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EDITORIAL

The Indian Sugar Industry. Owing to the introduction of new varieties of canes evolved at the Coimbatore Station and the fillip given to the Industry by the protective tarriff on sugar imports, the Indian Sugar Industry has been making steady progess during the last two decades. India has now reached a stage, when she can not only supply all her own requirements, but has considerable quantities of exportable surplus of refined sugar left. But in recent years, the restriction placed on the industry, by the imposition of an excise duty and the increase in railway freights together with the ban on exports of sugar by sea, have acted as severe handicaps and the profits accruing to the growers and the manufacturers are steadily falling. While it must be admitted that the excise duty and the increase in railway freight are but just legitimate demands on a prosperous industry, we are of opinion that the ban on exports which acts as a severe handicap on the industry should be forthwith removed. The sugar manufacturers in India have been for some time past vigorously agitating for the removal of this ban, and from the figures furnished by them, it would appear that India produces annually 14,00,000 tons of refined sugar, while the total consumption in the country is only 10,50,000, tons. The surplus quantity of 350,000 tons, has either to be distributed in India by increasing the per capita consumption, or be exported to overseas markets. There will be considerable objection to the former course owing to the adverse effect it will have on prices and on the cottage industry of jaggery manufacture. Hence, the removal of ban on export of sugar by sea is the only course which will meet with the approval of the agriculturist. Besides this, at least till the cessation of the war, a ban should be imposed on imports by sea, in order that the world's surplus sugar is not dumped in the Indian markets. Having said this for the sugar manufacturers, we are constrained to remind them that they have not always been fair to the cane grower, and but for government intervention would have often deprived him of his legitimate share of the profits. We would urge them to remember that the interests of the cultivator are closely linked with theirs, and while they are reluctant to share their excess profits with him, they should not be eager to shift their losses on to his shoulders.

The War. As we go to press we learn that the barbaric hordes of a mechanised army under the guidance of a dictator who for sheer ruthlessness and evilmindedness would appear to surpass Attilla the Hun, are invading one helpless country after another, leaving in their trail dire destruction and disaster. Neither ethical values nor the fear for the future of the human race, would seem to deter this invader from his evil course, and it is to the eternal glory of Great Britain and France that they have gallantly and unselfishly stood up against this monster, and in this hour of grave peril let all men silently send up their fervant prayers to almighty God that the world may yet be rendered safe for all peace loving and rightminded men.

A Plea for a Protective Duty on Rice.

By I. S. KUTTALINGAM PILLAI.

Member, Rice Committee, I. C. A. R.

Introduction. Rice is a crop of an all-India importance. Its cultivation is wide and important in the Provinces of Bengal, Madras, Bihar, and Assam. With its 72 million acres, India has the largest area under rice among the countries of the world. Her outturn of rice is a little over half of what is produced in the world and four-seventh of the production of Asia, the most important rice producing continent in the world. Out of the world production of 830,000 quintals of rice in 1935—6, Asia alone produced 772,000 quintals of which 442,880 quintals formed the share of India and Burma together. Burma alone produced only a sixth of this amount. These figures clearly show the importance of India in the production of rice as well as the relatively minor contribution of Burma to the world output.

An anomaly. In spite of the fact that India tops the list in the matter of both output and acreage under rice, it is pathetic but true that she has no voice in the determination of the world price-level of rice. This is due to Burma's proportionately vast export surplus of rice. Notwithstanding India's pre-eminent position as a rice-producer, she is suffering from a deficit supply which meets only about 92 % of her national demands. This shortage is made up by imports from abroad, mainly from Burma. In recent years, after the commencement of the era of subsidised rice production in some European countries and the expansion of rice cultivation in both the American continents, the over-sea markets of Burma have dwindled considerably. Consequently Burma has come to look upon India as the main market for her export surplus. It is true that Burma helps India by making up her shortage. But in doing so, she depresses the price-level in this country to such an extent that the rice producers are hard hit and as a consequence the rural economy of the rice-growing provinces is disturbed to an alarming extent. Statistics are not wanting to prove that the competition of Burma in Indian markets with the home producers has sagged the price to a level that is unremunerative to the majority of rice-growers in this country. It may be argued that if rice-cultivation is unremunerative, there would be a change over and more economic, if not lucrative crops would be substituted. This has not happened owing to two reasons. Firstly most of the lands under rice cannot be utilized for any other cultivation. Secondly custom, the curse of peasant economy, keeps the peasants in the uneconomic groove of cultivating what their forefathers had done for several generations before them. Our rice growers have persisted in raising rice crops against severe odds. They have to contend against the low cost of production of rice in the fertile Irravady delta and against the inelastic production of an export surplus in Burma. While being thankful to Burma for eliminating scarcity in India, it is incumbent upon us to study the attitude of Burma

towards Indian markets. Burma would fain sell her rice in foreign markets but owing to the closure of European markets, she naturally turns toward India as the last resort. She has come to count on India as a permanent market for her superfluous rice. Her present position is that she should sell her rice in India or have it rot in her fields. Although she does not sell at a price in India below the home price and thus avoid the indictment of dumping in the technical sense, her act has got all the unsavoury features of dumping in excelsis because the price of rice in India drops immediately a Rangoon steamer is sighted from the Indian coast. This is but as it should be: as every tyro in Economics knows that the price is governed by the marginal supply; the very low marginal cost of production of Burmese rice drags down the price-level in India. In discussing it in an academic manner it sounds right; but from the standpoint of the poor cultivator in India, this inexorable law whisks away the little profit he would have been dreaming about all the months since he planted the seedlings. Worse still in many cases, this lands him in severe loss. The rice grower in India is thus frustrated in his attempt to make an honest living by agriculture. The nature of his land and his social conditions positively rule out any possibility of his taking to commercial crops. Under such circumstances immediate relief is necessary, if he should be saved. India cannot also afford to be looking on unconcernedly at the process of her rice fields being turned to commercial farming ceaselessly. Already there is a shortage of rice and if this process is to operate for a decade, the gap between supply and demand of rice will be wider. Free import of rice from Burma may obviate scarcity today, but how can this continue? The import of 1·8 million tons of rice appears only to be a thin end of a wedge; and in course of time, India, primarily an agricultural country, may become dependant upon foreign countries for her staple food!

The need for a Protective duty. In order to remedy this state of affairs, it is not suggested that the import of rice should be completely prohibited from Burma. What is suggested is the imposition of duty, not heavy and prohibitive, but mild and sufficient, to safeguard the interests of the Indian rice-growers without injuring the consumers' interests. The object of this duty is to raise the price of rice to a remunerative level and to encourage Indian growers to produce sufficient to meet the national demand. One should agree with the proposition that high price is swallowed up in the long run by high costs. But it should be the endeavour of the Government to take this tide of higher prices to carry out the following programme in its entirety or in an amended form for increasing the output and make India self-sufficient regarding rice.

Increasing Indian Production. Increase of output should be achieved by increasing the yield from each acre. At present about 72,000,000 acres produce 25 million tons of rice meeting about 92 % of the country's demand. The object to be aimed at is to secure a 10 % increase in output. In India the yield per acre is estimated at 870 lbs. of rice. Spain, Italy and

Japan produce respectively nine, five and four times as much as India. Even if we cannot aspire for such a phenomenal increase in yield without radically altering the system of land tenure, methods of cultivation etc., it is possible to expect a 10 % to 15 % increase by the use of selected and pure seeds. " An increase in yield of at least 10% by the growing of strains obtained by simple selection in local varieties has been proved to be a possibility as the work of the Rice Botanists in the various provinces would show "—(Madras Government's note). The yield is today considerably affected by the C 3 seeds the peasants are using The grains in the same field do not mature simultaneously and the peasant has to harvest when more than half has ripened. If he waits for all the grains to ripen, he has to face the loss of early ripened grains due to shedding. Selected and pure seeds will eliminate this cause of low yield.

The problem of Seed supply. The next question to consider is how to supply such seeds to all peasants. It should not be difficult to find in every village enthusiastic land-holders who would cultivate a few acres of their lands according to the instructions and under the guidance of Agricultural Demonstrators. From these ' seed forms ' it is quite possible to supply the selected and pure seeds. This may be accomplished by means of a five-year plan. Along with the distribution of seeds, if efficient marketing methods on co-operative lines are devised and put into practice, the middlemen's and moneylenders' toll would be avoided and *pro tanto*, the peasants' profits increased.

Protection—a pre-requisite for improvement. It is not possible to carry out such a five-year plan at present, when the price has sagged down to an unremunerative level. It is only under the favourable auspices of an import duty that the five-year plan will be successful. Under the spell of the prolonged depression and low price level, the rice growers are languishing thoroughly demoralised. An import duty causing the price to look up a little, is indispensable to undertake any measure for improving rice production.

Consumers' interests. Now we turn to the effects of an import duty on the consumers. It is argued that the rise in price will detrimentally affect them. Firstly the price will not rise unduly high ; for a steep rise will induce Burmese exporters to pay the duty and sell rice in Indian markets. This possibility of an import duty-laden rice will act as a safety valve against arbitrary raising of price by local producers in times of scarcity. Secondly the small rise to be expected legitimately of an import duty will not be wholly appropriated by the rice growers. The advantages of this rise will be partially transmitted to the landless agricultural labourers who have recently become the object of sympathy with certain schools of opinion. It is often forgotten that prosperity of this class of agricultural proletariat is inextricably entwined with the lot of the landholders. The low price of rice has hit the rice growers and they have held up improvements of their lands

and expansion of cultivation and postponed even very necessary annual repairs of bunds and balks, thus reducing the volume of work available to the agricultural workers. All these restrictions to available work will be relaxed as soon as the prices look up, as a result of the change in the psychology of the landholders. These workers at present suffer from the lack of an alternative urban demand for their labour and therefore remain in involuntary idleness.

Possible Burmese reaction. Regarding the possibility of Burmese retaliation, her favourable balance of trade rules it out of practical politics. Besides Burma's oversea markets have shrunk without any hope of being recaptured. So she has to sell her rice in India, not at her own terms but at India's terms. India should not hesitate to dictate her own terms. When the spectre of economic nationalism is ravaging the whole outside world, if India remains wedded to moribund *laissez-faire* theories, it may be consistent with her ancient traditions of toleration but the policy is economically unsound and even dangerous. None can deny India's natural advantages for rice growing. If owing to public or private callousness, an ostrich-like policy is pursued and her natural resources are not utilized to their maximum capacity, more alert, vigorous and self-confident countries will take advantage of the situation and flood the free Indian market with their surplus rice which would have lost all the other markets in the world. 'When you are in Rome be a Roman,' is an old adage. This advice to the individual is no less apposite to nations. When there is economic nationalism everywhere, it is folly for any single country to be otherwise. Behave as others do, is hardly less applicable to nations than to individuals. In the case of India, protection of rice-growing is not like supporting an unsuitable industry on stilts but granting to an industry its desert that is long over-due. It is not essentially a military but an economic consideration that weighs in the matter of protection. Has not the duty on wheat improved the conditions of the wheat-growers in the Punjab ? Again the Indian sugar-cane growers could not have achieved the present degree of prosperity but for protection. What rice-growers demand is nothing more than bare justice to their cause. When wheat and sugar were protected, the argument that they would be of sectional advantage was, if raised, hushed into silence. Wheat is as widely consumed in the wheat growing provinces as rice in rice growing provinces, and sugar is consumed in all the provinces. The interests of the consumers were overridden for the time being for the sake of the ultimate good. In a similar spirit why should not rice, the staple industry of more than half of India, be protected. Such a protection is quite in consonance with the policy of discriminate protection, recommended by the Fiscal Commission and pursued for the last one decade and more.

