CROWFOOT Crowfoot (Eleusine indica\textsuperscript{44}), also known as goose-grass, has been in the Islands since 1902, is well distributed, and provides good pasturage.

CUCUMBER Cucumbers (Cucumis sativus) of several types are grown extensively in Hawaii, practically all the local demand for the fresh product being met by our commercial and home gardeners. Pickled cucumbers are imported in considerable quantities.

To protect against the attacks of the melon fly each cucumber, when very small, must be covered by a paper bag, which adds materially to the cost of production. In spite of this and other handicaps a very good quality of cucumber is grown here, and a moderately large industry has developed with over 100 acres devoted to the crop.

A special type is grown for the Oriental trade, the “Oriental preserving melon.” This cucumber is especially prized by the Chinese in the preparation of certain vegetable dishes.

See also “Melons,” and “Truck Crops.”

CUSTARD APPLE The custard apple (Annona reticulata) is a tropical fruit found only rarely in Hawaii, although it deserves much more attention from our horticulturists. Both in appearance and flavor it is exotic and one must cultivate a liking for it before appreciating its full merit.

Closely related fruits which are similar in appearance but differ markedly in flavor are the cherimoya, sour sop and sweet sop.

DAHLIA The tuberous roots of certain species of Dahlia, as variabilis, et al., yield levulose, an uncommon and high priced form of sugar. On the mainland there is some commercial interest in the production of this sugar, but in Hawaii no serious effort has been made to develop an industry on this plant. Dahlias of several species grow

\textsuperscript{44}St. John gives Dactyloctenium aegyptium as the name of this grass.
readily here and perhaps could be exploited commercially but for the production of levulose the common ti plant is much more promising.

DAIKON See under "Radish."

DAIRYING1 Dairy cattle were introduced to Hawaii in a limited way about the middle of the nineteenth century. Longhorn cattle had been introduced by Vancouver in 1793. Records as to when cattle were first used for dairy purposes are not complete. It is reported that William Harrison Rice started a dairy at Punahou School and pastured the cattle in the open range of upper Manoa about 1844. A commercial dairy was reported in operation on Judd Street in Honolulu in 1869 and by 1880 five dairies are reported to have been in operation in or near Honolulu.

Milk from dairy cows was a new food to the Hawaiians and they were slow in adopting it as an article of diet. It was not until an increasing number of people from foreign shores came to the Islands that a definite demand for dairy products occurred.

In the latter part of the past century, previous to Annexation, some of the beef ranches introduced dairy cows and made butter, some of which was shipped to Honolulu. At that time beef prices were very low and better returns were secured by making and selling butter. Following Annexation, prices of beef increased materially and the dairy industry in these ranches was largely abandoned, to be taken up about the same time in an enlarged way by farmers located near the cities who sold milk and the dairy industry has developed along this line. Not much butter or other manufactured dairy products are produced in Hawaii even today.

There has been a marked increase in the consumption of dairy products during the past quarter of a century. Hawaii now numbers among its people many who came from the Orient to whom milk was not a traditional food. By a program of education carried on in the schools, by

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1This statement was prepared by Prof. L. A. Henke.
various welfare agencies, and by the dairymen themselves, many of these people from the Orient as well as the Hawaiians have come to appreciate the great value of milk in maintaining their health and promoting the growth of their children. Milk is served in many of the schools of the Territory now as a health measure. Here, children acquire a taste for milk and as they grow to maturity and establish homes, they continue to use milk and give it to their children. Hence the expansion of the dairy industry has been much greater than would have been the case had it merely kept up with the increase in population.

Good, sanitary milk is being supplied by the producers and distributors of milk in Hawaii. Cattle are constantly inspected for dangerous diseases by the Veterinary Division of the Board of Agriculture and Forestry, and the Board of Health sees to it that the milk offered for sale meets all sanitary and legal requirements as regards sediment, fat, solids, and bacterial content. The fact that it is possible to buy in Hawaii high quality milk of the different grades whether certified, raw, or pasteurized, has no doubt been a big factor in increasing the demand for milk.

The data which follow concerning milk production and per capita consumption are based on the reports of milk inspectors and population estimates by the Board of Health. Milk inspectors report the number of cows and production of each herd on the days when they inspect the dairies. It is assumed that these days are average days and production for the year is computed on this assumption. There are some small, one- or two-cow family dairies from which no milk is sold and hence are not subject to inspection. Because of this, total production is slightly larger than here reported.

Imports include only such quantities of the various items as appear in the Customs reports. Comparatively small quantities of dairy and other products are brought to Hawaii from time to time by Army and Navy transports which are not included in these figures.
### MILK PRODUCTION COMPARISONS

<table>
<thead>
<tr>
<th>Year</th>
<th>Territory of Hawaii—</th>
<th>Year</th>
<th>Oahu—</th>
<th>Year</th>
<th>Hawaii—</th>
<th>Year</th>
<th>Maui—</th>
<th>Year</th>
<th>Kauai—</th>
<th>Year</th>
<th>Molokai—</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>28,630</td>
<td></td>
<td>1927-28</td>
<td>6,053</td>
<td>1,801</td>
<td></td>
<td>1927-28</td>
<td>800</td>
<td>1927-28</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>29,194</td>
<td></td>
<td>1931-32</td>
<td>51,518</td>
<td>2,044</td>
<td></td>
<td>1931-32</td>
<td>121</td>
<td>1931-32</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>31,850</td>
<td></td>
<td>1931-32</td>
<td>3,648</td>
<td>1,964</td>
<td></td>
<td>1931-32</td>
<td></td>
<td>1931-32</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>31,850</td>
<td></td>
<td>1935-36</td>
<td>5,629</td>
<td>1,964</td>
<td></td>
<td>1935-36</td>
<td>121</td>
<td>1935-36</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>31,850</td>
<td></td>
<td>1935-36</td>
<td>5,629</td>
<td>1,964</td>
<td></td>
<td>1935-36</td>
<td></td>
<td>1935-36</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarts Per Day</th>
<th>Total Milking Cows</th>
<th>Calculated Production Per Year lbs.</th>
<th>Average Production Per Cow Per Year lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1927-28</td>
<td>28,630</td>
<td>2,044</td>
<td>4,145</td>
<td>2,072</td>
</tr>
<tr>
<td>1931-32</td>
<td>3,648</td>
<td>1,964</td>
<td>2,862</td>
<td>3,474</td>
</tr>
<tr>
<td>1935-36</td>
<td>1,964</td>
<td>1,964</td>
<td>1,541</td>
<td>2,757</td>
</tr>
</tbody>
</table>

These production estimates show a marked increase during the eight years ending in 1936 but the big increase took place during the first four years of this period, and average production per cow is now only 5,231 pounds as compared with 5,034 pounds in 1931-32.

These figures on average production per cow per year are greatly influenced by the practice followed in some instances of using some of the better milking beef cows as dairy cows during part of the year, thereby increasing the number of so-called “dairy cows” without a corresponding increase in total production since these cows are generally inferior to the regular dairy cows.

According to U. S. Census data average production of milk per cow in 1919 was 2,508 pounds, which had increased to 5,022 pounds in 1929.

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2Assuming ratio between total cows and cows in milk at one time to be the same as on Hawaii.
Per capita consumption of fresh milk has not increased since 1932; consumption figures include such fresh locally produced milk as may be used in making cream, some 400,000 gallons of ice cream, around a quarter million pounds of cottage cheese, and very small amounts of butter. The increase prior to 1932 was very marked. This is shown in the following table:

**PINTS OF FRESH MILK CONSUMED PER PERSON PER DAY**

<table>
<thead>
<tr>
<th></th>
<th>1919</th>
<th>1929</th>
<th>1932</th>
<th>1936</th>
</tr>
</thead>
<tbody>
<tr>
<td>Territory</td>
<td>.11</td>
<td>.21</td>
<td>.27</td>
<td>.27</td>
</tr>
<tr>
<td>Oahu</td>
<td>.17</td>
<td>.27</td>
<td>.39</td>
<td>.39</td>
</tr>
<tr>
<td>Hawaii</td>
<td>.07</td>
<td>.17</td>
<td>.14</td>
<td>.14</td>
</tr>
<tr>
<td>Maui</td>
<td>.06</td>
<td>.16</td>
<td>.13</td>
<td>.13</td>
</tr>
<tr>
<td>Kauai</td>
<td>.05</td>
<td>.09</td>
<td>.11</td>
<td>.10</td>
</tr>
</tbody>
</table>

**Imports of Dairy Products**—There has been a constant and marked increase in imports of dairy products to Hawaii as is shown in the following comparisons:

**COMPARISONS IN DAIRY IMPORTS**

<table>
<thead>
<tr>
<th>Year</th>
<th>Butter lbs.</th>
<th>Condensed &amp; Powdered Milk lbs.</th>
<th>Cheese lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1926</td>
<td>2,177,305</td>
<td>5,890,760</td>
<td>441,918</td>
</tr>
<tr>
<td>1931</td>
<td>3,309,671</td>
<td>8,752,808</td>
<td>530,057</td>
</tr>
<tr>
<td>1936</td>
<td>3,975,331</td>
<td>12,610,396(^4)</td>
<td>777,933</td>
</tr>
</tbody>
</table>

The details of imports for year ending June 30, 1936, and their approximate fresh milk equivalent follow:

