

were then taken, the meats and hulls separated, and the specific gravities of the meats determined by the method described above, with results as shown in column III of the table given below. It is obvious that no definite conclusions as to the oil content of the seeds can be drawn from these results, since there are very little differences in the values obtained on samples low in oil from those high in oil.

In seeking an explanation as to why the specific gravity determinations did not prove an index to the oil content of the meats, the idea suggested itself that possibly there was sufficient air in the meats to cause these results. A sample of meats was placed in the pycnometer and enough water to cover the meats was added, and the pycnometer placed in a desiccator and laboratory vacuum applied. Air was seen to collect on the seeds and the seeds rose to the surface, showing that the meats contained considerable air. Specific gravity determinations were then made on the ten samples under laboratory vacuum, with results as shown in Column IV in the table below. It will be noted that results are considerably higher than before and that in general the seeds of higher oil content have lower specific gravities, but the results are not definite enough to be indicative.

The determinations were repeated under a very nearly complete vacuum obtained with a May-Nelson pump, with results as shown below in Column V. The values obtained are somewhat higher than before and in general the meats of higher oil content showed lower specific gravity, but there are so many irregularities that it can not be said that the specific gravities as found in meats from which all the air possible had been sucked out under a vacuum obtained with a May-Nelson pump are definitely indicative of the percentage of oil in the meats.

No.	I Percentage in seed	II Percentage of oil in meats	III Specific Gravity of meats	IV Specific Gravity lab. vac.	V Vacuum with May-Nelson pump
1	15.99	31.66	1.119	1.201	1.222
2	16.98	32.33	1.122	1.202	1.210
3	16.49	32.35	1.134	1.211	1.225
4	17.93	34.34	1.126	1.196	1.168
5	17.36	36.54	1.111	1.179	1.199
6	21.06	37.70	1.112	1.118	1.191
7	20.38	37.85	1.117	1.177	1.214
8	20.59	38.02	1.121	1.191	1.208
9	22.24	38.97	1.115	1.174	1.177
10	23.38	42.08	1.116	1.167	1.175

In view of the fact that it is not possible to get very high vacuum in the presence of water vapor, it was thought possible that exhausting in the absence of water vapor might remove the air from the seed more completely. This was found not to be the case. When seeds which had been exhausted as completely as possible in absence of water were covered with water and vacuum applied, air bubbles were seen to appear on these seeds, showing that the presence of water in some way helped to force the air out and more of it is removed when the seed is immersed in water than where no water is present and the results of specific gravity determinations were not at all indicative of the oil content.

In conclusion it may be said that unfortunately the values for the specific gravities of cottonseed and cottonseed meats as determined in this work have not proved an index to the oil content and even if the values on the meats obtained under vacuum with the May-Nelson pump had proven fairly satisfactory, it is probable that more time, skill and operators would be required than in determining the oil by the usual method. However,

it seems desirable to publish the results of this work in order to save future investigators to whom the same idea may occur, the trouble of repeating the work and possibly it may suggest to some fertile mind a solution of the problem. Furthermore, it is possible that the method might prove successful with the smooth seeds such as the peanut, sesame, etc., but no work has yet been done on seeds other than cottonseed.

LIBERIA AS A POTENTIAL ASSET TO AMERICAN VEGETABLE OIL INTERESTS

By J. H. Shrader

Liberia probably has around forty to fifty million bearing palm-oil trees of three to five, more or less, distinct varieties. Not 5 per cent of the raw materials from these palms is at present exported. The reasons for this are the non-development of the interior, faulty transportation, and governmental troubles. In addition to the above obstacles, a law is still on the statute books which prevents white men from carrying on trade through barter stations in the interior. Such trade had been controlled by the Germans, and thus the above law was made to exclude them, but being still in force it likewise prevents any other white man from developing this trade. Previous to the war Germany controlled practically all of the interior trade and was doing a splendid business in oil-palm kernels and palm oil. They had probably fifty or more barter stations on all of the waterways and traffic routes coming to the coast.

The \$5,000,000 American loan, if it is put through on the proposed lines, will, of course, change the whole situation within a very few months; that is, it will not only put Liberia as a nation on her feet again, but about \$1,000,000 out of the \$5,000,000 will be available for improving the old and opening new transportation routes from which not only palm products but piassava kola, shea-butter, ivory, and drug materials (such as calabar beans, strophanthus, etc.) can be exported. The American loan will also automatically favor American interests and eventually squeeze out British, French, and German monopolies.

The interior natives are in most cases anxious for the Americans to come in and open up their countries for trade. They are keen for American goods and will buy them at preposterous prices, giving in payment, of course, not cash but raw materials, such as piassava fiber (from the Raphia palm, used for brushes, mats, etc.). As an instance of their appreciation of American ideas, between fifty and one hundred miles of broad trails have been built by tribes in the eastern (extreme interior) section of Liberia during 1920 by natives using their bare hands, sticks, and, in a few cases, hand-made hoes and hatches. An American district commissioner used a pocket level for some of the rough grading of the trails. The chiefs obliged the natives to do the rest without even furnishing them rice or other food. This could not be done in any other country in Africa.

The present unsatisfactory state of affairs has been brought about through the treatment of the interior tribes by the civilized coast Liberians. The governing faction of Liberia is made up of a few hundred "educated" Liberians descended from American colonists and a few—five or six thousand—others of the civilized natives inhabiting five coast towns and a few smaller villages near the coast and on the St. Paul River. The number of interior natives, of course, is unknown, and the two million suggested by Sir Harry Johnston and other British writers is probably much too high an estimate.