Summary and Conclusions. Rice is one of the major crops of India. The price level, since the depression when it reached the nadir, has not risen to a remunerative level. The continued depressed level of prices has depressed the minds of the rice-growers. Unless some immediate remedy

is applied to raise the price level, the rice-growers will be completely beaten hollow by the Burmese competitors and the acreage under rice instead of remaining stationary, will decrease. That will lead to a wider gap between supply and demand, which will be aggravated by the growth of population. Although any increase in the rice area is not imperative the yield per acre should be increased by scientific methods of cultivation. The rice grower at present is paralysed by the deplorably low price level. It is impossible to stimulate him into activity without an import duty on foreign rice. It may be argued that it is an artificial hampering of the free operation of economic forces. An incision of a carbuncle is an artificial meddling but necessary to save the patient. So also protection is necessary to save the rice grower. Without convincing him by the concrete rise in the price level, any amount of research, dissemination of scientific knowledge etc. will be futile. Hence the urgency for an import duty. Procrastination, the sin of all democratic governments, will rob the Indian rice grower of the good that an import duty can do for him. The only practicable solution lies in the granting of protection to rice without any delay. Inaction at this stage will slide the rice growers into the slough of despondency from which it will be hard to rescue them.

Cotton linings for irrigation ditches may be the new way to make a dent in the surplus cotton stock piles of the South, it was suggested to the National Reclamation Association meeting at Denver. The new utilisation of cotton supplements the use of cotton fabrics as a binder for secondary highways and airport runways. W. H. Robinson manager of an irrigation district in Idaho, described how a section of an irrigation canal was lined with a mixture of asphalt and gravel backed by heavy cotton fabric. Water losses in this section, which formely ran from 20 per cent to 30 per cent, have now been cut to about one and one half percent. The standard method of lining irrigation canals is with concrete, which pays for itself despite high cost. The cotton-gravel-ashpalt liner is cheaper.

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Introduction of sugarcane varieties in the Presidency.

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Introduction. Sugarcane is one of the important 'cash' crops, grown on a fairly extensive scale, in some of the districts of the Presidency. The crop received attention, even in the early years of the Agricultural Department, when it was under the control of the Board of Revenue. During the years 1895 to 1897, the area under this crop in the Godavari district, declined, due to the ravage of "Red-rot" (*Colletotrichum falcatum*). It was in 1898, that an Economic Botanist, the late Dr. Barber, was appointed to investigate the disease and overcome it, if possible. In 1901, a small extent of land was leased in the Godavari district, to grow different canes and select therefrom the resistant types. It was felt that this was the most practical method to deal with the situation. This resulted in the establishment of Agricultural Research Station, Samalkot, which was opened in 1902, for this purpose. This crop, as the facts indicate, received attention, even long before the Department became an independent one, as it did in 1906, the year in which a whole time Director of Agriculture was appointed.

Government enterprise. The introduction of varieties from foreign countries, took place, long before the appointment of the Economic Botanist. The available records indicate, that the throwing open of the English market in 1835, was the first occasion when attention was paid to this crop. The credit goes to Dr. Robert Wright, who was then the Secretary of the Agri-Horticultural Society, Madras. He was the first person to take initiative in the matter, by addressing a letter in November 1836, to the Government of Madras, indicating the possibilities of improving the crop, with the object of manufacturing sugar and exporting the commodity to the English market. Acting on the advice of Dr. Wright, the local Government, requested the Government of Mauritius, in December 1836, to send a consignment of a few cuttings of sugarcane cultivated in that island. It took two years, for the request to be complied with and the consignment arrived in 1838 – over hundred years ago.

The entire consignment was placed in charge of Dr. Wright and, further, a subsidy was given by the local Government to meet the cost of multiplication and distribution of setts to different parts of the Presidency. The distribution was, in 1839, to the Collectors of each district for trial. In 1840, it is stated that demand for seed material was so heavy that the Society was not able to meet them. The local Government, till 1850, continued to support the scheme for distribution of seed material and even offered to remit assessment on lands, utilised for the multiplication of seed material It was these canes, from Mauritius, that first solved the disease problem. in the Godavari district. Some of these are still in cultivation both in our Presidency and in the adjoining Bombay Presidency.

Private enterprise. In addition to these steps, taken by the local Government, certain varieties from foreign countries were also introduced through private enterprise, as indicated below :—

(a) In 1844, sugar factories were established at Aska (Ganjam District), Chittivalsa (Vizagapatam District) and near Rajahmundry (Godavari District) by some enterprising European businessmen. They had some share in the introduction of varieties from foreign countries, presumably, with the idea of getting better varieties of cane for their factories.

(b) Some foreign varieties, much in favour with the ryots of the Bombay Presidency, were also imported, by ryots of the bordering districts of South Kanara and Bellary.

(c) The indentured labour coolies, returning from foreign countries such as British Guiana, West Indies, South Africa, Natal, etc., were also responsible, to a certain extent, in the introduction of varieties.

Other varieties. Besides Mauritius, varieties were imported from Barbados, Demarara, Queensland, Fiji and Java. They have become so common with the ryots now, that their original names have been replaced by names in local Indian languages. The following instances will bear truth of this statement :—

(i) *Hathakabbu* of Bellary District, *Tella cheruku* of Chittoor District, *Poovan* of Coimbatore District, *Keli* of Godavari District and *Polabontha* of Vizagapatam District are the names given in different localities, for one and the same foreign variety.

(ii) *Natalam, Patta Karumbu, Nama Karumbu, Namalu, Desari, Saralu Yerrapattavali* are the names given in different localities, for one and the same foreign variety—Striped Mauritius.

(iii) *Vellai* (otherwise known as Seemai) of Coimbatore District, *Yerra* (Red Mauritius), *Arati Poovu* (Purple Mauritius), *Panni Karumbu* and Fiji B are some instances where foreign varieties have lost their original names. The present position is, that for statistical purposes, with the exception of a few—J 247 and Fiji B (Badila)—all these foreign varieties are reckoned as indigenous. The main object of this note, is to correct this misnomer.

Conclusion. In this Presidency, at present, these foreign varieties have completely replaced the indigenous variety. Since 1932, these foreign varieties are being gradually replaced by varieties evolved at the Imperial Cane Breeding Station, Coimbatore. The expression "Improved variety" has come to be synonymous with the "Coimbatore canes". Judging from the rate of progress made, it is not too much to expect, that in the course of about five to ten years, the whole area under sugarcane in the Presidency will be under "Coimbatore varieties".

Tea Cultivation in South India.*

By E. A. STONE

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(Continued from Vol. XXVII Page 161)

Cultivation in Tea. Weeding continues the whole year round. At certain times of the year, in the good growing weather before and after the monsoons, weeds grow very fast ; at these times a seed can grow into a full size plant which in its turn is producing seed in about 5 weeks or less. During the heavy rains the growth of weeds is less rapid, but weeds pulled out and left on the ground will continue to grow and flower. It is therefore necessary to collect them into big heaps which should be turned over after a few weeks to avoid spreading of seeds. In the dry weather there is little need of weeding, once the estates have been thoroughly cleaned up from the previous rains. It is usual for an estate to have seven, eight or nine complete rounds of weeding in a year. During the heavy rains only hand-weeding is done to avoid loosening the top soil too much and thereby losing it. With the hand weeders a few coolies are sent with weeding forks or *kokras* to clean up any grassy patches, but these being usually found in flat places forking will not cause much erosion. After the heavy rains are finished, clean weeding is started, using *kokras*. Fields which have recently been pruned and so have less cover from the tea will be the weediest and need cleaning up first. By the end of January an estate is usually quite clean. 'Kokra weeding' is then continued until heavy and regular rain is falling i. e. about May.

Weeds are mostly grasses and members of the family Compositae. Woody shrubs and trees seeded from nearby jungles have to be rooted out, and every time a field is pruned the ferns growing close under the tea bushes should be carefully eradicated (not that ferns should be left at other times ; it is easiest to get them out completely at pruning time). At the same time as weeding a field, all flowering weeds in its swamps should be sickled, and roads and drains cleaned. During the heavy rains, roads and drains need special attention for keeping clean if blockages and washouts with resultant loss of top soil are to be avoided, and culverts especially should be regularly inspected.

This question of soil erosion occupies the planters' mind a lot, and all kinds of devices are used to combat it. As mentioned, only hand weeding is done during the heavy rains, and all small weeds are left. Where there is plenty of loose stone, contour walls $1\frac{1}{2}' \times 1\frac{1}{2}'$ are built which by holding up the soil, form terraces. Contour trenches are dug for breaking the wash, but these cause a lot of damage to the tea roots. Another good plan is to

* [We apologise to our readers for the long gap between the third and fourth instalments of this series. The author's absence on leave out of India and the outbreak of the war have caused an unavoidable delay. *Ed. M. A. J.*]

build walls all round the bottom edges of fields so separating them from the swamps and raising the field level at the bottom above the swamp, where previously continual scraping away of grass growing from the swamp up into the tea has exposed the tea roots. This helps also to keep the swamp drains clear, and where swamps are used for cattle grazing, the walls assist in keeping the cattle out of the tea-fields.

Growing plants for green manure helps, especially of the spreading variety, but these I will mention later. Contours of Paspalam or other non-seeding grass may be grown, but these tend to encourage field rats which feed on the roots.

Antimalarial work. Malaria is prevalent in most hill districts of South India, and this work is essential. Swampy areas have to be drained correctly and blockages of rock blasted out to get even flow of water in the drains. These drains and all stream and river edges must be kept clear of grass and vegetation in the mosquito breeding months (before and after rains), and oiled with *malariol* weekly.

Forking. This work is usually done after heavy rains are over and before the dry weather, to break up the capillaries in the soil and conserve the moisture, as well as for aerating the soil and increasing the bacterial action in it. Most of my readers will know more about this subject than I, so I will pass on quickly, only pausing to say that in forking, care has to be taken not to damage the tea roots or expose them on the surface. 'Envelope forking' where the earth is not turned over, but merely loosened and pushed forward is the usual method employed.

Control of Shade. Tea likes a thin dappled shade, and for this, silver oak (*Grevillea robusta)* trees are planted in rows (previously mentioned) about every 12 rows of tea apart. These trees if allowed to grow on without any form of control become enormously big and give too dense a shade. Some planters cut the trees across and control them as low as 15 feet from the ground. Others prefer to cut them at 25' to 30' from the ground, keeping all the side branches cut off upto 15 feet. Albizzias, Acacias, and other trees are also planted for shade, but the Grevillea is mostly used.

(To be continued).

A Note on the Edible Fruits found wild in the Madras Presidency.

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Introduction. Fruits of several plants growing wild in the forests and waste places are either eaten when ripe or the unripe ones used in curries or pickles. Various kinds of wild fruits are collected from the forests and sold in the adjoining villages or towns. The edible portion in most cases is the pulp of the fruit. In rare instances the fleshy thalamus or the aril of the seed or the seed kernel is the edible part. These fruits are known under various local names in different parts of the Presidency. These names so far known are given alphabetically at the end of this note. The distribution of these fruit trees together with short descriptions and other particulars are given below:—

The Sweet Thorn Family.

1. *Flacourtia montana* Grah.

Kanarese: Hanusampage; Malayalam: Chalian Pazham.

It is a small tree found in the forests of the West Coast and the Western Ghats.

Fruits are edible and are available in the Palghat market.

The Mangosteen Family.

2. *Garcinia indica* Chois.

Kanarese: Murgina huli; Malayalam: Panampuli.

A slender tree with drooping branches found in the Western Ghats in South Kanara, Coorg and Wynaad.

The pulp of the seeds is edible.

3. *Garcinia Cambogia* Desr.

Tamil: Penampuli; Malayalam: Kodapuli.

It is a large tree with drooping branches found commonly in the Western Ghats from Coorg to Travancore.

The fruit is of the size of an orange with several deep vertical grooves. The pulp of the seeds is edible.

4. *Garcinia tinctoria* Dunn.

Tamil: Mukki; Telugu: Iwara mamidi; Kanarese: Deva garige; Malayalam: Anavaya.

It is an evergreen handsome tree found in the Northern Circars, the Western Ghats in Mysore, Coorg, Nilgiris and Travancore.

The fruit is of the size of an orange, smooth and bright yellow in colour. The pulp of the seeds is eaten.

