

The Principal Chinese Vegetable Foods and Food Plants of Chinatown Markets

The array of vegetable foods found in the Chinatown markets of New York and other large cities has not only excited the curiosity of those looking for exotic foods but also stimulated interest in the plants themselves.

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Introduction

The vegetable produce of the Chinese not only is varied but is strange to Occidentals. Lists of Chinese food plants and descriptions of them have been published at various times, but little has been written specifically about the Chinese vegetable foods bought and sold in our metropolitan Chinatown markets. They represent an interesting and unique collection of tubers, greens, melons, fruits, nuts, seeds, grains and other food products. Because the Chinese in their own country have had to squeeze every ounce of food possible out of the soil to sustain their lives, they have more thoroughly investigated available plants for their food possibilities than we of the West, and this explains the greater variety of the foods and food plants which they use.

A few of the vegetables sold, such as cabbage, found their way into Chinese markets in the United States many years ago, but a large number, because they do not appeal to American palates, because of difficulties in raising them as agricultural crops or perhaps merely because they are as yet unknown to the American farmer, are cultivated by Chinese truck gardeners exclusively for Chinese use, that is, for their own benefit or for Chinese-American restaurants. Some,

however, are very good eating and deserve an opportunity to compete in American markets. Among the foremost promoters of Chinese vegetables for use in the United States was Dr. L. H. Bailey. Others, like F. N. Meyer, were of the opinion that it would take some time for the white race to acquire a taste for the majority of Chinese vegetable products. Foreigners living in China have made good use of some of the more delicate tasting vegetables, *e.g.*, water chestnuts and bamboo shoots, and upon their return have continued to eat them when they could be found.

This article does not attempt to provide a completely comprehensive treatment of all Chinese vegetable foods appearing in the markets, but an effort has been made in it to assemble and present some of the scattered information about those most commonly seen. The illustrations are photographs taken by Miss Fleda Griffith, formerly of the New York Botanical Garden, of samples collected by the author from the Chinese food shops in New York's Chinatown. The collection was made before World War II, when supplies of fresh, dried, pickled and candied articles of food were readily available. No exact estimate of the effects of the war on this supply is made, but it is apparent from the canned Chinese foods on the market put up in this country that, whatever the difficulties in keeping supplies moving, they

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have been in some measure overcome. Fresh greens, legumes and some cucurbits are locally raised for the markets on Chinese farms of Long Island, New York, and in scattered areas southward along the eastern seaboard. It is also reported that greens for the winter trade and some subtropical articles are supplied from gardens in Florida and even from Cuba.

In the following discussion the vegetable foods are divided into five groups *a*) cereal grains and other seeds; *b*) roots and tubers; *c*) shoots and greens; *d*) fruits and nuts; and *e*) cucurbits. If a plant contributes to two or more categories, it is discussed in its entirety when first mentioned. Algae and fungi used as foods are not discussed in this paper. All figures given in analyses are percentages.

Cereal Grains and Other Seeds

Rice. Rice (Mi) is the staff-of-life among the Chinese. It constitutes more than a third of their daily food and one-half of the vegetable part of their diet if the menus of all classes are averaged. Though not a purely Chinese food, it is from China that we have the earliest reports of it. The term "rice" is basic in the Chinese language and has come to mean "food" in general. Since earliest times the use of rice as food and its cultivation have spread over the whole world, and today there are many varieties. The earliest distinctions were made between glutinous and non-glutinous rice, also between water rice (Shui Mi) and dry or upland rice (Han Mi). The Chinese are very particular about their rice, and when moving from one part of the country to another, they usually carry their own with them.

The rice most commonly used is grown in water and is botanically known as *Oryza sativa* L. It is planted and germinated under water in small paddies before planting it out. The paddy fields,

each surrounded by low earthen dikes, cover valley bottoms and flood plains, and even climb the hillsides by a succession of narrow terraces which follow the contour of the land. The water buffalo, which must spend a part of each day in the water for his own well-being, is still used to drag the ancient wooden plow through the muck of the paddies. In some areas two and even three crops are raised and harvested annually. When ripe, the grain is beaten out by the ancient method of flailing, and the beaten ears are tossed into the air so that the chaff is blown free. The methods of rice-growing in China do not change with the passage of time.

The rice bought in Chinese markets is mostly polished rice, but there is some unpolished (whole or rough) rice sold also. The rice stocked in the grocery stores of American cities, unless otherwise designated, is polished. According to Chinese custom, only polished rice is fit to be eaten; unpolished rice is eaten only by coolies and livestock. Westerners, however, find the latter more healthful, though the former is the basis of many dishes. An unvaried diet of polished rice causes beri-beri, and many of the poor Chinese contract the disease for this reason. It is energy-giving but has little food value. It lacks not only vitamin B₁ but also other vitamins. As seen from analyses, whole rice is recommended on account of its definitely superior content of vitamins, salts and protein.

Whole or rough rice is the product after threshing. To polish it, the rice is milled. Milling removes the rough bran and polishes it white. In the process, first the hull and then the germ and all the layers of bran are removed except a part of the last layer. Only the starchy part of the kernel is left, surrounded by a part of the last seed-coat layer which is very rich in protein. Milling removes only about 10% of the protein. When

the germ is removed with the bran, 85% of the oil content of the kernel is lost. It is of note that rice-bran oil has been used in the cosmetic industry as an ingredient in shampoos to prevent removal of natural oils from the scalp. The oil is claimed to possess excellent skin-lubricating action and to be particularly effective for nourishing the skin. Unpolished rice contains a fair amount of vitamins A and G, and is a good source of vitamin B. The calorific value per 100 gm. of rice averages approximately 350.

Besides rice in its usual cooked form, it is also eaten as congee and as a breakfast food in the form of puffed rice. Congee is a thick gruel made from pro-

distilling spirits, for pastry, for sweetmeats, for dumplings and as puffed rice. Chinese puffed rice is not so large as American puffed rice, being enlarged only to about twice the size of the ordinary grain. In China it is the foundation of candy balls, also a sticky confection sold by street vendors in strips or cakes. Cakes made of this rice and fried in camel's fat are used for hemorrhoids. Congee is used in fevers as a diuretic, and both internally and externally as a demulcent. Rice flowers are dried and used as a dentifrice and cosmetic. Ashes of the hulls serve to clean discolored teeth.

Analyses of polished, whole and glutinous rice are as follows:

	<i>Oryza sativa</i> L.		<i>Oryza montana</i> L.	<i>Oryza glutinosa</i> Lour.
	Polished 1st grade	Whole rice	Upland rice	Glutinous rice
Water	12.25	9.8	13.78	14.20
Protein	7.29	7.3	7.12	5.88
Fat	0.46	2.0	0.26	1.41
Carbohydrate	79.16	66.9	77.40	77.18
Crude fiber	0.18	8.6	0.68	0.20
Ash	0.66	5.4	0.76	1.13

longed boiling of rice and is an almost universal staple of the Chinese breakfast, being eaten with a relish of salted vegetables or bean curd. It is easily digested and fattening, and as a diet for the sick it is most excellent, being demulcent, cooling and nourishing.

Rice is said to benefit the breath, remove anxiety and thirst, check discharges, warm the viscera, harmonize the gases of the stomach and cause the growth of flesh. Lixiviated ash of rice straw is used as an antidote in arsenical poisoning. Rice straw is a useful roofing material, and there are many farm dwellings in Central and South China whose roofs are thatched with it. It also makes an excellent packing material for glassware and china, and is used for fuel.

Glutinous rice (No Mi) is used for

Soybean. An important and useful Chinese food sold in Chinatown and now thoroughly established and grown as a domestic crop in the corn belt of the middle western United States is the soybean, *Soja max* (L.) Piper. Once honored as one of the "five grains" sowed by the Emperor of China as part of the ritual performed at the vernal equinox ceremonies in old Peking, it now has a highly esteemed place as a raw material in the industrial world. Besides food, it constitutes an important basic material in the manufacture of soaps, oil, plastics, rubber and many other useful products.

Since early days people have exploited the soybean. It is referred to by the Chinese as "the poor man's meat and the poor man's milk". Since then the food aspects have been elaborated upon,

and soybeans are now served in more than 400 tasty ways by Chinese housewives. In New York the soybean is sold in the Chinese shops mainly in three forms: seeds, bean sprouts and bean curd. Soy sauce and soybean oil can also be obtained. The former is a heavy dark fluid which is used as a condiment to supply saltiness that brings out flavor, and the latter serves in cooking like other oil or butter, and also for lighting lamps.

In the United States the first reference to soybeans was made by James Mease in 1804. While the white, green, black, brown and spotted varieties were the first of importance, there were 16 sub-varieties based on differences in form, size and color. Now 2,500 forms are known, out of which 100 named varieties are handled by domestic growers and are the objects of much investigation by the Federal Government's Agricultural Experiment Stations.

The soybean as food is very important because of its high protein content. Not only do the beans provide good food, but the germinated seeds, known in the markets as "bean sprouts" (Fig. 1), provide a most palatable vegetable when cooked. These have become so popular that they are now canned and sold in American grocery shops. Bean cheese, or curd (Tou-fou), from soybeans is also eaten (Fig. 2). In the Chinese shops bean curd is kept in empty kerosene tins under water. To make it, soybeans are soaked in water three hours, reduced to a paste, then cooked. After being strained through a coarse cloth, the milky white filtrate, rich in protein and fat, is treated with crude salt (mag-

nesium chloride). The protein material is precipitated, and the coagulated mass is pressed and kneaded into small cakes. The cakes may be dipped for a few moments into a saline solution of curcuma. A filtrate from cooked soybeans resembles milk and is known as "soybean milk". When heated, a skin such as forms on milk rises to the surface. For many purposes it can be successfully substituted for cow's milk.

Food uses of soybeans, such as flour and meal, should be mentioned. It is said that as high as 20% of soybean flour can be used in making bread without changing the flavor while increasing the protein content from 6% to 12%. This bread is said to be good for diabetics. Soybean flour contains four times as much protein as oat flour, *i.e.*, 52.20% to 13.87%, and about one-fifth the amount of fat (1.2% to 6.18%). The manufacture of soybean flour yields an important by-product, lecithin, which is a fat rich in phosphorus and very useful in the preparation of certain foods and medicines. It is commercially less expensive than lecithin obtained from eggs.

