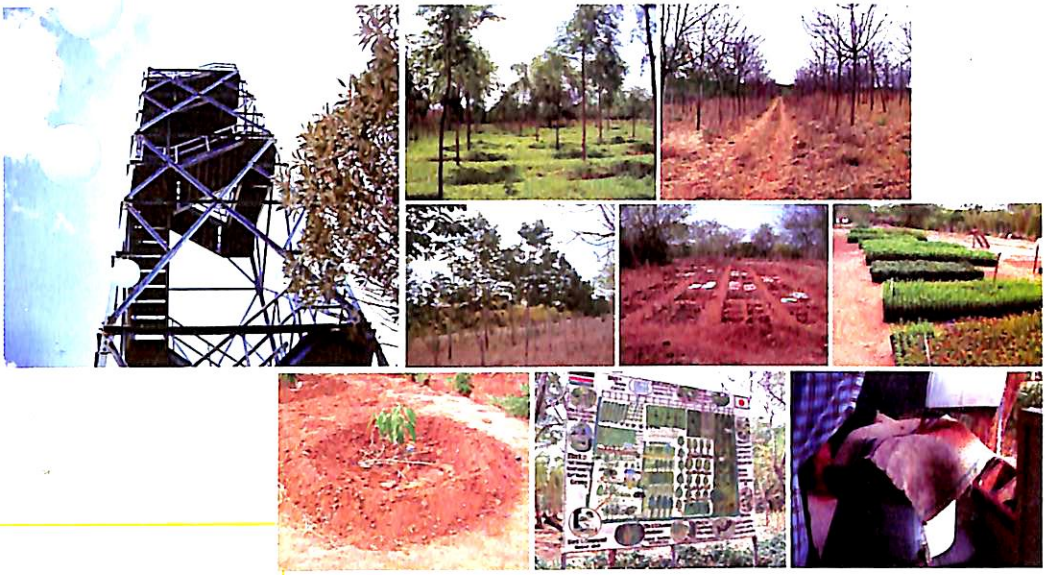
Tiva Forest Demonstration Guide

ISFP Technical Guide Series No . 1



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Intensified Social Forestry Project in Semi-arid Areas (ISFP) , Kenya

ISFP Technical Guide Series

Intensified Social Forestry Project in Semi-arid Areas (ISFP) aims at improving the living standard of the people in semi-arid areas while enhancing sustainable environmental conservation. The objective is being achieved through capacity building of the Forest Department, promotion of its extension activities, development of practical knowledge and techniques and information sharing among the stakeholders.

Technical guide series No.1 'Tiva Forest Demonstration Guide' introduces the achievements of Tiva pilot demonstration forest, which had been attained during SOFEM and current activities being improved by ISFP, from various technical points of view.

Objectives of this technical guide series are to disseminate and share project outcomes and generated knowledge, as well as promote our principles on sustainability and project ownership among stakeholders. Any comments and interaction are welcome from you. We would like to walk together with you towards appropriate intensification of social forestry.

Yuichi Sato
ISFP Chief Advisor

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Introduction

Dry areas of this country account for approximately 80% of the total land area. They exhibit severe climatic conditions which generally hinder the application of forestry technologies developed in and for high potential areas. However, it is the vision of Kenya Forestry Research Institute (KEFRI) that woodland resources in the dry areas of Kenya are managed on a sustainable basis. The main objective of this guide is to facilitate visitors to our Tiva Dryland forest to appreciate the various technologies developed and demonstrated in it to enhance tree planting.

The guide contains a map showing the locality of different technologies and a brief history of the forest. It has three main areas: the nursery; the demonstration plot; and the field. In the nursery, three activities are highlighted. These include mass production of *Melia volkensii* through the various stages of processing the fruits; verification of traditional methods of raising melia seedlings; and finally the initial steps of establishing melia hedgerow to facilitate mass production of superior seedlings using cuttings.

In the demonstration plot, the kitchen has three technologies. These are the traditional water filter, the improved cooking stove and the evaporative charcoal cooler. The farm part of the plot highlights the water harvesting micro-catchments and the establishment of mulberry seedlings.

Further in the field, several activities are demonstrated. They include: the indigenous fruit trees of the drylands; management trial of *Dalbergia melanoxylon*, a plot comparing conservation tillage and traditional cultivation; and melia pilot plantation. In addition, there are trials on establishment of *D. melanoxylon* using water retention chemical (Terra Cottem [TC]); spacing trials of *M.volkensii*, *Eucalyptus camaldulensis* and *Acacia senegal*; and finally a trial on the performance of hybrids of *Eucalyptus grandis* and *camaldulensis* in the dry areas.

