A MULTIPURPOSE TREE FOR PUERTO RICO[1]

By
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(Abstract)

Cadam (Anthocephalus cadamba Miq.) grows very rapidly on a wide variety of sites in Puerto Rico. Tree form is excellent, seed is produced in abundance every year by mature trees, planting is easy and cheap, and relatively little care is required after planting. No important attacks of insects or disease have occurred on trees grown in Puerto Rico for 35 years.

The moderate density (0.45 based on green volume and oven-dry weight) and very low volumetric shrinkage (10 percent) from green to oven-dry condition, together with excellent machining characteristics, indicate many possible uses for locally-grown cadam. An industrial complex centered on plywood manufacture could convert residues into particle board. Included should be a modest sawmill for converting lower log grades into lumber for furniture and millwork. Chemical treatments now available add the durability and termite resistance not provided by nature.

1/ Presented at meeting of Sociedad Americana de Ciencias Agrícolas, December 10, 1965.

(Approximate Text)

Cadam (Anthocephalus cadamba (Roxb.) Miq.) is a native of southeastern Asia, India, Burma, Ceylon, Java, Borneo, and Sarawak. (Worthington 1959) The first seedlings known to have been planted in Puerto Rico were in the old arboretum at the University of Puerto Rico and in the same year at the Maricao Fish Hatchery. Those at the University were removed when the armory was built, so the only mature trees are those at Maricao, now 35 years old (slides 1 - 2).

As you can see (slide 3) trees are tall, straight, and with lower boles smooth and free of branches. Maximum tree size is about 120 feet tall and 7 feet in diameter (Kraemer 1951). If you will notice on the tree (slide 4) 5 years old, branches are excurrent and tend to be nearly horizontal; therefore drop off easily.

(slide 5) Leaves are opposite, simple, and 5-12 inches long. Flowers are very small, in bur-like heads 1 - 2 inches in diameter. They are fragrant and very attractive to bees. Fruit is a globose orange fleshy mass of closely packed capsules (Troup 1921) each containing 4 minute seeds, less than 1 mm wide and 1 - 3 mm long. The fruit is eaten by birds, bats, cattle, and people but is not really very desirable for people; to me, it tastes rather like a green guava but with an even greater proportion of seeds. Fruiting begins on many trees by age 5, and has been abundant every year in Puerto Rico. Falls to ground as a mass when ripe, so easy collection.

Germination of seed is good, and seedlings are easy to raise in the nursery, after they are about an inch tall. From such a small seed,

they are of course very tiny initially and must be handled very carefully at first, rather like tobacco. Outplanting is usually 4 - 8 months after sowing seed, when the transplant is about one foot tall. Trees can be planted barerooted or as stumps, with good survival in either case.

Early growth is good (figure 5) and suppression of competing weeds and grass is outstanding. Although we feel grazing animals should be kept out of young plantations, cadam is very resistant to browsing damage and on one of our adaptability plots with 12 species, cadam was the only species which survived some cows breaking into the plot.

I have already mentioned that early growth is good. Worth noting is that growth has been rapid on study plots from sea level to about 2000 feet, the lowest and highest tested; on sandy soils as well as clay, although pine is better adapted on all but the very best of the sandy loams; and where rainfall is 60 inches or more per year. It does not do well on severely eroded clays of the mountains, although it does about as well as any hardwood. Nipe clay, especially, has given poor results. Hot, dry sites are also not very suitable. Friable clay soils with sufficient rainfall are best; in other words, the species is almost ideally suited to the sites which have been in shade-grown coffee.

A quick comparison (figure 6) of Puerto Rican height growth with that in Indonesia shows our better sites, of those tested so far, are of medium quality for cadam. Also shown for comparison are poplar and slash pine (Bennett 1963) heights at the same ages.

Diameter growth (figure 7) is also shown to be reasonably rapid, and continuing into large sizes when trees are given adequate space for development.

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Finally, is any tree crop a paying proposition? (figure 8) Poplars are grown by private landowners on some of the best alluvial crop lands of Italy, France, Holland, Belgium, and Spain, to mention a few of the countries. Expected returns are shown in the lower curve (Christie 1959).

Several million acres have been planted to slash pine in Australia, New Zealand, and the southern United States, and hundreds of thousands of those acres are level or gently rolling land withdrawn from row-crop cultivation in order to establish the pine. Expected returns on a medium site are shown by the middle curve (Bennett 1963).

