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PB1465 Tree Crops for Marginal Farmland - Paulownia

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Tree Crops for Marginal Farmland

Paulownia

With a Financial Analysis

THE UNIVERSITY of TENNESSEE

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Paulownia

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Tree Crops for Marginal Farmland

Many landowners would like to increase income from their property, as well as decrease income variability. A growing number of property owners are investigating new and diversified sources of income. A resource that has not been tapped to its full potential is marginal farmland, specifically its use for growing tree crops. More than 30 million acres of woodland and idle pasture and cropland exist in the Southeast, and much of this land could be producing valuable tree crops.

The Tree Crops for Marginal Farmland Project seeks to provide landowners with basic information about growing and marketing tree crops. Tree crops have many advantages for owners with marginal or unused land. The cost of inputs is relatively low, and economic returns may be quite competitive with alternatives. Marginal lands converted from annual row crop and pasture production to tree crops can reduce soil erosion, improve water quality, reduce total pesticide and fertilizer applications, and produce more profitable returns for the landowner.

Five introductory guides are available in this series. They provide information on a specific tree crop that can be grown on small or medium-sized tracts of marginal or unused farmland. All these crops are common to areas of the Southeastern United States, but their economic potential should be evaluated. The tree crops chosen for this series are:

White Pine for Timber
Black Walnut for Timber and Nuts
Loblolly Pine for Timber
Paulownia for Timber
White and Virginia Pine for Christmas Trees

Your decision to grow a tree crop should be made only after careful consideration of the growing time, expense requirements, market conditions, expected returns and your personal objectives. These guides will help you make your decision. In addition, you should seek information from representatives of organizations such as your state Forestry Service, your local Extension office and private consultants.

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Large leaves and immature fruit clusters of Paulownia.

Credit: James H. Miller, USDA Forest Service

All photos, unless otherwise specified, courtesy of Wayne Clatterbuck.

How to Use This Guide

This guide describes cultural practices used to grow Paulownia (*Paulownia* spp.) trees in the southern United States and the cost of those practices. A financial analysis is included that uses typical costs and expected returns to evaluate a representative investment.

While reading this guide, take special note of the cultural practices described and their estimated costs. Think about potential markets for the harvest. Read how to evaluate your potential investment, and think about the other benefits of tree crops. Read the case study, "The Smith Family," to get a better idea of how these investments can be evaluated. To conduct a financial analysis of your own situation, carefully estimate all the production costs, and then take your estimates to your local Extension agent, farm management agent or consultant for assistance.

Paulownia: Description and Uses

Paulownia is native to the Orient. It is also called the Chinese Empress tree, the Princess tree or the Kiri tree. Paulownia is known for its extremely fast growth, clusters of showy and fragrant lavender flowers, elephant-ear-sized leaves and extraordinary cash value. The major commercial market is with Japan. Paulownia is used to make furniture, gift boxes, bowls, toys, clogs, handicrafts and musical instruments. The wood is also used for traditional products such as construction lumber, plywood and veneer.

Although many species of Paulownia exist in Asia, many are considered subtropical and will not become marketable trees in the southern United States. The three species commonly recommended for planting in the United States are *Paulownia tomentosa* (Royal Paulownia), *P. fortunei* (white-flowered Paulownia) and *P. elongata.* Royal Paulownia is more tolerant to cold winter temperatures to 0 degrees F, while *P. fortunei* and *P. elongata* are more susceptible to cold winter temperatures and

should be planted where winter temperatures rarely get below 20 degrees F.

In Japan, Paulownia wood is used for a multitude of products because it is attractive, strong, lightweight, quick-drying, versatile and has good resonance qualities. The wood is easily worked and will not split or crack when spikes are driven into it or with rapid drying. Demand is so great that Japan imports large quantities of logs and lumber from China, Taiwan, the United States, Brazil, Argentina, Paraguay and Thailand.

Paulownia was introduced into the United States as a landscape tree nearly 150 years ago and has since become naturalized in 33 states. When American sawmill companies became aware of strong markets for Paulownia in the 1970s, a cutting frenzy began. Very high prices were paid for slow-growing wild trees, largely because of their size and closeness of growth rings. These conditions created a demand for high wood quality desired for many Japanese products, especially instruments and other specialty items. Since most large wild trees have been cut, attention has shifted to growing Paulownia trees in plantations.