**DAIRY PRODUCTS SHIPPED TO HAWAII**

**YEAR ENDING JUNE 30, 1936**

<table>
<thead>
<tr>
<th></th>
<th>Quantity lbs.</th>
<th>Value Dollars</th>
<th>Approximate Fresh Milk Equivalent lbs.</th>
<th>Per cent from Foreign Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh milk (inc. sterilized)</td>
<td>45,632</td>
<td>5,603</td>
<td>45,632</td>
<td>0</td>
</tr>
<tr>
<td>Condensed milk</td>
<td>11,950,029</td>
<td>808,938</td>
<td>29,875,072</td>
<td>0</td>
</tr>
<tr>
<td>Dried milk, infant foods, malted milk etc.(^5)</td>
<td>660,367</td>
<td>92,624</td>
<td>6,603,670</td>
<td>1.0</td>
</tr>
<tr>
<td>Butter</td>
<td>3,975,331</td>
<td>1,171,209</td>
<td>79,506,620</td>
<td>18.7</td>
</tr>
<tr>
<td>Cheese</td>
<td>777,933</td>
<td>158,534</td>
<td>7,779,330</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17,409,292</td>
<td>2,236,908</td>
<td>123,810,324</td>
<td>19.8</td>
</tr>
</tbody>
</table>

\(^3\)Fiscal year ending June 30, 1936.
\(^4\)Includes 448,751 pounds of powdered milk.
\(^5\)67% skimmed milk powder, 32% malted milk and infant foods, 1% whole milk powder.
Proportion of Dairy Products Produced in Hawaii—

With local production of fresh milk estimated at 41,951,951 pounds for the year ending June 30, 1936, and with dairy products having a fresh milk equivalent of 123,810,324 shipped to Hawaii during the same period it appears that only 25 per cent of the dairy products consumed in Hawaii were locally produced during that period.

YEARNL PER CAPITA CONSUMPTION OF DAIRY PRODUCTS
IN HAWAII

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1919</td>
<td>4.3</td>
<td>1.2</td>
<td>13.9</td>
<td>43.2</td>
<td>175</td>
</tr>
<tr>
<td>1928</td>
<td>7.8</td>
<td>1.3</td>
<td>18.1</td>
<td>89.8</td>
<td>314</td>
</tr>
<tr>
<td>1931</td>
<td>8.9</td>
<td>1.4</td>
<td>23.3</td>
<td>102.0</td>
<td>352</td>
</tr>
<tr>
<td>1936</td>
<td>10.1</td>
<td>2.0</td>
<td>32.07</td>
<td>196.7</td>
<td>422</td>
</tr>
</tbody>
</table>

While this shows a continued marked increase based on the whole milk equivalent, it should be noted that this increase since 1931 is largely due to an increase in the consumption of condensed milk. Seemingly we have reached a point where the per capita increase in consumption of fresh milk is very small.

Average per capita consumption on the mainland of the United States on a whole milk equivalent basis is about double the 422 pounds consumed in the Territory of Hawaii.

Methods—There has been a marked shift in the manner of dairying during the past fifteen years, notably on Oahu where over three-quarters of the milk of the Territory is produced. Dairies which formerly were located in or right on the edge of the city have largely been moved further out in the country, many of them across the Pali. Formerly these dairies, when nearer to Honolulu, relied for roughages largely on soiling crops produced at a high labor cost or on miscellaneous grasses, the cutting of which with a hand knife was a costly procedure often followed

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6Fiscal year ending June 30, 1936.

7Includes 1.1 pounds of skimmed milk powder, an unknown part of which is used for feeding livestock and poultry.
by a long haul of about twenty miles. Now, however, they let the cattle harvest their own roughage in pastures, which is a far more economical method when land rentals are not too high.

Holstein cattle are most numerous, with Guernseys, Jerseys, and Ayrshires following in the order named. Some dairies raise calves to replenish their herd but others rely largely on the purchase of young cows secured from the mainland or outside islands, feeling that cows can be purchased more economically than they can be raised. The tendency, however, seems to be toward securing good bulls and raising more calves.

Milk production costs are high, largely due to relatively high land values and the high cost of imported concentrates. The Hawaii Experiment Station has demonstrated in repeated experiments that local, low cost by-products, as cane molasses and pineapple bran, can be used to a much greater extent than was formerly believed practicable in the feeding of dairy cows, and the use of these feeds is increasing each year.

There were 140 commercial dairies in the Territory in 1936. Many of the larger dairies operate milk routes but the bulk of the milk is sold on a wholesale basis to distributors. About 56 per cent of the total milk is pasteurized, 35 per cent is sold as raw milk, and 9 per cent is certified. Half of the total number of dairies are located on the Island of Oahu.

Possibilities of Future Expansion—Further expansion of the dairy industry in Hawaii will be influenced by the increase in population and by a further increase in the per capita consumption of fresh milk which is still very low compared to mainland standards.

If Hawaii is able to produce milk cheaply enough to compete with imported dairy products such as butter, cheese, and condensed milk, great expansion of the dairy industry could take place but such expansion would likely be limited to the more remote regions at elevations above those most suitable for the production of sugar and pineapples. These areas are now largely used for beef
production and hence such expansion would necessarily compete with beef ranches for the required land.


**DALLIS GRASS** Dallis grass (*Paspalum dilatatum*) has been widely planted in pastures throughout the Territory in the past 20 years and is considered an excellent addition.


**DANDELION** The dandelion (*Taraxacum vulgare*), which grows here very abundantly as a weed, may be used either as cooked greens or as a salad plant. Orientals and sometimes Occidentals make use of this plant as food, although its consumption thus is not great at any time. There are varieties which are sometimes found in cultivation, but not in Hawaii.

**DASHEEN** See "Taro."

**DATE** The date is the fruit of a palm tree (*Phoenix dactylifera*) which grows to best advantage in sub-tropical desert regions. Hawaii is not an ideal country for the commercial production of this fruit, but there are some districts here in which suitable climatic conditions exist. The dry leeward portions of the Islands, in places where the soil is good and there is an ample supply of irrigation water, offer some promise for this crop, but even in such situations there is danger of a tropical rain shower falling on the bunches of fruit when they are in the final stages of maturing, and this is very injurious, as it may cause fermentation and interfere with the normal ripening processes.

The date palm was introduced into Hawaii many years ago and one may find individual trees and small clumps in many localities, but nowhere in the Islands has there been any successful commercial exploitation of this valuable fruit. Excellent bunches of dates are sometimes exhibited at county fairs here.

In 1927 the Hawaii Experiment Station secured several
hundred young plants of different varieties from Southern California, where a large date industry has been developed during the past 25 years, but no significant results have thus far appeared.

A closely related species (*Phoenix canariensis*) grows abundantly in gardens and along roadsides in Hawaii, producing bunches of small fruits which are scarcely worthy of being called edible. The pulp is thin and not very sweet, and is puckery to the taste. It has no commercial value.


**DERRIS**  
*Derris* (*Derris elliptica*) is a tropical plant which contains an insecticidal substance called rotenone. It is grown commercially in southern Asia and to some extent in Porto Rico. As the rotenone is concentrated chiefly in the roots, that part of the plant is harvested, dried and ground into powder.

Cuttings of this derris were obtained from the Malay Peninsula in 1934 by the P.P.C.A. Experiment Station, in order that a test might be made of the effects of growing the plant between rows of pineapple plants; it was believed that the derris roots might give off sufficient rotenone to kill the nematodes infesting pineapple roots. Trials of this in the Wahiawa (Oahu) region have thus far proven unsuccessful and the plan has been abandoned.

The Hawaii Experiment Station is making further tests of the plant to determine whether or not there are localities in Hawaii well suited to its culture. Likewise, certain related species which also contain rotenone, are being tested. Some of these were obtained by the Station in 1930 and have been under trial since.

**DUCKS**  
Raising of ducks both for meat and eggs is practiced in Hawaii to a limited extent, mostly by Chinese farmers and suburban householders. Hawaii offers favorable conditions for this industry, and it ought to be expanded.

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8About the same time the Agricultural Extension Service obtained cuttings of derris from the Philippine Islands and distributed them for trial planting to several collaborators in various parts of the Territory.
See also "Poultry."
Ref.—Haw. For. Agr. 1911:253 (on feeding ducks).

DURIAN The durian (Durio zibethinus) is a Malay tree which produces a large fruit somewhat resembling a breadfruit except that its exterior is covered with coarse, thorny warts. The pulp is of excellent flavor but has a very offensive odor. There are very few trees in Hawaii.

EGGPLANT The eggplant (Solanum melongena) is well adapted to the sub-tropics and thrives particularly well in Hawaii. Two varieties are commonly grown here, a round type and an elongate type. One or both are found in most truck and home gardens, for culture is easy and the market demand constant. A recent crop survey (1936) shows between 50 and 75 acres in the aggregate devoted to this crop.

EKOA See "Koahaole."

ELEPHANT GRASS Elephant grass, or Napier grass (Pennisetum purpureum) was introduced into Hawaii in 1915 by the Hawaii Experiment Station and in the ensuing twenty years has become of great importance in pasturage. It is also used extensively as fodder, and as a soiling crop. When used as fodder it is cut every 30 days to prevent its becoming too large and coarse. Yields of 100 tons of green fodder per acre per year are not uncommon.