Growth on a medium site for cadam is shown by the upper curve (Sudarmo 1957). If only 300 acres of this quality were planted per year, within 20 years Puerto Rico could be supplying 10 percent of the wood presently imported and more than $6 million a year could be added to the local economy, making a contribution to Puerto Rico of $1000 per acre per year. The portion of the $1000 which would go to the landowner cannot be known until a local market is developed, but even 10 percent would be $100 per acre per year. This from a crop for which almost no labor is needed from establishment until harvesting, and with low labor requirements even then.

Doctor Briscoe has reviewed the results of growth rate studies of cadam and has demonstrated that the yields may be very high. As for agricultural crops, we strive for high productivity but we are also very much concerned with the utilization potential.

A few preliminary evaluations of some of the wood properties or characteristics have been made. Most of the information available on locally-grown wood comes from one old stem (30 years of age) and is supplemented by data from six 4-year old stems.

Machining Properties

For many uses such as furniture, millwork, turnery, etc. we are interested in how a wood responds to various cutting tools. Extensive testing has been done on the machining characteristics of Puerto Rican woods. Shaping or milling a profile on the edge of a board appears to be most critical. If a good surface is obtained in this ~~operation~~ test on a particular wood, then we can expect similar results for other machining operations.

(slide 1) Relative shaping quality

Note that cadam rates high-close to Burma teak and Canadian birch, superior to *Swietenia macrophylla* now imported in large quantities from Mexico and other Latin American sources.

(slide 2) Relative planing quality

Again cadam shows excellent results, being as good as teak.

RELATIVE SHAPING QUALITY

(Percent of pieces in each category)

Species and Source	Good to Excellent Pct.	Poor to Very Poor Pct.
1. Mahogany (St. Croix)	92	4
2. Teak (Burma)	79	17
3. Cadam (plantation)	71	17
4. Birch (Canada)	71	17
5. Sweetgum (U.S.A.)	38	46
6. Mahogany (Mexico)	21	52
7. Mahogany (Perú)	11	73

RELATIVE PLANING QUALITY

(Percent of pieces in each category)

Species and Source	Good to Excellent Pct.	Poor to Very Poor Pct.
1. Mahogany (St. Croix)	92	0
2. Cadam (plantation)	92	0
3. Teak (Burma)	92	0
4. Mahogany (Mexico)	74	11
5. Birch (Canada)	52	12
6. Mahogany (Perú)	44	29
7. Mahogany (Honduras)	43	20

Specific Gravity and Shrinkage

A Representative Sp Gr value for the 30-year-old tree is .45 (based on green volume and oven-dry weight). This comes to a weight of 33 pounds/cubic foot at a moisture content of 12 percent. Average weight per cubic foot reported for cadam growing in India is identical to this value (Trotter 1944). Young local growth (4-year-old trees) yields wood having a specific gravity of .39. Wood of the same age in the mature tree also has a specific gravity of .39. From this we can conclude that though wood from a single tree was used in these preliminary tests, the results can be considered as representative for the species. Specific gravity is closely related to many wood properties, most important being mechanical properties and shrinkage. Since cadam has the same specific gravity as sweetgum (a wood highly favored in the furniture industry) then we can expect cadam to be strong enough to meet most of the design requirements of furniture.

Shrinkage is also of prime concern and reflects the amount of dimension change to be expected in wood with changes in moisture content. Cadam has very low volumetric shrinkage (from green to oven-dry condition) of 10 percent. This is a much lower value than for highly favored furniture woods used in the United States and Europe.

(slide 3) Shows the specific gravity of some ~~[illegible]~~ furniture woods and their shrinkage values.

SPECIFIC GRAVITY AND VOLUMETRIC SHRINKAGE

Species	Specific Gravity	Volumetric Shrinkage
		Pct.
Cadam	.45	8.8
Cadam (young growth)1/	.39	8.7
Mahogany	.48	7.6
Baboen	.42	17.6
Black cherry	.47	11.5
Sweetgum	.44	13.8
Magnolia	.44	13.6

1/ Average values for 6 trees age 4 years (wood from comparable growth zones in the mature tree had an identical density).

Aside from having excellent machining characteristics, a very low shrinkage, and a moderate density, features that make this wood particularly suitable for furniture manufacture, cadam also has very good seasoning properties.

For most uses wood must be dried to a low moisture content. Wood going into furniture that will be used locally in an air-conditioned room should be dried to a moisture content of about 8 - 10 percent.

