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THE KANDY FLORA

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EDITORIAL

THE COCONUT INDUSTRY

THE present world shortage of fats is estimated by some to last till about 1960, on the footing that the demand remains stationary at pre-war levels. Needless to say, the magnitude of the demand will diminish continuously as the production machinery disrupted by the war returns step by step to normal conditions. The Coconut Industry, then, will enjoy a decade, at least, of undeserved prosperity—undeserved, because the industry as a whole had done very little since the depression even to supply vacancies, much less to improve its standards of cultivation. The degree of prosperity will be limited, of course, by the extent to which internal conditions remain tranquil and balanced. After that, what will be its fate ?

There are still many who look longingly and hopefully back to the good old days when the Industry was invested with the smug title of the " Consols of the East "—even though Consolidated Annuities have themselves now ceased to be a symbol of rock-like constancy in the financial world. The semi-monopolistic market that the Coconut Industry once enjoyed and which brought in its effortless dividends has gone, never to return. Whale oil, on the one hand, and competing oil seeds, on the other, can be relied on to disturb its economic stability pretty effectively.

There are others who, by multiplying an individual's fat requirements according to correct nutritional standards by the world's population, predict that, far from there being a glut in the oil seeds market, there is likely to be a progressively increasing demand. They base their calculations on the collective conscience of the world which, being now roused to the supreme importance of correct feeding for mankind, will pursue that objective until the aim is achieved. There can be no doubt that if the fat requirements of every person in the world are met even to a limited extent, the prospects for the Coconut Industry are likely to be extremely rosy for a very long time. But how far the collective conscience of the world can be impelled to do what is right within a reasonably short period is something about which very few

will care to speculate. It is a significant fact that the collective conscience of the world shows signs of sentience only during periods of stress and is prone to resume its slumbers when the tension has disappeared. Suffice it, therefore, to say that to be lulled into a feeling of security by this possibility is to be somewhat imprudent and unrealistic.

There are also other optimists who have already begun to pin their faith on the much publicised millennium of a brave new world for our economic salvation—a world in which the nations would join in brotherly amity and decide how each should utilize its resources so that all may live in plenty. Already, we can see the walls of this brave new world toppling in ruin before rival ideologies, rival greeds and rival hates; and the nations that met to solve the problems of the world are talking—suavely and politely, of course—across the conference table, with their hands in their pistol pockets. The looked-for millennium is thus receding rapidly into the background. No wonder, then, that the Ceylon Government, with commendable realism, has appointed a Commission to decide what should be done to 200,000 acres of its rubber which have become uneconomic because its partner in a bulk purchase scheme found it possible to buy rubber at 60 cents a lb. in other quarters, although it had thankfully accepted the commodity at Re. 1 a lb. at a critical time when the market value could have been several times that price. This rubber transaction reveals one defect in these bulk purchase schemes in relation to world trade. If there is more than one producer, brotherly amity will incline towards the brother that sells for less.

The same fate will undoubtedly overtake the Coconut Industry of this Island when other fat and oil activities are operating at maximum potential. Already, we hear of an undertaking in Tanganyika and the neighbouring countries for the production of 800,000 tons of ground-nut per year—an undertaking that is to cost £24,000,000, and which involves the construction of a special port for the handling of the merchandise. The operation is to be financed by British capital. Is it to be wondered at if, in the future, the oil requirements of the United Kingdom are met on the basis of a priority for this source? This enormous expenditure on the part of the United Kingdom may be regarded as a pointer to the possibility—or rather, the impossibility—of depending too much on a pre-planned system of international trade.

The Coconut Industry of this Island cannot, under normal conditions, have much influence on the oil seed market of the world. Is the Ceylon coconut grower, for that reason, to await the impending doom with resignation, and not do anything about it? It seems, however, that there is no cause for pessimism if he but follows closely the economic and agricultural trends within his own country and plans for the development and for the satisfaction of an internal demand.

In Ceylon, as elsewhere, the vital necessity of a proper nutritional level for its inhabitants has been fully recognised as the most important item in its programme of development. The milk needs of this country, at a minimum, have been estimated to be 100 million gallons a year. Our production at present is only 20 million gallons. Dr. Norman Wright, in his recent report, fixed our requirements in milch cattle, for this purpose, at 375,000 animals, producing 300 gallons per year each. Obviously, he has worked on the basis of a yield of one gallon per animal over a lactation period of 300 days.

Let us adopt this as a working hypothesis for our calculations, though local conditions make a few corrections necessary to relate it to actuality. This involves feeding each cow with a production ration of 3 lb. of concentrates per day. It is presumed here that the maintenance ration will be supplied by grass. Each cow will therefore need annually 900 lb. of concentrates. If we utilise coconut poonac for the purpose, this works out at the equivalent of about 2,500 lb. of copra or 4 candies—the annual yield of roughly 2 3/4 acres under coconut. It will thus be seen that if our requirements of concentrates are met from local resources, the entire existing acreage will have to be utilised for supplying our needs. No account is taken here, of course, of our draught animals and other livestock.

Let us examine the question of coconut exports from another angle. In this country, where the food needs of its inhabitants are notoriously dependent on the industry and bounty of other lands, it is a relief to be able to say that its fat requirements are met for the most part from internal resources. It is estimated that no less than 750 million coconuts are annually consumed in this country as human food. The process of utilisation is important. The kernel is scraped, incorporated with water and pressed through a colander. The " milk " so extracted is used as a base for preparing curries. The residues in the colander are put to such minor use as feeding poultry. As against these 750 million nuts, about 670 millions or their equivalent in partly processed products are sent out of the country mainly in the form of copra, or desiccated coconuts, oil or poonac. In recent times, a very large trade in the export of nuts themselves has also arisen. Of these two sides of the Coconut Industry, there can be no doubt whatsoever that the former enures more to the benefit of the country than the latter. For it loses very little of its capital wealth in the process.

In assessing the relative value of exports in the economy of this Island, it is important to bear in mind the relation of the exported material to the depletion of the country's soil. When exporting rubber, for instance, in the form of smoked sheets, we are actually exporting a compound consisting of a mixture of hydrocarbons. Its constituents, therefore, are obtained from the atmosphere and are illimitable in quantity, and the soil loses little or nothing in the process. Its export does not appreciably alter the balance of minerals in the soil. Whatever the rubber tree takes from the soil, it surrenders to the soil when it ceases to live. It is, therefore, a beneficent crop in more senses than one. The case of coconut produce is entirely different. What is exported is the fruit and with its transport overseas, the country loses in a normal year roughly 1,200 tons of nitrogen, 500 tons of Phosphoric Acid, 450 tons of Potash and 325 tons of Lime. The nitrogen is a particularly severe loss, as it is in the form of readily assimilable protein which is very useful for feeding livestock.

The only product of the coconut that we can export without loss is the oil itself. It consists of Carbon, Hydrogen and Oxygen in chemical combination and as these are derived mainly from the atmosphere, there is no objection to its export, from the point of view of the maintenance of soil fertility. Two-thirds of the copra consists of oil; the balance in the form of poonac must be put back into the soil, preferably through livestock.

Especially at this juncture, when the balance of trade is turning so heavily against us, the practice of exporting poonac or desiccated coconuts or the kernels themselves is to be deprecated. The whole process savours of soil mining and we are living on our capital without knowing it. A careful revision of the policy towards the export of coconut products other than oils seems called for, for both these important reasons. The illusory advantages of high prices outside should be weighed carefully against the damage that the capital wealth of the country suffers in the long run. A plan that will enable the fertility of the soil to be preserved, while the nutritional level is substantially advanced at the same time, is one that is worthy of consideration.

RECENT STUDIES ON THE MANURING OF COCONUTS IN CEYLON (CONTINUED)

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(5) MANURING OF FODDER GRASSES GROWN BETWEEN PALMS

Among others may be mentioned an experiment carried out at Kirimetiana Estate, Lunuwila, from December, 1939, to the end of 1943 to study the problems of manuring and management of fodder grass (Napier) planted between palms. The treatments tested were O, N and NPK with and without fodder. The bare results may be summarized as follows :— (*a*) Where no manures were applied, the growing of Napier between palms depressed the yield of copra up to almost 39 per cent. in the 4th and concluding year of the experiment, (*b*) Heavy applications of N. produced a slight set back of 10 per cent. in the copra yield of the " *No-Fodder* " plots. On the contrary the applicaton of this dose of nitrogen to the fodder brought about an increase up to 44 per cent. over the " *Fodder* " plots to which no manures were applied. This may be because excess nitrogen is taken up by the growing fodder and a set back thereby prevented, as conclusion based on the Bandirippuwa Experiment, (*c*) In the " *No-Fodder* " plots NPK complete mixture produced an increase of yield up to 38 per cent. over the unmanured plots ; and a corresponding increase of yield of 59 per cent. in the " fodder " plots over its corresponding " control " plots, (*d*) Growth of fodder was poor and only 3 cuttings per annum were obtained in the later stage of the experiment. Manuring with NPK increased the yield of fodder grass eightfold, but taking the maximum yield of the NPK plots no more than 4 tons per acre per annum was obtained—a poor yield indeed.

It should also be remembered that Napier grass has an unusually high potash requirement as shown by Burton and Lefebure recently (11) and should therefore compete with coconuts for this essential requirement.

Under the dry conditions prevalent in most coconut areas the possibilities of growing Napier between palms and that without affecting the yields of copra seem remote. Perhaps Guinea Grass may have been a better choice. A more hopeful line seems to lie in improving existing coconut pastures on better principles of management by introducing legumes and by rotational controlled grazing and avoiding over-grazing. Therein lies a field of investigation awaiting development. Cattle and pasture form an important link in the fertility cycle of coconut estates.

Further, the flush of fodder grass is obtained during the wet months when estate cattle have adequate pasture, while during droughts when

a succulent reserve of food would be useful, there is very little growth. Trials in ensiling the fodder in a small tower silo were not particularly successful. Coconut black beetle was found to breed in the ensilage.

(6) COVER CROP EXPERIMENT

We now come to a manurial experiment on a rather controversial subject—cover crops, their utilization and manuring, laid down at Bandirippuwa estate in 1937 on an area of lateritic gravel, the poorest fields of the estate. The cover tested was Centrosema.

TABLE IX.

COVER CROP EXPERIMENT

Adjusted Mean Yields per Acre. (66 Palms.) (lbs. Copra Acre.) per annum.

Treatment.— G. I. Year : 1937–1938	G. II. 1938–1939	G. III. 1939–1940	G. IV. 1940–1941	G. V. 1941–1942	G. VI. 1942–1943	G. VII. 1943–1944
No. Cover NPK	1406	1185	1369	1406	1974	1674
Cover K	1207	624	1266	1185	1875	1417
Cover NK	1200	782	1340	1164	1894	1453
Cover PK	1193	631	1218	1072	1813	1442
Cover NP	1233	738	1127	1145	1618	1303
Cover NPK	1241	829	1365	1270	2030	1556
Standard Error	106·1	81·5	91·4	174·3	173·6	182·4
Significant Difference P·05	126·2	96·9	109·0	207·0	206·3	216·9

The results of the differential manurial treatments are summarized in Table IX, from which the following conclusions can be drawn : (*a*) The growth of the cover crop produced a sharp decline of yield which reached a peak in the third year. This, it may be mentioned coincided with a severe drought, which no doubt enhanced the set-back ; (*b*) The incorporation of covers along with manures at the end of the *second year* caused a recovery in the cover plots in the *fourth year*. This recovery has been maintained in the subsequent years ; (*c*) There was no significant difference between palms manured with a complete NPK mixture without cover in circular trenches when compared to palms where cover was also grown and the same mixture broadcast and turned into the soil along with the cover ; (*d*) There is no significant difference between the yields produced by the addition of K, NK and NPK where cover is grown and turned in along with manure ; (*e*) Absence of potash (*i.e.* only NP) produced a significant decline in yield where cover is incorporated. Once again the importance of potash is confirmed.

It has not been possible to carry out parallel laboratory investigations to study—(*a*) The nitrogen changes in the soil, (*b*) The phosphate problem and (*c*) Moisture content of the soil.

The above results are strictly applicable to lateritic gravels and may not hold true to other soil types under different climatic conditions, but none the less the dangers of growing covers and having them untreated during droughts competing for soil moisture with the palms have to be kept in mind.

TABLE X.

Profit or loss from manuring Good Soil based on data of manurial experiment at Bandirippuwa Estate, when Price of Copra and cost of manuring vary.

Average biennial increase due to manuring (9-year period) = 496 lbs. = ·885 candies per acre in 2 years.

PROFIT OR LOSS PER ACRE DURING TWO-YEAR PERIOD.

Price of Copra per Candy	Gross Value of Increase Yield due to Manuring	Cost of Manuring once in two years.					
Rs.	Rs. c.	Rs. c. 0 50	Rs. c. 0 75	Rs. c. 1 0	Rs. c. 1 25	Rs. c. 1 50	Per palm
—	—	30 0	45 0	60 0	75 0	90 0	Per acre (60 palms.)
20	17 70	—12 30	—27 30	—42 30	—57 30	—72 30	
30	26 55	— 3 45	—18 45	—33 45	—48 45	—63 45	
40	35 40	5 40	—19 60	—24 60	—34 60	—54 60	
50	44 25	14 25	— 0 75	—15 75	—30 75	—45 75	
60	53 10	23 10	8 10	— 6 90	—21 90	—36 90	
70	61 95	31 95	16 95	1 95	—13 05	—28 05	
80	70 80	40 80	25 80	10 80	— 4 20	—19 20	
90	79 65	49 65	34 65	19 65	4 65	—10 35	
100	88 50	58 50	43 50	28 50	13 50	— 1 50	

TABLE XI.

Profit or loss from manuring Poor Soil based on data of manurial experiment at Ahangama when Price of Copra and cost of manuring vary.

Average increase due to manuring during 2 years —1,052 lbs. or 1·875 candies per acre.

Price of Copra per Candy	Gross Value of Increase due to Manuring	PROFIT OR LOSS PER ACRE DURING TWO-YEAR PERIOD					
		Cost of Manuring once in two years.					
Rs.	Rs. c.	Rs. c. 0 50	Rs. c. 0 75	Rs. c. 1 0	Rs. c. 1 25	Rs. c. 1 50	Per palm Rs.
—	—	30 0	45 0	60 0	75 0	90 0	Per acre Rs.
20	37 58	7 50	— 7 50	— 22	—37	—62	
30	56 37	26	11 37	— 3 63	—19	—34	
40	75 16	45	30	15	Nil	—15	
50	93 95	64	49	34	19	4	
60	112	82	67	52	37	22	
70	132	102	87	72	57	42	
80	150	120	105	90	75	60	
90	169	139	124	109	94	79	
100	188	158	143	128	113	98	

(7) MANURING OF UNDERPLANTED YOUNG PALMS

An experiment laid down at Letchemy Estate, Nattandiya, to study the problems of manuring of young palms underplanted is now in its fifth year. Height measurements and leaf counts of each seedling as it develops have been kept; but until the palms come into bearing it is considered premature to draw any conclusions, *as both height and leaf growth have yet to be proved as being reliable standards of productivity.* It is of interest to record that one palm (in the 6th year) has just come into flower.

(8) ECONOMICS OF MANURING*

In considering the economics of manuring and the application of the Law of Diminishing Returns, not merely the soil conditions controlling the response, but also the following combinations of economic factors have to be considered: (*a*) Low prices of copra and low prices of manures such as prevailed from 1930 to 1941; (*b*) High prices of copra and a proportionately higher price of manures such as prevail today; (*c*) High prices of copra and low prices of manures as prevailed in the pre-depression period up to 1930. The case of low price of copra and high price of manures need not be discussed, as manuring under such conditions is unlikely.

The following items of importance today in the cost of production have to be carefully kept in mind:—

(*a*) The rise in the price of manures, an increase nearly threefold compared to pre-war conditions.

(*b*) The rise in cost of labour from 40 cents pre-war to Re. 1·30 today involving a heavy charge for the cost of application. On gravelly soils it costs nearly 25 cents or more to cut and close a manure circle, so that the all-in cost manuring is about Re. 1·25 to Re. 1·35 per palm.

At the present levels, the cost of manuring fully at the level recommended by the Coconut Research Scheme is about Rs. 95 per acre every two years, or Rs. 47·50 a year. It will be shown later that this will be an economic proposition—particularly on poor soils—with a guaranteed copra price of Rs. 125 for five years. Admittedly, however, it is a high initial cost to bear for those properties which perforce neglected for many years, are only giving crops of the order of 1,000 nuts an acre.

With the copra price stabilized at a fair level for five years, there is every incentive to planned economy.

