An American Palm Oil Industry

American Tropics Afford Means to Our Economic Independence.

By HAKON WADELL

THE past half century has witnessed a gradual substitution throughout the world of vegetable oil for animal fats, both in domestic and industrial life. The world demand for vegetable oil has risen steadily in recent decades, and there seems to be no upper limit to the possible demand. The major uses are for edible oils, soap stock and lubricants.

Palm kernels, palm kernel oil and coconut oil, on account of their inherent properties, have become a necessity in the whole range of fats which are compounded and sold for edible purposes; such as butter substitutes, margarine and kindred edible fats. Large quantities of palm kernel oil enter also into the manufacture of candles, lubricants and soap, the first and last being the most important. After the greater part of the oil has been expressed from the kernels, the resulting oil cake forms a valuable cattle food.

Palm oil, obtained from the "pericarp" of the African oil palm fruit, is used chiefly for the manufacture of soap and candles. Large quantities go into the manufacture of tinplate, to prevent oxidation before the plates are dipped in the molten tin. An enormous quantity is consumed by the railway companies of the world, who use it extensively for greasing axle-boxes of railway carriages.

With the advent of the World War, it early became apparent that one of the critical links in the chain of self-sufficiency was the available supply of fats and oils. The Central Powers were isolated from a supply which for years they had been fostering within the tropics. The United States, holding but few interests in the tropical vegetable oil production, were in regard to palm oil entirely dependent upon licenses of the English Government, who controlled the African palm oil industry.

In respect to quantity, coconut oil is the most important of the vegetable oils entering into international trade. The principal sources of the world's supply of coconut oil are the Philippine Islands, the Dutch East Indies, Straits Settlements, British India, and Ceylon. With the exception of comparatively small investments in the coconut plantations of the Philippine Islands, the United States has practically no interests in tropical coconut production.

The consumption of coconut oil has advanced more rapidly in the United States than in western Europe—from less than 100 million pounds in 1913 to an average of 330 million pounds from 1919 to 1923. The proportion of the total supply of coconut oil consumed in this country has increased from 14.2 per cent in 1913 to 34 per cent in 1923.

In regard to the vegetable oil industry in general, it appears from available facts that the production of vegetable oils is an industry which may in the future be developed extensively in the tropics. Under such cicumstances it is high time that we, as an indus-

ATTALEA COHUNE mart., as found in Guatemala

trial nation, realize to the full the vital importance of getting a foothold in tropical oil production. In the American forest regions bordering the Equator the fecund vegetable growth provides an immense variety of raw materials which may be exploited with little trouble. Here we may find lavish supplies of oils and fats to satisfy the needs for industrial oils. The value, extent and importance of a prospective American palm oil industry are only realized by the few

who have actively investigated the possibilities of its development. Thousands of tons of valuable material are annually going to waste in Central and South American regions.

The Supply Is Near at Hand

Several of the most important oil palms of America belong to the genus Attalea. More than twenty species of these beautiful trees are known, all native to America and inhabiting various parts of South America, Mexico and Central America. Their stems are generally of middle size, often lofty, cylindrical and smooth; but there are also some stemless species. The leaves of all are very handsome, large and regular pinnate. One of the most important as a source of vegetable oil is the species Attalea Cohune.

For local consumption a small industry is carried on by the natives throughout the countries where the tree occurs. The trunks are used for building purposes, the leaves for thatching and the young leaf bases for the manufacture of brooms and brushes. Cord and hammocks are made from the fibres of the young leaves, which in Costa Rica, at least, are used for making hats. From the trunk a liquor similar to that of the coco palm is obtained. The young bud or "cabbage" is cooked and eaten. The fruits are the most important part of the plant. The kernels are fed to cattle and hogs or used for human food, especially for the preparation of sweetmeats. The kernel oil is extracted and used as a sort of vegetable butter, a delicacy in food, as an illuminant and for the native manufacture of soap and candles. The shell, which is hard as bone and exceedingly strong and resistant to crushing stress has been used locally for the making of buttons. With the demand for combating the use of poison gas in the war, it was found that the shell, when carbonized, acted as an absorbent against the injurious effects of the gas, and it therefore became one of the principal elements used in the manufacture of the gas mask.

The fat obtained from the outer fibrous layer of the fruit has hitherto not been exploited. Owing to the bulky and fibrous nature of the outer layer, the fat could perhaps not be obtained by expression but would have to be extracted by means of solvents. This however needs further experiments. The writer believes that machinery could be invented for the expression of the oil, in which case the obtained atta-cohune oil would be worth taking care of as a by-product in the exploitation of the fruits for the kernels. The atta-cohune oil, expressed and treated in a correct way, would probably realize prices approximating those of commercial palm oil.

