The Cultivation and Preparation of Ginger.

THE following section dealing on the Cultivation and Preparation of Ginger is taken from the article on "Ginger: its Cultivation, Preparation and Trade" in the *Bulletin of the Imperial Institute*, Vol. XXIV., No. 4, 1926:—

Climatic Requirements.

For the successful cultivation of ginger the essential requirements as regards climate are a good rainfall and a high temperature during the growing period. In the ginger-growing region of Jamaica the mean annual rainfall is 88 in., whilst in South-West India it is over 100 in. A dry season during the resting period and prior to planting is an advantage, as it facilitates the thorough preparation of the soil required for the crop, but is not essential.

Owing to the fact that a high temperature is needed for the optimum growth of the plant, cultivation is naturally most successful in tropical and sub-tropical regions. It need not be restricted to such areas however. Provided that the heat and sunshine are sufficient during the greater part of the year, a cold winter is immaterial as before this period is reached the rhizomes will have been dug up from the ground, the bulk already prepared for the market and the remainder stored for planting the following season. These are actually the conditions obtaining round Canton and also in parts of Queensland where the crop is grown.

As regards altitude the plant succeeds in Jamaica from sea-level to considerable elevations, and in India also it is grown both in the low country and up to 4,000—5,000 feet in the Himalayas.

Soil and Manure.

Ginger is an exhaustive crop and, unless manures are readily and cheaply available, the soil in which it is grown must be rich in plant food. The plant will not succeed in land liable to become water-logged or in soil of a gravelly or very sandy nature. The most suitable kind of soil, therefore, is a rich vegetable loam. The land must be well drained, as if water collects about the rhizome the latter is liable to rot.

The best varieties of Jamaica ginger are grown on a sandy loam, and in India the ginger produced on the compact black soils is said to be inferior to that grown on the lighter sandy loams. The amount of sand should probably be not more than 30 per cent., and of clay not above 20 per cent.

In Jamaica the primitive plan of clearing forest lands by fire was largely followed, and on this cleared land ginger was grown until the soil became exhausted, when it was abandoned and a new piece of land put into cultivation. This wasteful method resulted in the production of large tracts of exhausted land, which could only be brought under cultivation once more

after considerable expenditure on chemical manures. In order to avoid this objectionable way of using land, experiments were carried out by the Jamaica Agricultural Society with a view to ascertaining the most suitable manures for ginger. A mixture composed of marl, with 10 per cent. each of soluble phosphates, ammonia, and potash salts, applied at the rate of one ton per acre, gave the best results. On worn-out land a yield equivalent to 2,960 lb. of ginger per acre was obtained with this manure, whilst on the unmanured, exhausted land the plants hardly grew, and gave no return.

In most parts of India manuring is regularly practised, the manures generally employed being oil-cake and dung. In some parts old and well-decayed cow-dung is either applied at the time of the first ploughing or is put in the holes made when planting the crop. During growth the ground is sometimes top-dressed with mustard-cake and castor-cake, whilst the mulch of leaves, etc., often applied to the ground after planting, also serves to enrich the soil.

The principal constituents removed from the soil by ginger are stated to be lime and phosphoric acid, and it is the replacement of these constituents which should be aimed at.

Cultivation.

In Jamaica two methods of cultivation are adopted. That by which the best ginger is obtained consists in planting in March or April portions of selected rhizomes from the previous year's crop, care being taken that each portion planted contains an "eye" (embryo stem). The land is raised into ridges and the pieces of rhizome are placed a few inches below the surface and about one foot apart, the process being much the same as that observed in planting potatos. It is advisable thoroughly to clear the land of weeds before planting the rhizomes, as the removal of weeds becomes difficult later on when the ginger plants have developed. Unless the rainfall is good it is necessary to resort to irrigation, as the plants require a good supply of water. The ginger produced in the foregoing way is known as "plant ginger."

"Ratoon ginger" is obtained by leaving in the soil from year to year a portion of a rhizome containing an "eye." This "eye" develops in the normal way, giving rise to a supply of rhizomes in the succeeding season. "Ratoon ginger" is smaller and contains more fibre than "plant ginger," and the product obtained by this means is said to deteriorate steadily from year to year.

In some parts of India it is usual to plant the crop in beds about 10 to 12 feet long and 3 or 4 feet wide, in which the sets are placed about 9 in. to 1 ft. apart. The field is then covered over with the leaves of trees or other green manure to keep the soil moist, and over the leaves organic manure is spread to a depth of about ½ in. At the end of the rainy season it is necessary to resort to irrigation. During the first three months of the dry season the field is weeded about three times.

Before planting, the land must be thoroughly hoed (or ploughed) and harrowed, in order to produce a fine tilth. In planting large fields it would appear preferable to open up drills about 4 in. deep and 2 ft. apart, much as is done in planting potatos on a large scale. Artificial manure, such as superphosphate and bone meal, can then be incorporated in the soil at the bottom of the drill, before planting the sets.