As suggested by its name, this grass grows to gigantic size in comparison with most species, rivaling sugar cane in this respect. When a field of elephant grass is to be used for pasturage cattle must be kept out until the grass is about three fourths grown, after which it will stand the normal trampling well. It is palatable and nutritious, and cattle come off it in prime condition. It is considered an excellent fattening grass in wet districts.

Merker grass is a closely related species which is not considered as valuable as elephant (Napier) grass.
ENDIVE  This lettuce-like salad plant (*Cichorium Endivia*) is found but rarely in vegetable gardens of Hawaii. Importations from the mainland amount to about 20,000 pounds per year. Consumption is mostly in the tourist hotels.

See also “Truck Crops.”

EUCALYPTUS  Several species of *Eucalyptus* were introduced into Hawaii from Australia during the early years of the current century and seemed to find very congenial conditions here. Since certain species are used in Australia as important sources of lumber and ship timbers, it was urged that Hawaii should make an effort to establish forests of Eucalyptus for future commercial use when present forest resources might be depleted.1 Thousands of seedlings were planted, especially on Maui and Oahu by the Board of Agriculture and Forestry to determine their economic value under Hawaiian conditions.

As a source of lumber not any of the Eucalyptus species have yet proven to be worth commercial exploitation in Hawaii, because of the strong tendency of the wood to check and split.

For fence posts the Eucalyptus is not as good as the Ohia, Koa, Mamani and some other native woods, but is used extensively on some ranches where it is abundant and more readily available than the other kinds. When properly creosoted these posts last a good number of years.

As fuel wood, Eucalyptus is especially valuable, for it grows rapidly and lends itself well to being used in this way. Tests show that certain species are superior to others in this regard.2

The tannin extract from Eucalyptus leaves is useful in removing scale from boilers.3 Certain oils and other valuable commercial articles are derived from the Eucalyptus in Australia, but thus far no serious efforts have been made to develop such an industry here.

Many hundreds of acres of land at elevations of 1,000

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1Haw. For. Agr. 1911:229-231. Also, see Planters Record IV, p. 82 (1911).
to 5,000 feet are covered by Eucalyptus in these Islands; in some cases (as Waialua) these plantings are a source of some revenue, while in others they are considered more as a liability than an asset.

**EUGENIA** This is a genus of tropical trees, with many species scattered throughout the tropics. A few have been introduced into Hawaii during the past hundred years, and two of them, the mountain apple and Java plum, have established themselves in the wild state. None of them have been thought to offer sufficiently attractive economic possibilities to justify cultivation on a commercial scale in these Islands, but perhaps the Surinam cherry should be given such a trial. The species occurring in Hawaii are:

- Brazilian Plum
- Java Plum
- Mountain Apple
- Rose Apple
- Surinam Cherry
- Water Apple

**EUPHORBIA LORIFOLIA** In 1912 J. F. Rock discovered a large stand of a native Hawaiian species of *Euphorbia* on the Island of Hawaii. Since all species of this genus have milky sap in abundance and some are valuable sources of rubber, he took samples of the latex to be analyzed, for at that time Hawaii was much interested in the possibility of developing a large rubber industry.

Analyses were not encouraging, however, for in comparison with Ceara this Euphorbia latex was very low in rubber content, and in quality, also, it was inferior.

As a source of chicle, for chewing gum, the newly discovered Hawaiian tree seemed to offer some promise, but no serious efforts were made to develop its manufacture here.

For further information on the subject of rubber, see "Rubber."

FAYA  The faya is a large shrub or small tree (*Myrica faya*) with fragrant wood which is used in Portugal for incense purposes. The leaves, also, are somewhat fragrant. It was introduced into Hawaii some few years ago from the Madeira Islands, and now is spreading rapidly in some of the upland areas of the Island of Hawaii, causing alarm among the ranchers operating there. The seeds are disseminated by birds. Thus far no commercial value has been attached to this tree in Hawaii.

FEEDS FOR LIVESTOCK  Hawaii produces many kinds of crops and products which are used to a greater or lesser extent in feeding livestock; in addition there are some which have been tried but not developed as regular crops. Each of the following is discussed briefly in its alphabetical order:

- Alfalfa
- Algaroba
- Bagasse
- Buckwheat
- Carob
- Cassava
- Corn
- Cowpea
- Grasses of many kinds
- Honohono
- Hubam clover
- Koahaole
- Molasses
- Pigeon pea
- Pineapple bran
- Salt bush
- Sorghum
- Sugar
- Sunflower
- Sweet clover
- Sweet potato
- Uba cane
- Velvet beans
- Vetch

Raw sugar has been used experimentally as a feed for livestock. When 5 to 10 per cent of the ration for hogs is raw sugar, the appetite of the animals is stimulated and more feed is consumed, resulting in an increase of daily gains in weight. If the cost of raw sugar is low, this may reduce the unit cost of fattening swine. At ordinary prices, however, raw sugar is not an economical feed for livestock.

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FEIJOA  The feijoa (*Feijoa sellowiana*), called also pineapple guava, is a close relative of the guava and resembles it in shape and structure of both fruit and flower. It is a shrub with more value as an ornamental than as a commercial source of fruit, for in Hawaii it does not thrive as well as the guava, nor is its fruit in demand in our markets. It was introduced about 20 years ago from California, where it is developing as a commercial fruit of some importance. It occurs in some gardens here, but not commonly.

See also “Guava.”


FERN  See “Tree Fern.”

FERN TIPS  The tender tips of certain ferns as *Pteridium aquilinum*, are commonly used as food in Hawaii, especially by Orientals. Neither of these ferns is cultivated, for they are abundant in certain forest areas and may be had for the gathering.

The tips of the young fronds, when still tender and succulent, may be eaten if first stripped of their velvety covering, soaked overnight in water to remove an unpleasant acid, and cooked according to standard recipes. See also “Tree Fern.”

FESCUE GRASS  Fescue grass, or brome fescue (*Festuca dertonensis*), is widely distributed and usually grazed closely by cattle, showing that it is relished.

Another species, *Festuca elatior*, is under trial and may prove to be more valuable.


FIBER CROPS  The production of fibers for industrial purposes is highly developed in some countries but in Hawaii is of very minor importance in proportion to other industries. This latter fact is not due, however, to any lack of effort to establish such industries, for a goodly

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number of fiber crops have been tried or proposed here:

Broom fibers—
  broom corn
Cloth fibers—
  banana
  cotton
  flax
  pineapple
  silk
Matting, mats, basketry, etc.—
  coconut
  lauhala
  matting sedges
Paper fibers—
  bagasse
  bamboo
  malina
Rope fibers
  bowstring hemp
  manila hemp
  olona
  ramie
  sisal
  sunn hemp
Stuffing and upholstery fibers—
  cotton
  pulu
Thatching and building fibers—
  coconut
  lauhala
  pili
  sugar cane (bagasse)

FICUS  See “Fig,” also “Rubber.”

FIG  There are a very large number of species of trees which produce figs, belonging to the genus Ficus; some of them, as the banyans, grow to immense size and are important features of tropical vegetation. Only a few of the species produce fruit that is marketable, and these are cultivated chiefly in sub-tropical regions. At least
one kind of edible fig, though it is not known which, was introduced by Marin sometime prior to 1813. As all fig species are easily propagated from cuttings and since fig cuttings will withstand long exposure before being planted, it followed naturally that many introductions of this fruit tree were made. It was frequently mentioned in meetings of the Royal Hawaiian Agricultural Society as being well adapted to Hawaiian conditions and a very useful item in the list of fruits cultivated here.

Four varieties were noted in 1851: bush fig, tree fig, China fig and Turkey (Smyrna) fig, the last being considered the best for all practical purposes.

Some limited efforts were made to establish a dried-fig industry in the 1850's and at various times subsequently, but the climate proved not to be quite suitable and nothing of large commercial importance ever developed in this line.

Some have urged, and still declare, that there are great potential possibilities of fig production in these Islands, but no serious effort has been put forth to realize them. Fig growing today is limited chiefly to home gardens, with here and there a small commercial planting, the total of which is under 50 acres. The fruit fly is a hindrance to successful production. The species cultivated is *Ficus carica*, a large, dark-colored variety. The Kadota and Black Mission varieties are under test at the Kona branch of the Hawaii Experiment Station (Annual Report 1936, p. 95).

Ref.—Haw. Exp. Sta. Bul. 77:27-29 (uses of fig); Planters Monthly X, 227; XIX, 519.

**FLAX**  Flax (*Linum usitatissimum*) seems to prosper better in temperate and subtemperate regions than in the tropics. A few trials of this fiber plant were made by the Hawaii Experiment Station some twenty years ago, but the results were not sufficiently encouraging to warrant commercial planting. The yield of seed was good, at the rate of 17 bushels per acre in two plantings, but the yield of straw for fiber was disappointing.

Many years earlier (1851) an effort was made to estab—

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lish a flax industry here but with no success. This effort was directed toward the production of fiber; it is possible that flax grown for the oil content of its seed (linseed oil of commerce) would prove to be a profitable basis for an industry in Hawaii.

This plant "requires" a light soil well prepared before planting, germinates in 4 days under good conditions, and matures usually in 90 days. It can be drilled or broadcasted, care being taken to insure an even stand when fiber is wanted for manufacture."