The Olive Linden Family.

5. *Elaeocarpus serratus* L.

Tamil: Vlang karei; Verali palam; Kanarese: Bigada; Malayalam: Nalla kara.

It is a small tree found throughout the Western Ghats in the overgreen forests from South Kanara to Travancore.

The fleshy outer-portion of the fruits is eaten and is also made into pickles.

The Bastard Sandal Family.

6. *Erythroxylon monogynum* Roxb.

Tamil : Devadara, Chempulichi ; Telugu : Adivi-gerenta ; Kanarese : Devadaru.

It is a small tree found throughout the Presidency in dry forests.

The small red juicy fruits are eaten and are very refreshing.

The Wampee Tree Family.

7. *Clausena Willdenovii* W. & A.

Tamil : Kattukkariveppilai ; Malayalam : Kurakatu.

A small tree found in the Carnatic, Shevaroy Hills of Salem, Western Ghats from Mysore through Nilgiris to Travancore.

The fruit resembles currants and is very delicious.

The Citrus Family.

8. Feronia limonia (Linn.) Swingle (F. Elephantum Correa).

English: The Elephant Apple, The Wood Apple. Tamil : Vilangai, Vilam palam ; Telugu : Velaga ; Kanarese : Belathannu.

It is a large tree found in Northern Circars, Deccan and Carnatic in dry and open forests.

The fruit is of the size of a large orange. The pulp of the fruit is eaten. The fruit is sold in bazaars.

9. *Aegle Marmelos* Corr.

English : The Bael Tree ; Tamil : Vilvam ; Telugu : Maridu ; Malyalam : Koovalam.

A small deciduous thorny tree found in Northern Circars, Deccan and Carnatic in dry forests ; often cultivated in the West Coast.

Ripe fruits are sweet, nutritious and are sometimes eaten. Sherbet is also prepared of them.

10. *Garuga pinnata* Roxb.

Tamil : Kare vemba ; Telugu : Garuga ; Kanarese : Hala.

It is a large tree found in Northern Circars, Deccan from Hyderabad to Mysore, Western Ghats in South Kanara, Malabar and Coimbatore.

The fruit is of the size of gooseberry. It is eaten raw or pickled.

The Margosa Family.

11. *Azadirachta indica* A. Juss. (*Melia Azadirachta* Linn.)

English: The Neem or Margosa tree ; Tamil : Veppam ; Telugu : Veppa ; Kanarese : Bevina-mara ; Malayalam : Veppu.

It is a large tree found in the dry forests of Deccan and Carnatic.

The pulp of the fruit is eaten.

The Spindle Tree Family.

12. *Salacia reticulata* Wt.

Malayalam : Korandi pazham.

It is a large climbing shrub found in the West Coast at Quilon, Kottayam and other places in Travancore. The pulp of the large tubercled fruit is edible.

The Jujube Family.

13. *Zizyphus Jujuba* Lam.

Tamil: Yellande, Ilantha; Telugu: Rengha; Kanarese: Yelchi; Malayalam: Cherumali.

A medium sized thorny tree found in all the dry districts of the presidency. The cultivated forms yield larger and better fruits. The fruits are sold in bazaars.

14. *Zizyphus Oenoplia Mill.*

Tamil: Kottei ; Telugu: Paranu, Pariki ; Malayalam: Mulli.

It is a thorny, straggling shrub found in all districts in dry forests. The small black fruits are pleasant to eat.

The Soapnut Family.

15. *Schleichera trijuga* Willd.

Tamil : Puvan ; Telugu : Puska ; Kanarese : Chakota ; Malayalam : Puvam.

It is a large tree found in all forest districts. The aril of the seed is eaten.

16. *Nephelium Longana* Camb.

English : The Longan ; Tamil : Puvatti, Katta puvan ; Kanarese : Kanakindeli ; Malayalam : Pasakotta.

It is a large evergreen tree found in the Western Ghats from South Kanara and Mysore to Tinnevelly. The aril of the seed is edible.

The Mango Family.

17. *Spondias mangifera* Willd.

English : The Indian Hog-plum ; Tamil : Katmaa ; Telugu: Adavi mamadi ; Malayalam : Ambazham.

A fairly large tree found in deciduous forests in all districts up to about 2,000 feet. The fruits are eaten and are also pickled.

18. *Buchanania Lanzan* Spreng.

Tamil: Morala, Chara paruppu ; Telugu : Morli, Sara ; Kanarese : Nurkul ; Malayalam : Munga pera.

It is a medium sized tree found in deciduous forests in all districts. The kernel of the seed is a common substitute for almonds and it is sold in bazaars.

19. *Buchanania lonceolata* Wt.

Tamil. Miricuda ; Telugu. Pandijaruga ; Malayalam, Mala maavu.

A medium sized tree found in the evergreen forests of Travancore.

The kernel of the seed is eaten.

20. *Buchanania ngustifolia* Roxb.

Tamil. Mudamah, Kolamavu ; Telugu. Morli sara, Pedda morali.

It is a medium sized tree found in Deccan and Carnatic in dry forests from Hyderabad to Travancore.

The kernel of the seed, the best of three species, is eaten.

21. *Semecarpus Anacardium* Linn. f.

Tamil. Shenkottei ; Telugu. Jiri ; Kanarese. Gheru ; Malayalam : Thenkotta.

A moderate sized tree found in all the deciduous forests of the Presidency.

The fleshy cup (hypocarp) on which the nut rests is edible.

The kernels of the nuts are also eaten.

The Leguminosae Family.

22. *Pithecolobium dulce* Benth.

English : Manilla tamarind ; Tamil : Korkapuli; Telugu : Simachinta; Kanarese : Sime hunase.

A moderate sized tree grown in all dry plains districts as a hedge plant.

The whitish pulp enveloping the seed is eaten. It is sold in bazaars.

The Rose Family.

23. *Rubus niveus* Thunb.

A straggling shrub found in all the mountainous tracts above 4000 feet.

The fruits are somewhat dry but are very palatable. Large quantities of them are sold in the bazaars of all hill stations.

24. *Rubus ellipticus* Sm.

A large straggling shrub found in the hills of Northern Circars and Deccan above 4,000 feet and of the Western Ghats usually above 6,000 feet.

The yellow fruits have the flavour of raspberry. It is either eaten raw or made into preserves. It is sold in bazaars in all hill stations. It is one of the best wild fruits of India.

25. *Rubus rugosus* Sm. var. *Thwaitesii* Focke.

A large scrambling shrub found in the Nilgiris and other hill stations above 5,000 feet.

The red fruits are edible and are also used in jam making.

The Strawberry Family.

26. *Fragaria milgherrensis* Schl.

A stout creeping wild strawberry found in the Western Ghats, Nilgiris; and Pulney Hills above 6,000 feet.

The fruits are pleasant to eat.

The Myrobalan Family.

27. *Terminalia Catappa* Linn.

English : The Indian Almond ; Tamil : Nat Badam ; Telugu : Bedam ; Malayalam : Adamaram.

A moderate sized deciduous and handsome tree grown in gardens and avenues.

The pulp of the fruit is eaten. The nut kernels with thin spirally folded cotyledons are eaten.

The Guava Family.

28. *Rhodomyrtus tomentosa* W.

English : Hill Gooseberry ; Tamil : Kattu Koyya ; Kanarese : Tavuti ; Malayalam : Koratta.

A thickly tomentose shrub found in the Nilgiri and Pulney Hills above 5,000 feet.

The fruits are pleasant to eat. They are sold in bazaars in the hill stations.

The Rose Apple Family.

29. *Syzygium zeylanicum* DC.

Tamil : Marungi ; Kanarese : Kunnerale ; Malayalam : Pula.

A small handsome tree found in the Western Ghats from South Kanara to Travancore.

The white fruits are edible.

30. *Syzygium Jambolanum* DC.

English : Black Plum ; Tamil : Naval ; Telugu : Neredu ; Kanarese : Nerale ; Malayalam : Naga.

A large evergreen tree found in all forest districts of the Presidency.

The purple fruits are eaten and are sold in bazaars. This fruit is not to be eaten extensively as it is apt to bring on fever.

The Bilberry Family.

31. *Memecylon edule* Roxb.

English : The Iron Wood tree ; Tamil : Kaya ; Telugu : Alli ; Kanarese : Alamaru ; Malayalam : Kalayam.

A large shrub found in the hilly tracts of Northern Circars, North Arcot, Cuddapah and other places.

The small black purple fruits are eaten.

The Oenothera Family.

32. *Trapa bispinosa* Roxb.

English : The Water-chestnut, the Singhara Nut ; Tamil : Singhara.

A floating plant found in wells, tanks and pools in many places of the Presidency.

The kernel of the fruit is eaten either raw or cooked.

The Gourd Family.

33. *Coccinia indica* W. & A. (*Cephalandra indica* Naud.)

Tamil : Kovai ; Telugu : Kaidonda.

A pretty climber found in most plains districts of the Presidency on hedges and bushes.

Both ripe and unripe fruits are eaten raw or cooked.

34. ***Momordica dioica*** Roxb.

Tamil : Palupaghel Telugu : Potukandulu ; Kanarese : Gid hagalu.

A perennial tuberous-rooted climber found in the plains districts of the Carnatic and West Coast up to 4,000 feet.

The tender fruits are made into curries and eaten.

35. ***Momordica tuberosa*** Cogn.

A trailing plant with tuberous rootstock found in Deccan and Carnatic, in Mysore, Bellary, Anantapur and down to Tinnevelly on black cotton soils.

The dark green and ribbed fruits are edible.

The Cactus Family.

36. ***Opuntia Dillenii*** Haw.

English : The Prickly Pear; Tamil : Seppathi kalli Telugu : Nagadali ; Kanarese : Cappatigalli ; Malayalam : Nagamullu.

A ramous spiny bush indigenous to Tropical America but naturalized in all the southern districts of the Presidency.

The red fruits are eaten by poor people.

The Heath Family.

Gaultheria fragrantissima Wall.

English : The Indian Winter Green.

A large shrub found in the Western Ghats, Nilgiris, Pulneys and hills of Travancore above 6,000 feet.

The fruits are edible.

The Sapodilla Family.

38. *Sideroxylon tomentosum* Roxb.

Tamil : Palai ; Kanarese : Hudugolla. A thorny tree found in Northern Circars, hills of South Kanara to Coimbatore in dry forests. The fruits are used in curries and are also pickled.

39. *Bassia latifolia* Roxb.

English : The Mahua tree ; Tamil : Iluppai ; Telugu : Ippa : Kanarese : Ippi.

A large deciduous tree found in Northern Circars, Deccan, in the Nallamalai hills and south to North Arcot, Salem and Coimbatore.

The fruits and the succulent flowers (corollas) are eaten raw or cooked.

The Ebony Family.

40. ***Diospyros Melanoxylon*** Roxb.

English : Coromandel Ebony ; Tamil : Tumbi ; Telugu : Tumi, Tumki ; Kanarese : Balai.

It is a moderate sized deciduous tree found in Northern Circars, Deccan and Carnatic.

The fruits are eaten.

41. *Diospyros tomentosa* Roxb.

Tamil : Tumbi ; Telugu : Chitta tumiki ; Kanarese : Kaulay.

A large tree found in Northern Circars down to the Godaveri in deciduous forests.

The fruit is edible.

The Mustard Tree Family.

42. *Azima tetracantha* Lam.

Tamil : Chengam chedi ; Telugu : Thella-upi ; Kanarese : Bilivuppi ; Malayalam : Sankunkuppi.

It is a straggling thorny shrub found in the Circars, Deccan and Carnatic.

The white berries are eaten.

The Bengal Current Family.

43. *Carissa spinarum* Linn.

Tamil : Chiru Kila ; Telugu : Wakoilu.

A thorny shrub with zig-zag branches found in Northern Circars and Carnatic down to Travancore in dry scrub forests.

The small dark-purple fruits are eaten and are sometimes sold in bazaars.

44. *Carissa Carandas* Linn.