Analyses of soybeans give the following results:

Moisture	8.88
Protein	42.20
(True proteids)	31.28)
Fat	13.36
Fiber	5.20
Carbohydrate	26.13
Ash	4.23
(Starch)	small quantities)

Analyses of four food products of soybean are shown in the following tabulation:

	Water	Protein	Fat	Carbohydrate	Undet.
Bean cheese (Tou-fou)	76.15	13.15	7.09	1.40	...
Soybean milk	93.10	3.13	1.89	0.51	...
Bean oil (Tao-yu)	57.12	7.49	...	18.76	...
Soy sauce (Tao-jung)	62.86	12.67	1.21	6.71	2.77

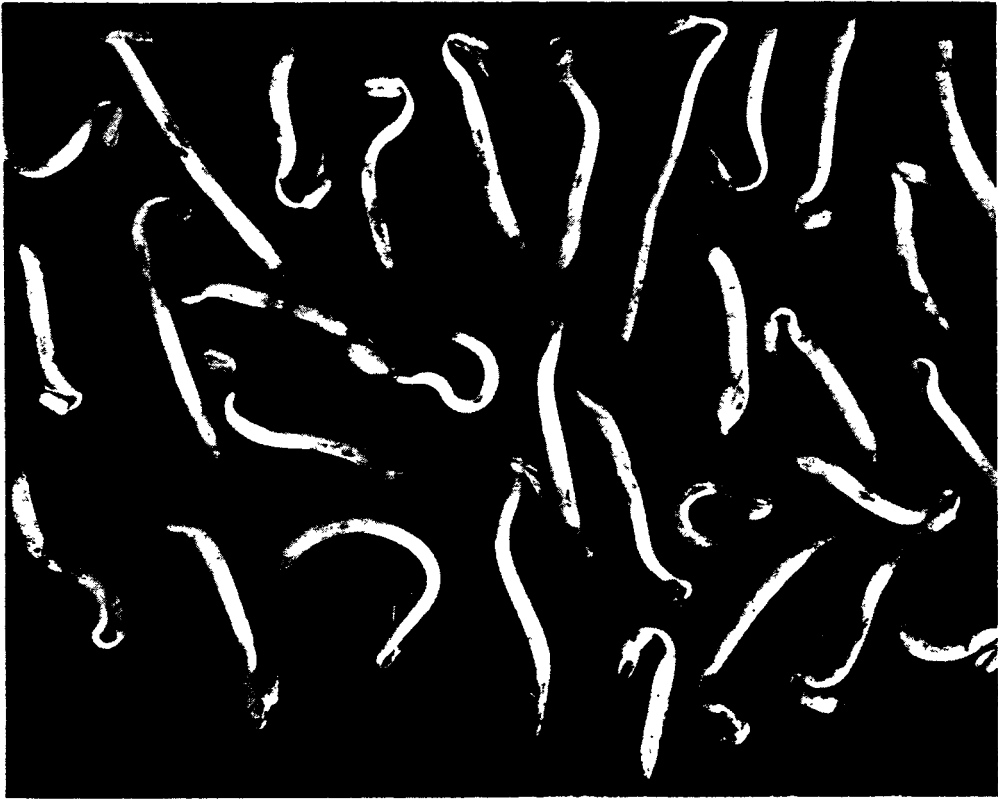


FIG. 1 (*Upper*). Bean sprouts ready for cooking.

FIG. 2 (*Lower*). Tou-fou, bean curd, a cheese made from soybean.

According to Jones, dried soybeans contain potassium, sodium, calcium, iron, copper, magnesium, phosphorus, sulphur, chlorine, manganese and zinc. Another analysis for mineral content shows that yellow soybeans contain 0.49% aluminum as aluminum oxide, about the same of iron as iron oxide, 7.45% calcium as calcium oxide, and 7.34% magnesium as magnesium oxide. Soybean sprouts contain 0.43%, 10.96% and 8.63% for the same minerals, respectively.

The nutritional merits of the soybean are further evident in some figures found in a Chinese study of several important food plants. The biological value of soybean curd is designated as 65, and the coefficient of digestibility is 96. Soybeans are a good source of vitamin B, and they contain a small amount of vitamin G. Tests made with Chinese mice have shown both yellow and green soybean sprouts to be abundant sources of vitamin B. In other tests soybean curd (Tou-fou) was shown to possess a fair amount of vitamin A. Soybean oil contains little vitamin A or vitamin D. The fuel value of soybeans per pound is 1,985 calories.

Because of the industrial importance of soybeans and soybean products, some account should here be given of the uses to which they are put. The property of nitrogen-fixation in the nodules on the roots of the plant makes soybean a useful green manure and helps other plants associated with it to grow better. Since the nitrogen content of plants with nodules is 2.78% as compared with 1.77% in plants without nodules, the former are important as hay and forage for animals. Soybean hay contains 11.7% digestible crude protein as compared with 10.6% for lucerne hay and less for others. Oil bean cake, after the oil has been expressed, is used for fertilizer and also for animal food. The crude soybean oil, besides its use in cooking, goes mostly into the manufacture of soap. It is said

to give to soap the property of lathering, even in a 3.5% concentration of salt. In the manufacture of soft soap, soybean oil is superior to linseed oil, and in the manufacture of hard soap hydrogenated soybean oil is recommended as the best substitute for beef tallow.

Soybean meal is the raw material from which two important basic industrial products are made, a plastic and a fiber. Soybean meal with 9.28% moisture content plasticizes when subjected to 100° C. and a pressure of 5,000 pounds per square inch for five minutes. When plasticized, it seems to exhibit flow with the moisture content as low as 1%. For this reason the plastic does not fracture spontaneously on drying; it holds its shape well and is almost transparent. The only disadvantage has been that plastics made from either soybean meal or soybean protein are hygroscopic. Most of these plastics go into the manufacture of automobiles. The protein fiber from soybeans has the advantage, on the other hand, over those synthesized from cellulose of cotton and wood, in that the protein fibers are warmer and retain their shape longer. Furthermore, under controlled conditions the yield of protein fiber from plants will be 100% steady in contrast to that of animal protein fiber which is known to be variable. It is interesting to note that 200 pounds of soybean wool can be produced on the same amount of land that will yield only five pounds of sheep's wool. During the war about 1,000 pounds of soybean wool were produced each day, and all of it went into winter uniforms for the armed forces.

Thirty-six different varnishes containing 100% of their oil content from soybeans have been developed and given exposure tests. The acid-, alkali-, and water-resistance of many of these oils is excellent, but their drying is not so rapid as that of the super-quick lacquers which are so popular. Soybean oil is also the

basis of a capital substitute for rubber. The rubber-like material made from soybean oil, known as "norepol", has a tensile strength of about 500 pounds per square inch. It also exhibits good resistance to abrasion and is impervious to water and alcohol so that it can replace rubber in such products as insulation, shoe heels, fruit-jar rings, gaskets and tubing.

One of the more recent achievements in the exploitation of soybean protein has been the production of a stabilizer in foam fire-fighting apparatus used against burning oil tanks and on ships. World War II was chiefly responsible for this advance. Over 5,000,000 gallons of foam liquid were produced during the war, and in 1944 alone 900,000 bushels, or 40% of the total industrial consumption of soybeans in that year, were thus used. Other uses, too numerous to mention, include enamels, printing ink, linoleum, shortenings, margarine, foundry cores, glycerin, billiard balls and notepaper. In general values the crops of soybeans and the by-products derived therefrom in the United States represent an annual total income of \$45,000,000.

Mung Beans. Two kinds of mung beans are found in the food shops of New York's Chinatown, the green variety and the red. The former is botani-

and "Hung Tou" or "Ch'ih-hsiao Tou". These small edible bean seeds, almost spherical but flattened at both ends, are grown in China between rows of sweet potatoes and cotton, and ripen before either of the latter crops is ready to be harvested. Not only are the seeds edible and nutritious, but the green pods are also eaten. Over a hundred kinds of mung bean are grown in China and other Asiatic countries. In the United States the crop is becoming of increasing importance as a forage plant. The Hung Tou is good food for donkeys but is too heavy and heating for mankind.

Bean sprouts bought in the markets for eating are mostly from mung beans. The sprouts are made by soaking the beans in water, and are used in soup and as an ingredient in other Chinese dishes. They are also good cooked as a table vegetable with milk. The green mung bean is often ground into flour and can be used for making the kind of vermicelli known as "Fen-t'iao".

The mung bean contains proteins that are biologically complete and thus is superior to many other members of the bean family; it is reportedly deficient, however, in lime and sodium chloride. The following is an analysis of the green mung bean, green mung sprouts, and the red mung bean:

	<i>Phaseolus mungo</i> L. var. <i>radiatus</i> Bak.		<i>Phaseolus mungo</i> L. var. <i>subtrilobata</i> Fr. et Sav.
	Green bean	Bean sprouts	Red bean
Water	9.88	93.22	14.91
Protein	22.97	2.50	19.06
Fat	1.50	0.15	0.76
Carbohydrate	57.78	3.18	57.40
Crude fiber	4.04	0.63	4.44
Ash	3.83	0.32	3.43

cally known as *Phaseolus mungo* L. var. *radiatus* Bak., the latter as *P. mungo* L. var. *subtrilobata* Fr. et Sav. Their Chinese names are, respectively, "Lu Tou"

The calorific value per 100 gm. is 345 for the green mung bean and 321 for the red. Mung bean sprouts, while they are a good source of vitamins B and C, and

fair in A, have a calorific value only of 25. The green mung is fair in vitamins A, B and G, but low in C; the red mung is fair only in vitamins E and G.

Medicinally Lu Tou is considered to be a resolvent, carminative, antifebrile and counter-poisonous remedy. It is prescribed for lesions following smallpox, obstinate dysentery, bladder difficulties in the aged, and all sorts of poisons. Bean meal is similarly used and is highly regarded as a poultice in boils and abscesses, and as an antivinous remedy. The seed coat alone is considered antifebrile and is used in opacity of the cornea. The pods are used in obstinate dysentery, the flowers to counteract the effects of wine, and sprouts are considered to be countervinous and antifebrile. The leaves are steeped in vinegar and used in cholera. The Hung Tou is said to drive away dropsy and scatter carcinomatous and purulent swellings. It is prescribed in even a larger number of similar difficulties than the Lu Tou; many of these are obstetrical, such as threatened abortion, menstruation during pregnancy, difficult labor, retained placenta, post-partum trouble and non-secretion of milk. The leaves are recommended in fever and urinary difficulties, and the sprouts in threatened abortion, whether from abortive tendency or from injury.

Lotus. Lotus seeds (Lien Tzu), the "beans" that Pythagoras was said to have once forbade his disciples to eat, constitute another delicacy found in the Chinatown food shops (Fig. 3). They are produced by the Chinese lotus, *Nelumbium speciosum* Willd., and are about the size of a marble, white after the coverings are removed. The germ (plumule), which is green, must be removed because it is very bitter. Though they are an expensive luxury reserved for the rich, the poor man on special occasions may enjoy candied lotus seeds, or Bak-pao Fan, a kind of pudding with "eight precious" ingredients, of which one is

lotus seeds. They are eaten raw, candied, roasted, boiled or ground into flour, and are considered nourishing and highly beneficial to bodily health and strength, in promoting circulation and strengthening virility.

The composition of dried lotus seeds is:

Water	8.72	Carbohydrate	58.14
Protein	16.64	Crude fiber	3.15
Fat	2.44	Ash	3.03
		Undetermined	7.88

The viability of lotus seeds is well known. Experimenting with lotus seeds discovered buried deep in the soil of a certain district in southern Manchuria, one Japanese authority states that seeds buried at least 120 years had retained their vitality and that all seeds used in the test germinated without exception. After filing the seed coat the first signs of germination appeared in about four days.

