

However, the best Colombian coffee marketed, and perhaps the coffee commanding the highest price, is the so-called Medellin Excelso, and it is claimed that superiority in this case is due to the special quality of soil (volcanic ash), but it also receives careful cultivation and preparation. The Medellin Excelso is selling about twice the price^{of} the number Santos 4, the top brand of Brazil.

Generally speaking, the differential between the "Brazils" and the "Milds" have been diminishing, perhaps due to the increasing supply of the latter, possibly as a result of the policy of blending.

The following table shows the change in prices and in parities which have taken place during the last seven years, at the end of January, between

	1923	1924	1925	1926	1927	1928	1929
Rio	12.30	11.00	23.50	18.75	15.00	14.3/8	18.50
Santos	16.25	16.50	28.25	24.00	19.25	21.75	24.00
Washed Colombians	22.00	20.75	29.00	31.50	24.50	27.00	25.00

The future of the coffee industry is not easy to foretell. The policy of Brazil can be permanently successful if used only to maintain uniform prices from year to year upon a production which does not on the average exceed the market demands. The high price of coffee and low price of sugar tends to cause a reduction of sugar and increase of coffee^{production.} Thus Cuba, which has been an importer of coffee, is planting coffee trees, and probably will become an exporter of the product. On the whole, however, an examination of the production table seems to show that the principal menace to the valorization system is from the increase of production within Brazil. Shortage of labor tends to restrict expansion in most of the coffee-producing countries of Central and South America, but until recently Brazil has subsidized immigration from Europe by refunding steamship fares. This policy, ~~however~~, has been recently discontinued, at least so far as the State of Sao Paulo is concerned. So much is at stake in the maintenance of the valorization plan that it seems probable that nothing will be left undone to keep production within the

bounds necessary to that purpose.

The rapid increase of consumption which has been going on in recent years may be confidently expected to continue, for many important countries as yet are comparatively small consumers. The continuing improvement in economic conditions in Europe, and especially in Central Europe, affords much promise.

We see no reason, therefore, to be discouraged about the development of coffee production in Panama. It is impossible that the increase in this country can make any impression upon the world market, at least for many years, and it is a reasonable expectation that high grade coffees will command remunerative prices.

CACAO

Second in Rank of Panama's Exports.

Cacao ranks next to bananas among Panama's exports, although far behind. The declared value of the exports in 1927 was \$366,128. Cacao has been grown in Chiriqui Province for a long time, and of excellent quality. The product of one estate has had a reputation for many years of commanding prices equal to the best ruling on the London market.

The principal production thus far, however, has been from the replacement plantings of the United Fruit Company in Bocas del Toro, on lands abandoned for bananas on account of the banana disease. The Company's production in Panama in 1928 was 6,359,414 pounds. The plantings have given fairly satisfactory results, yielding uniform quality, but ~~for reasons beyond our control~~ all cacao prices have been low. The Company produces cacao extensively only in Costa Rica and Panama, its operations upon this product being a new departure. Its 1928 report says on this subject:

"Further research work has been carried on with respect to improved methods of fermenting and curing cacao. The practical application of this work has resulted in giving the Company's product a higher grading and classification in the cacao markets."

The Company's action in broadening its activities in Panama, although forced by ill-fortune besetting the banana branch of the business, will have the result of securing a scientific demonstration of cacao culture in Panama.

The World Situation in Cacao.

The cacao bean is one of the tropical products for which demand has been expanding in recent years. The roasted bean from which the fatty substance (cacao butter) has been extracted is the basis of cocoa, marketed in powdered condition. The roasted bean in which the butter is left is the basis of chocolate. The other by-products are cacao butter, already mentioned, now chiefly used for cosmetics and perfumery, and a so-called cacao tea, obtained from ground shells of the cacao bean, a cheap drink used in certain European countries.

The cacao bean is obtained from the pod of a small tree, about the size of a coffee tree, indigenous to certain restricted areas of the regions ranging from 10 to 12 degrees north and south of the equator. Unlike the coffee tree, the cacao bush is grown at moderate elevations, not over 1,500 feet above the sea level. It requires high temperature, well distributed rainfall and above all a sheltered position. The peculiarity of the plant is a great development of "surface roots." This makes inadvisable ordinary cultivation practices, and usually very little cultivation is attempted.

As in the case of coffee there are wide differences in the taste and aroma of the cacao bean, traceable to varied conditions of climate, cultivation and soil. The many varieties can be broadly divided into two groups. The first includes the sweet or orillo cacao, the highest quality and very aromatic. It was domesticated by the Aztecs and Incas, and formerly constituted the chief supply. It comes from Venezuela, Ecuador, Nicaragua, ^{now} and ~~is now~~ produced also in Java, Ceylon and Samsa. The other group includes various species of the Forastero or bitter cacao bean which in recent years is the main source of the commercial product. Although inferior in quality

to orillo or sweet cacao, it is much hardier and brings a better yield.

It comes from Africa, the Gold Coast, Nigeria Colony, the Island of St. Thome, Brazil and the Caribbean countries, Santo Domingo being an important producer.

