select a piece of land measuring 24m by 12m with relatively uniform soil characteristics on a flat or gently sloping area. This land should be provided by one member of the group – “host farmer”.
2. Prepare the land by clearing of bushes and shrubs before the rain season starts. The land should also be ripped using oxen plough to increase infiltration of rainwater.
3. Divide the plot into two equal plots of 12m by 12m for the two (2) tree species before the rains start as shown in the layout above.
4. At the same time, divide the plot perpendicular to the first division into two equal plots of 24m by 6m for agriculture crop testing: you can compare a new variety of maize against local variety; one crop variety with manure and without; or one crop variety with fertilizer and without.

5. Stake out the two plots at a spacing of 4m by 4m before the rains start.

6. Dig tree planting holes measuring at least 30cm by 30cm wide and 30cm deep.

7. Before the onset of the rains, identify source of seedlings of the selected species, purchase and deliver them near the planting site.

8. Construct fences surrounding the plot. This will be done to ensure that the whole plot is protected from animals even after harvesting of crops.

9. After the onset of the rains, plant the tree seedlings of the two selected species as early as possible so that they can take advantage of the rains for a long period.

10. Plant the agricultural crop for the trial selected. Use the recommended spacing between rows, and seeds in a row, by agriculture extension officers in your area.

11. Weed the plot according to normal farming practice. Oxen ploughs should be used to plough the land between crops to improve water infiltration and its subsequent conservation.

12. At regular intervals during the season, monitor crop and tree growth i.e. tree survival, tree damage, tree height, crop length, number of life and dead leaves and record the observations of at least three (3) maize plants in each of the four plots of 12m by 6m. Observe pests and diseases both in trees and crops.

13. When the crops are ready, the group should meet and agree on the day to harvest.

14. From each of the four plots of 12m by 6m harvest carefully each plot separately and measure the yields from each plot and compare the yields.

15. Compare the survival and height of the two tree species selected.

Questions to discuss

• Was there a crop yield difference between the different plots?

• Was there any difference in tree height growth and survival between the two selected species in year one and year two?

• Were there any advantages and/or disadvantages of intercropping each tree species with food crops?

• What were some of the problems encountered in the establishment and management of the woodlot?
2. Wood Lots for Poles and Firewood

Objectives
In this trial, you will compare the performance of a wood fuel species planted at two different spacings. Agricultural crops like beans can be planted in both plots at different spacing to compare the yields during the first year.

Material
Implements for land preparation and cultivation, supply of beans, seedlings of wood fuel species as chosen by the group, sticks, string, tape measure, ruler, pencil and note books.

Procedures
1. Select a piece of land measuring 12m by 6m with relatively uniform soil characteristics on a flat or gently sloping area. This land should be provided by one member of the group – “host farmer”.

2. Prepare the land by clearing the bushes and shrubs before the rainy season starts. The land should also be ripped using oxen plough to increase infiltration of rainwater.
3. Divide the plot into two equal plots of 6m by 6m for two (2) tree species before the rains start as shown in the layout above.

4. At the same time, divide the plot into two equal plots of 6m by 6m for agriculture crop testing, you may compare: a new variety of maize against local variety; one crop variety with manure against without; or one crop variety with fertilizer against without.

5. Stake out one plot at a spacing of 2m by 2m and the other at 1m by 1m before the rains start.

6. Dig tree planting holes measuring at least 30cm by 30cm wide and 30cm deep.

7. Before the onset of the rains, identify where seedlings of the selected species are available, purchase and deliver them near the planting site.

8. Construct fences surrounding the plot. This will be done to ensure that the whole plot is protected from animals for a long period after harvesting of crops.

9. After the onset of the rains, plant the tree seedlings of the two selected species as early as possible so that they can take advantage of the rains for a long period.

10. Weed the plot according to normal farming practice. Oxen ploughs should be used to plough the land between crops to improve water infiltration and its subsequent conservation.

11. At regular intervals during the growing season, monitor crop and tree growth i.e. tree survival, tree damage, tree height, crop height, number of life and dead leaves and record the observations of at least three (3) maize plants in each plot of 24m by 6m. Observe pest and disease both in trees and crops.

12. When the crops are ready, the group should meet and agree on the day to harvest.

13. From each of the two plots of 6m by 6m, harvest carefully each plot separately, measure the yields from each of the plot and compare the yields.

14. Compare the survival and height of the two tree species selected.

Questions to discuss

• Was there a crop yield difference between the two plots?

• Was there any difference in tree height and survival between species 1 and species 2 after one and two years?

• What were some the problems encountered in the establishment and management of the woodlot?

• Were there any advantages and/or disadvantages of intercropping each tree species with food crop?
3. Fruit Orchards

Objectives
In this trial you shall test the performance of different varieties of fruits e.g. avocados or citrus in terms of size and quality of fruits, the flowering and fruiting time and pest and drought resistance.

Material
Implements to prepare the land and undertake cultivation, seedlings of different grafted avocado varieties, maize/sorghum/millet and bean/green grams seeds, notebooks, pencils and measuring tapes to be obtained.