The various activities in this guide are presented through photographs and brief explanations. Wherever necessary, graphical illustrations are provided to enhance the appreciation of the activity or technology.

It is the intention of KEFRI that these activities shall not only provide useful scientific information, but shall also act as demonstration plots to inspire the many visitors to Tiva to engage in tree planting on their farms which are found in similar conditions.

Tiva forest

Tiva is situated in Kwa vonza location, Yatta division of Kitui district in the Eastern Province. It is 21 km north-west of Kitui along the Nairobi-Kitui road. The forest lies between longitude 37^0 47' E and 37^0 52'E; and between latitude 1^0 19'S and 1^0 22'S at an altitude of 1000 to 1200 meters above sea level.

The forest has an area of 1150 hectares situated in two blocks: the eastern and western blocks covering approximately 820 and 330 ha respectively.

The site has a rolling terrain without a distinct drainage system. Water scarcity is a major impediment to most tree establishment activities.

The soils have a course sandy texture with a moderate to shallow profile. Their water holding capacity is quite poor and erosion over time has reduced the effective soil depth considerably. Moisture stress and soil management are critical for effective tree establishment. The shallow soil depth has far reaching effect on tree establishment as it forces the tree crop to subsist on the shallow soil profile which often becomes dry.

Tiva station receives a bimodal rainfall pattern. The long rains occur between March and May while the short rains are between October and December with a peak in November. Records kept over ten years show that the area receives an average rainfall of 670 mm ranging from 237 mm to 1120 mm. Temperatures range between 20^0C and 30^0C. The short rains are however more reliable as there is a shorter dry period before the onset of the long rains than from the long rains to the short ones.

The woodland is dotted with a number of species and provenance trials where over 50 indigenous and exotic tree species have been tried over time. Management of soil moisture through improved infiltration and reduced evaporation have facilitated successful establishment of trees as portrayed in the past land preparation, weeding and mulching trials.