In Table X and XI, I have presented an analysis of the economics of manuring on profit and loss basis under varying prices of manuring and copra, based on a sliding scale, for the good soils as represented by the N. P. K. experiment at Bandirippuwa Estate (Table III.) and on poor soils by the data of the Ahangama experiment (Table IV).

In the case of the good soil, the average annual increase for the nine-year period, for the higher dose of potash, comes to 248 lbs. copra or 496 lbs. biennially, *ie.*, 0·885 candies (Table III). It will be seen that even at Rs. 40 a candy, manuring would just pay when prices of manures were cheap as under pre-war conditions, assuming manuring is biennially and regularly continued for at least 4 manuring cycles.

Even when copra is Rs. 100 a candy, manuring is a loss when cost of manuring is Re. 1·50 per palm. At Re. 1·25 per palm for manuring and

* This section has been revised to bring the information to date.

copra at Rs. 100 as today, there is a small profit of Rs. 13·50 per acre biennially. This, of course, assumes a long-range stabilised copra market, which is high even beyond five years. Assuming an average copra price of Rs. 50 on good soils, the limit of cost of manuring per palm should not exceed 50 cents.

In such soils we should not foster the delusion that after one or two applications of manure all's well. Fortunately or unfortunately such high yielding soils form only a small acreage comprising the alluvia of the Ma Oya and Deduru Oya valleys, the estuarine deposits between Ma Oya and Deduru Oya estuaries and of the Puttalam and Battuluoya Lagoons. *On such soils high farming is no remedy for low prices.*

On the poor soils, which I again repeat, form the major percentage of the Island, and which must demand our immediate attention, the case is different. Besides improving the capital value of such lands manuring brings in an immediate and profitable return. Even at Rs. 20 copra per candy manuring is just profitable when price of manuring is 50 cents a palm. At this price of manuring, the profit is nearly Rs. 158 per acre biennially when copra is Rs. 100. Even at Rs. 1·50 per palm for manuring it is just paying at Rs. 50 copra and at Rs. 100 copra the profit is nearly Rs. 100.

In 1937, nearly 10 years ago, in a press article entitled : "Economic manuring and cultivation of coconuts in Ceylon" (33) I put forward this same theory of economic manuring based on the interpretation of the Law of Diminishing Returns. It has now been confirmed by subsequent experimental data which were not available at that time.

Today, with an assured, stabilised copra market I must reiterate these views and call upon all those who possess coconut estates, neglected and not manured since 1930 when the depression began, to beg or borrow and manure somehow and that with expedition.

Replanting cannot produce any visible effects on crops for many years, whereas it is a reasonable inference from our data that on poor soils an increase of 1,000 nuts per acre per annum will be realised by adequate manuring after fifteen months.

On this basis, if 100,000 acres, a very modest extent indeed out of a total acreage of one million acres of coconuts are manured annually, the increase of crop would be 200 million nuts, so that the alleged decline in production can be easily caught up in 3 years. 100,000 acres annually in a 5-year plan is far too low a target with a stable market, and our aim must be at least 300,000 acres annually, by propaganda, credit facilities and Government assistance as a national effort on the lines of the Co-operative Aided Manure Scheme. This would mean an increase of 600 million nuts based on a modest estimate. This must indeed be our aim and all those who have the interest of the industry at heart must join in this campaign.

Indeed, if prices of manures come down as they are likely to do, more intensive manuring with higher doses aiming at a higher level of response of even 1,500 to 2,000 nuts per acre per annum on a linear incremental basis should be our target. These calculations are not ideal day-dreams or a mere counsel of perfection, but based on scientific realities, which we must and can achieve so that not a single poor yielding estate remains unmanured, and an average yield of at least 2,500 nuts per acre per annum obtained, or the present production more than doubled.

A complete discussion is not possible during the time at my disposal. I have endeavoured to summarise nine years' investigations on the manuring and nutrition of the coconut palm. Nine years in the life of the coconut palm is a short span—barely equal to 9 months in the life of an annual crop. The latter period is indeed significant—and to use a human analogy—be considered a gestation period in a programme of studies of the nutrition, physiology and manuring of the coconut palm.

The next stage must follow when these preliminary, yet let us hope, useful data, develop into a more consolidated programme of planned investigations on more ambitious lines. With enlarged resources and expansion of staff we hope to obtain in the not very distant future, it is our hope that before the end of the next decade further light will be shed on the life, growth and development of the main agricultural crop of this Island—once indeed the Consols of the East.

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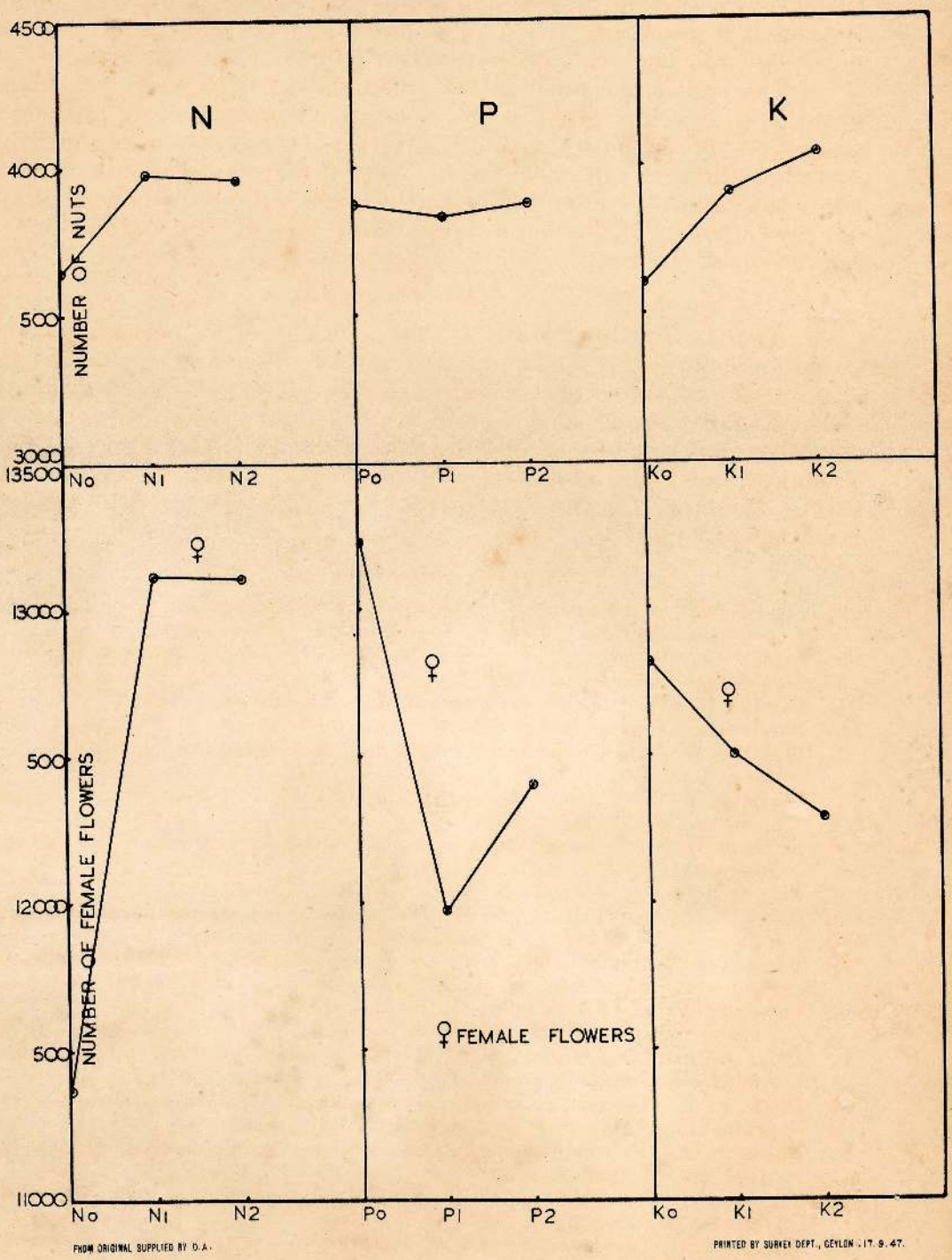
DIAGRAM 6.

FEMALE FLOWERS AND NUTS.

MEAN OF 6 YEARS (MIII to MVIII)



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THE POSSIBILITIES OF THE UTILIZATION OF DDT AND GAMMEXANE FOR PLANT PROTECTION IN CEYLON

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DURING the past five years two important new insecticides have come into prominence as being the most effective insect poisons so far discovered for dealing with insect pests. These are "DDT" and "Gammexane (666)", two synthetic organic chemicals. They have much resemblance to each other in their properties as far as methods of application and toxicity to insects are concerned. The general principles of the irutilization will thus be largely controlled by the same factors.

"DDT" or 2, 2-bis (parachlorophenyl), 1, 1, 1-trichloroethane or dichlorodiphenyltrichloroethane, was first prepared in 1874 by Ziedler. The chemically pure substance is a crystalline solid, practically colourless and almost odourless. It is relatively stable and has low volatility. It is insoluble in water but soluble in most organic solvents. In 1936, J. R. Geigy of Basle, Switzerland, discovered that it possessed insecticidal properties. It has been very extensively used during the war for the control of mosquitoes, flies and household pests. Since 1943 it has been widely tested as an insecticide for use against insects attacking plants and domestic animals, and its insecticidal effectiveness contrasted with the commonly used insecticides like the Arsenic, Pyrethrum, Derris and Nicotine products. Comprehensive large scale field trials have, however, been relatively few on account of supplies not being available during the war for general or civilian use.

Gammexane or 666, the Gamma isomer of Benzene hexachloride or 1, 2, 3, 4, 5, 6–hexachlorcyclohexane, is a substance rather similar in appearance and general physical properties to DDT. It is rapidly decomposed in the presence of alkalies but it is stable in the presence of ground limestone or chalk either dry or in water at ordinary temperatures. Its insecticidal usefulness was discovered by Raucort in 1941 in connexion with the control of the clothes moth when it was found to be superior to Napthalene and Paradichlorobenzene, and by Thomas and others in 1942 in connexion with the control of the Turnip flea beetle in England. Subsequently, it has been tested against various agricultural pests on the majority of which it has shown a high toxic effect, comparable with the results achieved with DDT and far superior to the common insecticides.

Both DDT and Gammexane can be used as dispersible powders diluted with selected materials or in solution in an organic solvent, these solutions being diluted for use with kerosene and other suitable oils. Against mosquitoes and household pests, where water sprays are not necessary, relatively high concentrations of the active ingredient can be used and from 5–10 per cent.

of the insecticides have been applied. A 5 per cent. DDT in kerosene has been generally found to be the most economical method of spray application in these cases. For agricultural use, however, where water sprays are required only much lower concentrations have been available for use as sprays. As dusts higher concentrations have been available.

The insecticidal properties of both these substances and their manner of action appear to be somewhat similar. Their toxicity to almost all insects against which they can be applied is definitely greater than that of the well known insecticides generally used for the control of agricultural pests. In their mode of action they appear to act as nerve poisons and are effective both when ingested with food or when absorbed through the outer body wall. The first symptoms are the twitching of movable organs. This is followed by paralysis of the legs and eventually collapse and death. The speed of knock-down especially with Gammexane is not so great as that given by Pyrethrum. It is largely dependent on the size or body weight of the insect, as well the general habits and activity of the insect in cases where the spray or dust is not directly applied on them. Death occurs with few exceptions only several minutes or hours after the actual exposure to the insecticide. Apart from the direct effect obtained by application of the insecticide on the body or food of the insect, both insecticides have a very potent residual action, being effectively absorbed from surfaces to which the insecticide has been applied through the tarsi of the legs. This residue is able to withstand atmospheric conditions and is thus effective for several days after application, thus contributing a cumulative effect and greatly increasing mortality. There is of course individual variation depending on the particular insect and insecticide used and the nature of the application on the plant surface.

From trials already carried out in various countries, DDT has been found to be more effective than other standard insecticides for insects of such widely different habit as surface feeding beetles and caterpillars, sucking insects and even certain boring insects. It has also been successfully used against stored grain-infesting insects and soil insects. Gammexane has not been so extensively tested but has given more or less similar results, showing a toxicity value equal to or greater than DDT in the majority of cases. It has also been clearly shown in actual tests both on a laboratory and field scale that the insecticidal effectiveness of these two substances against practically all the insects tested is not less and is usually far superior to other insecticides which can be used. Amongst insects which are extremely sensitive to DDT are the Diptera including the flies and mosquitœs, and it has been very successfully used on a large scale in controlling these pests. Many tests have also been carried out against important agricultural pests with DDT. In America DDT has been found to be far superior to Derris, Pyrethrum and Nicotine against Cabbage caterpillars. It has been found to be superior to arsenates for the control of the cotton boll weevils, bollworm and cotton bugs. As an orchard spray against Codling moth and other pests it has been found to be superior to arsenate sprays. It has also been found to be very effective on sucking bugs such as, Capsids and leaf hopper pests against which it has been difficult to utilize other insecticides economically in order to effect a satisfactory control. On the other hand it is very toxic to bees and other pollinating insects, as well as to parasitic and predatory insects which effect in many cases a natural control of pests. It is also toxic to fish and crustacea but fortunately rather less so to birds and mammals.

As far as man and domestic animals are concerned the concentration of these insecticides in applications to plants is too small to cause any harm or produce any toxic symptoms. They are, however, very much more toxic to all animals as an emulsion than as an oil or suspension and particular care should be exercised if an emulsion is used. Sprays have better residual effects than dusts, the deposit being more stable and not affected by the mechanical effects of rain.

DESCRIPTION OF TRIALS

In Ceylon these insecticides have only been available in sufficient quantity for tests on a laboratory scale and trials have been directed chiefly towards ascertaining the relative degree of toxicity for individual pests with a view to working out effective dosage strength and the most suitable manner of application in the field. In addition to the descriptive account given, the final observations on mortality are recorded in comparative tables.

Stored grain insects.—In carrying out the trials a sample size of 125 oz. of grain was used and storage done in jute hessian bags placed on a cement floor. Green gram, cowpea, and wheat were used, the two former being infested with *Bruchus chinensis* L., and the wheat with *Calandra oryzae* L., and *Rhizopertha dominica* F. Insecticidal dusts were the proprietary products D025 (666) and Gesarol (DDT). Preliminary tests showed that dosages of less than ·025 per cent. Gammexane and ·012 per cent. DDT became progressively infested after 4–6 weeks of storage. Dosages of ·025 per cent. (666) and ·012 per cent. DDT were the most suitable and were found to destroy all insects in the grain and to keep grain free from attack for a period of 6 months and over. The use of higher dosages did not make an appreciable difference to the effectiveness of the treatment. No detrimental effect on germination was experienced and no ill effects were produced on poultry fed with the treated grain for a continuous period of 2 weeks.

Leptocorisa varicornis F.—The insects were exposed to the insecticides in cages containing the host plants where the plants alone were treated and also where the internal surface of the cage as well as the plants were treated. In the former case the insects were retained in the original cages into which they were introduced. In the latter they were transferred to untreated cages after a specific period of exposure in the treated cage. Mortality was taken as the point at which the insect was unable to support itself upright on its legs, and observations regarding mortality were noted only up to a period of 48 hours after the time of initial introduction of the insects. Insecticidal preparations used were made from Geigy's Gesarol (DDT) and Imperial Chemical Industries products, D025 and D919.

Preliminary tests showed that there was no appreciable difference between effects on adults and effects on 3rd and 4th instar nymphs, and final tests were made only using adults. Dust applications of lower than 3 per cent. active principle were not sufficienctly effective when applied only on the plant surface, giving an incomplete and inconstant mortality. Dusts containing 3 per cent. and over of active principle were very effective producing 100 per cent. mortality. The effectiveness was retained on the walls of the cage for a period extending up to 3 weeks, but was not sufficiently retained on the plant surface to produce effective mortality for a period longer than 5–7 days. Gammexane seemed to be more toxic to the insects than DDT, producing quicker mortatilty and longer residual effect.

DDT was tried also as a spray. A spray containing ·1 per cent. active principle produced no appreciable effect unless insects were exposed to it for a continuous period of not less than 6 hours in cages which had all surfaces treated with the insecticide. Spray application containing ·5 per cent. active principle gave 100 per cent. mortality after exposure for 2 hours. The effectiveness of the spray application was retained for nearly one week on plant surfaces and up to nearly 2 weeks on the surface of the cage.