Layout
Procedures

1. Select a relatively flat field of 22 by 22 metres
2. Before the start of the rains, clear the piece of land bushes and shrubs. This should also be ripped using oxen plough to increase infiltration of rainwater.
3. Mark the planting points at a spacing of 7m by 7m in 21m by 21m plot so that the plot has 9 fruit trees. Dig holes of 90cm by 90cm by 90 cm for the planting of the fruit tree seedlings. This is only applicable for avocados; for the other fruit tree seedlings, use 60cm by 60cm by 60cm as shown in the layout above.
4. At the same time, divide the plot into two equal plots of 21m by 10.5m for agriculture crop testing, you may compare: a new variety of maize against local variety; one crop variety with manure against without, or one crop variety with fertilizer against without.
5. In each fruit seedling planting hole, put a third of a 90kg bag of animal manure. Mix it with the topsoil to fill the hole.
6. Select three appropriate fruit varieties (Avocado: Hass, Fuerte, Gwen, Bacon, Pinkerton, Reed, Lamb Hass and Zutano among others.)
7. Before the onset of the rains, identify where the selected varieties of Avocado fruit seedlings are available, purchase and deliver them near the planting site.
8. Plant the agriculture crops between the rows of fruit trees using the recommended spacing by agriculturists for the area.
9. Plant pigeon peas in the outer strip of 2.5m width surrounding the plot. This will be done to ensure that the whole plot is protected from animals for a long period
10. Immediately after the onset of rains, plant the three different varieties of Avocado fruit tree seedlings each in its own row of three trees.
11. Weed the plot according to normal farming practice. Oxen plough should be used to plough the land between crops to improve water infiltration and its subsequent conservation.
12. During the growing season, monitor the crop growth rate, count the number of leaves, number of cobs, and record other observations of three (3) maize plants in each plot of 21m by 10.5m. Also monitor pests and diseases.
13. At regular intervals, monitor the fruit seedling survival, height and count the number of branches and branchlet of the fruit trees, any pest and disease problems and monitor the time of flowering for each fruit tree species.
14. When the crops are ready, the group should meet and agree on the day to harvest.
15. From each of the two (2) plots of 21m by 10.5m harvest carefully each plot separately and measure the yields from each of the sub plots.
Questions to discuss

• At what time did the different fruit varieties start flowering and fruiting?
• Is there any difference in crop yield in the first and second year? What is the probable cause?
• Which variety among the three fruit varieties performed best?
• What are the advantages and disadvantages of having different varieties of fruit trees?

4. Fodder Bank for Livestock

Objectives

In this trial you shall discover the benefits of growing fodder trees on the farm for feeding livestock. Fodder is green vegetation from trees that is harvested and fed to animals without allowing the animals to feed directly on them. This helps to ensure provision of feed to animals during the dry season.

Material

Implements for land preparation and weeding, supply of seedlings/cuttings of the two selected species and beans/green grams, sticks, notebooks, pencil, ruler and tape measure.

Layout
Procedures

1. Select a field with relatively uniform soil characteristic on a flat or gently sloping land.
2. The land should be at least 6m by 12m so that two species may be tried on plots of 3m by 12m each.
3. Before the rainy season, clear the bushes and shrubs. The plot should also be ripped using oxen plough to increase infiltration of rainwater.
4. Stake the plots for the planting spots at a spacing of 1.50m by 0.75m. Dig the holes of 30cm by 30cm by 30 cm for the planting of the fodder tree species seedlings as shown in the layout above.
5. Before the onset of the rains, identify where seedlings of the selected two species are available, purchase and deliver them near the planting site.
6. Plant beans/green grams between the rows of trees in the two plots uniformly using the spacing recommended by agriculturists for the area.
7. Construct fences surrounding the plot. This will be done to ensure that the whole plot is protected from animals for a long period after harvesting of crops.
8. After the onset of the rains, plant the fodder tree seedlings as early as possible so that they can take advantage of the rains for a long period.
9. Weed the plots according to normal farming practice. Oxen ploughs should be used to plough the land between crops to improve water infiltration and its subsequent conservation.
10. At regular intervals during the year, monitor the following in all the plots: height growth of the planted trees, survival of the trees and the number of branches. Monitor pests and diseases on both trees and crops.
11. Harvest the crops from all the plots separately and record the yields.
12. When the fodder is ready for harvesting, measure the weight of the fodder harvested in each plot every time in kilograms. Feed the same to specific number of animals and compare with the common animal feeds.
13. Do a cost benefit analysis to evaluate the advantages and disadvantages of growing the two different fodder tree species together with agricultural crops.

Questions to discuss

- Is there any difference in yield i.e. weight of material cut from the two fodder tree species, what do you think was the reason?
- What are the advantages and/or disadvantages of cutting and carrying the feed to the animals?
- Was there a noticeable health change and milk production among the animals fed on the fodder?
5. Bamboo Planting

Objectives
In this trial you will compare the performance of two species of bamboos planted with agricultural crops at a moderate spacing and also the crop yields during the first one or two years.

Material
Implements for land preparation and cultivation, supply of maize/sorghum/millet seeds, seedlings of species 1 and species 2 as chosen by the group, sticks, tape measure, ruler, string, note books and pencil.