The rootstock of the lotus is another food on sale (Fig. 4). It looks like links of a large sausage and is bought raw in bulk, boiled and sold in slices, or preserved dry in slices (Fig. 5) for future shipment to other localities. The "arrow-root" made from the fleshy rhizome is called "Ou-fen" and is aromatic and sweet. It is held to be nutritious and a good tonic, increasing the mental faculties and quieting the spirits, and is believed to be of great value in the treatment of diarrhea and dysentery. It is also given for diseases of the chest and as an ingredient in a food prepared for infants who can not be nursed. Ou-fen is made by crushing the root, washing the starch out with water, and allowing it to settle until the water can be poured off.

The fresh rootstock is 84.2% water. An analysis of the water-free residue shows it to contain protein, 9.9% (albuminoids, 5.8%); fat, 1.2%; carbohydrates, 65.0%; crude fiber, 4.8%; ash, 4.8%; and undetermined substances, 14.3%. Their fibrous nature and failure to soften after prolonged boiling prevent

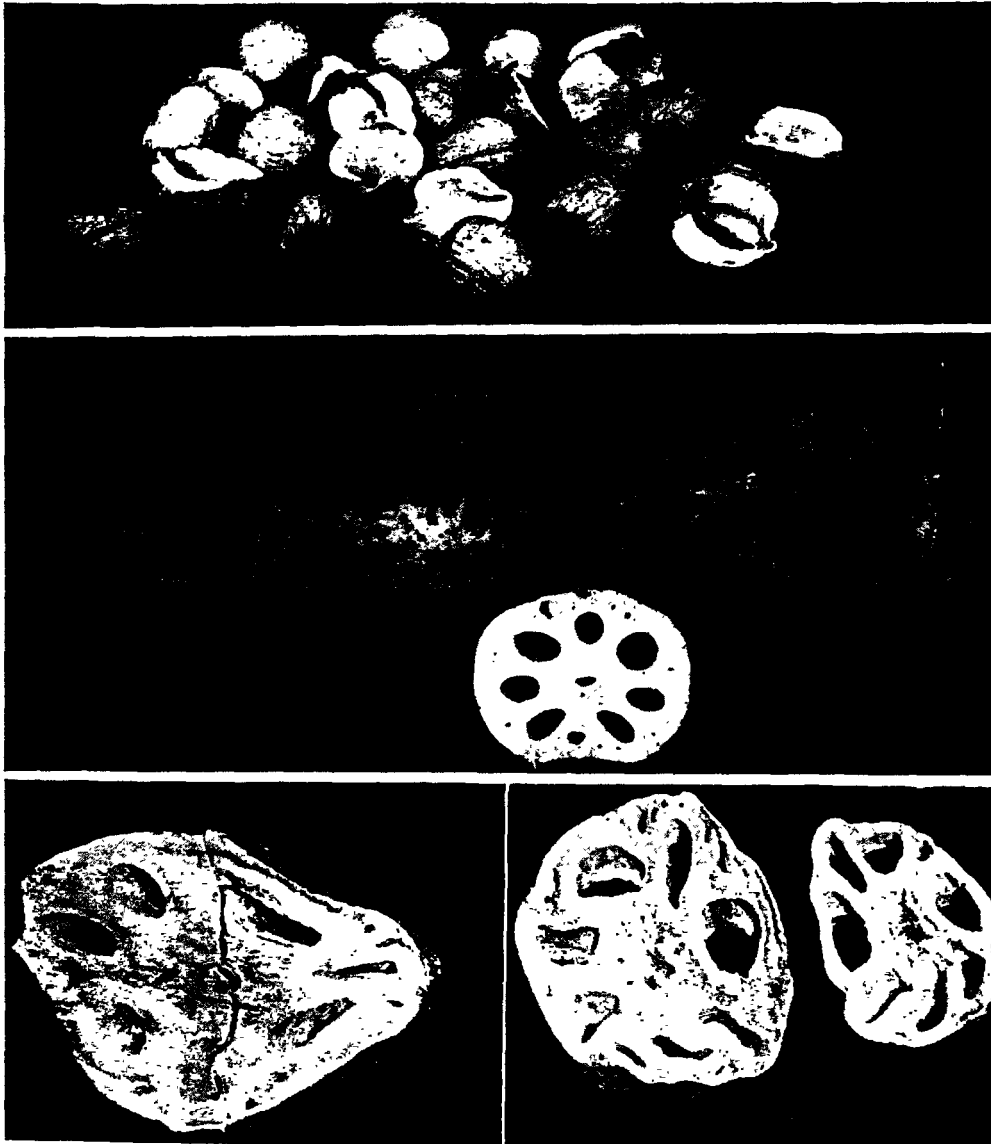


FIG. 3 (Upper). Dried lotus seeds.

FIG. 4 (Center). Fresh lotus root. Slice shows internal structure.

FIG. 5 (Lower). Dried slices of lotus root as sold in Chinese grocery stores.

these roots from being a satisfactory food from the American viewpoint. There has been considerable research on the vitamin C content of lotus roots and lotus seeds. From feeding tests made on guinea-pigs with the juice of lotus root, 10 cc. daily was found to be antiscor-

butic. By microchemical tests confirmation of the vitamin C content was obtained not only for lotus roots but also for lotus seeds.

Ginkgo Seeds. One of the most celebrated trees from China is the ginkgo (*Ginkgo biloba* L.). It not only is his-

torically famous, produces beautiful white satiny wood and has a soil conservation value, but it also produces edible seeds, called "Pak-Ko" (white fruit), which are sold in food shops. Ginkgo is dioecious, that is, any one tree produces only male or female flowers, and the fruits are therefore borne only on the female. When ripe they are about the size of small plums and golden in color. They are gathered when they fall and thrown into a vat of water where they are allowed to ferment. The odor of the decomposing pulp is very offensive, but this process facilitates extraction of the seed.

The pulp contains a series of fatty acids from formic to caprylic, including acetic and butyric, and has been known to cause severe cases of skin poisoning. Besides having a resinous quality the fruits are bitter to the taste and are astringent in effect.

The seeds are two- or three-angled, white and thin-shelled. The Chinese say that the three-angled seeds produce male trees, the two-angled, female trees. The seeds when eaten raw are toxic to some people, causing a dermatitis or swollen glands, and on rare occasions have even proven fatal. In order to be eaten safely, they must be cooked or roasted. Americans do not fancy ginkgo seeds, but both the Japanese and Chinese eat them as an appetizer, as a tasty ingredient in certain dishes, or after the meal to aid digestion. The seeds will germinate readily when planted, but growth is slow and struggling. Suckers from the base of an old tree grow much more vigorously.

The kernel of the ginkgo seed contains only starch, whereas those of most other conifers contain oil. The dry kernels have 62% to 68% starch, 6% cane sugar, 11% to 13% protein, and 1.5% to 3.0% fat. It has been reported that the Chinese use the seeds to wash clothes and that the seeds may be digested in wine

or oil to make a kind of detergent cosmetic by virtue of the fatty principle in them.

Roots and Tubers

Yam Bean. Among the tuberous forms of plant food found in Chinese shops, the yam bean (*Pachyrhizus erosus* (L.) Urb.), called "Fan-Ko", has achieved a high place. The fleshy root is nearly globular (Fig. 6) and its flesh is firm and



FIG. 6. Yam bean tuber.

sweet, but it is tough, a disadvantage so far as American palates are concerned. Generally it is the young tubers which are eaten, while the older ones are principally used as a source of starch which is of superior quality. The starch is present in nearly spherical grains which appear singly or in compound form and do not show stratification, a diagnostic character of the yam bean. An analysis of original material from the tubers gives the following results:

Water	78.09	Carbohydrate	14.00
Protein	2.18	Crude fiber	1.43
Fat	0.80	Ash	0.80
		Undetermined	3.31

The pods of this legume, because of their hairs, can not be eaten without causing diarrhea. The seeds contain a small amount of poisonous resin, a very active fish poison, and from the twining stem the natives of Fiji derive a tough fiber which is used in making fish-nets. No medical uses are known for this plant.

Kudzu. Another leguminous tuber-bearing plant is the kudzu vine, *Pueraria Thunbergiana* Benth. It is fast-growing, bears papilionaceous purple flowers, and has some ornamental value. It is chiefly used as a source of starch and is said to have industrial possibilities for paper manufacture. In New York's Chinatown kudzu appears on sale in the form of long potato-like tubers, trimmed at both ends (Fig. 7). The roots may branch and grow to great length, assuming grotesque forms.

As a source of food for American tastes the roots do not make a suitable vegetable, since they contain a great deal of fiber, and no amount of boiling will make them soft. They can, therefore, be used only for the starch which they yield. The fresh roots are reported to contain 40% of starch. A kind of flour called "Ko-fen" is made of this starch. The starch swells in water, and one teaspoonful is sufficient to make a large dish of soup. It is sweet to the taste, fine and without odor. In Japan the vine is used as a forage plant for cattle. Because of its capacity to adjust to growth in dry and poor soils, it can be used to form pasture.

The fibers from the inner bark of the vine can be made into a "grass linen" similar to that made from the fibers of *Boehmeria nivea* Gaudich. The cloth is called "Ko-pu" and because it is smooth and does not cling to the skin, it is favored for summer wear. Use of the fiber for making paper has also been reported. In Japan the young branches may serve as a binding material in much



FIG. 7. Kudzu root bought in New York's Chinatown.

the same way osier branches are used. One of the modern uses of kudzu vine is in the prevention of gullying; it thus serves an important purpose in current anti-erosion programs. Its rapid growth and its capacity to root at the nodes as it grows over the ground make it a valuable soil-binding plant. Soon after rooting bacterial nodules appear on the newly formed roots. Consequently this plant can render great service as a green manure by its capacity to enrich the land in nitrogen.



According to ancient medical practice in China, colds, fever, influenza, dysentery, snake and insect bites are treated with a decoction made from the root. It is also taken as an antidote for poisonous drugs, such as croton oil, and is applied in cases of dog bite. The seeds, shoots, flowers and stems also have medical use.

Taro. One of the oldest food plants is taro (*Colocasia esculenta* (L.) Schott.*), an important root crop for millions of people for well over 2,000 years. The first known records come from China where it is called "Wu". It spread from the continent of Asia to Japan, south to Malaysia, then east and west to all parts of the tropical and subtropical world. Cultivation of Yu-t'ou, another name for taro in China, has been reported through central and south China.

The plant is a stemless aroid with tufts of large heart-shaped leaves which spring from a central underground corm surrounded by a cluster of tubers. It flowers rarely and has never been observed to produce seed, though reference to seed is made in Chinese literature. Taro is grown for its tubers. It is propagated vegetatively by separating them from the mother plant and planting them individually. Today there are probably about 1,000 horticultural varieties. The dasheen, somewhat familiar to Americans, is a related species. Certain qualities enhance the value of taro plants over many other crops in tropical agriculture. The taro plant is adapted to wet or dry culture, grows rapidly in optimum conditions of soil and moisture, and produces two to four times the average yield of potatoes. Harvesting in both wet and dry fields is done by hand-pulling.

* Also named *Colocasia antiquorum* var. *esculentum* Schott.