The following production figures show a phenomenal growth from 1913 to 1924, and a rather uniform production since:

World Crops of Cacao in tons of 1,000 kilos.							
	1928	1927	1924	1923	1922	1913	
Accra - - -	223,000	209,000	222,000	197,000	159,000	51,000	
Bahia - - -	72,000	72,000	69,000	65,500	48,500	30,000	
Lagos - - -	50,000	40,000	38,000	33,000	32,000	3,500	
San Thome - -	14,000	14,000	25,000	13,000	18,500	35,500	
Sanchez - - -	19,000	26,000	23,000	20,000	19,000	19,500	
Ecuador - - -	20,000	21,000	33,000	31,000	44,000	42,000	
Trinidad - - -	26,000	23,000	25,500	30,500	23,000	22,000	
Venezuela - -	13,000	15,000	18,000	22,500	21,000	18,000	
Other countries -	63,000	62,000	55,500	44,500	45,500	32,000	
Totals -	500,000	482,000	509,000	457,000	410,500	253,500	

The feature of the industry in recent years has been the great development in West Africa, where the industry is in the hands of the natives, who have thus made practically their first appearance in world trade. The plantations there are mere forests of cacao bushes, growing with little cultivation and attention. The British firms handling the product usually maintain in most cases, simply collecting stations, which also distribute imported articles chiefly of British origin. The industry has been built up by this barter trade.

A price differential always has existed in favor of the production first described, which unquestionably is of higher quality, but manufacturers have increased their skill in handling the new production, which is more abundant, and prefer it on account of the lower price. The range of prices in recent years is shown by the following table:

Quotations per pound, ex dock in New York (I (Average of high and low prices.)					
	1928	1927	1926	1925	1
D.D. Accra (Gold Coast) -	12.25	15.31	12.76	9.32	8
San Thome - - -	13.62	15.88	13.25	10.12	9
Bahia Good Fair (Brazil)	12.56	15.12	12.75	9.44	8
Guayaquil Sup. Red (Ecuador)	15.88	21.00	19.12	16.25	17
Maracaibo (Venezuela) -	25.25	26.50	25.50	24.50	24

ag bowls.

Present prices are about on a level with those of 1913, or lower, which, of course, signifies that relative^{ly} they have suffered a great decline, resulting from the growth of the African production.

The largest single consumer is now the United States, using about one-third of the world production, and with a per capita consumption in 1926 about three times that of 1913. Germany, Holland and France show considerable increases while England has more than doubled her quota in that time.

On account of the great production in British West Africa under British auspices the principal market has been on the London Cacao Exchange, but recently an Exchange has been established in New York and operations there have become very important.

On the whole, the situation in cacao is not as bad as it might be or has been. Prices are low, but have recovered from the low level of 1920-25, and consumption now seems to be gaining faster than production. Chocolate has become a very popular confection and its use is extending in many ways. It is one of the tropical products for which a steadily increasing demand may be expected.

THE COCONUT AND PRODUCTS.

Exports of Coconuts from Panama.

Coconuts are one of the best known exports of Panama and in value rank after bananas, cacao, and possibly hides. The price of coconuts soared during the war, rising from \$25 per thousand to \$95 per thousand at the high point, and the number exported reached a high point at 19,758,949 in 1918, from which it declined to 17,435,234 in 1922, 15,254,528 in 1923, and 14,160,630 in 1928. Copra, dried meat of the coconut, has not been manufactured in Panama, conditions favoring exportation of the nuts to New York.

Coconuts were admitted into the United States free of duty until 1922,

when the Fordney act placed a duty upon them of 1/2 cent each, which, in view of the fact that the nuts and their products have been admitted free from Porto Rico and the Philippines, has placed Panama at a disadvantage.

The low Atlantic coast of Panama is especially suited to the coconut tree, and the shipments have been mainly from that side, with the San Blas Indians as the principal producers. These people, holding their lands, which border the Caribbean east of Colon for about 120 miles, with numerous islands, are said to have at least 300,000 coconut trees, which yield a crop of nuts bearing a high reputation for their meaty quality.

An attempt at production on a large scale on the Pacific side west of the Canal has been ^{un-}successful, it is reported, on account of a plant disease. Every plant has its enemies, the palm tree like the rest, but on account of the importance of the tree a great amount of research work has been done in this case, to which later reference will be made. Experience elsewhere indicates that Panama should value the coconut palm as an asset of great possibilities, notwithstanding the difficulties which have been experienced with diseases and insect pests.

Products of the Coconut.

