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## Recommendations for Agroforestry Programs in Remote Villages of Developing Countries, Based on Research in Haiti

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## **Contents**

1.	Introduction.....	2
2.	Methodology of 1985 Study .....	2
3.	Plantation Planning.....	3
3.1	Selection of Best Plots for Tree Planting.....	4
3.2	Choice of Agroforestry Strategy .....	7
4.	Recommendations for Extension Manual.....	13
4.1	Content of Manual.....	13
4.2	Discussion with Farmers .....	14
5.	References.....	17

## **1. Introduction**

A highly innovative and successful agroforestry program to support farmers in remote villages was implemented in Haiti from 1981 to 1991. During that period, the Haiti Agroforestry Project implemented by the Pan American Development Foundation (PADF) helped 203,347 farmers plant 48,202,000 trees on their properties (Smucker and Timyan 1995).

In 1985, PADF supported a study to determine how to teach the farmers to better plan and manage their agroforestry plantations (Buffum and King 1985). I was selected for the study because I had been working for PADF as an Agroforestry Extension Advisor since the start of the program. The second researcher, Wendy King, worked in Haiti for USAID. Our study concluded that the number of successful plantations could be increased by providing better training to participating farmers on three related issues: which part of their farm they should plant trees on; which tree planting system they should use, and how they should later manage their plantations.

This 1998 report is a modified and much shorter version of the original 116 page report prepared in 1985. The 1998 report focuses on recommendations that could be applied to agroforestry programs other developing countries where I work, so this version does not include the detailed farmer case studies, illustrations, and other information that only apply to Haiti.

## **2. Methodology of 1985 Study**

The 1985 study had two main components. The first was to compare the planning and management decisions made by farmers with successful versus unsuccessful tree plantations. The second was to use an analysis of farmer decision making to develop a new plantation planning and management component for the PADF extension program. The 1985 study was conducted in the village of Chomey, which is located near the town of Bainet on the south coast of Haiti. The study was conducted through in-depth interviews and field visits with tree planters. I had worked closely with Chomey farmers since the spring of 1982, and had provided trees to farmers in the spring and fall of each year. By 1985 when the study was conducted, 220 farmers in Chomey had already planted a total of 48,250 trees during eight planting seasons. Many of the trees were large enough that the farmers had a good sense of species performance and tree-crop interactions.

Our first step was to select the informants for the study. Using survival rate information from the inspections conducted after each planting, we divided the planters into three categories of having good, average, or poor tree survival. We evaluated the farmers' survival rates by comparing them with other farmers who planted in the same planting season, because overall survival varied greatly from season to season. We selected thirteen farmers to be interviewed, seven with good survival in their plantations and six with poor survival. Five of the informants had planted PADF trees during two seasons, and two planted in two locations during the same season. Therefore, a total of twenty tree plantations were included in the study.

We set up a schedule to each meet with one farmer per day. The local extension agent assisted in setting up meetings with the farmers, but did not accompany us on any of the field visits, because we assumed that the farmers would be more candid if the extension agent was not present. We tried to visit every plot the farmers worked (with or without planted trees), but some of the plots were too far away. The thirteen informants worked a total of 95 plots, of which we visited 85 plots.

For each plot, we collected information concerning its size, crop history, slope, aspect, and relative fertility. We asked who actually worked the land, and what were long term plans for the plot. If a plot did not have PADF trees on it, we asked why the farmer chose not to plant there, whether he thought trees would survive there, and which planting system would be most appropriate for the site. If a visited plot had trees on it, we asked: why he selected the plot and the planting strategy; why the trees did or did not do well; how he felt about the planting strategy; how the trees affected his garden; how he intended to harvest the trees; and how often he visited the plot. Each farm visit took between four and six hours to complete, and the farmers were compensated for their time.

### **3. Plantation Planning**

In the analysis of the thirteen farmer case studies, a pattern of farmer decision making emerged. All of the informants followed a two-step decision making process in planning where and how to incorporate the trees into their farms. Their first step was to eliminate garden plots that they did not consider to be suitable for tree planting. The second step was to consider which of the remaining plots would benefit most from the trees: where the trees would grow the best, and which planting configuration would be best suited to the needs of the farmer.

