Tomato Cultivation.

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Section I. In the Hambantota District.

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History.

TOMATOS first began to be cultivated in the Hambantota District on a commercial scale in 1923. At the present time it is being largely cultivated around Ambalantota, Tissa, Ranna, and Wiraketiya. Of all the garden crops grown in this district tomatos give the best and the quickest returns.

Soils.

It thrives best in sandy loams and alluvial soils on the river banks which are well drained.

Seasons.

In this district tomatos are extensively grown as a dry crop during the Maha season from September to February, but it is also cultivated during Yala on a very small scale where irrigation facilities are available. Tomatos grown during Yala fetch a better price than the Maha crop.

Seed and Nurseries.

The best result so far obtained are from selected seed, which should be stored in air-tight tins. A handy receptacle for this purpose is a cigarette tin. Well ripe, fair sized fruits are plucked from healthy plants. The seeds are carefully removed from the fruits and washed in fresh water to remove the sticky substance on the seed. When the seeds are well washed they are removed and mixed with fine wood ashes and then sun-dried for seven to ten days according to weather conditions. When the seeds are perfectly dry, the excess ash is removed by winnowing. After these operations the seeds are put in cigarette tins and made air-tight. In this connection I may mention that seed obtained from fresh fruits just at the time of sowing germinates well, grows into healthy plants, but the yields have always been observed to be poor, and the fruits of these plants are usually smaller than the fruits of the stored seed from one season to another.

Seed Beds.

Four ounces of seed are sufficient to raise seedlings to transplant an acre. There are two methods of preparing nurseries, taking into consideration the prevalence of white ants in the locality :—

(*a*) In places where there is no damage from white ants the seed beds are prepared on elevated ground under the shade of trees, so that they are not affected by heavy rains. Tomato seedlings are very delicate, and require a great deal of care in rearing. The seed beds are almost universally prepared by a special treatment of sterilization by burning. The burning of straw, dry leaves, logs, &c., on seed beds produces a high temperature in the soil, which not only has the effect of sterilizing the soil, but improves the tilth of the seed-bed and kills the weeds in the nursery, so that the growth of seedlings is more rapid as well as more vigorous. After sterilization the ground should be cleared of rough stones, big clods of earth, and the soil dug and raised into beds of uniform level. The width of each bed should not be more than 4 feet. The length may be of any workable dimensions, according to the lay of the land where the seed bed is prepared. The beds should be 4 to 6 inches high with a drain of 12 inches in width between each bed so as to facilitate watering, weeding, and removal of insect pests.

(*b*) In places where the seeds are liable to be destroyed by white ants, the seed beds are prepared on platforms put above ground or in boxes. The platforms are made by fixing six posts into the ground, into which cross sticks are tied up at a height of 3 feet from the ground level. Over this structure strips of bamboo, &c., are placed, thus forming a platform. Woven coconut branches are spread over this platform, and then fine soil mixed with wood ashes, free from rough stones and clods, are spread to a uniform height of about 6 inches. It is best to tar the posts which are fixed to the ground in order to prevent the invasion of white ants to the seed beds.

The seeds are sown in nurseries for the Maha crop during August and September. After sowing, the seed bed is lightly covered with fine soil and the surface lightly pressed down. It is advisable to sow the seeds in rows of 4 inches apart in order to facilitate cultivation, watering, and removal of insect pests; this procedure makes it easy to uproot seedlings for transplanting. A heavy watering is done just after sowing. The seed beds are given sufficient water in the morning and evening, according to weather conditions. It is necessary to have the nurseries shaded by erecting a structure, on the top of which branches of coconut are placed to keep away the excessive heat of the sun as well as heavy rain. On cloudy days the shade may be removed in order to admit air and light. When well watered the seed germinates in four to five days. Heavy rain or continuous dry weather is disastrous to young seedlings. The seed beds have to be carefully weeded, and caterpillars and other insects, which do a great deal of damage, have to be looked for every morning, and if any dead plants are found they should at once be removed. Owing to the uncertainty of the setting of the monsoon in the district, it is advisable to sow the nurseries two or three times at an interval of about a week, and at each time sowing a certain portion of the seed-bed in order to ensure a good supply of seedlings of the proper age for transplanting. As the seedlings are delicate, and as there is always a demand for them, twice the area required for transplanting is usually prepared by careful gardeners.