Layout
Procedures

1. Select a relatively flat field of 16 by 16 metres

2. Before the start of the rains, clear the piece of land bushes and shrubs. This should also be ripped using oxen plough to increase infiltration of rainwater.

3. Mark the planting points at a spacing of 4m by 4m in the 16m by 16m plot so that the plot take 16 bamboos. Dig the holes of 30cm by 30cm by 30 cm for the planting of the bamboo tree seedlings.

4. At the same time, divide the plot into two equal plots of 16m by 8m for agriculture crop testing: you may compare one crop variety (maize) with fertilizer against without.

5. Select two bamboo varieties (Indigenous/Local and Exotic.)

6. Before the onset of the rains, identify where the selected varieties of bamboo seedlings are available, purchase and deliver them near the planting site.

7. Plant the agriculture crops between the rows of bamboo using the recommended spacing by agriculturists for the area.

8. Construct a fence surrounding the plot. This will be done to ensure that the whole plot is protected from animals for a long period

9. Immediately after the onset of rains, plant the two varieties of bamboo seedlings each in a 16m by 8m plot as shown in diagram above.

10. Weed the plot according to normal farming practice. Oxen ploughs should be used to plough the land between crops to improve water infiltration and its subsequent conservation.

11. During the growing season, monitor the crop growth rate, count the number of leaves, number of cobs, and record other observations of three (3) maize plants in each plot of 8m by 8m. Also monitor pests and diseases.

12. At regular intervals, monitor the bamboo seedling survival, height and count the number of new shoots and any pest and disease problems for each bamboo variety.

13. When the crops are ready, the group should meet and agree on the day to harvest.

14. From each of the four (4) plots of 8m by 8m harvest carefully each plot separately and measure the yields from each of the sub plots.

15. Crops can be planted in second year in the same manner.

Questions to discuss

• How was the yield difference between the crops planted with fertilizer/manure and without?
Is there any difference in crop yield between the first and second year? What is the probable cause?
Which variety of bamboo performed better in terms of survival and growth?

6. Tree Nurseries

a. Seed pre-treatment using water

The process of germination starts once the seeds have obtained adequate amount of water thus initiating the development of the young embryo. The intake of this water varies with species depending on the prevailing condition. In this trial, you are to learn through comparison whether pre-treating seeds with hot water or soaking them in cold water overnight improve their germination.

Treatments

- Soak seeds in cold water overnight
- Pre-treat seeds with hot water
- Control (do not soak)

Duration

1 Month

Procedures

1. Select a tree species for trial and obtain some seed of the same. Divide randomly some 300 seeds into three equal portions of 100 seeds each. Subject one portion to hot water pre-treatment; soak one portion in cold water overnight while you leave the other portion untreated. Sow the three portions under similar conditions. Check daily and water the seedbed when it is dry.

2. When germination starts, count germinated seedlings from each treatment on a daily basis and prick out.
AESA parameters
Number of germinated seedlings and time taken

Summary table

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Germination</th>
<th>No of seedlings</th>
<th>Germination %</th>
<th>Remarks</th>
</tr>
</thead>
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<tr>
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<td>1 2 3 4 5 6 7 8 9 10 11 12 13........24 25 26 27 28 29 30 31</td>
<td></td>
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<td>Hot water</td>
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<td>Cold water</td>
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<tr>
<td>Control</td>
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</tr>
</tbody>
</table>

Questions to discuss

• How many seedlings germinated in each seedbed?
• How many days did it take for the seed to start germinating in each treatment?
• How long did it take for germination to end in each treatment?
• Apart from the time of germination, is/are there any other difference(s) in the characteristics of seedlings?
• What were the advantages and disadvantages of the two different pre-treatments in terms of germination and health of the seedlings?

b. Species germination performance

After sowing of seeds of different species, some will germinate immediately while others will take some time. While delay in germination is not a negative effect, it is necessary for you to know which species germinate fast and those that are slow for planning purposes. This shall therefore guide in the future planning of nursery activities so that seedlings are retained in the nursery for as little time as is absolutely necessary to produce a health sturdy stock.

Treatments

The various commonly sown species in the locality shall be divided in two general groups. These are the slow growing and the fast growing species. They shall be sown under similar conditions in specific parts of a seedbed.

Duration

1 Month

Procedure

A seedbed shall be prepared and divided into four sections. In each section 100 seeds of a single species shall be sown. The whole bed shall have the same soil
media, watering regime and cover for shade if applied. The germinated seedling shall be counted and pricked out into the pots.

Slow growing species shall be germinated between May and June while the fast ones shall be sown between December and January.

**AESA parameters**

Number of germinated seedlings

**Summary table**

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of seedlings Germinated</th>
<th>No of seedlings</th>
<th>Germination %</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13.….24 25 26 27 28 29 30 31</td>
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<td>B</td>
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<td>C</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

c. **Difference between direct and indirect seed sowing**

Seeds can be sown either directly into poly-bags where they are maintained until they are ready to plant out in the field or they can be sown in seedbeds and later pricked out into bags. Normally the procedure used depends on the size of the seed; for very small sized seeds, it is advised that the same are sown in seed beds while the big sized ones can be sown using either methods. The objective of this trial is to determine the most appropriate sowing method for large sized seed.

