# The Madras Agricultural Journal.

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## EDITORIAL

**Essential Oils** The Empire's production of essential oils used in medicine, perfumery and for industrial purposes is by no means inconsiderable. For some years now, there have been developments in this direction in Kenya, Palestine, Rhodesia, Tanganyika and the Seychelles. But these countries do not certainly exhaust the Empire's resources. There are certainly other tropical places like India, Ceylon, etc., whose potentialities in this important matter have to be explored. Though the present times require the growing of food crops in preference to others, this matter also deserves our careful thinking as *essential oils* have to play a very important part both now and in post-war India. Especially to-day, medicine makes its demands most. The Therapeutics Requirements Committee of the Medical Research Council have listed up a number of drugs of vegetable origin which they have urged should be grown in the Empire. Some of them are already under cultivation in India in small scale and others should be tried. Some of them, the tropical ones, must certainly do well in the plains while others of temperate nature should prove a success in the hills. At present there is no large scale industry of any essential oil either for medicinal or perfumery purposes. At Yercaud, Salem District, *Geranium* is being cultivated by a few missionaries. It was learnt from one of them that about 50 acres of land was planted with *Geranium* and that it is now three years since he planted them. It is stated that the branches of these are cut twice a year and the oil is extracted which is being sent to the Mysore Soap Factory, Bangalore, for use in the manufacture of soap. There are three species of *Geranium*, namely, *Pelargonium capitatum* Ait, *P. graveolens* L' Herit., and *P. radula* L' Herit. which yield the oil. Geraniums come up splendidly well in the hills of South India and for any enterprising person there should be no difficulty in growing these. Another important plant which merits our consideration is the Camphor. It has not been quite a success so far. However, it needs more trials, especially, when we see now its imports are affected by the war. Apart from its use as an incense, it is very valuable in medicine. A few other plants of medicinal value like the Dill or Anethum (*Peucedanum graveolens* Benth. & Hk. f.) (Tam. Satakuppai; Tel. Saupa: Hind. Sowa, Soya), the Caraway (*Carum carvi* Linn.) (Tam. Seemai Sombu; Tel. Shima Sompu); the Neroli (*Citrus sinensis*

Osbeck); the Bishop's weed (*Carum copticum* Benth.) (Tam. Omum; Tel. Vomamu); Fennel (*Foeniculum vulgare* Mill.), etc, are under cultivation in a spasmodic fashion and there are others of medicinal value which could and should be tried as for some years more, the chances of getting them from overseas are remote. Such of them which should be given a fair trial are Camphor (*Cinnamomum Camphora* Nees.), Chamomile (*Anthemis nobilis* Linn.), Bergamot (*Citrus Aurantium* Linn., *var.* bergamia). Plants which are widely used in perfumery and are under cultivation are the Geraniums about which mention has already been made and the Cochin Lemon grass (*Cymbopogon flexuosus* Wats.) which yields the "Cochin Lemon Grass Oil" and it is largely cultivated in Travancore. The production of this oil is a war-time industry at present. There are others which have to be given a fair trial such as, Cananga (*Canangium odoratum* King.) which is doing well at Madras and the Lavendar (*Lavandula latifolia* Vill. and *L. officinalis* Chaix.) which may come up well in the hills.

**Grow more vegetables.** Owing to the present war, some of the cities are being declared as emergency areas from time to time and consequently people from these places are migrating to other places which are comparatively smaller than the evacuated ones. While the increased population is able to get fairly easily ordinary provisions, the supply of vegetables is certainly a serious problem. Every body who has a little compound must grow as much vegetables as he can not only to supply himself but also help others in this time of need and make a little extra income also. All efforts should be made in this direction and vegetable crops, such as, the greens, the egg plant or brinjal, the radish, cluster beans, tomato, etc., which are hardy should be raised on a large scale to meet the growing demand. All waste places should now be brought under the plough. Even live fences should be of plants, like tapioca, which produce some useful material. That vegetables form an important part of our daily food is admitted on all hands. War time needs are essential cereals, like rice, *cholam* and *ragi* pulses, and a few vegetables and fruits that could be easily grown. Any cereal together with a little greens or tomatoes supplies our needs so far as nutrition is concerned. In days of transport difficulties every place must be self-contained, and grow its own food crops.

**Subsidy to the Madras Agricultural Journal.** We are glad to announce that the Government of Madras were pleased to grant a recurring annual grant of Rs. 400 to the Madras Agricultural Students' Union from the current year, for improving the scope and utility of the Journal. We record our grateful thanks to the Government for the same.

# Perennial or Tree Castor*

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**Introduction.** The familiar forms of castor, *Ricinus communis L.* are the cultivated varieties raised either dry or irrigated. Distinct from these there also exist certain perennial tree types of which little is known. Mention is made of the perennial variety in most of the literature on castor, but in no instance has an attempt been made to distinguish it from the other types or yet to describe it fully. Popova (3), the Russian worker, makes mention of a wild type of castor growing in India and elsewhere but does not say whether it is a perennial type. Hil'tebrandt(2) recognises the perennial form but does not describe it. Bahl(1) has it that in tropical countries the castor plant reaches the dimensions of a small tree and may attain a height of 20' to 30' or more, with a stout trunk and branches. In cooler countries, he adds, it becomes a shrub or bush 8' to 12' high and in localities where frosts occur it is a herbaceous perennial. There are numerous other references also which go to show, that, though the existence of a distinct variety perennial in habit and growing into a tree has been known, no detailed study has so far been made of this variety.

In this paper an attempt has been made to describe in detail the perennial types collected from various parts of the Madras Presidency and indicate the similarities and differences between the cultivated and perennial varieties of castor. The agricultural utility of the tree form has also been discussed as it is felt that some of the economic forms may with advantage be brought under cultivation.

**Occurrence.** In Madras Presidency the perennial castor is found to occur in almost all districts irrespective of altitude or climatic variation. But it is seen to thrive best on the hills viz. Nilgiris, Kodaikanals, Shevroys and Anamalais, between the two altitudes of 3,000 feet and 6,000 feet above sea level. Below 3,000 feet and on the plains, though it survives, its natural spread is very limited. Above 6,000 feet, again, it is met with occasionally mostly in non-frosty areas and sheltered corners not exposed to high winds. Thus, on the Nilgiris, this variety is seen in a wild form growing luxuriantly between Burliar (3,000 feet) and Coonoor (up to 6,000

* Contribution No. 16 of the Oil Seeds Section of the Madras Department of Agriculture.

Paper read on 8th November 1940 before the Association of Economic Biologists, *Coimbatore.*

feet). At Ootacamund and higher up it is seen in very restricted numbers. Lower to Burliar, at Kallar and below, this type is again seen only in patches. In the plains it is met with in most of the districts but only to a very limited extent.

**Description of the perennial type.** The perennial castor is a small tree growing to a height of eight to fifteen feet. The spread of the top varies from ten to twenty feet. The stem is thick and woody, and in a grown up tree about ten to twenty inches in circumference. The bark of the stem is conspicuous in older trees. Branching is continuous and multiple, the number of sympodiums met with increasing in relation to the age of the tree. The primary branches are also woody the thickest of them being nearly twelve to fifteen inches in circumference. In other morphological characters such as stem colour, nature of inflorescence, shape and size of leaf, nature of capsules, size and shape of beans, etc. the perennials are polymorphic like the ordinary cultivated forms.

The seed characteristics being the most important economically, variations observed in seed size, the number of beans per pound, and the oil and free fatty acid contents of the seed in some of the distinct types of perennial castor collected from different parts of the Presidency are given below :

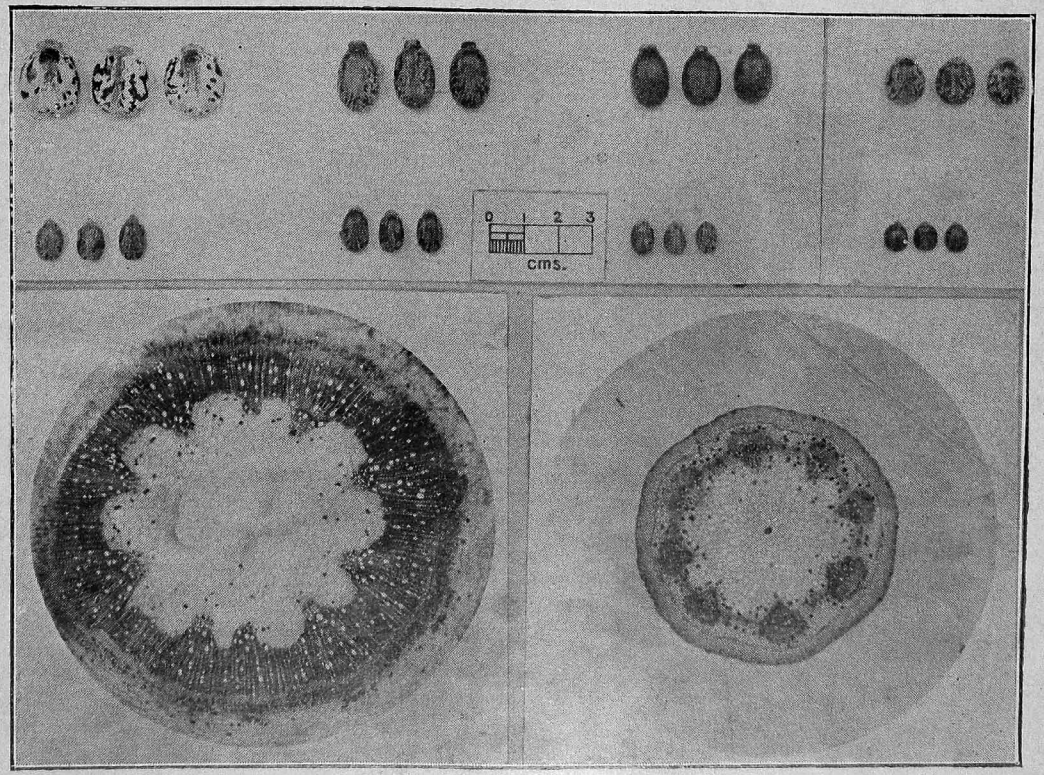
**Variation in the size, oil and free fatty acid content of seeds of perennial castor.**

| Place of collection. | Seed measurements. | | | Number of beans per pound. | Oil content. | Free fatty acid content. |
|---|---|---|---|---|---|---|
| | Length. | Breadth. | Thickness. | | | |
| | Cms. | Cms. | Cms. | | % | % |
| Anamalais No. 1 | 1·85 | 1·44 | 0·80 | 448 | 56·33 | 0·35 |
| Gudalur Big-sized | 1·74 | 1·01 | 0·69 | 688 | 51·22 | 0·36 |
| Nanjanad | 1·49 | 0·86 | 0·69 | 1,072 | 49·99 | 0·76 |
| Anamalais No. 2 | 1·27 | 0·96 | 0·63 | 1,152 | 49·59 | 0·62 |
| Cuddapah | 1·18 | 0·94 | 0·64 | 1,243 | 44·87 | 1·24 |
| Gudalur Small-sized | 1·02 | 0·70 | 0·50 | 2,448 | 48·88 | 0·57 |
| Coonoor | 1·15 | 0·68 | 0·47 | 2,656 | 49·69 | 0·79 |
| Anamalais No. 3 | 1·09 | 0·63 | 0·48 | 2,784 | 49·24 | 0·62 |
| South Arcot No. 2 | 0·98 | 0·61 | 0·46 | 3,232 | 46·77 | 0·52 |
| South Kanara | 0·93 | 0·61 | 0·44 | 3,456 | 44·49 | 1·27 |
| Malabar No. 2 | 0·95 | 0·57 | 0·45 | 3,552 | 47·42 | 1·10 |
| Ootacamund | 0·83 | 0·62 | 0·40 | 4,192 | 43·16 | 1·33 |
| Malabar No. 1 | 0·86 | 0·58 | 0·43 | 4,864 | 44·10 | 0·84 |
| South Arcot No. 1 | 0·91 | 0·54 | 0·41 | 5,376 | 45·00 | 0·78 |

The following observations based on the data obtained for different seeds are of interest:—

(i) The seeds of the perennial varieties vary considerably in size (figure 1) and are generally classed as big, medium or small. The number of beans (shelled seeds) per pound in the different varieties varies widely depending upon the seed size and ranges from as low a figure as 448 to as many as 5,376.