Tiva pilot forest map

Acacia senegal
spacing trial

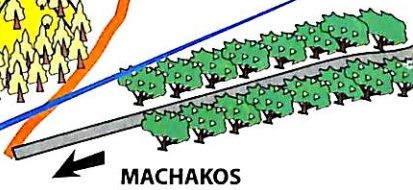
***Melia volkensii* spacing Trial**

Eucalyptus **Hybrid**

Eucalyptus camaldulensis
spacing trial plot

Dalbergia melanoxylon
establishment trial

Kwavonza Hill



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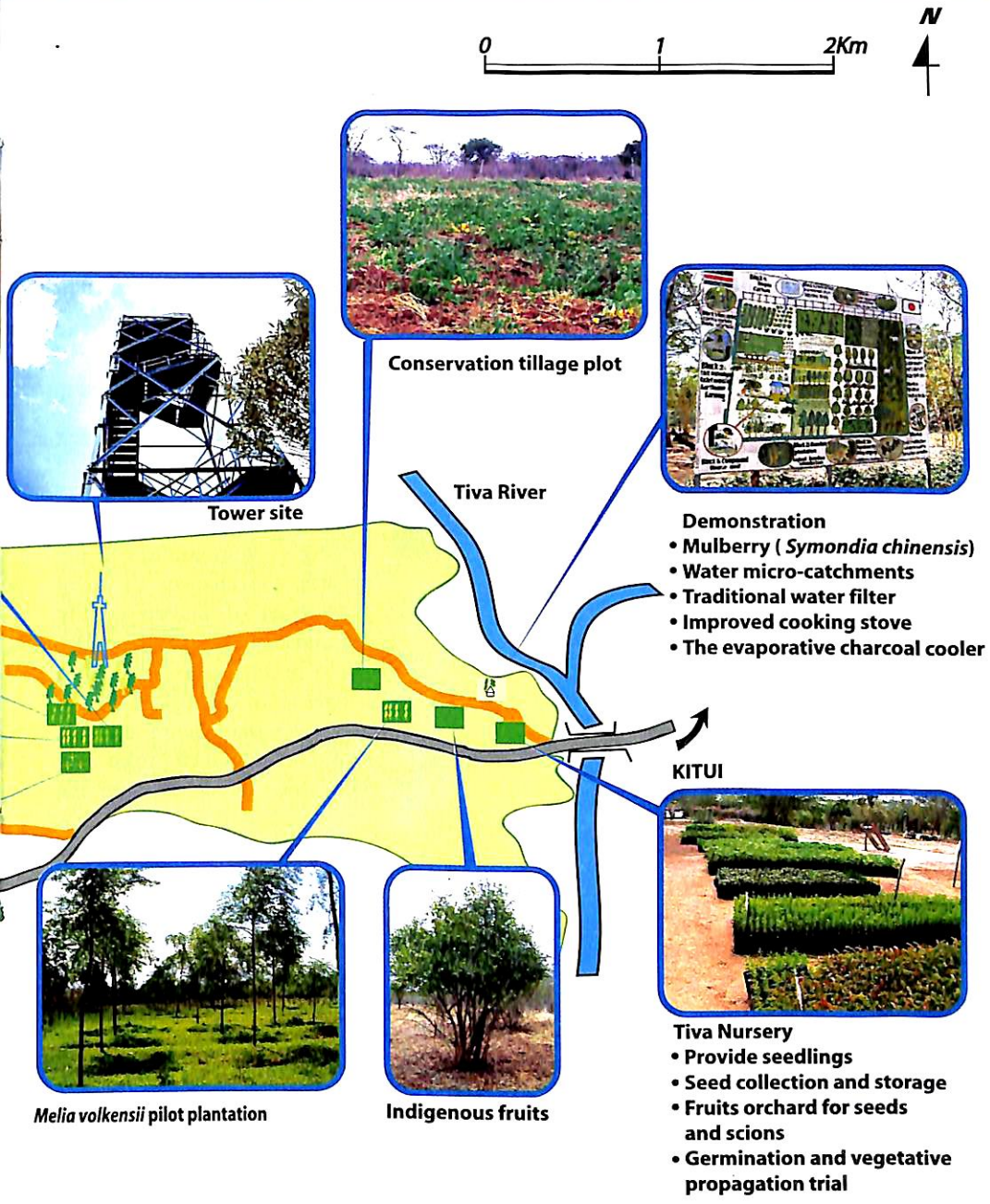
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Conservation tillage plot
Tower site
Tiva River
Demonstration
• Mulberry (Symondia chinensis)
• Water micro-catchments
• Traditional water filter
• Improved cooking stove
• The evaporative charcoal cooler
KITUI
Tiva Nursery
• Provide seedlings
• Seed collection and storage
• Fruits orchard for seeds and scions
• Germination and vegetative propagation trial
Melia volkensii pilot plantation
Indigenous fruits

Improvement of Melia volkensii

Above : Grafted melia seedlings

Below : Water tank to irrigate hedges of melia established from cutting

Left : Rooted melia cuttings established under drip irrigation

So far the raising of *Melia volkensii* seedlings has depended on the general collection of seed from trees on farms and in the wilderness. Usually this has been from the goat sheds where regurgitated nuts are collected. This procedure does not allow the use of seed of known quality as goats feed on all fallen fruits wherever they are grazing. With improvement of rooting of stem cuttings of the species, the chances of using germplasm of known quality are enhanced. It was therefore found necessary to establish a hedgerow of cuttings of known origin so that future cuttings shall be obtained from the same for establishment of the future plantations. However, if conditions of raising rooted cuttings are limiting, it is possible to use grafted melia scions from known origin to establish clonal seed orchards for improved seeds.

Verification of traditional methods

Above : Experimental site at Tiva research and demonstration station

Using a range of studies, KEFRI has been able to improve the production of the tree seedlings. This development could theoretically increase the planting of *Melia volkensii* by farmers. However, surveys carried out on the farms have indicated that farmers are still unable to achieve adequate number of seedlings for their planting but are raising some using different methods.

KEFRI in collaboration with Intensified Social Forestry Project (ISFP) conducted a survey in 2004 to document traditional methods used by farmers to germinate Melia seeds in Kitui, Mwingi, Taita Taveta, Mbeere, Makueni and Tharaka districts. Four common methods were identified, namely: scarification through burning of the nuts; use of troughs with manure; cracking of nuts; and use of long-term beds. It was necessary to validate these methods through on-station research in order to determine their effectiveness and explore possibilities of improving the promising ones.

Six treatments replicated 4 times using 3 provenances were tried at Tiva. Investigations were carried out on the following.

1. Scarification by burning with dry grass
2. Burying the nuts with manure
3. Cracking of nuts and sowing them
4. Scarification combined with trough and manure
5. Scarification combined with cracking
6. Source of seed (provenances)
7. State of the nuts (fresh and those from the goat shed)

Initial observations indicate that cracking and scarification by burning showed some slight germination. Use of troughs and burying the nuts in manure has so far not resulted in any germination.

