

A
Simple Guide
(Handbook)

To
On-Farm Tree Nurseries

In
Asals Kitui District:

KENYA/JAPAN
SOCIAL FORESTRY TRAINING PROJECT:

BY:

C.N. ONGW'EYA
K. YAMAUCHI

KENYA/FORESTRY RESEARCH INSTITUTE
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FORWARD:

Kenyan/Japan Social forestry Training Project has since 1987 have been collaborating with women groups, Schools, individual farmers etc. in various stages of tree planting Activities particularly establishment of small scale nurseries (on-farm tree nurseries).

Upto the beginning of the 2nd phase in 1993, the project has had upto 40 women groups and seven Primary Schools and is infact now extending its Activities to the other neighbouring locations of Kyangwithya, Matinyani, Kathivo and Nzambani.

The Project has been training the farmers, teachers, front-line Extension workers, and technical assistants mainly on the on-farm Nursery management and techniques. The Project even provide at the end of every course some seeds and polythene tubes to enable them start an on-farm nursery.

From this context it has therefore been seen necessary to come up with a simple guide on on-farm tree nurseries in ASALs with particular reference to Kitui District. This will be a simple portable handbook for use mainly by individual farmers, women groups, schools, and Technical staff in Extension services.

The same handbook could also be used by other Officers in the related Ministries/Departments, in areas that have similar climatic, soil condition like that of Kitui.

C.N. ONGWEYA
FORESTER/KEFRI



1: **INTRODUCTION:**

1:1 **Definition of forestry & Social Forestry:**

- Forestry is the Scientific management of forests for the production of goods and services for economic use and social welfare from the forests and trees.
- Social forestry is forestry for the people, of the people and by the people.

It is expected that the people themselves plant the trees, basically on their own lands for their own benefits as opposed to conventional forestry.

(a) **Benefits of forestry:**

Forests are important as it produces goods and services which satisfies man's immediate demands on daily basis.

Goods include the followings:

- | | |
|--------------------|-------------|
| - Fuelwood | - Fruits |
| - Poles | - Seeds |
| - Fittos (withies) | - Fodder |
| - Charcoal | - Dyes |
| - Timber | - Gums etc. |

Services include the following:

- Water conservation
- Soil conservation
- Climate amelioration
- Ornamentation etc.

(b) **Balance between Demand and Supply:**

- The population of Kenya is increasing very rapidly.
- This population therefore needs more goods and services from the forests.
- Our forests and trees are actually decreasing now especially in the ASAL areas like that of Kitui.
- It therefore becomes very difficult to get benefits of forests as they are either very scarce/ few or poor.

(c) **Necessities of Tree planting:**

- It is necessary for you and your children to plant trees now in order to continue to benefit from the forests and become even self reliant. See Appendix I.

1:2 Tree Nursery:

- Remember that only healthy and vigorous tree seedlings can grow up in the field.
- Tree nursery is therefore a place where we can raise healthy and vigorous tree seedlings before out planting in the field.
- Tree nursery can also be defined as a cornerstone for forestry.

1:3 How Social Forestry Training Project Helps you:

- Social forestry promotes self-help tree planting activities at grass-root levels so that rural people can enjoy the benefits of forests.
- The Project can help in offering technical guidance to the farmers.
- It also offers training for communities on tree planting techniques and management, including the nursery management & techniques as well.

2: NURSERY ESTABLISHMENT:

2:1 Why an on-farm tree Nursery:

(a) Self-sufficiency:

- Seedlings can be raised to the number and species required at the convenient time-thus time when the seedlings are required/needed.

(b) More Economical:

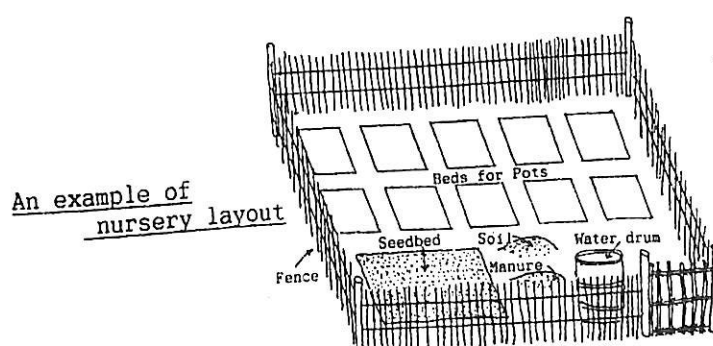
- Time and costs for transport of the seedlings are saved.

(c) Proximity:

- The nursery can conveniently be established close to the areas and need of the farmer.

