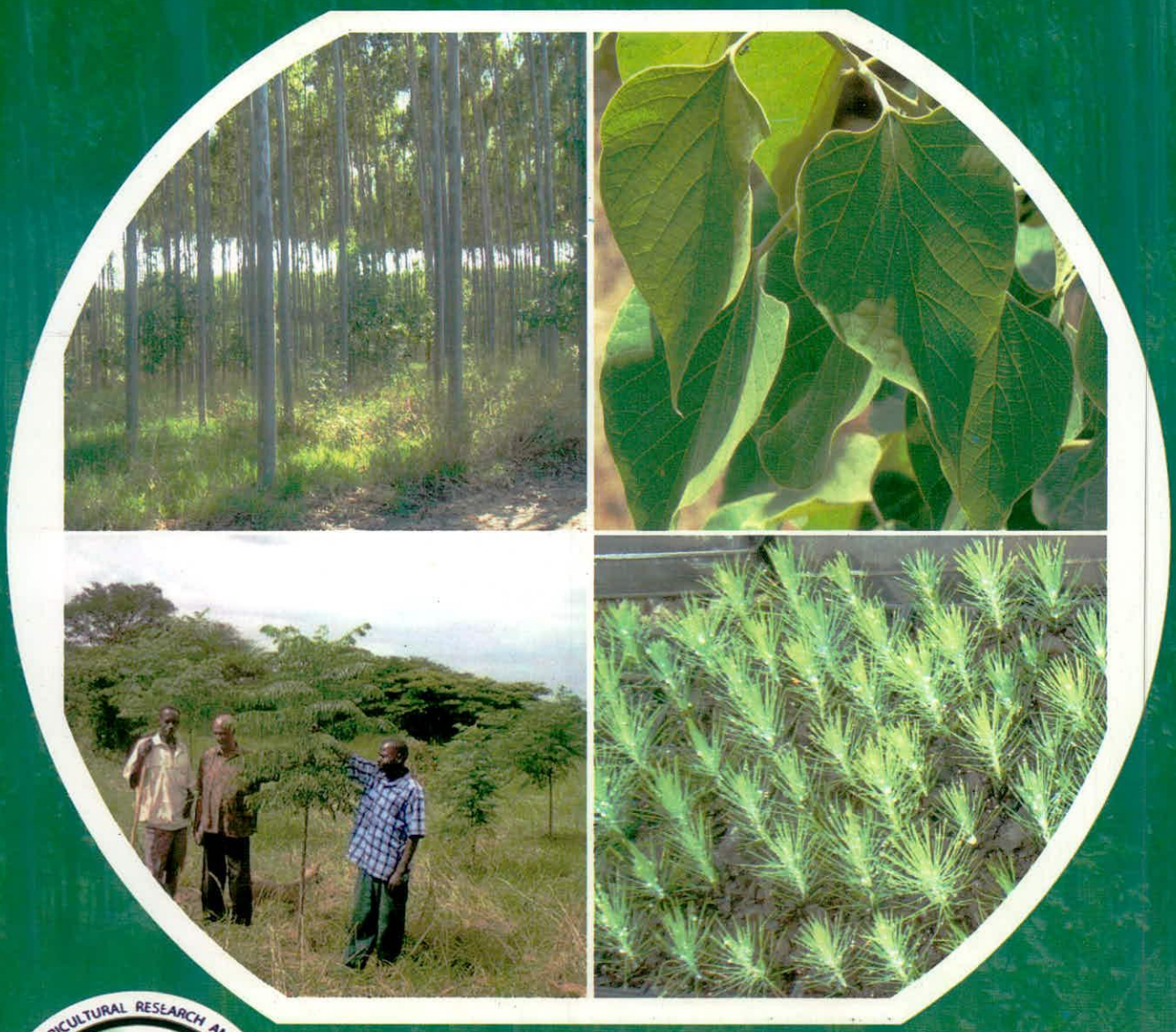
NATIONAL AGRICULTURAL RESEARCH ORGANISATION

NARO

THE REPUBLIC OF UGANDA

SELECTED FAST GROWING TREE SPECIES SUITABLE FOR NORTHERN UGANDA



NGETTA ZONAL AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE

NGEZARDI

IDENTIFICATION AND PROMOTION OF SELECTED FAST GROWING AGRO-FORESTRY TREE SPECIES PROJECT,

Ngetta Zonal Agricultural Research and Development Institute (NgeZARDI)

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OCTOBER 2013

Introduction

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The concept of agro-forestry in this modern era involves the purposeful incorporation of trees on our farmlands to diversify income sources and conserve the environment. Gone are the days when the demand for fuelwood, timber and poles in the Lango and Acholi sub-regions was largely met from natural forests and woodlands. Most of the traditional sources of these products have been exhausted and because of this, it is not rear to see trucks bringing in timber from as far as the Democratic Republic of Congo.