Melia volkensii propagation

1

Above : Mature Melia fruit

Mature melia nuts are collected from up the tree or on the ground. They can also be obtained from goat shed where depulped fruits are regurgitated by the animals.

2

The seeds of melia must be extracted from the fruits through breaking the hard nut cover. KEFRI has already developed and fabricated an equipment that has improved the quantities of sound seeds one can process.

Above : Melia seed extractor

Right : Extraction of melia seeds

3

The extracted seeds are pretreated before sowing in clean river sand. The pretreatment involves nipping the seed cover and then soaking in cold water for 24 hours. The soaked seeds are then slit through the two seed coats and sown.

Left : Separating seed from clean nuts

4

Melia seeds require humid warm conditions for germination to occur. This is provided by watering the sown seeds heavily and covering them with a polyethylene sheet. Additional watering may not be necessary.

Sowing of Melia seeds is done in a humid non-mist propagator where temperatures are relatively high. Germination takes place after 7days.

5

Seven days after sowing majority of the seedlings have germinated.

6

Pricked out seedlings are kept in the shade and slowly exposed to direct sunshine over time. Excessive watering of melia seedlings may cause death due to damping.

Melia seedlings are pricked out not more than 2days after germination.

Right : A green house provide the right enviroment for seedling growth

7

Immediately after pricking out, seedlings are kept in the green house away from direct sunshine.

8

Then after the seedlings are kept such that they receive sun shine only half of the day.

9

One month after pricking out the seedlings are strong enough to be exposed in an open nursery.

Tiva demonstration plot

Tiva on-station farm forestry demonstration plot is a technology transfer tool that has been utilised since 1988 by KEFRI/FD/JICA technical cooperation. The plot was expanded under the Social Forestry Extension Model Development Project (SOFEM) that ended in 2002. A survey carried out at the end of the project identified technologies that were popular for scaling up. Other new technologies that are appropriate were also recommended for introduction in the plot.

The demonstration plot occupies an area of 0.9 ha and accommodates five technological themes. These are: production of high value fruit tree seedlings; homestead management; agri-silvi-pastoral practices; woodlots of high value tree species; and basic household nutrition improvement.

Among the fruit trees are the grafted mangoes and citrus, and *Sclerocarya birrea* (Amarula). The home set up has the basic components of filtering the usually muddy dirty water; efficient use of wood fuel, traditional method of cooling water and preserving vegetables in absence of the modern refrigeration facilities.

Above : Demonstation pilot layout between 1997 and 2002

Mulberry (*Symondia chinensis*)

Above : Mullbery seedlings established between rows of beans. Note the bottles used to water the seedlings

Mulberry (*Symondia chinensis*) is an important tree species that remains green throughout the dry season in the arid areas. It is a tree whose foliage is normally used for rearing silkworm, but can also be given as forage to other livestock such as goats, sheep and cows. Its berries are edible.

The tree is quite easy to raise from stem cuttings without using any rooting hormones. Rooting of the cuttings is more profuse among the moderately medium sized ones with diameter of around 1 cm. While attempts should be made to put the cuttings in the pots immediately they are cut, delay of up to 5 days under shade does not affect the cuttings substantially. It is quite easy to establish the rooted cuttings with minimal watering even during the dry season.

Right : Mullbery seedlings during a dry season

Water micro-catchments

Water harvesting structures such as micro-catchments enhance the performance of trees by collecting surface runoff and concentrating it around the root zone of the planted trees. There are different types of micro-catchments:

Above : V - shaped micro-catchment

(1) V - shaped micro-catchments

This is a V shaped basin with two adjoining arms at about 90° of about 2m with raised embankments of 30cm. They are normally recommended on gentle slopes with well-drained soils. They are easy to construct, applicable in more arid areas and in the event of heavy rains, they are able to release excess runoff.

However, these structures require regular maintenance, and are less effective on steep slopes as they easily break if they collect a lot of runoff. In case of such an occurrence they may also cause soil erosion as the water runs down. Wide shaped structures collect more water but they also require strong embankments. When weeding is done using oxen plough, the plough breaks the structures.

Above : W - shaped micro-catchment

(2) W - shaped micro-catchments

They are constructed by continuously connecting V-shaped catchments along the contour. They provide good results on gentle slopes with well-drained soils. They are highly effective in runoff retention and control of soil erosion. They are recommended in areas with low rainfall as they trap all the runoff. To guard against the breaking of the embankment, strong barriers are necessary in case of unusually heavy rains.

Left : Construction of a V-shaped micro-catchment in the field

(3) Circular shaped catchments

These are normally used in relatively flat areas and therefore no runoff can develop. They are constructed such that the area inside is slanted towards the centre where the seedling is planted. It is necessary to mulch the base of the seedling to ensure the collected water does not evaporate into the atmosphere.