Preparation of Land.

The field for planting out tomatos is prepared during the dry months of August and September. If the plot consists of jungle it is cleared and burnt. But if the plot is one which has been cultivated previously it is weeded and the weeds collected and burnt. After a shower of rain which is sufficient to moisten the soil, the land should be dug with mammoty, forked or ploughed, as the case may be. An application of lime and wood ashes before digging or ploughing gives good results. From experience I have found that the application of cowdung as a manure in tomato cultivation causes the prevalence of wilt.

Transplanting.

The seedlings are ready for transplantation when they have four to six leaves and are four to six weeks old. The transplantation begins in the beginning of October and extends as late as the middle of November. After the first shower of rain, when the ground is quite moist, transplanting is resorted to on a cloudy afternoon. Seedlings are planted 3 to 4 feet apart from one another, depending on the fertility of the soil. In this district, which has a dry climate it is preferable to plant early. When the nursery beds are sufficiently moistened to enable the seedlings to be uprooted without damage, they are removed in baskets to the field and planted in holes, which should be dug beforehand to receive them. Care should be taken when filling the holes with earth that this operation should be done in such manner that no water will stagnate at the collar of the seedling. The water thus collected will cause the stem to rot and will ultimately kill the plant. This damage is most noticeable in the case of imported varieties. If dry weather prevails after transplanting, the young plants should be protected from the sun by shading with twigs of trees until they are well established. Rannawara twigs answer this purpose most satisfactorily in this locality. It is also necessary, during dry weather, to water the transplanted seedlings for the first few days until they strike root.

Cultivation and After Care.

After the seedlings are well established weeding is done either with mamoties or by hoeing. Vacancies are filled in just before hoeing when the weather conditions are favourable. When the plants have grown to a height of a foot or so, they are earthed up, *i.e.*, heaping earth round the plant by scraping the ground round it. This operation not only keeps the plants firm but also encourages side-rooting, in addition to keeping the plot free of weeds. Two or three earthings are required at intervals of ten to fifteen days.

Manuring.

A top dressing of superphosphate during earthing up results in good yields.

Supports.

The fruits of imported varieties are readily spoilt by coming in contact with the ground, therefore it is advisable to have the plants supported with sticks to prevent the fruits touching the ground. This operation is usually done at the time when fruits are being formed.

Flowering and Fruiting.

Tomatos flower from four to five weeks from the date of planting out in the field, depending on the variety and climatic condition. Local varieties flower sooner and come into bearing early. Heavy rain during the flowering period causes the flowers not to set. In the case of local varieties fruits are ripe enough for harvesting in about eight to nine weeks after planting, but in the case of imported varieties it takes a fortnight longer. Picking is done once a week; matured green fruits as well as ripe ones are harvested at the time of picking. Harvesting begins early in December and extends up to the first week of February, depending on the weather conditions as well as the variety grown. The third picking gives the best proportion of the crop, and it is nearly 50 per cent. of the whole crop.

Prices and Market.

The gardener who established his crop early gets a higher price than the late cultivators, because the demand for tomatos at the beginning of the season is far greater than the supply at the beginning of the season. The prices vary according to the size of the fruits and variety grown. Imported varieties have so far not been found to stand the local field conditions as well as the smaller fruited local type, nor are the crops nearly as heavy.

The prices vary from cents 25 to 50 per 100 fruits in case of local varieties, and cents 50 to Re. 1 per 100 fruits of the imported varieties. The tomato crops grown up-country are scarce during the months of December and January and there is a keen demand in these months for tomatos grown in the drier parts of the Island for the Colombo market.

Yields.

The average yield of tomatos per acre may be taken as 50,000 to 60,000 fruits, fetching a price of Rs. 150 to Rs. 250. One acre on the Ambalantota Experiment Station in the very dry season of 1926—27 yielded a gross return of Rs. 130 with a nett profit of Rs. 70. This return would be increased by at least 25 per cent. if it were possible to avoid damage during transport to Colombo.

Pests and Diseases.

Epilachna Beetle.—The grubs of this pest were found in large numbers, causing considerable damage to the leaves of the tomato nursery plants. In the early stages hand-picking during the early morning may be resorted to, but when found in large numbers, spraying with a weak solution of Paris green may be effective. This pest was first observed in brinjal plants, from which it spread to the tomato nursery.