It is also worth noting that the integration of trees in the cropping system has the potential to improve soil fertility, provide fuelwood and fodder for livestock (more so in the dry season when feeds are scarce) as well as fruits for better nutrition. Other advantages of having tree components on farmland include; improved micro-climate, reduced soil erosion and damage from strong winds and trees provide good sources of nectar. It also goes without saying that products from an agro-forestry system such as fruits, honey and timber can definitely improve household income.

In order to meet the demand for tree products, a number of tree species have been introduced in Lango and Acholi and more farmers are deliberately integrating tree planting on their farms. However, it is clearly evident that the current level of tree planting does not match the demand for wood. This is partly because of the fears that people in this region attach to trees. These fears include; trees take long to mature, land is inadequate, they consume much of the land meant for agricultural production and their shades affect crop production. There is also fear of damage by pests and diseases, most notably the termites.

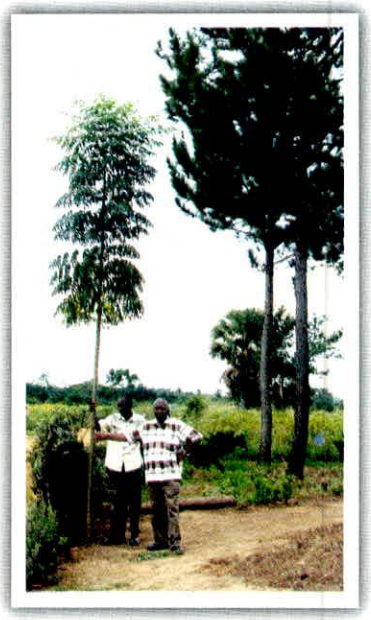
Bearing in mind the fears attached to agro-forestry and the enormous demand for tree products, it is apparent that strategies to scale up agro-forestry in the zone needs to be put in place. Such strategies would include the promotion of fast growing trees and training farmers on tree management. For this reason, a project entitled "Identification and promotion of selected fast growing agro-forestry tree species in the mid- Northern and Northern Agro-ecological Zone of Uganda" was developed by Ngetta ZARDI and implemented in Lango and Acholi sub-regions.

Through this project, the performance of identified fast growing tree species was assessed across the zone with the aim of promoting them among the farming communities in the zone for improved livelihood. Hence, in this booklet, some of the fears associated with tree planting or rather agro-forestry are addressed. It also looks at various fast growing trees suitable for the region, how they can be integrated and managed as well as their potential benefits and uses.

Melia volkensii

Description and distribution

Melia volkensii, locally known as *'Alira'* is a highly valued multipurpose tree native to the arid and semiarid lands of East Africa. It occurs naturally in Ethiopia, Kenya, Somalia and Tanzania. The tree is drought tolerant, fast growing and is capable of reaching height of 3 – 4m within one year. The wood from the tree is durable and resistant to termites.