**Treatments**

Direct and indirect sowing of seed

**Duration**

2 months

**Procedure**

Take 200 big size seeds of the same species and divide them into two sets of 100 seeds each. Sow 100 into individual pots and sow the remaining 100 into a seedbed. Subject the seeds to similar watering and shade if any is provided. Give time for germination to take place as observations are made regularly.

**AESA parameters**

* Numbers of germinated seed
d. Potting media effect on seedling growth

In this trial you will learn through comparison the best soil mixture to use in rising seedlings. Some soils have adequate plant nutrients while others are deficient in a number of plant nutrients. As a result some soils shall greatly improve with addition of either manure or fertilizers but others will register minimal growth improvement. You will therefore compare the growth performance of seedlings in the usual soil on the farm with seedlings of the same species grown in the same soil mixed with: manure, sand, fertilizer or a combination of the same.

Treatments

These are application of a mixture of:

- Soil, manure, sand and fertilizer
- Soil, manure and sand
- Soil and manure
- Soil only

An example of PTD experiment using different potting medias

Procedure

Assemble the materials at the nursery i.e. soil, sand, manure and fertilizer. Mix them into proper proportions. From each mixture, pot 100 containers of equal size. Transplant one hundred seedlings of the same species and size into each of the
four different batches of containers. The pricking out should be done on the same
day. All the seedlings should be given the same treatment thereafter as part of the
management. Arrange each treatment in one block for easy identification.
Monitor the growth performance of the seedlings in each treatment every week
and record the observation. Measure the height of five (5) randomly selected
seedlings in each treatment once a week.

**Duration**

2 to 3 months

**AESA parameters**

Height of seedlings and the girth

**Question to discuss**

- Which kind of problems have you observed in each treatment?
- Are there any advantages and/or disadvantages of using sand, fertilizer or
  manure in the potting soil?

**e. Species performance**

Different tree species grow at different rates under similar conditions. However,
while many species are suitable for timber production, their growth rates are quite
different. As a result some provide the products at an early age than the others.

The objective of this trial is to determine the growth rates of timber producing
species at the nursery stage.

**Treatments**

The species are Cypress, Pine, Eucalyptus and Grevillea.

**Procedure**

Assemble 50 young seedlings of relatively uniform size and age of each of the four
species: Cypress, Pine, Eucalyptus and Grevillea. Subject them to similar growing
conditions but specifically ensuring no water logging conditions prevail at any
time. Sample 5 seedlings randomly of each species during AESA taking every two
weeks.

**Duration**

3 months

**AESA parameters**

Height of seedlings and the girth
f. Shade effect

In this trial you shall test the effect of shade on the growth development of different species to determine those species that may require shade and those that can be raised in the open. You shall compare the growth development of seedlings of each species both under shade and in the open sun. The seedlings shall be tested both during the wet season and the dry season. The other nursery treatments for the seedlings such as watering, soil mixture or weeding shall be maintained the same so that the only difference is the application of shade.

**Seedlings in the open**

**Seedlings under shade**

**Procedure**

**Stage 1:** shading after pricking out for 2 months

Place ten seedlings of a specific species under shade and ten in an open area. Observe for one week and conclude the result.

**Stage 2:** shading during the dry season

Place ten seedlings of the same species as in stage 1 above under shade and ten in an open area. Water adequately to keep both treatments under the same moisture condition since the trial is to compare seedlings in the sun and those under shade and not watering frequency (obviously in open area, the seedlings may require more frequent watering)

**AESA parameters**

**Stage 1:** Survival rate

**Stage 2:** Height, girth, number of leaves, survival and a statement of their growth vigour

As these trials take a short period, the FFS may decide to try several species, one at a time to gain knowledge on the different species they encounter in their locality.
g. Types of seedling beds

There are numerous types of seedling beds in use. However, some are more appropriate for use in different climatic zones than others. In this trial, you are expected to learn the different types of bed to use in your area. Two types of beds shall be considered: these are the sunken beds and the raised beds. The other nursery conditions shall be maintained the same, which is, the species, age of seedlings, spacing, size of pots and the watering regime.

![Raised seedling bed](image1)

![Sunken seedling bed](image2)

**Procedure**

Immediately after pricking out, put 50 seedlings into each of these two beds.

**Duration**

1 month

It is possible to conclude this test even within a shorter period depending on the growth rate of the species.

**AESA parameters**

Height, girth, survival of seedlings, number of leaves

h. Different techniques of grafting

In this trial, you are expected to learn the different grafting techniques for mangoes. The main question shall be; which among the various grafting techniques is more appropriate than the others? Two grafting techniques shall be compared; these are the side or splice grafting and the top or wedge grafting. The other conditions including the size of rootstock, the source and size of scion and the general management of the grafts shall be maintained as similar as possible. For mangoes, the best season for this practice is May. The grafts shall be observed for a period of four (4) weeks.
Procedure
Select 50 rootstock of relatively the same size for two grafting treatments. Acquire 60 scions also of equal size as the root stock from a common source for mangoes. Prepare and graft 25 root stocks using top grafting and the other 25 using side grafting. Observe weekly and record the number of success.