The coconut palm is a wonderful gift of nature, for it may be questioned if another plant ~~can~~ provides so many kinds of useful products. Before the nut is opened the milk is a wholesome and refreshing drink, especially in the Tropics. It may also be fermented (tagalog). The meat of the nut may be eaten in fresh form, or, when dried (copra) is the basis of coconut-oil and coconut cake. Coconut oil itself has a ^{list of} long ~~uses~~. It may be manufactured into vegetable fats, lard and butter substitutes, such as oleomargarine, coconut butter; it is an important ingredient of soaps, especially of marine and free-lather varieties, of salad oils, emulsions, cosmetics, etc. The shell is made into combs, spoons, ~~rubber tapping cups,~~ carved articles, drinking bowls.

linoleum. Shredded coconut meat is used for culinary purposes and candy (chocolate-coated coconut bars). The fibers enveloping the nut may be woven into mats, carpets and ropes, and made into paper. The cake which is left after the oil is extracted from the meat is an excellent fattening food for cattle, sheep and poultry. The wood is good for cabinet work and building. The leaves are used for basket-making, mat-making, thatching and when young, for food or preserves. The sap may be made into palm sugar, fermented drinks or distilled beverages (arrack) and finally into vinegar. Thus a large well-managed estate can develop many by-products and practically utilize every part of the growth. Lately it was discovered that the charcoal made from coconut shells is one of the best known vapor absorbents and it is now used in factories to remove industrial stench (gasoline, etc.) from the air.

The Growing Market for Coconut Meat and Oil.

An immense demand for copra, the dried or dessicated meat of the coconut, and for the oil which is expressed from it, has been developing in world markets. Shredded coconut has many uses in the bakery and confectionery trades, but the largest demand is for the oil, which has become one of the most important vegetable oils. It comes on the market as a solid fat, stiffer than lard. The growing world-use of coconut oil is shown further on under the heading "Vegetable Oils." The oil content of copra varies from 60 to 70 per cent of the weight of the copra.

Imports of copra into the United States in 1913 aggregated 30,352,000 lbs., and in 1928 had increased to 500,982,000 lbs. In the same time, imports of coconut oil from the Philippines, the principal source, increased from 1,384,000 lbs. to 290,636,702 lbs. Indeed, the coconut and its products have become the basis of a great industry in the Philippines, largely because they have free entry into the United States, while imports which do not have

the privilege pay a duty of 1/2 cent each on coconuts and 3 1/2 cents per lb. on copra. The aggregate value of coconuts, copra, coconut oil and dessicated coconut meat ^{exported} from the Philippine Islands in 1927 was approximately \$40,000,000. The largest value is in the coconut oil, as no other country has so large a copra-crushing industry. The Philippines produce one-third of the world's supply of copra.

Panama needs for this product, as for others, access to the markets of the United States. It is quite within the range of possibility that the duties on coconuts and copra may be remitted eventually, as these products are no more competitive with products of the United States than are bananas.

The following table gives official export figures for the four principal producing countries since 1920, with comparative figures for a pre-war period for copra, dessicated coconut and coconut oil, reduced to a common basis: (*)

<u>Exports of Coconut Products</u> (In short tons)					
	<u>Philippine Islands.</u>	<u>Dutch East Indies.</u>	<u>British Malay</u>	<u>Ceylon</u>	<u>Total</u>
Average, 1909-13	134,443	261,769	- - -	107,037	- - -
1921	318,836	407,074	107,083	169,064	1,065,057
1922	373,623	378,867	201,860	185,574	1,139,924
1923	384,356	355,378	182,506	144,724	1,066,964
1924	371,069	390,976	188,571	194,233	1,144,849
1925	352,105	402,770	184,770	224,319	1,163,964
1926	406,525	441,335	222,351	227,012	1,297,223
1927	482,009	448,750	177,955	217,792	1,326,506
1928 (prelim.)	522,067	700,000	221,755	222,300	1,666,122

(*) U. S. Department of Agriculture, May 20, 1929.

Coconut Cultivation.

On account of unfavorable reports about plantation cultivation of coconuts, we are prompted to refer to the research work upon coconut cultivation that has been done by the British experimental stations. The British official publication entitled "Tropical Agricultural Research in the Empire," issued in 1927, has a chapter on "The Palms," from we take the following brief extracts:

"One bright spot in the research on palms is undoubtedly the very full study that has been made of the diseases and pests of the coconut. This study is quite recent and has been carried on in the greatest detail, including the trial and application of remedial measures, often on a very large scale.

* * * * *

Most of the diseases are now more or less under control; and at any rate a great deal of knowledge has been accumulated as to their origin and the proper methods to be adopted for preventing their spread. Pests, although present in greater variety, are of much less deadly nature than fungous diseases, and are now more easily controlled."

On account of the high value placed upon it, the coconut palm is now grown in practically every tropical country having a suitable temperature (80° to 90°) and a heavy, evenly distributed rainfall. The tree does not store much water and consequently cannot be successfully planted in districts where there are long periods of drought. It has no main or tap root, but a system of roots of equal size, very much like the sugar cane or ordinary grass. The trees consequently are not deeply planted, being too weak to penetrate hard sub-soils. It is known that one of the chief needs of the tree is for plenty of fresh soil water, giving moisture to these roots, and also that stagnant water is very harmful. The latter is said to be the cause of the most serious infections known to attack the tree, viz: the bud-rot and the root-rot. The first one has been disastrous, especially in the Caribbean countries.