# PERENNIAL CASTOR

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1. Seeds of perennial castor types.
2. Cross-section of seedling stem of perennial castor; 1½ months old— × 10.
3. Cross-section of seedling stem of annual castor; 1½ months old – × 10.

(ii) The oil content varies from 43 to 56 per cent. Though it is a common belief that smaller seeds contain more oil than the bigger seeds, in all the varieties examined the reverse seems to be the case.

The yield of seed from the different varieties showed a range from as low a figure as half a pound to four pounds per tree. "Anamalais No. 1", "Gudalur Big-sized" and "Nanjanad" appear to be the best yielding among the types collected so far. Their oil content is also high (50% and more). In any initial selection of perennial types for bringing under cultivation, these three would prove suitable material.

The most immediate and striking difference between the cultivated and perennial castor is the presence in the tree type of a large woody main stem and the multiple and continuous branching of the tree. Though the cultivated varieties under irrigation or more favourable conditions may reach appreciable dimensions in height and girth, these two characteristics are never found in them. The tree castor once it has come to fruit will always be found to be a bearing tree while in the cultivated types the fruiting is seasonal. The perennial type commonly lives up to ten years and more.

The anatomy of the stem of the tree type differs from that of the cultivated varieties. The latter have the characteristic herbaceous stem with limited secondary growth while the stem of the perennial is typically woody, secondary growth persisting as long as the tree lives. A seedling stem (figure 2) of the perennial castor has a more or less continuous cylinder of primary xylem ensheathed by an unbroken cylinder of secondary xylem which is added to, indefinitely. In the young stem of the same age (figure 3) of the cultivated castor the vascular tissues are arranged in the form of discrete bundles in a cylinder. The stem of the cultivated type develops to a determinate girth when further growth ceases.

Apart from these differences which make distinction between the two forms fairly easy, in all other respects they resemble one another. The *2n* and *n* number of chromosomes of the perennial types collected so far have been found to be 20 and 10 respectively which are the same as those recorded for cultivated varieties.

**Agricultural importance of perennial castor.** Since the perennial type of castor grows into a tree, it is very unlikely that it will be cultivated in arable land devoted to the annual crops. There are, however, other situations, where it could be raised with profit. Coffee and tea estates offer opportunities for exploiting the land further without hindrance to the main crop. Tree castor makes a good shade plant and by its perennial nature demands little diversion of attention from the requirements of the main commodity of the estate. The castor trees will yield annually substantial quantities of an oil seed which fetches a uniformly attractive price in the market. Apart, however, from coffee and tea estates, on the hills, waste lands by the side of rail or motor roads, fringes of forests, and other land

which is lying fallow due to one reason or other may be sown to the perennial type of castor with a view to get some income from otherwise unproductive land. In the plains, the tree castor is met with at present here and there in backyards, being grown for the seeds which yield oil of medicinal value. Its cultivation could be extended by utilisation of lands which are unfit for more productive purpose. Perennial castor has an extensive much branched root system. This feature makes it suitable for growing in areas subjected to soil erosion. Another use of the crop is its utility in providing fodder for cattle in places where fodder scarcity is frequent and grazing facilities are few. Lastly, where eri-silk worm rearing is established as a cottage industry, the perennial form offers a continuous supply of leaf and eliminates the necessity for growing fresh crops every year for this purpose.

Considered from the economic point of view, there are thrifty and unthrifty types of castor trees and it is only the former which should be raised for a money crop. The yielding capacity of the different types varies considerably as also that of individual trees in a type. Some trees branch more profusely than others but may have fewer capsules on each fruit cluster. A type with good branching, long and densely set fruit clusters, non-shattering capsules and with an oil percentage of more than 50 may be considered an economic variety.

In relation to the raising of castor trees in coffee and tea estates the following points merit consideration and attention must be devoted to them: (1) whether the castor trees will provide enough or excessive shade to the coffee or tea plant (2) whether the seed borer pest of castor *(Dichocrocis punctiferalis)* is also a pest on coffee or will it become so when the two crops are grown in close proximity to each other (3) if any of the other diseases of castor such as the leaf spot *(Cercospora ricini)* would find a new host in coffee or tea.

Cultivation of the perennial type is substantially that adopted for the annual excepting that the seed would have to be dibbled *in situ* with the necessary spacing required for any particular form. Sowing should be confined to the rainy season taking care to see that no prolonged drought or excessive rains are anticipated in the seedling stage of the crop. Preliminary trials conducted on the Nilgiris have shown that sowing during April with early rains is the best. The trees begin yielding in the first year and will continue to bear until the death of the plant.

**Pests and diseases.** Pests and diseases are comparatively few on this tree at higher elevations. However, mention may be made of the following which have been seen to a limited extent: the seed, capsule, and stem borer *(Dichocrocis punctiferalis)*, the castor mite *(Paratetranychus sp.)* and the leaf spot *(Cercospora ricini)*. In a recent trial of cultivated and perennial types of castor on the Potato Farm, Nanjanad, Nilgiris, the early blight disease of potatoes *(Bacillus solancearum)* was found to affect the young castor plants though nowhere has this disease been seen on the castor trees growing wild.

## Erratum.

"Perennial or Tree castor". Vol. XXX, No. 4, Page 112, last para, 6th line.

*Delete* "the early blight disease of potatoes (*Bacillus Solanacearum*", and *insert* "Alternaria sp."

**Summary.** Though mention is made of a wild type of castor perennial in habit in most of the literature on castor, no effort hitherto has been made to study it.

The perennial form of castor is seen widely distributed in Madras Presidency, but it thrives best between the two elevations of 3,000 and 6,000 feet above sea level.

The perennial variety of castor is polymorphic and its description conforms to that of *Ricinus communis L.* in general. But it grows into a tree, has a thick woody stem and reaches a height of 8 to 15 feet. Branching in this type is continuous and multiple. The anatomy of its seedling stem differs from that of the cultivated variety. While in the perennial the vascular tissue forms an unbroken cylinder, vascular bundles of the annual types are broken and discrete in number. Secondary growth of the stem is early and pronounced in the tree castor and continues so long as the tree lives. In the cultivated types, on the other hand, with fruit set, secondary growth ceases confining the stem to determinate growth. The *2n* and *n* number of chromosomes of the perennial forms are 20 and 10—the same as those obtained for cultivated types.

There are agriculturally useful forms of perennial castor which are suitable for bringing under cultivation. Those with good branching, long and densely set fruit clusters, non-shattering capsules and with an oil percentage of more than 50 are economic. The possible places for cultivation are coffee and tea estates, waste lands, rail and motor road sides and fringes of forests. The factors to be taken into consideration in such cultivation are given.

The perennial castor with its extensive and much branched root system aids in preventing soil erosion. It is useful as a fodder tree. It provides a continuous supply of leaf for eri silk worm rearing and eliminates the necessity for growing fresh crops every year.

## Literature.

1. Bahl, G. C. The Oil Seed Trade of India (1938), p. 26.
2. Hil'tebrandt, V. M. The Castor Oil Plant (*Ricinus communis* L.). The Imperial Bureau of Plant Genetics Translation.
3. Popova, G. M. Castor Beans in Central Asia. The Imperial Bureau of Plant Genetics Translation.

# Cultivation and Marketing of Lanka Tobacco

## (Godavari Dt.)

By A. SANKARAM, B. Sc. (Ag.)

Among the provinces of India, Madras takes the first place with regard to consumption of tobacco in the form of cigars and *cheroots*. The annual per capita consumption is 372,* and in the districts of Godavary and Vizagapatam the use of *cheroot* is almost universal. Tobacco cultivated in the *Lankas* (islands) of Godavary otherwise known as Lanka tobacco is famous and popular throughout the Northern Circars as the best among the varieties grown for *cheroots*. This is chiefly due to the mild agreeable flavour, even burning and white ash qualities of the variety.

*Lankas* are islands formed in the river beds of the Godavary. Depending upon the nature of permanency, fertility value estimated on the amount of the silt deposited and cultivable nature of the soil, the *lankas* are classified into three main classes. A. Class :— These are high level *lankas* and are free from easy submersion by floods. The chief crops raised in these are paddy, sorghum and tobacco. Major portions are set apart for grazing so as to give a chance of fallowing. These *lankas* are given on lease to the *ryots* for fixed terms of 10 to 20 years in public auction. The auction value generally ranges from Rs. 15 to 20 per acre per year.

B. Class :— These are subject to submersion when floods are very high in the river. The chief crops raised in them are tobacco, paddy and sorghum. These are leased out in public auction for fixed terms of 3 years. The value of auction varies from Rs. 30 to 50 per acre per year.

C. Class :— These are low-lying *lankas* and are often subject to submersion and heavy flooding, which makes their position very uncertain. As such they are annually leased out in public auction. The lands are heavily silted and very fertile. The chief crops raised are tobacco and sorghum. The auction value may range from Rs. 60 to 80 per acre per year.

In all the three types of *lankas* where tobacco is planted the growers resort to a practice known as the *Kavu* process This consists in the removal of any sand found in the sub-soil (one foot below) and replacing it with silt. The River Conservency Department generally plant *Nanal (Saccharum spontaneum)* to protect the embankments from erosion. This obstructs the flow of flood water and helps in the deposition of silt. The depth of silt accumulation of these *lankas* varies considerably. The high level *lankas* suffer from erosion of the top soil while the lowlying *lankas* are subject to sand casting or accretions, and in either case the loss has to be borne by the growers. The Government allows no remission or refund of the lease

* Vide *Report on the Marketing of Tobacco in India and Burma*, page 78, A. M, A 10/1400, Government of India,

amount except in cases where a portion of the *lanka* is completely eroded and forms a part of the river. In the case of accretions the *ryot* is not allowed to cultivate the new area. No water rate is charged for the *lankas*. The auction generally takes place during March and April, and the old tenants have to quit before the 15th of May.

**Details of cultivation.** *Soils.* The soils of the *lankas* in which the tobacco crop is raised are well drained, light, sandy loams, retentive of moisture, being mostly river silt. They become fertile due to the floods of the Godavary river.

*Area.* On an average the annual area under this type of tobacco will be 20,000 acres in the two districts of East and West Godavary.

*Rotation.* Tobacco is grown from September to March. In the *lankas* of the East Godavary District tobacco and chillies are grown in rotation with sorghum. In the high level lands bordering the river Godavary and its deltaic branches, subject to flooding during the South West Monsoon, *Patcha jonna* (yellow sorghum) is grown. A certain type of four course rotation is in practice round about the *lankas* of Amalapuram taluk, tobacco being raised for the first two years successively, followed by chillies and sorghum in the next two years. The *lanka* is then left as a *Beedu* (grazing ground), and the cultivation is shifted to another virgin *lanka*. In certain *lankas*, known as *Oota lanka*, a two course rotation is adopted, *Budama* paddy or chillies succeeding the tobacco crop. A rotation of *Budama* paddy or sorghum followed by chillies is practised in certain parts of the Kotipalli *lanka*.

*Nursery.* The successful raising of a nursery requires great skill and experience. High level lands with good irrigation and drainage facilities are always selected for the nursery. The plot is first cleared of weeds and stones. Three ploughings are given after penning cattle. Feeding cattle with green sunhemp fodder during the course of penning is considered to produce vigorous and healthy seedlings. The land is finally brought to a very fine tilth and divided into long narrow beds of 40 ft. by 21 ft., with irrigation and drainage channels. Square beds of the size 8 ft. by 8 ft. are also common round about Kotipalli *lanka*. The seed beds are finally levelled. About 2 to 3 tolas of well preserved seed is mixed with fine sand in the proportion of 1 to 16 and sown on or before 15th of September. The mixture is evenly sprinkled in four casts to ensure uniform spread of the seed. The beds are lightly stirred with a broad broom prepared out of dry redgram stalks. On the next day early in the morning water is sprinkled over the beds and once again they are lightly stirred with the broom. The prevalence of cool and cloudy weather at the time of raising the nurseries coupled with the constant watering of the beds to keep them moist obviates the necessity for shading the nursery. From the third day till seven days pot watering is done about six to eight times per day depending upon the weather. In a week from the date of sowing the seeds begin to germinate. From the date of germination for a period of eight days pot

watering is done thrice a day and later for a period of 16 days watering is done twice a day. During the next eight days watering is increased to four times a day to facilitate quick and vigorous growth of the seedlings. Thus after a period of 40 to 45 days from the date of sowing seedling will be ready for transplantation. Whenever found essential weeding is attended to in the nursery beds About $1\frac{1}{2}$ to 2 cents of the seed bed is raised for each acre of the main field.