To ensure the person responsible for grafting does not get tied doing one technique and do the other rather badly, the 2 techniques should be implemented simultaneously and the same person(s) should do the two.

AESA parameter
Number of successful grafts, number of branches developed, girth.

Questions to discuss
• Which method was more difficult and why?
• Which method was more successful and why?
• What were the advantages and disadvantages of both grafting techniques?

i. Post grafting management of seedlings
In this trial you are expected to learn through comparisons the most appropriate technique for successful grafting in as far as the covering of the grafts is concerned. The key question shall then be: do we need to cover the newly grafted seedlings with a polyethylene bag?

The treatments in this trial shall be: newly grafted seedlings covered with polyethylene bags and others not covered. The other management practices shall be maintained as similar as possible including the variety of fruits, the grafting technique and all other nursery practices.
Covered grafts  Not covered

**Duration**
21 days

**Procedure**
Graft 50 seedlings of mangoes of the same variety and cover them on top with polyethylene bags. Graft another 50 seedlings using the same batch of scions and root stock and leave them uncovered. Put all the grafts close together such that they are tended together at all times including the watering.

**AESA parameter**
Number of successful grafts

**j. Effect of age of root stock on rate of grafting success**
While undertaking grafting, it is often that the required rootstocks are not available in the nursery. These are consequently obtained from other nurseries, where they are normally remnants from the previous year’s stock (which are generally old) or the newly raised stock, which are most of the times very young and tender. The objective of this trial is to establish which is the most appropriate rootstock to use for grafting in such situations?

**Treatment**
Two types of rootstocks of the same species shall be obtained: old and young. These shall be grafted with scions from the same source and grafted using the same technique. For each batch, 20 grafted seedlings shall be prepared. All of them shall be subjected to similar nursery practices.

**Duration**
21 days.

**Procedure**
Graft 20 old seedlings of mangoes and another 20 young ones using the same batch of scions. Put all the grafted seedlings together but in a manner that is easy to identify each of them. Give the grafts similar nursery management practices.

To ensure the person responsible for grafting does not get tied doing one rootstock and do the other rather badly, the 2 rootstocks should be implemented simultaneously and the same person(s) should do the two.

**AESA parameters**
Number of successful grafts

**k. Effect of position of a seedling in a seedling bed**
This trial presupposes that the position of a seedling bed has some bearing on the tending and therefore the health of the seedling. The key question then is; does the position of the seedling in a bed affect its growth performance?

**Treatment**
A total of 144 seedlings of the same species shall be pricked out on the same day into polyethylene tubes/bags of the same size filled with the same soil medium. These shall be arranged in a 12 by 12 arrangement in a bed. The seedlings shall then be subjected to similar tending practices.

**Duration**
3 months
Procedure
After pricking out, arrange the seedlings in rows of 12 until the 12th row. Seedlings in the outer 2 rows on all 4 sides shall be considered as being in the periphery while those in the inner 8 by 8 rows shall be considered to be in the middle. Therefore, 80 seedlings are in the periphery while 64 are in the middle.

AESA parameters
Survival, height growth, girth

I. Effect of fertilizer and manure on seedling growth
The soil in our farms is normally deficient in terms of plant nutrients due to the continuous cultivation of the same. However, this is the only soil available on the farm for raising the forest trees before planting them in the field.

While the growth rate may be negatively affected by lack or limited plant nutrients, addition of fertilizer and/or manure may improve the growth rate and therefore shorten the nursery duration. The key question in this trial therefore is: is there any effect on the growth rate of seedlings as a result of adding either fertilizers or manure?

Treatment
Select 300 young seedlings of the same species, age and in similar containers. Divide them into 3 batches of 100 seedlings each. In batch 1 add fertilizer (approximately 5 gm per seedling). In batch 2 add manure (2 handfuls per seedling and then mix thoroughly with the soil and water heavily. Batch 3 shall be left as the control.

Fertilizer  Manure  Control

Duration
3 months

Procedure
Put 300 seedlings of relatively the same size in 3 batches of 100 seedlings each. Among the first batch of 100 seedlings, add fertilizer at the rate of 1 teaspoonful
per seedling. In the second batch add manure at the rate of one handful per seedling while the third batch shall be left as it is. Subsequently give similar nursery management treatments to the 3 batches

**AESA parameters:**

- Height growth
- Girth

### m. Watering frequency

The common belief among tree growers, is that watering must be carried out twice daily at all times to produce healthy vigorously growing seedlings. As a result there is a general tendency of over watering of seedlings in some situations, such as during cold period thus causing retarded growth or death of seedlings. This is especially so among pine seedlings. Consequently as tree growers, you need to know how frequently you should water the seedlings of different species.

**Treatment**

Treatments involving different watering frequency shall be applied. These are:

- Water once daily
- Water twice per day and
- Water once every other day

#### Duration

4 month

#### Procedure

Select 150 seedlings of the same species that are relatively young and of the same size. Divide them into 3 batches of 50 seedlings each.

Seedlings in batch 1 are to be watered once daily, batch 2 to be watered twice a day while batch 3 shall be watered after every other day. All other nursery practices should be maintained the same for all the three batches. For example you shall use the same water source, seedlings put in pots of same size and
watering must be done properly and at the same time (either evening or morning for all seedlings whenever it is done).