Paulownia may be planted as seedlings, rootstocks or root cuttings.

Paulownia plantations are relatively new in the United States, with the oldest planted in the late 1970s. Thus, there is much to be learned and tested about Paulownia plantation management, especially during the later stages, that will challenge growers, researchers and professionals.

Paulownia is categorized as an invasive exotic. Although there is little doubt that it is an exotic, the question of its invasiveness is open to conjecture. The many small seeds of Paulownia are wind-blown. However, the seeds do not germinate and survive unless the seed falls on sterile soil. New germinates of Paulownia have a high rate of mortality from damping-off disease caused by a variety of soil fungi. Generally, Paulownia does not colonize open areas unless sterile soil is present, as in construction activities, recent burned areas and road cuts. Rarely does Paulownia colonize fields, because of the ever-present fungi.

Paulownia does not compete with other trees because it does not maintain a terminal leader. Requiring full sunlight for continued development, it is often overtopped by other species and succumbs. Paulownia is usually found on the edge of a forest where sunlight is more available rather than the forest interior.

Due to the strict sunlight and soil requirements, the amount of Paulownia appears to have declined in recent years. Seed dispersal from Paulownia plantings does not appear to increase the amount of Paulownia outside plantations.

Most of the market for U.S. grown Paulownia is Japan. Only the slow-grown, high-grade trees from the United States are desired by Japanese markets. Poorer grades and fast-grown trees are not purchased from the United States. Trees with these characteristics are more easily obtained at less expense from sources closer to Japan. Entrepreneurs are trying to develop markets for Paulownia in the United States because of its superior strength-weight properties and workability, but the supply of the wood remains somewhat limited.

This publication describes the most common cultural practices used to produce marketable Paulownia trees. For illustrative purposes, it includes a sample financial analysis, which uses average costs and expected prices to estimate financial returns.

Production Management

Site Selection

The first step in having a successful Paulownia plantation is selecting the proper site for optimal growth. Although Paulownia is a fairly adaptable species, it grows best on gentle, lower slopes. The soil should be well-drained but have a high water-holding capacity, should be at least 25 inches deep and should have a pH around 6. Southern exposures should be avoided. Sites should be protected from prevailing winds because the thin bark of Paulownia is highly susceptible to sunscald and winter cold damage.

Paulownia can be grown throughout the southern United States. The most favorable growing regions include western Virginia; Maryland; the Carolinas; all of West Virginia; Kentucky and Tennessee; northern Georgia, Alabama and Mississippi; southeastern Missouri and northeastern Arkansas.

Site Preparation

Site preparation makes planting easier and creates favorable growing conditions for young seedlings. Site preparation operations will depend on the roughness and vegetation of the planting site. Old fields typically require herbicide treatment to control weeds and brush, disking or plowing to loosen the soil for root growth and subsoiling to allow roots to penetrate hardpans. Cut-over land will often have rocks, stumps and logging debris. Removal of this material with a tractor or bulldozer may be necessary to make future cultural practices easier. Some Paulownia growers hand-cultivate each planting spot to stimulate better root growth and to remove competing vegetation.

A number of chemicals are effective for controlling residual vegetation during site preparation. However, use is closely controlled by the Environmental Protection Agency, and regulations are subject to periodic change. For these reasons, specific chemicals rates and methods of application are not presented in this publication. The grower is referred to recommendations that are updated periodically by Extension

personnel. In using all chemical herbicides, rates and methods of application listed on the product label must be followed closely to ensure safe, effective control.

Control of herbaceous weeds in old fields and pastures begins in the fall prior to spring planting. The herbicide is sprayed in 2- to 3-foot wide strips or spots in which trees will be planted the following spring. A foliar herbicide is applied in early fall when weeds are actively growing to eliminate the well-established perennials. For growers who till in the fall prior to spring planting, spray areas with a foliar herbicide a week or two before tilling. If a foliar herbicide is applied in early fall, some additional form of weed control probably will be necessary to prevent re-invasion of weeds the following year.