With the exception of the three great virgin forests

comprising somewhere around 3,000 square miles and the vast "Jawquelli" territory in the center of the republic, the whole interior is fairly well populated. Some districts on the eastern boundary are practically all under cultivation, such as it is, with many very small villages and a few ranging from several hundred to a few thousand huts.

This is the last remaining unexplored section of Africa. If the American loan eventuates, it is proposed to start a scientific reconnaissance with a civil engineer, a forester, a biologist, and geologist. It is proposed to establish about six semi-permanent camps in the interior and from these bases to thoroughly explore this vast region and make its wealth of natural resources finally known to all. The National Boundary Commission is going ahead to delineate the French, British, and Liberian boundaries.

The extortion of adventurers, backed by the graft of local politicians, together with the brigandage of roving soldiers, has so antagonized the native tribes that many of the chiefs, just behind the coast, are "breaking" their towns, moving them back from the trails, and hiding them in the unexplored jungles impregnable to outsiders. They are dead against the present government because of its maladministration and would hail as saviors an enlightened government assuring them protection and fair treatment.

Palm kernels are shipped out from the following towns: Sinoe, Grand Bassa, Monrovia, Cape Mount (Robertsport). Palm fiber comes from Monrovia, Robertsport, and Marshall. The products of the palm tree, *f. o. b.* Liberia, are worth about \$1.00 per tree. A tree yields on an average eight to ten pounds of pericarp oil, and five to eight pounds of kernels. The agricultural adviser has proposed to plant a row of oil palm trees on either side of every trail and roadway throughout the territory. The returns from these should fully cover the expense of maintaining the highways of communication.

The best palm oil for human consumption, as made by the natives, is known as *ni'chna*. This is never solid, but is liquid at all temperatures that obtain in Africa, not excepting the cool nights. It is made by first boiling the fruit in an iron or brass kettle with an excess of water for about one-half hour, to loosen the pulp. The mass is then dumped into troughs until cool enough to handle. It is then pounded, kneaded, or given a twisting motion with the hands, to loosen the pericarp from the kernels, and thrown back into water again and boiled until all the oil that is readily available rises to the top and is skimmed off. After skimming off as much oil as possible, the mass is then dumped onto a sloped trough made from a hollowed-out log or an inclined canoe, to facilitate draining. The nuts are readily separated and the residue is thoroughly squeezed in the hands; a large percentage of the oil, however, necessarily remains in the spongy mass. This oily fiber is accordingly, when dried, a very fine fuel. The oil thus obtained is a bright orange red, never yellowish nor dark colored. The natives near the coast usually use this oil as such, but sometimes bleach it by "burning" or superheating it in kettles; this destroys somewhat the original mawkish flavor of the oil, and is thought to render it less "heavy" in the stomach.

The lower grade of oil is called the *bo'chna* oil. This is made by placing the palm fruit in deep pits and allowing the mass to ferment, sometimes assisting by kneading to soften and loosen the pericarp and facilitate the ready separation of the oil. The mass is then treated by boiling in water. This oil is the ordinary palm kernel oil of commerce and is solid at ordinary temperatures, so much so that it can be transported in palm-leaf bags.

It is usually full of dirt and other refuse and runs high in fatty acid. The shipper, or at least the coast middleman, usually melts the small lots of *bo'chna* to get an "even grade." The lowest grade oil is called *saw'chna*, and is made somewhat as *bo'chna*, but is assisted in its fermentation by throwing hot stones into the pit or heap. It is made from the lowest grade palm fruit, gathered from the ground usually in a rotting condition. It is therefore very malodorous, is very high in fatty acid, and more highly colored and darker than the above grades. Comparatively very small quantities of this are produced, as it is usually made from decayed fruit, which would not obtain in a section where the oil industry was in a fairly thriving condition.

Previous to throwing the pulpy mass from the first boiling back into the kettle for the actual oil recovery, it is common practice to pick out some of the palm nuts and throw them to one side; the rest are removed after the second boiling. These nuts contain the palm kernels of commerce. It is common for many tons of these nuts to accumulate on the refuse heaps of the villages. Old women, unable to work in the fields, squat by large stones and crack the nuts by using a hammer stone, aiming to merely crack the shell without crushing the kernel. On account of the very great irregularity, however, about one in four kernels is crushed. A day's work consists in cracking about 100 pounds of nuts. The shells are burned for fuel, making a remarkably hot flame, satisfactory for melting iron. The palm kernels are placed in bags (three braided oil-palm leaves, called *kanja*), constituting a burden of thirty to fifty pounds, and are brought down to the highways of commerce on the backs of natives. About ten to fifteen miles constitute a day's journey, and a native will not exercise himself for more than three successive days. Regions more than thirty to forty miles back from a river, railroad, or other main line of transportation are beyond the area of commercial exploitation.

Ni'chna is used in place of alcohol or gas by gold and silversmiths in making native jewelry. It is customary to place a little of the oil in a bowl, dip a rag in it, and blow the flame with a large blowpipe from such a wick direct onto the metal that is being worked, exactly as is done with an alcohol flame. It seems to be quite satisfactory in the hands of the natives for this purpose, giving no smoke, no soot, and melts the metal almost immediately.

It ain't the guns nor armament, nor funds that they
can pay,
But the close cooperation, that makes them win the
day—

It ain't the individual, nor the army as a whole,
But the everlastin' teamwork of every bloomin' soul.
—Rudyard Kipling.

What we do upon some great occasion will probably
depend upon what we already are, and what we are
will be the result of previous years of self-discipline.—
Canon Liddon.

"To be successful in one's profession is certainly
much to be desired, but no one can reasonably expect
that success will come without long, unremitting, heart-
breaking toil."

Success in most things depends upon knowing how
long it takes to succeed.—Montesquieu.

"He who can explain himself may command what
he wants."