(d) Higher Survival rates:

- The nursery is smaller and gets full attention of the farmer thus higher survival rates of the seedlings is expected.



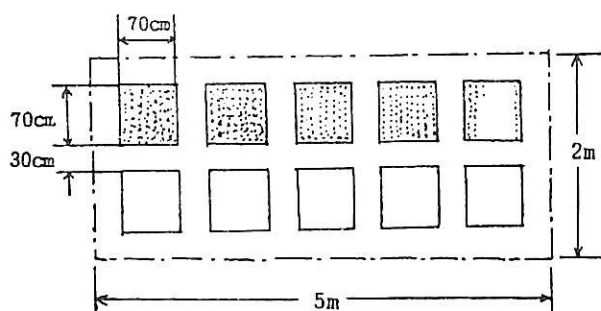
2:2 Selection of Nursery Site:

- There are several factors to be considered when selecting a nursery site.
- Out of these, the only fundamental ones for ASAL Areas like Kitui are:-

- (i) Secured & salty free water supply
- (ii) Availability of labour-Mwethya group members, School children, farmer & family.
- (iii) Level of gentle sloping and under a light shade.
- (iv) Convenient place where the nursery can be easily looked after and protected by members of the group/school.
- (v) In Arid & Semi Arid areas, most nurseries are located along the River rines where good top soil is readily available.

2:3 Scale/Size of an on-farm-nursery:

- The size of the nursery will depend on the farmers demand for tree seedlings and labour availability.
- For example if groups are to raise 1000 seedlings then they need $5m^2$ for putting seedlings and $5m^2$ for passage way i.e $5m^2 + 5m^2 = 10m^2$.
- For schools raising about 2000 seedlings, they will require about $10.0m^2$ for putting seedlings and $10.0m^2$ for passage ways i.e $10.0m^2 + 10.0m^2 = 20.0m^2$



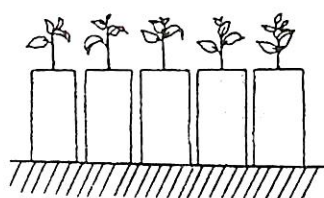
Minimum space for 1000 seedlings

2.4 When to set up an on-farm-nursery:

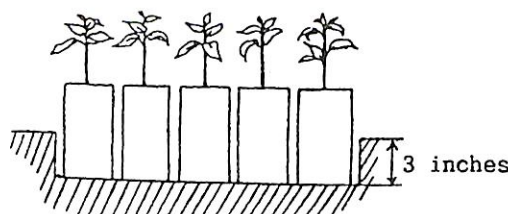
- The correct period to set up the on-farm nurseries in Kitui therefore should be between February and March every year.
- The time should also be convenient to ensure that the seedlings will be ready for out planting at the beginning of the rainy seasons in November.
- The nursery in the case of Kitui should be set up during the time the farmers have more free time to spare for this work and they are less active in the farms. See Appendix II.

2:5 Opening:

- There are only two ways of making a simple bed as has been the most common case in Kitui District.
- (a) - Just placing the polythene tubes on the flat ground. This has a disadvantage of water wastages through spilling of & evaporation, difficulty in using ash against termites.
- (b) - Having small sunken beds within which the pots filled with soil are aligned. The depth of the sunken beds is usually about 3 inches. This is actually the most recommended method in Kitui for the on-farm nurseries as they help in keeping the containers in position, ease application of Ash for termite control, ensures that there is less water wastage by **spilling off**.



(a) Flat level ground



(b) Polythene tubes within the sunken beds 3 inches deep for control of Evapotranspiration Asals

2:6 Nursery fencing:

- Fencing the Nursery strongly to keep off animals from destroying the seedlings.
- The fencing should be done using the locally available materials as twigs or thorny branches of Acacias.
- The live fencing is more recommended as it is permanent that the twigs or branches which are easily eaten up by termites and therefore needs regular replacement.
- Some of the recommended live fence species include both Exotic and indigenous trees. These are:-

- (i) Dovyalis caffra
- (ii) Caesalpinea decapitalata
- (iii) Prosopis juliflora
- (iv) Thevetia peruviana
- (v) Acacia mellifera
- (vi) Euphorbia tirucalli
- (vii) Lantana carnara etc.

2:7 Nursery tools:

- (1) Keeping the Nursery tools safely for continuous use.