Dacus cucurbitae Coq.—Insects were obtained from material collected from Cucumber and Snakegourd. Treatment was similar to that given to *Leptocorisa*. With insecticidal dusts containing 3 per cent. active ingredient, a 5-minute exposure to the treated surface was sufficient to produce 100 per cent. mortality. The mortality was reduced to 20 per cent. on the 5th day after application, the count being taken only up to 48 hours after original introduction. An exposure of two hours to the insecticidal surface gave 100 per cent. mortality, effectiveness being retained for nearly 2 weeks. Exposure to a surface sprayed with ·1 per cent. DDT gave 100 per cent. mortality with 6 hours continuous exposure, the surface remaining effective for 2 weeks. Insects exposed in cages in which plants alone were treated gave a 100 per cent. mortality up to the fifth day of treatment and over 50 per cent. mortality up to 8 days in the case of dusts containing 3 per cent. active ingredient.

Aularches miliaris L.—The insects used were 4th and 5th instar nymphs. Preliminary trials showed that at least 2 hours exposure period is necessary to bring about appreciable mortality as the movement of insects in the cage is relatively little. The insects were very much more sensitive to Gammexane than to DDT. A 2 hour exposure to dust containing 1 per cent. Gammexane produced 100 per cent. mortality. The effectiveness of the treated surface was retained for 1 week. With DDT a 2 hour exposure to a 3 per cent. dust failed to produce any mortality, while continuous exposure produced appreciable but not total mortality.

Agromyza phaseoli Coq.—Insects were kept in cages in which the plant surface alone was treated. A mortality of 100 per cent. was obtained for periods extending up to 10 days after initial application of dusts containing 3 per cent. active ingredient. The spray containing ·1 per cent. DDT was slightly less effective. In the application of the insecticides to garden plots it was found that appreciable mortality of plants through Agromyza attack was obtained when the insecticide application was carried out at intervals longer than 4 days. Both insecticides appeared to be equally effective.

Prodenia litura F.—Caterpillars of the 3rd and 4th instars were used for trials. The insects showed much reluctance to feed on treated leaves. Total mortality was obtained with both insecticides in dusts containing 3 per cent. active ingredient. A residual effect was maintained for over 4 days which was as long as leaves could be maintained in a suitable condition for feeding the caterpillars. A spray containing ·1 per cent. DDT was also effective and produced a mortality of 80 per cent. as compared with a 15 per cent. mortality in a parallel test in which Lead Arsenate was used at the rate of 1 oz. in 2 gallons of water. Observations were only carried out up to 2 days after the original introduction of the insects.

Miscellaneous insects.—Mortality ranging from 80–100 per cent. was obtained in the treatment of a number of insects attacking growing plants in the field, using a 3 per cent. Gammexane dust prepared from D025. Amongst these were *Ragmus importunitas* Dist. on Sunn-hemp : *Bagrada picta* F. on Radish : *Aulacophora intermedia* Jac. on cucumber : *Crocilodomia binotalis* Z. on cabbage : *Dorylus orientalis* Westw. on Radish : toxicity towards Honey Bees and parasitic Hymenoptera was found to be extremely high and comparatively greater than towards any of the destructive insects tested.

Phytocidal effects.—No appreciable scorching was produced on mature foliage by dust preparations containing less than 5 per cent. active ingredient of either insecticide. Slight scorching was produced by 3 per cent. dusts and ·1 per cent. sprays of both insecticides on tender foliage of Cucurbitaceous plants and and French beans.

DISCUSSION AND CONCLUSIONS

It appears from a comparison of these results with those obtained in other countries that the general insecticidal effects of these insecticides on crop pests in Ceylon have not been of such a high degree of potency as that which seems to be obtained from trials carried out in temperate countries. It is likely, therefore, that generally slightly higher dosages will be necessary in Ceylon. The degree of toxicity obtained however is quite relevant to claims made for these insecticides and definitely surpasses that of the older insecticides in common use. Despite this potency very much field experimentation is necessary before their economic value can be properly estimated and definite recommendations made for their use for general agricultural purposes in Ceylon. Even laboratory tests have indicated that the high insecticidal effects obtained for these insecticides may not be reflected by a corresponding high mortality in the field. Much will depend on the general habits and activities of the insects under natural conditions and the ecological factors of the area.

On the other hand the high insecticidal value of the substances can make them akin to a two-edged sword, as they could act equally effectively against beneficial insects, a factor of relatively negligible importance in the case of the older insecticides in use. In countries like Ceylon this is specially significant, as a large number of crop pests are normally kept at negligible population levels through the activities of insect parasites and predators. It would be essential therefore to watch the effects produced by the use of these insecticides on parasites and predators in any particular case. Honey bees would be also adversely affected by the application of these insecticides unless these applications are so timed as to avoid periods of major flowering, especially on crops regularly visited by bees.

The eventual economic efficiency of these insecticides can, therefore, only be properly ascertained after extensive and repeated field trials carried out in relation to specific pests in their natural environment. The preliminary trials carried out have shown, however, that they can be recommended for use on a restricted scale under special circumstances such as, minor pest epidemics in restricted areas where the natural balance has already been upset, and the sudden appearances of a pest in relatively large numbers in small or domestic gardens. Effective applications in this connexion, which can be recommended on the basis of the tests carried out, are, the use of dusts containing from 3–5 per cent. of the active ingredient in weekly applica-

tions, or, the use of aqueous sprays containing ·1–·5 per cent. of the active ingredient applied twice weekly. Dusts should be applied only under relatively dry conditions. It would also not be generally advisable to continue the application of the insecticides for periods longer than a fortnight at one stretch.

It may also be said that these two insecticides have good possibilities with regard to the control of the majority of serious economic pests of this country, for which at present the degree of control that can be achieved through insecticidal or other means is inadequate or uneconomic. In such cases, however, extensive trials will have to be carried out and detailed schedules of application obtained in connection with each specific pest.

At present Gammexane appears to be superior in toxic value to DDT for insects on plants and therefore the more promising of the two insecticides for agricultiral use, but much may still depend on the ability of manufacturers to produce water miscible sprays with high insecticidal contents.

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TABLE I.

Effect of Gammexane (666) and DDT on Stored Grain.

Grain.	Initial Infestation.	Treatment.	Later Infestation. After 3 months. Treated.	After 3 months. Control.	After 6 months. Treated.	After 6 months. Control.
Green gram	5%	·05% 666	6%	19%	4%	25%
Cowpea	6%	·025% 666	6%	12%	7%	56%
Wheat	8%	·05% 666	9%	42%	12%	64%
Wheat	8%	·012% DDT	7%	42%	9%	64%
Wheat	10%	·025% 666	11%	35%	12%	52%
Wheat	10%	·012% DDT	10%	35%	12%	52%

TABLE II

Effect of Gammexane and DDT on Various Insects.

(Insecticides applied both on plant surface and sides of cage).

Insect.	Insecticide Nature and Strength.	Period Exposure.	Mortality noted up to 48 hours after introduction. Day of application. Per Cent.	5 days later. Per Cent.	10 days later. Per Cent.	14 days later. Per Cent.
Leptocorisa varicornis	3 per cent. 666 Dust	2 hrs.	100	100	100	100
	3 per cent. 666 Dust	15 min.	100	60	40	0
	3 per cent. DDT Dust	2 hrs.	100	100	100	100
	3 per cent. DDT Dust	15 min.	100	20	20	0
	·5 per cent. DDT Spray	2 hrs.	100	0	—	—
	·1 per cent. DDT Spray	6 hrs.	100	40	0	—
Dacus cucurbitae	3 per cent. 666 Dust	2 hrs.	100	100	100	—
	3 per cent. 666 Dust	15 min.	100	100	20	—
	3 per cent. DDT Dust	2 hrs.	100	40	20	—
	3 per cent. DDT Dust	15 min.	100	100	20	—
	·1 per cent. DDT Spray	6 hrs.	100	60	0	—
Aularches miliaris	1 per cent. 666 Dust	2 hrs.	100	—	—	—
	3 per cent. 666 Dust	2 hrs.	100	100	—	—
	3 per cent. DDT Dust	2 hrs.	0	—	—	—
	·5 per cent. DDT Spray	24 hrs.	0	—	—	—

10 insects were used for each test ; a control was kept in all cases and percentage mortality was determined by taking the numbers alive at the end of the test as determining numbers with the numbers alive in control as maximum.

Table III.

Effect of Gammexane and DDT on Various Insects.

(Insecticides applied on plant surfaces only to which insects were continuously exposed.)

Insect.	Insecticide Nature and Strength.	Phytocidal effect on host plant.	Mortality noted up to 48 hours after introduction.		
			Day of application. Per Cent.	5 days later. Per Cent.	10 days later. Per Cent.
Leptocorisa varicornis	3 per cent. 666 Dust	None	100	100	10
	3 per cent. DDT Dust	None	100	80	0
	·1 per cent. DDT Spray	None	40	40	0
Dacus cucurbitae	3 per cent. 666 Dust	Slight scorching or tender foliage	100	100	40
	3 per cent. DDT Dust	do.	100	40	0
	·1 per cent. DDT Spray	None	100	0	0
Aularches miliaris	3 per cent. 666 Dust	None	100	100	20
	3 per cent. DDT Dust	None	800	0	0
	·1 per cent. DDT Spray	None	30	20	0
	·5 per cent. DDT Spray (emulsion)	Slight scorching	60	10	0
Prodenia litura	3 per cent. 666 Dust	None	100	80	—
	3 per cent. DDT Dust	None	100	60	—
	·1 per cent. DDT Spray	None	80	0	—
Agromyza phaseoli	3 per cent. 666 Dust	Slight scorching of tender foliage	100	100	100
	3 per cent. DDT Dust	None	100	100	60
	·1 per cent. DDT Spray	Slight scorching of tender foliage	100	80	20

10 insects were used for each test and treated plants retained in cage till observations were over; a control was kept in all cases and percentage mortality determined by taking the numbers alive at the end of test as the determining numbers with the numbers alive in control as maximum.

THE PERFORMANCE OF SOME IMPORTED VARIETIES OF AVOCADO IN CEYLON

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ABSTRACT

THE avocado, which is native to Central America and Mexico, is a fruit of high nutritive value. It should find an important place in the diet of our people since it is rich in minerals, fats, proteins and other health promoting substances.

The Common avocado which is grown locally from seed is not of high quality compared to the grafted varieties imported from California and Florida. These imported varieties fail to grow well on their own stocks but exhibit remarkable vigour of growth when worked on the local seedling stock. Of the varieties under trial Gottfried and St. Anne "take" more readily than Pollock and Puebla when budded. The Gottfried variety is the first to come into season in May and is followed by Puebla, Pollock and St. Anne which is a late variety maturing in August to September.

The avocado fails to grow in the dry zone; it is essentially a fruit for the wet zone where it grows best in the mid-country.

INTRODUCTION

The avocado, which is a member of the laurel family, is native to Central America and Mexico where it has been grown for centuries as an important food crop. It serves in some measure as a meat substitute in the diet of the native inhabitants whose favourite meal consists of avocado and corn cakes.

Popenoe (4) records the presence of wild avocadoes in remote parts of tropical America. These he regards as prototypes of some of the horticultural races that had spread from very early times to other regions around the Carribean and the Northern Andes of South America.

The most striking development in commercial culture of avocado has taken place in Florida (5) and California (2) where thriving industries have been established by large co-operative organizations. The avocado was probably brought to Florida by the early settlers although the recorded date of introduction was in 1883 when Henry Perrine sent trees from Mexico to be planted on his land south of Miami. It was introduced successfully into California in 1871. Since then it has been established in parts of South Africa and Australia, where production is on the increase because of its high nutritive value.

The date of introduction into Ceylon of the local seedling avocado which is of the West Indian type is not known ; but the available records indicate that budgrafts of Lyon, Puebla and Dutton varieties of avocado were established successfully in the Royal Botanic Gardens, Peradeniya, from a collection of popular varieties imported on May 12, 1927, from Armstrong nurseries, California. Further successful introductions were made of Gottfried, Trapp and Pollock from the United States Department of Agriculture, Washington, and of St. Anne from the Department of Agriculture, Trinidad B.W.I. Budwood of Winslowson and Collinson imported from Washington proved a failure, but seeds of Puebla and Harman varieties received from the California Avocado Growers' Association on December 20, 1932, were germinated satisfactorily and planted out in the Gardens. One budgraft of Fuerte, which is the leading variety in California with the highest oil content of 30 per cent. was brought from there by the writer in April, 1940, and has now been successfully multiplied on local avocado stocks.

HORTICULTURAL RACES

Most of the cultivated varieties of avocado belong to three horticultural races, the Mexican and Gautamalan from the highlands, and the West Indian from the lowlands. The Mexican which is considered by some as a distinct species *Persea drymifolia* Mez. is easily distinguishable from the other two classified as *Persea Americana* Mill. by the characteristic anise odour of the crushed leaves. The fruits are small to medium in size, smooth and thin skinned with a rich nutty flavour. The fruits of the Guatamalan race mature during winter and spring, and have a woody granular skin of comparative thickness ; while those of the West Indian race mature during summer and autumn and have a skin of leathery texture and medium thickness. The fruits of these races vary in colour from green to maroon or dark purple, and in shape from round to oval or pear shape. In Ceylon seedling trees of the local West Indian avocado grow well in the mid-country wet zone at elevations between 1,000 and 3,500 feet on well drained soils and have a short ripening season from July to September. They do not thrive in the low-country dry zone. The fruits are green in colour and not of the best quality and flavour compared to some of the imported varieties under trial.

Of these imported varieties Pollock, St. Anne, and Trapp belong to the West Indian race, Puebla and Harman are Mexican, Dutton and Lyon are Guatamalan, Gottfried is believed to be a natural Mexican-West Indian cross, and Fuerte a natural Mexican-Guatamalan cross. The fruits of Puebla, Dutton, and Gottfried turn purple as they ripen but the others remain green. The Pollock variety produces the largest fruits, each weighing $1\frac{1}{2}$ to 2 lb., while those of St. Anne which are second in size are more distinctly pear shaped.

The following are some of the desirable characteristics to be taken into account in the selection of varieties for planting :—

(1) Hardy and vigorous habit of growth.
(2) Heavy and regular bearing habit.
(3) Season of maturity when market demand is high.
(4) Uniformity in size and shape of fruit, medium size being preferred.

(5) Smooth and creamy pulp with rich nutty flavour and free from fibre.
(6) Oil content at least 6 per cent, but preferably higher.
(7) Skin smooth, tough and sufficiently thick to resist fruit fly attack.
(8) Seed small, fitting tight in cavity with seed coat firmly adhering to it.

DESIGN OF THE EXPERIMENT

This paper records the progress of the preliminary trials set down on a section of the Horticultural nursery at Peradeniya with four varieties of avocado, Gottfried, Puebla, Pollock and St. Anne budgrafted on the local West Indian avocado stock. The randomized block lay out with single tree plots was used owing to limitation of space in the nursery. The varietal treatments were replicated five times. Bud-grafts of five other varieties Fuerte, Lyon, Dutton, Trapp and R. B. G. Purple hybrid, a local purple-fruited selection which tends to fruit during the off seoasn, were planted outside the border rows for observation.

Budwood was taken from the following single parent trees of each variety and budded in the nursery on seedling stocks of uniform size in May, 1941 :—

Puebla tree No. EC 2 Royal Botanic Gardens, Peradeniya.
Gottfried tree No. EC 12 Royal Botanic Gardens, Peradeniya.
Pollock tree No. F8/4 Experiment Station, Peradeniya.
St. Anne tree No. F8/17 Experiment Station, Peradeniya.

The method of budding used was a variation of the modified Forkert method (1). A transverse incision was made on the stock and the bark was peeled downward as well as slightly upward to produce two flaps, one smaller than the other. The scion bud was inserted under the flaps and held firmly in position. The lower flap was trimmed to expose the " eye " of the bud and the " H " shaped panel thus formed was tied firmly with budding tape.

With Gottfried and St. Anne the percentage of successful bud " take " was 92 per cent. and 93 per cent. respectively, but for Pollock it was 87 per cent. and for Puebla 66 per cent. Even in subsequent attempts at budding with selected budwood Pollock and Puebla failed to shoot out so readily as Gottfried and St. Anne. Cleft grafting gave satisfactory results on clear days, but was a complete failure during wet weather owing to the incidence of anthracnose which killed the scion.

The budgrafts selected for the trials were planted in the permanent site on December 2, 1941, and records of height, girth of scion and stock at fixed points 6 cms. above and below the bud union were taken annually. The average measurements taken on July 22, 1946, are given in the following table :—

	Gottfried.	Puebla.	Pollock.	St. Anne.
Girth of Scion in Cms.	52·46	45·66	38·96	42·74
Girth of Stock in Cms.	59·94	55·78	45·92	53·04

There is no significant difference between the varieties in either-scion or stock girth. The analysis of variance of stock and scion girth is given in Appendix I.

None of the plants in the trial exhibited symptoms of stock-scion incompatibility in habit of growth which was normal. Both Gottfried and St. Anne were more vigorous than the others in the early stages.