J. F. Rock collected specimens of this plant in the wild state in 1914 on Haleakala Ranch, Maui.

FLORICULTURE An important feature of agriculture in Hawaii is the commercial production of flowers for use in bouquets and especially in leis. The most widely cultivated kinds are carnations, chrysanthemums, ginger, plumeria and pikaki. While no exact figures are available, it is known that a very extensive industry has been developed in the commercial production and sale of these flowers, amounting in the aggregate to well over $100,000 in a typical year.

For information concerning these and floriculture in general the reader is referred to "The Tropical Garden" by Kuck and Tongg (Macmillan, 1936). Also, an article by R. I. Lillie in Hawaiian Forester and Agriculturist 1920:6-9.

FLOWERS See "Floriculture."

FORESTS AND FOREST PRODUCTS Forests cover about 27 per cent of the total area of the Hawaiian Islands. Most of this is set aside by proclamation of the Governor as forest reserves, in order that this important part of Hawaii's natural resources may be conserved to the best possible advantage. The forest reserves are administered by the Territorial Board of Agriculture and Forestry, which maintains rangers to supervise and protect them from injury and damage.

The following table indicates the distribution of the forest reserves and the ratio to the entire land area on each island:

<table>
<thead>
<tr>
<th>Islands</th>
<th>Total Area (Acres)</th>
<th>Areas in Reserves (Acres)</th>
<th>Areas in Forests (Acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kauai</td>
<td>350,000</td>
<td>146,197</td>
<td>170,000</td>
</tr>
<tr>
<td>Oahu</td>
<td>382,720</td>
<td>117,210</td>
<td>140,000</td>
</tr>
<tr>
<td>Molokai</td>
<td>167,000</td>
<td>44,674</td>
<td>70,000</td>
</tr>
<tr>
<td>Maui</td>
<td>466,000</td>
<td>131,504</td>
<td>75,000</td>
</tr>
<tr>
<td>Hawaii</td>
<td>2,570,000</td>
<td>477,392</td>
<td>564,000</td>
</tr>
<tr>
<td>Lanai</td>
<td>89,305</td>
<td></td>
<td>4,000</td>
</tr>
<tr>
<td>Kahoolawe</td>
<td>28,260</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4,053,285</strong></td>
<td><strong>916,977</strong></td>
<td><strong>1,100,000</strong></td>
</tr>
</tbody>
</table>

The Hawaiian forests are tropical and therefore lack the pines, spruces and other coniferous trees familiar to the temperate zone forester. Instead of these, there are several Hawaiian trees usually of an evergreen nature, although some shed their leaves for a short period at certain seasons. The more common species are the following:

(1) The Kukui or Candlenut tree, which produces an oily nut used by the early Hawaiians for illuminating purposes, and whose frosted light-green foliage makes the tree very conspicuous, especially in the gulch bottoms and on slopes at the lower portions of the wet valleys.

(2) The Koa or Hawaiian Mahogany, which belongs to the Acacia family and which is found on well-drained soil on the slopes and ridge-tops. This furnished the natives with the large bodies for their dugout outrigger canoes, and the beautifully grained brown wood now is made into musical instruments, furniture and interior finish.

(3) The most abundant tree throughout the Hawaiian wet forests is the Ohia Lehua, a genus which has affinities in New Zealand. The blossoms of this tree are a bright scarlet pompon, sometimes yellow, and of them the old Hawaiian always spoke with that sort of tenderness with

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6This table and the paragraphs which follow it are taken from the first of a brief series of "Agricultural Studies" published by the University of Hawaii; Mr. C. S. Judd, Territorial Forester, collaborated in the preparation of the publication mentioned.
which a Scotchman speaks of heather. The Ohia is slow-growing and very hard to raise from seed, but it thrives on thin soil in exposed places, and comes in quickly on the new lava flows where moisture is present, making thus a very valuable component of the native flora. The wood is extremely hard and is excellent for flooring.

(4) Other trees found in association are the Kopiko, Kolea, Ahakea, Kauila, Kalia, Lama, Mamake, Naio and Olopua, with often an undergrowth of tree ferns, ie-ie and maile vines, and other abundant shrubbery.

(5) At the higher elevations on Maui and Hawaii the Mamani is found near the timber line up to 8,000 feet above sea level. This is a tree belonging to the bean family with bright yellow sweet-pea-like blossoms. The Mamani has the most durable wood of all the Hawaiian trees, and is highly prized by the ranchers for fence posts.

(6) Along the shore and growing not far inland may also be found the Milo, Kamani of two species, the coconut, and the rambling Hau. The latter furnishes a tough bark used for cordage.

(7) The Kou tree, most valuable because its wood was easy to work and made excellent calabashes and food dishes, is now becoming rare because of a defoliating moth.

The value of forest products varies from year to year according to amounts harvested. In 1903 the estimated value was about $125,000,7 including lumber, fence posts, tanbark, etc. Koa lumber to the value of $10,094 was taken out in 1905 and about $13,000 worth in 1907. In the preceding century the sandalwood trade yielded very large returns while it lasted, but now is no more (see "Sandalwood").

During the past twenty years there has been a fundamental change in the attitude of this Territory toward its forests; instead of exploiting them and taking out as much as possible in the way of timber and other commercial materials, the present policy is to protect and build up the forest cover as much as possible, for its

7Thrum's Annual 1903:61.
beneficial influence on rainfall and soil conservation. Consequently, there is very little activity in the way of lumbering or other exploitation of the forests.


FRENCH CHERRY See “Surinam Cherry.”

FROGS Frog raising has been indulged in by a few people in Hawaii now and then during the past several decades, but always on a very small scale. While there is a moderately good demand for this product in hotels, restaurants and ships, there are many hazards to be overcome in the raising of frogs and one should not go into the business without a thorough study of its requirements and risks.

At present there is some frog production on Kauai and a small amount on Oahu. The market could absorb more.

For detailed information on frog culture, see University of Hawaii Agricultural Extension Service, Agric. Notes No. 117 (Oct. 11, 1935).

FRUITS Horticulture in Hawaii has given a more or less thorough trial to the growing of many kinds of fruits and nuts, some of them of temperate zone origin but most of them tropical; a few kinds have become of large economic importance to this Territory, some others seem to offer promise of becoming so, but many will probably continue as horticultural rarities of interest chiefly to the fancier of new fruits.8

In their alphabetical order the following fruits are discussed in relationship to their potentialities for Hawaii:

8The best treatise on the nutritive values and uses of Tropical Fruits in Hawaii is Bulletin 77 of the Hawaii Experiment Station (1936), by C. D. Miller, K. Bazore and R. Robbins.
Akala berry Mandarin orange
Apple Mandrake
Apricot Mango
Avocado Mangosteen
Banana Monstera
Bhel Mountain apple
Brazilian plum Mulberry
Breadfruit Ohelo
Cactus pear Olive
Carambola Orange
Carissa Papaya
Cherimoya Passion fruit
Cherry Peach
Chinese orange Persimmon
Citron Pineapple
Custard apple Poha
Date Pomegranate
Durian Quince
Feijoa Raspberry
Fig Rose apple
Grapefruit Roselle
Grape Sapota
Guava Sour sop
Java plum Star apple
Jackfruit Strawberry
Kumquat Surinam cherry
Lemon Sweet sop
Lilikoi Waiawì
Lime Wampi
Litchi Water apple
Longan Waterlemon
Loquat Watermelon
Mammee Wi

FUNGUS See “Pepeiao Akua,” also “Mushroom.”
GARLIC Garlic (Allium sativum), especially delectable to certain racial groups, is produced in Hawaii only in very limited quantities, some 25 acres being devoted to it in 1936. Larger amounts are imported than are produced here.
   Its culture is similar to that of the onion.
See “Onion,” also “Truck Crops.”
129
GEESSE  The raising of geese is practiced in Hawaii only to a limited extent, chiefly for home consumption. See "Poultry."

GINGER  Commercial ginger comes from the roots of a tropical plant (*Zingiber officinale*) which grows well in Hawaii. There are many other species of ginger, some of them producing exceptionally beautiful flowers which are much prized in Hawaiian gardens. Several species grow wild in the mountain valleys, beside streams where the jungle shade and an abundance of water combine to provide ideal conditions.

Although our wild gingers have spicy root-stalks, for commercial use they are not considered the equal of the species named above which has become known to the trade as Jamaica ginger. This and certain similar varieties have been introduced here and are being grown successfully, but in comparatively limited amounts. A recent survey indicated that the total commercial plantings of ginger (for roots) in the Territory amount to only six or seven acres. The Prohibition era gave an unusual stimulus to the manufacture of ginger ale and, of course, there was a rise in the prices of ginger root which caused a little flurry of interest in Hawaii in 1924 to 1928. It was found, however, that because of higher wage standards and higher land values these Islands could scarcely compete with the West Indies and Central America.

Prevailing prices now vary from six to ten cents per pound, and with average production less than 2,000 pounds per acre, the net income is not very great.

Most of the ginger root produced here is consumed locally, only about ten per cent being shipped to the mainland. Consumption is not all in the making of ginger ale, for an appreciable quantity is used by the Chinese in flavoring certain foods.

The flower bracts of one species of ginger (*Zingiber mioga*) are used as a flavoring for soup by both Japanese and Chinese. This species is but sparingly cultivated in Hawaii.

The flowers of some of the species of ginger (especially
Hedychium coronarium) are used extensively in the making of leis, which are sold in very large numbers. While there is no exact information as to the extent of this business, it is estimated that between $100,000 and $200,000 annually is realized from this exotically lovely and fragrant flower.