Above : Circular shaped catchments

(4) Bottle watering

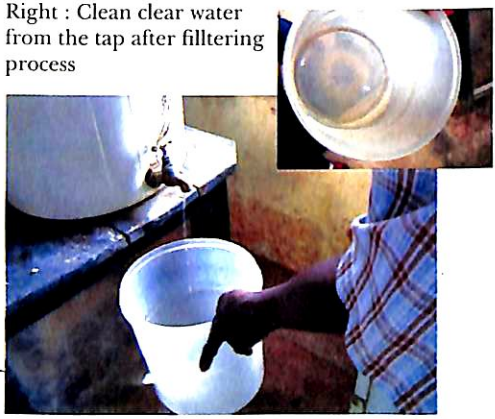
During drought it may be necessary to water some young trees to ensure their survival. This is achieved by supplying water to the plant directly to its roots using a bottle. A small hole is made on the lid of the bottle while its back is opened to allow putting of water. The bottle is then inserted into the soil next to the plant such that only a small part is exposed to the atmosphere. The burying of the bottle ensures the water does not heat up due to the high atmospheric temperature.

Above : Bottle watering

Traditional water filter

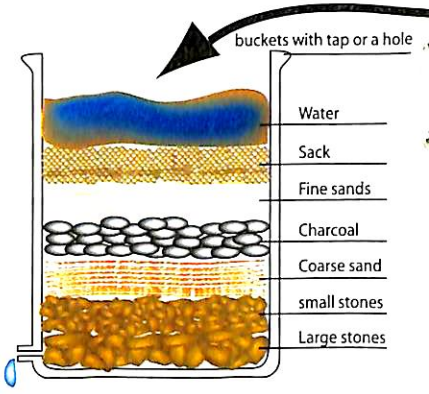
Left : Typical mud water poured into the water filter

Right : Clean clear water from the tap after filltering process



Availability of good quality domestic water is a major problem in the rural arid and semi arid areas where poverty levels are also quite high among the inhabitants.

Many residents of these areas depend on untreated water from shallow wells, rivers, earth dams and other insecure sources. Most of them are highly contaminated and lead to frequent water-born diseases especially during the dry season. During the rains, the arid areas are characterised by eroded rivers as a results of runoff from roadsides and farms. To improve the quality of the drinking water, a simple bucket water filter that utilizes stones, gravel, charcoal and sand to eliminate most impurities is used. This combined with boiling of the filtered water renders the water safe for drinking.



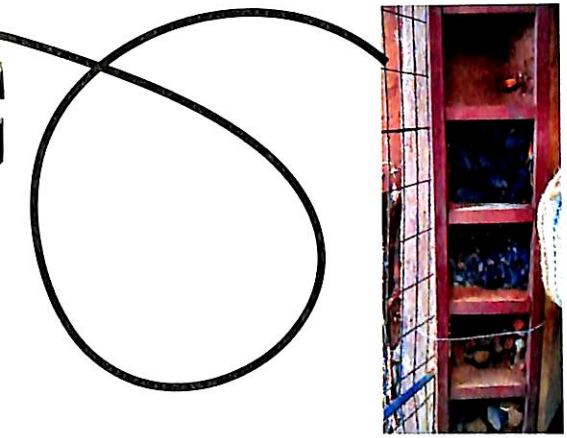
Above : Diagramatic illustration of traditional water filter

Improved cooking stove

Above : A 3 pot enzaro jiko. Note that the firewood is supplied at one point only

Fuel conservation in the dry areas remain an important strategy of preserving the ever decreasing natural wood resources. An improved cooking stove 'Enzaro jiko' has been promoted among homesteads in Kitui district. It is efficient and simple to construct using locally available material such as bricks, mud and cow dung. It can be constructed for use with a single or triple pots. It utilizes less wood fuel as compared to the traditional three stone jiko. At home, the jiko is usually accident free, has low maintenance cost and is less smoky. Furthermore, it allows more time to the mothers for other activities as it requires minimal wood fuel to prepare meals.

One disadvantage is that the jiko does not promote the social aspect of story telling in the evening, which was an important past time activity of passing information from one generation to the other as people warmed themselves.



Left : Ingredients of the water filter

Evaporative charcoal cooler

Above : Inside of a charcoal cooler showing the metal sheet lining

High temperatures lead to reduced shelf life of perishable foodstuffs in the drylands. Lack of electric power to majority of homesteads and the poverty level among the inhabitants curtails the use of modern refrigerators in the homes. A simple charcoal cooler has been used effectively to reduce the temperature considerably thus increasing the shelf life of perishable commodities. It is made of timber, wire mesh, metal sheet and a layer of charcoal to facilitate evaporation.

