Chinese Disturbances Bring to the Front the Question of Our Tung-Oil Supply

The Unsettled Condition of China Makes the Propagation of an American Tung Oil of Great Economic Importance

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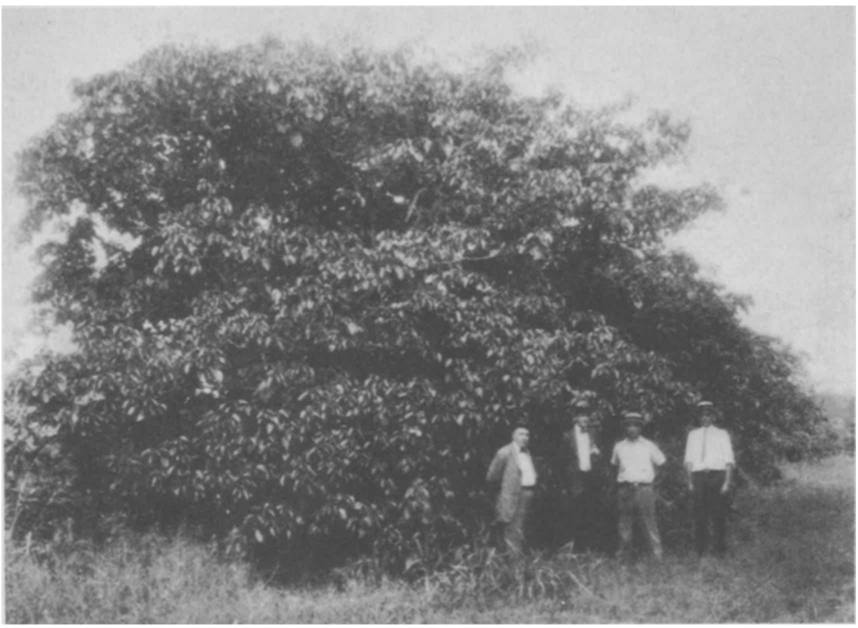


A domestic tung-oil tree in full bloom

A CROP recently introduced into America and which seems destined to take an important place in American agriculture and manufacture is the Chinese tung-oil or wood-oil tree. It belongs to the genus Aleurites, and the most promising variety for American use seems to be Aleurites fordi Hemsl. The fruits of the tree bear seed which contain tung-oil or wood-oil, one of the best drying oils known. It is used in large quantities in the manufacture of paints and varnishes. Tung-oil tends to make varnishes waterproof and reduces their liability to crack. It is said that waterproof varnishes cannot be made satisfactorily on a commercial scale without tung-oil.

The only source of tung-oil up to the present has been China. The Department of Commerce estimates that in 1925 the United States imported 101,554,000 pounds of tung-oil, valued at $11,386,000. However, the Chinese methods of extraction are crude, producing a low quality oil, which is often adulterated before it is shipped. It is produced in the interior of China, and is subject to heavy tax burdens and even to confiscation by bandits before it reaches the coast for shipping to America. At the present time the almost war-like unrest of the country, which bids fair to be of considerable duration, adds another complexity to the situation.

All of these factors have tended to make China an unsatisfactory source of supply, and consequently American manufacturers are interested in obtaining an American supply. In recent years, particularly, they have aided in endeavors to establish the crop in the Southern States.

The first plantings of tung-oil trees were brought to America in 1905 by the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture. It was first tried in California, but failed to do very well in that state. It has been tried also in a large number of Southern states, but has been found to thrive best in the northern part of Florida and the southern parts of Georgia, Alabama, Mississippi, and Louisiana. Above the central part of Georgia and Alabama, it is apt to be killed by cold in the winter.

The greatest development of tung-oil has taken place in Alachua County, Florida. Plantings were made on the farm of the Florida Agricultural Experiment Station in 1912, and in recent years two companies formed by the paint and varnish industry have developed the industry on a more extensive scale than has been done heretofore. These companies are the American Tung-Oil Corporation and the Alachua Tung-Oil Company. They and other Alachua County planters have about 3,000 acres set to tung-oil trees, some of whch are bearing. It is estimated by B. F. Williamson, in charge of the properties of both companies, that 30,000 trees will bear fruit this year, and approximately 160,000 will be in bearing by 1928. As soon as enough crop is being produced to justify it, a crushing mill is planned for the county.