On account of the crop taking up such large quantities of plant food a system of rotation should be adopted if possible. This is done in some parts of Jamaica, where much of the ginger is grown in small quantities as a garden plant, in association with bananas, chillies, etc.

The method of growing ginger in the Canton district of China differs considerably from that practised in countries where dried ginger is the objective. Low-lying ground is usually selected for the crop and the cuttings are set at intervals of 6 in. in ridges about 1 ft. high and 2 ft. apart. Water is kept continuously between the ridges. After the shoots have reached a height of from 6 in. to 1 ft. the plants are heavily manured at frequent intervals with urine or nightsoil mixed with water. This favours the formation of the succulent rhizome characteristic of Chinese ginger.

"Ratoon ginger" matures early, and in Jamaica is harvested from March to December; but "plant ginger" is not ready for digging until December or January, the rhizomes being gathered as they mature from that time until March. The rhizomes are known to be ready for digging when the stalks wither, this taking place shortly after the disappearance of the flowers. In Jamaica the plant flowers during September. The rhizomes are twisted out of the ground with a fork or a hoe. In performing this operation great care is necessary, as any injury inflicted on the rhizome depreciates its market value. Considerable experience is necessary in order to lift ginger rhizomes properly.

The "hands" (complete rhizomes and adherent fibrous roots) are piled in heaps, the fibrous roots are broken off, and the soil and dirt removed immediately, as otherwise it is difficult to get the finished ginger white. The rhizomes should not be allowed to lie long in heaps, as they are liable to ferment. The usual plan is, as soon as the rootlets and excess of soil have been removed, to throw the ginger into water to be ready for "peeling" or "scraping." This is done in Jamaica by means of a special knife, consisting merely of a narrow straight blade riveted to a wooden handle; in India the outer skin is scraped off with a shell or piece of broken earthenware. In the case of Sierra Leone ginger of the ordinary grade the flat sides of the hands are scraped with a spoon and the hands are then laid out to dry without washing in water.

The operation of peeling, if carried out in a proper manner, is a very delicate one, the object being to remove the skin without destroying the cells immediately below it, since these cells contain much of the oil upon which the aroma of the best qualities of ginger depends. As the rhizomes are peeled they are thrown into water and washed; and the more carefully the washing is done the whiter will be the resulting product. As a rule the peeled "hands" are allowed to remain in water overnight. Some planters in Jamaica add a small proportion of lime-juice to the wash water at this stage, at the rate of about half a pint to six or seven gallons of water, in order to produce a whiter root.

After washing, the peeled rhizomes are placed in a "barbecue," which consists merely of a piece of levelled ground covered with cement, on which the ginger is placed to dry in the sun. Where a "barbecue" is not available, a "mat," consisting of sticks driven into the ground, across which are laid boards or palm or banana leaves, is used, on which the ginger is exposed until it is dry. Uniform drying of the rhizomes is essential for the production of first-class ginger and to prevent mildew; and to ensure this they should be separately turned over by hand at least once on the first day. Careful planters put their ginger out daily at sunrise, and take it in each night at sundown; conducted in the latter way the operation of drying usually takes from six to eight days. The ginger, if not sufficiently white in appearance, has to be bleached by further washing, and after being redried is ready to be packed for export. In some parts of India the peeled rhizomes are bleached by soaking in lime-water for a short time and exposing them for about 12 hours after drying to the fumes of burning sulphur in a specially constructed bleaching-room, at the rate of 7 lb. of sulphur per ton of rhizomes.

The finished ginger is graded according to size and colour of the "hands" — the best grades consisting of the large plump "hands" free from traces of mildew, and the poorest the shrivelled, dark-coloured "hands." As a rule the crop is divided into four or five grades. The best "hands" obtained in Jamaica weigh as much as 8 oz., 4 oz. being an average weight.

Unpeeled ginger is merely freed from its rootlets and excess of soil, and then thoroughly washed in water or scalded in a boiler of hot water, and finally dried in the sun.

Preparation of Preserved Ginger.—In China the first crop of ginger is ready about three months after planting. This is known as "young ginger" and is the least pungent and most expensive. Unlike the Jamaica and Indian ginger, the rhizomes are not allowed to mature, as they become too pungent for the purpose for which they are required. After harvesting the roots are washed and the skin carefully scraped off. They are then punctured by means of a fork and afterwards washed in rice water (the water left after washing rice) to improve the colour. The rhizomes are next boiled in three or four changes of refined sugar and water for one or two hours, until thoroughly soaked. They are then placed in barrels or other containers and covered with syrup. In the case of dry preserved ginger, the wet rhizomes are strained till dry and then rolled in sugar placed on bamboo matting.

