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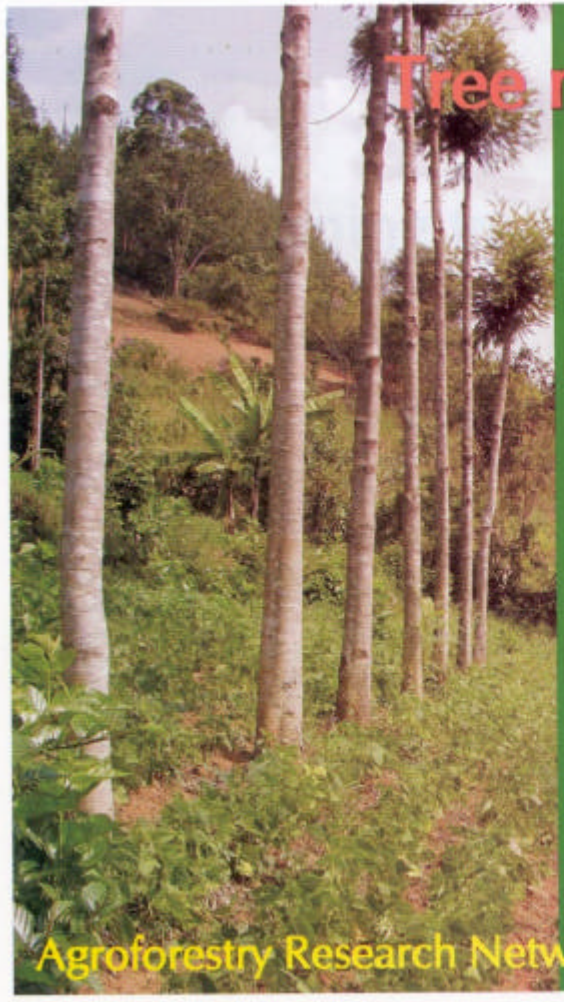

Tree management for farming

Technical Bulletin (3)

Pruning trees growing in cropland

Agroforestry Research Network for Africa (AFRENA)-Project Uganda

Tree management for farming

Pruning trees growing in cropland

This project was jointly implemented by



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1. INTRODUCTION

Forests once covered most of the highlands in East and Central Africa. Settlers gradually removed the trees because that was thought to be necessary for agriculture. In those early days, land was plentiful and wood could be collected from the remaining forests. Today, most of these forests have disappeared and many of the remaining ones are protected. Farms in the highlands of East and Central Africa are usually small, making it difficult for the farmer to allocate land for:

- Cropping for food and income,
- Fodder for livestock,
- Trees for firewood, stakes, timber, mulch and fodder, and
- A homestead with a garden.

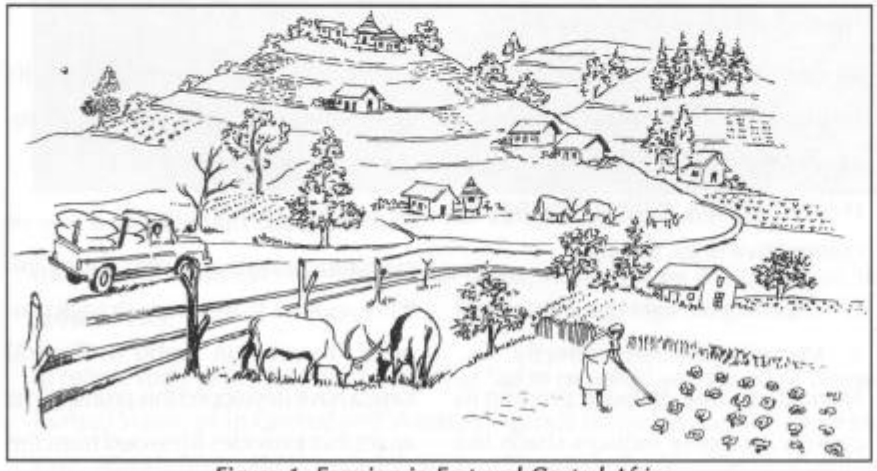

Figure 1: Farming in East and Central Africa.