Other growers omit the foliar herbicide and use only a soil-applied herbicide in late fall. Soil-applied herbicides should not be used early in the fall because they lose much of their effectiveness in controlling weeds the following year. Mowing or tilling prior to applying these herbicides produces better and more uniform results.

Sometimes weed control in plantations cannot be started until just before planting in the spring. If it is begun early, before weeds have begun substantial growth, an application of a soil-applied herbicide about two weeks before planting normally controls all but the most deep-rooted perennials. Tilling can also be used effectively. If, however, weeds have already begun to grow vigorously, effective weed control probably will require tilling and/or application of a foliar herbicide.

Tree Planting

Most Paulownia plantations are planted with seedlings or rootstocks. In either case, the planting material should be ordered in advance to assure your supply. Planting stock is available from private nurseries.

The planting density should be high enough so that a forest-like competitive stand will develop quickly. Competition will limit rapid growth and improve log quality. Tree spacing of 10 to 12 feet square is recommended.

Stock should be planted after the last killing frost in the spring, usually from May to mid-June in Tennessee. If the soil is dry and rain is not anticipated, you may need to water around newly planted trees.

Weed Control

Since Paulownia cannot grow under shaded conditions, good weed control in the first year of the plantation is critical. You may control weeds either with a directed herbicide spray for both grass and broadleaves or by mowing. Several passes per year with a mower may be necessary during the first few years.

Irrigation

Like other plants, Paulownia seedlings can die from inadequate moisture. To protect your investment, irrigate the young plantation during dry periods. This can be time-consuming and expensive, but it may carry the young trees through difficult dry periods.

Coppicing

A realistic management objective is that each tree produce a single log, which is high-quality, straight and 10 to 16 feet long. Cutting young trees at ground level and allowing them to resprout from the root collar is called *coppicing.* This operation results in straighter, better-formed stems. Paulownia does not produce a true terminal bud. A lateral, side bud develops into a new leader each year, producing a stem crook(s) that results in a poorly formed tree. The purpose of coppicing is to promote a clear, straight 8- to 16-foot sprout in the first year following coppicing. Stems should be coppiced when trees have a 3-inch root collar, usually one to three years after planting. At 3 inches, the tree has developed an adequate root system to allow a sprout of 10 to 16 feet in one growing season. Trees should be coppiced in early March before spring growth and the resulting multiple sprouts should be thinned in late May or June to the strongest single sprout.

Pruning

Pruning is the practice of removing buds and lateral branches to promote upward growth and better quality stems. No pruning

Coppicing young Paulownia stems result in better form and growth of the new sprout. Select coppice stems that originate at ground level (a), not those weaker sprouts that originate on the cut stem above the ground (b).

is necessary until after the stems are coppiced. Lateral branches form from buds located at the joint of the leaf stalk and the tree stem. Removing these buds and branches before they become woody allows the stem to remain branchless until the desired height has been reached. Prune buds and branches several times each year for three years after coppicing to maintain a clear stem. Do not overprune! A minimal live crown ratio (length of crown / total tree length) of 30 percent should be maintained.

Sprout growth of Paulownia one year after coppicing.

Pest Control

Paulownia trees experience relatively few pest problems. However, trees sometimes are affected by insect, disease and animal pests. Defoliating insects may cause minor damage, but Paulownia trees are not seriously damaged by insect attacks. Stem cankers can be serious with Paulownia. Keeping trees in a thrifty and vigorous growing condition usually deters fungal infections. Some animal pests, such as mice, voles, rabbits,

groundhogs and deer have also caused problems by root feeding, girdling or antler rubbing. Control of all pests should follow standard procedures for other tree crops. Check with your local forester or county Extension office for specific information regarding pesticide use.

Although sunscald is not a pest problem, it can cause serious damage to Paulownia trees. Southern exposures and protection from desiccating winds should be addressed through proper site selection.

Thinning

Once Paulownia trees have clear 16-foot stems, no further pruning or coppicing is necessary. As the trees grow, they will start to crowd and compete with each other for growing space. The diameter growth rate will begin to decrease. Diameter growth is affected by tree density. If density is too high, thinning may be necessary. Choose an appropriate density level and maintain it with periodic thinnings. Generally, six growing rings per inch or a diameter growth of 1/3 inch per year is an acceptable growth rate for producing high-value trees for the current market. Remember that high-quality, profitable logs of Paulownia for export are grown slowly, with small growth rings.