The Pollock variety was the first to come into flower two years after planting, but was not allowed to set fruit so early. During the next two years all the varieties except St. Anne came into flower, but hardly any set fruit.

This year all the varieties were in fruit although it is too early yet for them to bear normal crops. Gottfried was the first to flower at the end of last November and the fruits were harvested in May. It was followed by Puebla which came into flower slightly earlier than Pollock in January. The fruits of Puebla ripened during May to June, and those of Pollock from June to August. St. Anne was the last to come into flower in February, and the fruits began to mature during September. Most of them were badly attacked by anthracnose probably owing to the abnormal wet weather experienced during the month. All the varieties except St. Anne came into flower again in August and it remains to be seen whether it would result in the production of a second crop early next year. The other varieties planted outside the border rows in 1944 are too young to come into bearing, but they have all grown well on the local stock.

DISCUSSION

It would be seen that there is so far no evidence of incompatibility between any of these varieties and the West Indian stock which is acclimatised to local conditions in the wet zone. Seed of the local variety is available in plenty during the season, and seedling stock could be raised on a commercial scale with little difficulty.

Most of the trees in the trial have just come into bearing and it is premature to compare the yields of the different varieties. But their period of bearing is of considerable interest because of the possibilities of extending the fruiting season. In Florida and California where commercial culture of avocado has greatly advanced the aim of the grower is to produce fruits all the year round by the use of early, late and mid-season varieties. The remarkable progress made in this direction has according to Popenoe (4) aroused the interest of the growers in the Carribean to the possibility of extending the short ripening season of their native West Indian seedling by planting Guatamalans and Guatamalan-West Indian crosses. A similar situation exists in this country where the local variety is in season only from July to early September. Of the imported varieties Gottfried tends to be early while St. Anne is late. When more is known of the performance of the others it would be possible to recommend a suitable selection of varieties that would materially extend the present avocado season.

NUTRITIVE VALUE OF AVOCADO

The avocado is a fruit of high nutritive value. No other fresh fruit is so rich in fat, protein, minerals and vitamins A and B. The fat content may vary from 2 to 30 per cent. of the fresh fruit according to the variety, but the quality of the fruit is not dependant on it since some varieties such as the Pollock with low fat content are highly esteemed for their flavour. Because of its high calorific value and very low carbohydrate content the avocado makes an admirable food for diabetic cases.

The fruit is highly relished in America, where it is often served " on the half-shell " as a salad with celery, lettuce, tomato, onion and French dressing or Mayonnaise. Some people prefer to eat it plain, others with sugar and cream or pepper and salt. It makes an excellent sandwich spread when mashed and seasoned with tomato catsup, lemon juice and vinegar or onion. Cooking causes the fruit to develop a very bitter flavour owing to the presence of a tannin, but it could be diced and added to vegetable soup, consommé or omelette just before serving.

The following are some recipés from Hawaii (3) which should help to make people in this country cultivate a taste for the fruit :—

AVOCADO COCKTAIL (6 servings)

4½ cups diced avocado
1 cup tomato cat-sup
1 tea spoonful finely chopped onions or juice
1½ table spoonful lemon juice
1½ tea spoonful Worcestershire sauce
1½ tea spoonful salt

Sprinkle salt over the avocado and chill. Combine other ingredients, chill and pour over avocado just before serving.

AVOCADO PAPAYA COCKTAIL (6 servings)

3 cups diced avocado
1½ cups diced ripe papaya
½ cup tomato cat-sup
3 table spoonful cream

Add cream and catsup when ready to serve and pour over chilled diced fruit.

AVOCADO PINEAPPLE SALAD (6 servings)

6 slices fresh pineapple
2 cups avocado slices
⅓ cup mashed avocado pulp
⅔ cup mayonnaise
2 table spoonful lime juice

Place pineapple and avocado slices on lettuce leaves. Make a dressing of the other ingredients, chill and pour over salad.

CURRIED AVOCADO (6 servings)

4 table spoonful butter
5 table spoonful flour
2 cups milk
1½ tea spoonful salt
2 to 3 tea spoonful curry powder
2 cups diced avocado

Melt butter, add flour and stir to make a smooth paste ; stir in milk gradually, cooking until the mixture thickens. Season with curry powder, salt and pepper. Remove from fire and just before serving add avocado. Serve with cooked rice and mango chutney.

ACKNOWLEDGEMENTS

The writer's thanks are due to Mr. M. B. Wijesekera, Foreman, Horticultural Nursery, Peradeniya, for his assistance in taking growth records.

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APPENDIX I.

Avocado Trial—Peradeniya.

Analysis of Variance of Scion Girth.

	DF.	SS.	Variance.	F.	5 % Point.
Blocks	4	6077·00	1519·3		
Treatment	3	48834·00	16278·00	3·03	3·49
Error	12	64464·00	5372·00		
Total	19	119375·00			

Analysis of Variance of Stock .Girth.

	DF.	SS.	Variance.	F.	5 % Point.
Blocks	4	25664·0	6416·0		
Treatments	3	56435·0	18811·7	3·08	3·49
Error	12	73232·0	6102·7		
Total	19	155331·0			

RAIN CLOUDS AND RAIN IN CEYLON

(*Continuation*)

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6. TYPES OF RAIN IN CEYLON

Rain may be classified according to its cause into the following types :—

(1) *Convectional Rain*, caused by the ascent of warm moist air,
(2) *Orographical Rain*, caused by the ascent of moist air over mountain ranges or high hills,
(3) *Frontal Rain*, caused by the ascent of warm moist air over colder air, and
(4) *Depressional Rain*, caused by the ascent of moist air at an area of low pressure.

Convectional Rain may be subdivided into rain due to convection during the day and during the night. I shall give in more detail the cause of each type and some of their characteristics.

Convectional Rain formed by Day.—During the day the land absorbs solar radiation and warms up. It then warms the air above it, which ascends and forms cloud and rain when the air is sufficiently moist. This convection is very active on bright sunny days when winds are light.

Because the sea does not warm up appreciably by absorption of solar radiation, convection here takes place in a different way. The moist air over the sea absorbs a small part of the solar radiation, becomes warmer and ascends. This ascent, however, is able to form clouds and rain only when the air is very moist and nearly unstable—a condition greatly favouring ascent.

Convection over the Island produces clouds of the type shown in figure VIII (*a*), which give showers and thundershowers inland between noon and evening. When sea breeze is marked, the clouds concentrate as shown in figure VIII (*b*) and give fairly heavy rain inland. When there is appreciable wind in the upper levels in any direction, the cloud and rain travel towards the coast in that direction. When convection is vigorous and thunder-clouds form inland and develop large hoods of alto-stratus cloud as in figure VIII (*c*), the rain travels towards the coast as a thundersquall while the sheet of alto-stratus gives drizzle and rain accompanied by a little thunder in regions outside the path of the thundersquall.

When convection over the sea forms rainclouds and winds are favourable, these rainclouds are carried across the coast and give showers, as shown in figure IX (*a*), or rainsqualls, as in figure IX (*b*) and (*c*), in the coastal areas between noon and evening. The larger of these rainsqualls are sometimes accompanied by a little thunder.

Convectional Rain formed by Night.—During the night the sea and the moist air over it cool very slowly while the air at higher levels cools faster by radiation. The warmer air below then ascends and forms cloud and rain when it is moist, warm and nearly unstable. When winds are favourable these rainclouds too, are carried across the coast and give showers or rain-squalls, as shown in figure IX, in the coastal regions before and after dawn. Here again, the larger rainsqualls are sometimes accompanied by lightning and thunder.

Over land, convection is not active at night because the land cools rapidly by radiation. However, convection started over land during the day continues and gives rain at night, or convection taking place over the sea at night is carried over land and gives rain in the early hours of the morning.

Orographical Rain.—When winds cause moist air to ascend over mountain ranges or high hills, cloud and rain are formed. The ascent alone of moist air over the hills and mountain ranges in the centre of Ceylon, which are mainly below 7,000 feet, would produce only a steady drizzle on their windward slopes, as shown in figure X (*a*). Other factors, however, contribute to produce the heavier and more widespread rain we experience when steady moist winds blow across the Island. Firstly, convection commences cloud formation and rain before the air reaches the hills—often over the sea—thus giving rain between the coast and the hills, and also increasing the rain on the hill-sides by helping the formation of larger drops. Secondly, the clouds formed by ascent over the hills or mountains continue to ascend further and produce heavier rain. When the winds are strong the clouds often ascend to even three times the height of the mountains. The cloud is then carried horizontally as a sheet of alto-stratus which gives overcast skies over a large area and sometimes drizzle or rain as shown in figure X (*b*) and (*c*).

Orographical rain occurs at all times of the day, and varies in intensity because of the convectional factor in it.

Frontal Rain.—When warm moist air and colder air meet or flow side by side, either the warm air rises over the colder, or the colder air flows under the warmer and pushes it up. In either case cloud and rain form in the rising warm air. The boundaries at the ground where the air masses meet are called "fronts", in the former case a "warm front" as shown in figure XI (*a*) and in the latter a "cold front" as in figure XI (*b*).

Because temperatures over the Island vary a great deal owing to several causes and data are lacking, it is rarely possible to identify fronts in our neighbourhood. Frontal rain is widespread and generally continuous, but owing to convectional effects it varies in intensity at different times of the day.

Depressional Rain.—The term "depressional rain" is not restricted here to rain from depressions only but is extended to include all rain of the same type and from a similar cause—an "area of low pressure". At an area of low pressure winds are usually light and the air ascending and forming cloud and rain. Often, however, when there is rain of this type it is not possible to identify an area of low pressure on our surface pressure charts, but I have frequently found evidence of it at a higher level from the directions of the winds there. Even when a depression is forming and there is heavy

rain, no marked area of low pressure may be evident at the ground at first. It is some time later that winds strengthen and pressure falls at the central area.

When there are rain clouds giving light, moderate or heavy rain almost continuously with no appreciable wind it is usually termed " unsettled weather " and is illustrated in figure XII (*a*). When the clouds extend to a great height and give rain with thunder at all times of the day and night it is called " thundery weather " and is illustrated in figure XII (*b*). Unsettled weather or thundery weather with heavy rain often develops stronger winds and intensifies into " depressions " and " cyclonic storms ", the cloud formation of which is shown in figure XII (*c*).

The thunderclouds at the more intense areas of low pressure, particularly depressions, usually develop a hood of alto-stratus cloud extending in some westerly direction and giving widespread drizzle and rain. Because despressions to the north-east and north draw moist south-westerly winds across the Island, they generally give fairly heavy rain here. Depressions to the north-west or west, if sufficiently far off not to affect the weather over the Island directly, usually give fair weather.

Rain at areas of low pressure too, is more or less continuous but its intensity is affected by convection.

7. THE SEASONAL RAINS OF CEYLON

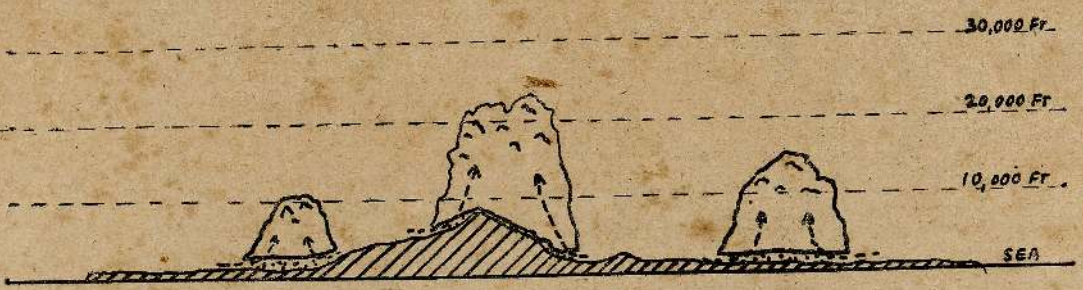
There are four main seasons in Ceylon—the First Intermonsoon Season, the South-west Monsoon, the Second Intermonsoon Season and the North-east Monsoon. In addition there are characteristic spells of heavy rain such as are experienced about the time of the setting in of the South-west Monsoon (popularly known as the " bursting of the monsoon ") and during the setting in of the North-east Monsoon. However, a fairly large part of the Island's rainfall, almost throughout the year, is due to " unsettled weather " and " thundery weather " which occasionally develop into areas of low pressure, depressions and cyclonic storms.

The seasons vary in duration from year to year. They do not have well-defined beginnings and endings but usually merge one into another. For example, there might be an advance of the south-west monsoon followed by a return to local thunderstorms of the intermonsoon season. Further, the rain of any season is often of more than one type, while the rain at any time may be the result of two or more causes working conjointly. For instance, convection is active to some extent almost every day and adds its effect to rain from other causes.

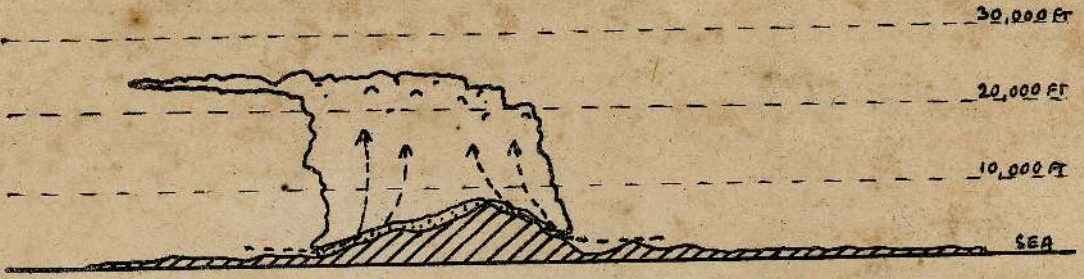
The First Intermonsoon Season (*March to mid-May*).—During this season winds are often light to a great height and heating of the land and sea by the sun, which is nearly overhead, is at a maximum—conditions most favourable for convection. During the latter part of the season there are warm light to moderate westerly winds which are shallow.

The rain of this season is of the following types :—

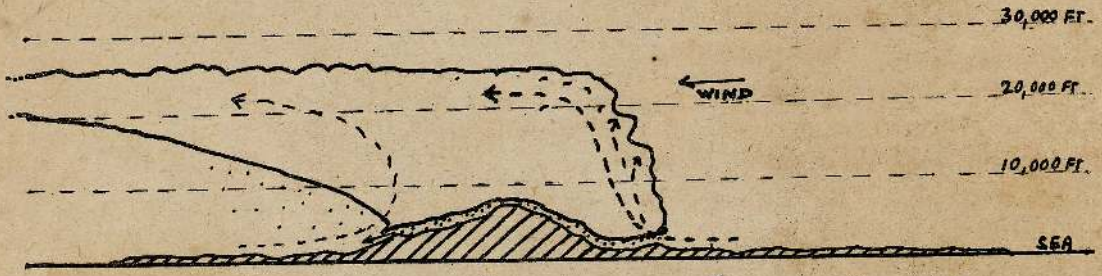
(*a*) *Convectional Rain by Day.*—When winds are light to a great height and the air sufficiently moist, convection takes place over land and gives scattered showers, thundershowers, or thundersqualls, according to the intensity of convection



(a) SCATTERED SHOWERS



(b) THUNDERSTORM INLAND



(C) THUNDERSTORM INLAND, WITH THUNDERSQUALL

FIGURE VIII – CONVECTION RAINCLOUDS OVER LAND

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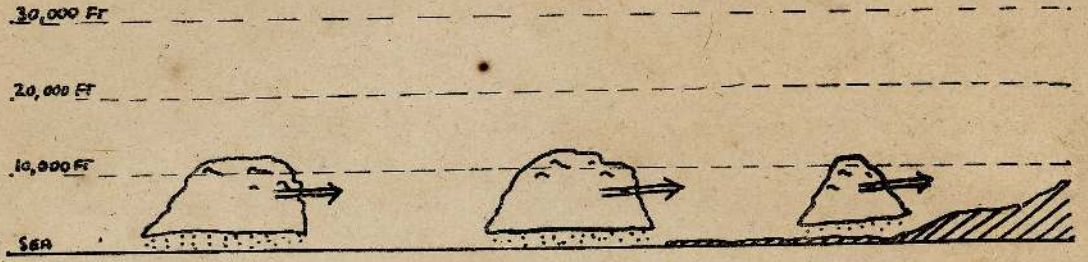
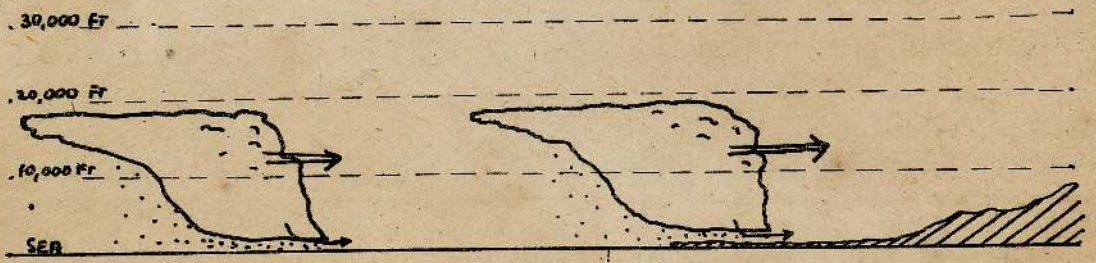
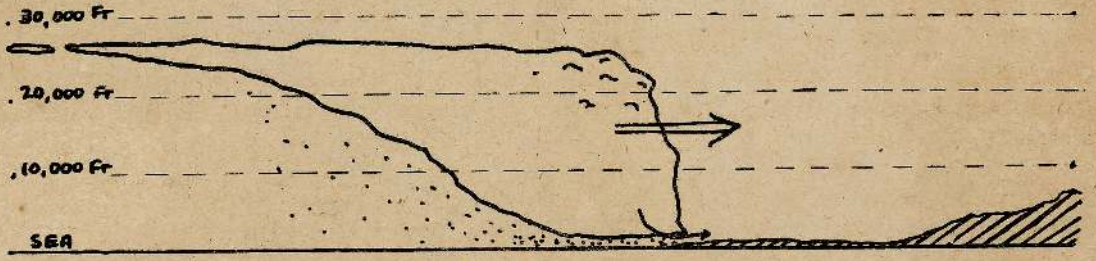