While many farmers have accepted the idea that planting hedges for protection, fodder or soil conservation is beneficial for their farms, they often find it difficult to integrate tall trees for poles and timber on their farms. In some areas, e.g. Embu in Kenya, such trees are planted and maintained along the farms' boundaries. But many farmers are still reluctant to plant such trees because they have observed competition between trees and crops when grown together on a piece of land. In this brochure, we explore the nature of this competition and how it could be reduced by pruning to encourage growing trees and crops together. This can diversify farm products, reduce risk and give an overall increase in farm production and income.

2. EFFECTS OF TREES ON CROPS

There are two main types of agroforestry systems:

1. Those where trees and crops are grown in a rotation (sequential systems), like improved tree fallows; and
2. Those where trees and crops grow together on the same piece of land at the same time (simultaneous systems), e.g. contour hedges or boundary planting.

In the second case, when trees and crops grow together on the same piece of land, trees will have positive and negative effects on the crops, as shown in Figure 2.

Positive and negative effects of trees often occur at the same time. Of the negative effects, competition for water from the soil is usually the most important. The goal of good agroforestry practice is to enhance the positive effects while reducing the competitive ones, through:

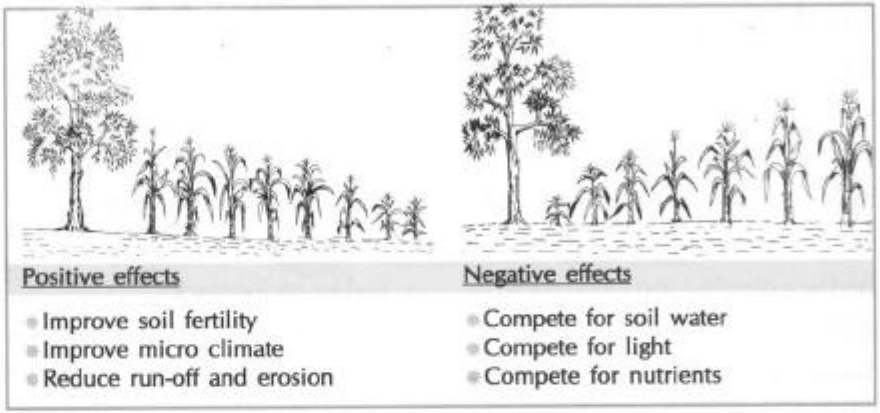

Figure 2: *Effects of trees on crops*

- Choosing the right tree species,and
- Managing the trees correctly.

Managing a tree, through pruning its canopy, not only reduces shade but also limits water use (transpiration) by the tree. Therefore pruning limits its competition for soil water, so it reduces the negative effects.

Removing the branches of a tree or even removing the whole canopy initially appears to be a very strange proposal. Farmers in Embu in Central Kenya have developed this pruning into an art that provides firewood from the cut branches, enhances the timber



Figure 3: Un-managed trees can compete severely with crops

quality and reduces competition with crops, while having little effect on tree growth rates.

In recent surveys in East Africa no similar "art of pruning" was found in Western Kenya (Siaya), or in Central and Western Uganda (Mukono and Kabale). However, reports from other countries, such as Bangladesh, describe very sophisticated tree management systems to maximise the overall production of the tree-crop association.

3. ADVANTAGES OF CROWN PRUNING

Besides reducing competition for light and soil water and increasing crop yield there are other important advantages of pruning trees:

- The branches cut while pruning provide firewood, and
- If pruning is done correctly, timber quality will be improved.

Why is that?

When trees are grown in a forest or a plantation, they compete strongly with their "neighbours" for light. They therefore will have few strong branches and good timber quality. Trees grown in a

line in a field, e.g. along the boundary, will however produce many strong branches. Each of these branches will result in a knot in the timber, and there will be a smaller volume of timber in the valuable trunk (Figure 4). Knotty timber is weaker and more difficult to work and fetches lower prices.