The tuber is ovoid or obovoid, somewhat hairy, and at short intervals is encircled with rings, between which here and there is borne an occasional eye or bud (Fig. 8). The flesh of the tuber is like that of the potato, only more cheesy in consistency, and white generally speaking, though often creamy, tinged with yellow, rose or purple. In the Chinese food shops two kinds of tubers appear, large ones which function as corms and support the main plant and small ones which grow out at the side as lateral appendages.

Tubers may be steamed, boiled or baked; they may also be preserved in salt and dried for future use. Tests show that the corm is a high energy-producing food containing about 30% starch and 3% sugar. The moisture content is 61%, the protein a little over 1%, with a trace of fat and crude fiber. The ash produced is alkaline. When eaten in quantity, taro is a good source of highly assimilable calcium and phosphorus. It is similar to white potatoes in vitamin content except for thiamin, of which taro is a greater source. The leaves and petioles when cooked are excellent sources of vitamin A and a good source of vitamin C.

In Hawaii a fermented paste called "poi" is made from the pounded steamed corms. By addition of water, the consistency of poi is controlled; either a thin paste of "two-finger" consistency or a thick paste of only "one-finger" consistency is made. Dried taro products are flour and breakfast grits. It is interesting to note that taro which makes the best poi also makes the best flour. Taro bread containing 15% taro flour and 85% wheat flour stays fresher than ordinary bread because of the moisture-absorbing properties of taro. Cakes, cookies and doughnuts taste better when made with this flour. Taro flour makes

FIG. 8 (Upper). Taro tubers from the Chinese food shops.

FIG. 9 (Lower). Chinese arrowhead tubers.

excellent thickening for gravies and puddings because it does not contain the glutinous properties of wheat and become rubbery as consequence. Modern exploitation of the taro began in 1937 when the Hawaiian Taro Products Ltd. started operating. The company produced flour (Poyo-Meal), beverage powders (Taro-Lactin), a flour-skim milk infant food, and Taro-Malt, or Poyo-

cents, derive great benefits from this easily digested nutritive food. It is also recommended strongly in pre-natal diets as well as for nursing mothers. Taro flour is prescribed to cereal allergy sufferers.

Chinese Arrowhead. In the Chinese food shops of New York two kinds of arrowhead tubers are sold; one is a native of China and is botanically a



FIG. 10. Tubers of *Sagittaria latifolia* Willd., the North American arrowhead.

Malt, a plain or chocolate-flavored malt beverage powder.

Certain medicinal virtues are ascribed to taro. Seeds, though never observed in cultivated forms, are cited in Chinese literature as being slightly poisonous. A decoction of seeds, leaves or stalks may be used as an application in insect bites and other poisons. Taro-Lactin is now a regularly prescribed infant food, and patients suffering from ulcers and other alimentary disorders, or convales-

variety of *Sagittaria sagittifolia* L.; the other is *S. latifolia* Willd. which the Chinese have come to know only since they have been in America. The North American species was found by the Lewis and Clark expedition in 1804 to be the food mainstay of the Chinook Indians of Oregon, and in 1852 Perry noted this plant in the diet of the Chippewas. The Chinese arrowhead tuber is cooked and eaten in the same way as the taro. At Foochow it is planted like taro in the

spring and the tubers are harvested in October. Each plant produces four to six tubers. The tender stalk is also occasionally used for food. In Japan the arrowhead is cultivated as a food plant.

those of the Chinese species are broader and have less divergent basal lobes. An interesting observation has been made concerning the relation of root growth to leaf expansion in this plant. The first

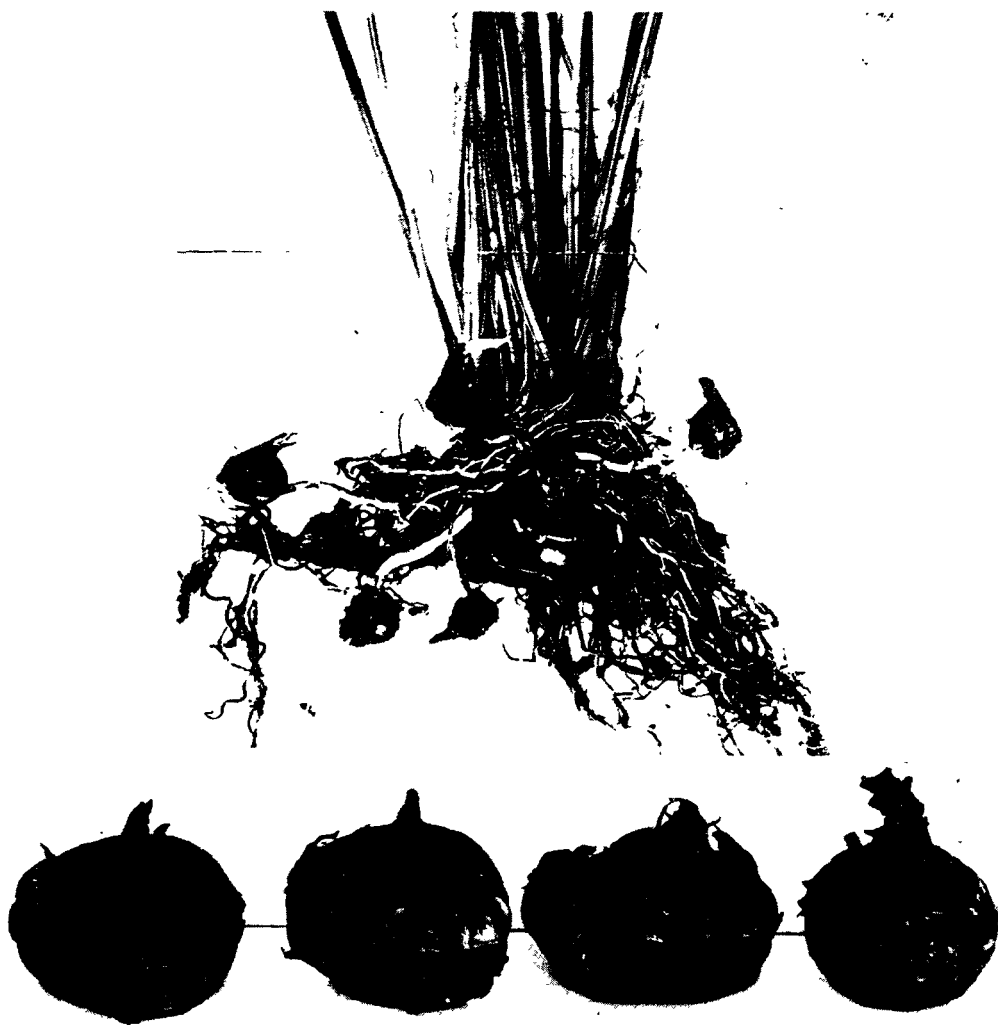


FIG. 11. Basal section and corms of Chinese water chestnut.

The name "arrowhead" comes from the arrow-shaped leaves held up by long petioles above the surface of shallow stagnant pools in which the plant grows. The leaves of the North American arrowhead have divergent basal lobes, while

leaves are always narrow ovate-lanceolate, and each succeeding one is broader until sagittate lobes are developed and the leaf reaches its mature dimensions. Keeping the roots trimmed back when the plant is young checks leaf expansion

so that the leaves do not become sagittate. Trimming the roots after the plant has started to produce sagittate leaves, however, has no effect; sagittate leaves are produced continuously but they are smaller.

The Chinese arrowhead tuber (T'zuku) in shape resembles a small dark colored flattish onion about two inches in diameter and a little more than an inch in height (Fig. 9). A shoot projects from the center, and two lines encircle the tuber, indicating the scars of the sheathing leaves. The North American tuber (*S. latifolia*), on the other hand, is laterally compressed, has a terminal sprout at one end and two to four leaf scars (Fig. 10). Flowers are

The raw tuber of the arrowhead exudes a milky juice, and its flesh is like that of a potato and serves as a source of starch. When boiled it becomes sweet and acquires a farinaceous taste. The nitrogenous elements are *a*) an albuminoid, soluble and caseinlike; *b*) a soluble albumen coagulating at 74° C.; *c*) a small amount of a non-albuminoid; and *d*) varying amounts of non-albuminoids, of which asparagin is an important constituent. The tubers are reported to be without vitamin content and the fuel value is 94 calories per 100 gm.

Analysis of fresh tubers shows them to have the following composition:

	<i>Sagittaria sagittifolia</i> L. var. <i>sinensis</i> (Sims) Makino	<i>Sagittaria latifolia</i> Willd.
Water	61.51	68.88
Protein:	7.00	4.44
Albuminoids	4.71	3.98
Amides (by difference)	2.29	0.46
Fat	0.24	0.76
Starch	22.95	19.69
Cane sugar	*2.26	2.49
Pentosans	0.32	...
Crude fiber	0.72	0.98
Ash	1.69	2.04
Undetermined	3.31	2.71

* Sample contained no reducing sugars.

borne in whorls clustered about a scape that comes up directly from the rootstock. The flowers are imperfect and dichogamy is highly advanced. The seed of the arrowhead has not been described.

Propagation is by tubers and so readily takes place that compact masses of these plants spread over wide areas of water surface unless uprooted periodically. The projecting sprout develops a terminal bud from which roots and leaves emerge to form an independent plant. This in turn develops runners, at the ends of which new plants appear. The axillary buds on the old tuber may produce new shoots that will develop a new plant system or may decay, leaving its offshoot independent.

The arrowhead has many therapeutic uses in China. Bruised leaves are applied to infected sores, snake and insect bites, and as a powder to itching diseases. Eating raw tubers is said to be dangerous, producing fluxes and hemorrhoids and inducing premature birth.

Chinese Water Chestnut. The name "water chestnut" is applied to both the fruits of the genus *Trapa*, described later, and to the flattish corm of a sedge, *Scirpus tuberosus* Roxb. (Fig. 11), which is not in any way related to *Trapa*. We are here concerned with the sedge corm, and among the Chinese names applied to it, the one commonly used is "Ma-hai". In the markets the corm is dark reddish-brown and is about an inch and

a half in diameter. The meat, which is succulent like that of an apple, is of uniform consistency, and the taste resembles that of sweet corn. They may be eaten raw or cooked. These along with bamboo shoots and other Chinese vegetables are cooked and served with meals in the homes of foreigners in China. Pared and impaled on thin bamboo sticks, they are sold by street vendors and eaten raw almost as a confection. Sliced water chestnuts are one of the ingredients of chop suey in the United States, and shredded they often appear in meat and fish dishes. Americans who take the trouble to shop in the Chinese markets have found them delectable in salads and soups.

The Chinese water chestnut is about 77% water. The cane-sugar content in water-free samples averages about 27.5%, while protein is rather low. The starch content is between 7% and 8% in the fresh corm.

The plant which produces the corms which in turn produce new plants, grows in stagnant water and sends up cylindrical hollow leaves which project above the water level. Runners grow radially from the top of the old corm at the base of these leaves and on the end of each develops a young corm which at maturity is disconnected from the old plant and planted separately.

It is said that the Chinese water chestnut also possesses medicinal virtue. For example, when children accidentally swallow coins, water chestnuts are immediately given to them in quantities, either raw or boiled, and are claimed to decompose the metal.

