

THE CULTIVATION OF TIMBER AND POSSIBILITIES FOR FUTURE EXPANSION IN THE SUGAR BELT OF NATAL AND ZULULAND

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Timber has been cultivated in Zululand by the Department of Forestry for over 35 years. The species propagated are chiefly of the exotic coniferous varieties, with shelter and firebelts composed mainly of *Eucalyptus*.

These plantations now cover 13,000 acres, but owing to the comparative immaturity of the greater area, have only played a small part in supplying the wartime needs of the Union for building materials. They have, however, contributed a considerable quantity of timber for box shooks.

Timber growing on a commercial scale by private enterprise is of comparatively recent origin along the coastal region of Natal and Zululand, dating back to about 23 years ago when the late Major Rattray commenced a planting programme of some 2,000 acres of *Eucalyptus saligna*.

The timber was planted chiefly with a view to supplying the gold mining industry with props, packs, etc. The area planted consisted mainly of very poor, deep, sandy soil, generally unsuitable for the economic production of agricultural crops of any kind.

Contrary to the prophecies of critics who predicted dire calamity for the enterprise, success was assured when the entire plantation was purchased for a substantial sum by a well-known firm of timber merchants, for distribution to the mines. These plantations have now increased to 5,000 acres, including 1,000 acres of *Pinus caribaea*, with a programme of a further 2,000 acres in hand.

The immediate result of the success of this venture was that many other farmers in the Lower Umfolozi and Hlabisa districts, most of whom had been labouring under great difficulties and enduring considerable hardships planting sugarcane on land totally unsuited for its cultivation, embarked on a programme of timber planting. I think I am safe in saying that none of these gentlemen has had cause to regret his enterprise.

This sudden trend to afforestation has led to nearly 40,000 acres of *Eucalyptus saligna* being established in this part of Zululand by private enterprise, and the problem of disposal now faces the industry, as it is obvious that it will be impossible for all growers to dispose of their timber to the mines.

Prior to hostilities the gold mining industry annually consumed approximately 800,000 tons of timber. Owing to the war and the resultant hold-up of mining expansion the quantity of timber used has been considerably reduced during the past few years. It has been found that a seven year rotation gives the best results with *saligna* for mining timber. At this age, in suitable areas, it will produce an average of 70 tons per acre. Therefore, the Lower Umfolozi district alone, cutting 5,000 acres per annum, can produce nearly half the entire pre-war requirements of the mines. As there are about 250,000 acres of *Eucalyptus* and 300,000 acres of wattles planted in the Union it will be seen immediately that there is already a greater area under timber than is needed to meet the demand for mining timber. Even the possible post-war expansion of the mining industry in the Free State and elsewhere cannot materially assist in absorbing the available surplus.

The obvious outcome of this glut of timber will be competition between growers throughout the country and price cutting to a marked degree. The price will be reduced to an uneconomic level for some, and others will have no market at all.

In this price war the marginal growers, and growers on the Natal and Zululand coast can be considered such, will be at a distinct disadvantage; the only feature in their favour being that *saligna* from Zululand has definitely proved itself to be the best mining timber available. Railage to the Rand from Zululand is about 18s. per ton, which is more than what the farmer receives on rail for his timber.

A clear indication that the trend of mining timber prices is

downward is that in 1928 the price f.o.r. Kwambonambi was as high as 23s. per ton. By 1936 it had been reduced to 16s., and in 1939 it had come down to the low figure of 13s. 6d. per ton. This reduction in price has come about as a result of the increased planting already mentioned. It will be seen from this that the price cutting rot has already set in.

The extension of the railway from Gollel to Piet Retief would bring markets closer but coast growers would still be at a disadvantage.

It is therefore abundantly clear that other markets must be found to absorb timber already planted, let alone future plantings. With this end in view the late Major Rattray submitted samples of *saligna* to the Imperial Institute, London, in 1929, to be tested for its value for the production of pulp for industrial use, the following report being received:—

Description.

"The specimen of wood, which was stated to be from a 6-year-old tree, consisted of a portion of the trunk, 5 ins. in diameter, from which the bark had been removed. The colour varied from almost white in the sapwood to a pale pink tint in the heartwood. The wood was fairly soft, rather coarse-grained, and contained a large number of hard knots.