The main and common nursery tools include the following:-

- | | |
|-------------------|-----------------|
| - Garden Rake | - Slasher |
| - Jembe | - Watering can |
| - Shovel | - Wheelbarrow |
| - Panga | - Pruning knife |
| - Water drum | - Soil sieves |
| - Water jerrycans | - Panga |

- (2) It is important that not all the listed tools must be made available so as to start a tree nursery. There should also be no limits to improvisation.

It is highlighted that the main stress should be a use of local materials as much as possible.

It is therefore important here to categorically say that the main few nursery implements necessary for an on-farm nursery are:-

- (1) Watering-can can be improvised by using a kimbo tin of 2 Kg with several fine holes made on the bottom.
- (2) Watery jerrycan for collecting water from the far away rivers using a donkey.
- (3) Water Drum for reserving water for use in nursery.
- (4) Jembe for making sunken beds and clearing the nursery site.
- (5) Panga for bush clearing & cutting fencing materials.
- (6) Knives for Root Pruning
- (7) Soil sieve for sieving the nearby collected nursery soil & dug manure before mixing in the ratio of 4:1 (parts of soil: dug manure).

2:8 Nursery Records:

- To be a good nursery the records as pertains the nursery tools including seeds, the dates of sowing, germination, visits, etc. should be clearly kept.
- Such are actually very important information as they can enable you to improve on what was not well previously.
- Therefore the most important books to be kept by the front-line Extension Officer in conjunction with the farmer/group/school owning a nursery should include the followings:-

(a) Visitors book-

Keeps records of visits made to the nursery and the kind of visitors and their origins, comments, recommendations etc.

(b) Nursery Diary-

Records all nursery activities carried out on daily basis, and this sometimes also indicates the number of labour force for a given operation.

Also any observations in the nursery which is worth recording is noted here. It also indicates nursery stock etc.

(c) Nursery Ledger book-

Keeps safe records of the nursery tools in the store, seeds collected, sown , and those given away. Even the balances in the stores.

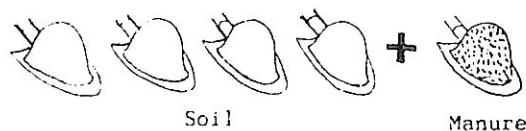
NB: Labeling in the nurseries showing the species names, dates of sowing, dates of germinations, species number etc. is also an important exercise.

3: SOWING:

3:1 Potting Soil:

- To produce good and healthy seedlings, a fertile soil is paramount. This could be collected from beneath some trees or areas where organic materials from the farm are deposited.
- This therefore calls for a good soil collection site identified in time.
- The soil should allow easy drainage and should be able to retain moisture.
- The soil is then dug using jembes after scraping off the green vegetation.
- The soil is therefore mixed with dung manure in the ratio of:

Soil	Manure
4:	1:



Soil mixing ratio

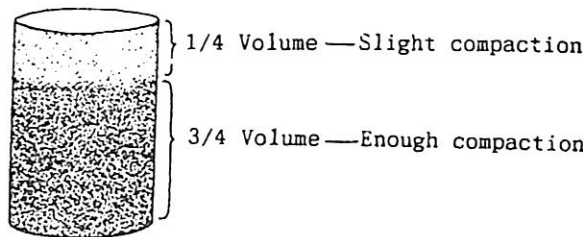
NB: This has always given us better results i.e healthy and vigorous seedlings for out planting.

- After mixing in the above ratio, it is sprinkled with water to keep it moist but not wet.

3:2

Potting in the Nursery:

- The pot sizes recommended in Kitui is that of 4 x 7 inches and is supposed to be filled with soil. Leaving a small space as if it is completely filled with soil to the brim, Some of the water will pour out with very little infiltration.
- When filling the pots with soil, please ensure that the first 3/4 volume has enough compaction while the last 1/4 volume should have only slight compaction
- Also note that the soil for filling the tubes should be moist but not wet to make ball.

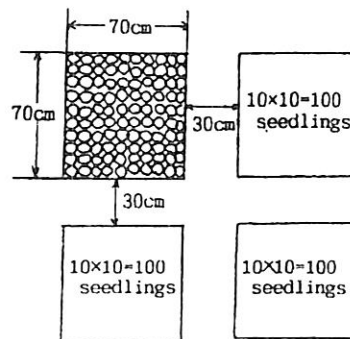


Compaction of soil in the pot

NB: - The same principle applies also to kimbo tins, milk tetrapacks, plastic containers etc.

3:3 Pot arrangements:

- The nursery should be made to run in an East-West direction so as to ensure even spread of the sun radiation all over the beds.
- The sunken beds (sometimes called blocks) each carrying 100 pots should also be made to run in the same direction.
- Each of the blocks should measure 70cm x 70cm and is enough to accommodate one hundred seedlings of 4 x 7 inches pots with passage way allowance of 30cm from one block to the next.