It has been suggested that the outer layer of the fruit, because of its fibrous character, could be used in the manufacture of paper pulp.

In a hydraulic press, the kernels yield about the same percentage of fat as copra and rather more than commercial palm kernels, and as the atta-cohune kernel oil resembles very closely coconut oil, the kernels should, if shipped in commercial quantities and in good condition, realize prices approximating those of copra. Judging from the results of the analyses the atta-cohune press cake should, as a feeding stuff, be equal in value to coconut cake.

Difficulties of Exploitation

The native exploitation of the *co-*

quito de aceite (Attalea cohune of the Pacific coast) in Colima in Mexico is primitive. The collection of the fruits is operated by contractors, who gather the laborers together and supervise their work. The fruits are collected and their outer fibrous part is removed by hand by the blow of a cylindrical stone. The remaining nuts are desiccated in the sun till the kernels rattle in the shell, whereafter they are cracked by hand by means of a hard cylindrical stone. The kernels are toasted and brought to the local oil mill, consisting of a runner and a bedstone, between which the kernels are mashed.

In the southern district of Purification, State of Jalisco, Mexico, about 200,000 kilos of atta-cohune kernels are produced without cultivation in a zone of about eight miles square. The resulting oil is estimated at 116,667 kilos, and it is thought that with improved methods of extraction a larger percentage of oil might be secured. It is reported that 129,600 kilos of kernels are produced in the district of Tabares, State of Guerrero. One native soap factory at Guaymas is said to have used 100,000 pounds of atta-cohune kernel oil a year.

In Central America the greater part of the kernels is extracted by the natives. An industrious native gathers 1/2 to 2/3 ton of nuts per day, or if mules are at his disposal he might collect up to 1.5 tons or more. The fruits are spread out on a "patio" or drying floor, where they remain for several weeks. This drying loosens the kernel from the shell. The native then cracks the nuts between two stones. The average man is able to crack and separate the kernels from about 100 to 125 pounds of nuts per day, which give 10 to 15 pounds of free kernels. The kernels are either sold on the local market or prepared for the extraction of the oil. In the last case the kernels are pounded in a wooden mortar, and the resulting sediment boiled down with water until the oil or fat floats. The oil is skimmed off, heated in an iron pot, so as to disengage all the aqueous particles, and then bottled. Sometimes the boiled pulp is pressed in rude sacks or cloths.

The first record of any attempt in Central America to make commercial use of the atta-cohune nuts was in 1869 when two Frenchmen, De La Roche and Roquerle, came to British Honduras. They returned to France with a small supply of oil and some nuts for further experiments. Since that time the English have interested themselves in attempts to make the extraction of the oil commercially profitable. Some years ago the Tropical Co., Ltd., in Belize, tried a machine built on the principle of a rock crusher, but the difficulty was in separating kernel and husk after the machine had cracked he nuts.

In recent years various other attempts have been made, but without any great success, evidently owing to difficulties in extraction of the kernels, inappropriate working plans, and lack of capital. During the war, when there was a special demand for the shells as well as for vegetable fats, the industry prospered, but with peace the interest ceased, and the production fell back practically to the stage previous to the war. The latest and what probably will prove to be the most successful venture in regard to the atta-cohune industry in Central America, is a small soap-making plant at Stann Creek in British Honduras. Soap is made from the extracted oil and sold in the Colony. There is also some idea of developing atta-cohune planta-

tions within easy distance of Stann Creek Railway, and of raising cattle on the pasture between the trees.

In Colombia the atta-cohune industry is not exploited to any extent as yet, though in recent years efforts to establish an oil mill at Barranquilla have been made by an American associated with a Colombian. This plant is to crush the nuts and refine the oil for export.

The difficulty of cracking the shell of the nuts has perhaps been the greatest stumbling block to the successful development of an American palm oil industry. A pressure of up to 1,800 pounds is necessary to break the shell. Many kinds of breakers and crushers have been tried with the object of cracking the shell without crushing the enclosed kernel. Various types of rock crushers were used. They broke the shell, but in so doing crushed the kernel and partially pressed out the oil which, upon contact with the warm and humid tropical atmosphere, turned rancid, spoiling the product for market.

The thin, dark brown, closely adhering skin, covering the kernel, seems to be of a certain importance for the preservation of the oil during the transportation and storage of the kernels. Undamaged or slightly scratched kernels have been stored by the writer for years in rooms with a temperature of about 23°C. (73° Fahr) and with free air circulation, without any noticeable change in taste or odor of the kernels. Kernels preserved under the same conditions for three months, when exposed to pressure of about 200 pounds remained practically in the same shape and no loss of oil could be observed. Undamaged kernels may be transported in bulk or in common sacks without spoilage.