**Preparatory cultivation of the main field.** The nature of preparatory cultivation depends on the type of *lanka* selected. If it is a newly formed one the land is first given a thorough digging and it is ploughed 10 to 12 times and brought to condition. If it is a '*Beedu*' (cultivated and left fallow for 3 or 4 years) the grass is cut and the soil dug and ploughed. If it is a '*Chalaka*' (land in which only one crop of tobacco was already raised) 10 to 12 ploughings are given. The preparatory cultivation commences by about September and the fields will be ready for transplantation in November.

*Manuring.* Manuring is not at all practised, as the *lanka* selected for raising the crop may be a newly formed one with a deposit of silt of high fertility or a *beedu* fallowed for 3 or 4 years, or land in which only one crop was raised.

*Planting.* After the preparation of the main field, planting commences during the first week of November. The seedlings are planted in holes two feet apart both ways made with a local hand tool called *Gouddalikam* (a hand hoe with a long handle enabling one to work while standing). The planting holes are first watered and then planted with the seedlings. The first watering is locally termed as *Yeta pota* (meaning watering for planting). The skill of the labourers is such that even without any preliminary marking, planting will be in straight lines with accurate spacings. About 10,890 seedlings are required to plant an acre. As the weather at this period is cool and cloudy with incessant moist breeze from the Godavary river shading of the planted seedlings is not essential.

*Irrigation.* On the next day after planting early in the morning a pot watering, known locally as *Chali pota* (watering for establishment) is given. On the third day another watering, called locally as *Puli pota* (watering for growth) is given, after which no watering is done till the seventh day. On the seventh day along with pot watering gaps are filled up. This is the final watering and from thence the entire crop is treated dry in fairly rich soils. But in poor soils where rains fail one or two irrigations are given to prevent the crop from drying up.

*After cultivation.* Fifteen days after planting a weeding is done. One month later a *mamuti* hoeing is usually given. No other inter-cultivation is done except one more weeding if found essential. When the plants are 50 days old from the date of planting they begin to put forth flowers. A few well grown and healthy plants are allowed to flower and

set seed while the rest are topped, leaving about 10 well developed leaves per plant. Ten days after topping, suckering will commence which will be repeated thrice at intervals of eight days.

*Pests and Diseases.* Of the insect pests affecting the crop the tobacco caterpillar *(Prodenia litura)* is the most serious one. The only remedial measure in practice is the careful examination of the under surface of the leaves to destroy the egg masses. The next important pest is the tobacco Aphis. It takes a heavy toll of the crop in certain years. In cases of severe infestation spraying of the crop with tobacco decoction gives good results. The parasitic plant *Orobanche* (*Bodu* or *Malli)*, appears in fields continuously cropped with tobacco. The ravages of the parasite are not severe at any rate in the *lankas* in view of the good rotation and fallowing. Only weeding out of the parasitic plants and their destruction is the control measure in practice. A common fungus disease is the Mildew, locally known as *Challa* in which the basal leaves become completely withered and coated with white powdery patches. Such leaves are locally known as *Tepa aku.* When the infestation is found to be serious the affected leaves are removed. Another disease, locally known as *Karru* affects the leaves with red stripes on them and this is believed to be due to the use of aged seedlings of more than 45 days.

*Harvesting.* The crop is generally ready for harvest in about 95 to 100 days from the date of planting. The arched development of the lower leaves and their general thickening with light yellowish oval spots (locally called as *Kandi badda poda)* on the top 3 or 4 leaves are the chief signs of maturity. On any convenient day not exceeding 105 days the plants are cut in the evening at about 4 P. M. If necessary the harvest will be continued during the nights also. A peculiar feature of the harvest is that each leaf is cut from the plant along with about half the internode on either side of the leaf with the aid of a small, un-serrated, sharp sickle while the crop is standing on the field. This type of harvest is locally termed as *Chettu meeda kota* (harvesting on the plant). The entire cut crop is left in the field till the next morning when it is removed to thatched sheds for curing.

*Curing.* The stuff brought from the field is arranged into a circular heap with the butt ends inside and tips outside on a clean even moistened mud floor. Towards the evening they are taken out and the leaves are stitched with a needle and fibre of Agave *(Kittanara).* Ten leaves with backs of their midribs touching one another are stitched to form one unit (bundle). These bundles are then taken to the curing sheds. These are temporary sheds built in the open field near the river bed in the direction of the wind which favours the process of curing. A typical shed measures 48′ × 25′ × 14′ in length, breadth and height respectively. The space inside is divided with bamboos into compartments $5\frac{1}{2}' \times 5\frac{1}{2}' \times 2\frac{1}{2}'$. Coir strings are tied lengthwise in the shed in each compartment 4 in. apart. On these

strings the stitched bundles are arranged such that the successive leaves are on the alternate side of the string. A shed of the above dimensions can hold the produce of two acres at a time. It takes 25 to 30 days for complete curing. During the curing season which lasts for two and a half months (January 15 to end of March) three curings can be made. Thus for each unit of six acres a shed of the above dimensions is necessary. The absence of any traces of greenness on the internodes and veins of the leaf and the general softness of the leaf are the indications of perfect curing. The bundles are then removed from strings and arranged into circular heaps of about 200 mds. each. The heaps are changed and rebuilt twice a day. During the second change the bottom portion of the leaf is dipped in water and carefully examined, for rectification of wrinkles of the leaf if any. After two days the heap is taken out and graded. The graded leaves are arranged into bundles known as *Chattolu*. These bundles are packed in palmyra leaf mats and weigh about 200 lb. each.

*Grading*. Systematic grading based on colour, size, condition and aroma of the leaf is not practised. However every tobacco grower clearly recognises five grades in the stuff he produces and the chief factors that have a bearing on these grades are the colour, weight and the position of the leaf on the plant. The top ones fetch the highest price and the bottom ones the lowest. An ideal *cheroot* leaf of the *lanka* tobacco possesses the following qualities:--

i) Colour—Light to dark brown.

ii) Texture—Leaf of medium thickness, pliable and smooth, the veins being less prominent.

iii) Size—The wrapper should be 9 to 12 in. broad and 24 in. long but the size is unimportant for a filler.

iv) Strength—Mild.

v) Blemish—Free from all disease spots or patches.

vi) Burning quality—Slow, regular and continuous burning is required. Evenness of burning is more important.

vii) Ash—Whitish colour.

viii) Flavour and aroma—Agreeable and pleasing.

It may be stated here that there is always an appreciable variation in the quality of tobacco grown in different *lankas*. Tobacco produced on certain *lankas* has a great reputation and fetch a better price. Owing to this variation in quality buyers proceed from place to place to collect the best stuff leaving no opportunity for the producers to get it to a central market for sale. The table below gives the five grades with their local terms, their relative market values and percentage of yield of each grade to the total yield of the stuff per acre.

| Grade designation. | Local name. | Yield per acre lb. | Percent. of each grade of the total yield. | Value per Md. (20 lb.) | Total value of each grade. | Remarks |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | Rs. | Rs. | |
| First | Koti | 40 | 5 | 24 | 48 | 2 or 3 leaves from top. |
| Second | Baru | 400 | 53 | 16 | 320 | Next 3 leaves. |
| Third | Mattasam | 160 | 22 | 12 | 96 | Next 2 leaves. |
| Fourth | Gulla | 120 | 16 | 5 | 30 | Next 1 or 2 leaves. |
| Fifth | Tepa | 30 | 4 | 2 | 3 | Rest of the leaves. |
| | Total. | 750 | 100 | — | 497 | — |

**Marketing Season.** Unlike other agricultural commodities the sales of tobacco are pushed up in post-harvest months (April to August) owing to the fear of the deterioration of the quality of the stuff at later periods. Thus the season commences with April and usually extends up to August. The period of peak transactions is between May and July.

**Markets.** The markets of Rajahmundry and Cocanada are principal assembling centres for *Lanka* Tobacco. The sellers at these markets are mostly the merchants who make their primary purchases in the villages. This practice probably continues in the absence of systematic and organised grading, and marketing. The establishment of a few markets in some of the important producing centres where growers could bring their tobacco for sale would go a long way in improving and standardising the prices.

**Quality and Price.** It is important to emphasise that the price is entirely dependent on the quality of the leaf graded according to the position of the leaf on the plant. Generally a striking difference of 35 to 40 per cent. prevails between the first and second grades.

**Demand.** There is a good demand for the tobacco throughout the districts of East and West Godavary, parts of Vizagapatam and Kistna. In general the habitual smokers are so particular of this type of tobacco that they make certain of their purchase soon after curing from reputed *lankas*. The demand for *cheroots* is least in summer and highest during the winter.

**Storage.** Generally growers prefer to dispose off the stocks at the earliest opportunity for fear of losses during storage and want of adequate facilities to store the same. In spite of few instances where the growers that stored the stuff derived gain, it is admitted by many that profiteering by holding of stocks for sale at later periods is uncertain. During storage, the losses through dryage, and other causes amount to 35 to 40 per cent.

**Manufacture of cheroots—A cottage industry.** The Lanka tobacco is solely used for the manufacture of *cheroots* and this is mostly carried on

as a cottage industry. Like many other artisans the Indian cigar maker works with very few tools; a small board, a pair of scissors, a smooth stone to serve as a pounder and a double edged curved knife are all that he requires. From a bundle by his side he draws out leaf by leaf and tears off the midrib and passes the remainder to his assistant who sorts it out into varieties, the best to be used as wrapper and the rest as filler. The busy assistant first shapes out a rough cigar and covers it with a coarse binder of tobacco. This is the core and it is further shaped by rolling on the board. Much skill and dexterity are required here, for care must be taken not to choke the air passages and at the same time the appearance must be maintained. After rolling, the outer cover, called the robe or wrapper, is put on and the ends scissored off. A *cheroot* man and his assistant can roll about 800 to 1,000 *cheroots* in a day of eight hours and their wages vary from 12 annas to Rs. 2 per 1,000 according to the finish and quality. About 2,400 to 3,000 *cheroots* can be prepared from a maund of the tobacco depending on the size of the cheroot.

**Economics of Cultivation.** The cost of cultivation as shown below comes to Rs. 85—8—0 per acre including the rental value. If the cultivator is a tenant the rental value will be very high amounting to Rs. 250 to 300 per acre per year. The gross income from one acre will be Rs. 497 and the net income left to the tenant will be Rs. 162.

**Conclusion.** The high profits obtained may attract every one to take up to cultivation of this crop. But there are a number of risks to be faced, namely,—weather conditions like rain and drought, erosion, accretions on the land, incidence of pests and diseases, etc. These factors also adversely affect the quality of the final product resulting in the reduction of the nett returns. Only in years when all the conditions are normal the indicated profits are realised and this may happen once in five or six years. The crop is cultivated by a group of six to eight *ryots* in large holdings of 20 to 25 acres. Instances of smaller holdings of 2 to 3 acres managed by individual ryots are not wanting. Although all the agricultural classes take up to it, monopoly is held by the *Kammas*, an important agricultural community of the tract.

**Acknowledgments.** At different stages during the course of the enquiry and the preparation of this paper the writer has been ably assisted by Sri C. Venkatachalam B. Sc (Ag.) and this opportunity is taken to acknowledge the help received, and to thank Sri T. Nataraj B. A, B. Sc. (Ag.), Assistant Lecturer in Agriculture, Agricultural College, Coimbatore, for helpful criticism and valuable suggestions on the paper.