***Melia* tree at 12 months**



Bark of mature *Melia* tree

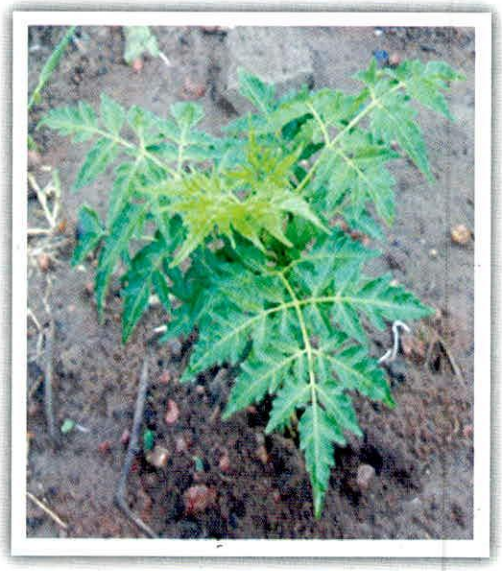
Uses and Benefits

M. volkensii has mahogany type of timber and it compares favorably with Teak (*Tectona grandis*), Mahogany (*Khaya spp*) and Mvule (*Milicia excelsa*). *Melia* can be processed as high-value timber for use in furniture and door making. In Kenya, *Melia* is one of the highly valued multipurpose trees in the arid and semi arid lands. For this reason, the income from a 10 to 15 year plantation of *M. volkensii* is estimated to be approximately Ksh 3 million (US$ 35,294 or Ugx 90,659,697) per hectare. The leaves and fruits provide fodder for cattle and goats especially towards the end of the dry season (a time when fodder is extremely scarce). *Alira* is also suitable for dry land agro-forestry, bee-keeping, wood fuel and making of acoustic drums. The leaf concoctions of *M. volkensii* are used as flea and fly repellants (which is particularly effective on goat kids).

Propagation and Tree Management

Commonly used propagation methods include transplanting from wildlings, root cuttings arising from accidentally or deliberately damaged roots and seed propagation. Root cuttings results in unstable trees and therefore not preferred.

M. volkensii tends to develop heavy lateral branching, which necessitates pruning from the 1st year onwards. This is done to maintain a clean straight bole. *M. volkensii* is compatible with a number of crops. However, when the crown is fully developed, thinning should be done to reduce shading on light-demanding crops like sorghum and millet.

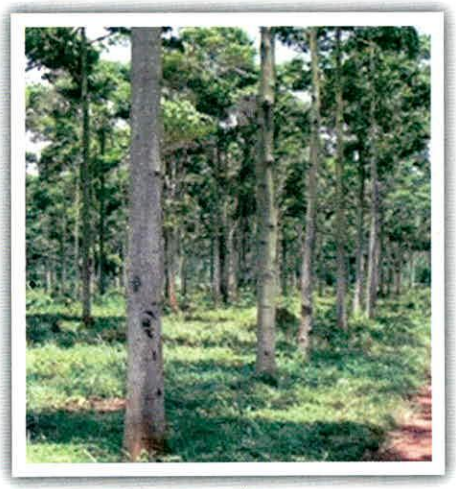


***M. volkensii* seedling**

Maesopsis eminii (Musizi)



Leaves of *Musizi* tree



Mature *Maesopsis* trees

Description and Distribution

Maesopsis eminii is a fast-growing, large tree which has gained a reputation as a plantation tree and useful timber species in the humid tropics. It is a leafy, semi-deciduous tree 10-30 m in height with a clear bole (stem) up to 10m. *Musizi* is a colonising tree species of the central African rainforest, occurring naturally in the triangle between Liberia, Uganda and southern Angola. The species is indigenous to Uganda where it grows in moist evergreen forests and moist semi-deciduous forests as well as in grasslands at altitudes between 700 and 1500m.

Uses and Benefits

Musizi is gaining more popularity because it matures faster than introduced coniferous trees such as Pines, *Araucaria* and Cypress and it produces comparatively more wood per unit area. *M. eminii* has been successfully used as a shade tree for coffee and banana plantations in Uganda and for cocoa in the Democratic Republic of Congo. The timber is strong and durable when harvested from a mature tree and is suitable for making fascia boards, furniture, plywood and boxes in addition to providing support for ceilings. Due to its fast growth, *Musizi* is also suitable for fuelwood. However, untreated wood is vulnerable to termites and decays when left in contact with the ground or continual moisture.

Propagation and Tree Management

Musizi is propagated mainly by seed. There are approximately 800 dry seeds per kilogram which can be stored in airtight containers (plastic jars or aluminum packets) in a cool dry place for 1 – 2 years without significant loss of viability. Seeds usually germinate within 20 to 30 days after sowing (by spreading) on a seedbed and pretreatment is not necessary. The average germination rate of mature and healthy seeds is 40-60%. Seedlings are planted out after 4-6 months when they are about 30cm tall.

Spacing of *Maesopsis* depends on the intended benefits. A narrow spacing is required for fuelwood and pole production whereas larger spacing is needed for timber production and shade provision. For timber production, a spacing of 5x5m is appropriate but 7x7m is recommended for use as shade trees. Alternatively, one may opt to start with a narrow spacing of say, 3.5x3.5m and thinning (felling some trees) after the 5th year to end up with a spacing of 7x7m. Rotations are about 12-15 years for timber and 6-8 years for fuelwood, poles and pulp production.