GOA BEAN This little known bean (Psophocarpus tetragonolobus) is a recent introduction from India and gives some promise of becoming very popular. Its pods are “winged” along the angular edges, and when immature are succulent and have a delightful flavor. Cultivation in Hawaii is very limited.


GOATS The first goats in Hawaii were brought here in 1778 by Captain Cook. From this and a few subsequent introductions they became exceedingly numerous, living wild in the mountains. Their economic value to the Islands has never been great, however, for as a source of meat they are not held in as high esteem as certain other animals.

The only source of revenue from wild goats of any considerable importance is the hide. Goat skins have been exported in varying amounts, but the total value of these shipments in any one year has never been great; in 1850 the exports were 26,519 skins, valued at $3,977; in no subsequent year did the annual shipments equal those of 1850 in numbers of skins, but in some years the unit prices went much higher and brought the total value to higher figures, $15,573, for example, in 1885.

In the present century there has been very little business in the collecting and using or exporting of goat skins, annual shipments having dwindled by 1900 to a value of $1,721.

Far more than offsetting this small economic value is the damage done by wild goats to forests and pastures, which make them more of a liability than an asset. Efforts have been put forth by ranchers and by the Board of Agriculture and Forestry for many years to exterminate this pest and on most of the islands they have been success-
ful. On the Island of Hawaii, however, large numbers still remain. In 1922 an extensive "drive," using a hundred or more men and boys on horseback, resulted in the rounding up and killing of 7,000 goats from the Puuwaawaa section. At that time it was estimated that there were about 68,000 on the Island.

The keeping of domestic goats, chiefly for their milk yield, has never been developed in Hawaii to any considerable extent, although a number of efforts have been made to establish such an industry. In the 1920's a considerable wave of interest in the Toggenberg breed for milk purposes was aroused by W. Twigg-Smith.


GOBO  See "Burdock."

GOOSEBERRY  See "Poha."

GOOSE GRASS  See "Crowfoot."

GOURD  Gourds of many species abound in the subtropics and tropics, most of them, however, not being fit for use as food. Among the economic plants noted by Captain Cook as having been in Hawaii prior to his arrival was a species of calabash gourd used for holding water and foods. This and similar species are still grown on a small scale.

The dishcloth gourd (*Luffa acutangula*) is an introduction from southern Asia and is used chiefly by the Chinese. The mature fruits are a foot or two in length and only an inch or two in diameter, but are always harvested when immature and comparatively small, for only then is the flesh succulent and good to eat. The exterior of the fruit is characteristically ribbed, which makes it resemble somewhat the okra; in fact, it is sometimes called "Chinese okra," but is very distinct botanically.

This gourd is found in many vegetable gardens, grown for market, the total acreage devoted to it being probably less than 20 acres.


GRANADILLA  See "Passion Fruit."

GRAPE  A small industry in the growing of grapes
has existed in Hawaii for a hundred years or longer, but it has never developed to any considerable size. In 1815 a Spaniard, Francisco Marin, who had been in Hawaii for a number of years, wrote in his journal that on a certain day he “was planting vines for the King.” In all probability that was the Isabella wine grape \( (Vitis Labrusca) \) from Madeira, for it is known that this variety came to Hawaii at a very early date. Its cultivation was taken up by a few people, but apparently did not become general. This was perhaps due to two factors: (1) climatic and soil conditions did not prove to be ideal; and (2) there was a considerable popular opposition to wine manufacture because of strong missionary influences. By 1850 grape growing had made so little progress that a contemporary\(^1\) writing of “the Vine and Tobacco” states that what little grape culture there was at that time was very poor.

Imported wines were so costly, however, that in spite of handicaps of climate and public opinion efforts were repeatedly made to develop an industry for at least sufficient production to take care of local consumption needs. In 1852 John Montgomery\(^2\) brought in some fifty varieties of grapes from Australia in the hope that some might prove to be better than the kinds already here. He was enthusiastic about the possibilities of this industry, as indicated by his exclaiming on “how many hundreds, nay thousands of acres of waste land might be converted into smiling vineyards, yielding their tens of thousands yearly to the meagre produce of our Islands.”\(^3\) He reckoned an acre of vines worth $1,000. No great success resulted, however, from these efforts and grape growing continued at about the same low level with occasional spurts of renewed interest. The Isabella still was considered the best variety for Hawaii, and no good table grape had been found which would produce well here.

When in 1901 the U. S. Department of Agriculture was surveying the general situation in this newly annexed Territory with a view to establishing an agricultural experiment station as a means of fostering diversification

of farming, the small industry in grape growing then existing was noted among many other crops as a possibility for expansion. The Portuguese population was increasing steadily by new immigration at that time and the new Experiment Station undertook to introduce new grape varieties in response to the interest of this important racial group. In 1905-6 some 175 new varieties were brought in for trial at Makawao, Maui, where a commercial vineyard was being projected in large dimensions. At about that time, too, there were ambitious beginnings in the vicinity of Hilo. In 1911 the interest in grape growing was sufficiently general and popular to cause the Legislature to request the Experiment Station to issue a special bulletin on the subject in the Portuguese language. Meanwhile, a good deal of attention was being given by the Station specialists to problems of fertilizing and pruning of the vine, to the development of the most efficient type of trellis, and to the control of insect pests. The "Japanese beetle" (Adoretus) was proving to be exceedingly destructive, by devouring the foliage. Poison sprays were recommended, but were not very effective in regions where frequent rains washed the poison off the leaves.

The net result of trying many different varieties during all these years was the establishment of the Isabella as the best for Hawaiian conditions, thus confirming the findings of the early vineyardists. It alone seems to be able to withstand the nematode worms in the soil which attack the roots of most all others so effectively that they die in a year or two. Notwithstanding the interest and assistance of the Experiment Station and of the Legislature, and in spite of the ambitious beginnings made at Makawao and Hilo, the grape and wine industry has never developed beyond the stage of infancy. At no time has there been a total area of as much as 100 acres in producing vineyards, and the total today is considerably less than fifty acres, nearly all of it near Hilo. On each of the other islands there are small home plantings aggregating only a few acres in all.

GRAPEFRUIT The grapefruit (Citrus grandis), widely familiar as a breakfast fruit, is better adapted to the tropics than are the common orange and lemon, which are close relatives. Although introduced into Hawaii a good many years ago, it has not been planted extensively for commercial purposes, perhaps because of the fact that the Mediterranean fruitfly attacks it more destructively than most other fruits.

The largest commercial planting is in the Puna district of Hawaii where one orchardist has several acres under cultivation, with a ready market in Hilo for all that he produces. Many home gardens contain a tree or two, for household use. The Hawaii Experiment Station has propagated and distributed several good varieties.

Pomelo is a name sometimes used synonymously with grapefruit, but more commonly it refers to a large, thick-skinned, coarse type grown in China and prized for the fragrance of its rind.

Shaddock is another name commonly used for the Asiatic pomelo.

GRASSES Some 49 species of grasses of more or less value as feed for range cattle are present in Hawaii, some widely disseminated while others are still in the process of becoming established. Some of these grasses are very valuable in that they have made it possible to raise more cattle per unit area, thereby enhancing the worth of the livestock industry to the Territory.

The Hawaii Experiment Station has made many introductions and tried many species in its several grass gardens maintained at various elevations. In addition to these introductions several other kinds have been brought in by ranchmen. Some have come in accidentally as seeds lodged in imported hay and may be pests rather than beneficial. All that have been successful, or seem promising, are included in the list below, together with a few common species that are relatively valueless. In their proper alphabetical sequence some of the species are very briefly treated; for a detailed statement about all of them see Bulletin 65 of the Hawaii Experiment Station, “Range

4Mr. K. Iwasaki, a graduate of the University of Hawaii.
Grasses of Hawaii," published in 1933. A later bulletin, No. 76, discusses the factors affecting the chemical composition of pasture grasses, for this is basic to the nutritive value of these grasses as cattle feed.

The grasses of interest to livestock producers in Hawaii are these:

*Agrostis alba*—Redtop grass  
*Andropogon annulatus*—Angleton grass  
*Andropogon nodosus*—Wilder grass  
*Andropogon saccharoides*—Silver beardgrass  
*Andropogon sericeus*—Australian bluegrass  
*Anthoxanthum odoratum*—Sweet vernal grass  
*Arrhenatherum elatius*—Tall oatgrass  
*Axonopus compressus*—Carpet grass  
*Bromus unioloides*—Bromegrass  
*Chloris gayana*—Rhodes grass  
*Cynodon dactylon*—Bermuda grass  
*Dactylis glomerata*—Orchard grass  
*Digitaria pruriens*—Crabgrass  
*Digitaria sanguinalis*—Crabgrass  
*Digitaria violacea*—Crabgrass  
*Eleusine indica*—Crowfoot  
*Festuca dertonensis*—Brome fescue  
*Festuca elatior*—Tall fescue  
*Heteropogon contortus*—Pili grass  
*Holcus lanatus*—Velvet grass  
*Ixophorus unisetus*—Mexican grass  
*Lolium multiflorum*—Italian ryegrass  
*Melinis minutiflora*—Molasses grass  
*Microlaena stipoides*—Meadow rice grass  
*Oryzopsis miliacea*  
*Panicum maximum*—Guinea grass  
*Panicum purpurascens*—Panicum  
*Paspalum conjugatum*—Hilo grass  
*Paspalum dilatatum*—Paspalum grass  
*Paspalum fimbriatum*—Panama paspalum  
*Paspalum notatum*—Babia grass  
*Paspalum orbiculare*—Rice grass  
*Paspalum urvillei*—Vasey grass  
*Pennisetum clandestinum*—Kikuyu  
*Pennisetum clandestinum*
Pennisetum purpureum—Elephant or Napier grass  
Phalaris tuberosa  
*Poa pratensis*—Bluegrass  
*Rhaphis aciculata*—Pilipiliula  
*Sacciolepis contracta*—Glenwood grass  
*Setaria lutescens*—Yellow foxtail  
*Setaria verticillata*—Bristly foxtail  
*Sorghum vulgare sudanensis*—Sudan grass  
*Sporobolus berteroanus*—Rattail grass  
*Stenotaphrum secundatum*—Buffalo grass  
*Trichachne insularis*—Silk grass  
*Tricholaena rosea*—Natal grass


**GUAVA** There are two principal species of guava in Hawaii: the red strawberry guava (*Psidium cattleianum*) and the common species (*Psidium guajava*), the latter occurring in several varieties, including the so-called “white” variety, the “sweet” variety, and others.

