BALSA AS A COMMERCIAL CROP

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HISTORY.—Since the Balsa tree (*Ochroma Lagopus*) has not been grown outside the Botanic Gardens in Ceylon, except for a tree or two here and there, there is little in the way of experimental experience to draw upon as to its future commercial value. It is an exotic tree, native of Tropical America and the West Indies and was introduced to the Royal Botanic Gardens, Peradeniya, first in 1884. The original tree died in 1925, at the age of 29 years and a seedling to replace it was planted out in 1926 which in its turn reached maturity and died in 1944, *i.e.*, at 18 years of age. The disparity in age of maturity is due to the fact that the original tree was planted near the central portion of Gardens where soil is heavy, loamy and cabooky and growth comparatively slow, whilst the 1925–26 seedling was planted in the river bank in a very light and sandy soil.

The extremely rapid growth of the 1925–26 tree which had by 1931 reached a height of between seventy and eighty feet and a girth approaching five feet at base called for remark as it was known to be a very useful wood if it could be grown to a specific gravity of roughly 0·15 or less, and this rapid growth would indicate such to be the case with our tree. In addition, it was learned that the rate of growth of the American trees which yield the commercial timber was not superior to our tree, age for age.

A stock of seedlings was raised, and the possibilities of this timber in Ceylon put before the general public in 1931 *via* the newspapers through Mr. A. T. Sydney Smith who had for his part been experimenting with the tree since 1920. Several dozen applications were received for seedlings and supplies made but nothing more was heard of balsa till 1941.

On the receipt of urgent requests from aircraft firms in Australia in 1941 the recipients of the 1931 seedlings were contacted but results were poor, many having not persevered, whilst others had grown the trees, then 10 years of age, under unsuitable conditions resulting in slow growth whereby timber became too heavy in weight for commercial purposes. Specimens of branch wood sent for investigation varied from 18 lb. to 28 lb. per cubic foot, whereas 14 to 15 lb. per cubic foot is the limit for commercial purposes.

A few trees in the Gardens however, grown in light sandy river bank soil, were of good size and structure varying from 6 ft. 6 in. to 9 ft. in girth at base. They were of course 10 years of age whereas trees grown for commercial produce reach the best felling stage at about 5 years of age—as did doubtless our own trees. Branch specimens of these 10-year old trees were however prepared and air-dried to a weight of 11½ lb. per cubic foot. The wood appeared to be of very fine structure and remarkably good colour,

superior in fact to a sample of the Equador wood sent by an Australian aircraft firm. Some hand specimens of our trees were therefore sent to Australia with explanation of age of tree to account for weight, and the scarcity of the product in Ceylon was mentioned.

The following is an extract from the report on the specmens :—

"This is what we call medium Balsa and exceedingly good, one fault is in the cutting; it was not cut along the grain as well as it might have been; in a sample of course this was of no consequence at all. The weight of the sample is quite good and we are most anxious to get the rest of this tree to cut up and see how it goes with users here. The sample of the wood sent by you is a very good example of the type of log we want. If you are going to cut it in Ceylon the width and the thickness were just right, the length of course is immaterial within reasonable limits, say 22 feet or something like that."

On these reports a garden tree was cut, the best parts selected and 48 cubic feet sent the aircraft company. Their report on this was as follows :—

"The timber arrived alright. The wood looks very nice and indeed I had a bit cut to see what the grain was like so that I could tell you I think, it is excellent. The tree of course has been sent down to the big mill to be cut into the three inch-pieces and I have not seen this. I will tell you how it turns out later on". . . . . "Just a line to let you know that the log has just been cut into flitches for final cutting. I have had a panel or two taken off so that I could have a look at it and let you know what we thought of it. This tree is really beautiful wood, pure white and although a little heavier than the usual run of South American Balsa is nevertheless excellent and very much nicer (in appearance) than the first tree you felled. The quality is also excellent of both lots; there is little to choose between them on that point."

"In my letter of July 25, I mentioned that I had just seen a panel cut from the last log sent. I said that I thought it was a little heavier than the South American wood. I want to correct this statement. Our sawyer points out that he took the panels for me from the wood before it was properly dry. It had been lying in the rain after they cut it into flitches, now that it is dry it is a splendid weight and very much superior to what we have been getting from South America recently."

This was followed by the despatch of a second tree, which was commented on as follows :—

"Yesterday for the first time I saw the last shipment of wood. It had been cut into flitches and it really is beautiful; it is the best wood we have seen for years. There may be a flitch or two a bit knotty, but nothing to speak of."

A third and last tree the Gardens could spare was finally cut and forwarded, this being the largest tree of all which yielded 155 cubic feet and brought us in Rs. 407 nett. Their reaction to this third and final tree was as follows :—

"We are just beginning to cut the last tree and my word it is beautiful wood, better even than the others."