Heliothis obsoleta—Tomato Fruit Borer.—The caterpillar bites a hole in the fruit and only thrusts its head inside leaving the other parts of the body exposed, and it continues its work of destruction from one fruit to another till a large number are destroyed by a single caterpillar. The fruits thus attacked start decaying and quickly rot. Fruits of all stages of development are bored into. This pest also attacks Indian corn and cotton. Tomatos should not therefore be grown near to cotton or Indian corn and if grown on land previously occupied with cotton or Indian corn, it should be thoroughly ploughed over in order to expose and destroy the pupae of this pest in the soil. Hand-pick and destroy the caterpillars whenever possible.

Tomato Wilt Disease.—This serious bacterial disease of tomato is not so prevalent in this district as in the wet zone. Few cases were observed where tomatos were grown on lowlying situations. The diseased plants were uprooted and destroyed.

Section II. In the Jaffna District.

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Tomato cultivation is mainly confined to garden-lands in certain villages in this district. With the growing popularity of the crop the demand for high quality tomatos is increasing, and there is a need for improvement in the quality of tomatos grown for the market. During the last few seasons an attempt was made to grow better grade tomatos for shipment by rail to Colombo on the Experiment Station, Jaffna, and the following is a summary of the mehtods followed :—

Soils.

Soils of a loamy or sandy loam character are preferable to tomato cultivation. Heavy and poorly drained soils give unsatisfactory returns and soils ploughed when they are too wet seldom yield a profit. Tomatos grown on light soils are of a better quality than those grown on heavier soils.

Season.

In the Jaffna District tomatos are grown during the north-east monsoon season, September to March. Some attempts have been made to grow the crop during the dry season, but these efforts have been unsatisfactory on account of the strong winds during this season of the year.

Crop Rotation.

It is very important that the crop should fit in some system of rotation prevalent in the locality. Tomatos should not follow tomatos, brinjals, chillies, or tobacco. In and around the vicinity of the Experiment Station tomatos are followed in the same season with tenai and kurakkan. Cowpeas and ground nuts could also be profitably included in the rotation. It is the practice in this district to set apart the poorest part of the land for the tomato crop, using the good ground for the other crops. The crop should, however, occupy good land if success is to be expected.

Varieties and Seed.

An inferior variety is grown in the villages. The fruits of this variety are inclined to be small and rough, and the yield is not so good as some of the imported varieties grown on the Experiment Station. Six introduced varieties, viz., Large red, Stone, Mammoth, Ponderosa, Perfection, and Peach tomatos, have been under trial since 1921. The variety Stone has given the best results. It produces a high yield of solid fruits of medium size.

The successful cultivation of tomatos depends on the use of selected seeds of suitable varieties. Individual plants of the desired type should be marked, and the fruits of these plants taken for seed for the next season.

Seed Beds.

Beds 3 feet by 3 feet are formed with mamoties on land previously ploughed or hoed three or four times. The beds are then levelled and well-rotten cattle manure or village sweepings containing a good proportion of ashes are applied at the rate of two baskets per bed and mixed well with the top soil by means of mamoties. About 1 oz. of seeds is sown in each bed evenly, and mixed with the soil by means of the fingers so that the seeds may be slightly covered by the soil. Two beds sown with 2 oz. of seeds are usually sufficient to transplant an acre. The beds are then watered. Before the water soaks into the bed, powdered dry cattle manure is strewn over the bed to cover any seed which may still be lying exposed on the surface. To keep the soil moist and to ensure an even germination the beds are covered with straw or dried plaintain leaves. These should be removed on the seventh or eighth day, when the plants appear above the ground. The beds should be watered every morning till the seedlings are ready for removal. The beds should be weeded once or twice by hand. In thirty to thirty-five days the seedlings will be ready for transplanting. If they are allowed to stand longer in the nurseries they are said to withstand drought when transplanted, but this gives no advantage as far as crop is concerned.

Preparation of the Land.