The strawberry guava is of common occurrence in home gardens but seems not to have been able to establish itself in the wild state except possibly in a few limited areas. Although it has some commercial possibilities it has never been cultivated on that basis, probably because of the abundance of the common (yellow) species.

The common species has become the dominant ground cover in many uncultivated foothill areas and on some mountain slopes, crowding out many other types of vegetation and in some instances ruining pastures. Many thousands of acres have thus been occupied by this hardy shrub, the origin of which in Hawaii is not known with certainty. It probably was introduced early in the nineteenth century as a garden shrub and escaped into the wild, disseminated by birds.

Perhaps the most serious indictment against the guava is not, however, its occupation of good land and the expensiveness of clearing it away for the cultivation of other crops, but the fact that it harbors the Mediterranean fruitfly and makes it practically impossible ever to exterminate this pest. While there are principal fruiting seasons, there are some fruits to be found at any time of

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the year, thus assuring a perpetual source of food for this fruitfly which is the direct cause of costly restrictions against the shipping of many kinds of fruits to the American mainland.

Such are the liabilities of the guava, but there are items to enter on the other side of the ledger. It produces thousands of tons of fruit every year, much of which is gathered and used for jelly-making both commercially and in countless homes. Any estimate of the value of this would be a guess, but it is probable that the total is over $100,000 per year.

Recent studies in the Nutrition Laboratory of the local University show that guava juice has nearly four times the vitamin value of orange juice as a preventive of rickets and similar disorders.

As an ingredient of fruit punches guava juice is proving to be very desirable and it is not impossible that a major industry might develop out of the beginnings made in the use of this fruit which grows so abundantly here.

Almost no effort has been made to cultivate the common guava in Hawaii, although in some other countries it is under regular cultivation. It is quite possible that the application of science to the selection of superior strains and to the proper cultivation of the shrub might greatly increase the quantity per unit area and the quality of the product so that the guava could become a feature of great economic importance in these Islands, instead of a liability.

The *waiawai*, or mandrake, is a variety of the strawberry guava but is more a tree than a shrub. Its fruit is orange yellow and somewhat inferior in flavor, but is eaten to some extent. The tree is a handsome ornamental and occurs not uncommonly in gardens.

See also "Feijoa."


GUAYULE Guayule (*Parthenium argentatum*) is a desert shrub, occurring in northern Mexico and southwestern United States, the latex of which is used com-
mercially in the making of rubber. During the past quarter century there has been some interest in the south-western states in the cultivation of this plant on an extensive scale, as a means of providing a domestic source of rubber.

Some 25 years ago the Cookes undertook to establish this plant on Molokai, where it was believed the conditions for it were ideal. An investment of several thousands of dollars was made in obtaining a supply of guayule seed in Mexico and in preparing the land for planting. Unfortunately, however, the seed failed to germinate, and the project was abandoned.6

GUINEA GRASS. Guinea grass (*Panicum maximum*) is becoming widely distributed and in some localities is highly valued for pasturage. It was first introduced by D. M. Forbes in the 1880's.


HALA. The leaves of the hala tree, or screw pine (*Pandanus odoratissimus*), provide excellent material for the weaving of mats, hats and many other useful articles, and have been used in this way by the Hawaiians for many centuries. Before the coming of western civilization it was by far the most important fiber plant in these Islands.

The economic value of this tree in those early times is difficult to estimate, but certainly it was relatively great. During that period, however, and even down to the present century the products of this fiber plant were chiefly for local use; in the nineteenth century there was a small amount of unorganized exportation, chiefly through purchases by tourists and travellers.

By 1910 a small movement had begun to develop an organized business in the shipping of lauhala products to the mainland, as there was a belief that it "should become an industry in these Islands" by using the labor of women at home and children in the schools.1 In that year (1910) special efforts were put forth in this direction and as a result some $6,798 worth of articles made of lauhala were shipped to the mainland. Subsequent years,

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6Information furnished by Mr. Richard A. Cooke.
7Thrum's Annual 1911:38.
however, did not keep up that standard, though small amounts were shipped continuously. It should be noted that the following table of figures does not indicate the full extent of this industry, for sales within Hawaii are several times as great in the total amount as the reported exports:

**EXPORTS OF LAUHALA PRODUCTS**

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</tr>
<tr>
<td>1928</td>
<td>1,698</td>
</tr>
<tr>
<td>1929</td>
<td>2,540</td>
</tr>
<tr>
<td>1930</td>
<td>2,038</td>
</tr>
<tr>
<td>1931</td>
<td>2,221</td>
</tr>
</tbody>
</table>

At the present time there is a strong effort being put forth by the Hawaiian Board of Missions to stimulate a revival of this ancient art among the Hawaiian families living in certain rural areas where the hala trees are especially abundant, as in Puna and Kona, etc. It is believed that a lucrative, though small, industry can be fostered which will appreciably augment the income of many rural homes. It is said that some 200 families are now engaged in this industry and the market for the products is steadily expanding.

**HAWAIIAN RASPBERRY** See “Akala.”

**HEMP** Hemp (*Cannabis sativa*) is a temperate zone plant of the milkweed family. The fibers of its stems constitute the hemp of commerce, used extensively in the making of rope, twine, laces and many other things. In its leaves and flowers there is a drug, known as hashish or marijuana, which in some countries is the source of some revenue and much evil.

Until recently, the making of hemp fiber has required a great deal of tedious human labor and, consequently, it was chiefly in countries of low wage standards that the industry developed. India, especially, has long been noted for its production of hemp fiber, as well as hashish. In recent years, however, American inventiveness has developed machines which harvest and lay out the hemp
plants for retting and later gather and clean the fiber. This has made possible the development of a hemp fiber industry in those sections of the United States where climatic conditions are favorable, as in the northern Mississippi Valley states.

Hemp culture has recently been given a limited trial in Hawaii, seed having been obtained by the Agricultural Extension Service a year ago. Plantings at Hanalei and Kapaa on Kauai and at Makawao on Maui showed poor results.

Several other fiber plants are commonly called hemp: manila hemp, a relative of the banana (see “Manila”); sisal hemp, a kind of century plant, or Agave (see “Sisal”), and malina, which is a closely related species (see “Malina”); sunn hemp, a leguminous plant (see “Sunn Hemp”), and bowstring hemp (see “Sansevieria”).

HEVEA  See “Rubber.”

HIBISCUS  The hibiscus,² official flower of Hawaii and most lovely of all her ornamentals, may scarcely be considered to be of commercial importance except possibly as an article of sale by nurseries. The poor keeping qualities of the flowers and their omnipresence in all yards and at all times of the year have prevented the development of a regular market for the hibiscus. From the esthetic point of view, however, this garden plant has very great value not measurable in dollars and cents.

There are many householders and some horticulturists who find a pleasant avocation in the breeding of new hibiscus varieties by cross-pollination, with the result that there are now many thousands of named varieties.

The earliest of these originators was Valentine Holt who in 1910 to 1914 as a specialist at the Hawaii Experiment Station introduced some new types from abroad and by crossing had over 1,000 different varieties, some of them exceedingly beautiful. In those years the Station distributed about 150,000 cuttings of hibiscus for home beautification.

For detailed information as to culture, propagation, cross-pollination and other subjects, the reader is referred

²The principal parent species of the many hybrids in Hawaii is Hibiscus rosa-sinensis.
HILO GRASS  Hilo grass (*Paspalum conjugatum*) has been in Hawaii since 1840, or earlier, and is very widely distributed and abundant. As a pasture grass it is considered relatively inferior, to be used only until better kinds can be established.


HOGS  See “Swine.”

HONEY  See “Bees.”

HONEY-DEW MELON  This horticultural variant of the cantaloupe and muskmelon is produced to a very limited extent in Hawaii. See “Cantaloupe.”

HONEYWORT  Honeywort (*Cryptotaenia canadensis*) produces scented foliage somewhat resembling celery leaves in appearance. The leaves are used as a condiment in soup, or as greens. Production is very limited, chiefly in the upper ends of the valleys near Honolulu.

See also “Truck Crops.”