Meanwhile, in view of the possibilities of this product in Ceylon as a future enterprise, experiment plots of 100 seedlings in October 1941 and 30 in 1942 were made in the Gardens river bank and the Superintendent, Pallekelly Group, was asked to afford me facilities for measuring and recording growth &c., of a small plot of 26 trees among his plantings made in October 1941 also. Annexures A and B show the progress of these plots which to say the least give remarkable figures as to growth. A summary indicates that in the (*a*) poor river washed sand area at Peradeniya combined with close planting, 10 ft. by 10 ft. growth was good for the first and second years but tailed off in the third year but (*b*) with larger spacing of 12 ft. by 15 ft. and in spite of poor soil conditions the required growth of 1 foot in girth per annum is maintained. At Pallekelly with spacing of 20 feet apart and in a sandy soil of good humus content the required growth of 1 foot in girth per annum is exceeded. In June 1945, the largest tree at Pallekelly (3 years and 8 months of age) was in fact 4 ft. 8 in. in circumference at 3 feet from ground. At 5 feet circumference the trees are marketable.

To date therefore, in the quality of the wood that Ceylon can produce the Balsa tree so far put to the test (and over aged trees at that) has attained commercial requirements and the rate of growth as shown by the young plants in the new experiment areas shows this to have attained requirements of a commercial product also. What remains now is for the young trees now coming along to be put to commercial test for quality and texture and to ascertain the future consumption possibility of this wood.

There seems every reason to believe that any tree attaining the average of 1 foot in girth for each year of age will in 5 years (girth 5 feet) produce wood of the required specific gravity of $7\frac{1}{2}$ to $8\frac{1}{2}$ lb. per cubic foot, which is first grade in lightness. Incidentally the Imperial Institute authorities consider lightness of wood ($7\frac{1}{2}$ lb.) the principal requirement whereas the aeroplane manufacturers whilst appreciating light wood give a preference to texture and working qualities of the wood and will use a heavier wood possessing such characteristics. As soon therefore as a few of the 1941 trees attain a five-feet girth, samples will be sent the Imperial Institute, to the aircraft manufacturers in Australia, and to the Timber Adviser to the R. A. F. and Government of India for report. I have a firm conviction that wood of this size and age grown in Ceylon will reach a quality equal if not superior to the product now exported as first grade wood from South America, but the opinion is entitrely my own of course, supported however by periodical testing of trees cut, for thinning out purposes, of the 1941 trees planted 10 ft. by 10 ft. which, as it now appears was much too close in plant spacing.

What mostly concerns the potential grower is uudoubtedly the consumption possibilities. This is hard to estimate as the various Government statisticians report that Balsa is not kept separate from other timber imports. As far as can be ascertained the demand for the wood in Australia was small before the war but was stimulated to great heights from 1941 onward. Whether this small consumption was due to a meagre demand or to paucity of supply is difficult to ascertain. It seems a general complaint of all workers on Balsa that it has always been most difficult to obtain quality material and the best has to be made of inferior wood of small diameter and short

ends. It was the ample size and good quality of the Ceylon wood, despite its weight from old tree material which can be remedied, that has given the Ceylon wood a very good start.

The general opinion among those who are conversant with Balsa and its uses, taking pre-war figures as a guide and ignoring the phenomenal war increases, is that—

(*a*) The nature of the work for which Balsa is used is not conducive to consumption of the wood in great bulk. It is split into such thin flitches, often 1/16th inch thickness, for fairing and lining that, compared with other timber and its uses, a given quantity goes much farther, but quite large quantities are used for model aeroplane making and it seems evident that new uses are being found for the wood and more so as the civil aircraft industry grows after the war.

(*b*) That supplies have always been low, difficult to obtain and, when secured, generally of poor quality.

(*c*) That if the quality and size of wood seen in Ceylon can be put on the market it would not only open up new uses but oust the Equador and Mexican product from the eastern market and even from the European market.

(*d*) That wood should be procurable in Ceylon by the buyers at a rate of between 2*d*. to 3*d*. per sq. ft. (2 to 3*sh*. per cu. ft.) which was the pre-war rate of this wood for many years. It is the good quality of the Ceylon wood against the inferior consignments of American wood that would, if price is approximately equal, gain its place in all markets as there is much waste with inferior material.

It would seem therefore that there is already a market that might be acquired by reason of the good quality wood that we can produce and that with the increase after the war of commercial planes we may considerably extend that market.

It is however wise in introducing a new subject such as this not to overproduce in the early stages but to see how things progress when good wood from Ceylon becomes available for test and use, for up to now supplies from Ceylon have been non-existent and only small supplies from the Netherlands East Indies have been available to the market.