### **3.1 Selection of Best Plots for Tree Planting**

Land tenure was used by virtually all of the informants as a criterion for eliminating plots from tree planting activities. Every farmer worked a number of garden plots with different land tenure arrangements. The various land tenure arrangements provided the farmer with different degrees of security in tree tenure. For example, almost every farmer gardened at least one plot that either did not belong to him or which did not have secure land tenure. For the most part, the farmers were reluctant to plant trees on these plots. They were very concerned with land tenure issues, and were generally unwilling to plant trees unless they were sure that they would remain the undisputed owners of the trees.

- **Purchased or Separated Inherited Land**

Most of the informants owned at least one purchased plot or inherited plot which had been legally separated. The farmers had deeds for these plots, and their land tenure was completely secure. Whenever possible, the farmers planted their PADF trees on these plots because they knew that they would be the undisputed owners of the trees.

- **Undivided Inherited Land**

Many families do not bother to officially subdivide their inherited land because of the legal costs involved. Instead, the families make an informal division themselves. Some informants indicated that they were comfortable with planting trees on undivided land, while others would not consider doing so. It depended on their level of confidence that the trees would still be theirs when ready to be harvested.

- **Sharecropping for Another Farmer**

Sharecropping is common even for farmers who own substantial amounts of land. Several informants both sharecropped gardens for other landowners and had other farmers sharecropping gardens for them. The ideal arrangement is to have someone sharecrop one of your least fertile and most distant gardens, while you sharecrop someone else's garden that is more fertile and closer to your house. In this way it is possible to upgrade your farm without either purchasing more land or working more acreage.

A sharecropper has little to gain by planting trees on a sharecropped plot. Traditionally the sharecropper is entitled to half of what the garden produces, but hardwood trees are the property of the land owner alone. There is also no long term security in being a sharecropper. Therefore, all of the other informants were adamant about not wanting to plant trees on land they worked as sharecroppers.

- **Rented Gardens**

Many Chomey farmers rent garden plots from other farmers. It is possible to rent land by the season, by the year, or to lease it on a long term basis. When a farmer rents a garden to a non-relative, he charges whatever he thinks the tenant is willing to pay. However, many older farmers, with more land, rent land to their families or friends and charge only a nominal rent. A tenant farmer has the right to harvest anything he plants in the garden, including trees. But one informant mentioned that he was not willing to plant PADF trees on a rented plot, because the owner had the right at any time to either take back the land himself or rent it to another farmer.

- **Land Under Negotiation**

Some farmers eliminated plots they gardened from tree planting activities because they were still in the process of buying them. It is common for a farmer to make a down payment on a piece of land and farm it for a year or two before the legal paperwork is finished and he makes the final payment. So they were not willing to plant trees on these plots until they were sure that this land transaction would not be cancelled.

- **Labor Arrangements**

A second major factor in the plot elimination process is the labor arrangement. A landowner has several options for supplying the necessary labor to garden a piece of land. Each option offers him a different amount of control over how well his tree seedlings are cared for. The most controlled labor situation is when the landowner works the land himself or with the assistance of family members. This is the best option as far as tree care is concerned.

Another arrangement, which the informants perceived as relatively safe in terms of tree care, is to hire day wage laborers. Each one of our informants said they supervised the day wage laborers in order to maximize the day's work. Thus, they were able to remind the workers to watch out for the seedlings.

Sometimes several farmers form a group and rotate the provision of labor to the group members. Once again, the landowner is always present with this arrangement, and can protect seedlings he has planted on the plot. But some informants commented that this arrangement was not desirable because it was often difficult to get all of the members' gardens cultivated in time to catch the rains.

Another common labor strategy of the informants was to employ a sharecropper to garden one of their plots. In this case the land owner has clear rights over the trees. However, the informants felt strongly that it was better to plant trees on plots that they worked themselves, rather than on plots with a sharecropper. The sharecropper does not stand to benefit from the trees, and may feel that the trees will make his work in the garden more difficult and reduce crop production. Some sharecroppers even purposefully damage the trees by lighting fires near them or tethering animals near the trees. Therefore, only one of the thirteen informants planted trees on a plot that a sharecropper worked. That informant supervised his sharecropper sufficiently to protect the trees. In this exceptional case, planting trees on a sharecropped plot worked out very well. Every other informant that owned sharecropped plots decided to plant trees on plots they worked themselves.