The land is ploughed deep four or five times after the harvest of the preceding crop and is left exposed till the latter part of October, when the planting of the crop commences. Previous to planting a ploughing is given when there is little moisture as possible in the soil. The soil should be well exposed for about a week to dry in order to give opportunity for thorough preparation and for the effective covering of the manure. The land is then formed into ridges and furrows—the distance between two ridges being 3 feet. It was observed that crops planted on ridges established quicker than those planted in flat beds. The shedding of blossoms owing to excessive moisture in the soil during wet weather or over watering is avoided if planting on ridges is adopted. The ridge and furrow system facilitates irrigation and drainage.

Manures.

Many cultivators in this locality prefer to grow crops with the residuals of manures applied to the crop preceding tomatos rather than to apply manure to the tomato crop itself. The application of moderate quantities of well-rotten cattle manure at 10 to 12 cart-loads per acre has, however, been found necessary on the Experiment Station in order to secure good results. The application of cattle manure in large quantities is liable to promote excessive vegetative growth at the expense of the setting of fruits. Fresh manure as a rule should never be applied in preparing for planting tomatos. On the Experiment Station a compost is prepared at the rate of 5 cart-loads of horse dung, 4 cart-loads of cattle manure, and 3 cwt. of fish manure per acre about six weeks in advance. By this method the manure will become thoroughly decomposed, and is applied between the rows about three weeks after the planting of the crop. In stiff soils, where the land tends to become wet during the season, it is a good practice, to overcome this difficulty, to place round the base of each plant one or two handfuls of manure. This manure affords a dry footing to the plant, provides drainage of the soil, and supplies plant food for the quick growth of the plant. In this district, where there is a scarcity of cattle manure it was found to be a good practice to supplement an appli-

cation of the village refuse with 2 cwt. of superphosphate and 1 cwt. of nitrate of soda per acre. The application of nitrate of soda may be made in two doses—the first application should be made about three weeks after transplanting, and the second one about the time that the plants have set their fruits. The soil should be slightly stirred after the application of manure.

Transplanting.

In the Jaffna District the time of transplanting ranges from the last week in October till the latter part of November, but as a rule most of the transplanting is done during the last week of October. The product of this goes to the market during January, ahead of the late planted crops. The plants are set out in one side of the ridge 2½ feet apart. Transplanting is done with a pointed wooden pin about 1½ inch in diameter and about 1 foot long. The holes are kept ready before the plants are pulled out for transplanting. The beds from which the seedlings are to be removed should be well soaked by watering, so as to soften the soil and to allow of the seedlings being removed with the least injury to the roots. Only well developed, vigorous, and healthy seedlings are chosen and placed by the sides of the holes. The seedlings are then transplanted and the soil is pressed firmly round the plants. If the planting is done in damp weather no watering was found to be necessary. If the weather was bright and clear, it was found beneficial to moderately shade the plants and water them for three or four days. No watering is necessary after this for about fifteen days, by which time the crop establishes itself well and begins to grow.

After Cultivation.

Within a fortnight after planting the crop is intercultivated fairly deep with the Planet Junior Cultivator, and subsequent shallow cultivation should be done as soon as the soil is dry enough after every rain until the plants are four to five weeks old. Hand hoeing between the plants is necessary practically after every cultivation, and all weeds should be kept out. Cultivation of the crop may be discontinued about the time the picking of fruit commences.

Staking and Pruning.

In the villages the cultivators allow the plant to grow naturally upon the ground. But in the production of tomatos of good quality staking is desirable to prevent the fruits from coming in contact with the soil. The stakes are usually 3½ to 4½ feet long and sharpened at one end so that they may be easily driven into the ground. About six weeks after transplanting a stake is driven beside each plant about 3 inches from the base. The tying of the plants to the stakes should commence immediately, and be repeated every ten days until about five tyings are made. Soft hemp twine or plaintain fibre should be used for tying. In tying, the plant should be drawn up close to the stake by passing the string around the stake and crossing between the stake and stem of the plant.

Pruning tomatos consists of cuttings or pinching out all side shoots as they appear about the base or in the axils of the leaves. The main stem should be clear of all side shoots to a height of about 18 inches from the base. The removal of side shoots should be attended to at least once a week during the active growing period in order to concentrate all the vigour of the plant in the formation of fruit.

Irrigation.