Plantings have been made also by these and other companies and by individual farmers in the central and northern part of Florida, southern Georgia, and the Gulf regions of Alabama, Mississippi, and Louisiana.

The tung-oil tree is a straggly growing deciduous tree, the leaves of which are large, dark green, and more or less heart shaped, often with three lobes. The tree grows to a height of from 25 to 35 feet, and measures from 6 to around 12 inches in diameter.

Propagation is by means of seed. The Florida Experiment Station has conducted budding work in an effort to accurately and rapidly propagate certain trees that bear fruit in clusters instead of singly, and consequently bear much more fruit. Seedling tung-oil trees, like seedling fruit trees, are mongrel and, while seedings bear some resemblance to the parent, growth habits of the parent tree cannot be transmitted with certainty to the seedling.

While the tung-oil tree gives excellent response to fertilizers and cultivation, it will grow on poor soils and with very little cultivation. The trees require a well drained, non-lime soil for best results. Both winter and summer cover crops to help retain and build up the fertility of the soil have been found to give good results in tung-oil groves.

The tung-oil fruit resembles a rusty apple in outward appearance, but is divided into sections, each section containing a seed or "nut." The number of seed in a fruit varies from 5 to 15, but is most often 5. Although the seed are not true nuts, they are generally spoken of as nuts.

The fruits generally mature in October and November, and harvesting is very simple. The fruits are allowed to mature and fall to the ground, where they may be harvested at once or they may be

Young tung-oil tree in bloom in Florida

A cluster of American tung-oil fruits

allowed to remain on the ground for weeks or even months before they are gathered. When the fruits are allowed to lie for several weeks, the outer husks are easier to pull off and free the seed.

The oil in the seed is contained in little cells or sacs. When it is expressed, the meat of the seed should be moist to prevent the oil from being absorbed by the meat after it is pressed from the oil sacs.

It is possible to express tung-oil on hydraulic presses such as are used in the manufacture of peanut and cottonseed oils. In this process the meat is first run through a roller and reduced to a meal. It is then transferred to a heating or tempering apparatus, which brings it to a uniform temperature and makes the oil flow freely. It next goes to a former, which forms it into cakes, at the same time wrapping it with press cloths made from camel's hair. It is then placed in stacks with perforated plates between, 12 to 15 cakes to a stack. Pressure is then directed against the whole by a hydraulic ram. The cake remains in the press and the oil finds its way through open channels to a drain tank, where it is settled or filtered.

Fortunately, little or no color is extracted from the meats with the oil. Some oil seeds—like cotton seed—contain color cells and the color is soluble in the oil, so that it is necessary to remove the color from the crude oil by refining. Refining is not necessary in the case of tung-oil. The only thing required after pressing is to let the oil settle, and then to filter it.

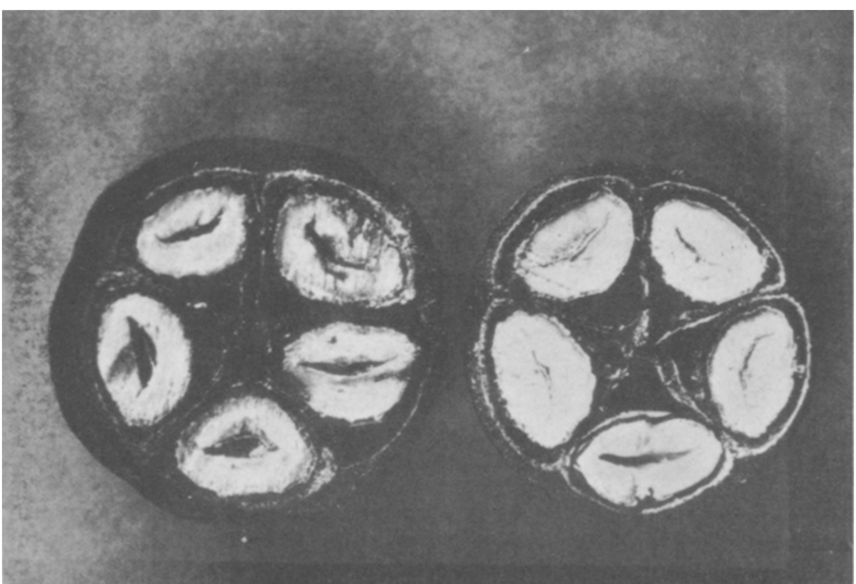
Another method of extraction, called the expeller process, is more adapted for use with tung-oil seeds. In the expeller process, the seeds are cracked and fed into the expeller. The expeller is a steel cylinder built up of staves like a barrel. A shaft runs through the cylinder and on this shaft is a broken screw. At the far end is a cone that can be tightened as required. The tung-oil meats are forced against this cone, and the broken screw creates pressure. The oil finds its way between the staves.