Tamil : Kalaka ; Telugu : Kalivi ; Kanarese : Karekai.

A large thorny shrub found in Northern Circars, Deccan and Carnatic in dry forests ; often cultivated.

The purple fruits are eaten and the green ones are made into pickles.

45. *Carissa paucinervia* A. DC.

Malayalam : Kari-mulli.

A diffuse spiny shrub found in Deccan, hills of Mysore, Salem and Coimbatore ; Western Ghats, Nilgiri hills, etc. Dark purple fruits are eaten.

The Poison Nut Family.

46. *Strychnos potatorum* Linn. f.

English : The Clearing Nut ; Tamil : Tetthan Kottai ; Telugu : Chilla ; Kanarese : Chilu.

A medium sized tree found in Northern Circars, Deccan and Carnatic to Travancore, in deciduous forests.

The black pulp of the fruit is eaten. Young fruits are made into preserve.

The Sebesten Family.

47. *Cordia obliqua* Willd.

Tamil : Vidi, Shiru Naruvilli ; Telugu : Iriki, Nakkeri ; Kanarese : Challe ; Malayalam : Virusham.

A moderate sized deciduous tree found in all forest districts.

The mucilaginous ripe fruits are eaten.

48. *Cordia Wallichii* G. Don.

Same local names as for No. 47.

A moderate sized tree found in Deccan and Western Ghats in deciduous forests.

The mucilaginous ripe fruits are eaten.

The Night shade Family.

49. *Solanum nigrum* Linn.

English: Garden night-shade; Tamil: Mana-thakkali; Telugu: Kamanchi chettu, Kanchi chettu; Malayalam: Mulaku-thakkali.

An erect annual herb found in all districts.

The sun dried unripe berries are eaten as curries and are considered very cooling.

50. *Solanum pubescens* Willd.

Tamil: Sundakkai; Telugu: Kasivuste; Kanarese: Sonde; Malayalam: Cheria Chunda, Chundanga.

A large shrub found in Deccan and Carnatic to the east slopes of the Western Ghats in open scrub forests.

The sundried unripe fruits are eaten as curries.

51. *Solanum indicum* Linn.

English: Indian night-shade; Tamil: Siru Sundai; Telugu: Thella Molakai; Malayalam. Puththeri Chunda.

A branched prickly undershrub found in all districts in the plains and lower hills.

The fruits are used as vegetable.

The Oleaster Family.

52. *Elaeagnus conferta* Roxb.

Tamil: Kolungai; Kanarese: Hittele, Hulige; Malayalam: Kayalam-puvalli.

A large often thorny straggling shrub found in Northern Circars, West Coast and Western Ghats at low levels.

The red fruits are edible and are sold in bazaars.

53. *Elaeagnus Kologa* Schlecht.

Local names are same as for No. 52. A large sometimes thorny climbing shrub found in the margins of shola forests in Western Ghats Nilgiris and Pulneys. The orange red fruits are edible and are sold in bazaars in the hill stations.

The Gooseberry Family.

54. *Emblica officinalis* Gaertn. (*Phyllanthus emblica* Linn).

English: The Emblic Myrobalan; Tamil: Nelli; Telugu: Usiriki; Kanarese: Nelli; Malayalam: Nelli.

A moderate sized deciduous tree found in Northern Circars, Deccan and Carnatic and also in Western Ghats. The unripe fruits are used for pickles and are sold in bazaars.

55. ***Emblica Fischeri*** Gamble.

Local names, distribution, etc., same as for No. 54. The unripe fruits are used for pickles.

The Kokra Laurel Family.

56. *Aporosa Lindleyana* Baill.

Tamil : Vittil ; Kanarese : Sulla, Sali : Malayalam : Vetti.

A medium sized evergreen tree found in the Western Ghats from South Kanara and Mysore to Anamalais and Travancore in evergreen forests. The ripe fruits are edible.

The Chinese Laurel Family.

57. *Antidesma Menasu* Miq.

Tamil: Nirilai; Telugu: Nakkagadamu; Malayalam : Putharaval.

A small tree found in the Western Ghats, hills of North Coimbatore, Shevaroy Hills of Salem, etc., in evergreen forests.

The small red fruits are edible.

88. ***Antidesma diandrum*** Roth.

Tamil : Acarippuli ; Telugu : Pellagumudu ; Kanarese : Sannaguige.

A small deciduous tree found in Northern Circars, Deccan and Carnatic and at low levels to Travancore.

The purplish-red small fruits are edible.

59. *Antidesma Ghaesembilla* Gaertn.

Telugu ; Polari, Pulsur ; Kanarese : Pulimpurase ; Malayalam : Ceriyannatim.

A small deciduous tree found in Northern Circars, Deccan and Carnatic at low elevations.

The red purple fruits are edible.

The Spurge Family.

60. *Baccaurea courtallensis* M. Arg.

Tamil : Puvai ; Kanarese : Kolikuki ; Malayalam : Mutta Thuri.

An evergreen tree found in the Western Ghats from South Kanara to Travancore. The crimson fruits about 1″ in diameter are edible.

61. ***Aleurites moluccana*** Willd.

English : The Candle Nut ; Tamil : Nattu-akrottu-kottai ; Telugu : Nattu-akrottu-vittu ; Kanarese : Natakrodu ; Malayalam : Akrottu.

A hand-some tree found in the Western Ghats in the Wynaad. The kernels are edible and taste like walnut.

The Big Family.

62. *Ficus glomerata* Roxb.

Tamil : Telugu : Kanarese and Malayalam : Atti.

A large deciduous tree found in all districts in evergreen forests. The ripe fruits are edible.

The Jak Family.

63. *Artocarpus hirsuta* Lam.

Tamil : Ayani Pila ; Kanarese : Halasu ; Malayalam : Anhili Pilavu, A very large evergreen tree found in evergreen forests of the West Coast, Coorg, Mysore, Wynaad and Anamalais to Travancore. The fruit resembles a miniature jak fruit and the fleshy perianth is eaten and is very delicious.

64. *Artocarpus Lakoocha* Roxb.

Tamil : Colaippakku ; Telugu : Nakkarenu ; Kanarese : Lakuca ; Malayalam : Lakucam.

A large deciduous tree found in the hill forests of Coorg, Mysore, West Coast, Ganjam, Vizagapatam, etc.

The fruits are edible.

The Date Palm Family.

65 *Phoenix sylvestris* Roxb.

English : The Wild Date Palm ; Tamil : Icham ; Telugu : Pedda-ita ; Kanarese : Ichal.

A large palm attaining a height of 30 to 40 feet found in all dry districts of the Presidency.

The ripe fruits are edible.

66. *Phoenix farinifera* Roxb.

Tamil : Ithi ; Telugu : Chitti-sita, Chiruta-ita ; Kanarese : Ichal.

A small tree growing to about 2' in height found especially in coastal regions of the Presidency.

The ripe fruits are sweet and are eaten.

67. *Phoenix humilis* Royle., var. *pedunculata* Becc.

Tamil : Malai Icham ; Telugu : Konda-ita ;

Stems 1 to 2 feet in height. Found in all the hilly districts.

The ripe fruits are sweet and are edible.

The Palmyra Family.

68. *Borassus flabellifer* Linn.

English : The Palmyra Palm ; Tamil : Panei ; Telugu : Tatti ; Kanarese : Tali ; Malayalam : Karum-pana.

A tall palm attaining a height of 50 to 60 feet found in most districts.

The ripe fruits are eaten by poor. The kernel of the young nut is much relished and is sold in bazaars.

The alphabetical list of common and local names of the edible fruits found wild in this Presidency.

Acarippuli (Tam.) 58
Adamaram (Mal.) 27
Adavi mamadi (Tel.) 17
Adivi-gerenta (Tel.) 6
Akrottu (Mal.) 61
Alamaru (Kan.) 31
Alli (Tel.) 31
Ambazham (Mal.) 17
Anavaya (Mal.) 4
Anhili pilavu (Mal.) 63
Atti (Tam., Tel., Kan., Mal) 62
Ayani pila (Tam.) 63
Bael tree (Eng.) 9
Balai (Kan.) 40
Bedam (Tel.) 27
Belathannu (Kan.) 8
Bevina-mara (Kan.) 11
Bigada (Kan.) 5
Bilivuppi (Kan.) 42
Black plum (Eng.) 30
Candle nut (Eng.) 61
Cappatigalli (Kan.) 36
Ceriyannatim (Mal.) 59
Chakota (Kan.) 15
Chalian pazham (Mal.) 1
Challe (Kan.) 47, 48
Chara paruppu (Tam.) 18
Chempulichi (Tam.) 6
Chengam chedi (Tam.) 42
Cheria chunda (Mal) 50
Cherumali (Mal.) 13.
Chilla (Tel.) 46
Chilu (Kan.) 46
Chiru kila (Tam.) 43
Chiruta-ita (Tel.) 66
Chitta tumiki (Tel.) 41
Chitti-sita (Tel.) 66
Chundanga (Mal.) 50
Clearing nut (Eng.) 46
Colaippakku (Tam.) 64
Coromandel ebony (Eng.) 40
Devadara (Tam.) 6
Devagarige (Kan.) 4
Devadaru (Kan.) 6
Elephant apple (Eng.) 8
Emblic myrobalan (Eng.) 54
Garden night-shade (Eng.) 49
Garuga (Tel.) 10
Gheru (Kan.) 21
Gid hagalu (Kan.) 34
Hala (Kan.) 10
Halasu (Kan.) 63
Hanusampage (Kan.) 1
Hill gooseberry (Eng.) 28
Hittele (Kan.) 52, 53
Hudugolla (Kan.) 38
Hulige (Kan.) 52, 53
Ichal (Kan.) 65, 66
Icham (Tam.) 65
Ilantha (Tam.) 13
Iluppai (Tam.) 39
Indian almond (Eng.) 27
Indian hog-plum (Eng.) 17
Indian night-shade (Eng.) 51
Indian winter green (Eng.) 37
Ippa (Tel.) 39
Ippi (Kan.) 39
Iriki (Tel.) 47, 48
Iron wood Tree (Eng.) 31
Ithi (Tam.) 66
Iwara mamidi (Tel.) 4
Jiri (Tel.) 21
Kaidonda (Tel.) 33
Kalaaka (Tam.) 44
Kalayam (Mal.) 31
Kalivi (Tel.) 44
Kamanchi chettu (Tel.) 49
Kanakindeli (Kan.) 16
Kanchi chettu (Tel.) 49
Kare vemba (Tam.) 10
Karekai (Kan.) 44
Kari-mulli (Mal.) 45
Karum-pana (Mal.) 68
Kasivuste (Tel.) 50
Katmaa (Tam.) 17
Katta puvan (Tam.) 16
Kattukkariveppilai (Tam.) 7
Kattu koyya (Tam.) 28
Kaulay (Kan.) 41
Kaya (Tam.) 31
Kayalampuvalli (Mal.) 52, 53
Kodapuli (Mal.) 3
Kolamavu (Tam.) 20
Kolikuki (Kan.) 60
Kolungai (Tam) 52, 53
Konda-ita (Tel.) 67
Koovalam (Mal.) 9
Korandi pazham (Mal.) 12
Koratta (Mal.) 28
Korkapuli (Tam.) 22
Kottei (Tam.) 14
Kovai (Tam.) 33
Kunnerale (Kan.) 29
Kurakatu (Mal.) 7

ABSTRACTS

The Genetics and Chemistry of Flower Colour Variation. W. J. C. Lawrence and J. R. Price. (Biological Reviews) Vol. 15 (1940) No 1.

Colour is one of the characters of plants and animals most frequently used in genetical investigations. Separation of colour types by visual comparisons alone is inadequate and sometimes misleading as they represent only a first analysis. For a further understanding of the developmental processes involved a knowledge of the chemical structure and properties of the pigments responsible is needed. It is in the flower pigments that gene action can also be examined in its fundamental sense, namely as governing simple chemical changes: oxidation, reduction, methylation and glycoside formation.