Results of Examination.

ANALYSIS.—A representative portion of the material was submitted to chemical examination with the following results:—

Moisture...	9.3 per cent.
Ash ...	0.5 per cent.
Cellulose in wood as received ...	56.9 per cent.
Cellulose expressed on the moisture-free wood .	62.6 per cent.

The ultimate fibres were found to have the following dimensions:—

	Length in mms.	Diameter in mms.
Maximum ...	2.1	0.0330
Minimum...	0.8	0.0102
Average ...	1.4	0.0163

PAPER-MAKING TRIALS.—The chipped wood was submitted to treatment with caustic soda, under conditions similar to those employed commercially for the production of paper pulp by the soda process, with the following results:—

Caustic Soda used.	Conditions of Digestion		Parts of Caustic Soda consumed for 100 parts of wood	Yield of dry Pulp expressed on the wood as received.	
	Time hrs.	Temp. C.		Unbleached	Bleached
Parts per 100 parts of wood	20	5	12.7	55	50
Parts per 100 parts of solution	3	160			

Under the conditions of treatment employed, a well digested pulp was obtained which furnished a fairly soft, opaque, pale brown paper of good strength. A small quantity of imperfectly reduced material was present, due most probably to the knotty nature of the wood. The pulp bleached with some difficulty to a cream colour, and then furnished a paper of similar strength and character to that from the unbleached pulp.

The above results show that this *E. saligna* wood from a 6-year-old tree furnishes an excellent yield of pulp under comparatively mild treatment with caustic soda, and produces a fairly soft, opaque paper of good strength. The pulp somewhat resembled commercial poplar pulp but was composed of rather longer fibres (averaging 1.4 mm. as compared with 1.0 mm.) and the paper was stronger than that furnished by poplar pulp. Unlike the latter, however, it required a strong bleaching solution to bleach it to even a moderately pale colour, and it might consequently not be suitable for use in the production of the higher grades of printing papers.

TESTS TO DETERMINE THE SUITABILITY OF THE WOOD FOR ARTIFICIAL SILK MANUFACTURE.—The unbleached pulp obtained in the paper making trial was treated with a quantity of standard bleaching powder equivalent to 20 per cent. of the original weight of the wood. The bleached pulp was then immersed in dilute sodium sulphite solution (2 per cent.) for a short period, in order to remove any free chlorine present and to improve the colour of the pulp by dissolving any lignin unaffected by the bleaching treatment. The pulp was then thoroughly washed, treated with cold 1 per cent. hydrochloric acid to remove insoluble calcium salts, and finally freed from acid with distilled water, pressed and air-dried. The bleached pulp thus obtained was somewhat superior in colour and appearance to that produced in the paper-making trial.

The yield of dry bleached pulp, calculated on the original wood, was 42 per cent. On chemical examination the pulp gave the following figures, which are shown in comparison with those recorded for bleached sulphite pulp suitable for the manufacture of artificial silk and with the figures supplied by a large firm of artificial silk manufacturers for the wood pulp regularly in use in their factory:—

	Present Sample	Figures recorded for Bleached Sulphite Pulp		Manufacturers' Figures.	
		Hottenroth	Rowe		
Moisture per cent.	8.20	8 to 12	10	—	
Calculated moisture free material	Ash, per cent.	0.33	0.15 to 0.3	0.1 to 0.4	0.17
	a-Cellulose, per cent. . .	85.00	85 to 89	86 to 89	89.63
	B-Cellulose, per cent. . .	10.20	—	6 to 8	3.69
	Y-Cellulose, per cent. . .	4.80	—	3 to 5	6.63
	Copper Number,	2.04	2 to 3	2 to 3	2.47
	Phloroglucinol Absorption Value	1.60	—	—	1.03
Soda Absorption Value	209	—	—	162	
Acetone Extract, per cent.	0.46	0.6 to 0.7	—	—	

These results show that the *E. saligna* pulp as prepared at the Imperial Institute contained a rather low percentage of a-Cellulose whilst the figures for B-Cellulose, ash, and phloroglucinol absorption value are somewhat higher than those usually regarded as satisfactory for pulp for artificial silk production.