Land tenure insecurity and labor arrangements were the most common reasons for eliminating plots from consideration for tree planting. Other reasons that were given by the informants for eliminating plots are discussed below in descending order of the frequency with which they were mentioned.

- **Damage From Grazing Animals**

Some informants eliminated plots where they feared free grazing animals would damage their trees. In one region of Chomey, many residents let their graze freely each winter. Every informant that owned land in that area eliminated those plots from consideration for tree planting due to the grazing problem. A couple of informants also eliminated gardens in other locations because they knew that their neighbors were not careful with their goats.

- **Distance From Home /Surveillance**

Several informants eliminated a plot because it was too far from their home and they could not visit it regularly. The major reason the informants preferred to visit their tree plot frequently was to check if grazing animals were damaging the trees.



However, they were also concerned that other villagers who did not receive trees might steal some of their freshly planted seedlings. They clearly valued the trees and wanted to keep a close watch over them.

- **Existence Of Non-Project Trees**

Several informants eliminated plots for tree planting that already had trees. An extreme case was a plot completely covered with a dense woodlot. More typically, an eliminated plot would either have a number of trees planted on the perimeter, or several widely spaced trees in the middle. The farmers preferred to plant on plots that had few or no trees in them already.

- **Plot Fertility**

Several informants eliminated plots which they considered too infertile or arid for the trees to thrive. These farmers wanted to maximize tree growth and were willing to plant on more fertile land. Conversely, some other informants eliminated their most fertile and flat plots because they valued the plots as crop land, and did not want trees to interfere with crop production. Some felt that trees should be kept out of fertile gardens as much as possible, except for steep plots that had erosion problems. But plot elimination on the basis of productivity was dependent on the amount and quality of land available to the farmer.

- **Fire**

In the Chomey area, farmers do not burn their fields, even though they may pile up thorny weeds and burn the pile. Therefore, fire was not cited as a factor for eliminating plots. However, in other areas of Haiti, farmers burn their fields to clear them. Plots in these areas should be eliminated from consideration for tree planting since the seedlings will not survive the fire.

### **3.2 Choice of Agroforestry Strategy**

After eliminating plots that are not suitable for tree planting, the farmer considers his remaining plots, and decides which agroforestry strategy would be best for each plot. This second step of choosing a strategy depends on several factors. The farmer bases his choice on an assessment of his plots' productivity, his long term plan for the plots, and the impact that the trees would have on crop production.

All of the informants employed one of four agroforestry strategies: a solid plantation on infertile land; a solid plantation on average to fertile land; a border planting on average to fertile land; or rows of trees on average to fertile land.

- **Solid Plantation on Infertile Land**

Six of the twenty plantations belonging to the informants were solid plantations on infertile land. A farmer employing this strategy chooses a section of one of his gardens that is no longer able to produce foodcrops economically, and plants trees at a 2x2 meter spacing during the last season of gardening the plot. He is not actually taking any land out of crop production, because he would have left the land fallow anyway. In most cases the tree plantation does not cause the plot to be left fallow any longer than it would have been otherwise.

Three informants adopted this strategy with excellent results. Relatively infertile plots, which would have been left fallow anyway, were converted into productive woodlots. In each case, the trees were planted during a season when the plot was cultivated for crops, so the soil was well worked over. After three years, all three plantations contained harvestable trees, and the steep, degraded sites were covered with a thick layer of humus. The three informants felt that the trees had increased the plot's fertility enough to make it economically worthwhile to plant foodcrops again after the trees are harvested. All three informants were content with the strategy and planned to plant more trees in a similar fashion.