The great majority of flower pigments belong to three main classes, the anthocyanins and the anthoxanthins, both of which are sap-soluble, and the carotinoids, which are generally found in the plastids and are not sap soluble. Most of the anthocyanins are derived from three hydroxy-flavylium salts viz., pelargonidin, cyanidin and delphinidin These substances are the colour producing part of the anthocyanin molecule. They occur in combination with one or two molecules of a sugar, this compound being an anthocyanin. In themselves they differ only in the number of hydroxyl groups in the 2 phenyl nucleus cyanidin for example has one more hydroxyl group in the molecule than pelargonidin and delphinidin two more This is one of the principal factors upon which variation in flower colour depends, as an increase in the number of oxygen atoms causes a marked increase in blueness of tone. The scarlet pelargonium, deep red rose and purple delphinium are good examples of colours due to pelargoridin, cyanidin and delphinidin derivatives respectively. There are two other factors viz. methylation of hydroxyl groups and the position of attachment of sugar molecules which influence the colour of anthocyanins and the combinations of the three factors give rise to 12 anthocyanins each slightly different in colour, but together covering a wide range from scarlet to purple. These variations are due to differences which are internal. Conditions external to the molecule may also affect the colour of anthocyanins such as copigmentation or the pH of the cell sap. The anthoxanthins are glucosides which range in colour from ivory to yellow. There are four ways in which they may be concerned in flower colour: (a) in flowers which have no anthocyanin they may be directly responsible for some or all of the colour (b) when a yellow anthoxanthin occurs together with an anthocyanin, the resultant colour is a blend of the two (c) in the presence of anthocyanins, ivory anthoxanthins do not contribute independently to the colour, but they may do so indirectly by their "copigmenting" action. Copigments are substances which when present in the same solution as an anthocyanin form weak additive complexes that are much bluer than the anthocyanin alone (d) the presence of much anthoxanthin may lead to almost complete suppression of anthocyanin (these two classes of substances are formed from the same starting materials limited in quantity). The carotinoids comprise a number of yellow or orange substances, xanthophylls and carotins. In the absence of anthocyanins they are either solely responsible for flower colour, or are supplemented by yellow anthoxanthins. In the presence of anthocyanins the colour is a blend of the two.

Pigment production is genetically controlled and in a number of cases complementary genes are involved. Variation in the amount of any pigment is also gene controlled. Modifications of the chemical structure of anthocyanins. including the state of oxidation, glycosidal type and probably the degree of methylation are each determined by simple gene relationships. Heritable chemical differences result in the first place from gene action. They may be accentuated or minimised by gene interaction, which can modify dominance

relationships and is sometimes the cause of epistasy. Extensive literature has been cited on the subject. U. N. R.

Growth of lemon fruits in relation to moisture content of soil— Furr, J. R., and Taylor, C. A.—Tech. Bull. U. S. Dep. Agric. 610, 1938, pp. 71. bibl. 19; 15 cents;—

The investigations recorded were undertaken in California to determine the response of lemon trees to variations in soil moisture conditions within the root zone, in the proportion of soil wetted and in the length of time between irrigations. Changes in apparent growth rate of lemon fruits were found to serve as an excellent index of the relative water deficit of the tree, turgor deficit arising before the first visible sign of leaf wilting or any decrease in the transpiration rate occur. Root concentration and soil moisture extraction varied greatly in all orchards examined. The moisture content of regions of highest root concentration was reduced to wilting range (i. e. the period between the permanent wilt of basal leavas on well established sunflower plants to the complete wilt of all leaves) before a water deficit was evident from fruit measurements. Before the moisture content of all the soil of any easily delineated zone, such as the top foot, had reached wilting range, appreciable parts of the soil had remained in wilting range for long periods and high water deficits had developed in the trees. It was possible when first water deficit developed in the fruit to find soil moisture contents varying from within wilting range to near field capacity. These variations in the most uniform orchards were great enough to render averages of soil moisture percentages unreliable as a measure of the water supply of the trees. In field experiments, if only one half the surface area was maintained with soil moisture above the wilting range, the trees received an ample water supply. Variability in root concentration prevented the determination by ordinary methods of soil sampling of the actual proportion of soil in the root zone that was reduced into the wilting range without causing severe water deficit or reduction in the final size of the fruit. The rate of extraction of water from one part of the soil in the root zone was influenced by the moisture content of the soil in other parts of the root zone. If water was applied only when apparent growth of fruit was unaffected on heavy and medium soils but reduced on light soils. On plots of all three soil types water withheld until apparent growth of fruit ceased or leaves began to roll resulted in pronounced reduction of final fruit size, some loss of leaves and, on the light soil in injury to small twigs. Fruit measurements should be used not to predict when water should be applied, but to determine whether established practices are producing desired results. If fruit growth decreases materially before irrigation and increases sharply after irrigation, it is evident that there was an appreciable water deficit prior to irrigation and the measure of this deficit may be gauged from the magnitude in the difference in growth rate just before and just after irrigation. (*Horticultural Abstracts* 9 (1939) : 259)

Unique method of drainage devised by San Fernando grower, Anon. Calif. Citrogr., 1939, 24 : 120.

In an orchard in California which it was impossible to drain in the ordinary way without running the water on to an orchard on a lower level, a new method was devised. At the 5 lowest points pits 2 feet in diameter were drilled to sand 35 feet below. The holes so made were filled with cement pipes in 3 ft. lengths standing one on top of the other but not cemented together. To these holes the drains were led. Instead of using the customary perforated tile pipes, trenches 4 feet deep with a 3% fall were dug. In the bottom of each trench a small trench, in depth the width of a shovel or 8 inches square was made. The small trench was filled with stones up to 2 inches and were then filled in with soil. The trenches are connected with the drainage pits by 7 joints. The results are said to have restored the failing orchard to health.

(*Horticultural Abstracts* 9 (1939) : 260).

EXTRACTS

Note on a Method of Raising Seedlings for Arid Districts.

Trouble is often experienced in establishing seedling trees and shrubs in arid districts, owing to the low moisture content of the surface soil. In drought years the same difficulty is encountered in districts that normally have a good rainfall.

The method described aims at producing seedlings with longer root systems than are obtained with ordinary nursery practice. A long root system enables the seedling plant to be independent of moisture in the top six inches of soil, to draw on sub-soil moisture as soon as it is planted out. The procedure is as follows:— Bamboos with an internal diameter of not less than 2 in. are cut into sections 20 in. long one end being cut just below a node, which forms the bottom of th receptacle. A hole about ¾ in. diameter is made in the bottom of each section. The bamboos are then split in half longitudinally, and one half of each section is soaked in a 1½ per cent solution of sulphate of ammonia for several hours.

After soaking the halves are fitted together again and secured with wire of suitable gauge, at top and bottom.

Thus one half of each 'pot' has been treated with sulphate of ammonia, and the other half remains untreated.

Seed should be sown in boxes or nursery beds. When the seedlings are large enough to handle they are transplanted to the pots which have been filled previously with a good potting mixture.

The land where planting is to be done is prepared by digging a large hole for each tree, manuring and filling in the holes again.

Planting is carried out as follows:— A hole the length of the bamboo pot is made with a crowbar, the wires which hold the pot together are removed, and the halves of the pot are separated. The roots of the plant will be clinging to the half of the pot that has been treated with sulphate of ammonia; this is inserted in the hole with the plant, thus preventing any buckling of the roots, soil is then filled in and firmed down in the ordinary way.

(*The East African Agricultural Journal* Vol. 5, No. 5, p. 363).

Progress of the Agricultural Adjustment Act Programme in the U. S. A.

Six years have now passed since the Government began to balance supply with demand to raise prices of agricultural crops, to improve soil and to promote a sounder farm programme in the South. Before 1933 the farmers bought in a protected market and sold in an open market with no offsets. The A. A. A. began to offset this inequality in agriculture by the adoption of several methods. The results may be summarised as follows.

The average area under cotton during the four years prior to 1932—33 was 41·5 million acres. This has been cut by an average of 16·5 million acres a year in the past six years. The total cash income to the cotton growers from cotton, lint, seed and government payments in the three years before the A. A. A. and in the six years after the A. A. A. is given in the table.

Year.	Total value of lint and seed in million dollars.	Payment by Govt. in million dollars.	Grand total in million dollars.
1930—31	752		752
1931—32	526		526
1932—33	464		464
1933—34	678	180	858
1934—35	735	115	850
1935—36	695	160	855
1936—37	906	82	988
1937—38	913	65	978
1938—39	598	266	860

It will be plain that despite the smaller area, the total income was more. Besides, the acre yields in cotton have increased. From 1923—1932 the average cotton yield per acre was 169·9 lb. of lint, from 1928—1932 the yield was 173·9 lbs. The average for the last seven years 1933—1939 was 217 lb. During the same period the decrease in the cotton area was 38·7% but the cut in cotton lint production was only 11% due to the higher yield per unit area.

The extra land released from cotton was used for the production of food and feed. The area under cotton has gone up by a million acres, oats by three hundred and thirty seven thousand acres, wheat by two and three quarters of a million acres, all hay two and a quarter million acres, sweet sorghum by more than a million acres, sorghum by half a million, cowpeas by nearly a million, peanuts by three hundred thousand acres, truck crops by two hundred thousand acres, interplanted legumes nine million acres, and legume crops for soil improvement in million acres.

Something over 325 million feet of terraces have been built on eroded farms and thousands of acres of forest land have been replanted by farmers.

In other words the farmers are building up some assets that may be cashed in later on in the shape of better farms with better yields on account of their following the programme set out by the government during the last six years.

[Abstracted from the article "Farmers to ballot on quotas" by Stanley Andrews, *American Cotton Grower*, December 1939.]

Gleanings.

Cockroaches and their control: These household pests are nocturnal in habit, hiding in any dark crevices, corners or cupboards during the day, and coming out to feed at night. Kitchens are particularly favoured by the attention of these obnoxious insects, but by carefully locating any sheltering sites they are fairly easily treated.

The most satisfactory chemical for killing these insects is sodium fluoride, a white powder. Although poisonous to humans, if taken internally in sufficient quantity, provided reasonable care is taken in its use, the risk of contamination of foods is negligible.

The best method of reaching the cockroaches is to dust this powder into crevices by means of a small blow-gun or bellows, or scatter it on the floor and shelves of cupboards. The insects pick up the powder on the legs and antennae (feelers) and, in order to clean off the powder, drain these members between the mouth parts; by this means the poison passes to the stomach and kills the insects.

In dry situations, the powder remains more or less indefinitely, but where subject to moisture, it is liable to cake and become useless. In such cases, it may be advisable to blow the dust into the hiding places once a week at least.

Another matter that should receive careful attention is the masses of eggs. These are enclosed in a brown capsule, about half an inch long and rounded on the ends; the outer side is often covered with a white mealy-like powder. These are placed in cracks along wainscotting, crevices, behind doors etc. Wherever found, they should be destroyed, as each capsule contains a number of eggs.

As cockroaches breed in heaps of decaying leaves etc., care should be taken to turn over periodically any heaps of garden rubbish etc., in the vicinity of dwellings. (*The New Guinea Agricultural Gazette*, Vol. 5, No 3, p. 4).

Britain, the World's Pedigree Stock Farm. Being interested in the agricultural and stock position in war-time Britain and watching the trend of events on "the other side" one comes across some very interesting and unusual facts at times. Going through the list of different breeds of live-stock, one is amazed at the number—some of which we in Queensland rarely hear about. The British Isles have been termed the pedigree stock farm of the world; and rightly so, when one realises that it is the home of ninety-five distinct breeds of stock—to say nothing of the various crosses of these breeds.

The figures are:—Four distinct breeds of heavy draught horses; sixteen light horse breeds, fifteen beef and dual purpose cattle breeds, nine dairy cattle breeds, nine long-wooled sheep breeds, eleven downs and other sheep breeds; thirteen mountain sheep breeds, twelve breeds of pig; and six breeds of goats.

The remarkable thing is that each breed is flourishing and has a large following of "fanciers". (*Queensland Agricultural Journal*, Vol. LIII (1940); 422).