**Details of cost of cultivation per acre.**

| | | | |
|---|---|---|---|
| Digging up grass and removal of stubbles on contract at Rs. 12 per acre | 12 | 0 | 0 |
| Twelve ploughings with a country plough ... ... | 15 | 0 | 0 |
| Cost of nursery to transplant an acre of the main field ... ... | 8 | 0 | 0 |
| Planting—10 women at 4 annas each ... ... ... ... | 2 | 8 | 0 |
| Gap filling—2 women at 4 annas each ... ... ... ... | 0 | 8 | 0 |

| | | | |
|---|---|---|---|
| Mamuti hoeing—10 men at 6 annas each | 3 | 12 | 0 |
| First weeding— 10 women at 4 annas each | 2 | 8 | 0 |
| Second weeding—8 ,, ,, | 2 | 0 | 0 |
| Topping—4 men at 6 annas each | 1 | 8 | 0 |
| First suckering - 6 women at 4 annas each | 1 | 8 | 0 |
| Second ,, 8 ,, ,, | 2 | 0 | 0 |
| Third ,, 6 ,, ,, | 1 | 8 | 0 |
| Harvest - 6 men at 6 annas each | 2 | 4 | 0 |
| Curing, grading etc. at Rs. 2 per *putti* for 1½ *putties* | 3 | 0 | 0 |
| Cost of curing shed (thatched shed) Rs. 15 less half the value realised on sale after use | 7 | 8 | 0 |
| Assessment or auction value (average) | 20 | 0 | 0 |
| Total cost of cultivation per acre | 85 | 8 | 0 |
| Rent of land (if the cultivator is a tenant) | 250 | 0 | 0 |
| Gross value realised by sale of the produce | 497 | 0 | 0 |
| Net gain per acre | 161 | 8 | 0 |

## Mango Nursery Practices in the West Coast.

By T. GOPALAN NAYAR, B. Sc. Ag.,

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**Introduction.** To meet the growing demand for fruit plants of dependable quality, a Government fruit nursery was added to the Agricultural Research Station, Taliparamba in 1938. Mango nursery practices predominate the activities of this nursery. After a survey of the leading orchards of Malabar and South Kanara districts a number of scion plantations were selected in suitable centres where mango inarching is being done on a fairly large scale for the past three years. As a result of the experience gained in this work a few observations on certain nursery practices suited to the West Coast, as well as other useful data regarding the production of mango grafts are given in this note.

**Raising of Seedling Rootstocks.** Ripe mango fruits from early and heavy bearing trees of seedling races are collected during May—June. Of the seedling types used for seed propagation "Puliyan", "Bappakaya", 'Kurukkan" and 'Olor" are the outstanding varieties. Stones from ripe fruits, after rejection of light seeds, are immediately sown in seed beds one foot apart with the plumule end up. 'Sowing the mango stones with plumule up produces a straight taproot and stem, both of which characters facilitate inarching" (K. C. Naik, 1941).

Sen and Mallick (1940) have mentioned that mango seeds cannot be stored under ordinary conditions and that for successful germination the stone should be sown soon after its removal from the ripe fruit. Germination observations on over 700,000 mango stones have shown that only about a fourth of the total germinate within two months after sowing and the later germinations lack in vigour and consequently have to be rejected as unfit for stock purposes. The progress of germination of two of the commonest seedling varieties are given below :--

**TABLE I**

| Variety. | Total no. of seeds sown. | Date of sowing. | Weekly progress of germination after sowing | | | | | | Percentage germination in 9 weeks after sowing. |
|---|---|---|---|---|---|---|---|---|---|
| | | | 4th week | 5th week | 6th week | 7th week | 8th week | 9th week | |
| Puliyan | 3800 | 19/20-5-39 | 104 | 325 | 698 | 825 | 918 | 957 | 25·2 |
| Bappakaya | 3100 | 20-5-39 | 461 | 545 | 655 | 669 | 679 | 685 | 21·1 |

During germination studies it was also observed that heavy seeds which sank in water gave convincingly higher germination percentage than light ones which floated or did not readily sink in water. Table II gives the details of germination.

**TABLE II**

| Variety. | Nature of seed. | No. sown. | Date of sowing. | Percentage germination. |
|---|---|---|---|---|
| Bappakaya | Heavy | 1000 | 23--5—39 | 22·9 |
| Do. | Light | 1000 | Do. | 13·1 |

**Potting.** Within two to three months after germination some of the earlier germinated seedlings show remarkable growth and these are sometimes lifted for potting if the object is to produce grafts within a year after sowing stones.

The following summary of operations will make this clear.

| | |
|---|---|
| May—June | Sow mango stones. |
| September—October | Pot very vigorous growing seedlings. |
| November | Graft to scion branches. |
| December | Give first cut. |
| January | Give second cut. |
| February | Separate graft from scion parents. |
| March—April | Keep for hardening. |
| May—June | Grafts are ready for distribution. |

But generally mango seedlings are uprooted and potted only during the next South West monsoon, when they are about a year old.

At Taliparamba and other nursery centres in the West Coast hill grass or bamboo tubes are preferred to mud pot for potting. Both these materials are efficient and also cheap, if the grafts are not again repotted in mud pots before distribution. Hill grass potting is cheaper than bamboo and all the stock plants which are grafted early during the monsoon are invariably potted with this material. During summer the hill grass not only becomes brittle but moisture inside dries quicker and consequently bamboo tubes are preferred for potting. About 2,000 seedlings can be potted with about three rupees worth of hill grass though with the same amount bamboo tubes for potting 300 seedlings or mud pots for potting 150 seedlings only can be purchased. One disadvantage with hill grass potting is that it has to be renewed when kept exposed for more than a season. Potting is easier and more successful during the monsoon period when

seedlings can be lifted with naked roots and potted. A boy cooly can pot about hundred seedlings in a day in bamboo tubes and about fifty, if the material is hill grass. Casualties during potting vary from 10 to 25 per cent more under trying hot weather conditions. With timely and proper defoliation a few days previous to uprooting the seedlings and a little more care, potting is being successfully done even during the hot weather period so as to make a good number of seedlings available for grafting early during the monsoon with the idea of minimising the watering charges of grafts on parent trees.

**Inarching.** About one month after potting when the seedlings have established well within the pot space, they are taken up for grafting. From date of inarching to date of separation, a period of three months is found to be quite sufficient for the graft mango varieties growing in the West Coast. If inarching is taken up during June—July it is possible to dispense with the watering of grafts on mother trees and thereby reduce the cost of production of graft appreciably.

The table given below indicates that it is possible to take up inarching operations on a fairly successful scale during May to December. Due to the unfavourable hot weather conditions this work was not attempted during February to April. The figures relate to only one rootstock variety.

**TABLE III**

| Months during which grafting was done. | 1939—40. | | | 1940—41. | | |
|---|---|---|---|---|---|---|
| | No. grafted. | No. separated. | Percentage take. | No. grafted. | No. separated | Percentage take. |
| May | ... | ... | ... | 135 | 118 | 87·4 |
| June | 325 | 258 | 79·4 | 1660 | 1416 | 85·3 |
| July | 691 | 540 | 78·2 | 934 | 635 | 68·0 |
| August | 437 | 403 | 92·2 | 449 | 343 | 76·4 |
| September | 470 | 415 | 88·3 | 362 | 330 | 91·2 |
| October | 1252 | 1157 | 92·4 | 532 | 395 | 74·3 |
| November | 925 | 823 | 88·9 | 639 | 591 | 92·5 |
| December | 1474 | 1094 | 74·3 | 305 | 227 | 74·4 |
| January | 336 | 232 | 63·4 | 130 | 74 | 56·9 |

**Nursing of Grafts after Separation.** After separation from the scion parent the grafts are kept for hardening under shade in a cool place in summer or under thatched shed with sides open in the monsoon period. The grafts separated during the earlier half of the South-West monsoon become ready for distribution during the latter half after keeping for hardening for about a month or more. Due to the humid and cool weather conditions prevailing at this period the casualties in hardening beds are much less than in summer months. The sales of mango grafts commence from the end of May and continue till the end of October, depending upon the planting season. All the grafts which are separated from October onwards have to be nursed till next June when only the main planting season commences. To successfully tide over this fairly long

period of rainless weather the grafts are de-potted and planted temporarily in a rich and cool place commanding easy irrigation facilities. After planting it is necessary to shade the graft for about a month. The casualties in the hardening beds vary from five to as much as thirty per cent, the higher death rates being mainly due to the adverse seasonal conditions. The grafts, thus planted, put on better growth flush than those growing in pots. These are re-potted in the beginning of the South West monsoon so as to be available for distribution during June-July.

**Cost of Production of Grafts.** The distance of the scion plantation from the nursery site and the season during which inarching is done are two of the important factors affecting the cost of production of grafts. In all commercial nursery enterprises, therefore, great attention is paid to reduce the transport charges of stock plants and grafts on parent trees. The average cost of production of grafts at the Agricultural Research Station, Taliparamba, and at any one of the scion plantations in Chirakkal Taluk, all situated within twenty miles from Taliparamba, are detailed below.

**Cost of Production of Grafts.**

| Particulars of Expenditure. | A. R. S. Taliparamba. | Centres in Chirakal Taluq (average of 5 gardeners). |
|---|---|---|
| Total number grafted ... ... ... | 1095 | 2285 |
| Number of good grafts available for sale after casualties in hardening beds. ... ... | 700 | 1250 |
| 1. Cost of potted stock plants @ Rs. 5 per 100 ... | 54 12 0 | 114 4 0 |
| 2. Transport charges of stock plants to scion plantation ... ... ... ... | ... | 18 0 0 |
| 3. Cost of grafting materials ... ... | 8 4 0 | 19 0 0 |
| 4. Wages of coolies for grafting, giving cuts and for separation of grafts ... ... | 21 8 0 | 65 11 0 |
| 5. Watering charges of grafts on parent trees ... | 38 0 0 | 29 7 0 |
| 6. Transport charges of grafts back to farm ... | ... | 18 0 0 |
| 7. Scion value @ 0—1—0 per successful graft ... | 54 0 0 (864 separated) | 121 14 0 (2950 separated) |
| 8. Cost of mud pots and potting charges ... | 30 0 0 | 57 8 0 |
| 9. Proportionate watering charges in hardening beds till required for distribution ... | 10 0 0 | 18 0 0 |
| | 216 8 0 | 461 12 0 |
| Average cost of production of a graft ... | 0 5 0 | 0 5 11 |

**Summary.** 1. The various seasonal operations from mango seed to graft as adopted at the Taliparamba Fruit Nursery, viz., collection and sowing of stones, germination observations on two of the important seedling types of Malabar, raising of seedling root-stocks, potting, inarching and care of grafts after separation have been briefly dealt with in this note.

2. The use of hill grass and bamboo tubes as cheap and efficient potting materials has been mentioned as a common nursery practice in this tract.

3. Results of mango inarching on a bulk scale during different months for two consecutive years have been furnished to indicate the possibility under West Coast conditions of the scope for bulk production of grafts during the major part of a year.

4. Figures for the cost of production of grafts at the Agricultural Research Station, Taliparamba, and the average figure for a few nearby centres are also given.

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## SELECTED ARTICLE

## The Search for Economic Plants

By SIR ARTHUR W. HILL, K. C. M. G., F. R. S.,
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The search for plants yielding spices and the history of their cultivation and use, as well as the story of the transport of the spices, is a romance which includes accounts of geographical discovery, monopolies, economic warfare, annexations of territories, and all the vices of theft, envy, hatred and malice, and all uncharitableness enumerated by the Apostle St. Paul.

Perhaps the spice which should be put in the forefront is pepper (*Piper nigrum*), native of Malabar and of the forests of Travancore, a spice now too seldom seen or appreciated in its natural conditions as black pepper corns, which was the staple article of trade between Europe and India for many ages. Most people to-day use white pepper, which is the small berry-like fruit or peppercorn, ground after its pericarp has been removed, thus depriving it of some of its pungency and best seasoning qualities.

Pepper was well known to Theophrastus in the fourth century, B. C., and to Dioscorides and Pliny, the former stating it to be a product of India. Its export from Barake on the Malabar coast, near Calicut is recorded in A. D. 64, and black pepper is one of the spices on which the Romans levied duty at Alexandria about A. D. 176. The first particulars, we have, that it was a climbing plant "sticking close to high trees like a vine" occur in the writings of Cosmas Indicopleustes, a merchant and later a monk, who wrote about A. D. 540.