3 year old *Musizi trees at Ngetta ZARDI*

Grevillea robusta

Description and Distribution



The fern-like leaves of *Grevillea*

Grevillea robusta, commonly known as Silky-Oak tree is a fast-growing evergreen tree measuring up to 30m tall and 1m in diameter. It is characterized by golden-yellow bottle brush like flowers and Olive-green, fern-like leaves that are silky and silvery beneath. *G. robusta* occurs naturally in Australia. It has been introduced into warm, temperate, subtropical highland regions around the world and is widely planted in India, Sri Lanka and many countries in Africa, including Uganda.



***Grevillea* bottle brush-like flowers**

Uses and Benefits

Before aluminum became popular, the timber from *G. robusta* was widely used for external window joinery as it is resistant to rotting. Its timber is also used for making furniture, and in Sri Lanka and East Africa the tree is planted as a fuelwood species. Because of its fast growth and ability to tolerate poor soil, *G. robusta* has been used for reclamation of deforested land in Africa and America. *Grevillea* is a well known shade tree in coffee and tea plantations. Its spreading branching system makes it ideal for windbreaks hence providing protection against wind-induced mechanical damage. *G. robusta* is an excellent tree for bee keeping and its honey is dark amber of high density (very good quality) with a pronounced flavour. The cut leaves of *Grevillea* make a fabulous addition to flower bouquets.

Propagation and Management

G. robusta can be propagated through seed and cuttings, although seed propagation is the commonest method. No pretreatment of seed is required, and it germinates readily in a moist environment.

A spacing of 2.5-3 x 3-4 m and a plant density of 800-1200 trees/ha is recommended for plantations. Weed control is essential for the two years after planting. A spacing of 7x7m is suitable when *Grevillea* is used as a shade tree. Shading in coffee and tea plantations can be enhanced by pollarding and pruning. Pollarding is cutting timber off a tree at the top of the trunk to produce new growth.

G. robusta should probably not be planted near houses due to their large size, messy habit, and the brittleness of the wood as it ages. Tops of trees are known to break from the tree when there are strong winds.



A fine 10 yr old *Grevillea robusta*

Clonal *Eucalyptus* (Kalatus)



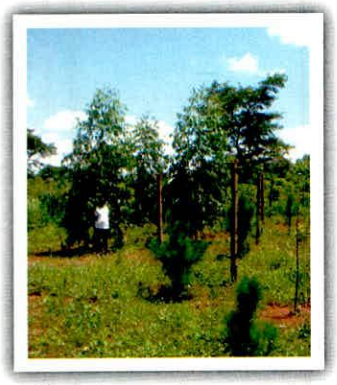
***Eucalyptus* cutting before rooting**

Introduction

Eucalyptus is a fast growing tree which is among one of the best species for agro-forestry. Clonal Eucalypts are vegetatively propagated through cuttings from a single mother tree having the most desirable genetic qualities. Clones have the same genetic qualities as the mother plant. Trees raised from each superior clone will be uniform, true to type and fast growing. Productivity of clones is higher compared to normal seedlings of eucalyptus.

Uses and Benefits

Wood of *Eucalyptus* is suitable for constructional timber, furniture, plywood, poles, paper pulp, fuel wood and packing cases. Due to its multiple uses, demand of eucalyptus wood is increasing day by day. Clonal *Eucalyptus* trees yield more, clear, straight and knot free timber in comparison to normal seed rooted *Eucalyptus* and its wood fetches better market price.



Clonal *Eucalytus* at 11 months

Propagation and Management

Clonal *Eucalyptus* is propagated vegetatively by cuttings from established mother gardens. The technique recommended for planting rooted cuttings is slightly different from that for seedlings. This involves planting them deeper such that the top level of the original cutting is covered by soil.

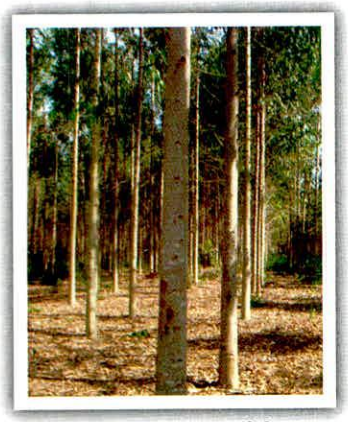


***Eucalyptus* clone ready for planting**

Spacings generally adopted by growers in Uganda for planting clonal eucalyptus are: 2mx2m, 2.5mx2.5m and 3m x 3m. It should be noted that a narrow spacing is recommended for production of poles, pulp and paper but a wider spacing is suitable for timber production. Alternatively, adopt a spacing of 3mx1.5m (888 trees per acre), then cut 50% of the trees for construction poles/supports and fuelwood at 2 years. Farmers have the option of again cutting 100 trees for fencing posts or firewood at 4 years, and another 100 at 6 years as transmission poles. This leaves behind 240 trees per acre for timber production at 8 – 10 years.