It is also well to realize that balsa could never become a commercial proposition such as rubber, tea or coconuts. Its soil requirements (of a light sandy river bank nature) restricts growth of first class wood to definite small areas. The strips of river and stream banks seem to be best, and if plantations are carried inland a heavier soil is met with, growth is slower and the wood, because of this slower growth, is harder and heavier.

The Gampola, Peradeniya, Kondesale, Pallekelly and Rajawella river strips by the Mahaweli-ganga are indicative of the type of soil and conditions required. Beyond a few acres at a stretch it is doubtful if suitable conditions are available. Suitable areas have to be looked for and are often scattered.

This in itself limits cultivation obviously and it is as well, for it will otherwise mean that every bit of spare or waste land would be planted up and high returns expected from it with disappointing results. This has in fact already occurred I am certain as one instance is known to me of 800 plants put in among Tea with very small planting holes and in quite a heavy soil. A timber tree will be produced doubtless, but not the light wood required.

So far about 20,000 plants have been distributed for planting together with a fair amount of seed, and to a wide range of applicants. Many of them have gone to areas considered by me as not suitable and it is I think probable that not more than 20 per cent. of the total plantings to date will be grown in the conditions to produce aeroplane wood.

Planting distances have varied from 10 ft. by 10 ft. to 20 ft. by 20 ft., *i.e.*, 435 to 108 to the acre but a good average might be put at about 220 to the acre, so that if 5,000 of the seedlings put out produce good wood there should be about 23 acres planted so far, spread over 3 years plantings.

Very well grown trees should produce 25 cubic feet of timber in 4 to 5 years, whilst moderately well grown trees should produce the same in 5 to 6 years. This indicates that 23 acres or 5,000 trees should provide approximately 125,000 cubic feet or about 40,000 cubic feet per year over 3 years.

Until some definite figures are available as to probable future consumption no accurate suggestion can be made as to what extent this wood should be planted. All Naval and Air personnel who have been consulted and those having some knowledge of the trade requirements or of the probable future uses of balsa are of opinion that the use of balsa after the war, as compared with pre-war consumption, will be very considerably increased but not to the excessive amounts of the present war years.

The pre-war annual consumption figures for some of the few Australian firms employed on the work in pre-war days is estimated by one to have been 50,000 to 80,000 super feet (4,120 to 6,600 cubic feet) and another of 60,000 super feet (5,000 cubic feet) whilst war consumption rates had reached 100,000 super feet (8,300 cubic feet) *per month.* These are Melbourne firms only.

The anticipated uses of balsa after the war, together with easier facilities for obtaining the wood is expected to increase the pre-war consumption many times in Australia alone. Air and Naval personnel engaged in this type of work are also of opinion that Great Britain would be the main market for our wood. India also has demands, the Director of Timber Supplies to the R.A.F. and the Government of India having already made personal enquiries into the Ceylon balsa supplies and appointed a local firm as agent for obtaining all balsa now being grown, on its reaching maturity.

To summarize therefore it has now been ascertained that Ceylon, if proper soil areas and climatic conditions are selected, can grow balsa quite easily, quickly, and of good quality at a very economic cost. The deciding factor as to how far plantings should go is that of consumption and till more definite information is acquired this item must be speculative. Personally I think Ceylon should plant and grow on at least 100 acres each year, planting 15 feet by 15 ft., as such spacing has proved to be the best. This spacing allows 193 trees to the acre of which 60 per cent. should

reach the high quality for aeroplane work at 5 years of age and the balance at 6 years of age. With 25 cubic feet per tree, this should produce roughly a quarter of a million cubic feet spread over 2 years, to be disposed of.

The following are the log book records of the balsa experiments conducted at Peradeniya on plantings made on October 6, 1941 and on October 6, 1942.

On October 6, 1941, a batch of 100 4-month-old seedlings was planted for trial purposes in the river bank of the Royal Botanic Gardens. The site is 20 feet above normal river level and consists of washed sand thrown up by the river at times of flood with a very small percentage of humus, since accumulated.

Holes 3 ft. by 3 ft. were excavated and in refilling three baskets of rotted cattle manure and two of normal garden soil were added. Growth was free and rapid from the start but caterpillar attacks being observed soon after planting out, weekly sprayings of Arsenate of Lead (one ounce in one gallon of water) were given each week for 4 weeks, after which the older and rougher leaves themselves resisted attack. The planting distance of this batch was 10 ft. by 10 ft.

On October 6, 1942, a second batch of 4-month-old seedlings, this time of 30 plants, was put out in an adjoining area of the same soil conditions and given the same preparations and other treatment as for the 1941 plantation. The planting distance of this second batch was however 12 ft. by 15 ft. as the purpose of this planting was particularly to compare advantage in height and girth, if any, due to the wider spacing. Atmospheric conditions during the first year's growth of each batch was remarkably alike, that of October 1941, to September 1942, recording 100·22 inches of rain on 204 days and from October 1942 to September 1943 recording 103·15 inches of rain on 205 days.