It is probable, however, that by submitting the wood to a rather more drastic treatment the a-cellulose could be increased and the B-cellulose and phloroglucinol absorption value reduced to satisfactory proportions. This treatment would somewhat reduce the yield of pulp. Whether such pulp would possess the necessary properties for conversion into artificial silk could only be determined by actual manufacturing trials."

A few months ago a consignment of saligna was sent to the S.A. Pulp and Paper Industries, Springs, for testing. The samples consisted of two complete 8-year-old saligna trees from coppice, or ratoon, growth. Tests are still proceeding under Professor Hisey of Syracuse University, New York State, but it is too early to report fully on the subject. I am given to understand, however, that the results are very encouraging and three samples of paper from this test are submitted for the inspection of those interested.

No. 1 is 100 per cent. saligna.

No. 2 is 50 per cent. saligna and 50 per cent. pine.

No. 3 is 100 per cent. pine.

I am told that the mixture of pine and saligna is the most satisfactory.

Samples of white paper from the same trees will be forthcoming shortly.

Professor Hisey, who is a paper expert, visited Kwambonambi and was very impressed with the possibilities for the establishment of a paper industry in Zululand.

The chief problems affecting an enterprise of this kind are:—

1. *Big capital outlay.*—A mill with a capacity of 30,000 tons timber per annum would have required pre-war a capital of nearly £1,000,000;
2. *Sufficient supplies of timber close to the factory.*—It requires two tons of dry timber to make one ton pulp. This is already available in saligna but still in short supply as regards pine;
3. *Sufficient supplies of suitable water.*—It requires 50,000 gallons of water to produce one ton pulp;

4. *Availability of the following raw materials.*—Soda ash, lime, coal, sulphur, salt, resin, allum, dyes, etc.

5. *Disposal of effluent;*

6. *Markets for manufactured products.*—South Africa imported prior to hostilities nearly £3,000,000 worth of pulp products in the form of paper for newsprint, wrapping papers, paper bags, cardboard boxes, wall paper, etc., etc.

In June, 1939, arrangements were made by me with the Imperial Institute for half-a-ton of saligna timber to be shipped to London for a further test for paper and artificial silk. Unfortunately the advent of war cut short these negotiations and the matter has been left in abeyance until the end of hostilities. I feel convinced that very interesting facts will emerge from the artificial silk test, and may well result in the establishment of a large and expanding rayon industry in Zululand and the Natal coast.

Saligna as a building timber and for general use has for a long time laboured under the disability of a very bad reputation, which started in World War 1, when many sawmillers exploited this timber with no regard to its unusual characteristics or its future. The object was purely to make as much money as possible while the opportunity presented itself. The timber was sawn by methods totally unsuited to its peculiarities and sold with very little or no attempt to air or kiln-dry it. Naturally it split, warped, twisted and did all the other things that timber submitted to this treatment can be expected to do. I regret to state that this malpractise has very largely persisted during World War II.

A short time ago a consignment of timber was sent by me to the Forest Products Institute at Pretoria to be tested for its value for flooring and box shooks. Space does not permit me to give details here of the test, but I am glad to say the result was satisfactory. The chief fault, as in the pulp and paper test, was loose knots. The texture and condition of the timber was very pleasing. This again illustrated that proper silvicultural methods must be adopted in plantations if high class results are to be attained and first grade material produced. The presence of loose knots in all the timber submitted to the tests mentioned was to be expected as the timber was planted primarily for mining timber, and no thinning, pruning or other approved forestry methods were practised. Nevertheless, the test, which was on a comparatively small scale, proved that the timber has great possibilities.

Since then several saw mills have been established in Zululand. Up to the present very little difficulty has been encountered in disposing of the timber on account of the acute timber shortage brought about by the war. However, buyers are becoming more discriminating and it is found that unless a system of grading is carefully carried out, buyers are not interested in the timber. This is all to the good as it forcibly brings home to millers and growers the fact that special care must be taken in the plantation and the mill if the product is to remain on the market.