Harvesting

When trees have reached a marketable size, the plantation can be clear-cut. As the trees near maturity, check market prices regularly. We recommend inviting competition to get the most value for your logs. Widely advertising your sale and using the sealed bid process with an accompanying sales contract is usually the best method to obtain maximum value for your trees.

Calendar of Silvicultural Practices

Common silvicultural practices for Paulownia and the approximate time to perform them are listed here. Not all the practices are necessary to establish and maintain a healthy stand of trees for every situation.

CALENDAR OF PAULOWNIA PRODUCTION	
WHAT TO DO	WHEN TO DO
Select a planting site Prepare the site with disking, subsoiling and/or herbicide	Late summer and fall
Prepare site, apply pre-emergent herbicide. Coppice trees *(after 2nd or 3rd growing season)*	Early March to mid-April
Plant rootstocks or seedlings Thin sprouts after coppicing Prune buds & lateral branches *(annually after coppicing)*	May to mid-June
Mow plantation Prune buds Water seedlings, if necessary	Summer
Thin plantation, if necessary	Winter

Financial Analysis

Paulownia production costs vary widely. Your time investment, land quality, equipment and hired labor availability or cost will all affect production costs. Some landowners may have the necessary labor and equipment to perform most of these practices. Others may find it necessary to contract the work. This section describes approximate costs for common cultural practices. Remember that all costs shown here are our estimates (2004 prices) and will likely vary from your actual costs.

Photo by Sara Clatterbuck

A 12-year-old, well-managed Paulownia plantation.

Site Preparation

The amount of site preparation depends upon site conditions and required weed control or debris removal. Control of competing vegetation is essential for optimal growth of Paulownia. Generally, an herbicide application is recommended to control herbaceous vegetation (grasses and broadleaves) because this vegetation is a fierce competitor for soil moisture. Mowing and disking help, but are not as effective as herbicides. Subsoiling is recommended if you have a hardpan. Site preparation costs average about $40 per acre, depending on treatment used. Costs may range from as little as $20 per acre up to $120 per acre if a bulldozer is used. Effective site preparation treatments will reduce the need for later weed control.

Tree Planting

The cost of tree planting includes planting stock and labor. Seedlings or rootstocks cost about $1 each. Planting cost depends upon the planting density, which ranges from 170 (16′ x 16′ spacing) to 450 (10′ x 10′ spacing) trees per acre. Typical cost for planting trees is $35 per acre.

Weed Control

Weeds may be controlled by herbicide application, mowing or both. Mowing costs average $35 per acre per year, and herbicide product and application costs can range from $18 to $45 per acre. We used $35 per acre per year. Weed control is necessary for at least three years after coppicing. After that time, the trees are no longer affected by shade cast from weeds.

Irrigation

Irrigation cost is extremely difficult to estimate. Typically, seedlings are irrigated only during a first-season drought. Weekly watering may be necessary during a severe drought. The distance from the water supply to the plantation will determine the feasibility of irrigation. These costs are not included in the financial analysis

Coppicing

These costs depend upon the number of trees coppiced per acre. On average, coppicing costs are approximately $25 per acre.

The purple flowers of Paulownia appear in April to May before the leaves emerge.

The seed pods of Paulownia mature in September or October and persist on the tree through the winter.

Each seed capsule of Paulownia may contain up to 1,500 seed. The small seed are easily disseminated by the wind.

Pruning

The cost depends upon plantation planting density and the extent of lateral budding and branching. Pruning cost ranges from 40 to 60 cents per tree per year. We used $175 per acre per year.

Pest Control

Control of insects, diseases or animal pests may be necessary, but these costs are difficult to estimate. Insecticide spraying costs $25 to $75 per acre depending on application method, while fencing to keep out deer costs approximately $200 per

Pruning lateral branches that often form at the joint of the leaf stalk and the tree stem helps to keep the stem clear and straight.

acre. Some growers apply seedling protectors to each tree. Such protectors eliminate animal pest problems and also may reduce weed control, but they cost approximately $1 per seedling. These costs may be sporadic, if incurred at all, and are not included in the financial analysis.

