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Cultivation of Tapioca in the Vizagapatam District.

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Introduction. The cultivation of tapioca is of importance at the present juncture, when the problem of food production is acute. Next to rice it is one of the staple food crops of the Travancore State and has largely contributed to the food supply there, specially among the poor. In the Presidency of Madras, its cultivation is chiefly concentrated on the West Coast and in the district of Vizagapatam, where it forms a cheap food of the poor class. It is also cultivated in parts of Chingleput, South Arcot, North Arcot and Tanjore districts. It possesses certain commendable features. "The plant is one of the most productive in the world and it has been claimed that an acre of cassava will yield more nutritive matter than six times the same area under wheat". Economically it is a paying crop and added to it the attention required for its cultivation is almost negligible. The green tops of certain varieties serve as fodder for the cattle.

Tapioca *(Manihot utilissima)* belongs to the family Euphorbiaceae and is a native of tropical America. It is a shrubby perennial growing to a height of 6 ft. to 8 ft. but an annual under cultivation. The crop is propagated by stem-cuttings which produce adventitious roots; these develop into tubers, enriched with starch, with the advance of age.

Soil and crop rotation. Tapioca thrives under varied climatic conditions and different soil types. It is a very successful drought resisting crop. Once provided with adequate moisture at the time of planting, it thrives well later on under adverse conditions of weather. Well-drained laterite and porous soils admixed with sand are considered to be ideal. Clayey and sticky soils subject to water logging are definitely unsuitable. In many of the taluks of the Vizagapatam district, where its cultivation is popular, it is commonly raised in garden lands and to a little extent as a rainfed crop in dry lands. On the West Coast it is mostly raised as a rainfed crop on all types of lands and occasionally in well drained wet lands in rotation with paddy. Even though it is not cultivated in the wet lands of the Vizagapatam district it is important as a bund crop around plots of sugarcane, paddy and plantain. Many of the market gardeners in and around Anakapalli raise this in the midst of other root crops like yams, colocasia, etc. In the garden lands, the crop comes in rotation with *ragi* or any vegetable crop like brinjal, *bendai*, etc. In the dry lands it follows dry paddy or a minor millet.

Preparatory cultivation and manuring. Moderately deep cultivation and fine tilth are desirable as would be obtained by four to six ploughings with a wooden plough. The ploughed field after manuring is thrown into ridges and furrows three feet apart and one foot high. Irrigation and drainage channels are formed at every 12 to 15 feet length of the furrow. Being

an exhaustive root crop it requires adequate manuring, which generally consists of 15 cartloads of cattle manure besides sheep penning.

Time of planting. The time of planting is largely determined by the local conditions of the monsoons. Adequate soil moisture is required at the time of planting and initial stages of growth. The best time will be soon after the break of the S. W. monsoon. In the garden lands of the Vizagapatam district planting in June, even under irrigation, is preferred as it is believed to encourage vigorous growth of plants resulting in heavier harvest of the tubers. Planting will commence in mid July on all types of dry lands. On the West Coast late planting at the end of the S. W. monsoon season (September) is sometimes necessary, but on dry lands planting can be done throughout the monsoon period.

Seed material and planting. The crop is raised from stem cuttings which are taken from the middle portions of healthy and mature main stems or branches. The setts used are usually 1 in. to 1½ in. thick and nearly a foot in length having four to six nodes. The woody parts at the base of the plant and tender portions of the top branches are unsuitable for the purpose. The cuttings are planted in different ways. The common method in vogue in the Vizagapatam district is to plant the cuttings in a slightly slanting position, on the crest of the ridges at three feet apart; two to three internodes or 4 in. to 6 in. of the cutting is buried in the soil. This method is considered to give satisfactory results. On the West Coast besides this type of planting, setts are also planted horizontally on the sides of the ridges, and the planted fields are mulched with dry leaves and straw. The number of setts per acre depends upon the planting distance adopted. A close planting of 3 ft. apart either way usually adopted on soils of average fertility requires 4840 setts per acre; while a wide planting of 5' apart on rich soils takes about 1750 setts per acre. As a mixed crop, planted along with yams or colocasia, at spacings of 10 ft. to 12 ft., 300 to 400 setts may be necessary for an acre.

Irrigation. In the garden lands the field is irrigated before planting. Three days after planting a light irrigation is given and a week or ten days later another watering is necessary. Later on, the crop is treated as dry excepting for one or two waterings given as the crop is nearing maturity and prior to harvest. On the whole in the garden lands, besides the rainfall, five irrigations are sufficient to bring the crop to harvest. In the upland areas of the district it is raised entirely with the rainfall received; but the period of maturity is longer by about a month.

After-care. The cuttings sprout in the course of two to three weeks after planting. At this stage the gaps are filled with fresh cuttings. The after-care consists chiefly in keeping of the land free of weeds. Not more than two weedings are essential besides one hand hoeing.