(a) SHOWERS



(b) SMALL RAINSQUALLS



(c) LARGE RAINSQUALLS

FIGURE IX – CONVECTION RAINCLOUDS OVER SEA

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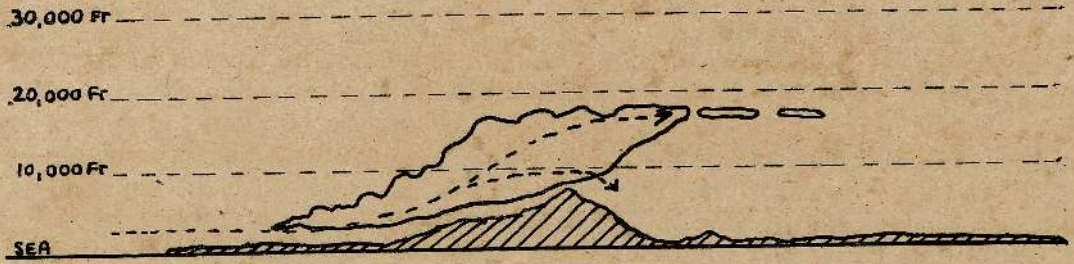
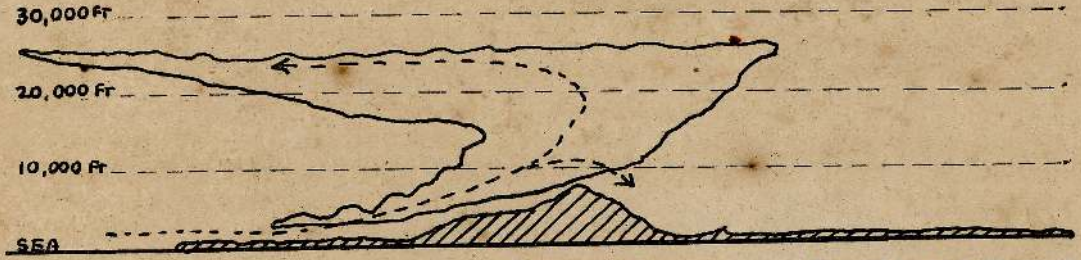
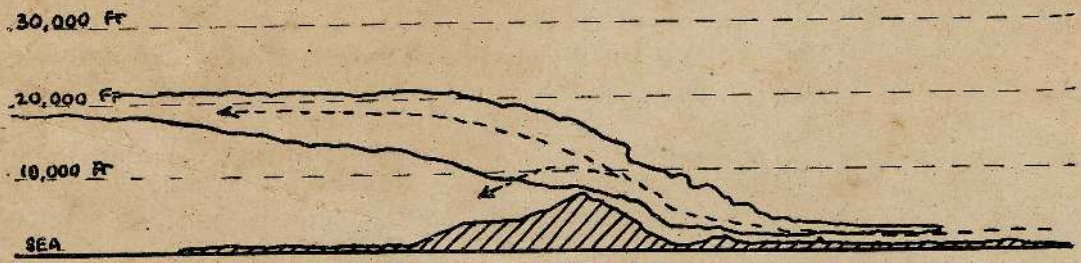


(a) PURELY OROGRAPHICAL RAINCLOUD



(b) HOOD CLOUD BY CONTINUED ASCENT — SOUTH-WEST MONSOON



(c) HOOD CLOUD BY CONTINUED ASCENT — NORTH-EAST MONSOON

FIGURE X - OROGRAPHICAL RAINCLOUDS

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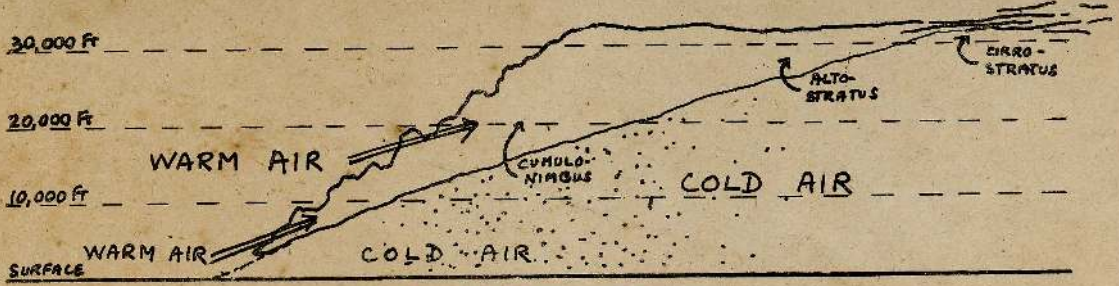
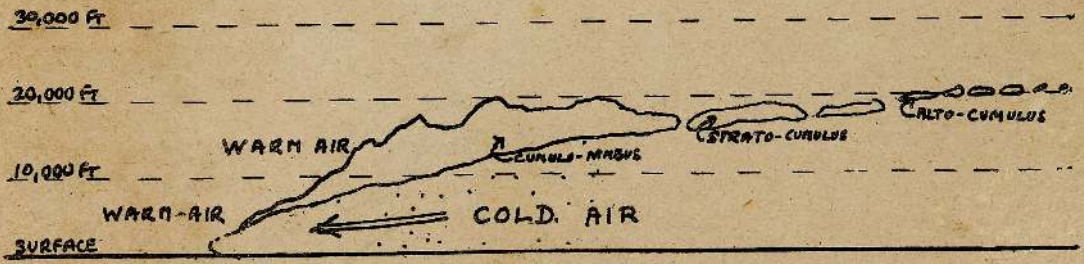


(a) AT A WARM FRONT



(b) AT A COLD FRONT

FIGURE XI - FRONTAL RAIN CLOUDS

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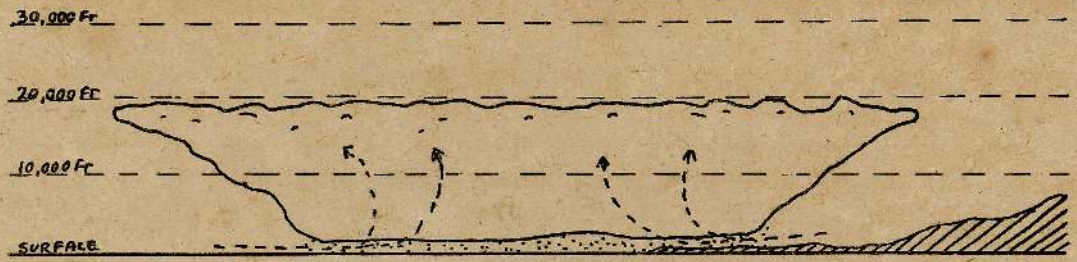
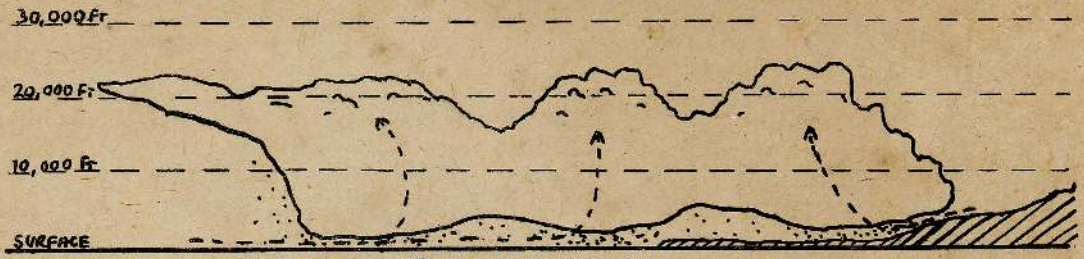
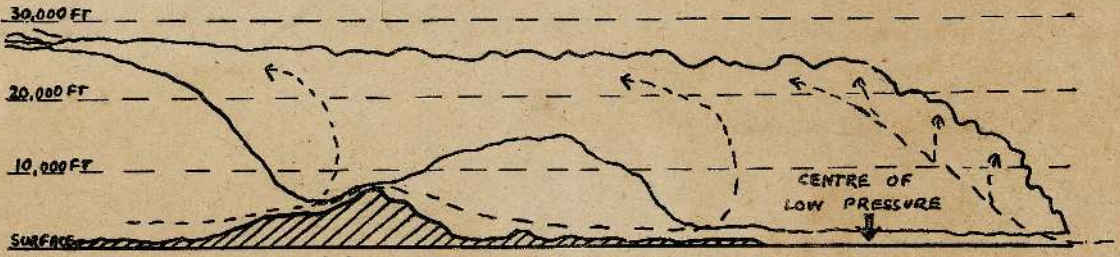


(a) UNSETTLED WEATHER



(b) THUNDERY WEATHER



(c) DEPRESSION WEATHER

FIGURE XII - DEPRESSIONAL RAINCLOUDS

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and the development of sea breeze. Thundershowers and thundersqualls are most common in April and usually travel from the inland hills to the west coast.

(*b*) *Convectional Rain by Night.*—During the night when the sea is warm and the air sufficiently moist and nearly unstable, convection takes place over the sea forming rainclouds by early morning. During April and May, when westerly winds prevail these rainclouds are carried across the south-west coast giving showers in these coastal regions about dawn.

(*c*) *Depressional Rain.*—Areas of low pressure form near the Island causing "unsettled weather" or "thundery weather" particularly in May. They occasionally develop into depressions and give heavy continuous and widespread rain.

Characteristic Spells of Heavy Rain in May (bursting of the Monsoon ?).—During May it is usual to have at least one spell of fairly widespread rain, particularly heavy in the south-west quarter of the Island. Though these spells of rain last for only a few days, yet they account for a good proportion of the total rainfall for the month. The rain falls from heavy thunderclouds spread over the land and sea, both during the day and the night. The clouds suggest that the air is very unstable and the rain is usually of the depressional type and the result of "unsettled weather" conditions. The "unsettled weather" sometimes develops into an area of low pressure or a depression which induces moderate to strong south-westerly winds which are more in evidence in the south-west quarter.

The south-west monsoon too, generally begins to establish itself near Ceylon some time in May. It sometimes becomes evident about the same time as one of these spells of heavy rain and gives the impression that the latter was due to the setting in (or bursting as most people call it) of the south-west monsoon.

On some occasions after the monsoon has set in quietly, there is a rapid strengthening of moonsoon accompanied by fairly heavy rain almost confined to the south-west quarter. This too, is often presumed to be the bursting of the monsoon.

The South-west Monsoon (May to September).—The south-west monsoon near Ceylon is not a steady wind even when well established. It varies in strength from weak to strong, becoming vigorous at times. It also varies a great deal in depth, often extending to over 15,000 feet. In direction, it varies from south-south-west to west, or even a little north of west. Rain is more likely when the direction of the wind is nearer south than west and also when the monsoon is deep. The monsoon is generally strong in the latter half of May and in June and July, when it gives most of its rain. By September convection is again very active and a major cause of rain.

Rain during the south-west monsoon is of the following types :—

(*a*) *Orographical Rain.*—Ascent of the moist monsoon winds over the hills and mountains in the central part of the Island gives orographical rain on their south-western slopes.

With strong wind, owing to the development of a hood effect by continued ascent, the rain spreads towards the south-west coast and towards the other side of the mountain ranges.

(*b*) *Convection Rain by Day.*—Convection over the land adds its effect to orographical rain when it is not too cloudy, particularly with weak or moderate monsoon. When the monsoon is weak or moderate convection takes place on the east side of the Island too. The convectional rainclouds there are fed by sea breeze from the east coast and give afternoon or evening thunderstorms on that side. Convection by day is active over the sea when the monsoon winds are moist and nearly unstable. The rainclouds formed are carried across the south-west coast giving showers and rainsqualls between noon and evening.

(*c*) *Convection Rain by Night.*—Convection is often active over the sea at night when the monsoon winds are moist and nearly unstable. The rainclouds formed are carried across the south-west coast by the monsoon winds, giving showers and rainsqualls before and after dawn. Sometimes these convectional rainclouds formed over the sea are carried to the land, continue growing, and become thunderclouds.

(*d*) *Depressional Rain.*—Areas of low pressure form during May, giving fairly heavy widespread rain and sometimes developing into depressions. During June they are hardly noticeable, while from July onwards they form again giving spells of fairly heavy rain followed by strengthening of the monsoon. In September they occasionally develop into depressions.

Corresponding to the bad weather associated with the advancing monsoon, the retreating monsoon too, sometimes gives a spell of thunderstorms some time in October. This does not occur regularly and is not of much violence.

The Second Intermonsoon Season (September to November).—During this season too, winds are generally light and heating of the land and sea by the sun is appreciable—conditions most favourable for convection. However, unlike the other intermonsoon period, areas of low pressure are frequent and more active, and helped by convection and possibly frontal effects they make this the rainiest season of the year for the Island as a whole. This intermonsoon season gives more rain to the north and east of the Island than the other does.

The rain is of the following types.—

(*a*) *Depressional Rain.*—Areas of low pressure occur frequently and give spells of " unsettled weather " and " thundery weather ", which sometimes develop into depressions near the Island. The rain is rather heavy and widespread, accompanied by thunder and often lasting several days.

(*b*) *Convectional Rain by Day.*—Convection by day over the land is not so marked as in the first intermonsoon season. It, however, adds its effect to other types of rain, causing an appreciable increase in the afternoon and evening.

(*c*) *Convection Rain by Night.*—Convection by night takes place over the sea, particularly to the east of the Island where it forms rainclouds and thunderclouds. The hoods of these thunderclouds often extend to the western side of the Island and give rain there too, especially when associated with areas of low pressure.

Setting in of the North-East Monsoon (November and December).—The setting in of the north-east monsoon is a more protracted process than that of the south-west monsoon. During November and early December the north-east monsoon begins to assert itself. Cold northerly to easterly winds, from some northerly source, advance southwards or south-westwards over the Island and cause the moist stagnant air to ascend over it. This *frontal effect*, aided to a great extent by *convection by day* over the land, causes fairly heavy widespread rain, particularly in the east and north of the Island. With moderate north-easterly winds, *convection by day* over the land causes thunderstorms in the north-west and west of the Island. Sea breeze is then active by noon, causing the north-east wind to swing round to north-west on the west coast. Later on, an afternoon or evening thundersquall travels on the west side of the Island from a north-easterly direction. *Convection at night* sometimes takes place over the sea, particularly on the east side of the Island, and may be associated with *areas of low pressure* which sometimes develop into depressions. Depressions to the east or north-east of the Island generally cause moist south-westerly winds to be drawn over the Island and give plenty of rain. Some depressions however induce cold northerly winds which give little rain though skies may be overcast. Usually by the end of December, the cold northerly winds having swept away the moist stagnant air, give a spell of crisp clear weather. This is not the real north-east monsoon which is a rain-bearing wind from an easterly source and gives mainly orographical rain.

The North-East Monsoon (December to March).—The north-east monsoon near Ceylon is not as persistent a wind as the south-west monsoon. It varies in strength from weak to strong, in direction from north to south of east, and also in depth. Northerly winds are usually cold and dry, while easterly winds are usually warm and moist in comparison. The north-east monsoon is generally strong at the end of December and in January, in February it is moderate and gives little rain, while in March it is generally weak and allows local convection by day to form thunderclouds inland.