However, the strategy was less successful for two informants who chose extremely degraded sites for their plantations. One planted his trees on a section of a garden that he had given up gardening several seasons earlier. He planted the trees by digging small holes with a metal spike in compacted, ungardened soil. The trees survived, but their growth was minimal. The site where another informant planted was not much better: steep and eroded, with a lot of exposed bedrock. The trees covered about one third of the poor section; and he did not expect to garden any part of the section for at least another few years. His trees had grown slightly better than those of the other informant, but he was disappointed with the plantation. He indicated that he had changed his approach and planned to plant on better land next time in order to have a successful plantation. Both informants had sound strategies for planning their plantations, but they had been overly optimistic about the ability of the trees to grow on degraded sites.

Unfortunately, their high expectations resulted from the PADF training program, which encouraged them to plant on their worst land without emphasizing the need for appropriate planting techniques. It is possible to establish small container seedlings on such sites, but only with intensive planting techniques, such as digging larger holes, building catchment basins, and applying mulch. The training program subsequently started to recommend that all planters employ these techniques for all plantations. But the program should stress that if a farmer is not willing to invest the labor to plant his trees in this fashion on harsh sites, he should plant his trees on a better site.

- **Solid Plantations on Fertile Land**

Three of the 20 solid plantations visited were on relatively fertile land. A farmer employing this strategy plants trees in a garden that he would not have otherwise left fallow. He makes a conscious decision to plant a woodlot in a plot, knowing that the trees will limit his ability to garden the plot during a period of several years. He adopts this strategy because he believes that the trees will yield a greater return than the crops usually planted there, or because he wants to diversify his production so that he can maintain a source of income in times of crop failure.

This strategy appeals most to farmers who have had experience selling wood products and are aware of the value of trees. It also appeals to farmers who can afford to invest in tree production by taking a garden out of crop production for several years. Two of the informants had successfully employed the strategy of planting trees on good, fertile land without any regrets. They felt that their tree plantations would be profitable, and that they would be able to garden the land again in the future. However, even though a third informant had no regrets about where he planted trees, his plantation had done very poorly. The problem was that the garden was already fallow with compacted soil when he planted trees in it, causing the growth of the trees to be poor.

Even on relatively fertile sites, small container seedlings will not do well unless they are planted in well-prepared soil. Realizing that most farmers are unwilling to spend a lot of time in ground preparation while planting their trees, the training program should more actively discourage farmers from planting trees in fallow fields, and should advise them either to plant in another location or to wait until they start gardening the site before planting trees there.

- **Border Plantings**

The most common strategy of the informants was to plant trees on the border of an average to fertile plot. Eight of the informants' twenty gardens were planted in this fashion. The farmers who planted on the borders tended to have smaller than average land holdings. They were interested in planting trees, but did not have land that they could afford to take out of crop production even for just a few years.

All informants who created border plantations were happy with the strategy. They often planted their trees on the most fertile of their eligible plots. They wanted the trees to benefit from their best soil, and did not think that a single row of trees on the border of their field would adversely affect their food crops. One informant expected the trees to improve food crop production by increasing moisture retention on his arid plot.

Most of the border plantations had survived and grown well. Only a few farmers had poor survival. The most common problem was that the trees were planted too close to a path where passing animals damaged the trees. Farmers planting border plantations should be encouraged to incorporate the trees into multi-species borders which include animal control species.

- **Rows of Trees**

The fourth strategy employed by the informants was to plant trees in rows in the middle of a field. This strategy offers the same advantages as planting on the border. If the trees are well pruned, they will not produce too much shade for crop production. One informant chose this strategy because he did not have any gardens that he was willing to take out of crop production, and he was happy with his rows of trees. A second advantage of the system is that it can be incorporated into a soil conservation structure. One informant planted rows of trees on the contour on the steepest, most eroded part of his garden. He planned to use the trees to anchor brushwood terraces.

The three informants who planted rows of trees in the middle of their fields were content with the strategy and planned to employ it again. However, rows of trees are particularly vulnerable to damage by grazing animals or by laborers weeding the field. The extension program should encourage row planting, but should emphasize the danger of animal damage and the need to mark the trees well so that wage laborers will be able to recognize them.

All of the informants employed one of the four strategies described above in planting their PADF trees. Three other planting strategies which the researchers recommend for incorporation in extension programs are described below.