Cows with Head and Tail lights for War-time "Black-outs". The nightly 'black-out' in the Old Country is causing considerable anxiety to many stock-owners. This is how one English farmer solved his difficulty:

After several of his cows had wandered on to dark country roads at night and been killed by passing motor cars and trucks he thought out a plan for placing head and tail lights on his cattle. Tiny lamps powered by small dry cells were fixed to the horn and tails of the animals, making them visible to motorists coming from either direction along the roads bordering his farm.

(*Queensland Agricultural Journal*, Vol. LII, (1940): 422).

Crop and Trade Reports.

Cotton—1939-40—Fifth or final report. The average of the areas under cotton in the Madras Province during the five years ending 1937—38 has represented 9·9 per cent of the total area under cotton in India.

2. The area under cotton in the Madras Province in 1939-40 is estimated at 2,206,200 acres as against 1,957,600 acres for the corresponding period of last year and 2,102,900 acres according to the forecast report issued in February. The present estimate for the Province represents an increase of 13·1 per cent as compared with the finally recorded area of 1,970,224 acres in 1938—39. The final estimate of last year exceeded the actuals by 0·4 per cent.

3. The increase in area in the current year as compared with the area in 1938—39 occurs in all the important cotton growing districts of the Province outside East Godavari and Nellore and is attributed to favourable rains and good prices during the sowing season. The variations are marked in Coimbatore (plus 107,500 acres), Ramnad (plus 39,600 acres) and Madura (plus 27,500 acres). The area estimated in respect of the Nellore district is the lowest reported in recent years.

Picking of cotton is in progress and may be finished in about a month.

4. Normal yield is expected in the Circars (Guntur excepted), Bellary, Cuddapah, Chittoor, Salem, Tinnevelly (Tinnevellies cotton) and South Kanara. A yield below normal is expected in the other districts of the Province due mainly to drought. The estimated yield is very low in Coimbatore (32 per cent for Uppam cotton, 44 per cent for irrigated Karuganni and 47 per cent for Nadam cotton and 74 per cent for rainfed Cambodia) and Tinnevelly (51 per cent for irrigated Cambodia and 61 per cent for rainfed Cambodia).

The seasonal factor for the Province as a whole works out to 77 per cent of the average for irrigated cotton and 92 per cent for unirrigated cotton, the corresponding figures according to the Season and Crop Report of last year being 85 per cent and 92 per cent respectively. On this basis, the yield works out to 420,900 bales of 400 lb. lint as against 372,010 bales of last year which represents an increase of 13·1 per cent. The yield in an average year is estimated at 506,570 bales. It is, however, too early to estimate the yield with accuracy as much will depend on future weather conditions and their effect on the second crop and on the amount of damage done by insect pests.

5. The estimated area and yield under the several varieties are given below:

(Area in hundreds of acres i. e., 00 being omitted; Yield in hundreds of bales of 400 lb. lint, i. e., 00 being omitted).

Variety.	Area		Corresponding yield.	
	1939—40 Acs.	1938—39 Acs.	1939—40 Bales.	1938—39 Bales.
Irrigated Cambodia	178,5	152,0	88,3	82,0
Dry Cambodia	191,3	187,9	33,8	35,6
Total, Cambodia.	369,8	339,9	122,1	117,6
Uppam in the Central Districts	25,8	20,1	2,8	2,8
Nadam and Bourbon	25,1	3,3	6	2
Total, Salem.	50,9	23,4	3,4	3,0
Tinnevellies *	709,3	575,2	157,5	139,9
White and red Northerns	195,0	175,0	23,2	22,2
Westerns	766,0	715,0	94,8	85,6
Warrangal and Cocanadas	107.2	123,3	18,9	19,9
Chinnapatti (Short staple)	8,0	5,8	1,0	7
Province.	2,206,2	1,957,6	420,9	388,9

* Includes Karunganni cotton grown in the Coimbatore district and Uppam, Karunganni and mixed country cotton grown in the South.

6. The table below gives final information so far as it is available on the crop of 1937-38:—

(Figures in hundreds of bales of 300 lb. lint, i e. 400 being omitted).

Item.	Particulars.	South.		Deccan, Northerns & Westerns.	Rest of the Province, Cocanadas & others.	Total.
		Tinnevellies and	Cambodia.			
	1.	2.	3.	4.	5.	6
1.	Pressed at presses and loose cotton received at mills in 1939—40	1,274	1,460	1,846	383	4,963

2. Subtract crop of 1937—38 pressed at presses and loose cotton received at mills in 1939—40 i. e., stocks of loose cotton held by the trade, ginneries, presses and mills on 31st January 1939.	287	399	154	65	905
3. Add loose cotton of the crop of 1938—39 held by the trade, ginneries presses and mills on 31st January 1940.	118	137	22	40	317
4. Add estimate of extra factory consumption.	37	Nil	38	25	100
5. Total crop of 1938—39.	1,142	1,198	1,752	383	4,475
6. Yield as estimated in April 1939.	1,429	1,176	1,078	206	3,889
7. Yield as estimated in the Season and Crop Report of 1938—39.	1,257	993	1,287	183	3,720

Note:— (1) The year 1939–40 relates to the period February 1939 to January 1940, whon the crop of 1939–40 generally comes to the market. The early sown crop in the Deccan, however, generally comes into the market from December in each year. The figures are taken from the weekly returns furnished by mills and presses.

(2) Items 2, 3 and 4. The figures are approximate.

7. The average wholesale price of cotton lint per imperial maund of 82⅔ lbs. equivalent to 3,200 tolas as reported from important markets on 9th April 1940 was about Rs. 21—6—0 for Cocanadas, Rs. 19–12–0 for white Northerns, Rs. 21–6–0 for red Northerns, Rs. 22—12—0 for Westerns (Jowari crop), Rs. 18—13—0 for Westerns (Mungari crop), Rs. 32—6—6 for Coimbatore Cambodia, Rs. 27—11—0 for Southern Cambodia. Rs. 29—14—0 for Coimbatore Karunganni, Rs. 27—8—0 for Tinnevelly Karunganni, Rs. 26—3—0 for Tinnevellies and Rs. 25—3—0 for Nadam cotton. When compared with the prices published in the last report, i.e., those which prevailed on 5th February 1940, these prices reveal a fall of about 18 per cent in the case of Westerns (Mungari), 17 per cent in the case of white Northerns, 16 per cent in the case of red Northerns, 15 per cent in the case of Tinnevellies, 11 per cent in the case of Westerns (Jowari) and Southern Cambodia, 10 per cent in the case of Tinnevelly Karunganni and 6 % in the case of Coimbatore Karunganni. 5 per cent in the case of Coimbatore Cambodia and 3 per cent in the case of Cocanadas cotton and a rise of about two per cent in the case of Nadam cotton.

Crop—Groundnut—1940—First report. The area sown with summer or irrigated crop of groundnut during the three months January to March 1940, is estimated at 42,800 acres. When compared with the estimated area of 46,400 acres for the corresponding period of last year, there is a decrease of 7·8 per cent.

2. Figures by districts are given below:—

District.	Estimate of area sown with irrigated groundnut from January to March.		Increase (+) or decrease (−) of the area in column (2) as compared with the area in column (3).
	1940	1939	
(1)	(2)	(3)	(4)
	Acres	Acres	Acres
Anantapur	200	300	− 100
Cuddapah	2,000	2,000	Nil.
Nellore	100	100	Nil.
Chingleput	6,000	6,000	Nil.
South Arcot	20,000	20,000	Nil.
Chittoor	5,000	5,000	Nil.
North Arcot	1,500	2,000	− 500
Trichinopoly	1,000	2,000	− 1,000
Tanjore	3,000	3,000	Nil.
Madura	3,000	5,000	− 2,000
Ramnad	1,000	1,000	Nil.
Total.	42,800	46,400	− 3,600

3. The wholesale price of groundnut (shelled) per Imperial maund of 82⅔ lb (equivalent to 3,200 tolas) as reported from important market centres on 9th April 1940 was Rs. 5—8—0 in Cuddalore, Rs. 5—2—0 in Guntur, Rs. 5—1—0 in Vizagapatam, Rs. 4—12—0 in Vizianagaram, Rs. 4—11—0 in Vellore, Rs. 4—10—0 in Tadpatri, Rs. 4—9—0 in Anantapur, Rs. 4—8—0 in Cuddapah, Rs. 4—7—0 in Nandyal, Rs. 4—5—0 in Adoni and Hindupur and Rs. 4—4—0 in Bellary. When compared with the prices on or about the same date last year, these prices reveal a rise of approximately 42 per cent in Tadpatri, 38 per cent in Adoni and Hindupur, 37 per cent in Nandyal, 34 per cent in Vellore, 33 per cent in Bellary and Cuddapah, 32 per cent in Guntur, 31 per cent in Cuddalore, 29 per cent in Vizagapatam, 23 per cent in Vizianagaram and 16 per cent in Anantapur.

Gingelly—1939-1940—Fourth or final report. The average of the areas under gingelly in the Madras Province during the five years ending 1937—1938 has represented 15·6 per cent of the total area under gingelly in India.

2. The area sown with gingelly in 1939-1940 is estimated at 803,900 acres. When compared with the area of 821,000 acres estimated for the corresponding period of last year, it reveals a decrease of about 2·1 per cent. The present estimate also reveals a decrease of about 8·3 per cent as compared with the finally recorded area of 876,397 acres last year. The area in an average year is estimated at 764,060 acres.

3. 202,000 acres have been reported as sown since the previous forecast report was issued in January as against 245,700 acres during the same period last year. These late sowings were mainly on wet lands in Vizagapatam, East Godavari, West Godavari, Cuddapah, Nellore, South Arcot, Trichinopoly and the south where gingelly was raised as a second crop after paddy.

4. As compared with the actual area sown last year, there has been a decrease in area in the Circars, the Deccan (Anantapur excepted) Nellore, South Arcot, Chittoor, Trichinopoly, the South and Malabar partly counterbalanced by an increase in area in the other districts of the Province. The variations are marked in North Arcot (+25,100 acres,) Salem, (+49,100 acres) and

Tinnevelly (-71,700 acres.) The areas reported for Anantapur, North Arcot, Salem and Coimbatore are the highest on record while the areas reported for Tanjore and Tinnevelly are the lowest on record.

5. The yield is estimated to be normal in Cuddapah, Salem and South Kanara and below normal in the other districts due mainly to drought, especially in South Arcot (60 per cent) and North Arcot (71 per cent). The condition of the late sown crop is not satisfactory except in the Circars and Cuddapah.

The seasonal factor for the Province as a whole works out to 84 per cent of the average as against 79 per cent according to the Season and Crop Report of last year. On this basis the total yield works out to 90,100 tons. This represents a decrease of 3·9 per cent when compared with the estimate of 93,760 tons in the Season and Crop Report of last year. The yield in an average year is estimated at 104,020 tons.

6. The wholesale price of gingelly per imperial maund of 82⅔ lb. (equivalent to 3,200 tolas) as reported from important markets on 9th April 1940 was Rs. 8 in Cocanada, Rs. 7—14—0 in Trichinopoly, Rs. 7—12—0 in Tinnevelly, Rs. 7-7-0 in Tuticorin Rs. 7—1—0 in Salem, Rs, 6—11—0 in Ellore and Cuddalore, Rs. 6—8—0 in Vizagapatam and Vizianagaram and Rs. 6—5—0 in Rajahmundry. When compared with the prices published in the last report, i. e., those which prevailed on 5th February 1940, these prices reveal a rise of approximately 20 per cent in Trichinopoly and Tuticorin, 13 per cent in Cuddalore and Tinnevelly, 11 per cent in Salem, 10 per cent in Ellore, 7 per cent in Cocanada and 6 per cent in Rajahmundry and a fall of approximately 7 per cent in Vizagapatam, the price remaining stationary in Vizianagaram. *(From Director of Industries, Madras.)*

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February to 3rd May 1940 amounted to 165,103 bales of 400 lb. lint as against an estimate of 366,800 bales of the total crop of 1939—40 The receipts in the corresponding period of the previous year were 157,627 bales. 162,308 bales mainly of pressed cotton were received at spinning mills and 8,483 bales were exported by sea while 49,259 bales were imported by sea mainly from Karachi.