Chinese Ginger. The much-branched finger-like rhizomes of ginger displayed for sale in New York Chinese food shops are the source of confections, condiments, essences and medicines used by the Chinese (Fig. 12). In the United States candied ginger, powdered ginger, ginger ale and preserved ginger are well



FIG. 12. Rhizome of Chinese ginger.

known. The plant producing these rhizomes is thought to be of Asiatic origin and is preferred to the West Indian variety because it is more succulent. There was some confusion at first in the identification of Chinese ginger, but it was finally determined to be *Zingiber officinale* Roscoe.

From the alluvial lands of the Canton delta where it is extensively cultivated, much of the ginger is exported as preserved ginger. It is cultivated as far north as Shantung province and is called by the Chinese, "Chiang". The plant was formerly believed not to flower, but eventually flowers were found. The inflorescence is dense and cone-like. No seed has ever been reported. The leaves when crushed are highly aromatic and even under normal conditions give off an odor. Volatile substances emanate from the rhizome which burn the hands if they are not covered. Ginger root, though easy to grow, is nowhere grown in the United States on a commercial scale. Propagation is by division of the rhizome.

According to a Chinese Materia

Medica, fresh ginger stimulates the digestive organs, quiets nausea, checks coughs and acts as a carminative and astringent remedy in dysentery. It is considered an antidote for mushroom poisoning. The ginger skin is used to clear opacity of the cornea, and the juice from the leaves is drunk as a digestive stimulant and as a local application in ecchymosis. Oil of ginger is used as a condiment. Essence of ginger, Chiang-lu,

(culms) before they have fully emerged from the ground. They originate at the joints (nodes) of the horizontal underground stem (rhizome) of the running type of bamboo (polypodial) or from a basal node of an old cane of the clump-forming type (sympodial). The shoots are severed in their very young stages from the mother plant in the spring and dug up. Fresh shoots sold in the native Chinese markets are conical in shape and



FIG. 13. Candied Chinese ginger.

is considered to be antiseptic, antimalarial and expectorant. A tincture is used as a stimulant in colds and indigestion.

Analyses show that the rhizome contains 3.7% of fatty oil, 1.35% of essential oil, and some gingerol and resin.

Shoots and Greens

Bamboo Shoots. Bamboo shoots, one of the ingredients of American-Chinese dishes in the United States, are really the swollen buds of bamboo canes

covered with tough, leathery, overlapping, sheathing leaves which protect the tender shoot and provide a smooth casing against rough soil particles as it forces its way up through the ground.

Proverb and saying are inextricably mixed with the ancient customs applied to bamboo cultivation. In regard to the time when bamboos produce their shoots, there is a saying in India that bamboos will not put up their shoots until the thunder comes. Kurz cites an incident

told by a certain Captain W. H. Sleeman. During the rains of 1835 the captain discovered that his bamboos at Jubalpoore had not produced their shoots at what he considered the usual time, so he asked his gardener the cause. The gardener replied, "We have had no thunder yet; as soon as the thunder comes you will get shoots". The captain inquired what possible connection there could be between claps of thunder and the shooting of bamboos. "God only knows", said the gardener, "but we know that until the thunder comes, the bamboos never shoot well". The thunder came and the gardener's theory seemed confirmed, for the bamboos began and continued to produce abundant shoots.

It is the practice in some parts to cover bamboo shoots with baskets as they come through the soil, because exposure to light will make them fibrous and bitter. In general, an eight-year plantation should annually produce 40 pounds of shoots per mow (one-sixth of an acre).

In New York's Chinatown, among the representative array of Chinese vegetable foods, both dried and canned shoots are displayed (Figs. 14 and 15). In spite of the desire of restaurants in the United States for fresh bamboo shoots, a source large enough to assure a steady supply is not yet available in this country to meet the demand. Chekiang province, among other bamboo-producing centers of China, is noted for the production of dried bamboo shoots. Most of the inhabitants of the Tien-mu Shan district make their living by preparing dried bamboo shoots. The sources of the product are divided into three groups, the "early" shoots, the "rock" shoots, and the "red" shoots. After the fresh shoots are dug out of the ground, they are washed and stripped of their sheath-leaves; then they are boiled in a big kettle filled with salt water. After two hours boiling, the shoots are taken out

of the kettle and placed in a closed chamber, where they are dried over a steady fire for about four hours. The partially dried shoots are then taken out of the oven and rolled between the hands, after which they are pounded flat with a hammer. The shoots may also be sliced lengthwise and dried. Once more they are put back in the oven and dried for about one and a half hours. When the drying process is finished, they are taken out, placed on a table and graded according to the degree of tenderness. The entire process lasts about two days. From 200 catties (266.66 pounds) only about 20 catties (26.6 pounds) are obtained because of the high water content.

Bamboo shoots are good food. The heart of a shoot is crisp and white, like that of a potato, but when cooked does not become mealy. They should be boiled in salted water about 30 minutes or more until tender. It is said that when Robert Fortune was in China, he was in the habit of eating bamboo shoots as a vegetable almost every day; foreigners in China today still use them as a regular table vegetable. Experimentally it has been proved that bamboo shoots contain vitamin C and have a fuel value of 185 calories per pound. An analysis shows their water content to be 90%; they also contain 3.2% protein, 0.2% fat, 6.2% carbohydrates, and 0.4% ash.

Among the species producing edible shoots, *Phyllostachys edulis* Carrière (*P. pubescens* H. de L.) is highly prized. It not only produces fine quality edible shoots but is one of the largest timber bamboos of eastern China and Japan. The story is told about Men Tsung, one of the 24 paragons of filial piety, that one day when his mother fell sick and craved soup made from young shoots of the bamboo, he went to a bamboo plantation to fetch some, but it was in the depth of winter when such things were not to be had. In his distress he wept so

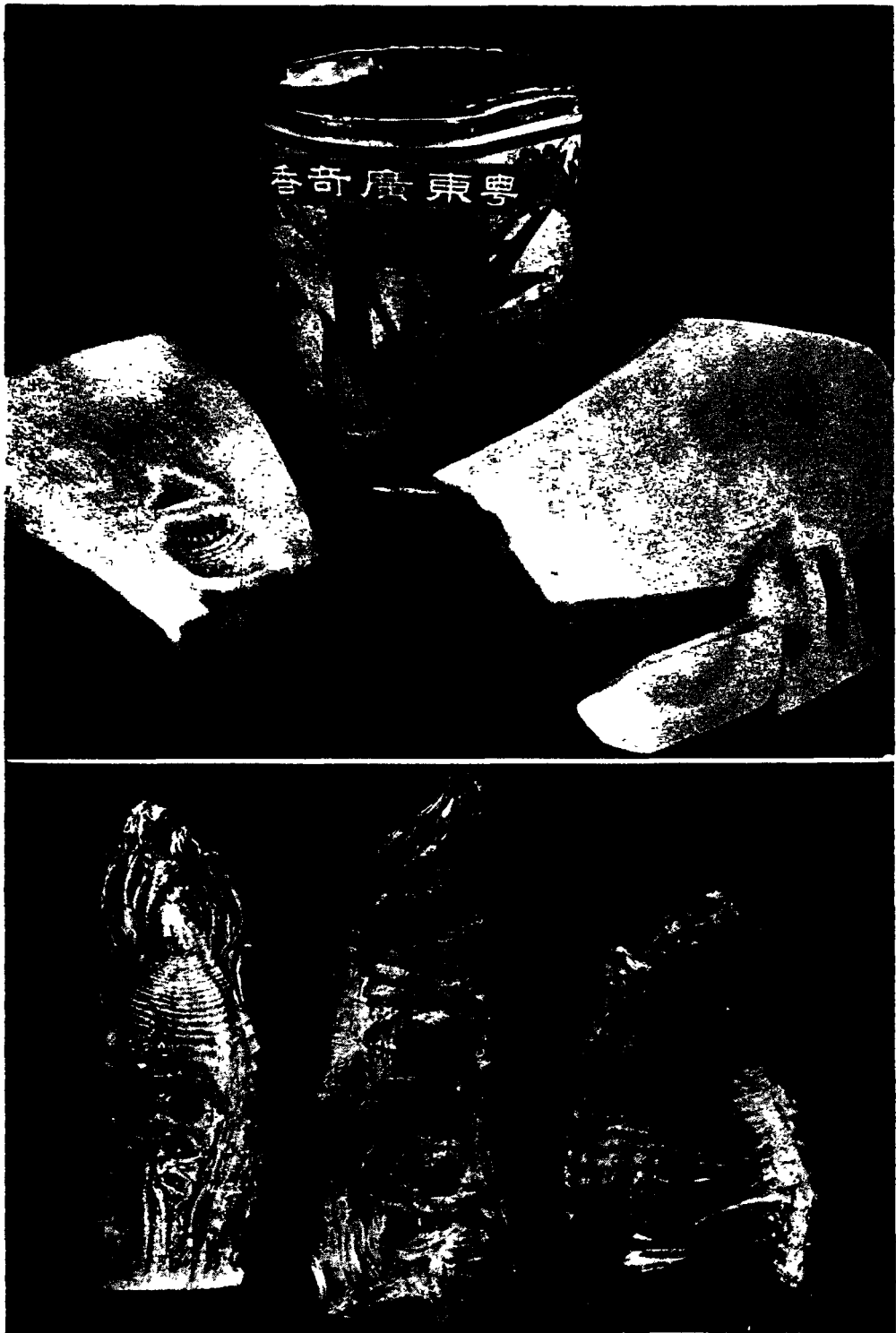


FIG. 14 (*Upper*). Contents of can of preserved bamboo shoots.
FIG. 15 (*Lower*). Dried slices of bamboo shoots.

hard that the ground covered with his tears was softened, so that an abundance of young shoots sprang up and he was able to gather enough to bring home to his sick mother.

Bamboos include the only trees of the grass family, and because of the peculiar structure of their canes with hollow internodes, of their hardness, of the great tensile strength of their fibers, and of the ease with which they can be split into strips, they are among the most useful plants in the world. Not only is the plant itself with its network of underground stems a fine soil stabilizer, good for stream banks and hillsides in preventing erosion, but also it may be used as a hedge plant and for windbreaks. Houses, sheds, bridges, barracks, even temporary airplane hangars are made of bamboo, as well as all sorts of furniture, implements and handles, baskets, crates, chicken coops, fences, buckets, trays, screens, blinds, draperies, pipes, stakes, canes and poles. In World War II a sort of three-story basket scaffolding of bamboo was built over the roofs of public buildings in the war areas of China in order to detonate aerial bombs before they struck the buildings. Bamboo was one of the first sources of paper in China and today with improved techniques produces fine quality paper. A visit to the Metropolitan Museum of Art in New York City will show to what extent bamboo has been used in the manufacture of musical instruments, especially among primitive peoples. These are only a few of the uses to which bamboo is put but they serve as an indication of the possibilities. Not only are the canes and shoots used, but also the leaves. A decoction of them, according to Chinese medical lore, can be fermented and used to treat fevers and to clarify the intellect. Congee with bamboo leaf decoction is thirst-relieving and purifies the heart. One of the small varieties of bamboo has very large leaves, large

enough that local shopkeepers can use them to wrap up small packages of confections. The tough sheath leaves of the shoots of *Phyllostachys edulis* are large enough to be used as material for the soles of sandals worn by coolies and farmers in the areas where they grow. Finally, bamboos are highly ornamental, and many varieties are grown for decorative purpose alone. Because of their grace as well as their versatility, they have figured greatly in the cultural progress of many Asiatic peoples, particularly of the Chinese and Japanese, and in their art have been given a place of distinction and symbolical significance.

