

TUNG TREE CULTIVATION IN THE SUGAR CANE AREA OF NATAL

By D. MOSES

The above paper was read by Mr. D. Moses.

The necessity for investigating the possibilities of crops other than sugar cane in this area has been pointed out in a previous paper and hence need not be referred to here. Furthermore many sugar cane growers have evinced great interest in this connection and consideration has been given to several different crops. Of these, it is proposed to deal briefly in this paper with the culture of the Tung Tree of China and to indicate the possibilities of the oil obtained therefrom, variously known as tung oil, wood oil or China wood oil.

The principal source of the world's supply of tung oil is China, from which country the exports of tung oil have risen from approximately 30,000 long tons in 1918 to 65,000 tons in 1928. Of this amount the United States of America imports annually from 40,000 to 50,000 tons, while the United Kingdom imports about 4,000 tons each year. Of late years there has been a tendency for the available Chinese supply of tung oil to fluctuate widely, and there has also arisen the problem of adulteration with cheaper oils, such as soybean oil, at the source of production. The problem of providing for alternative sources of supply has therefore been given some prominence in the United States, and latterly in Great Britain, with the result that this crop is now under trial in many parts of the world.

Tung oil is used primarily in the manufacture of water resisting and durable paints and varnishes and also in the manufacture of oilcloths and linoleums. The product has other uses, however, some of the more important being the preparation of insulating compounds for dynamos, cables and wire coatings, the waterproofing of fabrics, and the manufacture of India ink. The view is held that as tung oil becomes available in greater amounts it will be used largely in place of linseed oil and fossil gums, while other uses will be found for it in various industries. In view of these facts the possibilities of the future production of tung oil in the British Empire are considered to be very promising.

BOTANICAL CONSIDERATIONS:

There are five species of trees belonging to the Tung oil family *Aleurites*, but of these only three are cultivated mainly for the oil, namely, *Aleurites fordii*, *A. montana* and *A. cordata*. The two first-named are the principal species found in China, and of these *A. fordii* produces the bulk of the tung oil in commerce. This species is considered hardier

than *A. montana* and requires less rainfall, but so far as is known there is little or no difference between the oils produced by the two species. *A. cordata*, the species found in Japan, produces an oil inferior to the Chinese article.

According to the few sources of information available, tung trees in China grow luxuriantly in hilly country up to 2,500 feet in altitude and with a rainfall of not less than 30 inches. The statement is made that the absence of frost is desirable, although in their natural habitat the winters are severe. In this connection *A. fordii* is more hardy than the *A. montana*, which requires a higher rainfall and warmer temperature.

The trees are soft wooded with a low branching habit and bear large dense clusters of dark green heart-shaped leaves. They are completely deciduous, the blossoms making their appearance slightly in advance of the leaves in spring.

EXPERIMENTS AT UMBOGINTWINI:

Experiments have been conducted at Umbogintwini with tung trees since 1926, but as is often the case with new crops, mistakes have been made and there is still much to be learnt in connection with tung tree culture. *Aleurites fordii* has received the most attention and numerous plantings have been made of this variety. In general the seed germinates well either in well-rotted sawdust or in soil, and under favourable conditions the seedlings make rapid growth. *Aleurites montana* and *A. cordata* have also been tried, but up to the present we have not succeeded in getting any germination with the former, while from some thousands of *A. cordata* seeds we have obtained only a dozen trees.

The first field planting of the *A. fordii* variety has shown that in the coastal belt, with its high average wind velocity, tung trees will do best in sheltered sites. What is perhaps of even greater importance seems to be that this crop, notwithstanding its reputed ability to withstand neglect in China, must be grown as an orchard crop and given care and attention accordingly. Our experiments have also shown that on the sandy soils near the coast tung trees respond in a marked degree to applications of fertilisers.

The Japanese tung trees at Umbogintwini are much younger than the *A. fordii* trees, but so far seem to show greater vigour of growth.

A tendency has been observed in both varieties for young branches to die back, and it is considered

that this may be due to the lack of sufficiently low temperatures during the winter. We are therefore making renewed efforts to obtain seed of the *A. montana* species for trial under our sub-tropical conditions.

CULTURAL CONSIDERATIONS:

According to American authorities any soil, so long as it is well drained, is suitable for tung trees. The seed may be sown in tins or seed-beds and the young seedlings grown for one year either in single tins or nursery rows. When about one year old the young trees should be planted out in early spring while still dormant into their permanent site. Planting at stake may also be done if desired. In our most recent planting at Umbogintwini the seeds were received and planted in March, 1930, and the first seedlings planted out in the field in December of the same year.

In planting out the general recommendation is to the effect that the trees should be spaced in rows $12\frac{1}{2}$ ft. by 30 ft. In the third year they will begin to bear and will be in full bearing in the seventh year, when alternate rows may be removed, leaving the trees 30ft. x 25ft. As previously mentioned, the plantation must be well worked and the trees adequately fertilised.

In parts of China it is the practice to root up the plantations after the tenth year, but most investigators seem to agree that the bearing life of a tree may extend up to from twenty to thirty years.

The mature fruit is not unlike a small apple in size and shape and contains from three to seven firm brown seeds, although the usual number is five. At maturity the fruits fall from the trees and are gathered up when convenient. The tung oil of commerce is obtained from the seeds after they have been removed from the outer husk.