Suitable Clones

The National Forestry Resources Research Institute (NaFORRI) in Mukono, in conjunction with Mondi Forests (South Africa) and UK's Gatsby Charitable Foundation have tested a number of hybrid Eucalypt clones across the various agro-ecologies in Uganda since 2002. Some hybrids are better adapted to specific site conditions – e.g. drier or wetter, colder or warmer. Clones found to be suitable for Northern Uganda include; GC796, GC540, GC550, GC578 and GC796/2. These can be sourced from Gatsby nurseries in Mukono and Mbale. They are also available at Ngetta ZARDI.



Impressive 3 yr old GC796 *Eucalypt* clones in Dokolo district

Gmelina arborea (Owelo munu)

Description and Distribution

Gmelina arborea is a fast growing deciduous tree, occurring naturally in South East Asia (India, Burma, and Sri Lanka to southern China). *Gmelina* has been widely introduced in Brazil, Gambia, Honduras, Ivory Coast, Malaysia, Malawi, Nigeria, Panama, Philippines, Uganda and Sierra Leone. This tree that can attain a height of 30m grows on different localities and prefers moist fertile soils with 750–4500 mm rainfall. It does not thrive on ill-drained soils and remains stunted on dry, sandy or poor soils; drought also reduces it to a shrubby form.



Leaves, fruits and flowers of *Owelo muno*



***Gmelina* tree at 4 years**

Uses and Benefits

G. arborea has suitable characteristics for agroforestry, with fast growth and ease of establishment. *Gmelina arborea* produces high-quality wood, which is harvested for the manufacture of furniture and musical instruments. It is also used as structural timber, for instance in mines and ship building, as well as joinery, and to make plywood, matches, agricultural implements and even artificial limbs. The wood also produces good quality pulp used in the manufacture of cardboard and various grades of paper. Besides, *Owelo munu* makes fairly good charcoal having a calorific value of 4800 kcal/kg.

Gmelina arborea has a wide range of local medicinal uses. The juice or paste from young leaves has been used to treat gonorrhea, cough medicine, ulcers, fever, epilepsy and indigestion. Flowers of *Gmelina* produce abundant nectar, which produces high-quality honey.

Propagation and management

Gmelina arborea grows best in fertile, well-drained soils, and is normally propagated by seed. Viable seeds should be collected from standing trees with good qualities and there are about 1400 seeds/kg. Normally, seed is collected from the ground, de-pulped and then dried. Pretreatment is not necessary. For rapid germination, fresh seed should be soaked in cold water for 48 hours. For fuelwood, spacing at 2mx2m is recommended, wider spacings (e.g. 3mx3m) is suitable for timber plantations. For the first year or so, weeding is necessary until the canopy closes.

Owelo munu can be intercropped with ground nuts, maize, yams and beans. In order to minimize competition between tree and food crops, they should be planted 3 months later after tree planting and the distance between individual trees and food crops should be at least 60cm on either side of the tree. *Gmelina* tree coppices (re-grows) very well with vigorous growth. Young trees need protection from goats and cattle. *Gmelina* is harvestable within 5 years for fuel wood and 8 years for timber.

Albizzia chinensis (Silk tree)

Description and Distribution

Albizzia chinensis is a deciduous legume tree native to South and Southeast Asia (India, China, Indonesia, Cambodia, Thailand and Vietnam). It has a flat spreading crown up to 43m tall and trunk up to 140m in diameter. The tree shows much potential as a multipurpose plantation-grown species in India and is extensively cultivated in tea gardens for shade and improving soil fertility.



Leaves and flowers of *Albizzia Chinensis*

Uses and Benefits

Apart from providing firewood, *A. chinensis* has shown potential as a fodder because the leaves are readily eaten by goats. In India, it is used for boat building. The wood is resistant to termite and other insects attack. An extract of the wood has repellent property to subterranean termites. In tea and coffee plantations, it is used as a shade tree, often in a mixture with other trees such as *Grevillea*. As a fast growing tree legume, *A. chinensis* remains important in the reforestation of degraded land, nitrogen fixation, soil improvement and erosion control through slope stabilization.