The tomato requires an abundant supply of water. The crop will stand on the ground for about five months, *i.e.*, till March. If there is no rain for periods of four or five days the crop is irrigated immediately from a well. About twelve irrigations are required on the average during the stand of the crop on the land.

Harvesting and Handling.

The first batch of fruits will be ready for picking about ten weeks after planting. Tomatos are gathered three to four times a week. Galvanized iron buckets and baskets are used for picking in the field. Great care must be taken while transferring the fruit from one receptable to another to avoid bruising. It is advisable to put in a small quantity of straw at the bottom of the receptacle. The degree of ripeness of tomatos grown for local and outside markets is a matter for consideration. When tomatos are sent direct to the market and offered for sale within twenty hours of the time, they are allowed to become almost red ripe upon the vines. When tomatos are sent for markets outside the district, they are gathered in the advanced pink stage or when this colour covers two-thirds of the fruit. The fruits gathered in baskets are carried to the packing place, where they are cleaned by means of a soft cloth and then packed in baskets or boxes. Tomatos for local market are packed in ordinary baskets, but in shipment by rail kerosene oil boxes are utilized. A box carefully packed holds 35 lb. and consignments of tomatos packed in this manner and shipped by rail to Colombo have opened out in good condition.

Good quality tomatos gathered from staked and pruned plants fetch 30 cents per lb. in Colombo, as against 5 to 10 cents per lb. for the small local type. The acre yields during the past three years have worked out at 2,828, 3,200, and 3,576 lb. respectively, and the profits have averaged Rs. 400 per acre. Careful records have been kept of costs of cultivation, and these have been as follows :—

	Rs.	c.
Preparatory Cultivation	33	60
Manure and manuring	84	40
Seeds and planting	19	60
After cultivation (including harvesting) ...	103	0
Irrigation	84	60
Rs.	325	20

Methods of Packing Tomatos.

The following information has been secured from the Empire Marketing Board :—

1. The most successful method of packing tomatos for inland transport is that evolved by Messrs. George Monro of Covent Garden.

2. The first step is to grade the fruit carefully. Messrs. Monro use the following grades, distinguished by the colour of the labels on the boxes :—

(*a*) Blue label: Misshapen and small tomatos.

(*b*) Blue and white label: Small but ripe tomatos of good shape.

(*c*) White label: Small tomatos, making the third class of good fruit. These are generally *10 to 12 to the lb.*

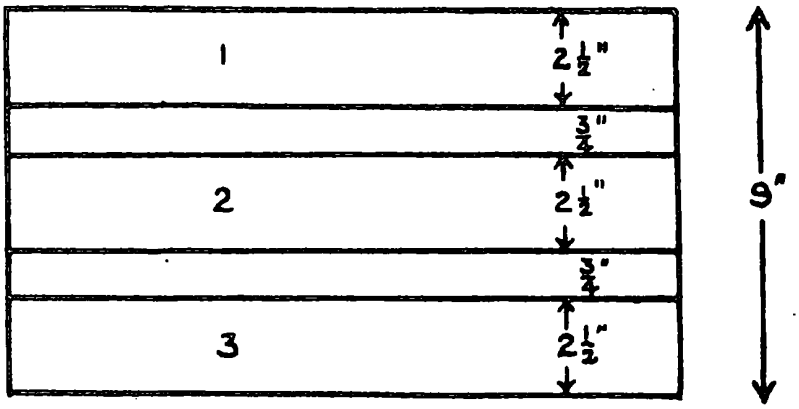
(*d*) Pink and white label: Medium sized tomatos, making the second class of good fruit. These are *about 8 to the lb.*

(*e*) Pink label: Large tomatos, making the first class of good fruit. These are *about 6 to the lb.*

3. The tomatos thus graded are packed into wooden boxes, each box taking *12 lb. nett* of fruit.

4. The top of the box consists of three broad slats, spaced so as to give ventilation, thus:—

Dimensions of box 15 in. by 9 in. by 5½ in.



Block by Survey Dept. Ceylon.

The floor of the box is added *last.*

5. For packing, the floorless box is turned upside down, and the bottom treated as if it were the top. As the base has not yet been added, the tomatos can be put into the open box.

6. The box is lined with clean tissue paper. A piece of corrugated cardboard packing is placed face upwards on the slats, which act, during the time of packing, as the bottom.