The majority of previously invented machines are too heavy for long transportation through the dense tropical forests, and require expensive road construction for hauling to the removed and less accessible parts of the atta-cohune forests. As the kernel constitutes only about 10 per cent of the entire fruit, the rest being largely composed of the rather valueless shell, the crude product can not stand the expense of a long haul, and for this reason heavy machinery with its high production capacity must for some part of the year close its operation for lack of fruits within paying distance of transportation.

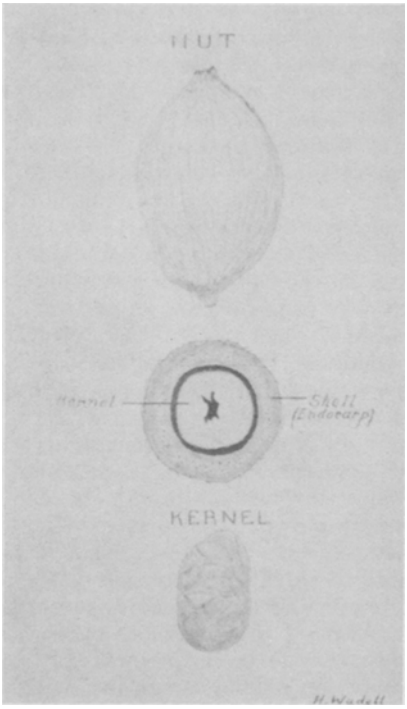
It has been suggested that if a small portable outfit could be constructed and taken into the regions where the trees are plentiful, thus effecting saving in the transportation of the crude product, the chief source of expense could be obviated and at the same time a continuous supply of material would be assured. Such machines, however, would not likely be sufficiently labor-saving nor efficient in handling the hard material.

A successful development of the atta-cohune industry is dependent upon suitable machinery in combination with appropriate working plans. The machinery should be able to extract the kernels without crushing them, it should be easily dismantled into portable parts, its size should be adjustable to the supply of fruits occurring within a paying distance of transportation and the construction should be simple enough that natives after short training would be able to handle it.

To each machine should be assigned an area not exceeding 16 square miles, except within territories with navigable rivers or other means of easy transportaton where in some instances a larger

field would be more favorable. The location of the machine and the size of the area of a larger field have to be carefully calculated in each individual case. With the shelling mill established in the center of an area of 16 square miles, the longest haul of the crude products would not exceed 2.5 miles.

The work can be continuous and not seasonal, as the nuts hang on the trees almost until the next crop is ready, and whether on the tree



Nut and kernel of attalea cohune

or fallen on the ground, the kernel does not deteriorate. So gathering can go on every day in the year. The principal thing to bear in mind is not to cut unripe fruits.

In many cases the fruits can be reached from the ground and easily severed from the stalk. Higher situated fruit clusters have to be reached by climbing the tree, the method of which is generally known among the natives.

After the raw material has passed the shelling mill the kernels should be brought to the concentration camp, which likewise can have a sheller of its own, if surrounded by a sufficient number of trees. The concentration camp should be situated at a navigable river, railway or truck road, allowing the transportation of large quantities of kernels at a time, thus reducing the transportation cost to the sea. The concentration camp should be equipped with a general repair shop, office, medical aid, etc. The size and equipment of the concentration camp are dependent upon the number of subordinated shelling camps. The greater the number of shelling camps is, the better compensated are the expenses of the concentration camp. Each concentration camp should not have less than four shelling camps.

Mules should be used for carrying the raw material to the shelling mill as well as for transportation of the kernels to he concentration camp. A path, wide enough to let the loaded animals through will be sufficient for the communication between the shelling mills and the concentration camp.

The local Indian population can be drawn upon for the labor supply. Since the laborer can have a home of his own near the shelling mill, with space allotted for cultivating corn and garden truck, and since he can return to his home every day, a better quality of labor can be counted on than in the chicle industry or other tropical forest exploitations, in which the workmen must be off in the woods away from their families for months at a time.

One square mile of an average

atta-cohune forest will produce yearly about 200 tons of nuts, which, having passed the shelling mill, result in about 20 tons (44,800 pounds) of kernels. If the oil in the outer fibrous layer of the fruits is taken care of the same area will produce about 4 tons (8,960 pounds) of atta-cohune oil.