Coconut may be produced successfully by small growers, as demonstrated by the San Blas Indians, and in fact the bulk of the production in all countries is from wild trees receiving no systematic cultivation.

Vegetable Fats and Oils.

The introduction of vegetable oils into common use in Northern Europe and the United States, and particularly the introduction of oils produced from tropical plants, might be described as one of the most interesting chapters in the history of commerce and industry. It is a story of great significance to the tropical countries.

A great change has occurred in a comparatively short time in the fats used for cooking and soap-making. Within the memory of many people the fats in almost exclusive use for culinary purposes were butter, tallow and lard, all derived from animals. Tallow was largely used also for soaps and candles, along with fish oils. Animal fats virtually are by-products, in the sense that animals are not produced primarily for the fat but for the lean meats, and therefore their production does not increase readily in response to merely an increasing demand for fats. The use of fats for other purposes than food, notably for the manufacture of soap, has increased rapidly, and the discovery that vegetable fats serve the same purpose as animal fats has been a boon to the world, for oil seeds and nuts can be produced as annual crops at comparatively low costs.

In the south of Europe and parts of Asia olive oil had long been a valued article of food, and in the Tropics other vegetable oils were so used, but in the United States the introduction of vegetable oils was through cotton seed oil. This at first was used for edible purposes more or less surreptitiously, as an adulterant. The substitution of it in lard and dairy products aroused vigorous opposition from the live stock and dairy interests, who sought to tax it out of existence, and a heavy tax is still maintained on margarine, in which the principal constituent now is vegetable oils. However, cotton seed oil came through ^{the} most searching tests and was vindicated as a wholesome food product.

The victory of cotton seed oil as a rival of animal fat increased the value of the cotton crop to the farmers producing it by many millions of dollars. The seed which had become worthless became the basis of an oil industry the product of which in the industry's biggest year, 1918, was valued at \$349,490,000.

However, the triumph of cotton seed was not the end of the vegetable oil story. It was only the beginning. It let down the bars and all of the

nuts and seeds came creeping in after. Coconut oil and other palm oils have largely displaced cotton seed oil for some uses, particularly for margarine and soap.

The International Institute of Agriculture at Rome is authority for the following tabular statement of the production of the more important vegetable oils of commerce in the year 1924.

	Pounds.
Cotton seed - - - - -	4,237,000,000
Coconut - - - - -	2,860,000,000
Peanut - - - - -	2,721,000,000
Linseed - - - - -	2,200,000,000
Palm and Palm kernel -	1,750,000,000
Olive - - - - -	1,634,000,000
Rapeseed - - - - -	1,023,000,000
Soy Bean - - - - -	880,000,000
Sesame - - - - -	444,000,000
Hemp - - - - -	238,000,000
Total - - - - -	18,037,000,000

This is by no means all of the vegetable oils or fats known on the market. Corn oil is becoming an important product, although not as yet entering largely into international trade. Cacao is a trade-commodity of rapidly increasing importance, as a source of fat. Sunflower seed, mustard seed, poppy-seed, castor-oil seed and numerous other seeds are trade-commodities of less importance. All of these and the oils listed above have industrial values and may serve as food as well as for other purposes. (*)

Some of these oils, as linseed,^{are} used more largely for industrial purposes than for food, but they are all edible. Some of the plants grow only in the Tropics, some do best in the temperate zone. Cotton, peanuts and the olive do well in the tropics or warm regions of the temperate

(*) Note. "The distinction between a fat and an oil is purely an accidental one depending upon the environment in which the substance happens to be placed. If the substance is solid at ordinary temperature, it is termed a fat; if fluid, an oil. This is merely a distinction of convenience, since all oils are solidified at lower temperatures and all fats melted at higher temperatures," (Fats and Oils: A General View," by Alsberg and Taylor; published by Food Research Institute, Stanford University.)

zones. Few plants that are efficient in producing fats do well in cold climates, but the warmer regions have many of them.

The producers of animal fats are still fighting the introduction of vegetable fats as substitutes. The manufacture of "filled" milk is prohibited. "Filled" milk is skim milk in which the natural fat has been replaced by coconut fat. Ice cream is another product in which an expensive fat may be replaced by a less expensive one, but this is usually prohibited by law. Filled cheese is taxed out of use. Nevertheless, the vegetable fats find uses in rapidly increasing quantities. The champions of cow's milk claim that it contains vitamins which are absent from the vegetable fats, but against this the claim is made that these vitamins are obtained in ^{ample} supply from any diet in which fresh vegetables or fruit are a liberal part.

Increased Consumption in Great Britain and the United States.

The war gave a great stimulus to the consumption of vegetable fats, on account of the rise of prices of animal fats. Thus in the United Kingdom during the seven year period from 1912 to 1919 the consumption of margarine, now made principally of coconut oil, advanced from eight pounds per capita to twenty pounds per capita, while the consumption of butter fell in the same period from seventeen pounds per capita to six pounds. In the United States the coconut oil was practically unknown twenty years ago, now it is the most important ingredient in production of margarine, and has almost displaced cotton-seed oil in soap-making.