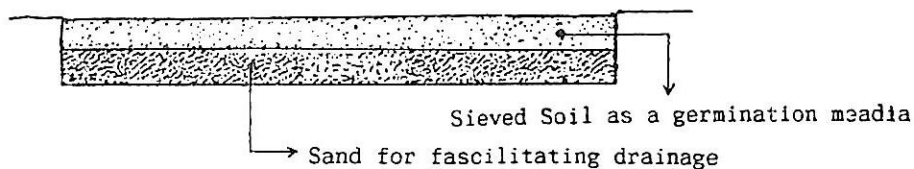
Arrangement of pots

3:5 Sowing into the seedbed:

- For all the smaller sized seeds and those of low germination percentages, use a seedbed. See appendix 3.
- After germination, transplant them into pots.
- It is important to note here that, small seeds like those of *Eucalyptus* species can only be raised in seedbed, then pricked out into the containers after a period of about 2 weeks when they will have achieved two to three leaflets. In this case the seeds have to be mixed with some sand to ensure even sowing in the ratio of 1:3 (seeds: sand) quantity.
- The normal size of a bed is 1.0m x 3.0m. This ensures a conducive working condition which is very convenient.

3:6 How to construct a simple local seedbed:

- Have the following materials:
 - Jembe
 - Shovel
 - Forest soil
 - Some sand.



Simple local seeded

NB: After putting the sieved soil, there should be some little compaction using a piece of wood.

3:7 Alternative Seedlings containers:

As is nowadays the case, the cost of clear/black polythene tubes are very expensive and not so many farmers can manage to purchase the same. The main stress is on the use of local materials which are readily available, cheap, and simple to use. This is able to ensure sustainability of the on farm nursery activities.

This has so much called for the use of the following:-

- (1) Kimbo tins
- (2) Blue band tin
- (3) Plastic oil containers
- (4) Milk packets from schools & shops i.e KCC. U.H.T.
- (5) Broken pots.
- (6) Plastic jerrycans for ornamental/ ceremonials.
- (7) Debe tins for ornamental/ ceremonials.
- (8) Banana leaves in high potential areas.

NB: When the milk packets and fat containers i.e tins are used then, they are supposed to be washed thoroughly by Omo or Aldrin solution so ensure that all fat strains are removed to lessen termite risks.

4: WATERING/SHADING/CULTIVATION:

4:1 Watering before germination:

- Before the seedlings have germinated, the amount of water required is a bit more than when the seeds have germinated.
- This is an important operation in tree nurseries and is mostly carried out by hand using a watering can. The seedlings containers should have drainage holes to avoid water logging.
- It is recommended to apply about 5 Lts - 6 Lts of water for every 100 seedlings daily in ASALs.

4:2 Watering after germination:

- After germination, 30 Litres of water per 1000 seedlings is recommended for ASAL situations like Kitui.
- This means 3 Lts per 100 seedlings per day.
- 1.5 Lts of water in the mornings and 1.5 Lts in the evenings per 100 seedlings daily is recommended.

4:3 Watering the seedlings towards planting out:

- The watering during such times should be reduced as it is the time the seedlings are supposed to be hardened off.
- The reduction should be about 2 Litres of water per 100 seedlings.
- This means 1.0 Litre per 100 seedlings in the morning and 1.0 Litre per 100 seedlings in the evening.

4:4 Recommended watering times in a day:

- Technically, it is recommended that watering should be done early morning and late evening.
- Early morning here will mean before 9:00 am.
- Late evening means after 4:00 pm when it is cool.
- Watering can be done by the use of watering can or improvised 2 Kg tin with several fine holes on the bottom.

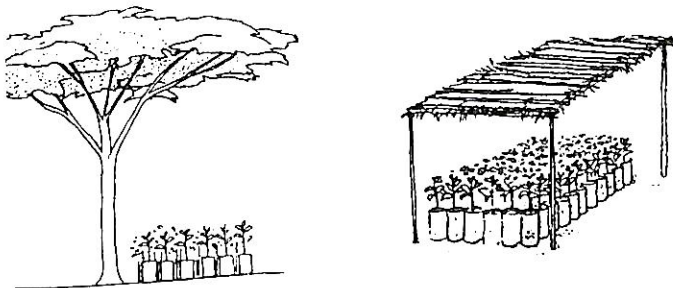
NB: Excess watering causes dislodging of seeds thus interfering with germination, as it lowers the soil temperatures, suffocates thus inhibiting germination to some extent. Water logged beds causes seed rot and encouraged fungal attack or bacterial attack resulting in poor germination.