Rain during the north-east monsoon is of the following types :—

(*a*) *Orographical Rain.*—Ascent of moist monsoon winds over the central mountains and hills gives orographical rain on their north-eastern slopes. With strong monsoon continued

ascent causes a hood effect to spread over the western and south-western part of the Island and give drizzle and light rain there.

(*b*) *Convectional Rain by Day.*—Convection by day over the land on the east side of the Island aids orographical rain, when skies are not too clouded. When the monsoon is moderate convection takes place in the north-west and west giving evening thundershowers and thundersqualls there. When the monsoon is weak convection causes thundershowers close to and among the inland hills. Convection by day over the sea causes showers and rainsqualls which are carried across the north-east and east coast by the monsoon winds between noon and evening.

(*c*) *Convectional Rain by Night.*—Convection at night takes place over the sea when the monsoon winds are moist and nearly unstable, and forms rainclouds. These rainclouds are carried across the north-east and east coast giving showers and rainsqualls in the morning.

(*d*) *Depressional Rain.*—Areas of low pressure often travel with the monsoon stream and gives spells of unsettled weather with rain. On a few occasions they have developed into depressions and given heavier rain.

FORECASTING RAIN IN CEYLON

It is perhaps fitting to conclude with the problem of forecasting rain. Forecasting is generally done with the help of weather charts, drawn at frequent intervals from observations reported from a wide network of stations. These charts show centres of low and high pressure, the development and movement of which are followed closely. From collected data and experience, certain probabilities of cloudiness, rain, wind, and temperature have been associated with these centres of pressure, their movement, and the various patterns made by them, and from these probabilities forecasts are made. In several countries the " fronts " along which " air masses " from various sources and with different properties meet, are identified and also used for forecasting. Additional help is obtained from charts showing upper winds, temperatures and humidities in the upper air, and other data.

In Ceylon, however, our weather charts are prepared only once a day and cover such a small area that they rarely show centres of low or high pressure. For the same reason, partly, " air masses " and " fronts " cannot be identified and used for forecasting. Upper wind observations are normally made at Colombo and Mannar, but because of the frequent loss of balloons in low cloud, this information is very scanty when most desired. We are therefore compelled to use simple indications, such as the presence of certain types of cloud and variations of temperature and humidity at upcountry stations. But these often do not give sufficient warning of weather changes which frequently take place over the Island overnight.

Our Ceylon weather service is in this state of backwardness and insufficiency due as much to the lack of sufficient trained staff and facilities for research, as to the lack of equipment. The coming development of Civil Aviation in Ceylon will soon demand dependable weather forecasts. For this, more frequent charts from observations over a wider area and taken by better trained observers will be necessary. More information of conditions in the upper air will also be needed. Another very important necessity, however, is an intense study of weather processes taking place in our neighbourhood, which are peculiar to our latitude and of which we still know too little. When these requirements are satisfied we should not only be in a position to give reasonably accurate forecasts for aviation, but we should also be of greater usefulness to agriculturists and others whose interests are connected with the weather.

My thanks are due to Dr. D. T. E. Dassanayake, Superintendent of the Colombo Observatory, for kindly reviewing this article and for many valuable suggestions.

GARCINIA IN CEYLON

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GARCINIA, a large genus of trees belonging to the family *Guttiferae*, is native to the Tropics of the Old World. The genus is represented in Ceylon by five indigenous species, viz.—

G. Morella Desrouss. *Kana-goraka, Gokatu, Kokatiya*—S.
G. Cambogia Desrouss. *Goraka*—S.
G. Echinocarpa Thw. *Madol*—S.
G. terpnophylla Thw. *Kokatiya*—S.
G. spicata Hk. f. *Ela-gokatu, Gonapana*—S.

All these species (except *G. echinocarpa* which is confined to the hills) occur in the moist low country. *G. mangostana* Linn., the mangosteen, is a native of Malaya, and had been introduced into Ceylon about the year 1800.

The two species, *G. Morella* and *G. Cambogia*, are of considerable economic value, and form the subject of this paper. *G. Morella* has a wide range of medicinal uses. *G. Cambogia* is employed extensively as a sour relish and in the curing of fish. *G. Morella* is a small, slow-growing, pyramidal, smooth-barked tree. *G. Cambogia* is a rough-barked, medium-sized tree with a rounded head and drooping branches. The flowers of both species are unisexual and dioecious. The fruit of *G. Morella* is small and ungrooved. The large, green, fluted fruit of *G. Cambogia* ripens into either an orange-yellow (*ela-goraka*) or a dull red (*rath-goraka*). The grooving of the fruit provides a simple specific distinction. Both species are moderately common in the wet forests of Western Ceylon from sea level to 2,000 ft.; *G. Cambogia* is more abundant. *G. Morella* blooms in May, and *G. Cambogia* during the period February to March.

G. Morella yields commercial gamboge. The Siamese product comes from a closely related species, viz. *G. Hanburyi*. The Ceylon and Siamese species were at one time erroneously considered identical. Trees over 12 years old are tapped for gamboge in wet weather by means of a spiral incision on the trunk; the yellow exudate is collected in bamboo receptacles. Gamboge was the yellow pigment used by the old Sinhalese fresco painters; it was itself a *valicciya*, and unlike other paints did not need the superimposition of a varnish. It is a dye for the robes of Buddhist monks. The golden ink used by the Siamese for writing on black paper consists of gamboge. It makes gold varnishes and gold lacquers. Gamboge paint is a water emulsion. The chief components of the resin are cambogic acid and a gum similar to that of the Acacias.

In primitive rituals, *G. Morella* filled a place comparable to the mistle-toe of the Druids. It is, however, on account of its immense medicinal value that it is prized by the Ceylonese. The literature of Ayurveda teems with references to the medicinal properties of various parts of the plant. King Buddhadasa's compilation "*SARARTHA SANGRAHAWA*" for instance, prescribes *goraka* for ailments as varied as rheumatism, rickets and enlargement of the spleen. *Goraka* is one of the five acid fruits specified in Ayurveda ; the other four belong to the genus *Citrus*, viz., lime, orange, *nas-naran and gada-thehi.*

Particularly noteworthy is the widespread use of the bark and tender leaves in the treatment of fractures. An external application of a leaf *mellum* promotes the setting of bones. Material used in external application is pounded with common salt. The bark and leaves are also applied to sprains, contusions and swellings. In combination with other drugs, the bark and leaves are used in the treatment of hernia. Oil expressed from the bark is applied to ulcers.

A gargle consisting of a water extract of the root prevents decaying gums. Chewing the aril that surrounds the seeds has the same effect.

The astringent properties of the fruit round pericarp are valued in medicine. The dried rind is the chief ingredient of decoctions given to women after confinement. A water extract of the rind remedies flatulence and nausea. Carbuncles, catarrh, cancer, consumption and skin diseases are reputed to respond to treatment with preparations from the rind.

The resin tapped from the bark possesses purgative properties which are usually not exploited in medicine. It cures acute gout. The resin after subjection to heat in a cashew shell (*Anacardium occidentale*) is used in the treatment of ulcers. In association with other drugs, the resin functions as a anthelmintic.

Goraka is used widely in the treatment of animal disorders. A water infusion of the rind is employed as a rinse in diseases of the mouth in cattle. Cattle with hoof afflictions are stood in a water suspension of the ground rind.

G. Morella and *G. indica* yield a semi-solid yellow fat, 'Kokam' butter, which is valued both as food and as medicine. The constituents in the fats from the two species are the same but the proportions differ. *G. Morella* has twice as much olein and half as much stearin in its fat as *G. indica.* The fat of *G. Morella* makes an indifferent lamp oil but may be satisfactory in the manufature of candles.

G. Cambogia is not used in medicine to the same extent as *G. Morella.* The yellow resin derived from it is not water soluble, and is accordingly of little value as paint. Hindus, however, use it for sectarial marks.

The high content of the fruit rind (pericarp) of *G. Cambogia* in acids makes it commercially valuable as flavouring and in the curing of fish. The

results of the rind analyses by Dr. D. E. V. Koch, Assistant Chemist, are as follows :—

Nature of sample.	Per cent juice Extracted.	Colour of extract.	Per cent total acids in extract.	Per cent non-volat. acids in extract.
1. Rind from fruit picked off tree in the Royal Botanic Gardens, Peradeniya .	68 ..	pale pink ..	5·72 ..	—
2. Rind from ripe fruit fallen off tree in Dodanwela	52 ..	orange red ..	6·88 ..	5·84
3. Cured commercial rind ..	— ..	light brown ..	29·74 in 100 gm of rind. ..	27·8 in 100 gm. of rind.

The analyses given above indicate that nearly 90 per cent. of the acids in the rind are not volatile, and consist almost completely of tartaric acid.

Rind used for curing is derived from fruits picked under-ripe; immature fruits are richer in acid. After removal of the kernel, the rind is sectioned into thicknesses varying inversely with the wetness of the weather; thick sections are difficult to dry. The slices usually average $\frac{1}{8}$ inch in thickness. The slices are sun-dried in thin layers for a period of 3–7 days. The material loses over 80 per cent. of its moisture on sun drying. The dried rind is smoked in a loft till such time as it is used or sold.

Deraniyagala (1933) gives a detailed account of the methods of fish curing that obtain in Ceylon; the information summarized below is derived from his paper. The use of the dried rind of *G. Cambogia* in the brine curing of fish goes back centuries. The ancient Sinhalese considered beef food for untouchables, and consumed large quantities of brine-cured (jadi) and dry-salt-cured fish (karavadu). Relays of pingos transported daily supplies of preserved fish to the palace at *Sitawaka*. The ingredients salt and goraka are used in brine-curing in the following proportions :—$1\frac{1}{2}$ cwt. salt and 14 lbs. *goraka* to an oil drum of fish; 2 cwt. salt and 20 lbs. *goraka* to a beer barrel of fish. The dried pulp of ripe tamarind is a satisfactory substitute for *goraka*, but is not widely used on account of its higher cost. The active principle is probably the same in both instances, viz., tartaric acid.

The treatment of fish in brine curing varies with size : (*a*) Fish less than 10 inches long is cured without evisceration and without *goraka*, (*b*) Fish between 10 inches and 22 inches in length is descaled (in order to secure effective penetration of the curing agents) and eviscerated. The fish then receives on one side, a succession of oblique cuts, spaced about an inch apart. The vertebral column is severed without damage to the skin on the ventral side. The head is ripped from the opercle to the snout. Salt and *goraka* are inserted into the incisions. Fish treated in this fashion are piled into wooden casks with further quantities of salt and *goraka*; layers of fish alternate with the layers of salt and *goraka*. Within a few hours of packing, the exosmosis of water into the salt converts it into a concentrate. Meanwhile, the fish in the cask is compacted by pressure, and further layers of fish are packed in till the cask is brimful. The brine concentrate is then returned to the cask, the fish is top dressed with a final layer of salt and

PLATE I.—Garcinia Cambogia Desrouss.

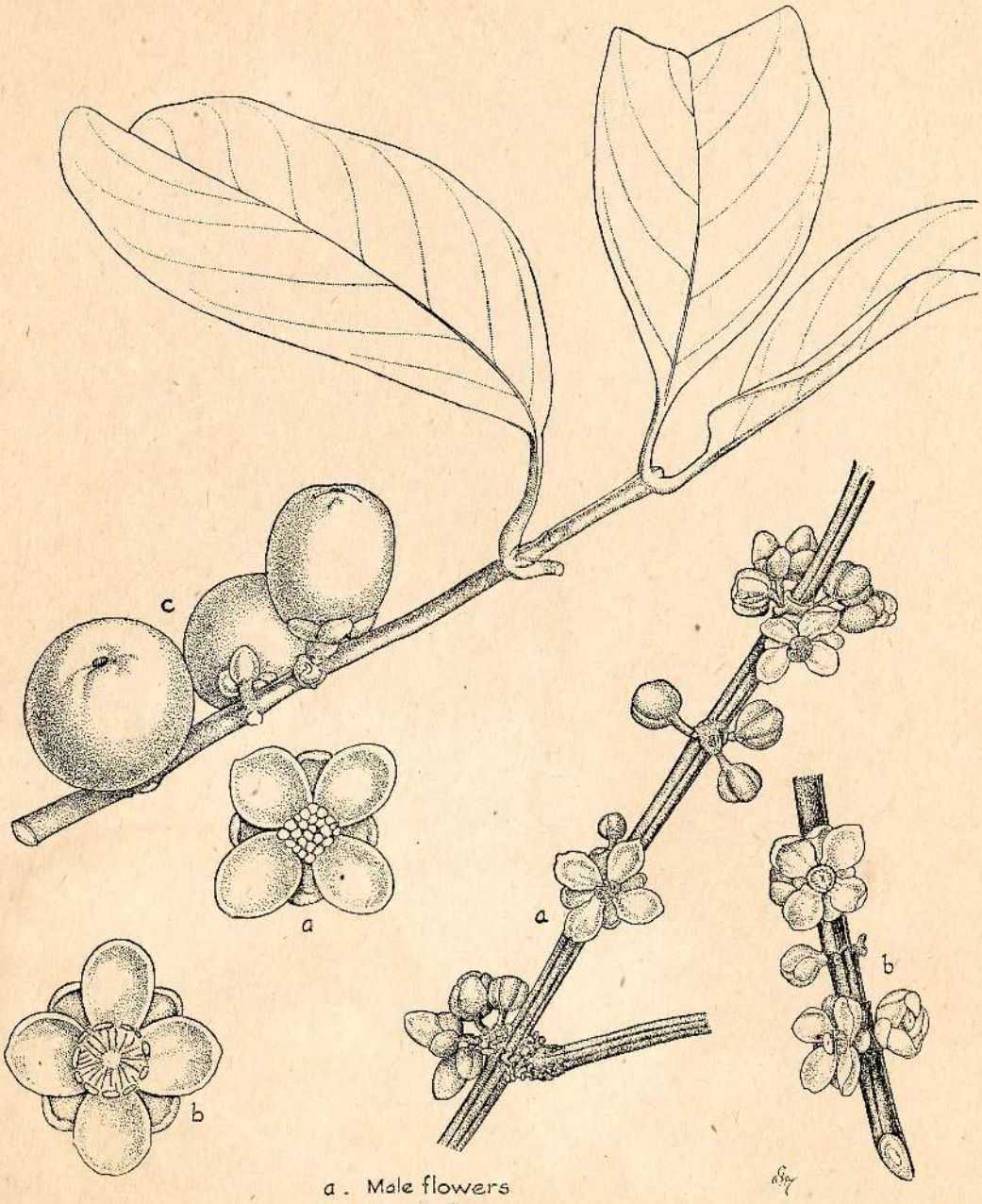

PLATE II.—Garcinia Morella Desrouss.

goraka, the lid is rammed down, and the cask is set aside to season. (*c*) Fish longer than 22 inches is cut into chunks, scarified and rubbed with pounded salt and placed in wooden barrels. Salt and *goraka* are added to the barrels which are then sealed. The fish matures in the brine that forms in the barrels.

Goraka not only possesses a pronounced acid reaction, and consequent marked antiseptic properties, but also counteracts the tang of the salt. Fish treated with *Goraka* accordingly does not demand prolonged washing prior to use.

A pickling vinegar prepared in the way described below had, at one time, been exported from Ceylon in considerable quantity : *Goraka*, the bark of *Moringa oleifera Lamk* (*Murunga S*), chillies and nutmeg are infused with fermented coconut or palmyrah toddy in stone jars exposed to the sun for three weeks and buried under ground for a further period of one month.

The dried rind of *G. Cambogia* is also used widely in flavouring curries, for polishing gold and silver, and as a substitute for acetic and formic acid in the coagulation of rubber latex.

The timber of both species, *G. Cambogia and G. Morella* is subject to early decomposition, and is accordingly used only for temporary structures. The heart wood of very old trees of *G. Cambogia* is, however, remarkably hard and durable.

ACKNOWLEDGMENTS

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In addition to the publications included in the bibliography vicarious reference to the following was available:—

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COLOUR INSTABILITY IN SOME PLANTAIN VARIETIES

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VARIATION of characters is largely manurial with such plants as the plantain, which is propagated vegetatively by planting of suckers detached from the parent plant.

In the course of observations made over a considerable period of as many as forty varieties of plantains in Ceylon, two varieties however, have displayed certain variations and as they are of rather special interest, notes are given below.

It is not attempted to explain these variations, but judging from their nature it would appear that these conditions are likely to be due to environmental or pathological causes. The possibility of these variations being bud mutations is, however, not completely ruled out.