Chinese Cabbage. Among the fresh leafy vegetables eaten by the Chinese and sold in Chinatown food shops, one of the most important is the Chinese cabbage. There are two kinds and they are sufficiently different that they are now referred to separate species, *Brassica chinensis* L. (Pak-choy) and *B. pe-t sai* Bailey (Pe-tsai). The two Chinese names are but two dialectic pronunciations for the same Chinese characters meaning "white vegetable". The latter is more highly esteemed than the former and has been successfully introduced into the United States. It is sold in the American markets mostly under the name "Shantung cabbage". This cabbage is an annual and is distinguished by its elongated loosely rolled head (much more compact in recently developed forms) and winged leaf petioles (Fig. 16). The former species, on the other hand, is a biennial plant, does not form a head, and its petioles are celery-like and marginless (Fig. 17). In the second year the plant develops a tuberous root not unlike a turnip in taste. Both cabbages are autumn vegetables and grow best in cool moist soil.

In order to keep the head of the pe-tsai cabbage compact and tender, its top should be tied together when nearly mature. The fresh head is prepared in the

same manner as ordinary cabbage and makes a very excellent table vegetable. It is milder and sweeter in taste than our domestic cabbage. The Chinese often serve it uncooked, shredded with sugar and vinegar. In the United States it is also eaten raw, sliced across its width in salads. Pe-tsai cabbage can be made into a good soup or puree which is easily digested by young infants.

The leaves of *B. chinensis* are spreading, like a turnip top, and are borne on long naked fleshy white stalks. These are the most edible portion and may be cooked and served in the manner of either cabbage or asparagus. The leaves are cooked and eaten as greens. In the Chinese markets the cabbages are sold as bundles of leaves or blanched petioles.

Analysis shows that the pe-tsai cabbage does not differ as regards food value from our cultivated cabbages; the water content is somewhat higher, but the protein content is somewhat lower. The pak-choy cabbage shows nearly the same composition except in the amount of reducing sugars; water-free material of pe-tsai amounts to about 30%, that of pak-choy only about 10%. Details are as follows:

vitamin A, but low in vitamin G. Pak-choy, on the other hand, is an excellent source of vitamin C, a good source also of both vitamin B and vitamin A, but fair only for vitamins D, E and G. Fresh leaves of *B. chinensis*, if pickled in salt for three days, lose 50% of their original vitamin B, but when pickled in a paste of salt and rice bran, the vitamin content is increased to almost four times the original value because of adsorption of water-soluble vitamin by the leaves.

Brassica chinensis is considered in Chinese medicine to be cooling and antivenous. Prolonged and excessive use is thought to be slightly deleterious, causing an itching eruption and retarding recovery from disease. Ginger is used as an antidote. Medicinal use is recommended in fevers and to quench the craving for wine. It is also considered to be laxative and diuretic. The seeds are used to arouse a "dead drunk", and the expressed seed oil, when rubbed on the scalp, is thought to promote growth of hair.

Chinese Celery. The Chinese variety of celery, *Apium graveolens* L. (Ch'in Ts'ai), is slender and green (Fig. 18),

	<i>Brassica pe-tsai</i> (Pe-tsai)		<i>Brassica chinensis</i> (Pak-choy)	
	Original	Water-free	Original	Water-free
Water	95.74	...	96.55	...
Protein:	1.19	28.07	0.78	21.96
Albuminoids	0.48	11.36	0.41	11.43
Amides (by difference)	0.71	16.71	0.37	10.53
Fat	0.15	3.57	0.10	2.82
Carbohydrates:	1.69	39.55	0.77	21.51
Starch	0.31	7.19	0.31	8.61
Cane sugar	0.09	2.11	0.09	2.45
Reducing sugar	1.29	30.25	0.37	10.45
Crude fiber	0.52	12.16	0.46	12.86
Ash	0.56	13.28	0.65	18.33
Undetermined	0.14	3.38	0.80	22.52

Pe-tsai contains a considerable amount of anti-scorbutic vitamin C and is a good source of vitamin B, is fair for

not thick-stemmed and crisp like the American cultivated variety. It is a common vegetable with the Chinese.



FIG. 16 (Left). Head of pe-tsai cabbage.

FIG. 17 (Right). Head of pak-choy cabbage.

Sometimes they eat it raw, but they usually take it about half cooked, which is certainly a safeguard when the native manner of using fertilizer in the garden is considered.

The properties of Chinese celery are such that it is considered digestive, cooling, quieting, alterative and tonic. It is recommended in menstrual fluxes and in digestive troubles of children. The expressed juice of the stalk is the form much used medicinally. The food value is high, the vitamin content including vitamins A, B, C and D; it is a particularly good source of vitamin B. Its fuel value in calories per 100 gm. is 17. The general composition is:

Water	93.6	Carbohydrate	3.3
Protein	.5	Crude fiber	1.1
Fat	.4	Ash	1.2

Lily Bulbs and Flowers. Lilies, including both *Lilium* and *Hemerocallis*,

are sources of food in China. Bulbs of the former are sold in Chinatown markets and are highly esteemed as a delicacy. *Lilium brownii* Poit. furnishes a large part of the bulbs used by the Chinese in San Francisco and elsewhere (Fig. 19). The bulbs of *L. tigrinum* Ker-Gawl., *L. cordifolium* Thunb., *L. bulbiferum* L. and other species are also used, both dry and fresh. One feature which recommends the lily bulb is the ease with which it is dried. The bulbs sold in the Chinese markets seem, according to one observer, to be nearly devoid of the bitter principle reported to occur in several species of *Lilium*. When boiled, they make a palatable food, but they can not be as cheaply cultivated as other comparable food plants, and furthermore the ornamental value of their flowers would prevent their extensive cultivation for use as food. In Japan a farinaceous food is derived from the

bulbs by first crushing them in wooden mortars and separating the starch from the cellular mass by repeated washing. The former is hung up in bags for winter use, while the latter is dried in round perforated cakes somewhat resembling miniature mill-stones and hung up to continue drying. Bulbs of the Chia-peh Ho (*L. tigrinum*), both cultivated and wild, when properly cooked are not at all bad eating.

The flowers of *Hemerocallis fulva* L. and *Lilium bulbiferum* L. also furnish food. Dried or fresh flowers of the former, the Chinese daylily, are sold in Chinese food shops under the names "Gum-tsoy" (golden vegetable) and "Gum-jum" (golden needles). They are used in soups and in meat dishes with noodles. The basal end of the dried flower is first removed and the rest is cut into several segments. Enough water is added to the flowers to insure soaking to a soft gelatinous mass which is then added to soups already cooked; the whole is then boiled. Lily flowers are also eaten as a vegetable, being a good source of vitamin A but only fair for B. Dried lily flowers formerly held a high place among exports from China.

An analysis of lily bulbs and flowers shows the following percentage content:

	<i>Lilium brownii</i>		<i>Lilium tigrinum</i>	<i>Hemerocallis fulva</i>
	Dried bulbs	Fresh bulbs	Fresh bulbs	Dried flowers
Water	10.16	66.72	71.46	18.13
Protein	5.57	2.33	4.51	9.33
Fat	0.37	0.59	0.24	2.45
Carbohydrate	65.49	21.90	21.60	60.49
Crude fiber	1.64	0.75	1.04	4.76
Ash	2.68	1.24	1.15	4.84
Undetermined	14.09	6.42

Bulbs of lilies are considered in Chinese medicine to be tonic, eliminant, carminative, quieting and expectorant. They are also used in epiphora, suppression of milk, post-partum neuroses, and externally in swellings and ulcers. The

flowers are dried, powdered and mixed with oil for the treatment of moist eczema and vesicular eruptions in children. The bulblets in the axils of the leaves are steeped in wine and used in the treatment of intestinal disorders. Dried bulbs appear in commerce as "Pai-ho Kan", while fresh bulbs are called "Hsien Pai-ho". A sort of starch is also made out of the bulbs, which is known as "Pai-ho Fen".

Fruits and Nuts

Chinese Date. Among the dried fruits stocked in Chinatown shops, usually in glass jars, is the Chinese date (Tsao), or jujube (Fig. 20). It is well known and is identified in the classics as one of the five principal fruits of China. Chinese dates are eaten fresh when they can be obtained; otherwise dried (like raisins or lychees), sugared, stewed or smoked. The taste is sweet, the meat firm, and when fresh the fruit is plump but has a wrinkled skin when dried. The color is dark red and the shape somewhat elongated or ovoid. Propagation is by seeds, but to insure true breeding of a variety, suckers from the base of the trees are planted.

The common species of jujube is *Zizyphus jujuba* Mill. which is a thorny tree-

like shrub, but the one from which Chinese dates come is *Z. sativa* Gaertn. (*Z. vulgaris* Lam.) which inclines to thornlessness under cultivation. Most Chinese dates come from North China, particularly from Shantung province where

they are best. The trees produce not only good edible fruits but also fruit which may be used for fodder, for ornament, for gum lac production by lac insects, and for medicinal purposes. The bark, particularly the root bark, is a commercially unimportant source of tannin. The wood of old trees is sought for the manufacture of combs and for all sorts of turnery.

Analysis of the fruit pulp is:

	Original	Dried
Water	13.44	...
Protein	2.93	3.39
Fat
Carbohydrate (sugars)	55.25	63.83
Crude fiber
Ash	1.73	2.00
Undetermined	26.65	30.78

The carotene content has been determined at 0.70 mg./g. of fruit pulp, and there is also a fair amount of vitamin C.

Medicinally the fruits of wild jujube are considered cooling, anodyne and tonic. The kernels of the seeds are reported to have a sedative effect and are recommended to those who are subject to sleeplessness. If eaten frequently, they are said to increase the flesh and strength. The cultivated fruits are considered nourishing, beneficial and laxative. They are thought to be an antidote to aconite poisoning and are recommended in nausea and vomiting; also for abdominal pain in pregnancy. They are also used externally in poultices and applications on wounds. The leaves are regarded as a diaphoretic and are prescribed in the typhoid fever of children. A decoction of the heartwood is said to have a beneficial action on the blood. The root is used in fevers of children and to promote growth of hair. The bark is used in a decoction with mulberry bark as a wash for inflamed eyes.

Chinese Olive. The olive-like fruits sold in Chinese food shops are not the



FIG. 18. Chinese celery.

olives (*Olea europea* L.) known to American grocery stores, but are furnished by two species of *Canarium*. Those of *C. album* Raeusch. are called "white olives" (Paak-laam) (Fig. 21), those of *C. pimela* König, "black olives" (Oo-laam or Wu-lan). Both species, until found wild on the Island of Hainan, were known only in cultivation. It was in 1845 that Robert Fortune first saw in Foochow the so-called Laam-shue, or Chinese olive. Other Chinese names for them are "Kan-lan" and "Ching-kuo".