(From Director of Agriculture, Madras),

Mofussil News and Notes.

Besthvaripet, Cambum Taluk (Cuddalore) Exhibition. An Agricultural exhibition was held on 29th and 30th April at Dasthavaripet during the refresher course of Elementary School teachers. The working of bund-former, H. H. Guntaka, buckscraper and mouldboard ploughs was demonstrated. The local demonstrator exhorted the teachers to play their part in improvement of agriculture, and the ryots of the locality to rationalise agriculture. N. A.

Kollegal-Cattle fair at Madeswaran hills. The annual cattle fair at Madeswaran hills was held during Mahasivaratri festival from 9th to 11 March. The animals gathered this year were slightly below the usual standard exhibited in this breeding tract. One notable feature was a fairly large sale of drycows for agricultural work. These cost Rs. 40 to Rs. 50 per pair, while good working bullocks cost from Rs. 80 to Rs. 100 per pair.

An agricultural exhibition was held which attracted from four to five thousand visitors from the rural areas. They were all impressed by the exhibits which included improved implements, improved strains of sugarcane (Co. 417 and 419) and cereals and improved models of cattle sheds. A similar exhibition held at Budivalu village from 23rd to 25th March was also a success. A special feature in this village was the fitting up of Kirloskar handpump for a well dug

with the aid of the Rural Development fund which has proved a blessing to the village. U. L. S.

Pattukotai-Exhibition. An enhibition of livestock was conducted on 7—4—40 during the S. P. C. A. annual show when large number of cattle and poultry were exhibited. There were about 1000 ryots present and the best cattle, sheep, goat, dogs, geese and high laying breeds of poultry were given prizes by the Association. Sri V. Nadimuthu Pillai the Local M. L. A., and the Revenue Divisional Officer were among those present on the occasion. The local Assistant Agricultural Demonstrator arranged an agricultural exhibition. The use of various improved agricultural implements were demonstrated and the advantages of using pure departmental strains of paddy, groundnut, ragi, green manure seeds, etc , were explained to the ryots with the aid of attractive charts. Agricultural leaflets were also distributed to the ryots present.

Again from 11—4--40 to 15—4 · 40 a small exhibition was conducted by the local Asst. Agricultural Demonstrator during the Annual Nadiamman Festival at Pattukottai which also proved a great success, Large number of ryots both from the C M. P. area and the delta of Tanjore and other districts gathered at the exhibition pandal. The exhibits were explained to them and leaflets in Tamil and English were distributed to ryots. A. G.

Samalkota : *Conference of Agricultural Officers.* The Agricultural Demonstrators of the East and West Godavary districts assembled at the Agricultural Research Station, Samalkota and discussed along with the Farm Staff and the Plant Pathology Assistant, as many as fifty subjects at a conference held from the 8th to 12th inst , under the guidance of Sri N. V. Raghava Rao, Assistant of Agriculture, Rajahmundry and Sri Y. G. Krishna Rao, Deputy Director of Agriculture, I Circle, Cocanada. It may be recalled that a previous conference of the kind, for these Godavary districts, was held in 1930. The conference was very useful for an exchange of ideas amongst the staff, on administrative and technical matters and on local agricultural problems. The farm staff successfully staged an interesting Drama entitled "Krishivala Vijayamu" written by Sri M. Suryanarayana, incorporating in its setting, the latest items of local agricultural improvements.

A paper on "Sugarcane-Retrospect and prospect" was read by Sri G. Satyanarayana member of the farm staff and was discussed.

Sri. U. Tirumal Rao, the plant pathologist of the Division arranged a display of the various bee-keeping appliances and held practical demonstrations, covering a whole day, on bee-keeping and on the methods to be adopted in handling colonies of bees. The Farm Manager, Sri. T. Ragabrahma Rao, got up an exhibition of poultry and farm products and research work on sunnhemp that is being done under I. C. A. R. subsidy.

A day was utilised in field demonstrations and the tackling of farm machinery and equipment, for labour saving purposes. M. S.

Tiruvadi-Exhibition. A large scale Agricultural Exhibition was held in the Central High School premises at Tiruvadi, between 23rd and 26th April 1940 during Sapthasthanam festival. The Tanjore District Board, the Co-operative Milk Supply Union, Tanjore and the South Indian Nursery, Kumbakonam were prominent among others who co-operated. There was a large crowd of visitors, estimated at ten thousand. Radio equipment and electric illumination provided an additional attraction. A. G.

Vuyyur-Agricultural and Industrial Exhibition. An exhibition was held from the 9th to 12th April in the premises of the Sugar factory with the kind co-operation of the factory management. The exhibition was opened by the Collector

and was presided over by the Director of Agriculture. Among the various exhibits of agricultural interest were early, medium and late duration sugarcane varieties breed at Coimbatore, high yielding strains in paddy, millets, oil-seeds, cotton, chilli gogu and Virginia tobacco, exhibits for the occasion. Improved implements for tillage and interculture and appliances for disease-control were shown. Attractive posters were a feature. Economical methods of planting manuring, earthing up and wrapping sugarcane, proper methods of irrigating orange gardens, the use of turmeric polisher, grading of eggs, potatoes and rice, seed treatment with fungicides and the use of sprayers and dusting appliances against pests and diseases were demonstrated. Cottage industries were re-presented by Poultry, bee colonies, canned fruit products and preserved fruit juices, leather, woollen and cotton goods of local manufacture, wooden toys, malts and tobacco seed oil and its products. The last item attracted unusual attention. Special lectures were delivered on agricultural subjects and deserving exhibitors were awarded merit certificates. I. S. R.

College and Estate News.

Season. Fairly heavy and continuous showers were received since the 22nd April and till now more than 12 inches of rain have been recorded. They have been useful to the standing crops such as chitrai cholam and sugarcane. As a result of the rains, Coimbatore has the good fortune of having a cool and pleasant weather.

B. Sc. Agricultural Results:— The results of the B. Sc. Agricultural degree examination are published elsewhere in this number.

Visitors:— Sri G Seshadri, Honorary visitor, and Secretary of the Agricultural Co-operative society, Negapatam visited the college and Research Institute on 22nd April.

Mr. J. P. Navarrette, Agricultural Officer, Mexico, who is on a world tour to study sugarcane and cereals stayed on the estate from 24th to 27th April. He acquainted himself in detail with the research work carried on in the different sections. He also gave an interesting lecture in ihe Freeman hall on the agricultural condition in Mexico and stated that agriculture was being gradually socialized in his country.

A batch of students undergoing Health officers' training led by Dr. R. M Mathew, Professor of Hygiene, Madras Medical College, visited the estate and made particular study of the clean handling of milk and making of butter in the Dairy, preparation of cholam malt, compost making and the working of the activated sludge.

Entomological Society of India (South Indian Branch). A meeting was held on 20th May. Sri. M. C. Cherian was re-elected as President for the year 1940. A short note on *Selepa docilis* a minor pest of brinjals and its parasite *Eupectrus euplexiae* was presented by Sri. M. C. Cherian and Sri. B. Rangiah Pillai. Interesting entomological specimens were also exhibited.

The Fieldmens' Association. On the eve of his retirement, the resident members of the association entertained Mr. S. Gnanaprakasam Pillai, Fieldman of the Paddy Specialists' and the first President of the association, at a dinner on the 12th May.

Correspondence.

To

The Editor, The Madras Agricultural Journal.

Sir,

I shall be very thankful to you if you can enlighten me on the following.

Striga lutea is perhaps one of the commonest and most dangerous weeds on cholam crop. To my knowledge there are only three species of striga namely *striga densiflora*, *striga lutea* and *striga euphrasiodes* which can be distinguished from one another by the colour of corolla and by the number of calyx lobes.

1. Are there any more species of striga affecting economic crops?

2. In circars and Tamil districts, does striga affect sugarcane seriously?

3. What other economic crops besides cholam and sugarcane have been found to be affected by this weed?

4. What other control measures have been devised besides uprooting and destroying the weed? Are there any experiments conducted for the eradication of this weed? If so, on what lines are they being conducted? Which line of these experiments is most promising for further work?

5. Which varieties of cane have been found to be most susceptiable and which are resistant? Are any trials being made to evolve a striga-resistant variety?

6. Is it a common phenomenon that striga is serious only in heavy and medium black cotton soils and not in light loamy and red soils and much less in sandy soils? If so, what may be the reasons for such a phenomenon?

Any literature in connection with this subject may be cited.

Thanking you,
Yours &c.,
K. S. Sastry.

Yedpalli,
April 23, 1940.

REPLY

The Editor, The Madras Agricultural Journal.

Sir,

Query. 1. In the Flora of Madras (Gamble 1924) five species of Striga are described, the distinguishing characters being mainly number of ribs on the calyx and the colour of the corolla. Two of the species, *S. lutea*, Lour. and *S. euphrasiodes*, Benth. are stated as parasitic on cereals and sugarcane; and *S. orobanchoides*, Benth. as a parasite on various plants chiefly, *Lepidagathis* in *Acanthaceae*, *Euphorbia antiquorum* and *Dysophylla*. It is also reported as a parasite on tobacco and legumes. A fourth species, *S. densiflora*, Benth. is described as 'not recorded as a parasite' by Gamble. But Luthra (1921) has observed it as a pest of sugarcane in the Punjab; and in the Annual Report of the Economic Botanist of the Department of Agriculture, Bombay Presidency, for 1937—38, it is recorded as a parasite on *Jowar*. About the fifth species, *S. Masuria*, Benth, no mention is made in the Flora regarding its parasitic qualities.

In the Flora of Tropical Africa, 24 species of Striga are described of which only five are mentioned as parasitic. These are.

1. *S. orobanchoides*, Benth. Parasitic on Indigofera and other legumes, Ipomoea, Euphorbia etc
2. *S. Rowlandii*, Engl. Parasitic on grasses.

3. S. *Barteri*, Engl do.
4. S. *hermonthica* Benth. Parasitic on Sorghum, Zea, etc.
5. S. *lutea*, Lour. A parasitic herb.

S. orobanchoides, Benth. has been recorded as a parasite on tobacco in Rhodesia.

Query 3. Among the major S. Indian crops, rice, ragi and maize are also observed to be attacked by Striga. Saunders (1933) quotes all the millets including Cumbu and Korra as hosts of *S. lutea*.

Query 4. *Control measures.* In the case of cereals the best method for S. Indian conditions seems to be to systematically and regularly uproot the plants as they appear without allowing them to flower and fruit, and if this is repeated for 3 or 4 seasons it can be finally eradicated. Though the cost of uprooting in a severely infested field may be high in the first year, in subsequent seasons it will be less, so that on the whole the average expenditure on this work will not be uneconomic compared to the loss caused by its attack.

In S. Africa, what is described as a' 'trap crop' of a short duration susceptible cereal, like early sorghum or Sudan grass is raised, and this is ploughed in and a maize crop is grown after that in the same year. This is reported to be effective in decreasing striga incidence in the succeeding maize crop; and when repeated for a number of years, the trap crop with the striga being ploughed in before the latter develops fruits, the incidence of the parasite is gradually reduced. In Rhodesia, Irungu cholam of Tinnevelly district in S. India has been reported 'as an excellent host of the parasite, *Striga lutea*, and is expected to prove very suitable as a trap crop for controlling the latter'. But many Rhodesian farmers seem to prefer hand cultivation or pulling out to trap-cropping.

The best solution for preventing striga attack is the evolution of varieties resistant to its attack. In sorghum, selections of Kafir resistant to striga attack have been evolved in S. Africa. Among the African collections grown at the Millets Breeding Station, Coimbatore, a variety from Tanganyika was observed to be resistant to striga. This has brown grains. This has been crossed with the local Periamanjal cholam and work is in progress for the isolation of desirable selections with high yield and resistance to striga attack.