The wealth of Venice and Genoa largely depended on this spice for tribute was levied on pepper, when money was scarce; it was often enacted that rents should be paid partly in pepper, and the Easterlings, according to the Statutes of Ethelred (A. D. 978—1016), coming in their ships to Billingsgate, had to pay at Christmas and Easter for the privilege of trading with London, a small tribute of cloth, five pairs of gloves, ten pounds of pepper and two barrels of vinegar. Now the only survival of this practice is the 'peppercorn rent', which signifies a merely nominal payment. The merchants who trafficked in spices in England were known as pepperers, and existed as a guild in the reign of Henry II and later were incorporated in the Grocers' Company.

Pepper, gums, myrrh, frankincense and cardamoms reached Europe mainly either by the Persian Gulf through Mesopotamia and Syria to the Levant or by the Red Sea and the Gulf of Suez and thence overland to Alexandria, while some

consignments were conveyed by Arabian or Chinese traders to a port in southern Arabia and thence overland by the Frankincense route via Petra to Gaza and to Acre. From Alexandria or from the Levantine ports to which the spices had come overland they were shipped in the days of the Roman Empire to Rome, and later to Venice or Genoa, which cities for so many years held the monopoly of the traffic in spices.

During the Middle Ages the price of pepper was exorbitant. The high cost of pepper was one of the main inducements to the Portuguese to search for a sea passage to India, in order to break down the Venetian monopoly in this and other spices. Vasco da Gama anchored off Calicut in May 1498, and thus to pepper very largely, therefore, may be attributed the discovery of the Cape of Good Hope.

About the year 1500 the cultivation of pepper was taken up in the western islands of the Malayan Archipelago, especially in the islands of Rhio and Penang, and in Johore. The Dutch East Indies, Singapore, Penang, Ceylon, India and Indo-China are now the chief sources of supply.

The Venetians made every effort to retain the valuable traffic in their own hands, but in 1522, the first consignment of pepper reached Antwerp direct from India in a Portuguese ship, and the trade continued to be a monopoly of the crown of Portugal until the eighteenth century. With the development of the all-sea route the overland traffic gradually came to an end. With regard to India, the century of Portuguese conquest of the West Coast may be recalled, then their ousting by the Dutch, and finally, British dominion under the East India Company, and the efforts of the French and Danes to secure a share in the lucrative trade. Pepper thus was one of the principal economic products which has not only greatly enriched those who have held monopolies in its traffic, but has also incited geographical discovery, resulting in wars to secure possession of its native country.

Cloves, cinnamon, cassia, nutmegs and mace each have a history in which high enterprise, warfare, subterfuge and theft have all played their part. Cloves are the dried flower buds of *Eugenia caryophyllata*, which is said to be native only in the five small islands of the Moluccas proper (Ternate, Tidore, Mutir, Machian and Bachina). The tree was introduced to Amboyna before the arrival of the Portuguese and is still cultivated there and in some of the neighbouring islands. Cloves are probably one of the oldest known of the spices, for it was customary for the Chinese Court officers, under the Han Dynasty, 266 B. C., to hold cloves in their mouth before addressing the Sovereign, to give their breath an agreeable odour. Nicolo Conti, a Venetian merchant, 1424—48, discovered the source of origin, previous writers having assumed that the places whence the spice was shipped, Ceylon, Java, or Malacca, were the homes of the plant. To the Portuguese, however, we owe our first accurate localization and description of the clove-tree, furnished by Pigafetta, the companion of Magellan, as he saw it in 1521.

For nearly a century the Portuguese were in control of the Spice Islands and had the principal share in the clove trade, until 1605, when the Dutch took possession of the Moluccas, and attempted to control the trade. They tried to restrict the tree to the Amboyna Islands—as they did with the nutmeg—and destroyed trees that might be growing elsewhere. Supplies, however, managed to reach England independently, though the Dutch monopoly was nearly complete until the latter end of the eighteenth century. Intrigue and theft apparently have played a very important part in the history of the clove in more recent times, for in 1770, the Governor of Mauritius and Bourbon, M. Poivre, procured living plants, both of cloves and nutmegs, and established them in those islands.

The clove industry of Zanzibar and Pemba is due to an Arab from Zanzibar, who managed to obtain plants in Mauritius and took them about the end of the eighteenth century to his own island. Great Britain also took her share in what were probably illicit introductions of the spice plants, for, after Penang was founded in 1786 by Captain Light, the East India Company deputed Christopher Smith—one of the Kew collectors sent out by Sir Joseph Banks and George III—to visit the Moluccas and bring back spice plants (cloves and nutmegs) for cultivation.

The cultivation of cloves is now being extensively developed in Madagascar, which may prove a menace to the industry of Zanzibar and Pemba.

One of the present day problems of economic plants relates to cloves, since the trees in Zanzibar are affected by a die-back disease, which demands careful research into ways of combating the malady and possibly of finding forms or varieties that may be resistant.

Nutmegs, *Myristica moschata*, are natives of the eastern islands of the Moluccas (Ceram, Banda) and of New Guinea. Nutmegs and mace, the crimson network artillus surrounding the nut, were imported into India at an early date by the Arabians and thus reached the West.

The home of the nutmeg was mentioned by Masudi about A. D. 918, and by the middle of the twelfth century nutmegs and mace were being imported to Aden, and duty on them was being levied at Acre about A. D. 1180. Ten years later they, with other aromatic products, were used in fumigating the streets of Rome at the coronation of the Emperor Henry VI. By the end of the twelfth century, nutmegs and mace were well known in Europe, but very costly, for about 1284, 1 lb. of mace cost 4 s. 7 d., the value then of three sheep or half as much as a cow. The Portuguese discovered the plant in Banda in 1572 and held the trade until they were driven out by the Dutch. The Dutch tried to restrict the trees to Banda and Amboyna by destroying the trees in all the other islands. In this, however, they appear to have been frustrated by pigeons, which swallowed the seeds and deposited them in the neighbouring islands.

Great Britain occupied the Spice Islands during 1796—1802, and thanks to Christopher Smith's mission and the activities of Sir Stamford Raffles, nutmegs and cloves were introduced to Bencollen (Sumatra) and Penang. Plants were sent to Kew about that time and thence to St. Vincent and Grenada, where nutmegs now flourish.

Cinnamon (*Cinnamomum zeylanicum*), native of Ceylon, and cassia bark, the product of *Cinnomomum cassia* from southern China, are probably the earliest known of the spices. Frequent references occur to them in the Bible, and Theophrastus, Herodotus, Dioscorides, and other ancient writers refer to them as precious odoriferous substances. Cassia is mentioned in the earliest Chinese herbal, about the year 2700 B. C. To the Chinese may almost certainly be attributed the discovery of cinnamon in Ceylon, since they traded to Ceylon in very early times, and were no doubt familiar with the Chinese cassia-yielding species of *Cinnamomum*, which is very similar in appearance to the true cinnamon of Ceylon. An Arab writer Kazwini, mentions cinnamon as a product of Ceylon in 1275, as do Ibn Batuta, the Muhammadan traveller, 1340, and Nicolo Conti, a hundred years later. The Portuguese discovered Ceylon after circumnavigating the Cape, and occupied the island on account of the cinnamon. Then the Dutch captured Ceylon, again because of cinnamon, about 1656, and established a monopoly in the spice, burning, as they did nutmegs, the stocks in Holland when the supply was greater than the demand. The English took Ceylon from the Dutch in 1796, and the East India Company held the monopoly in cinnamon until 1833.

The history of the spice plants has been dealt with at some length since they have played so important a part in geographical discovery, territorial acquisitions, and wars between European nations. There are, however, several plants of great economic importance which have travelled far from their lands of origin, of the wanderings of which we have no certain records. Among these are the coconut, sugarcane, banana, cassava, groundnut, and possibly the West African oil palm.

The coconut has no doubt been transported partly by ocean currents and partly by natives voyaging from island to island in the remote past when they took the nuts with them for food and planted them in the islands or coastal regions to which they migrated. Of ocean transport we have recent evidence in the germination of coconuts washed up on Anak Krakatau IV in 1932. The original home of the coconut seems definitely to have been the East Indian Islands, whence it has travelled to the West Indies and to America.

Sugarcane, also East Indian, must have been similarly conveyed by natives for food on their voyages and then planted by the settlers in their new homes. In this way it has been distributed throughout the tropics before the existence of historical records. The edible banana, probably native in Thailand and Malaya, must also have been transported in much the same way.

Both the groundnut *(Arachis hypogaea)* and the oil palm *(Elaeis guineensis)* afford puzzling problems. The groundnut is now the staple product of The Gambia, but all its near allies are natives of Brazil and there is none in Africa. Similarly, the closely related species of Elaeis occur in Brazil, but there is an allied species in Madagascar. It is an open question whether either economic plant is truly native in West Africa; if not, then it seems probable that natives voyaging from Brazil to West Africa may have brought over both the groundnut and oil palm, and also the American cassava *(Manihot utilissima)*, as food in their vessels, and so they became established on the west coast of Africa.

The cashew nut *(Anacardium occidentale)*, much used in confectionery and like salted almonds and pine kernels on our dinner tables, which is a native of tropical South America was introduced into South India in early days probably by the Portuguese. South India now supplies the major part of the world demand, and particularly the large markets of the United States of America. Nearly all the nuts imported to Great Britain and to the United States come from the south-west coast of India. Cheapness in the preparation of the product is the main reason for this somewhat anomalous condition of affairs.

Two misconceptions as to the original homes of economic plants may be mentioned here. First, the Jerusalem artichoke had nothing to do with the Holy Land—the name Jerusalem probably being a corruption of Terneusen in Holland, as Sir David Prain has ingeniously suggested, where tubers were first landed when they were brought over from America. Nor were either the New World pine-apple or prickly pear to be found in the Garden of Eden as figured by Parkinson on the title-page of his " Paradisus ".

Coming to more recent times, one is reminded of the attempt by Captain Bligh in the ill-fated voyage of the Bounty to introduce the bread fruit (Artocarpus) from Tahiti to the West Indies, and of the success of his efforts on his second voyage, and of the introductions of economic plants and also, alas, of weeds to Australia and New Zealand as impurities in the seeds of the imported crop plants.

A brief reference must be made to the introduction of Cinchona and Para rubber from South America to Kew, and thence to India, Jamaica, Ceylon and Malaya in 1861 and 1876 respectively, Flourishing plantations of Cinchona

exist in the Nilgiri Hills and at Mungpoo and Munsong near Darjeeling, but those in Jamaica have not been maintained. Attempts are now being made to extend the cultivation in East Africa and also in Panama and Porto Rico. Java, however, is the chief source of the drug, mainly because the climate of the island is particularly favourable for the cultivation of the species which yield the greatest amount of quinine. Java, unlike India, has two rainy seasons, the south-west and north-east monsoons, which produce conditions very like those which occur in the Andes. The soil also is very favourable, but Java's success with *Cinchona Calisaya* types is mainly due to climate. Java has also been fortunate in obtaining seed of a high-yielding form of *C. Calisaya--C. Ledgeriana*—which has flourished under Javan conditions.

After the stocks of *C. succirubra* and *C. Calisaya* had reached India, Mr. Charles Ledger, who had obtained seed of a high-yielding form of *C. Calisaya* collected near Pelechuco, to the east of Lake Titicaca, offered this seed to the superintendent of the Government Cinchona Plantations at Ootacamund, who rejected it. He then offered it to the Dutch, who had been experimenting, somewhat unsuccessfully, with Cinchona in Java. The Dutch bought the seed, and so came about the flourishing industry in the island.

One of the assistants in the Nilgiris, however, a gardener from Kew, extracted some of Ledger's seed, and sowed half of it in the Nilgiris and sent the other half to Mungpoo. When the superintendent saw the seedlings and learnt their origin he had them all thrown away. Those at Mungpoo, however, were under the care of Mr. Gammie, who appreciated their value and kept them; they proved to be as valuable as had been stated by Ledger. This form and other good-yielding strains of *C. Calisaya* are still in cultivation at Mungpoo and Munsong. In any event, as it has since been found, *C. Calisaya* and its forms do not succeed under the conditions in the Nilgiris, nor do they thrive quite as well in northern India as they do in the better climatic conditions of Java.