- **Wide Spacing**

Several informants mentioned that they were interested in planting trees with a wide spacing that mimics the natural regeneration spacing of several indigenous tree species. These farmers protected seedlings that grow up naturally in their gardens. They explained that the widely spaced and pruned trees did not interfere with crop production. In general, they felt that the trees were good for the soil, increasing moisture holding capacity and providing green manure in the leaves. Some species are recognized as competing with foodcrops for moisture. But the value of the wood outweighs its negative effects on crop production.

The farmers who were interested in the strategy of wide spacing had larger than average landholdings. To plant a larger number of trees the farmer has to have either a large plot or combine wide spacing with a border plantation. The wide spacing configuration is recommended for larger, dryer plots of less than average fertility that the farmer wants to continue cropping. The only problem with the wide spacing configuration is that the trees are more susceptible to animal and people damage. The trees must be clearly marked so laborers will see them when they are working in the plot. The farmer will not be able to tether animals in the plot while the trees are being established. Where possible, the tree species planted in the wide spacing configuration should be species that are unpalatable to animals.

- **Windbreaks**

Heavy winds cause a considerable amount of crop damage by damaging mature plants and desiccating the soil. During our field research, many farmers were worried that they would lose the season's bean harvest because strong winds were blowing away the bean flowers. Despite recurring crop loss due to the wind, the only observed traditional use of planting trees to protect crops from wind was near plantains. There was little awareness of the benefits of windbreaks, so agroforestry programs should put more effort into promoting the practice. Border plantings will deflect some of the wind's force. However, in windy sites, proper windbreaks are recommended. Technical information on windbreaks should be collected, a small number of demonstrations should be established, and the extension agents should be properly trained in planting windbreaks.

- **Live Fences**

Farmers in Chomey traditionally establish live fences by vegetative reproduction of local species. It is a valuable strategy for production for firewood, tool handles and poles. It could also provide a valuable source of forage and green manure if appropriate tree species are planted. Generally these fence rows are established to demarcate the boundary between a plot of land and a heavily travelled path. The trees are susceptible to damage from passing animals and people. So the traditional technology of sticking a branch into the ground to root is most appropriate since the rooting branches are able to withstand the abuse. Newly planted tree seedlings could not survive this planting strategy unless they are combined with other traditional protective border plants. To promote the planting strategy of live fences, an agroforestry program should establish a system for production and distribution of plant materials ready for transplanting. The program could help interested extension agents set up local sources for cuttings.

### **Conclusions on Agroforestry Strategy Choices**

The study concluded that many farmers did not have adequate information to make the best decisions about the second stage of plantation management, which was the choice of the best agroforestry strategy for one of the farmer's eligible plots. Therefore, the farmers could benefit from more training in selecting the best agroforestry strategy.

The major problem for a farmer when selecting a planting configuration is to appropriately match the configuration with both the plot's physical characteristics and the farmer's long term objectives for the plot. Some farmers base their strategies on incorrect assumptions about the trees' performance, while others do not consider the long term implication of the planting strategy they employ. This poor planning sometimes resulted in plantations with poor survival and growth. Other times it resulted in healthy plantations that the farmers regretted they planted because the trees competed with their foodcrops.

The farmers must be taught all of the disadvantages as well as the advantages of each planting strategy. There is no set formula for selecting the optimal planting strategy, but the training program can help farmers make more rational decisions. As a result, the planters will end up with more productive tree plantations which they will be more interested in replicating.

## **4. Recommendations for Extension Manual**

### **4.1 Content of Manual**

The most effective way to transfer knowledge to the farmers concerning plantation planning and management would be to develop an agroforestry extension manual which the extension agents would be trained to use during their meetings with individual farmers. The agroforestry extension manual for Haiti would be an expanded version of the existing planter information sheets with new sections on plantation planning and management.

The first part of the plantation planning section should cover plot selection. Most farmers already have a good sense of which plots would be unsuitable for tree planting. The inclusion of this information in the training program would reinforce their plot elimination process, and encourage all farmers to consider each of the potential problems that could arise on any plot. Points covered in the plot elimination section should include: land tenure security, labor arrangements, potential for animal browsing or fire damage, timing of fallow period, and surveillance. Farmers should be actively discouraged from planting on land that is already fallow when the trees are to be planted. The farmers should be encouraged to plant trees on land that is still being cultivated the season the trees are being planted, in order to maximize tree survival and growth.