Thinning

Thinning to control plantation density is not currently a common practice, because most existing plantations are too young to warrant this practice. Only older stands produce marketable lumber from thinnings. Since you will normally remove the poorest-quality trees, returns from thinning will be low.

Paulownia plantations are suited for some marginal farmlands, if the soil is well-drained.

Returns

The Paulownia log market is highly dependent upon Japanese demand. High prices are paid only for top-grade logs. Log grades are based on log diameter, growth ring width and the number of defects (Table 1). Better grades have more growth rings per inch of diameter, indicating slower growth and more years to reach a given diameter. Table 2 shows the price tradeoff between low-value (faster-growing) and high-value (slower-growing) Paulownia.

Table 1. Paulownia log grades based on small-end diameter and number of rings per inch of log cross-section (Graves 1989).

Log Diameter (in.)	LOG GRADE Rings Per Inch			
	8	6	4	< 4
20+	A1	B1	C1 or D	E
16-19	A2	B2	C2 or D	E
12-15	A3	B3	C3 or D	E
8-11	A4	B4	C4 or D	E

Table 2. Typical Paulownia stumpage prices in dollars per board-foot – Doyle Rule (Graves 1989).

Log Grade	Price ($/bd. ft.)	Log Grade	Price ($/bd. ft.)	Log Grade	Price ($/bd. ft.)	Log Grade	Price ($/bd. ft.)
A1	$8.00	**B1**	$5.00	**C1**	$2.20	**D**	$1.00
A2	$7.00	**B2**	$4.00	**C2**	$2.00	**E**	$ .50
A3	$6.00	**B3**	$3.00	**C3**	$2.00		
A4	$2.00	**B4**	$2.00	**C4**	$1.70		

Description of Grades:

Grade A: Logs are straight with a centered pith and round with no defects. Annual rings are tight and even, with at least eight rings per inch. Less than 1.0 percent of all Paulownia logs make this grade.

Grace B: Logs are allowed to have a couple, slight surface imperfections and one defect. Annual rings are tight with at least six rings per inch. About 40 percent of all Paulownia logs make this grade.

Grade C: Two defects are allowed. Logs must have at least four annual rings per inch. About 40 percent of Paulownia logs make this grade.

Grade D: Logs with more than two defects, but at least four annual rings per inch.

Grade E: All other logs, including otherwise high-quality logs with less than four rings per inch.

There is considerable market uncertainty associated with growing crops of Paulownia, both domestically and overseas. In addition, Paulownia stumpage prices in the U.S. vary by location. Such factors as log quality, distance from mill and terrain affect the price.

Evaluating Your Investment

Tree crops are different from most agricultural crops due to the long growing time needed to return profits. Many factors, such as inflation and interest rates, will have very important effects on profitability. For example, inflation may result in future returns that appear large in today's dollars, but have low future purchasing power. Also, since interest rates are closely related to inflation, interest cost incurred or interest income foregone will vary with inflation rates. Inflation is an important concern when considering investments that do not generate returns for many years.

Deciding whether Paulownia production is a good investment will require careful consideration of production costs, expected returns and how much your time is worth. After all, trees take much longer to grow than traditional crops, and your money will be invested for many years.

Returns must be discounted, because a dollar to be received tomorrow is not worth the same as a dollar received today. Whether a bird in the hand today is worth more than two (or even three) in the bush tomorrow depends upon your time preference for money and your evaluation of risk. In investment analysis, you should choose the discount rate that represents the return you could receive in alternative investments. With an annual discount rate of 10 percent, you should be just as pleased to receive $1 today as $1.10 next year.

Three measures to analyze an investment are:

- Present Net Worth (PNW) is similar to the term "profit." PNW represents the differences in the discounted revenues and the discounted costs.

- Annual Equivalent Value (AEV) is the Present Net Worth expressed as a constant annual return throughout the investment period. The AEV can be used to compare a tree-crop enterprise with field-crop returns on the same site.

- Internal Rate of Return (IRR) is the rate at which discounted revenues just equal discounted costs. An investment has good potential if the IRR exceeds rates from alternative investments with similar risk, timing and capital outlay.

The Smith Family

The story of the Smith family illustrates the economics of Paulownia production. You can use their experience as a reference for estimating the cost of managing your stand, but remember that no situation is typical. The Smith family's costs are only estimates and will probably be different from your costs.