4:5 Shading:

Shading in nurseries helps to maintain moisture conditions which improves germination and survival of seedlings. In humid areas, shading is necessary in seedbed a few weeks after pricking out. In hot arid and semi Arid areas, however, shading may be necessary for upto 2 months after germination (in directly sown containers) or after pricking out. The practice in some nurseries in dry areas is to plant trees in the nursery to provide some shade.

As the trees grow bigger & bigger, they provide too much shade, it is therefore necessary to carry out thinning and/or pruning in order to avoid overshading the seedlings.

- The shading here should be partial not complete and shaded seedlings must be removed gradually for a period of three (3) weeks before planting out otherwise they suffer great shock when taken directly from shade to the field for planting.



Shading

4:6 Cultivation:

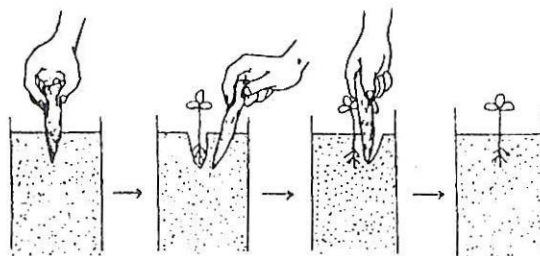
- Soil in beds or containers may tend to form a surface crust when the proportions of sand is low. Cultivation by use of dibble improves aeration and water infiltration of such soils. Great care should be taken however to avoid damaging young seedling by use of dibbles.

5: PRICKING OUT:

- When the seedlings have attained between 1-2 inches which is usually after 2 weeks, or so, depending on species, the pricking out process can be done.

Pricking out process:

- (a) - Get an empty container i.e kimbo or blue band tin.
 - Put water to about 7/8 volumes.
 - Put some sand inside it.
 - Using a dibbler stick, scoop the seedlings from the bed and put into the container holding the seedlings by the leaves.
 - Take care not to expose the roots directly to sunlight.
- (b) - Water the pots properly twice a day before pricking out.
 - Using a dibbler, make a small hole and then place the seedlings into the hole but not so deeply.
 - Give reasonable compaction by finger.
 - Do the same for all other seedlings.
 - After compaction, water the seedlings i.e. 100 seedlings for 3 Litres of water.
 - Ensure there is partial shade for about 2 weeks.
 - Remove the shade after 2 weeks so as to ensure enough sunlight for food manufacture i.e photosynthesis.



Pricking out

6: WEEDING IN THE NURSERY:

- Weeds are undesirable plants that compete for water and nutrients. They should thus be removed as soon as they appear.
- In small nurseries, this may be done manually.
- However the whole exercise may be drastically reduced by inducing weed germination through water and once initial weed growth has taken place, remix the soil and thus killing the germinated weeds. This should be done before putting the soil in the containers.
- After removing the weeds immediately they appear, regular checks should be made or is necessary.
- If the weeds are too big then we are supposed to use the dibble for careful removal.

7. TERMITE ERADICATION IN ON-FARM-NURSERIES

For termite eradication the locally available materials recommended include:-

- (1) Use of Ash
- (2) Use of used, Engine diesel oil
- (3) Use of pepper, urine, old battery, Tobacco nicotine etc.
- (4) Use of crushed leaves and seeds of both *Azadirachta indica* and *Melia azedarach*, a solution of which is used for watering the seedlings.
- (5) Wood vinegar.

8: ROOT PRUNING:

- The group members/farmer/schools should be keeping watch on seedlings root development into the soil by regular lifting up.
- Once noticed then root pruning becomes necessary.
- The purpose of root pruning is normally to prevent development of the long tap roots and promote growth of fibrous roots. It is important to water the seedlings heavily before and after root pruning.
- Root pruning is normally done by a taunt wire for underneath and sharp knife for side pruning in boxes or Swaziland beds. In tube stock a sharp knife is used. However even lifting or shifting the tubes or moving containers as if re-arranging them has been found to be an effective way of underneath root pruning.
- The pruning knives should be sharp and the process done once every two weeks.



Root prunning

9: **HARDENING OFF:**

- This is a technique used to re-condition the seedlings to field conditions. It exposes the seedlings to hard conditions in the field before they are planted out in the field.
- The main purpose of this exercise is to make the seedlings resistant to the difficult field conditions in Semi arid and Arid Areas.
- This technique is done by gradual reduction of the quantity of water applied, by removal of shade, arranging seedling put in one, two, or three lines, by partial lifting or frequent root pruning.