More recently Kew has taken an active part in the growing and distribution of species of Hydnocarpus (Flacourtiaceae), native in Burma, Indo-China and the East Indies, the seeds of which yield chaulmoogra oil, a specific for leprosy. With regard to this product it is interesting to mention that the resident physician of an asylum at Bangkok was treating the lepers there and trying to get chaulmoogra oil for the purpose when a botanist visiting the hospital was able to point out that supplies were close at hand, a tree was actually growing in the hospital compound, and it grows plentifully in Thailand.

Seeds of Aleurites (Euphorbiaceae), the source of the Chinese tung oil, a high class drying oil used for paint and varnish, have also recently been distributed by Kew to suitable parts of the Empire.

The recent widespread introduction of plants of economic importance to the tropical possessions of Great Britain and other countries has opened up political, as well as botanical, problems of considerable difficulty.

The growing of the West African oil palm in the Dutch East Indies where they have been fortunate in establishing a pure-breeding type of good quality oil palm, is a case in point which may set up a state of economic warfare, as also the establishment of the clove industry in Madagascar and cocoa in West Africa versus Trinidad. The effect of the sugar beet subsidy on sugarcane cultivation in the West Indies, the competition of sisal in East Africa with the native product from Mexico, and the plantations of uniform varieties of New Zealand flax in the Argentine afford further examples where economic botany and policy may conflict.

Then again, the case of transport and the cultivation of economic plants under plantation conditions disclose serious botanical problems. Not only may

insidious diseases be easily transported by air, but also large areas of crops grown under plantation conditions afford a very ready means for the spread of any insect or fungus disease. Among the diseases which now threaten important economic products may be mentioned the Panama and the leaf spot diseases of bananas. Cacao witchbroom of cocoa, mosaic of cassava and other economic crops, wither tip of limes and cloves in particular. Such maladies necessitate researches in order to try to produce forms and varieties which may be immune to the diseases, and research in this direction is being undertaken especially by the Imperial College of Tropical Agriculture in Trinidad (see Nature, March 9, p. 282; March 15, p. 313; March 22. p. 344; March 29, p. 380) and the East African Research Station, Amani, as well as by specialist officers in the Departments of Agriculture in the Dominions, Colonies, and in India. Attempts are also being made to discover higher-yielding forms of such economic plants as sugarcane, rice, para rubber and cacao, by cross-breeding and selection, and when found, propagating them by budding and grafting, cuttings or seed.

With regard to bananas, research is being undertaken to find wild types of Musa in the original home of the edible banana, in the hope of finding types immune to Panama disease, which can be used for cross-fertilizing with cultivated forms; similar work is also being undertaken in Trinidad with regard to Cacao. As we have recently found at Kew that young shoots of Cacao strike fairly rapidly, it will be possible to take cuttings from pure races of high-yielding plants, and so save the labour of budding and grafting.

Other economic plants which are receiving the attention of Kew at the present time for the benefit of our tropical possessions include passion fruit, papaw, cassava, Ephedra, Derris and tuba root or barbasco. The first three mentioned are affected by virus diseases and various types have been sent out to Amani in order that forms resistant to the virus disease may be raised in East Africa. Ephedra, Derris and tuba root yield important insecticides, and attempts are being made to cultivate plants yielding the highest quantity of rotenone, which is very variable in different strains and species. Socks obtained at Kew have been sent to the West Indies in the hope that a profitable industry may be established to meet the demand.

It may be useful to summarize, in conclusion, some of the more important economic plants which now form the principal industries of the countries to which they have been introduced.

*Cacao*, which is native of South and Central America, has been introduced to Trinidad and other West Indian islands and has for many years been one of their staple crops. More recently it has been introduced to the Gold Coast and is now the mainstay of that Colony.

*Cinchona*, also from South America, has been of great benefit to India and to Java.

*Para Rubber (Hevea)*, which was brought from South America, is now an important source of revenue to Malaya.

*Sisal (Agave)*, native of Central America, is now extensively planted in Kenya and Tanganyika and is a staple product in East Africa.

*Cloves* from the Spice Islands are the chief product to Zanzibar and Pemba.

*Cotton* has been introduced to various parts of the Empire, and is now a very important source of revenue to the Sudder, Uganda, Nigeria, etc.

The introduction of Tea from China to Ceylon and India has transformed vast areas of these countries and is a very important source of their revenue, while the introduction of Coffee to Jamaica and Costa Rica has resulted in important economic developments in those countries.

Reference may also be made to the introduction of wheat to Canada and Australia, which has added so largely to the prosperity of these Dominions. Nor should we forget what the introduction of the potato from South America, and the American tomato has meant in the way of valuable foodstuffs and financial benefit to the growers of these plants in Great Britain and Eire, on the Continent of Europe and elsewhere.

Then, as one further example, there is the great bulb industry of Holland, where the growing of hyacinths and tulips, especially, natives of the near East, has brought so much wealth to the country.

The problems raised by the introduction of economic plants from one country to another and their cultivation under plantation conditions provide ample occupation—apart from political considerations which may arise—for the plant pathologist, physiologist, agricultural chemist, the geneticist, and systematic botanist. As the writer of the book Ecclesiasticus has so truly said, " when a man thinketh he hath finished, then he is but at the beginning, and when he ceaseth, then shall be in perplexity ". (*Nature*, Vol. 148, No. 3740, pp. 15—16; Vol. 148, No. 3741, pp. 42—44.)

## ABSTRACTS

**Root Fibre Production of Some Perennial Grasses.** T. M. Stevenson and W. J. White. *Scientific Agriculture*, Vol. 22, No. 2, Oct. 1941. In Western Canada soil drifting has increased in extent and has become one of the major problems confronting agriculture. As a consequence of this soil drifting there is less of fertility, a reduction in water absorbing and water holding capacity and an increased tendency to erode. Wind erosion is mainly responsible for water erosion and consequent drought. The basic cause of wind erosion is the small size of the soil particles or aggregates. Any soil in powdery or in a single grain condition will drift. Large aggregates on the other hand are not removed by wind. While on most soils drifting can be held fairly well in check by cultural practices, such procedures do not eliminate the above underlying cause of erosion, and at best provide only, a temporary means of control.

The growing of grasses has been found to increase the size of soil aggregates. It has also been noted that grass species differ in their ability to influence soil structure and control soil drifting. From the data presented in the paper the authors conclude it is clear that grasses can and should be used extensively in Western Canada as a means of building up the soil, to prevent soil erosion. The practice of including grasses in rotations would not necessarily involve a drastic change from the present wheat farming methods. The inclusion of grasses in the rotation with the object of improving the soil may well be looked upon as a means of enabling the farmer to continue wheat growing through the control of erosion and maintenance of fertility as well as by aiding in the control of weeds, insect pests and diseases. T. V. R.

**Effect of mulching on evaporation of soil moisture.** Certain laboratory experiments were carried out by Dr. H. L. Penman of the Rothamsted Experimental Station on evaporation from freely drained soils. He concludes from the data obtained (*J. Agri. Sci.* 1941, 31, 454—65), that mulching will be beneficial when the soil surface and air temperatures are equal and that it will have little effect on water conservation where the soil will be self-mulched by the action of summer sunshine. He has further found that evaporation from a saline soil is much greater than from a non-saline soil and is also greater than from a non-saline soil under isothermal conditions. V. R.

# Gleanings.

**India's Nutrition Problems.** *Amla* contains vitamin which prevents scurvy. Vitamin C or ascorbic acid, the vitamin which prevents scurvy, is found in freah fruits and vegetables. Among vegetables, the green leafy varieties are the best sources. Pulses and cereal grains in the ordinary state contain no vitamin C. When however, they are allowed to sprout, the vitamin is formed in the grain and in the growing green sprouts.

There is one cheap and common fruit, namely *amla* or *nellikai* (*Emblica officinalis* Linn), which is probably the richest natural source of vitamin C. *Amla* (gooseberry) grows abundantly in all Indian forests and is obtainable in almost unlimited quantities from January to April. The fresh juice contains nearly twenty times as much vitamin C as orange juice, and a single fruit is equivalent in vitamin C content to one or two oranges.

The heating or drying of fresh fruits or vegetables usually leads to the destruction of most of all the vitamin C originally present. *Amla* is an exception among fruits because of its high initial vitamin C content, because it contains substances which practically protect the vitamin from destruction on heating and drying, and because its juice is strongly acid. Acidity has a protective action on vitamin C. Hence it is possible to preserve *amla* without losing much of the vitamin.

*Amla* is included as an ingredient in many Ayurvedic medicines and tonics. Fresh *amla* was found to be a most effective cure for scurvy when an outbreak of the disease occurred in 1940 in the Hissar famine area. Tablets made from *amla* powder contain vitamin C in concentrated form and this is a convenient method of preserving this vitamin for future use. (*Indian Information*, March 1, 1942.)

**Dried Bananas for Troops.** An indent for 3,500 lb. of dried bananas for supply to Indian troops has been received by the Foodstuffs Directorate of the Supply Department. Samples produced by two firms have already been approved by the Military Food Laboratory. Further sources of supply are being developed. (*Indian Information*, April 1, 1942.)

**Banana Flour for Bread.** As long ago as 1908 an article was published in *The Malayan Agricultural Journal* on 'Banana Flour and other flours from Tropical Products, with Notes on Banana Cultivation', followed in 1930 by an article on 'The Manufacture of Banana Flour'. These two articles advocated a wider use of banana flour for culinary purposes, and gave information on the most suitable varieties for the purpose together with statements of cost of production. Investigations carried out in the Department subsequent to the publication of the article in 1930 showed that the variety Pisang Tandok produces the brightest coloured flour, especially if the central core of the fruit is removed before drying. An attractive appearance is of particular importance in a food product, especially a new one.

A recent issue of *Food Manufacture* draws attention to this subject and quotes from the *Brazil News* of the installation of a plant at Santos where ripe bananas are dried and powdered by a process which does not destroy the cell structure and which conserves the vitamins.

The flour is put up in tins containing the equivalent of 5 lb. of mature fruit, one tablespoonful representing one banana. Retention of the vitamin content is important in that banana flour is a useful source of at least one member of the $B_2$ complex, recent work having revealed a riboflavin content of 0·84 mg. per kilogram of the raw fruit.

It will be recalled from the wholemeal bread controversy that both vitamin $B_1$ and $B_2$ are lacking in white bread, tinned banana flour may well prove a profitable subsidiary product of the banana plantations and our own West Indian growers are presumably alive to its possibilities. The saving in shipping space is another point in its favour. (*The Planters' Chronicle*, August 1941).

**Grass that Fights Snakes.** A grass with discriminating tastes, which co-operates with man in a most satisfactory fashion, has been discovered by Dr. Edward Morgan of Caracas, Venezuela. This strange grass drives away mosquitoes, ticks and snakes, and at the same time provides luxuriant pasturage on which livestock thrives and grows fat.

The plant accomplishes its beneficial purpose through an oily substance which exudes from its stems, especially during the blossoming period. It also has a peculiar, penetrating and pleasant odour, especially in the early morning before the dew is dry. The oil is so heavy a man can get his boots greased by walking through it.

Dr. Morgan, an English physician, first reported his discovery to a London medical society about a year ago, when a proposal to establish a Jewish refugee centre in British Guiana was violently opposed on the ground that the refugees could not endure the tropical conditions. Thousands of square miles of Northern South America and Central America may be opened to Northern European colonization through the finding.

The great curse of large areas of the country is malaria. This disease Dr. Morgan says, keeps the population of Venezuela down to about 4,000,000 although there is enough fertile land to support ten times this number.

Malaria-bearing mosquitoes swarm in tremendous numbers during the rainy season, from April to November. This is the time the grass is green the period when it is most potent as a shield against pest. Hardly a single mosquito can be found over a pasture sown with it. So powerful is it that cattle heavily infested with blood sucking ticks are free of them in a few days after being turned into such a pasture. Even the dreaded bush-master, most venomous of tropical snakes, will not come within smelling distance of such a field.

According to the Pan-American Sanitary Bureau, the grass is one of the richest of all feeds for horses, cows and mules. The plant is especially adapted to dry soil, and consequently the best prospects for its use are afforded by Venezula, Colombia, Eucader, the three Guianas, and possibly northward to Central Mexico.