Removing a tree's branches also reduces leaves and transpiration of the tree. This results in lower water uptake, but also lower rates of photosynthesis. The tree competes less with crops for water, but may also grow slower. Data from Kenya for example, shows that the diameter of trees where shoots are pruned is reduced by 13 % after 2 years (Table 1). Similar research in Bangladesh shows reduced diameter growth by up to 19% depending on the tree species and pruning intensity.

Most trees survive the treatment although losses increased from 2.1% in the unpruned treatments to 10.4% in some of the pruning treatments (Table 1).

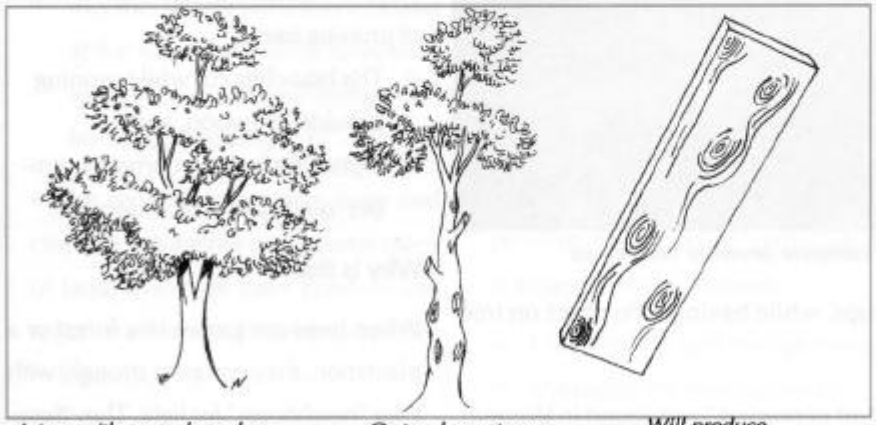

Figure 4: Causes of knots in timber.

4. HOW TO PRUNE

Although pruning can be done on older trees, it is best to begin when the trees are young. When trees reach about knee height, the branches on the lower half of the trees should be cut off with a sharp knife or secateurs (Figure 5). Pruning should continue as the tree grows, leaving the branches on the upper third of the tree uncut.

[1] Hocking, D. (1998): Trees in wetland rice fields. *Agroforestry Today 10 (3) 4-6*

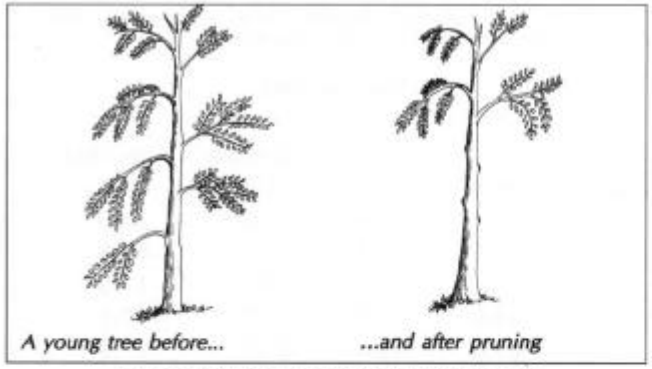

Figure 5: Pruning young saplings as they grow.

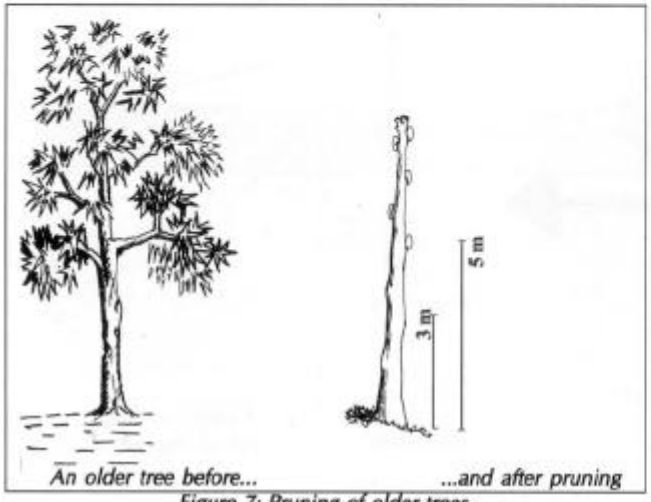

Figure 7: Pruning of older trees.