It consists of a hollow timber frame work filled with charcoal enclosing an air tight sheet metal internal box. A water tray reservoir is provided at the top to hold water that continuously wet the charcoal. As water in the layer of charcoal evaporates, it draws heat from the inside chamber.

Above : Charcoal cooler with water held on top of the trough

Melia volkensii pilot plantation

Melia volkensii is a drought-adapted species. During the wet season, the tree exhibit very vigorous growth that is characterized by heavy green foliage. As the dry season start setting in, the foliage turns yellowish green and the tree start loosing some of the leaves.

Further, into the dry season, the tree leaves turn yellow while more and more of the leaves are shed. Eventually at the height of the dry season in September and October, the trees are bare and from far, they appear dry and dead. However, scrutiny of the trees reveals the tips of the branches are still succulent and alive.

KEFRI through Kitui Regional Centre has an ambitious program of planting ten hectares of melia every year. The main challenge to this activity remains the browsing of the planted trees by both domestic animals from the surrounding communities and to a small extent the small wild animals such as dik diks.

Above : Rainy season

Melia Volkensii

Above : Slightly after rainy season

Above : Between dry and rainy season

different time of the year

Above : Dry season

Conservation tillage

Left : Planting site preparatioin
Note the cessive exposure of soil to evaporation

Conservation tillage technique is both a labour saving and moisture management farming system for crop establishment in the dry areas. The technique incorporates the use of a 'subsoiler' to open the ground for sowing of seed and introduction of manure or fertilizers. The 'subsoiler' is an additional implement that can be attached to the oxen plough.

Between the main crops, e.g. maize or trees, a cover crop is planted to reduce the baking of the ground by direct sunshine. In absence of cover crops, the weeds between the planted crops are initially sprayed with herbicide and subsequently individual weeds uprooted as they develop. This must be done before their seeds mature to eliminate the build up of weed seeds on the ground.

The 'subsoiler' is an additional implement that can be attached to the oxen plough. The use of this technique in the dry areas during rainfall deficit years shall enhance the amount of harvest realised.

Above : Dolichos under conservation tillage using herbicides

Below : Dolichos under normal cultivation

Dalbergia melanoxylon trial

Dalbergia melanoxylon is generally a tree of poor form normally multi-stemmed from the ground level. It develops heavy branches that cause the reduction of the size of the main bole. This causes the production of only short billets that limit the size of the carving realised from such trees.

A pruning trial was established in November 2000 in Tiva pilot forest. It involved pruning the saplings at different frequencies: monthly; bimonthly and tri-monthly. The trial was established in three replicates. Its objective was to determine the optimal pruning regime for improved stem quality of *D. melanoxylon*. The main driving force behind this trial was the fact that the species generally exhibits crooked stem form with different branches appearing as dominant stems at different times. Some casual observations made on managed trees have however revealed that form can be improved through silvicultural management as pruning.

Above : *D. melanoxylon* seedling coppicing after accidental cut

The plots have been maintained clean through intercropping of the trees with agricultural crops. The root collar diameter (diameter at ground level) of all the trees that are pruned in the tri-monthly are doing better than those in other treatments i.e. monthly and bimonthly). The diameter ranges between 2.0 cm and 2.5 cm within the treatments.

Left : *D. melanoxylon* saplings coppicing after cutting. The coppices are generally straight and less branchy

Left : *D. melanoxylon* saplings that has not been pruned

Left : *D. melanoxylon* saplings that is pruned monthly

Indigenous fruit trees


Tamarindus indica


Berchamia discolor


Sclerocarya birrea


Carrissa edulis

Due to harsh environmental conditions in arid and semiarid areas there is often high incident of crop failure, frequent famine and poor food security. There is need to introduce alternative sources of nutrition to supplement the commonly grown agricultural crops. Use of indigenous fruit tree species has gained recognition as one of the alternative source of food.

In the past, indigenous plants played an integral role in the diet of many communities, especially, in the nutritional quality and diversification of the food base in Africa. These species, which grow naturally in the drylands, have high tolerance to a variety of the environmental stresses in these areas. Over the decades, supply of indigenous fruits have relied on the wild with very little or no planting of these species on the farms. The reasons for farmers not planting range from lack of planting materials, poor knowledge on the propagation and establishment requirements to negative attitude towards the species. The aim of indigenous fruit demonstration plot was to act as a preliminary screening site for the species, germplasm production and conservation site, and establish a stand for silvicultural observation.