Query 6. Heavy infestation of striga has been observed on light loamy and red soils also; and it has been reported to flourish better on lighter types of soils, especially light red sandy ones, in S. Africa also.

Queries 2, 4 and 5 relating to sugarcane were referred to the Government Sugarcane Expert, Imperial Sugarcane Station, Coimbatore, and the information communicated by him is appended below :—

"Our knowledge of striga is limited to the experience gained at the Sugarcane Station alone. The first entry of seeds of striga into our station was through the floods of 1930 from the *vari* (jungle stream) running along the eastern boundary of our farm. Nowadays we occasionally get it through silt and sand carted into our station from the *vari*. The Presence of this weed in our farm was detected only after a couple of years after its entry, when it assumed a fairly serious form. I give below certain experiments which were conducted to eradicate it and the results obtained :—

(a) *Uprooting and burning the plants.* This method was successful only in those cases where it was possible to remove completely before flowering the whole under-ground stem system. The stem being very brittle it is very difficult to do this efficiently in which case activities of the underground stem get intensified and as a result produce a number of shoots in place of the one destroyed. This method was not found practicable.

(b) *Spraying with copper sulphate solution.* By spraying the above ground portions of the plant with 3 per cent solution of copper sulphate the above ground portion quickly dried away ; but within a few days new shoots sprang up in the same manner mentioned in item (a) above.

(c) *Spraying with tar emulsion.* This was not an effective treatment.

(d) *Flooding the field.* The fields were flooded and kept miry when there was no crop. The experiment was prematurely dropped as another method was found to be very effective and easy.

(e) The most effective and easy way of eradicating the Pest on our farm is that the striga plants are detected and treated before they begin to flower. Treatment consists in removing the soil round the stem of the plant so as to make a depression, as deep as possible, without breaking the stem. This depression is filled with 8 per cent solution of copper sulphate so as to bring the whole underground stem in contact with the solution as it goes down the soil. The whole plant is killed in one treatment when carefully done. It is by this method that we have been able to stamp out striga from our plots.

Query 5. We have not made a study of varietal resistance to this parasite ; but it is believed that all cultivated canes are susceptible."

The following publications may be referred to with advantage :—

Luthra J. C.— Striga as a root parasite on Sugarcane, *Agri. J. India.* 16 519—23, 1921.

Rhodesian Farmers— Successful Control of Witchweed. *Rhod. Agric. J.* Vol. 33 (1936), and Vol. 34 (1937.)

Saunders, A. R.— Studies in Phanerogamic Parasitism, with particular reference to *Striga lutea. Lour. Dept. Agri. Union of S. Africa: Sci. Bul.* 128 (1933)

Timson, S. D.— Witchweed. *Rhod. Agri. J.* 33 : 810—28 (1936), Vol. 35 : 29—39 (1938)

Yours &c.
G. N. Rangaswami Ayyangar.
M. A. Sankara Ayyar.

Weather Review—APRIL 1940.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	−0·5	7·3	South	Negapatam	0·6		0·7
	Calingapatam	0·1	−0·8	4·2		Aduthurai *	3·4	+2·0	3·5
	Vizagapatam	0·0	−0·7	1·8		Madura	3·7	+1·7	4·3
	Anakapalli *	0·3	−1·0	4·9		Pamban	4·7	+3·1	6·8
	Samalkota *					Koilpatti *			
	Maruteru *	0·0	−0·4	1·8		Palamkottah	4·5	+2·0	4·7
	Cocanada	1·4	+0·8	4·3					
	Masulipatam	0·1	−0·5	2·9					
	Guntur *	0·6	−0·2	4·6	West Coast	Trivandrum	6·9	+2·4	6·9
						Cochin	5·8	+1·1	6·0
Ceded Dists.	Kurnool	1·4	+0·8	1·5		Calicut	0·5	−2·8	0·6
	Nandyal *	0·0	0·0	0·0		Pattambi *	3·3	−0·4	3·3
	Hagari *	2·1	+1·2	2·1		Taliparamba *			
	Siruguppa *	1·2	+0·2	1·2		Kasargode *	3·7	+1·2	3·7
	Bellary	0·9	+0·1	0·9		Nileshwar *	0·6	−1·1	0·6
	Anantapur	0·6	+0·1	0·6		Mangalore	0·7	−0·6	0·7
	Rentachintala	0·2		0·3					
	Cuddapah	0·2	−0·3	0·6					
	Anantharaju-pet *	0·1	−2·6	1·1	Mysore and Coorg	Chitaldrug	2·1	+1·2	2·1
						Bangalore	1·7	+0·4	1·7
Carnatic	Nellore	2·6	+2·2	3·6		Mysore	2·3		2·3
	Madras	0·5	0·0	0·7		Mercara	4·9	+2·3	4·9
	Palur *								
	Tindivanam *	0·9	−0·2	1·4					
	Cuddalore	0·6		1·3	Hills	Kodaikanal	7·2	+2·9	8·6
						Coonoor			
Central	Vellore	1·2	+0·2	1·3		Ootacamund *	5·3	+0·3	5·7
	Salem	2·0	+0·2	4·3		Nanjanad *	4·2	+1·0	4·2
	Coimbatore	3·1	+1·7	3·3					
	Coimbatore A. C. & R. I. *	3·4	+1·6	3·6					
	Trichinopoly	0·8	−0·9	1·2					

*Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1937 published in the Fort St. George Gazette.

Weather Review for April 1940. The weather was generally dry over the peninsula till the 7th of the month, when secondary low pressures derived from the western disturbances traversing upper India caused fairly widespread thunder showers in South East Madras, Malabar and Mysore and scattered thunder showers in South Bombay Deccan, North Madras Coast and West Central Provinces. Rainfall has been in excess in most places except the Circars where it was in defect.

Skies were moderately to heavily clouded in the Madras Presidency, Malabar and North Madras Coast and lightly to moderately clouded in the Konkan, and Madras Deccan. The relative humidity was in excess in Malabar and the Konkan and was in defect in South East Madras. Temperatures were below normal in the Bombay Deccan and Mysore. The highest maximum of 111°F was recorded at Jalgaon on the 10th.

Chief amounts of rainfall.

Hagari	...	2·0″ on the 22nd.
Pamban	...	1·0″ on the 23rd.
Trivandrum	...	3·9″ on the 24th.
Kodaikanal	...	2·4″ on the 25th.
Kasargod	...	2·1″ on the 26th.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 4/40.

Absolute Maximum in shade	...	100·3°F.
Absolute Minimum in shade	...	65·0°F.
Mean Maximum in shade	...	95·8°F.
Departure from normal	...	+ 0·2°F.
Mean Minimum in shade	...	72·3°F.
Departure from normal	...	− 0·8°F.
Total rainfall for the month	...	3·44″
Departure from normal	...	+ 1·56
Heaviest fall in 24 hours	...	1·43″
Total number of rainy days	...	5
Mean daily wind velocity	...	1·5 m. p. h.
Departure from normal	...	− 1·1 m. p. h.
Mean humidity at 8 hours	...	69·8%
Departure from normal	...	− 1·3%

Summary. Dry weather prevailed during the 1st week of the month. From the 9th onwards thunder storm activity was felt and thunderstorms were quite frequent from the 22nd onwards. A total fall of 3·44″ was received during the month which was 1·56″ above normal for the month. The heaviest fall of 1·43″ was recorded on the 29th. Day temperatures were slightly above normal. The night temperatures, relative humidity at 8 hours and the mean daily wind velocity were all below normal.

P. V. R. & F. L. D.

Departmental Notifications.

Gazette Notifications.

Appointments.

Sri. V. N. Subbanna Acharya, Agricultural Demonstrator, Bellary is appointed to officiate as Assistant Director of Agriculture, Category 6, Class I, Madras Agricultural Service and is posted to Cuddapah Vice Sri. K. Raghava Acharya granted leave.

Sri. S. N. Chandrasekhara Ayyar, Assistant in Botany section, Coimbatore is appointed to officiate as Lecturer in Botany, Agricultural College, Coimbatore in category 8, class I Madras Agricultural Service Vice Sri. P. S. Jivana Rao on leave.

Subordinate Service.

Appointments.

Sri G. Konda Reddi, approved probationer is appointed as Assistant in Paddy section III grade (new) provisionally substantive without prejudice to his officiating appointment as Upper subordinate in the Agricultural section.

Janab M. Muhammed Obaidullah Shah Sahib, Assistant in Paddy section III grade-new provisionally substantive and officiating upper subordinate Agricultural section in the same grade, is appointed as Upper Subordinate, Agricultural Section.

Transfers.

Name of officers.	From	To
Sri K. Govindan Nambiar,	A. D., on leave	F. M. A. R. S. Nanjanad
Janab K. Soopi Haji Sahib,	Lower subordinate	F. M. A. R. S., Taliparamba
Sri L. Sankarakumar Pillai,	A. D., on leave	A. D., Rasipuram.
,, S. V. Parthasarathy,	Asst. in cotton A. R. S., Guntur.	Offg. Asst. in cotton Coimbatore.
,, A. B. Adisesha Reddy,	A. D., Dharmavaram,	A. D., Alur.
,, N. Raghava Rao,	Offg. Asst. in Entomology	A. D., Vizagapatam Dn.
,, R. *Narasimha* Acharya.	A. D., in Entomology St. Thomas Mount	Entomology section, Coimbatore undergo a course of training in Mycology section.
,, C. S. Balasubrahmanyam,	Asst. in Entomology, Cuddapah,	Entomology Asst. St. Thomas Mount
,, V. K. Appaji,	F. M., A. R. S, Palur,	A. D. Karur.
,, D. S. Subramaniya Ayyar,	A. D., Nilakottah,	F. M., A. R. S., Palur.
,, K. S. Krishnamurthi,	A. D., (on leave)	A. D., Nilakottah,

Leave.

Name of officers.	Period of leave.
Sri D. Srinivasa Rao, A. D., Narasaraopet.	Declared to have earned leave for 60 days from 2—5—40.
,, L. Neelakantan, Cotton Asst., A. R. S., Koilpatti.	L. a. p. for 1 month from 22—4—40.
,, L. Sankarakumara Pillai, A. D., Rasipuram.	L. a. p. on m. c. for 1 month from 4—5—40
,, C. S. Rajaratnam, A. D., Mycology, Coimbatore.	Extension of l. a. p. for 1 month from 28—4—40.
,, B. S. Narasimham, Asst. Chemistry, Coimbatore.	L. a. p. for 4 weeks from 6—5—40.
,, D. Hanumantha Rao, A. D., Cocanada.	L. a. p. for 1 month from the date of relief.
,, P. L. Narasimham, A. D., Bezwada.	L. a. p. for 1 month from 3—5—40.
,, J. David, A. D., Microtane Section.	L. a. p. for 2 months from 4—5—40.
,, M. K. Gopalan, A. D., Proddathur.	Extension of L a. p. for 1 month from 1—5—40.
,, A. Parameswara Jothi, Asst. A. D., Bhimilipatam.	L. a. p. on m. c. for 6 months from 1—3—40.
,, G. Ramabhadran, Asst. in Millets. A. R S., Koilpatti.	L. a. p. for 6 weeks from 13—5—40.
,, T. V. Rangaswami, Asst. in Cotton, Coimbatore.	L. a. p. for 2½ months from 29—4—40.
,, S. Venkatarama Ayyar, A. D., Sriperambudur.	L. a. p. for 1 month from 14—5—40.
,, J. Suryanarayana, A. D., Gurzala.	L. a. p. for 1 month from the date of relief.
,, N. V. Kalyanasundaram, F. M. Kalahasthi.	L. a. p. for 1 month from 15—5—40.
,, K. Dharmarajulu, Senior Asst. Botanist under I. C. C.	L. a. p. for 6 weeks from the date of relief.
,, V. Ratnaj Rao, A. D., Sulurpet.	L. a. p. for 1 month from 20—5—40.