7. The tomatos are carefully packed in layers, so that the whole package is tight and that none of the fruit is bruised.

8. The floor of the box is then nailed on as a lid, and the completed package is turned upside down, so that the three slats now come uppermost. The box is then ready for transport.

9. As tomatos go on ripening after being gathered, those which are intended for distant markets are packed before they are fully ripe.

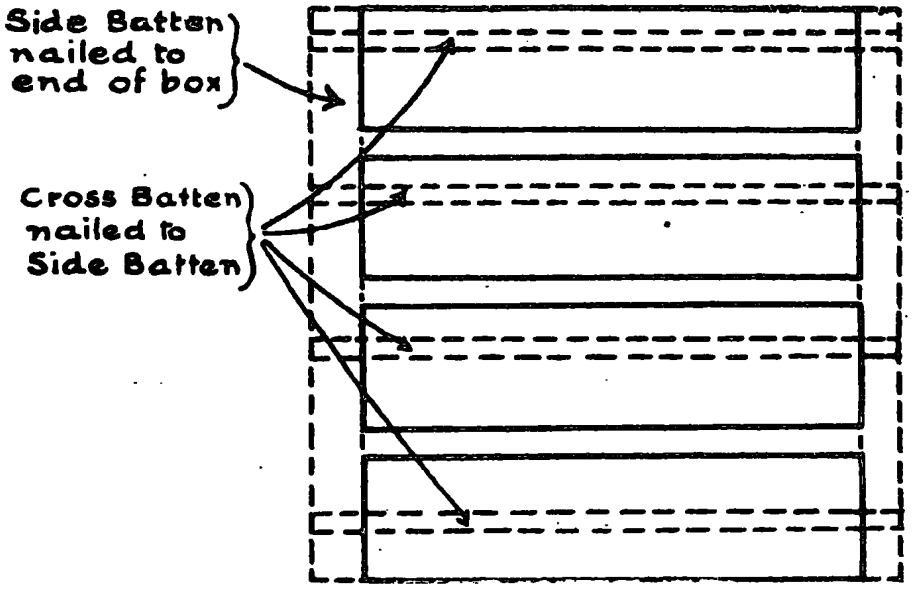
10. While in transit, the boxes should be handled gently, so as to avoid jolting and the consequent bruising of the fruit.

11. *Valenica* (*Spanish*) tomatos are packed in boxes, about 15 in. by 7 in by 4 in. Four or five of these boxes go to a bundle. The tomatos are graded into four classes, according to the size. They are put into the boxes when just beginning to turn colour. The fruit is packed naked, no special packing material being employed. The bundle contains about 1¼ cwt. of fruit.

12. *Canary* tomatos are packed in special boxes, called "deeps." The fruit is graded for size, and is packed while still not quite ripe. Each tomato is wrapped in tissue paper, and the box is lined with the same material. Peat or other fibrous material is used, to avoid the effect of

jolting in transit. Four grades are recognised, from the smallest size (p.p.) including p., and m.p., to m., the largest. About 80 lb. of fruit go to a bundle. The fruit is *always* packed with the stalk.

When packed, four "deeps" are arranged, one above the other, and are joined by $\frac{1}{4}$ in. battens at each corner. Other thinner battens are nailed on to these transversely, so that the whole bundle is made secure.



The "deeps" are about 15 in. by 8 in. by 5 in. They are made of 3/16 in. wood at the ends, and $\frac{1}{8}$ in. wood at the sides. The diagram shows the side view of a bundle. The dotted lines represent battens, and the four rectangles the sides of the four "deeps." The end view would be similar. The whole bundle is bound with wire tape.

13. *Dutch* tomatos come over in flat trays, containing about 20 lb. The fruit is graded, but no particular care is taken with the packing. The tray is covered with brown paper. At each corner (inside) there is a short length of 1 in. batten, projecting about 1 in. above the top of the tray. This serves to keep the trays apart when stacked.

14. *English* tomatos are frequently packed in chip baskets, each containing 12 lb. of graded fruit. The basket is lined with tissue paper, and covered with stout brown paper. It has a metal of wooden strip handle. It is claimed by some that the basket receives more careful handling on the railway than can be expected for any box. This, however, is not certain, and it would appear that the 12 lb. box is becoming more popular.