The plot was established in 1999 containing 10 species: *Vangueria rotundata Zizyphus mauritania Berchamia discolor*, *Carrissa edulis*, *Azanza garckaena*, *Tamarindus indica*, *Adansonia digitata Cordia ovalis* and *Laranthus uluguense*. Most species such as *Vangueria rotundata Zizyphus Mauritania Berchamia discolor Carrissa edulis*, *Azanza garckaena* and *Cordia ovalis* are already fruiting. The plot is still being maintained at Tiva through keeping off the domestic animals.


Zizyphus mauritania


Vangueria rotundata


Laranthus uluguense

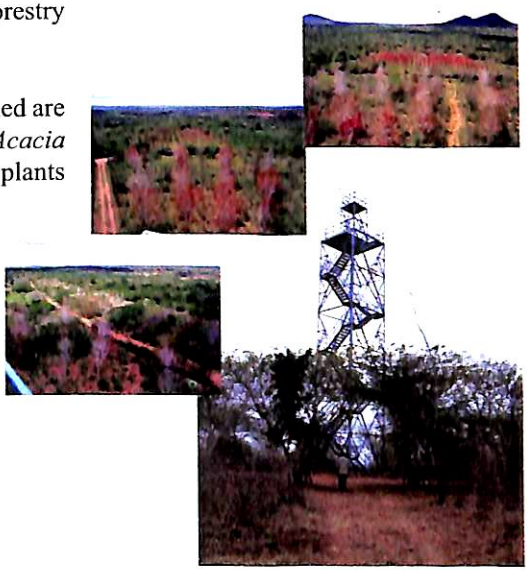
Tower site

Aesthetic value is one of the important management options in forestry. While this has always been true in humid and sub humid forestry, very little aesthetic value has been attached to dryland forestry. Tourism has been concentrated on the animals and less on plants. The pilot forest at Tiva provides a good scene for ecotourism. The forest is an island of woodland surrounded by farms that have been overexploited and bushes cleared for agriculture.

Above : The tower

The tower, apart from being used as a watch tower from where encroachment by the surrounding communities can be monitored, also serve as a recreation site from where the rich plant species diversity can be observed. A species-screening plot using Nelder design was established to serve the dual purpose of screening different tree species as well as beautifying the site for recreational purposes. In addition, the tower also acts as a monument of the Kenya/Japan cooperation in dryland forestry development in Kenya.

Eleven species out of the 14 species established are still surviving. *Jacaranda mimosifolia and Acacia polyacantha* performed poorly and most of the plants died.



Above : Surrounding scene as seen from the top of the tower

Melia volkensii spacing trial

Above : Melia saplings at different spacings

Above :Saplings at closer spacing loose their leaves earlier in dry season than those widely spaced

Melia volkensii is an indigenous tree species that is endemic in the semi arid areas of Kitui and the neighbouring districts. It is one of the most valued tree species by the inhabitants for its timber which is termite resistant and its fruits which provide dry season fodder for livestock. The planting of the species in the farms is fairly a recent activity. While the recommended spacing of planting of 4 m was based on convenience of using machinery such as tractors, farmers apply all sorts of management which results in diverse outcomes. It was therefore necessary to determine the appropriate planting pattern for adoption by farmers considering that thinning is not an option applicable on the farm.

A plot was established in November 2002 to determine the appropriate spacing of *Melia volkensii* at Tiva. The tree seedlings were planted at square spacing of 2.5 m, 3.0 m, 3.5 m and 4.0 m. At the age of approximately two and half years, saplings planted at close spacing of 2.5 m and 3.0 m have shown reduced growth. However, unlike a similer trial with the *Eucalyptus camaldulensis*, *M. volkensii* has not experienced any mortality among its trees.

Eucalyptus camaldulensis trial

Eucalyptus camaldulensis is one of the exotic drought resistant tree species planted in the semi arid areas. Some improved germplasm of the species were introduced in the country from Bulawayo Zimbabwe in 1997. These were established in woodlots by farmers in Mwingi, Makueni and Machakos districts. The trees started producing seeds in 2001, which farmers have been collecting for raising seedlings. In 2002, the Centre obtained some seeds to raise seedlings for planting at Tiva.

This plot was established in November 2002 to evaluate the adaptability of this species at Tiva under square spacings of 2.0, 2.5, 3.0 and 4.0 m. Though the tree species is quite adapted to drought conditions, trees planted at close spacings of 2.0 × 2.0 m and 2.5 × 2.5 m have been experiencing some mortality due to competition for soil moisture. Those spaced at 3.0 × 3.0 m and 4.0 × 4.0 m have not experienced significant mortality. The trees in these two wide spacings are also bigger in both diameter and height.