The grass will yield a heavy hay crop. It also drives away the big fierce bachacho ants which can invade and destroy a cornfield in a few days. "It should be planted, Dr. Morgan says, around every home in the tropics." (*The Planters' Chronicle*, December 1941.)

(It is unfortunate the botanical name of the grass has not been mentioned by Dr. Morgan, in the absence of which it is very difficult to identify it. As it is not easy to correspond overseas at present, we will be much obliged if the readers of this Journal can throw any light on this grass. *Editor, M. A. J.*).

**Fighting Incendiary Bombs.** There are several misconceptions about the incendiary bomb. It appears to be believed in many quarters, for instance, that the thermite electron metal types can be extinguished only with great difficulty because they supply their own oxygen for combustion. It is also held that hand fire extinguishers cannot be used because they generate obnoxious and dangerous gases. Both beliefs are erroneous.

Ignition of the thermite in an incendiary takes place by an impact detonator of the needle and percussion cap type and the tremendous heat developed ignites the electron metal casing, which then burns in the air.

A new extinguishing method consists essentially in the use of inorganic salts which are brought into effective contact with the incandescent bomb and become molten, extinguishing rapidly the main burning of the casing by choking the crevices and smothering the combustion because of elimination of air, and also by reducing the temperature to below the ignition point, which is extremely high. In this manner, wearing coloured glasses as a protection against the glare, an incendiary bomb can be extinguished easily and rapidly in about 20—25 seconds. (*The Planters' Chronicle*, September, 1941).

# Research Notes.

**Hybridization in Chillies** (*Capsicum Sp.*).

Hybridization, the important tool in a breeder's kit, is one of the chief sources of crop improvement and the same is being explored, to combine the desirable characters in the above genus. Even inter-generic hybridization, designed to combine the desirable genes from different genera into a single form has come into vogue with the establishment of the fact, that sterility, invariably arising from such crosses could be overcome by chromosome doubling. The intergeneric sterile crosses in wheat, e. g. those between wheat and Aegelops, and wheat and rye, are known to have become fertile amphidiploids following a doubling of their chromosomes, and yielded forms of economic importance. In the family Cruciferae, crosses between Raphanus and Brassica (Karpechenko, 1924) have been made and Raphanobrassica, a fertile amphidiploid genus obtained. The possibilities of obtaining new forms from such wide crosses have increased with the recent discovery by Blakeslee and others (1937) that Colchicine could induce chomosome doubling in sterile hybrids with a high degree of certainity.

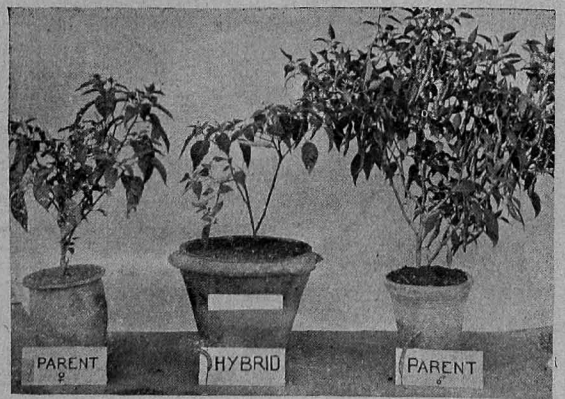
Chillies, belonging to the genus *Capsicum*, are largely grown in South India and constitute one of the most important commercial crops of the Presidency. In India, chilly is largely consumed in the form of spices and condiments; whereas abroad, in U. S. A. it is the chief source for the commercial preparation of Vitamin C. The small fruited types are usually more pungent and are used for the manufacture of Cayenne pepper and are regarded in pharmacy as a powerful stimulant and carminative. The long and pendent fruits, which are usually less pungent, possess a thin leathery pericarp, suitable for quick drying and are widely cultivated in tropical districts as dry chillies. The large non-pungent forms are becoming increasingly popular as a vegetable for daily household consumption in the form of salads, etc., while the Pimentos, with their large smooth fruits have been specially developed for canning purposes. The cosmopolitan nature of the crop fitting it to be cultivated in a variety of soils under a wide diversity of climatic conditions, in plains and on hills; and its ready response to irrigated and rainfed conditions are the most desirable characters.

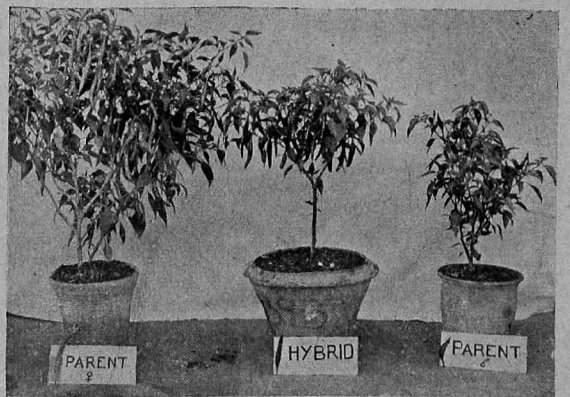
With a view to induce the pungent principle of the small fruited types into the long fruited commercial varieties, a series of cyclic crosses were made at this station during the previous year. Tobasco (*Capsicum* sp.) is a small fruited type and highly pungent with erect fruits. Strain No. 398 (*Capsicum annuum* L.) of the Guntur Station has long pendent fruits and is widely cultivated in the Province as a dry crop. It is a prolific yielder and possesses all desirable characters like, thin long fruits, bright red colour, thin leathery pericarp, persistent calyx, and tolerance to thrips.

This strain was crossed with Tobasco and the hybrid progenies are now under detailed study. The $F_1$ has inherited the pungency of Tobasco; and the erect habit of fruit disposition being dominant is quite perceptible. The size of

Chillies—Parents and Hybrids.

1

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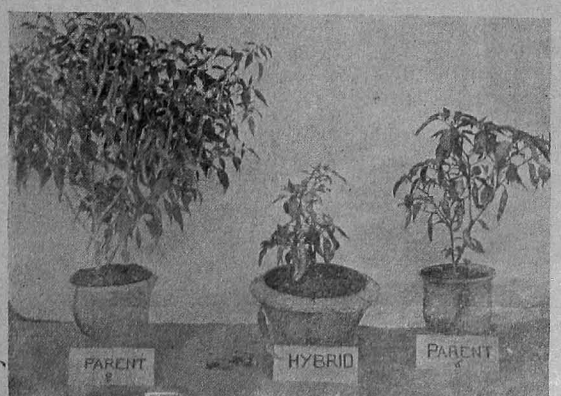


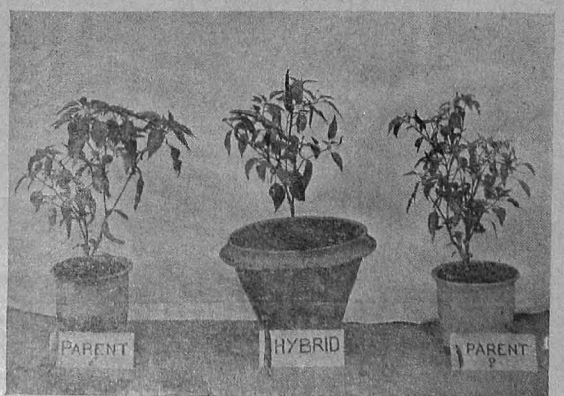


4

[*To face page 134.*

A Mutant in Gogu.


[*To face page 135.*

fruit is intermediate and the yield per plant is as good as of the commercial type. Attempts are under progress to back-cross the $F_1$ progeny with both the parents and very useful and economic types are expected to be evolved (Photo 1).

Jajpur *gurgiamukhi* is another erect, small fruited, pungent variety and the raw fruit instead of being green is deeply pigmented purple. This was crossed with No. 398, and the $F_1$ was erect and deeply pigmented, the size of fruit being intermediate. This cross indicates the dominance of pigmentation as well as the erect habit of fruit. Further work is under progress (Photo 2).

The fruit of No. 398 is thin and long and that of Hungarian Yellow Wax is large with a thick pericarp. A cross was effected between these two and the hybrids inherited the size of fruit of Hungarian Yellow Wax and the pericarp is rather intermediate. Further back-crossing to fix up the size of fruit and the prolificity of No. 398 is under progress (Photo 3).

With a view to combine the size of fruit and pungency, a cross was effected between Hungarian Yellow Wax (large sized fruit) and Jajpur. The hybrids were all large sized and once again the green colour (of the raw fruit) was found to be recessive to purple pigmentation. The hybrids are being back-crossed to fix up stable and suitable combinations (Photo 4).

A detailed study about these crosses is under preparation and will be published soon.

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M. P. Narasimha Rao, B. Sc. (Ag.)
Assoc. I. A. R. I.,
T. V. Subramanian, B. Sc. (Botany).

Agricultural Research Station,
Guntur: 4th December 1941.

**A Mutant in Gogu.** (*Hibiscus sp.*).

Two strains of Hibiscus, Imperial Pusa Nos. 5 and 6, were obtained this year from the Imperial Agricultural Research Institute, New Delhi and grown at the Guntur Station.

I. P. No. 6 is tall growing, and the stem is green throughout with shades of purple pigmentation on the petiole and at the leaf axils. No. 5, is dwarf and the stem is deeply pigmented purple, the colour waning as it reaches the top or the flower shoot. It flowered earlier by about 25 days and completed maturity far in advance. Its spines on the stem and petiole are more prominent whereas those in No. 6 are rather insignificant.

From a thickly populated crop of I. P. No. 6, only one plant, with deeply pigmented stem as in No. 5, was observed and watched with care. The flowering synchronised with that of No. 6, but the stem pigmentation and the prominence of spines exactly resembled those of No. 5. Another peculiarity is, it grew very tall, taller than both the strains and the pigmentation was deeper at the top, gradually waning away towards the base, whereas the colour development in No. 5 was found to be exactly the reverse.

I. P. No. 6 was already introduced into the tract and its popularity is daily on the increase, on account of its lengthy fibre which is glossy and attractive. The local opinion is that the fibre is not very strong, whereas that of No. 5, though short, is reputed to be better. If the plant spotted in No. 6 happens to be a natural cross between the two strains, its future, to give rise to a different variety possessing the desirable characters of No. 6 (lengthy and glossy fibre) and No. 5 (strong fibre), is very promising. The plant is still growing in the field and its selfed seed will be collected for future work.

M. P. Narasimha Rao, B. Sc. Ag.,
Assoc. I. A. R. I.

Agricultural Research Station,
Guntur: 4th December, 1941.

# Review.

**The Punjab Fruit Journal—Preservation Number.** There is an extreme dearth of authentic literature dealing with fruit and vegetable preservation pertaining to Indian conditions, as books written by foreign authors, do not fully answer our purpose. There is, consequently, a keen demand for the publication of suitable literature on the subject. And this demand is still further intensified by the present war inasmuch as importation of foreign products is almost completely stopped, there is need for local production, and in fact, a rare opportunity to develop this industry when it can have normal chance of survival without being strangled by foreign competition.

Keeping the above in view, the Punjab Fruit Development Board, which has earned a reputation for bringing authoritative literature on gardening suitable to Indian conditions, has devoted the fifth Annual Number of the Punjab Fruit Journal exclusively to Fruit and Vegetable Preservation industry. We congratulate our contemporary in completing the first quinquennium and for establishing itself as a successful venture in horticultural journalism in the East.

This compendium will surely be of immense use to those who are interested in Fruit and Vegetable Preservation and will be welcomed alike by research scholars and commercial magnates.

It is a handy illustrated Annual comprising seventy pages replete with facts essential for starting Preservation Industry both as a war and post-war measure. Some of the most informative articles in this 'souvenir' are :

Future of Fruit Preservation Industry—War and the Preservation Industry—Facilities for Training in Fruit Preservation—Equipment for a Fruit Preservation Factory—Preparation of Citrus Fruit Squashes and Cordials—Preparation and Preservation of Unfermented Apple Juice—Preparation of Jam from Pears and Plums—Tomato Ketchup—Tomato Juice—Guava Cheese—Pickling of Vegetables—Drying of Vegetables—Vinegar Manufacture for Home Use—Control of 'Spoilage' in Canned Foods—Summary of the work done in Fruit and Vegetable Preservation at the Fruit Products Laboratories, Lyallpur—Directory of Firms Supplying Fruit Products and Fruits.