Chinese olive trees are evergreen, resinous, develop a dense crown of spreading branches, and sometimes reach a height of 20 meters. The trunk is straight with whitish bark and light colored wood which is fairly common in the markets though expensive. Though native only to Hainan Island, the trees are now found cultivated all the way from CochinChina to the province of Szechwan in China

proper, including Kwangtung and Fukien provinces.

The fruit of the white olive is dirty

calories per pound. Other details in the composition of *Canarium album* fruit are:

	Pulp		Seed	
	Original	Water-free	Original	Water-free
Water	73.22	...	5.71	...
Protein	0.77	2.86	16.44	17.44
Fat	6.55	24.46	59.57	63.18
Carbohydrate	5.64	21.94	0.92	0.97
Crude fiber	4.15	15.48	3.20	3.39
Ash	1.50	5.61	5.16	5.47
Undetermined	8.17	30.53	9.00	9.54

yellow and is much wrinkled when ripe. The seed tapers to a point at both ends, is angled along its length, and is slightly rough. The fruit of the Chinese black olive, on the other hand, is purplish black, smooth when ripe; and the seed is blunt and smooth. The fruits ripen September to November and are about an inch and a half long. The seed is one- to three-celled and has one to three kernels.

The Chinese olive is highly esteemed as a condiment or as a side dish, either fresh or salted. Pulp of the fresh fruit is somewhat acrid and disagreeable, and so requires special treatment to make it palatable. It is often added to wine to moderate or counteract its effect. Not only is the fruit pulp eaten but also the kernels of the seeds, preferably those of the black olive. When fresh, the latter taste like walnuts and in composition show great similarity to them. They are sold under the Cantonese name "Laam Yen". A microscopic examination shows well formed aleurone grains and a yellow fatty oil which absorbs 83.17% of iodine.

The most important constituent of the fruit pulp is fat, which forms nearly one-fourth of the nutritive material. The ascorbic acid content in mg./g. of the edible portion determined by the iodine method is 0.15. The fuel value is 1150

The fruits are medicinally characterized in Chinese medical lore as stomachic, sialagogue, antiphlogistic, alexapharmic, antivenous and astringent. The seeds, incinerated and reduced to powder, are thought to have the power of dissolving fish bones accidentally swallowed, and are used in treatment of fluxes and eruptive diseases of children. Bruised kernels are used as a poultice for cold sores or fever blisters. Such poultices appear in commerce as do also the leaves of *Canarium pimela*. Kernels of this species are stimulant, tonic, and have corrective properties.

Lychee. The lychee (*Litchi chinensis* Sonn.) (Fig. 22) is supreme among the fruits of South China, and the first contact which most Americans have with truly Chinese fruits is with it. Chinese laundries in most of our big cities proffer lychees at Chinese New Year to their regular customers as a courtesy, and they can be bought in quantity in New York's Chinatown.

The fruits are round or oval and the outer coat is thin, leathery, brick red and covered with short hard points, becoming brittle when dry. When dried, the fruit pericarp loses its bright red and becomes grayish. The pulp of the fresh fruit is white, jelly-like and juicy, and encloses a single smooth brown seed. The dried pulp is like that of a raisin.



FIG. 19. Lily bulbs sold in Chinese markets for food.



FIG. 20 (Upper). Dried Chinese dates, *Zizyphus sativa* Gaertn.



FIG. 21 (Lower). Preserved Chinese white olives, *Canarium album* Raeusch.

There are many varieties but not all of them can be eaten fresh. Those that can not can be preserved by drying or canning. Others are used in making lychee wine.

The trees are evergreen and may grow to a height of 50 feet. Besides bearing edible fruit they furnish wood which has considerable value for cabinet work and interior furnishing. Most of them are found growing on dikes along canals or between fields where their roots are good soil-binders and hence add to the protection of the fields from floods. The roots are often dug out for fuel, for which they are much esteemed because they burn with a hot almost smokeless flame. Finally, lychee trees are considered very ornamental.

Analysis and nutritive evaluation of the dried fruit show the carbohydrates to be a mixture of simple easily digested sugars. Vitamins A and B are lacking in both the dried and the fresh fruit. Fresh lychees, however, are a good source of vitamin C. Their composition is:

Water	84.83	Carbohydrate	13.31
Protein	0.69	Crude fiber	0.23
Fat	0.58	Ash	0.37

Chinese Horned Chestnut. A frequently seen plant food of Chinese origin is the buffalo-head fruit, or horn chestnut (*Trapa bicornis* L.). A water plant produces the nut which when ripe falls to the bottom of the pond where it remains all winter. Because of its curious shape, it is frequently found in other than food shops, American as well as Chinese. The name "buffalo head" was given the nut because of its resemblance to the head of a buffalo with its two large curved horns (Fig. 24). Another name is "water chestnut", and its Chinese name is "Ling Ko". Robert Fortune tells how women and boys float about in round boats resembling wooden wash tubs, and push their way among the masses of plants without hurting them, collecting the nuts as they go.

Two related species also produce edible nuts, *Trapa bispinosa* Roxb., the Singhara nut of Ceylon, with nuts having two straight slender barbed spines, and *Trapa natans* L., a native European species which bears nuts with four spines. The specific name *caltrops* has also been given to the four-spined species because of its resemblance to the bronze or iron balls with radially projecting spikes (called caltrops) thrown on the ground in ancient warfare to slow the advance of foot soldiers or a cavalry charge. The latter plant has spread and become established in the United States, in some instances growing in such dense floating masses of vegetation as to choke the water course. The fresh nuts are said to be good in salads.

The nuts of the Chinese horn chestnut are always boiled before they are sold. If eaten raw, they are supposed to be harmful to the digestive tract. Considering the filthy stagnant water in which they grow, it is no wonder that worms and intestinal disorders inevitably follow if the nuts are eaten raw. When boiled, the nuts are considered nutritious and beneficial. Early writers assert that they relieve thirst, reduce fever and are helpful in cases of sunstroke. The flowers and shells of the fruits can be used in making an astringent, from which dye for the beard is obtained.

The starchy content of the fruit of *Trapa bicornis* L. in its dry state is 67.5% with 12.1% protein, of which 11.6% are albuminoids.

Chinese Almond. Chinese almonds are seed kernels of several sweet varieties of apricot, *Prunus armeniaca* L. (Hsing-jen), which, because they are grown in the northern province of Hopei (formerly Chihli), have led to the mistaken impression that almonds occur in China. In certain sections of that country true almonds would undoubtedly grow well.

These varieties, propagated exclusively from their seeds, produce edible kernels

which taste like true almonds. The four principal "almond"-producing varieties bear the following types of fruit: *a*) a small red fruit containing large medium soft stone and sweet kernel, the best variety; *b*) a larger fruit, also of red, but with hard stone; *c*) a yellow-fleshed fruit

States; salted or blanched Chinese almonds are also good eating. A tasty gruel and compound almond flour are also made from Chinese almonds. A bitter apricot kernel is highly toxic because of the presence of prussic acid. The bitter toxic kind is smaller; the

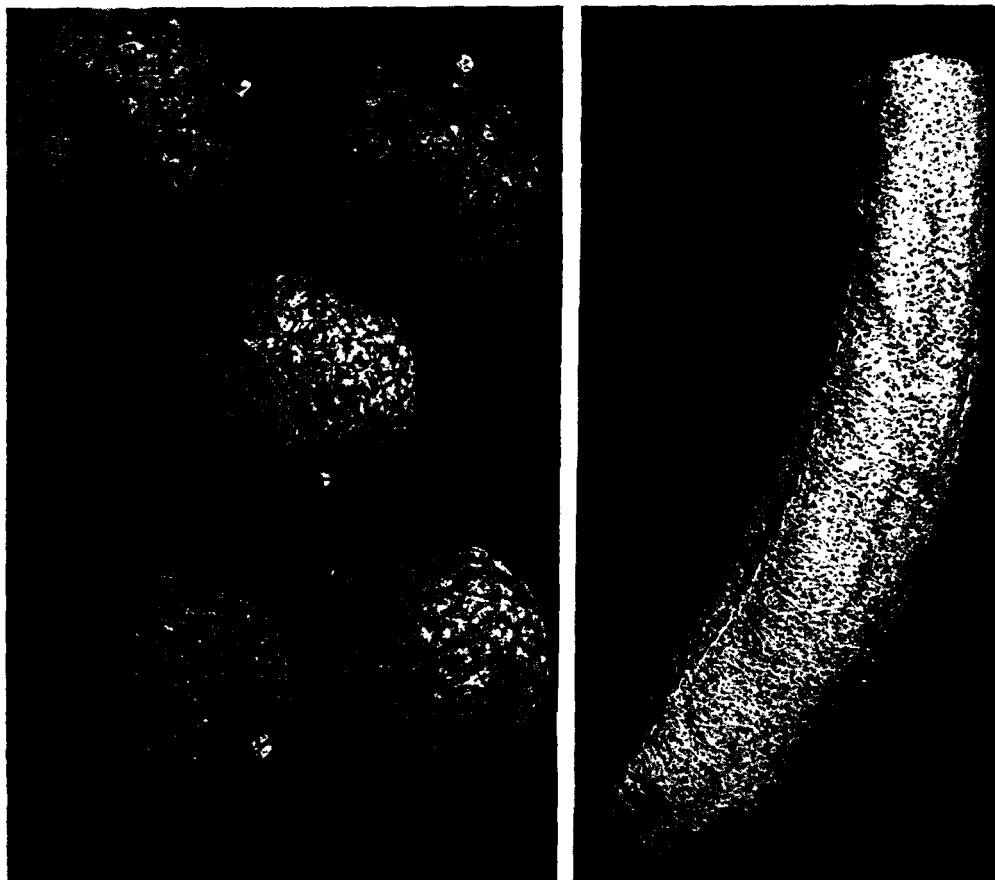


FIG. 22 (Left). Chinese lychees, *Litchi chinensis* Sonn.

FIG. 23 (Right). Skeleton of sponge gourd, *Luffa cylindrica* Roem.

with the same open tree habit as the preceding and also with hard stone; and *d*) a fruit with bitter seed kernel which in small quantities can be used to give flavor to confections and to make Chinese almond soup.

Almond cookies are served as dessert in Chinese restaurants in the United

larger sweet kind weigh more than half as much again. The very large amount of oil in the kernels makes a fine emulsion when the kernels are rubbed with water.

Chinese almonds are a fair source of vitamin A and a very good source of vitamin B, but have no vitamin C. Their



FIG. 24 (Upper). Chinese horned chestnuts, *Trapa bicornis* L.