The trees in the close spacing of 2.0 × 2.0 m and 2.5 × 2.5 m have also experienced more termite attack than those in widely spaced plots. This is mainly because once the trees are stressed; they become more prone to termite attack than those still vigorously growing.

Above : *E. camaldulensis* spacing trial at 2yrs 8 month. Note the dry vegetation on the ground

Eucalyptus hybrids

Above : *Eucalyptus* hybrids showing some dead saplings

Are the imported *Eucalyptus grandis* and *Eucalyptus camaldulensis* hybrids from South Africa good for planting in the dry areas like Tiva?

Since the introduction of hybrids of improved clones of *E. grandis* and *E. camaldulensis*, a large number of them have been planted in several places in Machakos, Makueni among other semi-arid districts. In Kitui district, a trial was established in October 2002 using eight different clones. These were put in 16 tree plots and replicated in four blocks. The trees were planted at 2.5 × 2.5 m spacing. During the first year, a commercial termicide 'Reagent 3G' was applied at the base of each plant to control the stem attack previously observed among some trees.

During the long dry season of May 2004, and the not so good short rains of November 2004, most of the clones succumbed to drought with some plots registering 100% mortality. This however contrasts to a great extent with the local landrace of *Eucalyptus tereticornis* and *E. camaldulensis* also established in the same trial whose trees were stressed by the same drought but recovered immediately the short rains were received.

D. melanoxylon establishment trial

Seedlings establishment in the semi arid areas are mainly limited by the available soil moisture and the duration of its availability. This effect is even more pronounced among the slow growing species such as *Dalbergia melanoxylon*. A trial was therefore established to evaluate the applicability of a water holding chemical, Terra Cottem, in improving the early growth of the species.

The trial had three main treatments that were being evaluated. These were a) the site preparation b) the size of planting pit and c) the amount of water retaining chemical put into an individual hole. The site preparation and pit size had the following combinations:

- Deep ripped with hole sizes of 100 × 100 × 100 cm.
- Deep ripped with hole sizes of 45 × 45 × 45 cm.
- Hand tilled with holes of 45 × 45 × 45 cm.

Under each of these treatment combinations, there were four plots of 25 seedlings. In the first two treatments, individual seedlings received a Terra Cottem dosage of 0 g, 50 g, 100 g and 150 g while plots in the third treatment received dosages of 0 g, 100 g, 200 g and 400 g.

All experimental plots were established using a spacing of 5 × 5 m between seedlings and had an outer guard row. Because of the possible root extension from lower to higher Terra Cottem levels, all Terra Cottem treatments were arranged in ascending order and the blocks randomized.

Above : Deep ripped plot showing vigorously growing seedlings

Below : Hand tilled plot with relatively small seedlings of less growth

Acacia senegal spacing trial

Above : *Acacia senegal* saplings at different spacings

Acacia senegal (L) Willd. is the botanic source of gum arabic, an important article of commerce for thousands of years. The species is native to the hot dry regions of Africa, parts of Middle East to as far as western India. Apart from gum arabic, the species is also valuable in various ways such as windbreak, soil stabilization and improvement of soil fertility through fixation of nitrogen.

Despite the importance of the species, in Kenya little has been done to develop the species to a commercial plantation partly because of inadequate information on establishment and plantation requirements. The objective of this trial was to determine the optimal spacing for establishment of *A. senegal*.

The experiment was established at Tiva Pilot Forest in 1997. The treatments consisted of five (5) spacing: 1 x 1 m, 2 x 2 m, 3.5 x 3.5 m, 4 x 4 m and 5 x 5 m. The experiment is still on going with preliminary assessment on height and diameter showing that wider spacing of 4 x 4 m and 5 x 5 m are performing better that closer spacing. Future assessments will also consider gum production at different spacing.

Author's profile

James Kimondo
Kitui Centre Director, KEFRI

Author's profile

James Kimondo is a research scientist working with Kenya Forestry Research Institute (KEFRI) since 1983. His main interests then were in Forest Biometric involving modeling and forest inventory. He has undertaken research in the area of evaluation of tree performance, tree establishment and development, natural regeneration among others .

Kimondo has been working in KEFRI Kitui Regional Centre since 1999 during the implementation of the SOFEM project as the Centre Director. A number of technologies were developed and demonstrated at Tiva Forest and demonstration plot.

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