For several reasons not all palms are fruit-bearing. Experience has shown that clearing of the ground round the tree will greatly add to the fruitfulness. Diseases and destructive enemies of the tree have not as yet been satisfactorily studied. The writer is, however, favorably impressed by the good condition of the atta-cohune forests. The harvesters should be kept on the watch for beetles and weevils (*Rhynchophorus palmarum*) and diseased or infected trees should be reduced to ashes without delay, otherwise germs might be scattered to the wind and be carried to neighboring trees.

There are two exceedingly valuable points in the superiority of the American wild growing oil palms over the coconut palm, the cultivation of which is perhaps the only investment of importance which American capital has hitherto found in the tropical palm industry. The first is that there is already at hand a full supply of all the oil palm fruit, which needs practically no cultivation, while great care and a long period has to be faced in the cultivation of coconut palms before a crop is borne. The second point is that, whereas a whole crop of young coconuts can be decimated by a tornado, it is impossible for this damage to occur to American oil palm fruit.

It would here be inappropriate to give a full and detailed report of the possible financial remuneration of a prospective atta-cohune industry. Practically all writers upon the subject have been optimists, a few have been reserved, but none of them have denied the possibilities of a successful industry, based upon scientific exploitation. Those familiar with the African palm oil industry know the enormous remuneration of its investments, and there is no reason why an American industry of the same kind should be less profitable, if developed in the right way. The South American exploitation of the so called *babassu*, a nut similar to the atta-cohune nut and obtained from two or more species of Attalea (*Attalea speciosa and Attalea funifera*) in spite of its primitive methods, has reached an unexpected development during the past ten years.

The principal difference between the African and the American conditions is the labor question. Inventors of American nut cracking machines have generally overlooked this problem, and although some of the inventions may be able to handle and crack the harder American palm nuts, they are not suitable for the American conditions. The African industry has in the negroes a cheap and plentiful supply of labor, while the American forests bordering on the Equator are thinly populated by Indians. The deficiency in labor of tropical America has to be compensated for by efficiency of machinery and working plans. The writer believes that if an exploitation of the American palm forests is organized upon the principles given above the remuneration of the new industry will be high and perhaps surpass that of the African. The development of an American palm oil industry is however not a task of a small concern, but of a large company with adequate financial backing.

Prospective Areas of Exploitation

In British Honduras the atta-cohune palm is said to occur over an area of nearly 2,000,000 acres or two-fifths of the total area of the Colony. It is the characteristic plant of the "cohune-ridges," a term applied to the land bordering the river valleys, or occupying extensive tracts, as in the west or south, or at the heads of some rivers. The term ridge is an unfortunate one and a better designation is "belt." The name Cohune—is used not because the atta-cohune palms predominate numerically, often constituting 20-30 per cent of the vegetation, but because it is far the most striking inhabitant in respect of appearance. Mahogany and many hard wood trees grow along with the palm.

In Spanish Honduras the greatest supply is found on the lowlands toward the eastern portion of the north coast. The Aguan River valley contains a single field of atta-cohune palms extending sixty to seventy miles up the river from its mouth, and with an average width of ten to twelve miles. It is estimated that an equipped force of 500 men could get 10,000 tons of nuts a month from this field alone.

The province of Izabal and the southern part of Petén, Guatemala, are a continuation of the atta-cohune belt of southern British Honduras and are estimated to have an area of about 1,500 square miles covered with atta-cohune palms.

The district of Coalcoman, State of Michoacan, Mexico, is reported to contain about 900,000 atta-cohune palms. The trees are exceedingly abundant in the States of Colima, Jalisco and Nyarit.

Summary

The world demand for vegetable oil has risen steadily in recent decades.

Coconut oil is one of the most important, in respect to quantity, of vegetable oils entering into international trade. The consumption of this oil together with palm kernel oil and palm oil has advanced rapidly in this country and the demand is on a steady increase. As the raw material of these oils is produced in the tropics, it is high time that we, as an industrial nation, realize to the full the vital importance of getting a foothold in tropical vegetable oil production.

In the American forest regions bordering the Equator the fecund vegetable growth provides an immense variety of raw materials which may be exploited with little trouble. Here we may find lavish supplies of oils and fats to satisfy our needs of industrial oils. Thousand of tons of valuable material are annually going to waste in these Central and South American regions.

One of the more important American oil palms is Attalea cohune, *Mart.*

There are several valuable points in the superiority of American wild-growing oil palms over the coconut palm, and there is no doubt that an American tropical palm oil production, based upon scientific exploitation, will stand the competition of the coconut as well as of the African palm oil industry. The large and unexploited Central and South American regions give an opportunity for investments with prospects of high remuneration and great possibilities of development.

The United States is the logical nation to foster the development of this profitable raw-material industry located so near our borders.