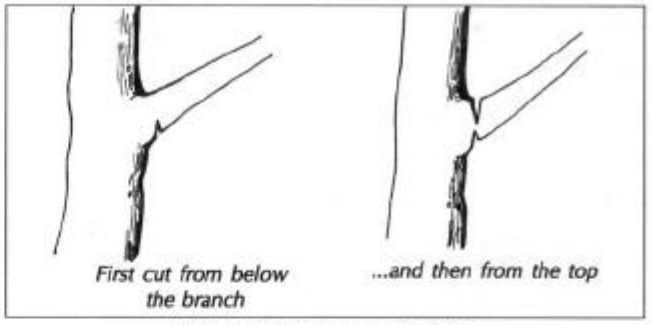

Figure 6: How to cut a branch.

It is very important to use sharp tools such as knives, secateurs, pangas and saws. For timber trees, the branches have to be cut close to the stem, otherwise the timber will show the same knots as if the branch was not cut at all. Avoid damaging the tree's bark when removing the branches: begin with a cut on the underside of the branch to prevent a tear developing when the branch falls (Figure 6). Always use slanting cuts which shed water.

If you cut a diseased branch, clean your tools thoroughly before making another cut, otherwise you might spread the disease.

As the tree grows tall, it is safest if you start pruning at the

top of the tree and work your way down.

- On the lower part of the stem (up to 3 metres) remove all branches and use a ladder to climb
- Leave a few longer branch stumps above 3m height to help when climbing the tree next time you have to prune (Figure 7), and
- Above approx. 5 metres height, the tree may be pollarded (cutting off the crown)

Pollarding of mature previously unpruned trees is a radical form of pruning. It has been shown in trials and by farmers in central Kenya to be a good method to reduce competition between trees and crops (Figure 8).

- Prune once per year or every two years before planting crops, and

Table 1: Average trunk diameter (at Breast Height) in cm and survival of 6-year old trees under different pruning regimes, Siaya, Kenya, 2 years after pruning. [2]

	Pruning used			
	Shoots	Roots	Shoots & Roots	No pruning
Casuarina equisetifolia	16.1	17.6	15.2	**17.9**
Eucalyptus grandis	22.8	19.6	22.8	**24.0**
Grevillea robusta	11.6	14.4	10.0	**15.5**
Markhamia lutea	10.4	10.4	8.9	**11.5**
Average	**14.8**	**15.2**	**13.8**	**17.1**
Trees survival [%]	**89.6**	**89.6**	**91.7**	**97.9**

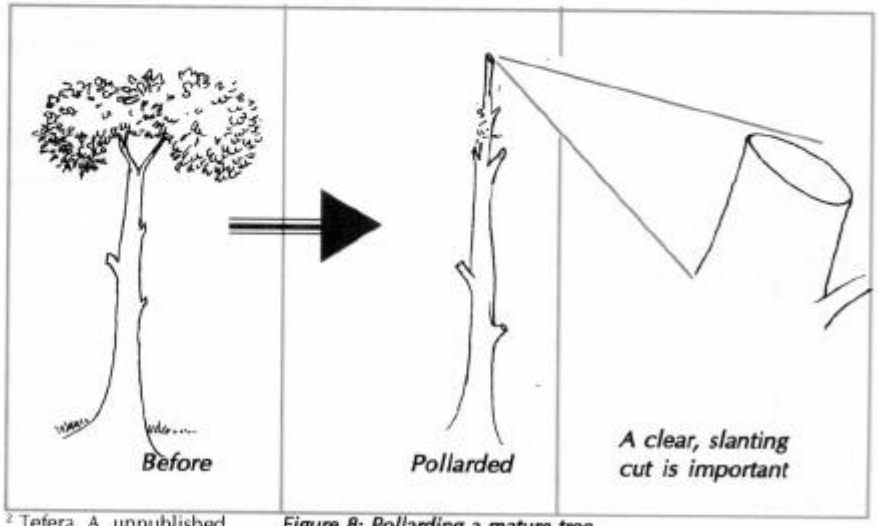

Figure 8: Pollarding a mature tree..