VARIETIES UNDER DISCUSSION

(1) Red Plantain (*Musa rubra*). The "Cuba" of the West Indies. (S) *Rathu Kochchi, Rathambala, Ranel ;* (T) *Sev valai.* A variety introduced towards the latter part of the 19th century and highly esteemed as a table plantain, but sometimes used as a vegetable in the mature state. The large plump, thickly set fruits are ox-blood red and when ripe assume a very pleasing golden red colour. Easily the tallest, the most robust and magnificent looking of the locally grown plantains, this variety luxuriates in the moist and rather cool regions of the Kandy and Kegalla Districts, often producing bunches weighing over a hundred weight.

It is rather sparing in the production of suckers and normally grows to about 15 ft. to 18 ft. at the base of the crown, the stout stem often measuring 1½ft. across at ground level.

Variation.—The stem of a typical red plantain is of a reddish garnet brown colour with petioles of a lighter hue ; but it has been noticed that this colour is not stable. When a sucker of a typical red plantain is planted out, it has been observed that the daughter suckers leading from the original plant tend to vary, losing the reddish pigment altogether. The transition may be gradual and may extend throughout several generations of clonal reproduction or the dimunition or total disappearance of pigmentation may be quite sudden, so much so, that in the same stool suckers of graded colour ranging from reddish garnet brown to dark green may appear or the stool may carry on the one side suckers typical of the variety and entirely green suckers on the other side.

This colour variation is not confined to the vegetative parts only, but the degree of pigmentation also varies in the fruit bunches borne. The writer has noticed bunches with half the bunch running longitudinally down with ox-blood red fruits and the other half with green fruits. Sometimes ox-blood red and green fruits occur scattered in the bunch giving it a mosaic pattern. Individual fruits at times display sectional colour variation with red and green stripes or the reddish pigment merging into green.

Red plantain varieties that have fully deviated from the type and assumed a green colour are locally known as *Gal-Anamalu* or *Sudu-Kochchi*. Such a variant has never been observed to go back to the original red coloured variety.

Deviation from the type is not only confined in regard to skin colour alone, but the colour of the flesh and taste of fruits also vary according to the degree of deviation.

The flesh of a typical red plantain when mature is of a salmon colour turning flesh colour on ripening and is very sweet and mealy, while that of a *Gal-Anamalu* (deviated type) is of a pale yellow orange turning salmon buff on ripening and is less sweet and not so soft. As a rule *Gal-Anamalu* trees grow more massive than *Rathambala* and produce larger bunches with bigger fruits. The fruits of the red variety however, have a greater demand and fetch a higher price in the market than those of the green variety.

(2) Ash-Plantain, *Musa* (*Paradisiaca*) *normalis*, (S) *Alu-Kehel*, (T) *Sambal-Valai*. An indigenous variety normally used as a vegetable, but also eaten when ripe and reputed to be of great therapeutic value. The fruits are 5–6 inches long, rather plump, angular and covered with a greyish bloom.

This variety attains a medium height, suckers very freely and grows equally well in the moist and dry zones. The stems are slender, pale yellowish green in colour with a marked greyish bloom in the upper regions of the stem and the petioles.

Variation.—This variety is also unstable displaying deviation in colour, producing suckers which are more green and losing the greyish bloom altogether, but does not so readily deteriorate in type as witnessed in the Red plantain. In the course of variation, trees in a stool may throw out bunches with greyish fruits showing streaks of green, while bunches that appear later carry fruits that are entirely green and devoid of the characteristic bloom. Sometimes the transition is not gradual, but a sudden departure from the type takes place, when a bunch thrown out from a succeeding sucker in the same stool carries green fruits altogether.

Such a variant is locally known as *Etamuru* or *Kalu-Kehel*. The fruits do not enjoy the same popularity as that of the original *ash-plantain*, the flesh being firm with the occasional appearance of hard seeds.

In this instance too, reversion to the original ash-plantain is not known.

The ash-plantain is very susceptible to the disease known as Anthracnose of plantains, but it has been noticed that the degressed type, *Etamuru* is remarkably resistant to, if not entirely free from this disease.

THE LIMING OF SOILS

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ALL plants need calcium to build up their tissues. In particular leguminous plants require a plentiful supply of it. Lime stimulates the growth of some crops to such an extent as to assist materially in the elimination of weeds. Good farmers realize that the use of lime helps them in replacing a one-crop economy by a type of farming embracing livestock—raising and feeding, or dairying. Liming alone may make the land productive or it may be an important one of several measures necessary. The most profitable and often the most striking effects may be seen on soils good in most respects but relatively low in lime. Not the least valuable result of liming the land is the encouragement it gives to the farmer in his work and management of crop rotations and care of the soil. It has to be emphasized that the limed farm is likely to build up rather than to wear out, and the quality of its products tends to perpetuate the interests of the farm-family in the land.

FARM PRACTICE OF LIMING

Grades.—Lime for agricultural purposes should preferably be of the high calcium limestone type containing not less than 90 per cent. of carbonate of lime. Fine-ground limestone should be fine enough for all material to pass a 20 mesh sieve and at least 75 per cent. of it to pass a 100 mesh sieve. Coarse ground limestone should all pass a 10 mesh sieve and at least 50 per cent. of it a 100 mesh sieve. It has to be emphasized that in the case of very coarse material, its action in the soil will obviously be slow.

Method of Application.—Since ground limestone and other lime products in carbonate form are not harmful to plants, they may be *spread* at any time, although applying lime, cattle manure and certain ammonia containing compounds at the same time is not advised. Applying lime after ploughing, to be followed by harrowing, is the most satisfactory practice. The time and method used should, however, be decided according to conditions and convenience. The lime should be thoroughly and uniformly distributed through the soil. Burned lime and hydrated lime require more care in application as they may possibly injure tender plants or seeds with which they come into contact.

Quantity.—The quantity of lime to be applied depends principally upon the various needs of the soil and the crop and also on the climatic conditions and the time of application. Applications recommended are usually from one-half ton upwards of burned lime of from one ton upward of ground limestone per acre.

EFFECT ON THE SOIL

All soils that need lime do not require it for the same reason. As a result of liming, a soil may be benefited (*a*) through the neutralization of its acidity, (*b*) the supplying of available calcium, when this element is deficient in the soil or (*c*) the improvement of its physical condition. In some cases all these effects will be obtained at the same time. Liming has been found to favour the flocculation of heavy soils, so that better aeration and drainage result. Hydrated lime and burned lime are more effective than ground limestone in bringing this about.

Turning under the vegetation of leguminous crops for green manure is one of the principal means of soil conservation and improvement of the fertility of land. Most of the soil-conserving and soil-improving crops grow best and produce most vegetation when the soil is kept nearly neutral in reaction by liming. Soil building crops, including many of the legumes, cannot be grown successfully on some soils without first applying lime. Lime, disked in, usually increases the biological processes of ammonification, nitrification and fixation of nitrogen in all soils that are on the acid side of neutrality.

In nearly all instances the decomposition of the organic matter in a soil will be greatly hastened by liming, although in the case of peats, owing to the resistant nature of the organic matter, the process is usually slow.

Liming increases the availability of phosphoric acid in most laterite and lateritic soils. It is particularly required in the tropics where the losses of calcium are great.

Maximum returns from cattle manure, green manure crops and certain commercial fertilizers may not be obtained where adverse soil conditions such as high soil acidity, poor tilth or poor drainage exist. Applications of lime to many acid soils long under cultivation, should precede the use of manures and fertilizers.

EFFECT ON YIELD OF CROP

Leguminous crops take large quantities of calcium from the soil and therefore require a plentiful supply of it. Furthermore, many legumes are sensitive to acid soil-conditions and grow poorly or not at all where such conditions exist. In the case of a field where the acidity is only just beyond the range of tolerance of certain arable crops and pastures there is considerable inequality in growth which results in a patchy appearance owing to the distribution of acidity being often local.

This is particularly true of alfalfa, red clover and sweet clover. White clover, cowpeas and soy beans do fairly well on slightly acid soils but it has to be mentioned that they usually respond to liming.

The great majority of garden and truck crops and cereals are often benefited by liming. Lime, disked in, generally increases the carrying capacity of pastures. All members of the citrus family thrive only in soils which are well supplied with lime. In general, it could be said that applying lime will result in larger returns and lower production costs for many crops.

WHAT SHOULD NOT BE EXPECTED OF LIMING

(1) Liming can improve only the condition in the *upper* soil making for better circulation of air and water. Impervious layers of hard-pan *below* are not materially affected by applications of lime; they should be broken up by other means.

(2) Liming cannot take the place of proper crop-rotation, cultivation or soil management. In fact, rotation and all cultural methods should be studied more carefully when lime is used.

(3) Liming should not be expected to build up a soil which is deficient in organic matter unless such organic matter is supplied either in manure or by green crops ploughed in. On sandy loams, the deficiency should initially be made good by organic manuring, while in all other cases it is often necessary to lime first and thereafter to build up the organic matter content by means of green-manuring or by applications of cattle manure or compost.

(4) Liming does not greatly hasten the decomposition of the organic matter of peaty soils. Repeated liming over several years will be found necessary.

(5) Lime does not supply potash but on the contrary may depress its content and temporarily at any rate its availability in the soil. In the case of soils, low in potash, liming should be followed by the use of suitable potassic fertilizers.

THE SOIL SURVEY OF KUNNATHUNAD TALUK

A. P. A. BRITO-MUTUNAYAGAM and M. C. ABRAHAM

FOUR distinct soil types have been identified in the area surveyed and of these the laterite soil, which is generally loamy in character, of low fertility status and poor water-holding capacity predominates.

The other types are alluvial soils, sandy loams and the kari soils, which are heavy clay soils, rich in highly acidic organic constituents.

The soils of the area surveyed have been regarded as being satisfactory in nitrogen, but their contents of total and available phosphoric acid and of available potash have been found to be low to extremely deficient.

The most noticeable feature of these soils is the fact that they are extremely deficient in lime, the total content of which is often lower than the percentage of total potash.

Remedial measures to correct for soil deficiencies have been suggested by the authors.—*D. E. V. K.*

REPORT OF THE PROCEEDINGS OF THE TENTH MEETING OF THE CENTRAL BOARD OF AGRICULTURE HELD AT PERADENIYA IN THE ASSEMBLY HALL OF THE SCHOOL OF AGRICULTURE, AT 10.30 A.M. ON MONDAY, AUGUST 12, 1946.

Mr. L. J. Seneviratne, Director of Agriculture, presided and the following members were present :—Mudaliyar N. M. Abulcassim Marikar ; Dissawa A. E. Madawala ; Mr. S. Sivapalan ; Mr. R. T. Chelliah ; Sir J. P. Obeyasekera ; Mr. S. Muttutamby ; Mr. S. G. Taylor, Director of Irrigation ; Mr. E. H. R. Tenison, Acting C. D. A. M. ; Mr. R. H. Spencer-Schrader ; Mr. A. G. Divitotawela ; Rev. Fr. L. W. Wickremasinghe ; Gate Mudaliyar N. Wickramaratne ; Mr. U. B. Unamboowe ; Dr. A. W. R. Joachim, Acting Deputy Director of Agriculture ; Mr. R. Bois,; Dr. D. E. V. Koch, Acting Chemist ; Mr. C. N. E. J. de Mel, Principal, School of Agriculture ; Mr. T. M. Z. Mahamooth, Acting Deputy Director (Animal Husbandry) and Government Veterinary Surgeon ; Mr. J. J. Heider ; Mr. C. A. M. de Silva ; Mr. James P. Fernando ; Colonel T. Y. Wright ; Sir Wilfred de Soysa ; Dr. R. V. Norris, Director of Tea Research Institute ; Dr. R. Child, Director, Coconut Research Scheme ; Mr. C. B. Edwards ; Mr. Marcus S. Rockwood ; Dr. W. R. C. Paul, Divisional Agricultural Officer, South-Western Division : Mr. C. A. de Silva, for Director, Rubber Research Scheme ; T. B. Poholiyadde Dissawe ; and M. J. Perera, C.C.S., Secretary.

The following visitors were also present :—Mr. G. de Soysa, C.C.S., Commissioner for Co-operative Development ; Mr. Chas R. Turbert, Specialist in Animal Husbandry ; Mr. E. J. Livera, Divisional Agricultural Officer, Southern Division ; Mr. S. K. Thuraisingham, Supervisor of State Farms ; Mr. J. E. Senaratne, Assistant in Systematic Botany ; Mr. W. Mathewson, Agricultural Engineer.

Letters and telegrams regretting inability to attend the meeting were received from the following members :—Mr. Bruce S. Gibbon ; Mr. A. R. Panditteseкera ; Mr. N. E. Ernst, Land Commissioner ; Mr. Bertram de Zylva ; Mr. H. W. Amarasuriya ; Gate Mudaliyar M. S. Kariappar ; Mudaliyar K. Chinnatamby ; Mr. K. Kanakasabai ; Mr. A. T. Sydney-Smith ; Mr. S. L. Bandara Dharmakirti ; Mr. C. N. D. Jonklaas ; Mr. Wilmot A. Perera ; Mr. H. E. C. Lushington, Conservator of Forests ; Mr. W. Dulling.

1. CONFIRMATION OF THE MINUTES OF THE LAST MEETING.

The minutes of the last meeting held on February 18, 1946, which had been circulated among members were confirmed subject to the amendments which had also been circulated to members.

The Chairman next referred to the regrettable death of the late Sir Solomon Dias Bandaranaike and mentioned that the late Sir Solomon Dias Bandaranaike's association with the Board of Agriculture dated back to the old Ceylon Agricultural Society of which he was a member and he also served in a similar capacity on the Board of Agriculture of the Ceylon Agricultural Society which was founded in 1904.

When the first Board was constituted by Ordinance No. 37 in 1922, Sir Solomon was nominated by H. E. the Governor to serve on the Board. He served in the Estate Products Committee, and in the Board of Agriculture, as well as on its Executive Committee. He was not a member of the present Central Board of Agriculture which was inaugurated on May 10, 1934, after which date the former Board of Agriculture ceased to function. His close association with agricultural practice lent point to his contributions to the discussions.

As a mark of respect to Sir Solomon the assembly passed the vote of condolence standing.

42. TALK ON "AGRICULTURAL MACHINERY", WITH SPECIAL REFERENCE TO CEYLON BY MR. W. MATTHEWSON (AGRICULTURAL ENGINEER TO THE DEPARTMENT OF AGRICULTURE).

The Chairman introduced Mr. W. Matthewson to the Board and siad that Mr. Matthewson had been chosen for the Department by the Colonial Office to help them to find out what best to do with the Agricultural implements imported to Ceylon, to find out Ceylon's requirements and how best to tackle the peculiar soils found in this Island. Mr. Matthewson had been in the Department for nearly a year and had toured the country extensively.

"Tractors were first introduced into U. K. about 1923 after the first world war. These machines were heavy and clumsy and not adapted for the land. (The "Overtime" and "Titan" were two of the types in use at that time). American designers improved on these machines in the succeeding years, and a number of fairly reliable tractors came on the market, among these being two of British manufacture, the Austin and the Rushton, and of course the well known Fordson which is produced at Dagenham.

Unfortunately due to the depression after the war Austin and Rushton ceased to manufacture tractors, and have not again ventured to do so, leaving the field clear to the American manufacturers. The Ford Co. still of course manufacture the Fordson in large numbers and it may be said that during the present war these tractors have been the keystone of the Ministry of Agriculture's effort in food production. Also made in U. K. are the Marshall and the David Brown, besides a number of small tractors including two very useful machines which are both on tracks, the Ransomes and the Bristol.

Against this America produces an imposing line of tractors of many makes and types too numerous to mention, and at present she leads the field in both production and design.

TRACTOR-TYPES

We have two different types of tractors in general use to-day. The wheel tractor and the tracklaying tractor each of which is manufactured in various models.

The general purpose wheel tractor is the most common type of tractor in use today probably due to its adaptability. This machine can be used either with steel or pneumatic wheels, the steel wheels being fitted when doing cultivation work and the pneumatics for haulage purposes. The pneumatics are also useful on the land, and many farmers never change over to the steel wheels but take other measures to reduce wheel-slip. (1) The tubes are filled with water, the extra weight giving greater traction, or strakes are fitted to the wheels. These strakes can be adjusted to project beyond the tyres thus acting on the same way as a steel wheel fitted with spade lugs.

The tractlaying tractor is not so common because it is relatively expensive both to buy and maintain, although from an engineering point of view it is more efficient. Again this is a one-purpose machine and is (or should) only be used for cultivation.

The higher maintenance costs are due to track wear, and here I would quote a statement made by a prominent Agricultural Institute.

> "While tractlaying tractors are highly efficient as regards rolling resistance and wheel slip, they should always be worked on the lowest possible gear. This is because of *track wear* which increased more or less in proportion to the speed of travel. Track wear is the most expensive item among maintenance costs and on sandy or 'cutting' soils, it may be so great that it is not economic to use a crawler tractor at all. Large implements are necessary to use the full power of a crawler in a low gear."

