

## THE USES AND PRODUCTION OF TUNG OIL

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Tung oil has been known and used in China for over sixty centuries for ship-caulking and as an ingredient in Chinese lacquers, but it was not introduced into the United States until 1869.<sup>1</sup> Its use was quite limited until during the World War when its values were first recognized. Since then its versatility has brought it recognition as a valuable and useful natural product.

Tung oil is the fastest drying oil known. A drying oil is one that makes substances with which it is mixed non-absorbent, completely repellent to water. Thus the addition of tung oil to certain organic and inorganic compounds and rosins gives quick-drying power to varnish and the ability to absorb oxygen and form a hard protective film that is resistant to boiling water, freezing, and former whitening effects.<sup>2</sup>

The general availability of tung oil in quantities commensurate with our growing needs served to heighten its value in spite of certain drawbacks, and in the opinion of a leading chemist its production has completely revolutionized paint and varnish manufacture.<sup>3</sup> By 1939 American manufacturers were relying upon it as their major drying oil.

Despite the earlier use of tung for lacquer, it was not used in paints in this country until 1936. In that year a new kind of paint, whose basal mixture consisted of 45% soy and 55% tung oil, was introduced. Thus in discovering a new use for soy oil the paint industry also broadened the use of tung oil. The addition of soy oil keeps tung from solidifying at a relatively low temperature and prevents destructive distillation that occurs when it is used alone.<sup>4</sup>

The modern auto is most grateful to tung. Cheaper but better paint and filler

jobs, improved gaskets, high grade brake linings, enameled surfaces, shellac, and bakelite and plastic fittings often depend upon it. Linoleum and oilcloth makers likewise tip their hats to it, while numerous other things, some of them vital to defense, have been improved with its addition. Raincoats, shower curtains, and balloon coverings now shed water because of tung treatment, and shot cartridges withstand wetting to a greater degree than before. Even a rubber substitute has been developed which is composed basically of tung.

Timber-poor China has long employed whatever means possible to prolong the life of paper and wood. It is tung oil that the Chinese have used to water-proof their buildings and writing materials,<sup>5</sup> to line their junks, as an important constituent in their varnishes, lacquers, paints, and japanning processes, and to give permanence to their masonry.<sup>6</sup>

Certainly the extensive use of tung has been a bonanza to American, European, and Chinese manufacturers and has improved the appearance of office, home, and barn.

Whereas tung is indigenous to various parts of Malaysia, Africa, and certain Pacific islands, China has long been the chief producer and exporter. In commercial circles and in parlance common to those acquainted with the oil it has been called chinawood oil. This is a misnomer. It is not a product of the wood, but is the oil extracted or expressed from the fruit of the tung tree. The word *TUNG* is Chinese for *heart*, and the leaf of the most important species of the family to which tung belongs is heart-shaped; hence the name. The tree is brittle and is usually covered with a maze of beautiful bell-shaped, generally

<sup>1</sup> Phillips, M. O.: Florida's Infant Industry, *Economic Geography*, vol. V., October, 1929, p. 348-357.

<sup>2</sup> Pulsifer, L. Valentine: The Romance of Valspar, Valentine & Co.

<sup>3</sup> Gardner, H. A., and Butler, Paul H.: Tung Oil Culture, National Paint, Varnish, and Lacquer Association, Inc., Washington, June, 1937, p. 8.

<sup>4</sup> Anonymous: Tung Oil's Marriage to Soybean, *Review of Reviews*, vol. XCIV, September, 1936, p. 4.

<sup>5</sup> Phillips: *Op. Cit.*, p. 348.

<sup>6</sup> Gardner and Butler: *Op. Cit.*, p. 2.

pink or white, entomophilous blossoms, which precede the leaves.

Inasmuch as tung is sensitive to cold weather, it thrives only in tropical and subtropical regions. In China, *Aleurites fordii*, the chief species, is important in four provinces, Szechwan, Hunan, Hupeh, and Chekiang, while *montana* species does best in tropical Kwangsi province, west of Canton.