From my own experience in milling and selling saligna the following emerges:—

1. When first offered for sale the timber was received with great suspicion owing to the bad reputation existing for South African timber and this class of timber in particular. After samples were submitted small trial truckloads were ordered and thereafter a steady stream of orders has been received, at a good price for selected timber. Rough sawn timber with loose knots, splits, warps, etc., is not acceptable and very difficult to sell even to-day. The demand for good timber far exceeds the supply.
2. This points to the fact that careful silvicultural practice must be established in all plantations, followed up by careful sawing and stacking and drying methods.
3. Saligna must be sawn immediately after felling, while water is still dripping out of the logs and must be carefully stacked immediately after sawn.
4. In order to obtain straight lumber, saligna must be sawn with due regard to the extraordinary stresses that are latent in this timber. All these stresses must be removed simultaneously. When this is done the results are undoubtedly very satisfactory. Unfortunately, suitable modern machinery will not be available until after the war and the

results will not be 100 per cent. until the particular machinery required is installed. However, temporary makeshift machinery has been utilised which partially overcomes these difficulties.

5. The timber is suitable for a multitude of purposes from building material, flooring, box shooks, furniture, broom handles, dowels, down to whitewash brush handles and shoe heels.
6. The best timber is obtained from coppice or ratoon growth.
7. With regard to its various uses an extract from a letter received by me from a practical timber specialist is of interest:

"As a timber specialist having thirty year's practical and commercial experience, especially in the manufacture of utility, domestic and high grade furniture, joinery and decorative interior fittings, it is my firm and definite opinion that the South African saligna as presently supplied from your estates, compares very favourably, and equals the hitherto overseas imported lauan and Philippine mahogany and cedar species.

"It is my further opinion that if the plantations of the said saligna were allowed to mature to approximately 12 to 15 years, with constant horticulturist supervision regarding pruning or lopping off of the branches, one could obtain, with practical and competent conversion, boards or planks up to 10 in. width, thus producing lumber equalling in texture and strength, warpage and shrinkage that of the overseas species such as Philippine mahogany, cedar, lime, pear, chestnut and basswood, apart from Baltic deals, in which respect the saligna specification to be used for certain building construction work would have to be from 2 to 9 in. width in all thicknesses up to 3 in. thick, with lengths from 10 feet and up.

"From a practical point of view the saligna, as presently handled from your mills, lends itself excellently to the treatment of French polishing and synthetic finishes, apart from painting, etc., etc., on a par with the herein mentioned timber species, including such hardwoods as oak, African and Honduras and American mahoganys.

"From a commercial point of view saligna can compare with any of the cedar family lumbers, providing the price is competitive for a post-war trade."

8. The final conclusion arrived at, as in the two tests already described, is that until the loose knots are eliminated some difficulty will be experienced in marketing, which will only be effected by careful selection. All other faults can be remedied in the saw mills.

The foregoing has dealt chiefly with *Eucalyptus saligna* for the future of which the writer has very great hopes, but pines also do extremely well on this coast, particularly *Pinus caribaea*. Though saligna grows twice as fast as this species, *Caribaea* pine grows at the rate of five to six feet per annum and is very easily established, the transplants being very hardy. It grows well in swampy land provided the water is not stagnant. A planting programme combining these two timbers should bring very fine returns from 8 years old with the former and 14 years in the case of the latter.

Markets are at the door, as both these timbers can be treated in the early stages, up to say 14 years, as a softwood on the coastal belt, where their extraordinary rapid growth is phenomenal.

Softwood to the value of nearly £2,000,000 was imported into the Union just prior to hostilities, and no doubt post-war development will require far more than this quantity.

However, timber takes time to grow, and patience and some capital is required.

In finalising, I would advocate for the sugar belt:—

1. A semi-afforestation policy, embracing all land suitable for timber growing, but unsuitable or not required for other agriculture or stock farming.

2. Species to be planted should be *Eucalyptus saligna* and *Pinus caribaea*, with a percentage of *Eucalyptus paniculata* and *Eucalyptus maculata*.

4. Careful silvicultural practice must be rigidly carried out.

5. Considerable capital is required, hence unless the planter has private means, a combination of cane and timber farming would be an ideal policy. This combination is also very satisfactory from the labour point of view as when cane cutting is over and weeding and cultivation has more or less come to an end, there is generally a period before the next cutting season when it is sometimes difficult to know what work to give the labour to keep them occupied. This period could be very well spent planting trees.