HONOHONO  Honohono (*Commelina diffusa*) is an astonishingly rapidly growing grass-like plant which is much used in Hawaii as a feed for livestock, particularly dairy cattle.

Some tests have shown that under favorable conditions an acre of this grass may yield over 200 tons of green matter per year, equal in feeding value to about 40 tons of green alfalfa.

Honohono grows wild in many places and is used both as pasturage and as a source of cut feed delivered to the dairy barn. As its feed value has been considered questionable by some dairymen, the belief being that it causes a lowering of the butterfat content of the milk, a test was made at the University Farm in 1925. The results justified the use of this common weed as a dairy feed, for the butterfat content seemed not to be adversely affected by its use. The principal item of cost in using this feed is the expense of cutting and transporting it to the dairy. As it grows usually in swampy regions it may be a poten-
tial source of liver-fluke infection in the dairy herd.

HORSE RADISH The horse radish (*Armoracia lapathifolia*), the root of which is used in the making of a spicy relish, is produced but sparingly in Hawaii, notwithstanding the fact that it grows readily and yields well. The consumption demand here is very limited.

See also “Truck Crops.”

HORSES* The first horses to be brought to Hawaii were imported in 1803 by Richard J. Cleveland who secured these animals in California. By 1851 the number had increased to about 12,000, but comments by agricultural observers in those days as reported in the Transactions of the Royal Hawaiian Agricultural Society indicate that probably not more than half of them were used for any worthwhile purpose and were probably more of a liability than an asset to their owners.

Thoroughbred horses were imported from England, probably by way of Australia, about 1870, and Aubrey Robinson brought in Arabians from India and Arabia in 1884.

Horse racing became popular in the Islands about seventy years ago and a race track was established in Kapiolani Park about 1872 and continued in use until about fifteen years ago. In the days of King Kalakaua a race track was maintained at Waimanalo. Racing fostered a new interest in horses, and animals of excellent breeding were brought to Hawaii. The interest in racing has, however, declined in Hawaii as it has on the mainland and at present race tracks in the Territory are limited to one at the Maui fairgrounds and another track for training purposes on the Parker Ranch.

Polo continues a popular game in the Territory and excellent polo ponies have been produced and matches are held each year, notably between teams from Maui, Oahu, and the Army.

In former days, overseers on plantations used light horses almost entirely in getting about to supervise their

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*This statement was prepared by Prof. L. A. Henke.*

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work but with the advent of motors and better roads on the plantations, automobiles are being more generally used for this work.

The light horses of the Islands are largely of thoroughbred breeding including some Arabians and American Saddle Horses.

Draft breeds have never been numerous, most plantations preferring mules for heavy work. Percherons probably lead among the draft breeds and many Percheron mares are used for mule production, notably on the Parker Ranch.

Practically all of the larger beef ranches maintain and produce some horses and offer their surplus for sale to "riding academies," of which there are several in Honolulu, and to other purchasers. Some of the better racing horses and polo ponies are sold on the mainland. In former years when the U. S. Army maintained a cavalry division in Hawaii, many locally produced horses were sold to the government.

The automobile and tractor have caused a large decrease in the number of horses in Hawaii, as indicated in the following tables:

<table>
<thead>
<tr>
<th>Year</th>
<th>Horses in Hawaii</th>
<th>Importations of Horses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>12,982</td>
<td>366</td>
</tr>
<tr>
<td>1910</td>
<td>15,856</td>
<td>147</td>
</tr>
<tr>
<td>1920</td>
<td>24,307</td>
<td>497</td>
</tr>
<tr>
<td>1930</td>
<td>15,797</td>
<td></td>
</tr>
</tbody>
</table>

Parasites affecting horses in Hawaii are listed in Haw. Exp. Sta. Annual Report 1936:82.

HUBAM CLOVER Hubam clover (*Melilotus alba annua*), a hybrid variety, is a temperate zone soiling and fodder crop which attracted much attention on the mainland a few years ago. It was given a trial here but the results were not promising.


INDIGO The indigo plant (*Indigofera suffruticosa*), cultivated in the East Indies and other tropical countries
for a dye which is expressed from it, was introduced into Hawaii in 1829 by Dr. A. P. Sevier\textsuperscript{1} with the idea that it might become the basis of an industry here. Its cultivation was not taken up, but nevertheless it became established in the wild state.

Some years later, a chemist, D. Frick, made some studies of the wild growth and reported\textsuperscript{2} some good possibilities of establishing an indigo industry in these Islands, using either the wild plants or returning them to cultivation. The Royal Hawaiian Agricultural Society appointed a committee to study\textsuperscript{3} the chemist’s recommendations and eventually a half-hearted endorsement was given, indicating that a moderate profit might be realized in manufacturing indigo from the wild plants, but if an effort should be made to develop the industry on the basis of cultivation the committee expressed the “fear that the very high price of labor would nearly, if not entirely, absorb all the profits.”

Notwithstanding this report, Frick himself undertook to establish an industry by building a small plant in Nuuanu Valley. After nearly a year’s trial he gave it up because of his inability to find a buyer for his product. No one in Hawaii or California was interested in buying, and he had insufficient capital to push his experiments further.

Many years later, in 1895, the growing of indigo was urged as a rotation crop on sugar lands. It was pointed out that some thirty years prior to that time “the Island of Oahu was overrun with wild indigo” and that cattle finally exterminated it by eating and trampling it.\textsuperscript{4}

**IRONWOOD** The ironwood tree (*Casuarina*, several species) is an introduction from Australia. It is a valuable addition to our list of trees, especially for the lowlands near the sea. It grows very rapidly and produces good fuel wood, one record on Kauai showing 65 cords per acre in 19 years of growth.\textsuperscript{5}

The ironwood is useful, also, in windbreaks and as a

\textsuperscript{2}Same, Vol. II, No. 2, p. 79.
\textsuperscript{3}Same, Vol. II, No. 2, p. 82-3 (1855).
\textsuperscript{4}Planters Monthly Vol. XIV, p. 486 (1895).
\textsuperscript{5}Haw. For. Age. 1915:208.
forest cover in the lower foothills where rainfall is not very abundant.
Ref.—Planters Record II, 1875 VI, 71, 77.

JACK BEAN  The jack bean or sword bean (*Canavallia ensiformis*), has been used advantageously as a soil-ing crop in Hawaii.
Ref.—Planters Record (H.S.P.A.) III, 54.

JACK FRUIT  The jack fruit (*Artocarpus integrifolia*) is similar in some respects to the breadfruit, which see; it is much less edible and is very uncommon in Hawaii.

JAMBOLAN PLUM  See “Java Plum.”

JAPANESE PLUM  See “Loquat.”

JAVA PLUM  The Java plum (*Eugenia Jambolana*), sometimes called jabolan plum or Portuguese plum, is a native of southern Asia. It was introduced into Hawaii many years ago for use as an ornamental and has established itself in the wild state in many localities throughout the Territory, bidding fair to become something of a nuisance because of the ease with which the seed is disseminated by mynah birds. The fruits are about the size and appearance of a small, purplish-black plum; although edible when thoroughly ripe, very little use is made of the fruit. Effects should be made to discover any potentialities in it for commercial exploitation, since it is becoming so abundant.

JELLY MAKING  There are many kinds of fruits in Hawaii suitable for use in the making of jellies and preserves on a commercial basis. A list would include the following:

Akala  Ohelo
Carambola  Orange
Carissa  Papaya
Guava  Pineapple
Java plum  Pohā
Jujube  Roselle
Kumquat  Surinam cherry
Loquat

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For detailed directions for the making of jellies and jams consult Bulletin 47 of the Hawaii Experiment Station.

**JERUSALEM ARTICHOKE** The Jerusalem artichoke (*Helianthus tuberosus*) is a sunflower, not an artichoke. It is of commercial importance due to the fact that its tubers yield levulose, an uncommon kind of sugar which commands a relatively high price in the market because of its rarity.

The U. S. Department of Agriculture has been for several years promoting the cultivation of this plant in various parts of the mainland for its commercial value as a source of sugar, with only moderately successful results. Trials have been made in Hawaii by the H.S.P.A. Experiment Station, but without practical success. The tubers grow readily enough here and produce vigorous plants, but the propagation from one planting to the next is difficult because of the fact that the tubers seem to require a resting period between seasons. The equable climate of Hawaii causes growth activities of the plant to be continuous, with no period of rest. It is said, too, that termites attack the tubers and destroy them.

A much more promising source of levulose in Hawaii is the common ti, which grows abundantly throughout the Islands.¹ See “Ti.”

**JESUIT NUT** The Jesuit Nut (*Trapa bicornis*) is a floating aquatic plant which produces a nut-like seed used by the Chinese in certain festivals. Its consumption here is very small and its production limited.


**JUJUBE** The jujube (*Zizyphus Jujuba*) is an Asiatic fruit, sometimes called Chinese date. It came to Hawaii from China many years ago. It is a small tree which produces yellow fruits about the size of a cherry or date, much prized by the Chinese for the making of condiments and preserves.

It is grown chiefly as an ornamental in Hawaii and is comparatively rare.

¹Information concerning these trials was obtained from Dr. H. L. Lyon, Director of the H.S.P.A. Experiment Station.
In California this fruit is processed in sugar syrup to give it a consistency similar to that of the dried date and in this form it is finding favor to an increasing extent. It is possible that an industry might be developed here on this basis, using some of the more arid areas for its cultivation, as the Lualualei homestead district near Waianae (Oahu).