The second part of the planning section should cover the farmer's choice of an agroforestry strategy for one of his eligible plots of land. The training information must include not only the advantages, but also the disadvantages, of each planting strategy. There is a great need for further training in this area. Some farmers make poor planning decisions due to a lack of information about the trees. They do not always consider the long term consequences of planting the trees on certain plots. The choice of agroforestry strategies should be presented to the farmers in terms of soil type and land characteristics, rather than tree planting configurations. A presentation of agroforestry strategy choices based on land types would more closely parallel the farmers' approach to decision making.

An important point to be stressed in choosing a strategy is that a farmer should only plant trees on an extremely degraded site if he can provide intensive ground preparation and tree maintenance. If a farmer is unwilling to invest a considerable amount of labor in a plantation in a harsh site, he should plant on a better site. The farmer should consider his desired end product in selecting a planting strategy.

Planting a solid plantation will result in straighter trees which will be better suited for boards and poles. Planting on the border or in rows will result in trees with more branches which are fine for charcoal production but not as good for lumber.

Three additional planting strategies that the agroforestry program should promote are wide spacing, windbreaks, and live fences. Some farmers are interested in planting trees with a wide spacing, but may assume that the program does not wish them to. Most farmers have never planted windbreaks, but could benefit greatly from them. Farmers are usually familiar with live fences established from cuttings of native species, but the program should establish sources for cuttings of both exotic and indigenous species. Roottrainer seedlings for live fences would not be appropriate for live fences unless the seedlings were incorporated into an existing animal barrier. The strategies for wide spacing, windbreaks, and live fences should be included in the agroforestry extension manual as recommended planting systems.

The management section of the extension manual should encourage the planters to start harvesting some of their trees. It should emphasize that the planters own the plantations and that they should manage their trees in whatever fashion is most profitable for them, whether it be for boards, poles, charcoal, or some other tree product. The training program should encourage farmers to cut some of their less-straight trees for charcoal production. Farmers who do not wish to make charcoal themselves should be encouraged to hire a sharecropper to make the charcoal. It should be stressed that thinning will help the rest of their trees, and that charcoal production will both bring in income and help improve soil fertility where the charcoal pit is located.

Other topics that should be covered in the management section are: pruning, coppice management, thinning, use of tree foliage for animal fodder, and expanding plantations by transplanting volunteers, producing a few seedlings in plastic bags, or direct seeding. A series of pictures linked to the extension manual would help the extension agents make a point by point presentation of the material to the farmers.

## **4.2 Discussion with Farmers**

The manual could include examples of how extension agents should discuss the issues mentioned above with the farmers. Some examples are below.



- **Plot Selection**

First you should think about all the plots of land that you work. Planting trees is a lot of work, so you should make sure you plant them in a suitable location. You do not want to spend time planting them unless it is clear that you will be the owner of the trees with the right to harvest them. It is usually better to plant trees on land that you work yourself rather than give out to a sharecropper. You are the one who is most interested in the trees, and you will make a point of taking care of the trees well. Therefore you do not want to plant the trees in a plot that you do not visit frequently unless you have someone there who will take care of them well for you.

You do not want to plant the trees in an area that has free-grazing goats or fires that can damage your trees. You can plant in a plot where you tether your animals as long as you are careful to keep them away from the trees. And you should not plant trees in a plot that is fallow. The trees will grow much better within a garden. If a plot where you wish to plant trees is already fallow, you should either end its fallow period or wait and plant trees there another year.

- **Planting Strategy**

After eliminating the plots which are not suitable for tree planting, you should select one of your remaining plots and decide on a planting strategy. There are several different strategies for planting trees in a garden. Each strategy has advantages and disadvantages. If you plant in an infertile plot, the trees will grow slowly and you will have to put more effort into planting them. But the trees will improve the fertility of the soil. If you plant in a fertile plot, the trees will grow faster and they will require less care, but they will take up some space in your garden. Consider the following strategies and decide which one is best for you.