The following tables show the utilization of fats and oils in making soap and margarine in the United States in the years stated;

Utilization of Fats and Oils in Soap-making in the United States. (In millions of pounds)

	<u>1912</u>	<u>1923</u>
Vegetable Oils		
Coconut - - - - -	79	268
Cottonseed - - - - -	221	64
Palm - - - - -	8	102
Other - - - - -	<u>58</u>	<u>58</u>
Total - - -	366	492

(Continued)

(Continued)	1912	1923
Animal fats and oils		
Tallow - - - - -	239	402
Greases and lard - - -	70	140
Other - - - - -	26	97
Total - - - - -	335	639
Unclassifiable - - - -	75	57
Grand Total - - - - -	776	1,188

Utilization of Fats and Oils in Margarine in the United States

In millions of Pounds)

	1912	1926
Vegetable Oils		
Coconut - - - - -	--	98
Cottonseed - - - - -	18	26
Peanut - - - - -	3	5
Other - - - - -	1	2
Total - - - - -	22	131
Animal fats and oils		
Oleo oil - - - - -	28	47
Oleostearine - - - - -	1	5
Oleo Stock - - - - -	-	3
Lard - - - - -	15	25
Other - - - - -	1	5
Total - - - - -	45	85
Grand Total - - - - -	67	216

Coconut and the other palm oils have won great favor for soap-making, owing to their superior solubility in water. They also produce a relatively hard soap with excellent keeping qualities. Consequently they now form the base of most quick lathering soaps, such as laundry chip soap, hard water and marine soap.

The aggregate average consumption of the principal oils and fats in the United States in the years stated was as follows: (*)

(Million pounds)

Average, 1921-1925

Vegetable Oils	
Cottonseed - - - - -	1,074
Coconut - - - - -	472
Palm kernel - - - - -	13
Palm - - - - -	90
Corn - - - - -	102
Olive - - - - -	104
Peanut - - - - -	20
Linseed - - - - -	654
Chinese Woods - - - - -	76
Soy Bean - - - - -	17
Castor - - - - -	35

(Continued)

Total - - - - - 2,657

Carried forward - - - - -	2,657
Animal fats and oils:	
Lard - - - - -	1,552
Oleo oil - - - - -	147
Oleostearine - - - - -	
Tallow - - - - -	
Inedible tallow - - - - -	346
Other inedible animal fats - - - - -	364
Total - - - - -	2,409

Fish	
Fish Oils - - - - -	134
	134

Grand Total - - - - - \$,200

(*)Data from U. S. Government of Commerce, Animal Fats and Oils, 1919-23 and 1924-25.

A by-product of the coconut oil industry is copra-cake, the residue of copra after the oil is pressed out. It is in demand in the United States and Europe, like linseed cake, as feed for cattle. Exports of copra-cake from the Philippines have a value of over \$2,000,000 per year.

Palm Oil and Palm Kernel Oil.

The nut of a palm tree, indigenous to the Congo basin, Africa, yields two kinds of oil which of late years have come on the market in increasing quantities. The fleshy portion of rind enveloping the kernel of this palm nut is the source of palm oil. The native process of extracting the palm oil is rather laborious and includes fermenting, kneading, cooking and pressing. The oil thus produced is so rancid that, unlike the palm kernel oil, it is unpalatable. The palm oil in the unbleached stage is used in the tin-plate industry as a flux on the discharge side of the pots of melted tin through which the sheet iron plates are passed to receive their coats of tar). When bleached the palm oil is used with other oils in production of soaps.

Palm kernel oil is obtained by crushing the palm kernel, the hard, interior seed, and is the latest product. It has practically the same uses as the coconut oil in ^{the} manufacture of vegetable margarine and quick lathering soaps. It possesses a highly important property for the margarine industry in

that margarine made from palm kernel oil shows little tendency to acquire a rancid taste.

The West African palm tree which is the source of these two oils is planted almost exclusively in West Africa and Dutch East Indies (Sumatra and Java).

The palm trees begin to produce in the fifth year after planting. About 1,700 to 1,800 pounds of oil is an average in Sumatra per acre.

The British, French and Dutch control practically the whole palm kernel and palm oil industries, which explains wherefor western Europe is the chief importer of the oils.

Palm Oil and Palm Kernel Oil Imports into Western Europe.

(In thousands of Pounds)

	<u>1913</u>	<u>1923</u>
Palm Oil	127,238	123,965
Palm Kernel Oil	6,987	290,350
(oil equivalent)		

In the western hemisphere the oil palm is grown in Brazil to a large extent. The British Government is attempting to introduce this palm to British Guiana but the plants are said to suffer from indigenous insect pests.

Pineapples.

The Pineapple is a native of tropical America, but has been planted in many tropical countries, and is one of the tropical products for which the demand has been rapidly increasing. The increased consumption has been mainly due to the popularity developed by the canned product.