**AESA parameters**
Height growth, girth, survival

**n. Effect of root pruning on seedlings growth**

Root pruning involves the cutting back of roots of seedlings that normally develop beyond the confines of the container. It is done to ensure that the seedlings do not get established in the nursery. Therefore it remains easy to shift seedlings in the nursery from one point to the other including taking them to the field during planting. However, this operation interferes with the normal growth of the seedlings. Consequently, considering that it is essential that sturdy seedlings of the right size must be raised in the nursery, the key question is, is it necessary to root prune?

**Treatment**

After pricking out 100 seedlings into polyethylene bags, divide randomly into two groups of 50 seedlings. One batch of 50 seedlings shall be subjected to root pruning whenever the roots develop beyond the confines of the container while the other batch of 50 seedlings shall be left with no disturbance. Other nursery operations shall be maintained in a similar manner as much as is practical. During weeding of seedlings, the ones not to be root pruned should not be lifted, as this causes the roots to be severed.

**Duration**
4 months

**AESA parameters**

<table>
<thead>
<tr>
<th>In the nursery:</th>
<th>Height, girth</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the field:</td>
<td>Survival, height growth</td>
</tr>
</tbody>
</table>
7. Home Garden

Objectives
In this trial, you will test the four main species or varieties of vegetables, root crops, herbs/medicinal plants or spices, in the traditional home garden. You shall practice the propagation and management, monitor the performances and compare the production and cost effectiveness.

Material
Implements for land preparation and cultivation, seeds of several vegetables, small fruits, root crops, herbs/medicinal plants/spices, locally available organic manure, fertilizer, chemicals, tape measure, ruler, sticks, string, notebooks and pencil.

Layout
Procedures

1. In each sub-group select one favourable species to try. If there are many sub-groups intending to try the same species, it may be necessary to differentiate the subgroups by assigning different varieties of the same species and compare their performances. The facilitator shall, while respecting the members preferences, guide them not to select some very inappropriate species, which will very unlikely adapt to the environmental conditions of the particular location.

2. Select a piece of land measuring 8m by 8m with relatively uniform soil characteristics on a flat or gently sloping area near the homestead. This land should be provided by one member of the group - “Host Farmer”.

3. Members shall also enter into an agreement with host farmer on the sharing of the product after harvesting.

4. Prepare the land by clearing and hoeing before the sowing.

5. Mark and stake out the plot (8m by 8m) with sticks or poles in small four planting ridge of 1m by 4m as shown in the layout. The ridges should be along the contour.

6. Divide each row into two and agree on which side to apply manure/fertilizer and which side to be left as the control (see the layout figure). Apply manure/fertilizer into the side of the row agreed by the group.

7. Construct fence against livestock including chicken.

8. Develop seedbed separately for the species, which require it. Transplant to the rows developed. If the species do not require seedbed and the planting materials are big enough, plants directly into the rows.

9. Develop the ridges and plant the seed/seedling/planting materials. Spacing and height of rows will depend on the species selected. If you are not sure consult an agriculturalist. Each species shall be planted at the spacing recommended.

10. The group can reduce the cost of chemicals by using tobacco, Datura, hot pepper, Neem or other herbal extract, etc.

11. Weed the plot according to normal farming practice.

12. At regular intervals during the season, monitor crop growth performance i.e. height, circumference, number, width and length of leaves; number and size of corns, and record the observation of at least three plants in each plot of 4m by 1m. Observe pest and disease both in crops also.

13. When the vegetables/root crops/herbs/medicinal plants/spices are ready, the group should meet and agree on the day to harvest.

14. During harvesting, record the yields and if the produce is sold, record also the income from each side of 1m by 4m ridge and each of the four vegetable species or varieties for further cost benefit analysis.
Questions to discuss

• Was there any yield difference between the half ridge with fertilizer/manure or mixture of fertilizer and manure, and the control (the half row without manure or fertilizer)?
• What measures has the group put in place to ensure harvesting is done well?
• Were there any advantages and disadvantages of using fertilizer or manure on the yields?
• What were some of the problems encountered in the establishment and management of the garden?

8. Beekeeping

Objectives

Beekeeping is one of the most important enterprises, which generates income in the short term through production of honey, beeswax and other products (2 to 3 times a year depending on season and environmental conditions). For learning purposes, in this trial you will compare the performance of several types of bee hives: Langstroth hive, Box hive (similar to Langstroth type but without inner frame), Traditional log hive, Improved log hive with queen excluder and Kenya Top Bar hive (KTBH) to determine the most appropriate type for the members.

Material

Langstroth Beehive, Kenya Top Bar Hive or Box Hive, Local Beehive, Wire mesh (Queen Excluder), Hanging Wire, Treated Posts, Bee Suits, Smoker, Hive Tools, Gum Boots, Torch.

Layout

2 to 3 types of hives can be selected depending on the provided learning budget.
Procedures

1. At the beginning of the enterprise, you can ask members to list up all flowering plants around the site including crops and weeds e.g. Acacia, Eucalyptus, Beans, Sun flower so that they can understand the existing vegetations or resources which will benefit the bees. Since nectar and pollen are the principal diet for bees, it is good for farmers to understand which kinds of flowering plants are available in the area. Through long term AESA observations on flowers, farmers may realize and appreciate the importance of existing vegetation especially forest resources.