If you have an infertile section of a garden that you want to leave fallow for several years, you can plant a solid plantation on it. This means you completely cover the infertile section with trees at a 2 meter spacing. You will have to stop gardening the plot when the trees become large. A solid plantation is the best way to produce straight trees which are suitable for lumber.

The solid plantation on infertile soil is a good tree planting strategy, but you have to remember two things. First, trees are tough, but they like good soil just like any other plant. If you plant trees in soil that is very degraded, they will not grow well unless you give them special attention. You should plant the trees together with other crops so that the soil will be worked over. Or you should dig deep holes for

them, and be sure to build catchment basins and apply compost. In other words, you must work harder to get good results on infertile soil. Secondly, you must remember that after the first couple of seasons you will not be able to plant crops for several years while the trees are growing. The trees will improve the fertility of the soil, and after you harvest them, you will be able to garden the section again.

If you have a sloped garden you can plant a row of trees on it. But if it is fertile soil, you may want to continue gardening it. Then the best strategy is to plant rows of trees on the contour. Plant the trees at 3 meter intervals within the rows, and leave a distance of 10 to 20 meters between the rows. The trees will help hold on to the soil, and you will be able to continue farming in between the rows. But you must remember to mark each seedling with a picket or three rocks. Otherwise, people working in the garden may not see them and may damage them while weeding the other crops. Also leave adequate space between the rows if you plan to tether animals in the plot. Use an A frame to trace out the contour. Your extension agent will show you how to use the A frame.

If you have a fertile garden, you may not want to plant any trees in it. But if you can plant trees on the perimeter, the garden will still be free for other crops. If you prune the trees well, they will not cause too much shade. This strategy will not adversely affect your foodcrops, and the trees will grow well because of the fertile soil. But they tend to produce more branches and will not be as well suited lumber as trees planted in a solid plantation. Do not plant the trees too close to a trail unless they are protected by some vegetation that serves as an animal barrier. Otherwise passing animals and people will damage them.

If you have a large field, you can plant trees throughout it with a wide spacing. Farmers have always protected volunteers that sprout in their fields because they know that the trees help retain soil humidity. But now in many places the big seed trees have been cut down. Plant the trees with a spacing of 10 x 10 meters. If you prune the trees well, you will be able to keep gardening the plot. This strategy is especially good for an arid site because it helps retain soil humidity. But if you plant with a wide spacing, you will not be able to tether animals in the plot for at least two years. And you must remember to mark all the seedlings with a stick or three rocks so that people working in the field do not damage them.

- **Plantation Management**

You are the owner of your trees. You planted them, and now you should decide the

best approach to manage and harvest your plantation so that you maximize your benefits. If you have some crooked trees, you could thin them out and make some charcoal. That will leave the straighter trees more room, and they will grow quicker. If you do not wish to make the charcoal yourself, you can employ someone else to make charcoal as a sharecropper. Make sure you tell him which trees to cut and which ones to leave. Locate the charcoal pit in the least fertile section of your field, as it will improve the soil's fertility. Remember that it is better to mulch crop residues than to burn them. You can earn some money selling your portion of the charcoal. And you will be able to plant a good foodcrop in the spot where the charcoal pit was.

Leave a few of the straightest trees to make boards from in a few years. You can harvest some of the trees sooner for posts or beams. But your plantation needs some attention to give you the maximum results. If you prune your trees well, they will be more valuable. When you prune the branches, cut them from the bottom so that you do not rip the bark. Use a sharp machete so that you get a good clean cut. Remember not to cut too many branches. Pruning the branches lets more sunlight reach the crops you plant near the trees, but if you prune more than one third of the branches, the tree will grow slower.

Many the trees will coppice. If several stems sprout from the stump of a tree, weed all but the biggest three. If you leave all of them, they will be too crowded, and none of the stems will produce a large tree. If small seedlings start to sprout naturally under your trees, you should dig a few up and transplant them in other parts of your garden. You can also collect seed from your trees and sow them in fields when you are planting other crops. Many trees can provide you with good animal forage in the dry season. Try feeding your animals some leaves from your trees and see which ones they will eat.

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