Yield.

The yield of ginger varies considerably with the climate, soil, and methods of cultivation employed. In Jamaica the average return is from 1,000 to 1,500 lb. of dried ginger per acre, but as much as 2,000 lb. per acre has been obtained under the best conditions. The recorded yields in different parts of India vary within wide limits. In Bengal it is stated that 1,000 to 1,500 lb. per acre is the average crop, in the Punjab 2,100 lb., in Travancore 2,000 to 2,500 lb., whilst in an experimental cultivation at Surat, Bombay Presidency, the yield was equivalent to over 8,000 lb. per acre. As already mentioned a yield equivalent to nearly 3,000 lb. per acre was obtained in Jamaica on exhausted land by the application of a suitable manure; and there is no doubt that, by careful cultivation and manuring, the yield in all the countries mentioned could be considerably increased. It takes about 4 tons of freshly dug rhizomes to give 1 ton of dried ginger.

Pests and Diseases.

Owing to the pungent nature of the shoots, the ginger plant is attacked by very few insect pests, and it has even been recommended that the crop should be planted in orchards to prevent the development of pests of fruit trees. At the Rangpur Agricultural Station, Bengal, however, the larva of a Drosophelid fly, which lives on coarse grasses, has been observed to do a good deal of harm to the shoots.

In Southern India the caterpillar of a butterfly, *Udaspes folus*, sometimes does great damage to the leaves, whilst the caterpillar of a moth, *Dichocrocis punctiferalis*, bores into the stem and rhizome, but seldom does serious harm. The latter is better known as a pest of castor plant in Southern India. In Travancore the rhizome is bored by the larva of a small fly (*Calabota* sp.) which deposits its eggs at the base of the plants; when the crop is gathered the larva migrates to wild arrowroot, where it completes its development. The best remedy is stated to be the destruction of the alternative food plant.

The coconut scale, *Aspidiotus destructor,* has been found to occur on ginger in Fiji, but no information appears to be on record as to the extent of the damage caused.

Considerable injury is inflicted on ginger crops in Jamaica by a disease called "black rot," which attacks the underground parts of the plant, and brings about decay of the rhizomes. The first indication of the disease is a yellowing of the leaves, which droop and wither; the bases of the stems become discoloured and rot, and finally decay spreads to the rhizomes, which disintegrate to form a putrefying mass of tissue. A fungus present in the decomposing rhizomes was found to form spores in a similar manner to *Allantospora radicicola,* Wakkar, a fungus which causes a root disease of sugar-cane in Java. It was not clearly shown, however, that the fungus found in the old rhizome was the cause of the disease (Howard, *Bull. Bot. Dept. Jamaica,* 1901, 8, 181; 1902, 9, 42).

A similar rot of the rhizome, caused by a species of Pythium, which occurs in India, was first recorded by Butler from Surat and is described by McRae in *Agric. Journ. India* (1911, 6, 139). The disease spreads rapidly through the soil, and to prevent infection of healthy plants every portion of an affected plant must be removed and burnt, whilst the soil itself should be treated with lime, or a light dressing of sulphate of iron may be applied. Isolation of infested soil by a trench has been tried with success, but in the case of a bad attack ginger should not be grown on the land for at least three years. The disease is most serious on wet, heavy soils, or in exceptionally rainy seasons, and it may be prevented to a large extent by draining the land, so that no water lies round the collar of the plant. Great care should be exercised in selecting only healthy rhizomes for planting purposes, any plants with even the slightest trace of disease being rejected. After a bad attack it is advisable to steep the rhizomes for about half an hour in Bordeaux mixture before planting, to destroy any fungus spores or hyphae on their surface or in the soil clinging to them. The fungus, which also occurs on tobacco and papaya in India, was at first thought to be *Pythium gracile,* Schenk, which in Europe is found on fresh water algae. Subramaniam, however, showed that it is a distinct species, which he calls *Pythium Butleri* (*Mem. Dept. Agric., India Bot. Ser.,* 1919, 10, 181).

Another disease of ginger which does some damage in Jamaica is locally called "corkrot." This cannot be detected until the crop is gathered, when the rhizomes are found to be of cork-like texture and quite valueless. The exact nature of this disease does not appear to have been investigated.

A new disease of ginger, caused by *Vermicularia Zingiberoe* and reported from the Godaveri District, is described by Sundararaman in *Mem. Agric. Journ., India, Bot. Ser.* (1922, 11, 209). The disease begins with small yellowish spots and later the whole leaf turns yellow and rots, resulting in a poor development of the rhizome. It makes rapid progress during a period of continued wet weather and high humidity but the advent of drier conditions checks its growth and the plant may recover. Spraying with Bordeaux mixture was found to be effective against the disease.