It seems that the first seeds to produce tung trees in America were imported from China in 1905. In that year the United States Department of Agriculture received nuts from Consul-General Wilcox of Hankow. The Experiment Station at Chico, California, presumably planted them at once.<sup>7</sup> Concurrently Dr. David Fairchild, in charge of the Division of Plant Introduction of the United States Department of Agriculture, became actively interested and through his efforts plantings were made in Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Texas.<sup>8</sup> By 1909 a government contingent was optimistically investigating tung conditions in China.

To the enthusiasm and experimental work of the late William H. Raynes, a well-known horticulturist of Tallahassee, Florida, is due much of the credit for the early developments of the tung oil trees in Florida, and that state leads in the promotion and interests of tung growth in the United States. From Raynes' one successful tree the first grove of commercial importance in the United States originated.<sup>9</sup>

With the favorable reports of the government "spies" who had investigated the growth of tung in China, expansion in the South appeared to far-sighted individuals a just and profitable venture. Both the Bureau of Chemistry and Soils and the Bureau of Plant Industry have assisted in the expansion of tung groves and production through many experiments, while state and local agencies have been devoting much attention to the production of tung crops as an economic policy.

The first extraction of American oil that was sufficient to attract commercial interests took place in January, 1929. As the extracting machine was installed near Gainesville, Florida, and the golden oil was pressed out, nationally known manufacturers, representatives of internationally powerful financiers, chemists, agriculturists, scientific workers, and many curious and interested laymen looked on. Since then extracting mills have been established at numerous places in the Tung Belt. The Belt extends along the Gulf from eastern Texas to central Florida, a strip of territory generally not exceeding 100 to 125 miles in width.<sup>10</sup>

Thus far tung production in the United States has been negligible compared to the huge amounts China has contributed. Our 11,000,000 pounds produced prior to 1941 were about 1.5% of the amount imported during those years. Yet the decade of the thirties showed a remarkable increase from practically nothing to 4,000,000 pounds produced in 1940. In 1939 there were over 12,500,000 trees in the United States, one-third of them bearing. This number is constantly increasing.<sup>11</sup>

Imports into the United States increased steadily from 1914 to 1937, amounting in that year to 175,000,000 pounds,<sup>12</sup> valued at \$25,000,000 (U. S.). But since then the Chinese Incident has greatly curtailed Chinese exports which have finally been entirely cut off. Meanwhile, American production is far from sufficient to supply recent demands. But on the optimistic side there are three noteworthy facts: that American oil is of much higher quality than Chinese and hence goes farther; that the mixture of tung oil with certain other lesser-quality oils now produces very excellent drying results; and, that our production is increasing.

Therefore, it appears logical that the United States will continue its efforts at becoming self-sufficient whether China rises again as a great exporter or not

<sup>7</sup> Newell, Wilmon, et al.: *The Tung Oil Tree*. University of Florida Experiment Station Gainesville; Bull. no. 280, June, 1935, p. 26.

<sup>8</sup> Concannon, C. C.: *Tung Oil Blue Book*, USDC Bureau of Foreign and Domestic Commerce, Washington, 1938, p. 3.

<sup>9</sup> Gardner, H. A., and Butler, Paul H.: *Op. Cit.*, p. 30.

<sup>10</sup> Concannon, C. C.: *Op. Cit.*, p. 5.

<sup>11</sup> Dickey, R. D.: Personal communication.

<sup>12</sup> Inspectorate General of Customs (China): *Foreign Trade of China, Maritime Customs (export volumes only)*, volumes covering years 1913 to 1939 inclusive.

After cessation of the war China will have to try to undersell the United States and must produce better oil if she's to compete with us. Tung has definitely had a setback because of the war, but it may emerge in a healthier, cheaper, and more stable condition if and when our South provides our needs, which according to some tung authorities may be as early as 1947.<sup>13</sup>

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<sup>13</sup> Anonymous: H. W. Bennett on Expansion of the Tung Industry, *New York Times*, June 26, 1932, part LV, p. 10: 2.

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