In either process there is left in the residue from 5 to 7 per cent oil. It is possible to extract with solvents and reduce the oil left in the residue to as low as 1 per cent.

The pomace or residue, which is poisonous, contains some plant nutrients and is used as a fertilizer. It tests 4½ to 5 per cent ammonia and a small amount of potash and phosphorous.

The Chinese are still using extraction methods of 1,000 years standing. Their press is made of a slot about 12 inches wide and two to three feet long cut lengthwise in a log. The meats are all prepared and crushed by hand. They are heated in open pans and put into small sacks. The sacks are put in the slot in the log, each sack separated from the next by a smooth stone. Then the slot is filled and pressing is ready to commence, thick wedges are driven by hand in one end, and then thinner wedges are driven until pressure is exerted.

The oil left in the residue by this method runs from 16 to 22 percent. The Chinese leave enough oil in the residue to pay all costs of pressing by modern methods. On account of poor control in handling and heating in the Chinese method, the meats are partially or wholly overheated, resulting in a dark oil partially decomposed and running from 5 to 8 percent free acid. With American methods, a light and practically neutral oil is produced, which is much better for use in varnishes and paints. It is estimated that one American press will do the work of 100 Chinamen.



Cross section of tung-oil fruit, showing the seeds or "nuts" which contain oil

Dr. Battle's New Cup Ready for Smalley Foundation Award

MEMBERS of the American Oil Chemists' Society will be interested in seeing the new cup which has been offered for the Smalley Foundation competition by Dr. H. B. Battle, President of the Battle Laboratory. As is generally known, the Battle Laboratory of Montgomery, Alabama, won permanent possession of the first cup last year, having then received the award for the third time. As was announced in OIL & FAT INDUSTRIES for September 1926, Dr. Battle very generously offered to supply a new cup, to be awarded on the same basis as before.

The rules of the competition provide that the cup be awarded each year to the collaborator in the cooperative meal work who has the highest average efficiency in the determination of oil and ammonia, in connection with the Smalley Foundation cooperative analytical work. The winner of any single year's competition keeps possession of it for that year; but the cup becomes the permanent possession of the collaborator only when he receives it three different times.

Second Smalley Foundation cup supplied by Dr. H. B. Battle

The new cup donated by Dr. Battle is shown on this page and members will agree that it is an unusually handsome prize worthy to symbolize the best efforts of the investigators. The Society feels greatly indebted to Dr. Battle for his generosity in providing the cup, as it is certain to stimulate interest in this highly valuable work.

Paper on the Detection of Butter Substitutes

THE annual meeting of the Society of Public Analysts was held March 2. Among the papers, "Cacao Butter Substitutes and their Detection" was read by A. W. Knapp, J. E. Moss, and A. Melley, who stated that the most useful single test was the determination of the "titre" of the fatty acids, and, in the absence of certain other fats (*e.g.*, coconut oil), this test enabled the amount of Borneo talow in admixture with cacao butter to be approximately determined after reference to a curve. A new method of determination was based on the fact that the green colour of Borneo tallow was not bleached by ultra-violet light, whereas the yellow colour of cacao butter was readily bleached. A weighed quantity of the fat was exposed for six hours to the rays of a standardised quartz mercury vapour lamp, and the colour then compared with the colours of a set of standards containing definite amounts of Borneo tallow.