Propagation and Management

The tree is mostly propagated by seed. Seeds should be collected after the pods have turned light brown in colour. They should be collected from the tree and not from the ground. There are about 3000 pods and 50,000 seeds per kg. Before sowing, the seed should be soaked in warm water for 5 minutes and thereafter in cold water for 24 hours. A germination percentage of about 50% should be obtained. After 6-8 weeks, the seedlings can be transplanted into the field.



***Albizzia chinensis* is a good shade tree for coffee**

A spacing of about 7-15 m has been adopted for providing shade in tea plantations; whereas for fodder production, the trees need to be grown at a spacing of 3m x 1m. Weeds have to be controlled regularly after transplanting until the plants reach a height of 1m. Trees grown for shade should grow to 7m tall and then cut back to 4m. The trees can be harvested for fodder twice a year during the growing season by cutting the stem back to 1m. *Albizzia* also tolerates frequent pruning.

Pinus caribaea var. hondurensis (Pine)

Description and distribution

Pinus caribaea var. hondurensis (PCH) is a fast growing and versatile tree 20-30m tall with a diameter of 50-80cm. It has needle-like leaves which usually occur in fascicles of 3 and a characteristic straight stem. PCH has a wide natural distribution from Bahamas, Colombia, Cuba, Guatemala, Honduras, Mexico and Nicaragua to Panama. In Uganda, it was introduced in the 1960's.



Cones bearing Pine seeds

Uses and Benefits

Pine has been widely planted for timber (e.g. furniture, fascia boards, and crates). In Uganda, timber from pine is valued more than any other softwood on the market. It is also a good source of firewood, wood pulp besides being used for plywood and land reclamation.

Propagation and Management



It's necessary to keep a 1 yr old plantation like this one weed free.

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PCH is easy to propagate from seed and 3 months after sowing; the seedlings are ready to be planted out. Mycorrhiza soil is needed for seedling growth and therefore must be added to nursery potting mix. A spacing of 3mx3m is recommended for timber stands giving 444 stems per acre (spa). Young trees should have a weed free radius of 50cm and the vegetation between rows should be removed frequently until canopy closure.

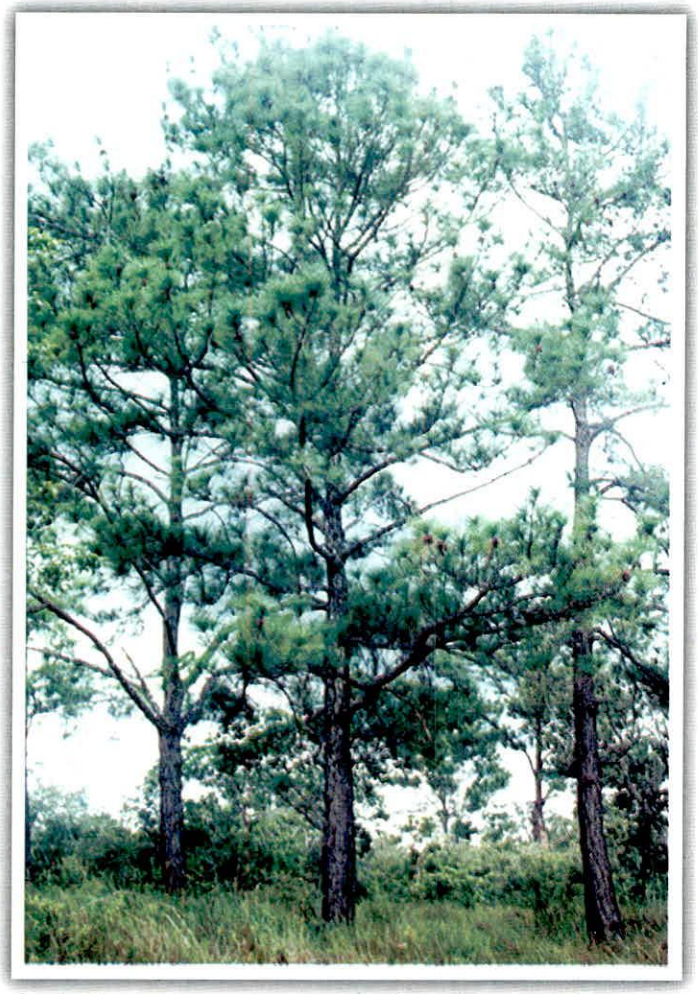
To produce large trees quickly, PCH must be heavily thinned. The 1st thin should reduce the stand to 300spa at 4-6 years, the 2nd thin to 200 spa at 6-9 years and the third to a final crop of 130 spa at 9-12 years. This implies that every thinning reduces the tree stand by 35%. High pruning in stages is recommended to produce knot-free timber and clean logs. PCH is moderately fire resistant after around 5 yrs when it develops a thick bark. However, it is necessary to maintain fire lines of 7-9m around the plantation (external fire lines) and 6m between compartments within the plantation.