2. Start preparing in February or August. March and September are good months for accumulation of honey by bees because the intensity of sunlight is high during these months. March is also a flowering season for many acacia trees.

3. Site selection and Preparation: The site for an apiary should be far from human activity such as homesteads and grazing areas. The site should have shade for hives and free from weeds and bushes, which will attract ants or other bee enemies.

4. Colonization: Initially start with only the Brood Box (without Super Box) in the apiary. When the time of bee swarms in the area start (usually end of March), hang or put the hives on the trees at the height of 2 to 3 m, the usual height the traditional hives are hung. This is because swarms of bees usually fly at that height in the air. If natural forest is close to your place, you can hang the box temporarily in the forest to catch bees.
5. Transferring colonised hive to permanent site and first inspection: After 2 weeks, put down the hives at the apiary and conduct the first practical/open hive inspection. If the colony has been developed in less than 4 frames out of 10 to 11, you can conclude that it is a weak colony. In this case release the queen and hang hive again to catch another swarm. If more than 5 frames are occupied, you can conclude it is a strong colony and you can continue with the colony. [Whether a colony is strong or weak will depend on the queen’s capacity but if you leave weak colonies for a long time, this will attract wax moth which eventually destroys them].

6. Weekly AESA observation (Visual Inspection): Visual observations should be conducted during weekly AESA sessions. The following parameters are important to be considered.

   **General Site Observations:**
   - Cleanliness or sanitary condition: Weeds/grasses around the apiary
   - Activeness of bees: Whether bees are flying in and out actively
   - Pests and Enemies around: are there ants or beetles getting into the hive?
     - Ants (Preventable by hanging hive with wire smeared with grease)
     - Big Beetles (Reduce the size of entrance holes in hive)

   **Others Surrounding Environment Analysis:**
   - Availability of Flowers: Flowering Plants, Species, Quantity
   - Availability of Water: Source (Rivers, Ponds, Others), Distance

Information on which month different kind of flowers are available in the area or the phenological data of the different tree species collected by the groups will be a very good source of information for new farmers who want to start beekeeping and even for researchers.

An example of AESA sheet is shown in next page:

7. Monthly inspection: Conduct practical open hive inspection monthly. Wear bee suits properly, use smoker to reduce aggressiveness of bees. Open hives to inspect pests and diseases, count how many frames are occupied by colony. For monthly AESA, both visual & practical open hive inspection data should be recorded. Practical AESA parameters are as follows:

   **Colony assessment:**
   - Number of frames occupied
   - Pests and enemies in the Hive
   - Diseases

8. If you find that all frames in brood box are fully occupied during monthly inspection and there are many flowers around, put queen excluder and super box on the top of brood box. Only honey will be stored in the super box since the queen will not able to lay the eggs in the super box. If you find all the
frames in the first super box are occupied and again there are still many flowers are around, you could add a second super box for increased honey production.

9. The amount of honey, that is, weight produced and the prices sold from each hive will be recorded for each hive separately. The data will be summed and analysed after 6 months or one year to compare the performance of each hive in terms of quantity of honey produced and income generated.
Questions to discuss

• How many Kilograms of honey have been produced from each type of hive (calculate per year); which type produced more honey?

• Which hive produced better quality honey?

• From the different types of hives, are there any other products rather than honey that you may get in future?

• Which type of hive is easier to manage?

• Compare the cost of each hive and the quantity of honey harvested. Which is the most cost effective type?

9. Fish Farming

Objectives

In this trial you will introduce a comparative experiment either between sole species and combined species of fish in the pond.

Material

Fingerlings of Tilapia, Catfish, Fish Feeds (Initial), Fish Net

Layout

![Fish Farming Layout Diagram]
Procedures

1. Select a relatively flat site where there is permanent water at all times. Clayish soil is better.

2. Construct two fish ponds. The commercial size of fish pond should be 200 to 300m³ but for FFS practice and experiment, 4m x 4m x 1m (16m³) will be applicable. If the ponds are constructed close to each other, it will be easy to connect them together after the experiment. The depth of the pond should not be more than 1m.

3. In case the area has poromeric (porous) soil, use plastic sheet at the bottom and sides to maintain the water in the pond.

4. Consult your fishery officer to get advice especially in construction design of the appropriate pond.

5. Put fresh water into the pond. Appropriate depth will be 70-80 cm. Refill the water after the initial soaking, to the 70-80 cm depth. Leave for a few days to warm the water. For Tilapia, 24-30°C is favourable temperature.

6. Find and purchase fingerlings of Tilapia (*Oreochromis niloticus*) and Catfish (*Clarias gariepinus*) and release into the ponds according to the plan of experiment (in case of two 4 x 4m pond, 40 Tilapia fingerlings in each pond and 8 of fingerlings of Catfish in one of the ponds. Feed them with same quantity of concentrated feed several times per day or as instructed by the fishery officers in the area.

7. If two species of fingerlings are not available, release the same number of Tilapia fingerling into both ponds (in case of two 4m x 4m pond, 40 Tilapia fingerlings in each pond). Feed one pond with concentrated feed and the other with traditional feed.