The pineapple thrives best in an equable climate where the temperature averages between 70° and 80°; and where dry and rainy seasons alternate, which describes the climate of Panama. The soil must be well drained, even to the extent of being quite dry. The character of the soil does not matter so much,

so that it will carry artificial fertilizer, which is heavily applied in Hawaii. The fruit is native to Panama and that produced on the Island of Toboga, in Panama Bay, has a reputation for exceptional flavor. It has not yet however, attained importance in the country's exports.

The Hawaiian Islands are the principal seat of the pineapple industry, and the canning of pineapples there received its first important impetus from the annexation of the Islands to the United States, which occurred in 1898 and gave assurance of permanent and free entry to the markets of that country. The first recorded pack of canned pineapples in the Islands was that of 1903, which amounted to 1,893 cases of twenty-four cans each. The production for 1911 and more recent years, as reported by the Association of Hawaiian Pineapple Cannors, has been as follows:

1911 - -	725,742
1915 - -	2,669,483
1920 - -	5,986,982
1925 - -	8,728,580

The Annual Report of the Governor of Hawaii to the Secretary of the Interior of the United States Government for the fiscal year ended June 30, 1928, states that "Hawaiian canned pineapples to the value of \$33,845,351 were shipped to the mainland of the United States in the year under review."

Ten companies participate in the business, of whom eight are home companies, incorporated under the laws of Hawaii, and two are outside companies.

The following particulars of the industry are of interest:

"The Association of Hawaiian Pineapple Cannors shows the amount of capital invested in canneries as \$16,381,500; in fields, \$13,958,500; acres under cultivation, \$49,356; number of employees in canneries -- average, 50,000; employees in fields -- average, 6,000; homesteaders growing pineapples and selling to canneries, 739; predominating races among employees -- Filipinos first, Japanese second; wages paid -- average, 10 hour day, in canneries, \$1.88; average, 10 hour day, in field, \$1.81; by-products -- pineapple bran, citric acid, alcohol, vinegar."

The consumption of canned pineapples in the United States, per capita, as calculated by the Department of Commerce, was approximately 1.77 lbs. in 1921. 2.23 lbs. in 1923. and 3.11 lbs. in 1925.

The pineapple industry has some development in Porto Rico, but there the fresh fruit shipments predominate. In the fiscal year 1928 they aggregated 549,280 crates, of the value of \$1,654,108. Shipments of canned pineapples had an aggregate value of \$141,268.

The most important foreign development of the industry is in the Straits Settlements. This production is exported almost wholly through Singapore, and the increase of these exports is shown by the figures of 79,146,000 lbs. in 1924 against 33,817,000^{lbs.} in 1913. Exports to Great Britain were 65,347,000 lbs. in 1924 against 23,013,000 lbs. in 1913. Evidently the fruit grows in favor where introduced.

Pineapples are a highly cultivated crop in ^{the} Hawaii Islands -- plowed four or five times, harrowed, fertilized heavily, given a paper mulch covering to keep down weeds and carefully guarded against insect pests by a research staff and experiment station, supported by the associated industry. The canneries have a remarkable equipment of specialized machinery, most of it devised within the Hawaiian industry.

Thus has been created a great industry, which twenty-five years ago was barely beginning, and now, by employment of Hawaiian labor and the use of Hawaiian soil, is producing an annual output at over \$30,000,000. It bids fair before many years to reach the limit of possible expansion in Hawaii, on account of the scarcity of available land.

It is not a cheap labor industry in Hawaii, as will be seen by the average wage stated above. The labor in the canneries is largely that of women and children.

It should ^{not} be thought that growing and canning pineapples is the chief source of wealth to the Hawaiian population. While total exports of fruit and nuts were valued at \$34,934,087, exports of sugar were valued at \$69,827,821, exports of coffee at \$1,397,720, and total exports at \$109,201,815.

The total population of the Hawaiian Islands June 30, 1928, as estimated in the Governor's Report was 348,767 persons, divided racially as follows:

<u>Number, June 30, 1928.</u>	
European aliens - - - - -	4, 031
America citizens - - - - -	64,397
Hawaiian - - - - -	20,720
Part Hawaiian - - - - -	25,984
Filipino - - - - -	60,078
Japanese - - - - -	134,600
Chinese - - - - -	25,310
Others - - - - -	<u>13,647</u>
Total - - - - -	348,767

This is a creditable showing of exports for the population, and we give it as showing what can be done with tropical products. It is true that the Islands have the benefit of free access to the markets of the United States, but even making allowance for this it is a good showing.

It is also worthy of remark that the pineapple canning industry in Hawaii has been developed from small beginnings by residents of the Islands. The early investments were small. The methods and even the machinery of the industry have been developed there. It is a fine example of home enterprise, worthy of emulation.

RUBBER

Rubber has far outstripped all other tropical products in percentage of production increase in the twenty years, a fact of course due mainly to the development of the automobile industry. Plants and trees yielding rubber are native to Panama and adjacent countries of Central and South America, and what is known as the Castilla tree was planted quite freely before the Hevea brasiliensis tree was generally agreed to be the best producer. At this time the Hevea product is practically the only rubber on the market. Until about 1900 all of the commercial rubber was produced from wild trees, but now more than 90 per cent is produced on rubber plantations from cultivated trees.