The cost of planting varies according to the conditions of the locality from about 30s. to over £4 per acre, depending on whether transplants are purchased or grown in the estate nursery, whether ploughing or harrowing is carried out and whether the land consists of sandy or heavy soils. To this must be added maintenance and fire protection costs.

Scientific research is finding more and more uses for timber and such discoveries as methylolurea, which is reputed to harden soft wood, prevent checking and splitting and cause wood to become so pliable that it can be twisted to any desired shape, open up fresh avenues for its uses. Research must be assisted and encouraged to the fullest extent.

Of interest to sugar people is the fact that a heavy impregnation with cane sugars reduces shrinkage in timber to about 50 per cent.

The prospects for the future of timber are very difficult to assess, as misstatements in articles on the subject are frequently made, which in some cases give the impression that a world timber famine can shortly be expected, and in others, warn the world of overproduction. The fact is that during this generation most countries have become increasingly timber conscious and have embarked on very extensive timber planting programmes. There are few parts of the world, however, where timber can grow as fast as on the coast of Natal and Zululand, and the prospects are to my mind good, though the policy must necessarily be regarded as a long term one. South Africa is still a very long way from being self-supporting.

To summarise, I would say plant more timber. The more the better! Without the quantity large industries cannot be developed, but with sufficient timber planted within easy distance of rail as in the case of the North and South coasts of Natal and Zululand, industries of all descriptions should in time spring up which will amply repay pioneers or their families for their initiative and enterprise.

The PRESIDENT, in opening the paper for discussion, drew attention to the pioneering work done by Mr. Rattray's late father. It was his foresight and enterprise which was largely responsible for timber cultivation along the coastal belt. The paper shewed that scientific and economic investigation was a pre-requisite to the establishment of an alternate crop.

Dr. HEDLEY said there was no doubt that *E. saligna* could be used for making paper, but the sugar industry had a raw material, bagasse, which was already largely prepared for such use. He was aware of the fact that its fibre was short and did not make a strong matt, and he also knew that attempts to utilize it for paper-making some years ago largely failed, but we should be prepared to learn from our failures. A very fine paper was being made in India using 52 per cent. bagasse and 48 per cent. bamboo pulp. The expert who was doing this work in India had visited this country and was surprised that we did not utilize our bagasse similarly. Of course we did not have such large resources of bamboo, but it should be possible to find some other long-fibred material to take its place.

The analyses of the bleached saligna pulp intended for rayon manufacture shewed the rather low alpha-cellulose of 85 to 89 per cent., and the very important cuprammonium viscosity was

not given at all. Here again bagasse could be utilized. We had in fact produced a very good bagasse pulp for rayon manufacture at the Experiment Station. The pulp had an alpha-cellulose content of about 93 to 94 per cent., and it had a very satisfactory cuprammonium viscosity of 25 to 30 centipoises.

The author referred to the astounding results which were being obtained by the treatment of all sorts of wood with plastics, by treating soft woods with methylolurea; for example the woods were hardened and by retaining their beautiful grain they could compete with the hard, heavy woods. They could therefore be used for purposes which were previously beyond their reach. After treatment some woods were so hard that they could be cut with a welding torch such as used for cutting steel, and the remarkable thing was that they did not catch fire. Light aeroplane propellers were now being made from treated wood which stood up to the terrific centrifugal force developed by the propeller. The marvellous discovery of plastic treatment of wood had revolutionized the uses of this raw material, and after the war treated wood would be in common use.

Trees could only be grown on marginal land for cane would not grow near them as their roots penetrated from a considerable distance into the cane lands.

The pioneers in tree planting were to be congratulated on their enterprise, but it was up to the sugar industry to utilize its by-products and bagasse in particular in the way indicated or they might find the ground cut from under their feet.

Mr. BOOTH agreed with Dr. Hedley that the sugar industry should exploit its own by-products first before extensive tree planting schemes were started in their area. He did not know the evaporating capacity of saligna trees, but he doubted whether in the end it would prove a wise policy to plant these trees in areas not particularly well supplied with rain. We should not forget the serious soil erosion problems which were now so urgent.