**KALE** Kale (*Brassica oleracea acephala*) is a relative of cabbage but does not form a head; its succulent leaves are cooked as greens. It is not commonly produced in Hawaii, but occasionally may be found in truck gardens.

**KAMANI** There are two different species of tree called kamani. One, *Terminalia catappa*, is a familiar shade tree with fruits which are shaped somewhat like an almond nut, hence the name “tropical almond.” The kernel of the seed is edible, either raw or roasted, but no commercial exploitation of this product has been developed.

The other, *Calophyllum inophyllum*, probably has a better right to the name “kamani,” as it has been in the Islands for many hundreds of years. Its fruits are globular and not good to eat.


**KAPA** See “Tapa.”

**KAPOK** The kapok, or cotton tree, (*Ceipa pentandra*) is a large tree which produces seed pods filled with light, silken fiber which is sometimes used for commercial purposes, as for stuffing pillows, mattresses, life-savers, etc. There are a few specimens of this species in various parts of the Territory, introduced by the Board of Agriculture and Forestry, but growth has been only moderately good, indicating that climatic and other conditions are not ideal. No commercial use has been made of them.

**KARBOTEX** See “Bagasse.”

**KIAWE** See “Algaroba.”

**KIKUYU GRASS** Kikuyu grass (*Pennisetum clandestinum*) was introduced into Hawaii in 1924 by F. G.
Krauss. It is proving to be very valuable and its use is spreading, especially in dairying regions.

KING ORANGE See “Mandarin Orange.”

KLU Klu is the Hawaiian name for a very common leguminous shrub (Acacia farnesiana) which grows freely in arid waste places. In India it is known as “cassie.” Its flower is valuable as a source of perfume and in India is an article of commerce, commanding 50 to 75 cents per pound when dried.

The Hawaii Experiment Station in its first year of operation (1901) called public attention to the klu flower as a possible source of new revenue in these Islands, but little effort has ever been put forth as a result to develop this wild “crop.” A few tests have been made of the perfume content of the Hawaiian klu, and these give indications that the flowers here are quite equal to and perhaps even a little better than the India product.

As a source of honey the klu has a small value, but far less than the algaroba.

KOA The koa (Acacia Koa) is a native of Hawaii and once comprised a large part of the forest cover here. The wood is used for furniture, cabinet work, ukuleles, etc. A quarter century ago and earlier it was taken from the forests more extensively than now, and was marketed under the trade name “Hawaiian Mahogany.”

See “Forest Products,” also, “Tan-bark.”

KOA HAOLE Koa haole, ekoa, or false koa (Leucaena glauca) is a very widely distributed shrub or small tree which grows wild in dry localities where little else will grow. Its foliage and pods are eaten by livestock and have a very high nutritious value, as the plant is a member of the leguminous family. Chemical analyses in the University laboratories indicate a high protein content, 6.74 percent in the fresh state and over 24 percent in dried material.

It should not be used as a feed for horses as it causes the tail to shed its hairs badly.

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For cattle and hogs it is a very valuable feed, because it is both nutritious and cheap. If dairy cattle are fed exclusively on koa haole the milk acquires a disagreeable flavor, but when used in a mixture with several other feeds, the milk flavor is not affected.

As a source of fiber this plant is said to have some value.


KOHLRABI The kohlrabi (Brassica oleracea Caulorapa), is a member of the mustard family which provides man with many food plants. The edible portion of the kohlrabi is the fleshy, succulent petiole and midrib of the large leaves.

Production of this plant in Hawaii is very limited, as the demand is not great. Some market gardeners devote small areas to its production, the aggregate of all probably being less than 5 acres.

See also “Truck Crops.”

KOLA The kola nut (Sterculia acuminata) is the source of a drug containing caffeine. The tree is a native of Africa. In 1884 an effort was made to establish the production of the kola nut as an industry in Hawaii, for the market was then offering $400 to $500 per ton for the nuts. A small quantity of seed was obtained from Africa by Mr. A. Jaeger and planted at Ulupalakua (Maui), but nothing of commercial importance seems to have resulted. Mr. C. S. Judd believes none of these trees is living today.


KUDZU The Kudzu (Pueraria thunbergiana) is a perennial vine which is sometimes grown for ornamental purposes in Hawaii. Its roots become greatly enlarged, resembling a sweet potato in general shape, but in texture being coarser and more fibrous. Although full grown root enlargements may attain a length of two feet and a diameter of twelve to eighteen inches, it is only the young roots that are fit for use as food. The older, larger roots are sometimes used in the manufacture of starch.¹

KUKUI  The kukui tree (*Aleurites moluccana*), widely distributed throughout the South Pacific and southern Asia, has been in Hawaii for many centuries, probably having been brought by Polynesian immigrants. Its light green foliage is a distinctive feature in the lower forests, especially in areas where rainfall is ample. The tree produces large quantities of oil-bearing nuts which are enclosed in a leathery husk. At maturity the nuts drop from the tree and soon the outer husk sloughs off, leaving a hard-shelled nut which encloses the oily kernel.

Hawaiians long ago discovered two uses for the nuts: as a condiment with their meals, and as a means of illuminating their houses. Small quantities of the kernels ground into a coarse meal were found to be wholesome, probably because of the laxative effect. Illumination was secured by "stringing" the nuts in a row on a green stick and igniting them, or by crushing the nuts and igniting the oil. From this use they have come to be called the "candle-nut."

The oil of various species of *Aleurites* has been used by man for many centuries, as food sometimes but much more commonly for oiling paper and wooden surfaces. Like linseed oil, it dries quickly and therefore is particularly valuable for protecting the surface of wood. When, therefore, foreigners came to Hawaii and found great quantities of these nuts available for the gathering, efforts began to be put forth to take advantage of the situation. Crude presses were made for expressing the oil and from time to time some hundreds or a few thousand gallons were shipped out to the United States. One report has it that exports reached an annual maximum of about 10,000 gallons between 1840 and 1850, all manufactured by very crude methods.

In 1855 a chemist by the name of Frick undertook to devise an improved type of machine for expressing and refining the oil and reported to the Royal Hawaiian Agricultural Society that he believed he had solved all the problems and could show the way to establishing a good industry in manufacturing this oil either for paint pur-

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poses, soap making or for culinary use. The annual crop of nuts continued to fall unused, however, for Frick's plans were not put to practical use.

In 1913 the Hawaii Experiment Station had its attention drawn to "the enormous quantities of kukui nuts going to waste throughout the Islands" and began a study of the problem. A bulletin was issued reviewing the existing knowledge on the subject, and offering an estimate that about 15,000 acres of mountain land was occupied by kukui, of which at least 10,000 would be accessible for gathering the nuts for commercial use; further, that the average yield of nuts should be about 5 tons per acre per year, and that these 50,000 tons of nuts when gathered and put through the presses should yield 2,375,000 gallons of oil.

Paint and varnish companies in the United States were at that time becoming interested in the possibilities of producing this oil in America in order that they might obviate the uncertainties of dealing with such a distant country as China. The Chinese tung oil, or wood oil, made from *Aleurites fordii* in China, was considered better than kukui oil, and extensive plantings of the Chinese species were being made in Florida and other southern states. While they preferred the tung oil, these manufacturers were interested, also, in Hawaiian kukui oil and for several years made various gestures calculated to stimulate a greater effort here at developing a large industry.

The chief obstacle seemed to be the cost of gathering the nuts. At prevailing prices for the oil, $1.50 per day was about all that could be paid for the labor of gathering nuts in the forests and that was apparently not enough to attract the response that was hoped would come when various firms and individuals at one time or another offered to buy nuts delivered to a factory.

When it was found that tung oil produced from *Aleurites fordii* is better for paint and varnish manufacture than the Hawaiian kukui oil, *Aleurites moluccana*, but that the latter species bears more heavily than the former, efforts were made by the Hawaii Experiment Station to cross-pollinate the two in the hope that the good qualities

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of both might be consolidated into one hybrid type of tree. Thus far nothing of commercial importance has resulted from these efforts.

Several experimental plantings of the tung oil tree \((Aleurites fordii)\) have been made in Hawaii, some by the Board of Agriculture and Forestry and some by individuals, as for example Mr. Pauls who has a small grove in Kona (above Keauhou). This tree grows best in a temperate zone climate where the nights are cold and frosts occur, and therefore in Hawaii only the upper elevations, above 4000 feet, should be considered. Such areas are usually difficult of access, the general terrain being mountainous and rough; thus, not only would the planting and cultivation be more expensive than on flat land, but the gathering of the nuts and transporting them to a factory would be relatively expensive. Florida is using large stretches of level lands for this tree, where it is possible to use machine methods on an economical basis.

By developing a hybrid type of tree which would bear abundantly the preferred kind of nut and would grow well in areas more accessible to being worked than the higher mountainous regions just mentioned, it might be possible to develop an industry on this commodity. At best, however, the prospect is not as attractive as that offered by certain other crops.


KUMQUAT The kumquat \((Fortunella japonica)\) is a member of the large group of citrus fruits. It is a shrub or small tree, useful as an ornamental, and produces an abundance of small, golden fruits resembling a sour orange in flavor and structure, but only an inch or less in diameter. The fruits are used sometimes in the making of preserves and marmalade. Although the kumquat grows very well in Hawaii and occurs not infrequently in gardens, it is not exploited commercially.