Seed recommendations

Improved seed from Australia (Queensland), South Africa (Mondi Forests) and Brazilian seed stands is recommended for Uganda. However, it is not enough for one to ask for 'Pine' from a tree nursery, it is important to specify which species of 'Pine' you need. Besides *Pinus Caribaea*, another Pine species that has been found to perform well in Northern Uganda is *Pinus Oocarpa*, although it has not been widely grown here.



Well pruned Pines like these produce knot-free timber



Such Pine trees cannot give clean logs. High pruning is recommended.

Other Tree Species and Issues

A. *Faidherbia albida*

Faidherbia albida locally known as 'Okutu' is a large thorny tree with great potential in agro-forestry. It is suitable for bee keeping, fodder and most importantly nitrogen fixation. The tree is highly valued because it sheds its leaves in the rainy season and retains them in the dry season. This means that it can not only grow among field crops without shading them but also act as an excellent shade tree for coffee.

B. Fruit trees

Mangoes, citrus and cashew nuts are some of the major fruit trees that have thrived well in the region. These have the potential to contribute to food security as well as increase household income. However, pest and disease control is a key factor in managing fruit trees. Apples usually do well in cold areas, but there are signs that they could also perform fairly well in some parts of Northern Uganda such as Oyam and Kole districts.

Planting Trees Together with Annuals

In the first two years of establishment, crops like beans, soy, peas or any vegetables can be grown with trees. Ideally, heavy feeder crops or those growing extremely fast like, maize, pearl millet, sorghum, sugarcane and sunflower should be avoided as they suppress tree seedlings. However, if these crops are to be planted with trees, regular and closely supervised line weeding or spot weeding is recommended. A ring of 50cm radius or line of 1m should be kept free of weeds.

Management of termites

Termites are one the most menacing tree pests. They usually affect trees such as *Grevillea, Eucalptus* and *Maesopsis* mostly at the young stage. As a result, people usually avoid planting these trees despite their economic, ecological or environmental benefits. However, termites are best managed by taking preventive measures, for instance, adding a termiticide like Regent 3G (powder) at planting which keeps termites away for 3 years. Another approach (mainly for small fields) is to dig a trench of 2 ft deep around the field which prevents termites from entering the planted area. In this case, those within the field should be dealt with by destroying termite mounds and killing the queen. Also, application of Chloropyriphos (such as Pyrinex) in deep holes around the stem at 2ml per liter of water per plant should be able to keep termites away. However, application may be repeated from time to time whenever need arises.

Shading of crops and Land Shortage

Inadequate land for tree planting and fear of their shading effect are some of the excuses for not planting trees. However, planting of trees along boundaries should be able to minimize shading and maximize land use. In fact, at a spacing of 3mx3m, an acre can accommodate 93 trees along the boundaries only. However, boundary planting of trees requires the consent of the neighbours.

Future Benefits

Trees, just like annual crops, are capable of providing short-term benefits. However, long-term returns are also important both for the environment and for our livelihoods. This is because a tree planted today will gain value by at least 300 times in the future making it a realistic and reliable retirement fund for individuals in active service not only in government institutions but also those in the private sector.

Acknowledgments

Information on tree description retrieved from World Agro-forestry tree database at **http://www.worldagroforestry.org/resources/databases/agroforestree**

Picture on poor canopy management of Pine retrieved in September 2013 from **http://dendrome.ucdavis.edutreegenesspeciesoracjpgpinus_caribaea_general.jpg**

The technical support provided by National Forestry Resources Research Institute (NaFORRI)

We also acknowledge the kind financial support provided by the Government of Uganda to Ngetta ZARDI through the NARO Competitive Grants Scheme

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