[2] Tefera, A. unpublished

Table 2: Tree species successfuly pruned and pollarded in recent experiments. [1]

Botanical	Name		Age [years] of trees pruned
	Rukiga	Luganda	
Grevillea robusta	Grevillea	Kalivariyo/Kalwenda	5 - 12
Alnus acuminata	Alnus		5 - 12
Eucalyptus grandis	Karutuusi	Entusi	8
Markhamia lutea	Omusaavu	Musavu	5 - 12
Acacia melanoxylon	Kasiya	Gasiya	8
Polyscias fulva	Omungo	Setala	8
Casuarina glauca	Kajwarina	Kasalina	8
Casuarina cunninghamiana	Kajwarina	Kasalina	8
Casuarina equisetifolia	Kajwarina	Kasalina	5 -12
Maesopsis eminii	Omusizi	Musizi	5 -12
Periserianthes falcataria	Omushebeya	Musebeya/Nango	8

FRUIT TREES OR TREES PLANTED AS WINDBREAKS, OR FOR SHADE SHOULD NEVER BE PRUNED IN THIS WAY!

SHOOT PRUNING

- reduces a tree's water uptake and shade,
- provides firewood,
- increases crop yield, and
- enhances timber quality.
- preferably should begin when the tree is still young,
- should be done every 1-2 years (young trees more frequently), and
- requires sharp tools and safety precautions.

[1] Dickens, S. unpublished

- Be careful with safety, heavy branches can kick you when they are cut, learn from more experienced people, do not climb trees when they are wet and slippery, do not allow anyone to stand where a branch can fall on them.

If trees have been planted near crops long time ago and they have never been pruned, they can still be pruned to reduce competition and to obtain firewood (see Table 2).

If a line of trees is planted along the farm boundary, the neighbouring farmer often agrees to share the prunings, and the timber from the trees.

5. A CASE FOR ROOT PRUNING?

Pruning the branches of trees reduces the tree's water use (transpiration) and therefore their total water uptake from the soil. However, it hardly affects the tree's root system. Although some roots may die after shoot pruning, this does not influence from which parts of the soil the trees take up the water. Most trees will take up water and nutrients from those soil layers where it is easiest. This is often from the upper soil layers from which the shallow rooted crops also take up their resources.

Pruning some of the shallow tree roots reduces the amount of tree roots in the surface soil and forces the trees to extract water from deeper soil layers. This reduces competition with shallow rooted crops like maize and beans.

First results from research stations and farmers' fields indicate that:

- Trees tolerate shallow root pruning,
- If there is no water stress, the effect on crop growth is minimal,
- But if dry spells occur, the yield near the root - pruned trees is much higher compared to the yield near trees that were not root pruned (Figure 9), and
- Other roots in deeper soil layers become more active to compensate for the roots that were pruned.

6. HOW TO ROOT-PRUNE

Pruning is done by opening a trench at least half a step (50 cm) away from the trees and about 1 foot (30cm) deep and cutting all tree roots. If young trees are root pruned , it may be sufficient to