FIG. 25 (Lower). The bottle gourd, *Lagenaria vulgaris* Ser.

calorific value is reported to be 606 calories per 100 grams. Fresh kernels of the sweet variety have the following composition:

Water	6.39	Carbohydrate	15.04
Protein	25.40	Crude fiber	2.97
Fat	47.30	Ash	2.90

In Chinese medicine the fruit of the bitter almond is considered to be useful in cases of heart disease. If eaten in excess, it is thought to harm the bones and muscles, to promote blindness and falling of the hair, "to benumb the mental faculties, and to injure parturient

women". On the other hand, if dried and eaten, the fruit is thirst-relieving and antifebrile. The kernel is considered to be somewhat harmful, and it is said that a double kernel will kill a man. Sedative, antispasmodic, demulcent, pec-

coction made by crushing the blanched kernels in boiling water, with addition of other drugs and flavoring ingredients, is sold in the streets of some Chinese towns as a kind of tea used in coughs, asthma and catarrhal affections. The juice of

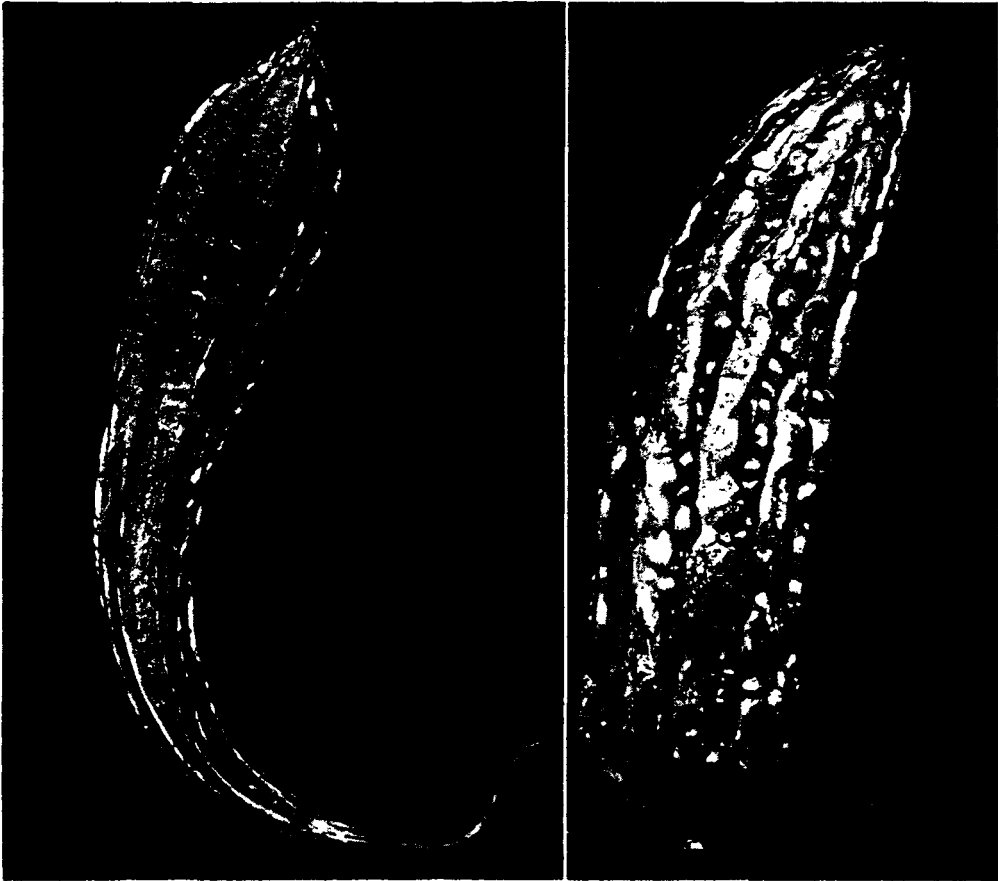


FIG. 26 (Left). The Sing-kwa. *Luffa acutangula* Roxb.

FIG. 27 (Right). The leprosy gourd, *Momordica charantia* L.

toral, vulnerary and anthelmintic properties are ascribed to the kernels. Ginger and licorice are combined with them to form a confection used as a tussic and expectorant remedy. Another confection prepared by a process of fermentation is used as a prophylactic and tonic. A de-

apricot kernels are added to rice-congee and given in hemorrhages. Kernels are also crushed and made into a paste which is applied in cases of inflammation of the eye. Apricot flowers, besides being considered tonic, are used in cosmetic preparations.

Cucurbits

Chinese Luffa. Cucurbits of all shapes and sizes are sold in Chinese food shops,

Analysis of the fruits of the two species is presented in the following tabulation:

	<i>Luffa acutangula</i>		<i>Luffa cylindrica</i>	
	Original material	Water-free material	Original material	Water-free material
Water	94.90	...	94.66	...
Protein	0.68	13.39	0.51	9.57
Fat	0.24	4.70	0.19	3.72
Carbohydrate	1.03	39.84	3.31	61.99
Crude fiber	0.72	14.03	0.46	8.58
Ash	0.43	8.43	0.41	7.65
Undetermined	1.00	19.61	0.45	8.49

among them the luffas which are long cucumber-like fruits. There are two kinds. The commonest one in the markets of Chinatown, New York, is the Sing-kwa which is *Luffa acutangula* Roxb. (Fig. 26). It is longer than a cucumber, tapers at one end, is slightly curved at the pointed end, and has ten prominent ridges running its entire length. The leaves are rounded in outline and are only slightly lobed. The other gourd is *Luffa cylindrica* Roem., called by the Chinese "Sze-kwa", and by English-speaking people, "sponge gourd". This type is more often found in drug stores because of its special use as a sponge (Fig. 23). It has the same curved cylindrical form as the Sing-kwa, but it is smooth and has ten dark longitudinal lines instead of ribs. While it normally reaches one to two feet in length, it is said that some varieties in warmer countries may reach a length of nine feet.

The young fruits of both species, when not more than four inches in length, are peeled, boiled and served with butter, pepper and salt, or used as an ingredient in curries. The expressed juice of the leaves can be used as green dye for cloth. In Japan the young fruits of the Sze-kwa (*L. cylindrica*) are sliced and dried for future use as a vegetable.

Further analysis shows that the fruit of Sing-kwa contains an amorphous bitter principle called "luffein" which acts as a purgative. Pressed cakes of this gourd are bitter and have a toxic reaction. The fruit of *L. cylindrica* (Sze-kwa) contains saponin and abundant mucous. Feeding tests show that the fruits of *L. cylindrica* are low in vitamin B. By the dye method they are shown to contain 122 international units of vitamin C.

The seeds of both species produce similar oil which is colorless, odorless and tasteless, and can be used as a substitute for olive oil. It contains 67.5% to 70.0% palmitic acid and 30.0% to 32.5% stearic acid; also some myristic acid as glycerides.

When the sponge gourd, or Sze-kwa, is mature, the pulp disappears and the vascular network, which is the skeleton of the fruit, hardens to form a dense mesh like that of a sponge. Because of its use in washing and drying, it is often called the "dish-cloth gourd". In addition to its use as a sponge, there are many other uses to which it is put, such as shock absorbers, table mats, slipper soles and packing material for fragile objects as well as for stuffing pillows, mattresses and saddles. Its insulating quality against heat gives it a special value in the manufacture of tropical

helmets. Matting, baskets, sandals and toys are made of it in combination with other materials. The uses reach even into the strategic class of materials, for they make excellent oil filters for steamships, and during the war the demand for them grew tremendously for use in outfitting naval vessels.

The ripe fruit of Sze-kwa, burned and pulverized, has a number of medicinal properties. The fiber also is esteemed as a medicine. The leaves even are used in skin diseases and orchitis, and the vine and root for decaying teeth, ozoena and parasitic infections.

Leprosy Gourd. Another cucurbit sold in Chinese markets is the leprosy gourd (*Momordica charantia* L.), or K'u-kwa (Fig. 27). The plant originally came from countries south of China, but has become domesticated in the southern provinces. They have been grown in Chinese vegetable gardens on Long Island.

The fruit is like a cucumber, six to seven inches in length, green, turning to yellow when ripe, and the skin is marked with longitudinal rows of oblong tubercles. When ripe it bursts open into three divisions, disclosing many rounded scar-

old ones are used for medicine. The fruits themselves are not regarded so much as a source of food as of flavor which they impart to preparations; hence they are often placed in the class of condiments. The pulp is sweet and can be eaten, but mostly the fruits are used in salads, in pickles or as an ingredient of curries. The seed masses may be dried and mixed with meat, and are used in the preparation of appetizers. The fruit may also be fried with chicken or chopped and mingled with pork, or cooked with codfish. In India the fruit is sliced and then fried. It is necessary, however, to boil it in water first in order to remove all bitterness. One of its names, La-kwa, means "bitter squash".

K'u-kwa is a fair source of vitamin A, an excellent source of vitamin B, and a good source of vitamin G. The fruit is considered to be cooling and strengthening. The seeds benefit the breath and invigorate the male principle (Yang).

Two-thirds of the nitrogenous constituents listed in the following analysis are albuminoid. Present also are considerable quantities of reducing sugars and true starch in relatively large amounts.

	Fresh fruits	Water-free material
Water	93.61	...
Protein:	1.18	18.48
Albuminoids	0.79	12.31
Amides (by difference)	0.39	6.18
Fat	0.20	3.19
Carbohydrates:	1.33	20.66
Starch	0.67	10.56
Cane sugar	0.06	0.74
Reducing sugar	0.60	9.36
Crude fiber	1.07	16.72
Ash	0.34	5.25
Undetermined	2.28	35.69

let pulp masses, each containing in the center a flat seed curiously marked and tuberculated.

Only the young fruits are eaten; the

Bottle Gourd. Another gourd sold for food in Chinatown markets is the bottle gourd (*Lagenaria vulgaris* Ser.) (Hu-lu), which is probably better known for its

practical uses than for its food value (Fig. 25). Only young fruits are sold because it is in that stage that they are best eaten. The bottle gourd is a double-bellied gourd, which in outline resembles figure eight; it represents one of three forms of fruit produced by varieties of this species. The three forms are the club-shaped gourd, the pear-shaped gourd or calabash, and the bottle gourd. They are cultivated in central and northern China and in Manchuria. They will also grow in the New York area.

Because they develop a hard shell, the fruits are used for many purposes beside food. Small varieties showing stripes and particolored patterns are grown for ornaments. The young seeds, young leaves and pulp are eaten as food, but the shells of mature specimens are used to make dishes, scoops, vessels to hold different kinds of liquids, beggars' collection boxes, musical instruments, drug bottles, floats and the like.

Seeds of the bottle gourd are boiled in salt water and eaten when cold as an appetizer by the rural classes in China. Pulp of the fresh fruit is sometimes eaten like squash, but if eaten in too great quantities is liable to cause vomiting and purging. Stripped and dried pulp, when boiled with water, soy, sugar, etc., is an article of food called "Kampio" and can be preserved as such for a long time if sealed. In the past the Japanese have been making Kampio and exporting it exclusively to China as a regular business.

The pulp of *L. vulgaris* has low caloric value, is a good source of vitamin B, but is only fair for vitamins C and G. It is considered to be cooling, diuretic and antilithic. The prickly cortex of the vine and the flowers are regarded as counterpoisons. Composition of the fresh fruit is as follows:

Water	91.50	Carbohydrate	3.33
Protein	0.64	Crude fiber	1.06
Fat	0.90	Ash	0.38

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