Cadam boards 1 1/4 inch thick were dried in a kiln to a moisture content of 8 percent. This required only 4 days and the lumber was free of checks or splits and had only very slight warp. Most hardwoods used in the States would have had devere degrade if dried at the same rate. Hardwood boards of this thickness will usually require double this drying time.

Miscellaneous

Cadam has a light creamy color with a yellow cast, has a straight grain and an even texture. Natural durability is low but chemical treatments can impart a high resistance to insect and fungal attack. Though natural color and figure are bland, stains and proper finishing can give a pleasing appearance (show sample).

Properties evaluated so far indicate that this wood can be used to make good quality plywood and should be highly favored for furniture production as well as for millwork, doors, boxes, etc.

Wood from plantations could support a sawmill and plywood complex and residues would be very suitable for production of particle board.

Cadam certainly has some wonderful possibilities for Puerto Rico. Why e.g. if one of you needs a 800 N fresh filter, why ~~Cadam~~ use Cadam!

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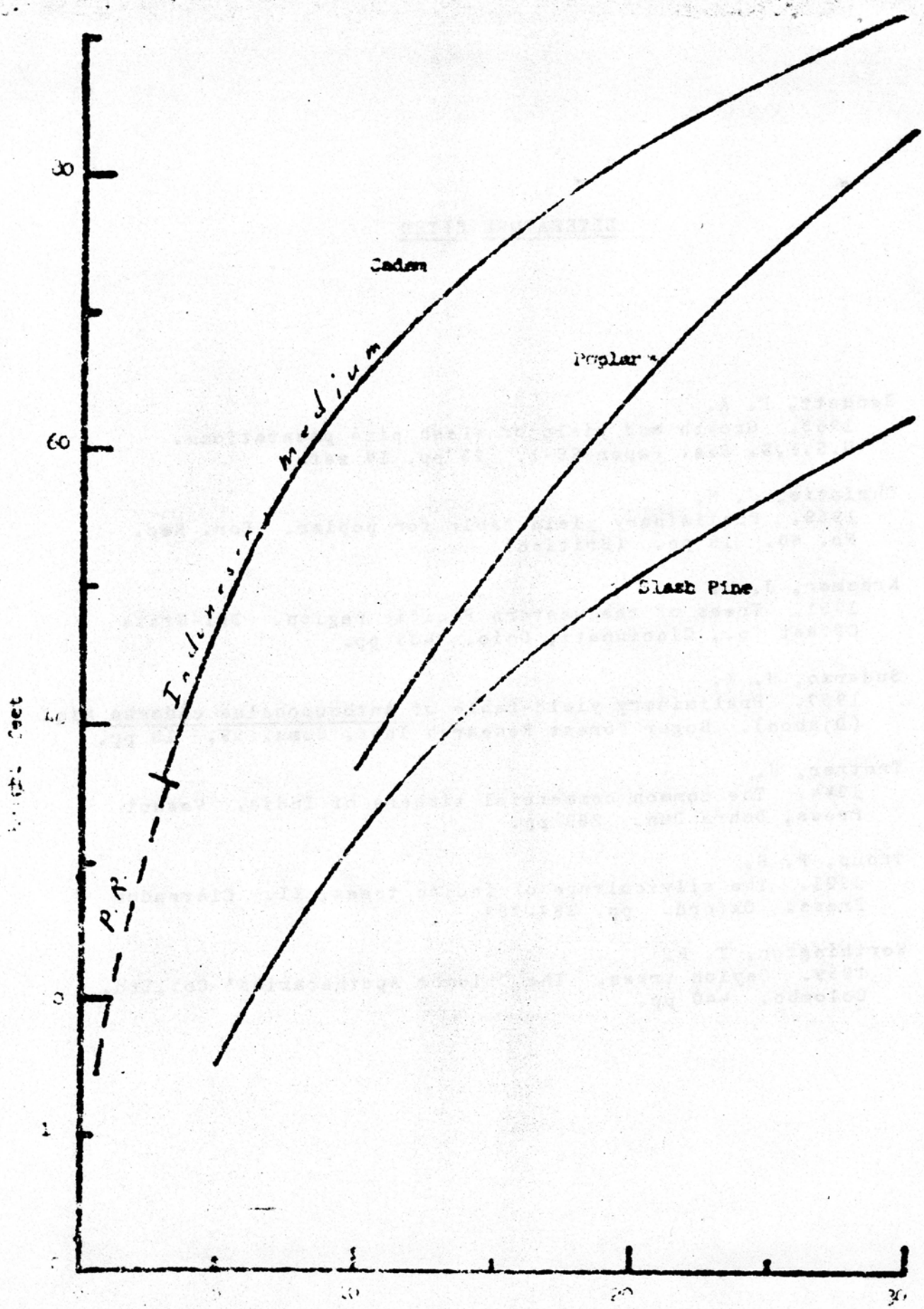
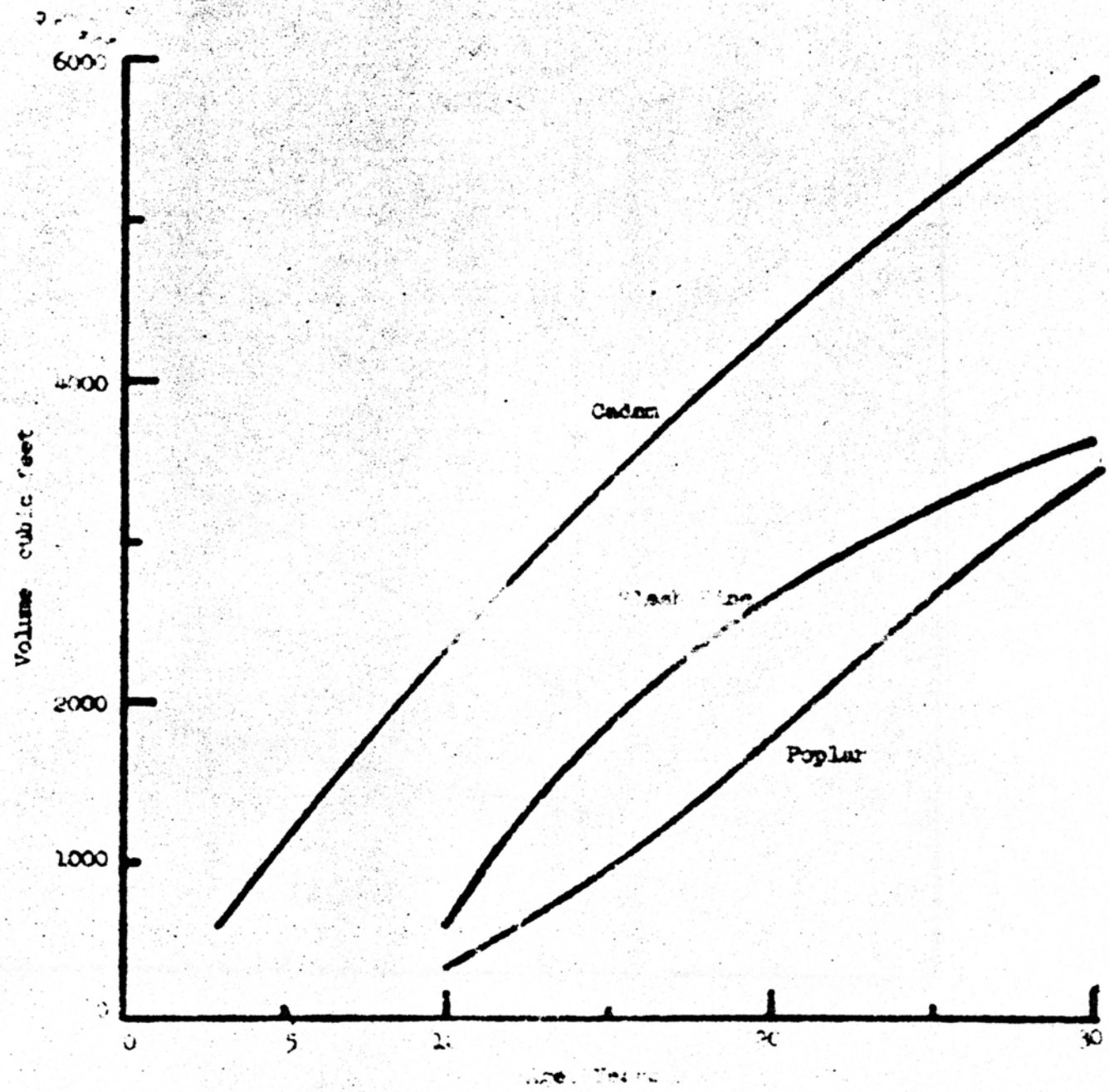


Cadam
Poplar
Slash Pine
Indonesian medium
P.R.
80
60
40
20
0
10
20
30


6000
4000
2000
1000
Volume cubic feet
Cedar
Poplar
0
5
10