The Smith family owns a farm with some abandoned cropland. They prepared the site by subsoiling and applying an herbicide application with a backpack sprayer. The subsoiling, chemicals and application cost $40 per acre. Then they hand-planted 302 rootstocks per acre on a 12-foot by 12-foot spacing. The rootstocks cost $1 each, and they valued their labor at $35 per acre.

Since weed control was necessary, the Smiths either mowed or applied herbicide once a year for the first six years. The total cost was $35 per acre per year. They coppiced the trees after the third growing season at a cost of $25 per acre, and pruned in years 4 through 6 at a cost of $175 per acre per year.

After six years, the Smiths' hard work was mostly completed. They expected that thinning would be necessary, but sales of thinned lumber would only cover the cost of thinning.
What can the Smiths expect for timber yield and price? Expected timber yield tables are not available for Paulownia, although they are for white pine, red oak and most other timber species. Some studies estimate that a 20-year-old Paulownia plantation will yield 10,000 to 12,000 board feet per acre (Doyle Rule). This assumes 100 trees that are 17 to 19 inches in diameter. Other studies estimate that Paulownia grown this fast would be Grade E (the lowest of Paulownia log grades.)

Twenty years is too short a rotation for good-quality logs. To produce logs that average Grade B and C, trees should be grown to 30 or 40 years, with a stand density such that harvested logs are 10 to 15 inches in diameter. If this is the case, a much lower board-foot yield is predicted. The Smiths estimate 6,000 board-feet per acre of Grade B and C logs for a 35-year rotation.

What about timber price? Growers report that Paulownia stumpage prices in 2004 were running from $2 to $10 per board-foot. The Smith's estimate is a conservative $2 to $3 per board-foot, or a return of $12,000 to $18,000 per acre for the 35-year rotation.

Let's see if the Smiths' investment was a profitable decision at the time of planting. The financial analysis assumed a 3 percent annual inflation factor for both costs and returns, and a 28 percent marginal income tax bracket.

Tables 3a and 3b show the results of the analysis for an average price of $2 per board foot and $3 per board foot, respectively. The Smiths decided that 10 percent was a good estimate of their desired return for this kind of investment. With their estimated costs and returns, at the $2 per board foot price, the present net worth at planting time was $2,302 per acre. Given the long time period between planting and harvest, the profit as expressed by PNW is very sensitive to the discount rate. If the Smiths were willing to accept a lower rate of return, their profit would be much higher. On the other hand, the Internal Rate of Return shows that they would just break even at 11.6 percent, after taxes. The Annual Equivalent Value shows that the return per acre per year averaged $182 after federal income taxes. This is very competitive with most row crops on marginal farmland. Calculations using a price of $3 per board foot are shown in Table 3b.

Table 3. The Smiths' financial analysis.

Table 3a

Yield = 6000 MBF/ac (Doyle Rule) Sawtimber Price = $2.00/BF	Discount Rate (%)				
	6	**8**	**10**	**12**	**14**
Present Net Worth ($/acre)	$7272	$4183	$2302	$1151	$446
Annual Equivalent Value ($/acre)	$407	$280	$182	$105	$47
Internal Rate of Return	11.6 % (after tax)				

The financial analysis for the Smith family does not include land costs or future real stumpage price increases (above the rate of inflation) or decreases. Prices for Paulownia logs are highly variable at any time, depending on log grade and export markets.

The analysis is for marginal land of average productivity. On more productive land with the same assumptions, greater rates of return would be expected. Alternatively, lower returns would be expected on less productive land.

Table 3b

Yield = 6000 MBF/ac (Doyle Rule) Sawtimber Price = $3.00/BF	Discount Rate (%)				
	6	**8**	**10**	**12**	**14**
Present Net Worth ($/acre)	$11368	$6717	$3880	$2141	$1070
Annual Equivalent Value ($/acre)	$636	$450	$306	$196	$112
Internal Rate of Return	**18.0 % (after tax)**				

Evaluating Alternative Tree Crops on Your Farm

Dollar returns and rates of returns are not the sole criteria in deciding whether to invest in a tree crop. Your decision will be based on many factors. These include market conditions in your area, how quickly you need a return on investment and how much time and effort you wish to put into managing the crop. You'll need to consider resources such as growing conditions, investment capital, labor costs and your own management ability. Only you know how your money and time are best spent.