(b) For termite eradication the locally available materials recommended include:-

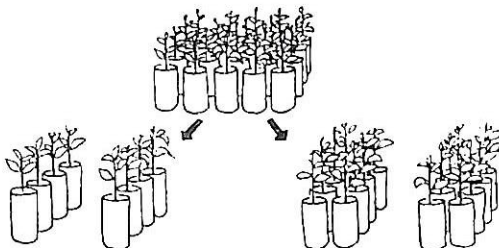
- (1) Use of Ash
- (2) Use of chicken droppings
- (3) Use of used, Engine diesel oil
- (4) Use of pepper, urine, old battery, Tobacco leaves etc.
by partial lifting or frequent root pruning,

(b) For termite eradication the locally available materials recommended include:-

- (1) Use of Ash
- (2) Use of chicken droppings
- (3) Use of used, Engine diesel oil
- (4) Use of pepper, urine, old battery, Tobacco leaves etc.

- Seedlings grown in the open beds and which have not been pruned before can be hardened by partially pulling them, several weeks before planting. Heavy watering should always be done just before planting out hardened seedlings.

- Hardening off should be done about 4 weeks or one month before planting out.



Re-arrangement of pots

10: OUT PLANTING:

- Seedlings must be in their best forms. Therefore the weak, stunted ones should be left in the Nursery (culled) and only the health ones used in the field. This will ensure better survival in the field hence good performance.

10:1 When to out plant:

- Tree seedlings require sufficient moisture build up. It is therefore best to do out planting at the beginning of the rainy season, after the first one or two heavy showers. It should be done in the early morning or in the evening when it is cool.
- In Kitui this is done during November long rains.

10:2 How out planting is done:

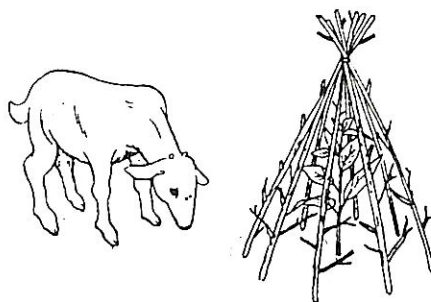
- Planting pits or holes of reasonable and recommendable sizes in ASALs i.e (diameter x depth) 45cm x 45cm or 30cm x 30cm must be prepared in time.
- Seedlings are then carefully transported to the planting site. The top soils should have been refilled within the first to second heavy rains.
- The pot or any other container is carefully removed and the seedlings are placed in the holes, then covered upto the original soil level.
- The soil is packed around the seedling to remove any air pockets by foot.

10.3 Recommendable seedling sizes:

The recommended seedling size is usually between 30cm - 50cm.

11: SEEDLINGS PROTECTION:

- Once you have planted your seedlings, care must be taken to protect them particularly from Livestock.
- This is done by individual tree seedlings fencing using twigs or branches of thorny Acacias.
- This keeps off the animals until they have attained a bigger size or height that the animal cannot be able to destroy the tree, then the twigs/branches can be removed and used as firewood.



Fencing individual seedling

12: Appendix I:

Below find a list of species preferred by the farmers and the purposes for which they are used:

Nos.	Botanical names	Local names	Uses
1	<i>Acacia albida</i>	Olasiti	Agroforestry/fodder
2	<i>Acacia melifera</i>	Muthia	Hedge/fuelwood
3	<i>Acacia nilotica</i>	Musemei	Medicinal/firewood
4	<i>Acacia polyacantha</i>	Musewa	Fodder/firewood
5	<i>Acacia gerardii</i>	Muthii	Firewood/fodder/water catchment
6	<i>Azadirachta indica</i>	Mwaluvaini	Medicinal/shade/ornamental
7	<i>Cassia siamea</i>	Ikengeka	Poles/firewood/shade
8	<i>Cassia spectabilis</i>	Ikengeka	Ornamental/shade
9	<i>Croton megalocarpus</i>	Muthulu	shade/timber/medicinal
10	<i>Casuarina equisetifolia</i>	Mvinji	Poles/windbreak/Agroforestry
11	<i>Dalbergia melanoxylon</i>	Mvingo	Wood carving/timber
12	<i>Delonix regia</i>	Mjohoro	Shade/ornamental
13	<i>Dovyalis caffra</i>	Kayava	Hedge/live fence
14	<i>Eucalyptus camaldulensis</i>	Musanduku	Poles/timber
15	Fruit trees e.g. Pawpaw, mangoes, guavas, lemons, passion fruits e.t.c.		Fruit production
16	<i>Grevillea robusta</i>	Mkima	Agroforestry/fooder/poles/timber/soil enrichment
17	<i>Leucaena leucocephala</i>	Lusina	Agroforestry/fodder/firewood
18	<i>Melia volkensii</i>	Mukau	Timber production
19	<i>Melia azadirach</i>	Mukau	Medicinal/shade/poles
20	<i>Parkinsonia aculeata</i>	Musoka	Hedge/live fence
21	<i>Sesbania sesbans</i>	-	Agroforestry/fodder
22	<i>Terminalia brownii</i>	Muuku	Medicinal/timber/shade/ornamental
23	<i>Tamarindus indica</i>	Muthumula	Fruit/shade
24	<i>Terminalia mentalis</i>	Mwavuli	Ornamental/shade
25	<i>Thevetia peruviana</i>	-	Hedge/live fence