DISEASES AND INSECT PESTS:

The tung tree is held to be singularly free from diseases and insect pests, and our experience at Umbogintwini to some extent bears this out. It has been noted though that unhealthy trees seem subject to eelworm attack and infestation by the scale insect *Aspidiotus lataniae*. A weevil *Ellimenes laesicollis* has also been observed feeding on the buds and developing flowers of the *A. fordii* species and on the bark of *A. cordata* trees, particularly on the young growth. Of the first crop of fruits now ripening at Umbogintwini, several show signs of some insect attack, but it is obviously impossible to say at this stage whether or not this is a distinct menace to tung oil production.

ECONOMIC ASPECTS:

In the light of the foregoing it would appear that on sheltered sites and with reasonable care and attention tung oil cultivation has favourable

prospects in the coastal belt of Natal, but until more information with regard to the crop is available, large scale plantings are not justified.

Accurate figures in respect to possible yields are practically non-existent, but it is said that Chinese trees yield from one to five bushels of fruit per season, according to age. Figures now being obtained in groves of bearing age in Florida show that 100 lbs. of dry fruit will produce from 2 to $2\frac{1}{2}$ gallons of oil, and at this rate with 116 trees to the acre, yields of from 100 to 300 gallons to the acre are possible. Preliminary records from one area of 220 acres in 1929 showed, however, that a yield of about 10 gallons to the acre would have been obtained had the seed been crushed. Part of this area was badly drained though and the whole of it was insufficiently fertilised. One five-acre grove in the same year produced at the rate of 42 gallons to the acre. The best yield in 1929 was obtained in the Gainesville district where 1.9 acres of six-year-old trees yielded at the rate of 97 gallons to the acre. There seems to be little doubt that with increasing knowledge of the crop, selection of high yielding strains and proper fertilisation, yields of from 100 to 150 gallons to the acre may be obtained in areas where the crop is adapted.

The price of tung oil in London is now in the neighbourhood of £70 to £80 per ton, which works out roughly at 5/7d. per gallon. Thus at the rate of 100 gallons per acre a gross return of £28 per acre would be obtained, from which would have to be deducted the costs of harvesting, expression of the oil and shipping to market.

From the foregoing it will be obvious that the future for tung tree culture in the coastal belt should not be painted in too glowing colours, but, on the other hand, it cannot be denied that the possibilities of the crop warrant careful consideration. There is no doubt that the demand for tung oil will grow, and we believe that Natal should be able to produce profitably its quota of Empire-grown tung oil.

African Explosives & Industries, Ltd.,
Umbogintwini.

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The CHAIRMAN stated that Mr. Moses had given them further thought for investigation in a new line; the necessity for having other baskets to put their eggs in was becoming more evident now when the first basket was beginning to crock up a bit. Tung Oil as a crop certainly sounded interesting, and there was probably a great deal more they wanted to know about it. He would like to know how the expression of the oil was done. Could each planter do with a small hand plant or would it be taken up and done centrally for a number of estates? They would also like to know if it was an

expensive matter or was it merely a matter of crushing it and running it into a barrel?

Mr. MOSES replied that they had not yet had to consider the question of expression of the oil. In China the seed was fermented and the oil pressed out in a very laborious and prehistoric method by means of wooden presses. In America the Tung Oil Corporation had put up a central plant. He thought if tung tree cultivation was established in this area it would be best to have a central plant which would do all the expressing. In reply to further questions, Mr. Moses stated that from the information they had been able to obtain the trees came to fruition at the end of six years, although he had recently seen copies of correspondence from the President of the American Tung Oil Corporation to the Research Chemist of the British Paint & Varnish Associations in which it was stated that the trees would not come into full bearing until ten years old, in which case the yield from the third to seventh year would be very light. It was hoped that the bearing life of the trees would extend up to 20 or 30 years. After maturity the trees yielded a yearly crop.

Mr. DODDS stated that he thought they were very much indebted to African Explosives & Industries, Ltd., and Mr. Moses for the many promising suggestions regarding alternative or rotation crops in sugar cane areas. In connection with the

tung oil tree he thought he could claim to be in some small way a pioneer in this country. In 1913 or 1914 he had received a small parcel of seed of *Aleurites cordata* from the Experiment Station at Chico in California. He thought he had been rather out of luck in getting one solitary seedling out of about 50 seeds, but in view of the experience of Mr. Moses he seemed, on the contrary, to have been fortunate. This solitary tree had been planted in rather an exposed position, but it was maintaining a struggling existence the last time he had seen it. It was on the estate of Mr. Patrick at Chakas Kraal and probably Mr. Patrick could tell them whether it was still in existence. Undoubtedly the tung oil tree was one of very great potential commercial value, tung oil being one of the most valuable oils in commerce. Of course it could not be regarded as a rotation crop, but as a permanent crop it might be utilised in those areas in which some people tried to grow cane but ought not. There were many patches here and there which for one reason or another would not grow sugar cane but would grow timber. Usually their advice to planters was to grow eucalyptus trees in such patches, which as a rule did well, but tung oil trees might prove even more valuable commercially, and the possibility was well worth further study.

Mr. PATRICK stated that the tree Mr. Dodds had mentioned had died off in a drought three years ago.