This Number is priced at Rs. 1—8—0 including postage, but to regular subscribers of the journal and the members of the Punjab Fruit Development Board, this number along with other issues of the journal is supplied free. The Annual subscription of the journal is Rs. 3 on pre-paid Money Order basis and Rs. 3—3- -0 on V. P. P. basis.

*Note* :— Popular abridged Urdu Edition of this special Preservation Number comprising 40 pages of reading matter priced at Re. 1 including postage on pre-paid Money Order basis or V. P. P. basis is also available for sale.

Copies are available from The Secretary, The Punjab P. C. Fruit Development Board Ltd., Lyallpur, Punjab.

# Crop and Trade Report.

**Cotton Raw, in the Madras Presidency.** The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1942 to 3rd April 1942 amounted to 76,631 bales of 400 lb. lint as against an estimate of 563,800 bales of the total crop of 1941—42. The receipts in the corresponding period of the previous year were 84,192 bales. 118,811 bales mainly of pressed cotton were received at spinning mills and 1,362 bales were exported by sea while 47,637 bales were imported by sea mainly from Karachi and Bombay. ***(From the Director of Agriculture, Madras).***

# Moffussil News and Notes.

**Anakapalle Research Station.** The annual Honey Day celebration was celebrated on the 10th March before a large gathering. All the modern appliances for bee keeping were exhibited. The honey extractor was also demonstrated. A talk on Bee Keeping on improved lines was given. (R. V.)

**Giddalur.** An Agricultural Exhibition was conducted at Krishnamsettipalli in Cumbum Taluk from the 28th to 30th March during Sri Rama Navami festival. Exhibits and posters on poultry, bee-keeping, mat-making and clay models were put up. Models of ideal manure pits, compost preparation, dry earth shed and urine trench were exhibited. On all the three days practical demonstrations of the working of improved implements, such as bundformer, H. M. Guntaka, mould board plough and mhote wheel were conducted. Samples of green manure crops and strains of crops, raised in flower pots, were also exhibited along with their seeds. This exhibition is considered to be the first of its kind in this taluk and attracted large crowds.

A competition of stone dragging by cattle was conducted on the first day and the owner of the winning cattle was presented with 20 tolas of silver.

Public meetings were held in the evenings in front of the exhibition stall which was attended by almost all the officials and enlightened public of Giddalur. (N. A.)

**Karamadai, Avanashi.** At the time of the Karamadai Car festival an agricultural exhibition was held from 2nd to 6th March. All labour saving implements like ploughs, cultivators, harrows, ridgers, chaff-cutters and improved seeds, malts, cream jaggery, bee keeping appliances and illustrated posters in Tamil were exhibited. Several enquiries from *ryots* were answered. The Karamadai Village Agricultural Association conducted an exhibition of *ryots'* produce, and prizes were awarded to the best exhibits of cotton, sugarcane, tobacco, cereals, fruits and vegetables. Mr. C. U. Nanjappa who is adopting several departmental improvements and who has helped in the spreading of several departmental strains of cotton, *ragi* and *cholam*, addressed the *ryots* impressing on them the great help rendered by the department in the uplift of agriculture, and requested them all to benefit themselves by adopting improved methods in agriculture and growing more food crops. (M. U. V.)

**Pithapuram.** The Honey Week was celebrated in Pithapuram Taluk, during which, the Agricultural Demonstrator and the Entomology Assistant, Samalkot, visited the villages of Kothapalli, Kondevaram, Navakandravada, Chitrada and Pithapuram, where bee keeping has established itself as an industry, and exhorted bee keepers to further the cause of this subsidiary occupation, harness the nectar secretions of varicus flowers that are now going to waste and extend the benefit of the industry in the localities that are proving favourable for bee keeping. The Agricultural Demonstrator, Pithapuram, delivered a lecture on bee keeping at Kondavaram, with the help of bromide pictures. On the last day of the Honey Week, (11th March) special celebrations were arranged in the Cornation bungalow of the Maharajah of Pithapur by the Honey and Wax Supply Co-operative Society with the co-operation of the Agricultural Department. An attractive stall with exhibits of appliances in bee keeping and honey varieties was got up by the Agricultural Department for the occasion. A meeting of workers, members and local public was held in the forenoon under the presidentship of Nawabzada Saadat Ulla Khan Esq., M. A. (Oxon.), Deputy Director of Agriculture, Cocanada (D. H. R.)

**Tinnevelly.** An Agricultural Exhibition was held at the Tinnevelly Collector's Bungalow on 21—3—42 during the prize distribution and fancy fete organised by the District War Committee. Improved strains of paddy, millets and cotton were exhibited. Malts from Government Agricultural Chemist, Coimbatore, candied fruits and fruit juices from the Fruit Specialist, Koduru, and fresh tomatoes and eggs from the Koilpatti Research Station were among the departmental exhibits that drew the attention of the visitors. A simple and efficient rat trap, with live rats, was demonstrated and this was largely appreciated by the visitors. Posters showing the methods of controlling pests and diseases and better methods of farming were put up. The exhibition was well attended and much appreciated by the visitors. (M. A. B.)

# College and Estate News.

**Students' Corner.** The B. Sc. Ag. first, second and the final examinations of the Madras University, 1942, were held on the following days. First Examination —1st April to 10th April. Second Examination—1st April to 17th April. Final Examination—8th April to 23rd April.

**M. Sc. Decree—University of Madras.** We offer our very hearty congratulations to Sri E. G. Sivaswami, B. Sc. Ag., on the award of M. Sc. Degree to him for his thesis on "Studies on quality in rice".

**A. R. P.** A. R. P. Lectures are being delivered by Sri D. Natarajan, B E., (Mad.), M. E. (Engineering College) and Dr. K. Narayanan, and so far two batches each consisting of a fairly large number of officers of the department have attended these lectures. All possible Air Raid protection is also being done for the Estate by the Principal with the help of other officers.

**D. A.'s Office.** The Office of the Director of Agriculture, Madras has been shifted to the Agricultural College and Research Institute, Lawley Road P. O., Coimbatore, from the 20th of this month.

# Departmental Notifications.

## *Gazetted Service.*

Rao Bahadur G. N. Rangaswami Ayyangar, Millets Specialist and Principal, Agricultural College, Coimbatore, leave for two months and nine days, from March 10, preparatory to retirement.

Mr. P. Venkataramiah, Government Agricultural Chemist, to be Agricultural Chemist and Principal, Agricultural College, Coimbatore from March 10.

Rao Bahadur V. Ramanatha Ayyar, Cotton Specialist, to be Cotton Specialist and Geneticist, Agricultural College, Coimbatore, from March 10.

## *Subordinate Service.*

**Transfers.**

| Name of officers. | From | To |
|---|---|---|
| Sri. R. Venkatarama Ayyar, | South Arcot Groundnut Market Committee, Cuddalore, | A. D. Krishnagiri. |
| „ K. Rangaswami Ayyangar, | A. D. Rapur, | A. D. Sulurpet. |
| „ C. Jagannatha Rao, | Asst. in Cotton, Nandyal. | Asst. in Cotton, Hagari. |

| | | |
|---|---|---|
| Sri. C. K. Ramachandran, | Asst. in Cotton, Hagari, | Asst. in Cotton, Coimbatore. |
| „ M. Kandaswami, | Asst. in Cotton, Coimbatore, | Asst. in Mycology, Coimbatore. |
| „ D. Bappayya, | Upper Subordinate (on leave), | A. D. Darsi, Nellore Dt. |

## Leave.

| Name of officers. | Period of leave. |
|---|---|
| Sri. P. V. Hariharan, Millet Asst., A. R. S., Palur, | L. a. p. for 1 month from 14—4—42. |
| „ U. Narasinga Rao, Asst. in Oil Seeds, Coimbatore, | L. a. p. for 55 days from 6—4—42. |
| „ K. Ramasubba Ayyar, A. D., Gobichettipalayam, | L. a. p. for 2 months and 15 days from 1—4—42. |
| „ T. Ramanujulu Naidu, A. D., Nagur, Godavary, | L. a. p. for 45 days from 25—4—42. |
| „ K. S. Ramana Rai, A. D., Harapanahalli, | Extension of l. a. p. for 1 month and 13 days from 8—4—42. |
| „ P. Lakshminarayana, Asst., F. M., A. R. S., Samalkot, | L. a. p. for 1 month from 4—4—42. |
| Bennet P. Masilamani, A. D., Tirupattur, | Extension of l. a. p. on m. c. for 59 days from 4—4—42. |
| Sri. K. Tejappa Shetty, A. D., Kalyandrug, | L. a. p. for 55 days from 8—4—42. |
| „ B. Siva Rao, A. D., Tuni, | L. a. p. for 2 months from 1—4—42. |
| „ K. Kunhikrishnan Nambiar, Asst. in Millets, Coimbatore, | L. a. p. for 1 month from 6—4—42. |
| „ K. Cherian Jacob, Asst. in Botany, Coimbatore, | L. a. p. for 1 month and 15 days from 6—4—42. |
| „ D. Bapayya, Agricultural Subordinate (on leave), | L. a. p. for 1 month from 13—4—42. |
| „ C. S. Krishnaswami Ayyar, A. D., Chidambaram. | L. a. p. for 1 month from the date of relief. |
| „ S. Ramachandra Ayyar, Asst. in Entomology, Coimbatore, | Extension of l. a. p. on m. c. for 2 months from 24—3—42. |
| „ G. Venkatakrishna Ayyar | Extension of l. a. p. for 2 months from 8—3—42. |
| „ K. Ambikacharan, | Extension of leave for 2 months from 13—4—42. |
| „ N. G. Narayanan, Asst. in Cotton, Nandyal, | Extension of l. a. p. for 2 months on m. c. from 29—3—42. |
| „ T. N. Balasubramaniam, A. D., Kumbakonam, | L. a. p. for 2 months from the date of relief. |
| „ D. Panakala Rao, A. D., Tadepalligudem, | L. a. p. on m. c. for 3 months from 11—3—42. |
| „ G. Sakharama Rao, A. D., Karkal, | L. a. p. for one month from 1—5—42. |

**Postings and orders—Marketing Section.**

The number of posts of Marketing Assistants has been increased from 4 to 6 from 1-4-1942. The head-quarters, the personnel and the jurisdiction of each of them are as follows:—1. Rajahmundry—Sri. D. Achyutarma Raju—Vizagapatam, East Godavari and West Godavari. 2. Guntur—Sri. M. Rami Reddi—Kistna Guntur, Nellore and Kurnool. 3. Chittoor—Sri. K. Raghunatha Reddi—Chittoor, Cuddapah, Anantapur and Bellary. 4. Madras—Sri. C. Annamalai—Madras, Chingleput, South Arcot and North Arcot. 5. Trichinopoly—Sri. T. K. Thangavelu. Tanjore, Trichinopoly, Madura, Ramnad and Tinnevelly. 6. Coimbatore —Sri. A. H. Subrahmanya Sarma—Salem, Coimbatore, The Nilgiris, Malabar and South Kanara.

## OBITUARY

## The Late Janab K. Sooppi Haji Sahib.

It is with profound regret that we record the untimely death of Janab Kunnumprath Sooppi Haji Sahib, Assistant Agricultural Demonstrator, Manjeri, and an old member of the Madras Agricultural Students' Union, after a fairly prolonged illness, on the morning of 12th April 1942.

Janab Sooppi Haji Sahib was born in the year 1897, in a respectable muslim family in the village of Thooneri in Malabar District. After undergoing the Certificate of Proficiency course at the Agricultural College, Coimbatore, he entered service as Assistant Farm Manager at Taliparamba Agricultural Research Station in the year 1920. Later on he worked in almost all West Coast Research Stations and also at Coonoor. He was deputed for coconut improvement work in Laccadives. After that he worked in Malabar and S. Kanara as a Demonstrator until he took ill in January last.

Mr. Soopi Haji was one of the very few muslim members who entered the Agricultural Department early. He was an industrious and sincere worker who was liked by one and all alike, and was very popular among the *ryots* wherever he worked. In Mr. Sooppi Haji's death the Department has lost a sincere and hard worker.

He leaves behind, his wife, two brothers, three sisters, and many relatives and friends. to whom we offer our sympathy.