Plot I.—Planted on *October 6, 1941*—100 plants 10 ft. by 10 ft. seedlings 4 months old and 6 inches in height.

	Height Ft. In.	Girth at Base Ft. In.	Girth at 3 Feet Ft. In.
Average on Oct. 6, 1942 (12 months) ..	20 4 ..	1 3⅓ ..	0 11⅓
„ „ Jan. 6, 1943 (15 „) ..	23 0 ..	1 5½ ..	1 1¾
„ „ April 6, 1943 (18 „) ..	27 9 ..	1 6½ ..	1 3
„ „ July 6, 1943 (21 „) ..	28 10 ..	1 8¾ ..	1 4½
„ „ Oct. 6, 1943 (24 „) ..	34 4 ..	1 9¾ ..	1 5

The tallest individual trees in this plantation on October 6, 1942, *i.e.*, at one year of age, were Nos. 51 and 52 with a height of 25 feet and that of the largest girth being tree No. 45 with a circumference of 1 ft. 1½ in. at 3 feet from ground.

On October 6, 1943, *i.e.*, at 2 years of age the tallest specimens in the plantation were Nos. 34 and 36 with a height of 41 feet and the tree of largest girth was No. 1 with a circumference of 2 ft. 1½ in. at 3 feet from ground.

Plot II.—Planted on *October 6, 1942*—30 plants, 12 ft. by 15 ft., seedlings 4 months old and 6 inches in height.

	Height.	Girth at Base.	Girth at 3 feet.
	Ft. In.	Ft. In.	Ft. In.
Average on April 6, 1943 (6 months) ..	8 $7\frac{1}{2}$ ..	0 $8\frac{3}{4}$ ..	0 6
„ „ July 6, 1943 (9 „) ..	14 10 ..	1 $1\frac{1}{2}$ ..	0 $10\frac{1}{4}$
„ „ Oct. 6, 1943 (12 „) ..	20 10 ..	1 $5\frac{1}{2}$ ..	1 2

The tallest individual tree in this plantation on October 6, 1943, *i.e.*, at 1 year of age was No. 18 with a height of 26 feet and the largest in girth was No. 25 with a circumference of 1 ft. 6 in. at 3 feet from ground.

As soil and climatic conditions are so similar for the two plots the advantage of wider spacing in plot II (12 ft. by 15 ft.) over plot I. (10 ft. by 10 ft.) at one year of age is plainly indicated. This advantage to the plot No. II will in all probability be enhanced in its second and subsequent years of growth.

Records taken on October 6, 1944, of plots I. and II. are now set out.

Plot I.—Planted on *October 6, 1941*—100 plants, 10 ft. by 10 ft., seedlings 4 months old and 6 inches in height :—

	Height.	Girth at 3 ft. from Ground.
	Ft. In.	Ft. In.
Average on Oct. 6, 1942—one year of age	20 4 ..	0 $11\frac{1}{3}$
„ „ Oct. 6, 1943—two years of age	34 4 ..	1 5
„ „ Oct. 6, 1944—three years of age	47 6 ..	2 0

The tallest individual tree in this plantation attained a height of 25 ft. in the first year, 41 ft. in the second year, and 57 ft. at third year of age.

The largest in girth in this plantation was 1 ft. $1\frac{1}{2}$ in. in the first year, 2 ft. $1\frac{1}{2}$ in. in the second, and 3 ft. $\frac{1}{2}$ in. in the third year at 3 feet from the ground.

Plot II.—Planted on *October 6, 1942*—30 plants, 12 ft. by 15 ft., seedlings 4 months old and 6 inches in height :—

	Height.	Girth at 3 ft. from Ground.
	Ft. In.	Ft. In.
Average on Oct. 6, 1943—one year of age	20 10 ..	1 2
„ „ Oct. 6, 1944—two years of age	37 0 ..	2 0

The tallest individual tree in this plantation attained a height of 26 ft. in the first year and 42 ft. at 2 years of age.

The largest in girth in this plantation was 1 ft. 6 in. in the first year and 2 ft. 5 in. at 2 years of age at 3 feet from ground.

An analysis of these records of growth is enlightening. Since soil and climatic conditions are the same for both plots and neither have been manured or otherwise benefited one against the other, the advantages of the wider spacing seems very marked. The wider spacing has also led to better uniformity of growth with a correspondingly better average.

The failure of the S.W. Monsoon has doubtless affected both plots adversely. A rainfall of 100·22 inches was recorded in the 1941–42 year, a fall of 103·15 inches in the 1942–43 year, but only 86·2 inches in the 1943–44 year. The log book records of the last S.W. period show a very perceptible decrease in average girth against the previous S.W. periods. Rainfall therefore is a very essential factor in growth.