The production of crude rubber in the world has increased since 1910 as shown by the following table:

	<u>World Production</u> (In Long tons)
1910 - - - - -	93,980
1915 - - - - -	170,826
1920 - - - - -	341,994
1925 - - - - -	527,549
1928 - - - - -	653,000

The average price of crude rubber on the New York market in the year 1910 was approximately \$2.00 per lb., having been rising for several years under the growing demand for automobile tires, while plantation rubber was yet a small factor. Indeed, 1910 is the first year for which there is a record of plantation rubber prices in New York, and that record shows an average for the year of \$2.07 per lb.

The following table shows that average New York price for each month since January, 1925:

	<u>Crude Rubber Prices</u> (Average of one price weekly in cents per pound, Ribbed, Smoked sheets, Hevea.) (Spot New York)				
	<u>1925</u>	<u>1926</u>	<u>1927</u>	<u>1928</u>	<u>1929</u>
January	36.4	39.6	39.3	40.0	20.1
February	35.6	62.1	38.2	31.6	24.2
March	41.3	58.4	41.0	26.9	24.6
April	44.5	20.9	40.9	19.9	21.5
May	57.1	48.1	40.8	18.9	21.8
June	77.1	43.1	37.0	19.3	20.3
July	104.2	41.3	35.0	19.2	
August	80.8	38.0	35.1	19.2	
September	89.3	41.3	33.8	18.3	
October	99.6	42.7	34.4	18.7	
November	104.8	39.9	37.9	18.2	
December	100.0	38.2	41.0	17.9	

Rubber in Panama.

The prospectus of the Darien Gold Mining Company, Ltd. of London, issued in 1907, represented that the property of the Company in Panama included rubber plantations having 250,000 trees, varying in age up to five years. It was stated that these plantations had considerably value, "experience showing that at the age of eight years the trees may be expected to yield a profit of three

to four shillings per year at least." Inasmuch as the mining operations were unprofitable ^{these} plantations were abandoned.

There is no question about there being a considerable area of land in Panama suitable for the growth of the Hevea tree. Under the auspices of the Department of Commerce of the United States a pamphlet was issued in 1926 entitled "Possibilities for Para Rubber in Northern Tropical America," prepared by John C. Treadwell, Special Agent, and C. Reed Hill, assistant of the Department of Commerce, and H. H. Bennett, Soil Scientist of the United States Department of Agriculture, these parties having made a field survey of Panama and other countries.

This report summarizes the situation in Panama as follows:

"The regions of Panama within which climate and topographic conditions are considered favorable for the production of Hevea rubber are;

Caribbean coast:

Chiriqui Lagoon and coast west to Costa Rican boundary.
Coast from Chiriqui Lagoon to Canal Zone.
Coast from Canal Zone to Colombian border.

Pacific coast:

Tuyra River region.

Interior;

Upper Chucunaque-Upper Bayano Basins.

Comparing conditions in the Caribbean countries with those of the rubber-producing countries of Asia, the report names certain natural advantages of the former, as follows:

"Certain natural advantages favor northern tropical America over most of the areas now available for new planting in Malaya and Sumatra. These are

1. The cost of land is low (\$1 to \$5 an acre).
2. Transportation facilities have already been arranged in many districts, and others have satisfactory water transportation.
3. The soil in certain areas is superior to that now to be had in the middle East.
4. There are available some areas clear of virgin jungle and others entirely or nearly clear of second-growth jungle.
5. There are no destructive grasses to combat such as the lallang, or cogon, grass of the East.
6. Some lands have soils and topography suitable for the use of plows.
7. If lands formerly cultivated are used, the hazards from root diseases are nil or greatly reduced."

The report goes on, however, to describe the advantage of the Middle East on account of cheap labor. It says upon this point:

"While large areas of land physically suitable for Hevea cultivation were located by the survey party in northern tropical America, as indicated in preceding pages, it may be stated as a generality that shortage of labor and high wages would constitute a handicap to extensive development of rubber plantations in competition with the present producing regions of the Middle East. In the latter, the basic wage is practically \$0.20 per day and the total charges (including sanitation, housing, etc.) against labor are from \$0.35 to \$0.40, while the prevailing daily wage in the banana districts of Central and South America is as high as \$1 to \$1.50."

The suggestion is made that the cost of preparing plantations for planting might be made less than in the East by utilizing abandoned banana plantations; and also that jungle clearing might cost less than there. It says:

"While it is believed that rubber can be brought into bearing at less cost on certain lands in northern tropical American than the present usual cost in the Middle East, the cost of production is a more serious problem. What the comparative labor conditions will be five or ten years hence can not be foretold. There is every reason to believe that labor and other costs in the Middle East will be higher than at present, but assuming that labor costs in both regions should be unchanged it can be roughly estimated that the cost of production in America will be around 32 cents per pound, as contrasted with 18 to 20 cents in the Middle East as at the present time. This is assuming that the upkeep of the American plantations after they come into bearing will be as good as the average of those of the Middle East."