8. Monitor fish and water condition every week. Sample some fish and measure them on a monthly basis.

9. After 10 to 12 months, capture all fishes and measure their weights and evaluate the results of both ponds.

Questions to discuss

- In which pond was the growth of Tilapia better? Is there any advantage of combining tilapia with catfish in the same pond?
- In which pond was the growth of Tilapia better when fed with different feeds? Is there any advantage in using concentrated feed over the traditional feed?
- Among the male and female fish, which grew faster? What kind of growth strategy can be taken to improve fish growth?
In your opinion, is fish farming really profitable considering the cost and work load involved?

10. Poultry Keeping

Objectives
In this trial you will introduce a comparative experiment either between local and grade chicken or the difference in growth of same class of chickens under traditional and modern feeding system.

Material
Day old chick (Grade layer), Chick (Local breed), Housing Material, Wire-mesh, Nails, Feeders, Drinkers, Drugs & Vaccines, Feed (Initial)

Procedures 1. Different types of chicken
1. Agree among members on which type of chicken rearing method; free range, semi-caged or full-caged the group is going to use.
2. Construct two appropriate sized cages as agreed among the members.
3. Procure same number of local and grade chick e.g. 20 local chick and 20 grade ones.
4. Feed both of them with same chick feed using the same quantity and frequency as recommended by livestock officer of the area.
5. At regular weekly intervals during the year, monitor the size and health condition among the local and grade chicken.
6. When they start laying eggs, record the number produced daily for one month.
7. Summarise the production among local and grade chicken and analyse the result and conclude.

Procedures 2. Different methods of chicken rearing
1. Agree among members on the type of chicken the group is going to raise and how many.
2. Agree among members on the husbandry methods; free range, semi-caged and full-caged, the group is going to compare.
3. Purchase agreed number (e.g. 40) of agreed type of chicken and divide into two populations (e.g. 20 + 20).

4. One group may be reared semi-caged while the other is left free ranging.

5. Feed both of them using the same diet with equal quantity of feed at the frequency recommended by livestock officer of the area.

6. At regular weekly intervals during the year, monitor the size and health condition in both groups of chicken.

7. When they start laying eggs, record the number of egg produced daily for one month by each group.

8. Summarise the production under both husbandry and analyse the results and conclude.

**Procedures 3. Different types of feed**

1. Agree among members on which types of chicken the group is going to raise and how many.

2. Agree among members on which type of chicken rearing method; free range, semi-caged and full-caged the group is going to use.

3. Purchase agreed number (e.g. 40) of agreed type of chicken and divide into two populations (e.g. 20 + 20).

4. Feed one population with the diet recommended by livestock officers while the other is reared through traditional or conventional practice.

5. At regular weekly interval during the year, monitor the size and health condition in both groups of chicken.

6. When they start laying eggs, record the number of egg produced daily for one month.

7. Summarise the production from both groups of chicken, analyse the result and conclude.

**Questions to discuss**

- Was there any difference in the period before initial egg production between local and grade chicken?
- Was there any difference in the production of eggs between free range, semi-caged and full-caged chicken?
- Was there any difference between the two different types of feeds on both local and grade chicken?
- Was there any difference in the frequency of egg production and price of eggs from local and grade chicken?
11. Dairy Animal Management

Objectives
In this trial you will introduce and experiment the cut and carry fodder grass for dairy animal feeding and evaluate the change in milk production, health condition of animals and general workload before and after introduction of the system.

Material
Napier Grass Cuttings, Fertilizers, Housing Material for making paddocks or zero-grazing unit, Nails, Drugs, Mineral licks, Vaccines, Acaricides

Procedures
1. Select a field with relatively uniform soil characteristic on a flat or gently sloping land. The land should be at least 12m by 18m.
2. Before the rainy season, clear the land of bushes and shrubs. This should also be ripped using oxen plough to increase infiltration of rainwater.

3. Before the onset of the rains, identify where the cuttings of Napier Grass are available.

4. After the onset of the rains, purchase and deliver Napier Grass cuttings to planting site.

5. Mark the planting spots in the plots and dig the holes at a spacing of 1m by 1m. Plant Napier Grass cuttings as early as possible so that they can take advantage of the rains for a long period.

6. Construct a fence surrounding the plot. This will be done to ensure that the whole plot is protected from animals at all times.

7. Weed the plot according to normal farming practice. Oxen plough should be used to plough the land between crops to improve water infiltration and its subsequent conservation.

8. At regular weekly intervals during the year, monitor the following in the plot: i.e. height growth of the planted grass, milk production and the health condition of the animal.

9. When the fodder grass has been established, harvest and weigh fodder and start feeding the animals.

10. Record milk production daily and health condition of the animals weekly.

11. Evaluate the advantages and disadvantages of feeding napier grass to milking animals.

Questions to discuss

• Was there any difference in milk production before and after feeding animals with “cut and carry” fodder grass.

• Was there any difference in the health of animals before and after feeding animals with “cut and carry” fodder grass.

• Was there any difference in the workload or labour requirement before and after starting to feed the animals with “cut and carry” fodder grass?
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