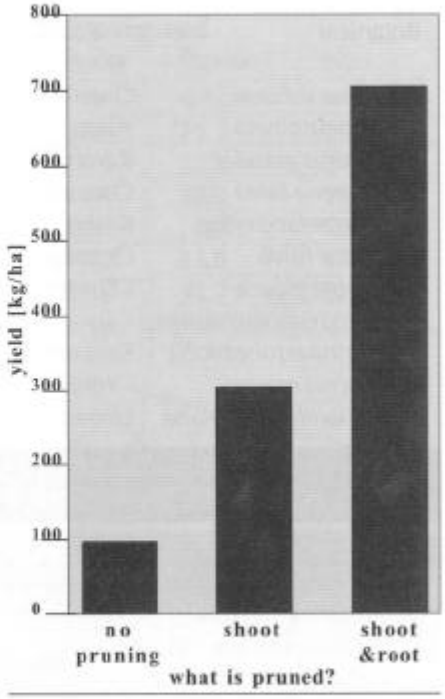

Figure 9: An example of the effect of pruning Grevillea robusta and Alnus acuminata on bean yield within 0-5 m of trees.(average of 12 farms near Kabale, first season 2000)

cut the roots by moving a panga through the soil. Initial results indicate that root pruning is required every one to two years and it reduces tree growth by about 12% (Table 1). It is very likely that the roots of different tree species will show different patterns of recovery. A number of risks still need to be explored further, such as the effects of root pruning on:

ROOT PRUNING:

- reduces water uptake by the tree from upper soil layers and so reduces competition with crops,
- increases crop yield, and
- reduces the effects of the trees on neighbouring farms.

It is not yet known whether it can:

- in some cases affect the stability of the tree if it is not done at the same time as crown pruning
- facilitate the infection of the tree with diseases.

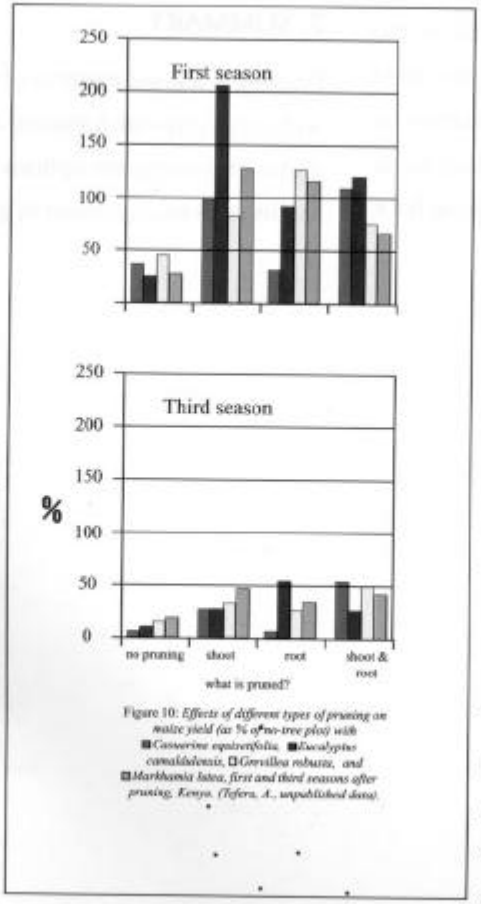

Figure 10: *Effects of different types of pruning on maize yield (as % of no-tree plot) with Casuarina equisetifolia, Eucalyptus camaldulensis, Grevillea robusta, and Markhamia lutea, first and third seasons after pruning, Kenya. (Tefera, A., unpublished data).*

- The stability of the tree,
- The infection of the tree with soil borne diseases through the cut surfaces.

On windy or steep sites, pruning should be done further from the tree. Also, stability will be improved if root pruning is not done on its own, but always with crown pruning (when tree growth may be reduced by 19% Table 1).

Although tree growth is reduced, this is more than compensated by increased crop yield, as indicated in Figures 9 and 10.

The first root pruning near large trees may be hard work, but each repruning gets easier. Many farmers indicate that they would accept annual root pruning, as it seems to

make trees and crops more compatible in the field. Root pruning of surface lateral roots could be done during the usual land preparation so that it does not become extra work. Also, some superficial surface lateral roots can be cut back during weeding.

7. SUMMARY

Pruning is a good method of managing trees to reduce competition with crops, provide firewood and improve timber quality. Both crown and root pruning are options which should be considered as part of routine tree management in agroforestry systems.

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