Harvest and yield. The plants will be ready for lifting after seven to eight months, i. e., in January. In the garden land it comes to harvest early

in December. The maturity of the crop is indicated by the formation of flowers and shedding of the leaves. The cracking of the surface soil is an additional sign of the full development of the roots. The maturity can well be tested by lifting a couple of plants to observe the stage of development. The harvest consists in lifting the plants after careful digging of the soil around the plant with a small hand crowbar, to minimise the damage to tubers. The tubers are kept in the shade for some time when the soil adhering to them crumbles into powder and drops off. The *ryots* who grow it on small holdings of 25 to 50 cents of land do not engage any labour for harvest. A plot of 3 to 5 cents will be harvested by the *ryot* and his family just before market days for immediate disposal of the produce as otherwise the tubers get spoilt on storage. The yields are very varying depending on a variety of conditions like the fertility of the soil, manure, irrigation, variety, etc. Taking 4000 plants per acre and calculating an yield of 4 lb. per plant, on the average, a total yield of 16,000 lb. of tubers can normally be expected out of an acre. Still higher yields are not uncommon. The raw produce finds a quick sale in the weekly markets as well as local markets. Roasted and boiled tubers are also offered for sale. Its export outside the production zone is almost negligible except in the West Coast.

Pests and diseases. The tapioca is comparatively free from pests and diseases. In the early stages the planting setts are found to be attacked by white ants in certain fields. On the West Coast it is a common practice to put a handful of ashes in the planting holes to ward off vermin of all sorts. Cattle browse on the tender shoots and leaves: wild pigs, porcupines and bandicoots damage the roots in a standing crop to a considerable degree.

Food value and uses of tubers. The tuber is a pure starchy food. The tubers are generally obtained cheap and tapioca may be considered as the cheapest food stuff. "The starch is used under the name of Brazillian arrow root and when made into pellets forms the tapioca of commerce. Cassarup a powerful antiseptic is a by-product." The tubers are roasted or boiled and eaten. The flour made by slicing and drying the tubers is used for preparing bread. The preparation of tapioca flour is a simple process. After the removal of the outer skin, the tubers are sliced $\frac{3}{4}$ in. to 1 in. thick, washed clean and dried in the sun until crisp. The dried slices can be stored in air tight tins and at times of need the flour can be obtained by pounding them in a mortar. Some varieties are known to develop poisonous substances. These can be rendered fit for consumption by thorough scraping of the rind and washing in water. Later the root slices are boiled in water for 10 to 15 minutes, water being changed twice or thrice. Tapioca starch is in great demand for sizing purposes.

Varieties. In the Vizagapatam district there are two important varieties distinguished by the stem colour and duration of the crop. The red-stemmed variety has a shorter duration and its tubers possess finer taste, than white-stemmed variety with a longer duration. A pure white variety

known as "Butterstick" is introduced from Cochin. The writer of this note had occasion to observe at the Hebbal Farm, Bangalore (Mysore), a giant variety of tapioca grown in the poultry runs for providing shade. The plant was about 12 ft. high and each was reported to yield several maunds of the roots. It is worth a trial in other parts of this presidency.

Economics of cultivation. The cost of cultivation comes to Rs. 75 per acre. Taking the average yield to be 14,000 lb. per acre which valued at 2 ps. per lb. gives a gross income from an acre of Rs. 145—13—4 or Rs. 145, and the net gain Rs. 70 per acre. Under the contract system of disposing off the crop, the contractor pays Rs. 120 per acre, the harvest charges being borne by the contractor himself, and the net gain for the *ryot* in this case will be Rs. 60 per acre.

Cost of cultivation per acre—details.

Preparatory cultivation	Rs.	10—0—0
15 cart loads of cattle manure, sheep penning and application of cattle manure,	»	15—0—0
Cost of 5000 setts @ Rs. 2 per 1000	»	10—0—0
Planting 8 Men @ 4 as. each	»	2—0—0
Irrigation— five	»	15—0—0
After-care (one hoeing and two weedings)	»	5—0—0
Harvest and cleaning—60 men	»	15—0—0
Assessment, etc.,	»	3—0—0
Total cost of cultivation per acre	»	75—0—0
Yield—14,000 lb. valued at 2 pies per lb.	»	145—0—0
Net gain per acre	»	70—0—0

Note:—Of the above items under cost of cultivation a farmer has to incur only Rs. 25 per acre as cash expenditure towards planting, after-care, harvest and assessment. Even this amount is not required for farmers who grow it on small holdings (25 to 35 cents) as the labour of the farmer and his family is more than adequate for successful cultivation. Planting material is invariably got from a previous crop or almost free from an obliging and friendly neighbour.

Conclusion. The crop is grown by a large number of *ryots* on small holdings varying from 25 to 35 cents or more and only a few farmers raise it on an acre scale. In view of the minimum cash expenditure necessary to raise this crop coupled with the attractive profits and fair demand for the produce it deserves encouragement in many parts of this presidency.