Appendix II:

Below find a nursery calendar for groups & Schools in Kwavonza, Kathivo, Changwithya, Matinyani & Nzambani locations in Kitui District.

Time of year	Activities to be undertaken	Remarks
January/February	Watering, pruning and other general maintenance of the few seedlings left in the small scale nurseries. Local seeds collection by groups and schools is carried out. Preparation of the nursery sites. Preparation of polythene tubes, collection of milk packets, tins etc. is carried out. Sorting out of seeds to be distributed to the small scale nursery participants.	
March	Distribution of seeds, polythene tubes to the schools and groups participating. Preparation of nursery soil, compost manure of proper mixing in the ration of 4:1 respectively. Repair of old nursery tools. Potting starts and the following seeds are directly sown: 1. <i>Cassia siamea</i> . 2. <i>Cassia spectabilis</i> . 3. <i>Grevillea robusta</i> . 4. <i>Parkinsonia aculeata</i> . 5. <i>Tamarindus indica</i> . 6. <i>Caesaphinea decapitalata</i> . 7. <i>Casuarina equisetifolia</i> . 8. <i>Delonix regia</i> . 9. <i>Melia azaderach</i> . 10. <i>Terminalia brownii</i> . 11. <i>Schinus molle</i> .	
April	Complete potting work. Continue sowing the following seeds for the species below: 1. <i>Prosopis juliflora</i> . 2. <i>Terminalia mentalis</i> . 3. <i>Croton megalocarpus</i> . 4. <i>Acacia species</i> . Planting of seedlings previously left in the nurseries. Sowing fruit tree seeds like: 1. <i>Carica papaya</i> . 2. <i>Psidium guajava</i> . 3. <i>Passion fruits</i> . 4. <i>Citrus sinensis</i> . 5. <i>Citrus lemon</i> . Other nursery routine activities continue being carried out.	
May	Sowing of the following species: 1. <i>Acacia polyacantha</i> . 2. <i>Dovyalis caffra</i> . 3. <i>Eucalyptus camuldulensis</i> . 4. <i>Leucaena leucocephala</i> . 5. <i>Sesbania sesbans</i> 6. <i>Sesbania grandiflora</i> . Priking out of <i>Eucalyptus species</i> from seedbeds. Other nursery routine work continue.	
June	Nursery routine activities ie. watering, general maintenance and may also include root pruning.	

July	Routine nursery activities continue
August	Nusery routine work continue
September	Nursery routine work continue
October	Evaluation of performances of the groups and school nurseries by the project staff. Hardening up process by less watering, frequent root pruning and creating space in lining up the seedlings. Pitting is done by the group members in their various homes and the schools pupils within their schools compounds. Other normal nursery activities continue. Complete potting work.
NOvember	With the onset of the long rains, the seedlings are distributed accordingly and planted.
December	Follow-up survey exercise of the seedlings planted by the schools and group members is carried out. Determination of the seedlings left in the small scale nurseries and taking care of the same.

- NB:
- Slow growing tree species are to be sown first.
 - Fast growing species are sown later.
 - The recommended plantable height is 30cm - 50cm tall.
 - There is little work during December and January.

Appendix III:

As has been outlined in the previous chapters that most of the tree species in Kitui (ASALs) are raised from direct sowing, it is therefore important to have a list for reference purposes showing those species raised from direct sowing and those which can as well be raised from seedbeds.

The following species can be raised from direct sowing.