This report was written at a time when rubber was worth more than 40 cents per pound in New York. In the past year it has averaged under 20 cents, which makes the operating costs as calculated seem prohibitive. Meantime, the Asiatic companies are known to have accomplished a substantial reduction in production costs, enabling them to produce profitably at 20 cents per lb.

It must be admitted, therefore, that the prospect is not bright for an early development of rubber plantations in Panama, but the natural conditions are favorable and other conditions may change. Furthermore, Panama's situation is improved by an increasing demand for any important tropical product, because in a sense the Tropics are one as a source of everything they produce. ~~There~~

~~cheap labor of Asia is employed in producing rubber it will not be available for the production of other commodities in which there may be more profit.~~

THE VEGETABLE FIBRES.

The principal fibres of importance in commerce are cotton, flax, jute, and the many varieties classed generally as hemp. The first three named are called soft fibres and are materials for the manufacture of cloth. India is the principal producer of jute, and wages in this industry are on a very low basis. What may be called common hemp is grown around the world in the temperate zones. It is used for low grade rope, twine and bagging. It is too coarse for textile uses and for other uses lacks strength in comparison with the tropical fibres. One hundred years ago temperate zone hemp was almost the only kind of rope material, but here, as in other fields already mentioned, a tropical product has been found to be cheaper, also better.

The tropical fibres are known as the hard fibres. The variety known in commerce as Manila hemp, produced in the Philippine Islands from the leaves of the Abaca plant has long held first place for quality and had almost no substitute approaching its class, until in comparatively recent years the sisal and hennequen varieties of the Agave family, native to Central America, have come into use. They have outstripped it in volume of consumption, particularly in the United States, chiefly on account of their use for binder twine in grain production. The sisal or hennequen fibre is stronger than the common hemp and cheaper than Manila.

Manila Hemp.

The abaca plant is supposed to be native to the Philippines, although it seems to be unknown in the wild state. It is cultivated for the fibre in the southern part of the Island of Luzon and in other islands southward, but has not been cultivated successfully in the northern part of Luzon. Although

Luzon lies wholly within the Tropics all of it is farther north than any part of Panama.

The Abaca plant is closely related to the banana plant and in general appearance very much like it, but does not produce edible fruit. It requires a hot, moist, climate and grows best where there is an abundant rainfall but good natural drainage. It will not endure swampy conditions, or prolonged drought. It grows well in a volcanic soil of loose texture. In the southern part of Luzon it is cultivated most extensively by small farmers, who merely cut down the brush and burn over the land, then make holes with their machetes for setting out the plants. Very little cultivation is given except to dig around the plants with the machetes. In southern Mindinao abaca is grown on large plantations where the land is regularly cleared and plowed and prepared as land would be prepared for a fruit orchard in the United States.

The plants are then set out at regular intervals in rows and the land between the plants is cultivated so as to conserve moisture and aid the growth of the plants. The fibre from these large plantations commands a price one or two cents per pound higher than that from the smaller plantations.

There are about twenty recognized grades of abaca fibre and in recent years there has been a very strong tendency to increase the production of the lower grades and decrease the production of the higher grades, probably induced by the competition of sisal.

Another important fibre of the Philippine Islands is cantala or Manila maguey. This is a hard fibre produced from the leaves of the cantala plant. Agave cantala. This plant is similar in appearance to the hennequen of the Yucatan peninsula ^{in Mexico} and the true sisal plant cultivated in East Africa, Java and Sumatra. These plants are propagated from suckers which are generally set out thickly, do not receive very much cultivation, and the product is cheaper than that from the abaca plant.

In recent years several large fibre-cleaning machines have been introduced on plantations, and the results are said to be satisfactory. This may have an important effect upon the costs of production.

Sisal and Hennequen.

Sisal and hennequen are closely related plants, frequently confused. Sisal has been introduced in most tropical countries, and grows readily in all of them. The fibre has assumed important proportions in East Africa, Ceylon, Dutch East Indies, Bahamas and Jamaica.

The sisal plant has a short trunk, bearing a number of dark, green, fleshy thick leaves, ranging from four to six feet in length. These leaves weigh on the average about two pounds each and contain about 3/4 per cent of dry fibre - the sisal.

The extraction of fibres from the leaves is usually performed in a factory, equipped with "decorticators," machines which first crush the leaves, ^{and} remove the pulpy cover from the fibre. Abundance of water is necessary for washing the fibre and for loosening it from the leaf pulp.

The sisal fibre is an excellent fibre, white, lustrous, possessing good strength and flexibility, and competes with Manila hemp for use in marine cordage.

Hennequen is a native of the Yucatan peninsula, where it constitutes the most important industry. This fibre is more brittle and less flexible than true sisal, is not so white or so well cleaned and is less uniform, hence the market price usually is about 10 per cent below the East African sisal, No. 1 grade.

Practically the entire production of Yucatan hennequen goes to the United States for manufacture into binder twine. The price has had some wild fluctuations in the last fifteen years. The rapid growth of demand stimulated production even more rapidly, resulting in low prices. The Government of the State of Yucatan took action to control the marketing of