The choice between tree crops also depends on the farm's resource base. For example, Paulownia may offer a relatively high return per acre but requires a sizeable amount of up-front investment capital to establish the stand. With site preparation,

planting, coppicing, weed control and pruning costs, a Paulownia plantation requires a large amount of investment capital that must be carried for many years.

Finally, consider risk. Numerous production problems such as weather, disease and insects can reduce the productivity of a stand. Also, costs vary widely. While trees are less risky than many agricultural crops, lost income can be considerable if a total disaster occurs. You may want to work through a few examples yourself, varying price and production levels, to get a feel for the risk inherent in the tree crop.

Use Table 4 for information regarding the many factors that should be considered in the decision to grow a particular tree crop.

Table 4. Information sources for tree crops selection.

Factor	Information Source
Geographic range of the tree crop, site suitability, local market conditions, initial investment costs, time and effort to required to grow the crop, insects and disease problems.	County forester, Extension agent
Soil conservation, wildlife and other benefits desired.	County conservationist, Extension agent
Cost-share programs.	County forester, NRCS office
Harvesting and marketing.	Private forestry consultants, Extension agents, county foresters

Sources of Information

The American Paulownia Association was formed in 1992 for growers and others interested in the production and marketing of Paulownia in the United States. Visit the association's Web site at *http://www.Paulowniatrees.org*

Federal and State Cost-Share Programs

If you want to raise a tree crop, investigate federal or state cost-share programs. In most counties, some money is available for forestry activities such as site preparation, tree planting, fire protection, erosion control and timber stand improvement. To find out what is available in your county, contact your county forester, Extension agent or local Natural Resources Conservation Service (NRCS) representative.

Cost-share funds simply reduce your cost of forestry activities. For example, a 50 percent cost-share on seedlings and tree planting may reduce the cost from $60 per acre to $30 per acre.

Other Benefits of Tree Crops

This guide has emphasized only the financial returns of tree crops. There are additional benefits and intrinsic values that result from planting trees. For example, wildlife are attracted to trees of all ages. Both game and non-game species of animals use plantations. With some sacrifice of wood production, a planting arrangement that increases habitat for wildlife can increase animal populations.

Trees also prevent soil erosion. Eliminating soil loss enhances land productivity and water quality. By stopping sediment from entering streams, your water resources will be cleaner and more suitable for fish and other aquatic species. Finally, tree crops screen the air and serve as a noise barrier. Again, proper design can maximize these benefits from your tree crop.

Moreover, most people enjoy the natural beauty only a tree or a forest can provide. Plant a tree crop today – and enjoy the many benefits for years to come.

Appendix

Assumptions Used for the Smith's Financial Analysis:

Item	Assumptions
Site preparation – subsoiling and herbicide application with a backpack sprayer	$40 per acre
Planting density	12-feet by 12-feet spacing (302 seedlings per acre)
Seedling price	$1 per seedling or rootstock
Planting cost	$35 per acre
Mowing and/or herbicide application	$35 per acre per year for the first 6 years
Coppicing	$25 per acre in year 3
Pruning	$175 per acre in years 4 - 6
Age at harvest	35 years
Sale price	$2.00 per board-foot
Yield	6 MBF per acre
Harvest expense	5% of sale price
Marginal income tax rate	28%
Inflation rate	3% per year
Tax treatment	Reforestation credits for planting, all else ordinary income/expenses

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Unique Wood Properties of Paulownia

- **Lightness.** Paulownia wood is about two-thirds the weight of lighter hardwoods (such as yellow-poplar) found in the United States.

- **Strength and Stability.** The wood is extremely strong and does not split or crack with rapid drying. Paulownia wood remains stable in high humidity.

- **Easily Dried.** Paulownia will air dry in about 30 days without warp.

- **Easily Worked.** The wood is easily processed and worked, especially when green. Logs can be peeled or sliced for veneer; craftsmen enjoy its versatility for woodworking and carving; and furniture manufacturers benefit from its lightness and stability.

- **Attractive.** The wood has an appealing grain pattern and is easily stained or painted.

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