- *Acacia polyacantha*
- *Acrocarpus fraxinifolia*
- *Azadirachta indica*
- *Caesalpinea decapitalata*
- *Cassia siamea*
- *Cassia spectabilis*
- *Carica papaya*
- *Croton megalocarpus*
- *Melia azadirach*
- *Parkinsonia aculeata*
- *Sesbania sesbans*
- *Sesbania grandiflora*
- *Tamarindus indica*
- *Terminalia brownii*
- *Terminalia mentalis*
- *Schinus molle*
- *Casuarina equisetifolia*

Whereas the followings are raised from seed beds and then pricked into the pots:

- *Prosopis juliflora*
- *Dovyalis caffra*
- *Jacaranda mimosaeifolia*
- *Leucaena leucocephala*
- *Schinus molle*
- *Sesbania sesbans*
- *Terminalia mentalis*
- *All Eucalyptus species*
- *Casuarina equisetifolia*
- *Melia volkensii*

Appendix IV: Seed sowing and sowing schedule:

The time for sowing a specific type of seed depends very much on the duration it takes to attain plantable size. It is important that seeds are sown in time so as to attain recommendable plantable size of 30-50cm tall in ASALs and this must be by November every year. The following sowing schedule should therefore be adhered to and it only deals with most preferred species in Kitui district.

SEED SOWING SCHEDULE

No. of months before planting out	Species names
11 months before planting out	Azadirachta indica Terminalia brownii
10 months before planting out	Cassia spectabilis
9 months before planting out	Acacia gerardii Acrocarpus fraxinifolia Delonix regia Grevillea robusta Mellia azadirach Terminalia mentalis
8 months before planting out	Caesalpinea decapitalata Cassia siamea Parkinsonia aculeata
7 months before planting out	Acacia albida Acacia polyacantha Casuarina equisetifolia Melia volkensii Prosopis juliflora Sesbania grandiflora
6 months before planting out.	Dovyalis caffra Eucalyptus paniculata
5 months before planting out	Eucalyptus camaldulensis Eucalyptus tereticornis Leucaena leucocephala Passion fruits Carica papaya
4 months before planting out	Sesbania sesbans

Appendix V:

Sometimes it is necessary to carry out pre-treatments for the seeds to be sown so as to facilitate germination. The below table therefore shows the outcome of pre-sowing treatments to various species carried out at Tiva nursery.

Pre-sowing treatments applicable to various tree species:

SPECIES	PRETREATMENT	GERMINATION (%)
1. <i>Acacia abyssinica</i>	80°C for 15 minutes	78
2. <i>Acacia albida</i>	80°C for 3 minutes	39
3. <i>Acacia gerrardii</i>	Cold water 12 hrs.	75
4. <i>Acacia holoicilica</i>	80°C for 7 minutes	86
5. <i>Acacia mearnsii</i>	80°C for 7 minutes	69
6. <i>Acacia nilotica</i>	Nipping	50
7. <i>Acacia polyacantha</i>	80°C until water cools	77
8. <i>Acacia tortilis</i>	Nipping	73
9. <i>Acrocarpus flaxinifolia</i>	Nipping	60
10. <i>Azadirachta indica</i>	Not necessary	95
11. <i>Bombax rhodoghaphalon</i>	80°C for 2 minutes	57
12. <i>Caesalpinia decapetala</i>	60°C for 3 minutes	75
13. <i>Cassia siamea</i>	60°C for 20 minutes	92
14. <i>Cassia spectabilis</i>	80°C for 10 minutes	68
15. <i>Casuarina equisetifolia</i>	Not necessary	90
16. <i>Croton megalocarpus</i>	Not necessary	99
17. <i>Eucalyptus spp.</i>	Not necessary	90
18. <i>Jacaranda mimosefolia</i>	Not necessary	69
19. <i>Leucaena leucocephala</i>	60° for 15 min.	96
20. <i>Melia volkensii</i>	Nipping	27
21. <i>Parkinsonia aculeata</i>	80°C for 3 minutes	86
22. <i>Phoenix reclinata</i>	60°C for 15 minutes	18
23. <i>Prosopis juliflora</i>	80°C for 15 minutes.	84
24. <i>Sesbania grandiflora</i>	Cold water 12 hrs.	74
25. <i>Sesbania sesban</i>	Not necessary	86
26. <i>Tamarindus indica</i>	60°C for 3 minutes	95
27. <i>Terminalia brownii</i>	Nipping	39
28. <i>Terminalia catappa</i>	60°C for 3 minutes	90
29. <i>Terminalia mentalis</i>	80°C for 15 minutes	49
30. <i>Terminalia prunioides</i>	Nipping	5
31. <i>Terminalia spinosa</i>	80°C for 3 minutes	13

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