The change over from animal to mechanised cultivation was in most cases done very gradually in U. K. up to 1939. When the second World War broke out this process was accelerated very considerably and tractor population increased by leaps and bounds. In Scotland

alone at the end of the war we had 20,000 tractors working. In order that these machines would be properly maintained, and the ancillary equipment set to get the best results, the Department of Agriculture appointed 12 Machinery Instructors. These Instructors were each given a district and their duties comprised of giving talks on Tractors and Machinery maintenance, how to set and work the various implements, and visit the various farms and give practical advice.

The change over in Ceylon from animal to machine has been revolutionary. As a result of this breakages have been very frequent and cost of keeping the machinery in working order has been high. This, together with the mediocre standard of work done has been due to the inexperience of the officers and tractor operators.

It is comparatively easy to drive a tractor but no driver can look after his tractor properly unless he knows something of the way it works. The modern tractor is a sturdy machine designed to stand continuous hard work but it contains a certain amount of complicated mechanism.

Again let us say a tractor works 200 days per year, making a total of 1,500 hours' work. This would be equivalent to a car which covers a 45,000 mile annually (which mileage is very uncommon for most cars) whereas the car is running on roads the tractors spend all its life in the field working under the worst conditions having to contend with dust which gets into the moving parts, and also in muddy conditions which puts extra strain on the engine, and transmission.

It will be seen therefore that a tractor should get much more attention than a car but unfortunately this is not the case. The point I would like to stress here is that while it is easy to drive a tractor, the operator should realise that he is in charge of a valuable and in some ways delicate piece of mechanism, and should treat it accordingly.

If through neglect or ignorance a tractor does not get proper maintenance :—

(1) It will never be capable of undertaking its full duty.
(2) Repair bills will be heavy.
(3) It will break down, generally at busy times.
(4) Its working life will be considerably shortened.
(5) Fuel will be wasted.

For this and other reasons which I consider more important : setting of implements and systematic cultivation I consider that we should have a better type of operator than we have at present. I am not alone in this respect having had complaints from other officers. One of these officers asked what I thought of our present tractor operators. My reply was that they knew something about how to drive a tractor, little or nothing about the implement they were pulling behind, and less about what they were trying to do in the field.

To explain this I will describe the most important implements, their uses, and also the type I consider most suitable for conditions in Ceylon.

First of all the plough which besides being the first implement used in cultivation, is in my opinion the most important implement of all as future operations depend almost entirely on whether good or bad ploughing has been done.

The object of ploughing are as follows :—

(1) To obtain a deep seed bed of good texture
(2) To create a mellow soil for the seed
(3) To add humus to the soil by covering trash
(4) To destroy and prevent weeds
(5) To leave the soil in such condition that the air will circulate freely
(6) To leave the soil in such condition that it will retain moisture from the air
(7) To destroy insects as well as their eggs.

I would make special mention of subject Nos. (4) and (6) as these take all other objects into account.

Ploughing should be deep where the type of soil allows this, and where it is not possible to have deep ploughing the land should be broken up with a subsoiler. Deep ploughing properly done (*i.e.*, where the furrow is completely inverted) is the most satisfactory method of weed control. Again deep ploughing and to a greater extent subsoiling would go a long way to preventing soil erosion as the rains would percolate into the soil instead of rushing along the hard pan formed by continuous shallow ploughing, so carrying the top soil away.

There are two main types of ploughs, the moulboard and disc plough. The mouldboard plough is definitely the best implement to accomplish the functions mentioned by me, as this plough when properly adjusted can completely invert the furrow slice covering all top growth, and burying weeds.

The disc plough does not make such a satisfactory job of this, but it holds an advantage in new land where there are stumps. This plough can jump over these whereas the moulboard plough is liable to become entangled resulting in it being broken or twisted. The disc plough also has an advantage in very hard conditions being better able to penetrate the ground than the moulboard type. To set and work the plough properly the operator must have a knowledge of all these points besides having a knowledge of proper system of ploughing a field.

What I recommend is : use the moulboard plough wherever and whenever it can be used, and the disc plough when it is impossible to get good results otherwise.

The plough alone produces a suitable tilth for a seed bed, and other implements are used, after the plough for this purpose. A disc harrow, preferably of the heavy type set at an angle can produce a good seed bed in most soils. There are soils of the clay type which may become cloddy in which the disc harrow does not give the desired results, and a Cambridge roller may be used with more effect. This roller which is comprised of a series of rings has a pulverising action and breaks up the clods fairly effectively. In very severe conditions even this may not be sufficient, and I feel that a cultivator of the Rotary type would be the most successful implement for producing a seed bed where these conditions exist. This would of course be used after ploughing in the ordinary way.

Seed drills and manure distributors although they are of a much more complicated construction than cultivation implements are actually much easier to set correctly.

It is a question of setting them to sow the requisite quantity of seed or manure and they can be cultivated to do this in two ways.

(1) By the stationary method whereby seed is put into the hopper, one wheel jacked up and turned a certain number of times to give an area equivalent to 1/10th of an acre. The seed which is ejected is collected and weighed, and a fairly accurate result can be obtained. The other method is by measuring $\frac{1}{4}$ acre and getting the desired setting by trial and error having a known quantity of seed in the box, and weighing the remainder after $\frac{1}{4}$ acre is sown.

In both instances when this setting has been found the position of the adjusting lever should be carefully noted for future use.

The moving machine requires very little setting, but the reaper builder of which there are six in Ceylon is a more intricate machine. These have not been used here as yet, and the only satisfactory way of explaining their use is by practical demonstration. The most important point to watch when using the machines I have just mentioned is working speed.

The most satisfactory speed recognised by all the leading agriculturists is 3-4 miles per hour, *i.e.*, the speed at which a pair of horses work.

In support of this I would mention that cultivations done by animal draught are still superior to those done by mechanical means, and again mechanised cultivation done at this speed has been proved much better than that done at higher speeds.

In so far as present conditions exist in Ceylon where areas are comparatively small I can see no future for the large tractor.

In my opinion the small tractor with steal and pneumatic wheels with directly attached and hydraulically operated implements, or the small trail-laying tractor will be much more economical and better suited to this country.

Improvements that should be made in the present tractors (and this applies particularly to Ceylon where conditons for tractor operating are very exacting) are comfort, simplicity and manoeuvrability. Better seats, labour saving devices and protection from the weather—these are the main requirements for comforts.

So far as styling is concerned I would suggest that we get away from the present conventional tractor and Agricultural Engineering Firms construct self-propelled implements such as self-propelled plough, seed drill, &c.

The self-propelled combined harvestor is already widely used in America, U. K. and elsewhere with outstanding success. This machine which has the cutter bar directly in front can go straight into a grain field, to cut and thrash the crop in one operation, and only one man is required to operate it.

If the combine harvester can accomplish this task successfully (and it does) there is no reason why other implements should not be made to work in the same fashion. The power unit could be made interchangeable to suit all the machines, and thus save the expense of having a separate engine for each.

In conclusion, and with reference to a remark made by a prominent agriculturist, Mr. Clyde Higgs, at a recent meeting, I say without any hesitation that mechanical cultivation does reduce manpower on a farm. By this I mean that acre for acre more workers are required where the old method is practised.

In Ceylon where there are still large areas to be cultivated labour requirements would of course increase as these areas were brought under cultivation."

QUESTIONS FROM THE HOUSE

Mudaliyar Abulcassim Marikar inquired what was the most suitable type of tractor that he would recommend for flat land country and whether he considered it most economic?

Mr. Matthewson : Any tractor is suitable, flat land being the ideal for tractors.

The cost would be reasonable. It would be economic if the tractor was maintained and handled properly. Cost would range from £200 and upwards, and would be reasonable.

Sir James Obeyasekera : How deep have you got to plough to destroy weeds?

Mr. Matthewson : It is not so much a question of depth as of ploughing properly, *i. e.*, completely inverting the furrow and putting all weeds to the bottom (6 in. minimum).

In winding up the discussion the Chairman expressed his thanks to Mr. Matthewson for his interesting talk which was fully appreciated by the members and remarked that the talk was most instructive.

3. The next item on the agenda was taken up.

Sir Wilfred de Soysa, Chairman of the Sub-Committee on Communal Grazing Grounds, in introducing the Interim Report of the Board's Sub-Committee on Communal Pasture Grounds (*vide* pages 18 and 19 of printed minutes of the 7th Board Meeting—November 26, 1945) made the following comments :—

> "In presenting the report of the sub-committee to formulate a scheme to provide communal grazing lands in the rural areas of the country, as the Chairman of the sub-committee I wish to emphasise on the great importance of setting apart grazing lands of sufficient size separately for (1) Milch Cattle, (2) Cart and Agricultural Cattle, (3) Slaughtering Cattle, and (4) for Buffaloes.

In Ceylon the question of cattle breeding and the provision of grazing lands had not been finally settled, though the question had been taken up on more than one occasion in the old Legislative Council but nothing has so far been finally settled. In order to bring this very important question primarily before the Central Board of Agriculture and then before the general public of the country, I have obtained necessary literature from England. In paragraph 2 of the Interim Report, we have quoted a very important paragraph issued in the publication on the Provision of Animal Fodder. The paragraph is self-explanatory and it needs no further comment. In the third paragraph of the Interim Report you will see that certain lands have been set apart for communal purposes in the villages in areas where Crown Lands are available but in provinces such as the Western and Central Provinces, I do not think such concessions are granted to the village population. We, therefore, should like to see, where there are Crown lands, certain areas should be set apart for village cattle and buffaloes in separate blocks. The sub-committee has already made a rough draft as to the scheme of supervising and controlling the systematic working of communal pasture grounds in different parts of the country, but we welcome any suggestions today which will be very useful in drafting the final Report.

As regards paragraph 4, the members of the sub-committee are in a better position to make recommendations based on the communicated article appearing in the "Ceylon Daily News" of Friday the 9th instant headed "Pasture Cultivation and improvement in Ceylon" being observations and experiments made by Mr. J. E. Senaratne, Assistant in Systematic Botany in the Department of Agriculture. It was a paper read at the meeting of the Cattle Breeders' Association on the 27th ultimo. I recommended that it should be read and carefully studied by all interested in cattle breeding. You will find that the species of grasses and legumes recommended for pasture are put down in the last part of that article. But the experiments on the lines already started by the Department of Agriculture should be continued and experiments may also be undertaken in creating new strains—that will be more nutritious and palatable and crossing varieties of the same species. For your own knowledge and guidance I wish to quote what the writer says in the first part of his paper.

During my visit to Aberystwyth in South Wales in July, 1938, I was impressed with the difference in growth and colour of the newly created and improved strains of certain grasses in comparison with the naturally grown strains of the same species. The improved grass was found to be broader in the blade, heavier in weight and also resulting in a larger quantity of hay.

With regard to paragraph 5 of the report these are necessary points that should be adopted when a system of communal grazing land comes into operation in the country.

Paragraph 6 deals with the building of "Silos" and keeping in stock "Ensilage" or "Silage" to feed the cattle during a drought. Under the same heading I would like to suggest the making of hay by allowing pasture grasses to grow to their full height without being grazed by cattle or mowed down with harrowing machines. Paragraphs 7, 8, 9, 10 and 11 deal with the working of communal pasture grounds which could be amended and elaborated to be included in a draft Ordinance that will probably come before the New Parliament.

On paragraph 12, the sub-committee has requested the Director for a list of communal reserves which I trust is now in hand. Finally in commending this report for discussion, we shall be much obliged if members of the Board would offer constructive criticisms and make necessary suggestions to enable the sub-committee to draft a final report that will be of paramount importance to the future of systematic breeding in Ceylon.

Next in importane to cattle and buffaloes I should like to see pasture grounds set apart in areas where sheep breeding could also be done on a large scale. Once the report on communal pastures is accepted, I hope the Board will elect another sub-committee to deal with sheep breeding in the country.

In reply to Mudaliyar Abulcassim Marikar, Gate Mudaliyar N. Wickramaratne (convener of the sub-committee) said that the sub-committee had not visited any areas yet but would do so before making the final report.

Col. Wright : They should find out where Crown lands are available.

4. NEW RESOLUTIONS

Mr. Marcus Rockwood moved that Mr. Spencer-Schrader's resolution (item 5 (x) on the agenda) be taken up first for discussion, seconded by Mr. C. A. M. de Silva. The members agreeing, Mr. Spencer-Schrader formally moved his resolution which reads as follows :—

> "That this Board recommends to Government the early formation of a separate Division of the Department of Agriculture solely for the purpose of surveying and investigating the various types of indigenous grasses and herbage suitable for pasture, and carrying out whatever steps are necessary to establish improved strains."

In support of his resolution Mr. Spencer-Schrader had sent in the following arguments :—

I think it will be accepted as an indisputable fact that almost all the types of imported pasture grasses have failed to establish themselves in Ceylon. The only success I can think of is *Paspalum dilatatum*. There may be a very few others that have adapted themselves to a few localities, but taken as a whole, exotic grasses have not been a success. The hand-feeding of cattle with such grasses as Guinea, Napier and Mauritius is not economical. In the first place the cost of cultivation is heavy ; in the second, it is not possible, where hand-feeding is practised, to give a cow a sufficiency of her staple food-grass. It has been established in New Zealand and elsewhere that on grass alone a cow can yield up to two gallons of milk daily, and concentrates are not necessary. Owing to insufficiency of grass in Ceylon, a minimum is fed and the deficiency is made good in concentrates which are very expensive. Using Guinea grass as fodder, my own experience has been that yields can only be maintained by feeding in addition 2 lbs. of concentrates for maintenance and 3½ lbs. for every gallon of milk produced. On this basis 9 lbs. of concentrates are required, in addition to as much Guinea grass as can be given, to produce two gallons of milk—the quantity that can be produced on grass alone, if one had a sufficiency. The high cost of cultivation of fodder grasses and the substitution of expensive concentrates for the cheaper grass are two of the chief factors which cause the price of milk in Ceylon to be much higher than in most other countries. In times such as the present, when supplies of concentrates are severely restricted, in addition to unduly high prices, milk yields decline by, perhaps, more than 50 per cent. It is probable that an unduly high proportion of concentrates in the ration of cows results in some deterioration in their offspring. I believe I am right in stating that, except in the case of the Government establishments which are run more as models than as commercial concerns, there have been very few instances where the daughters of good dairy cows have been better than, or even as good as, their dames. In my own experience, which extends for over thirty years, I have to confess that I cannot recall many cases due purely to breeding. When I had the pleasure of discussing this point with Dr. Norman Wright, he expressed his conviction that feeding contributed no less than 60 per cent. towards the improvement of stock. I would emphasise that both a cheap supply of milk and improvement of livestock depend, in great measure, on an adequacy of grass ; that the cultivation of grasses for hand-feeding cannot produce a sufficiency ; and that imported varieties of pasture grasses have not been a success. It would therefore seem that, if our livestock are to be improved and the price of milk brought down to a level at which the poorer people can obtain a supply, we have no alternative but to turn to our local grasses and attempt to improve them.

It is a fact that the work done at Aberystwyth by Sir George Stapledon and his assistant with the local British grasses resulted in almost a revolution in the methods of British farming, chiefly through the storage of abundant fertility in the soil under pastures, and that the greatest advance was achieved only when imported varieties were scrapped in favour of the indigenous. New Zealand was another country where exotic grasses were proved to be inferior to the indigenous. I am afraid, that we, in Ceylon, know very little about our local grasses, except their botanical names. Since so much depends on the improvement of pasture, I would urge that the time has come when it is vital for the welfare of the country that a special division of the Department of Agriculture be established solely for the purpose of studying our indigenous grasses with a view to improving them.

Mr. Marcus Rockwood seconded the resolution.

Gate Mudaliyar N. Wickramaratne said he was opposed to the appointment of a special officer for the work proposed on the ground that the expenditure was unwarranted, especially considering the work being done by Mr. J. E. Senaratne, Assistant in Systematic Botany.

After a brief discussion the Chairman said he took it that the Board agreed that more intensive work should be done on pasture grasses.

The motion was carried unanimously.

5. Gate Mudaliyar N. Wickramaratne then moved the following resolution standing in his name :—

> "That this Board requests the authorities to stop all slaughter of country cattle until the publication of full census figures as regards the availability of cattle in this country."

In support of the resolution he had sent the following arguments :—

"There is a danger of losing a very large percentage of our cattle if it is allowed to continue the present method of slaughter. This country is in need of more and more cattle for the growing population, for agricultural work and cattle products as milk, ghee and curd for the food of the people. If allowed the present rate of slaughter of cattle to be continued we will find the same fate of the man who killed the goose that laid the golden egg. We must be satisfied with what we get from Australia and our local production of pigs, and goats. 5,000 cwt. of meat from Australia can be shipped to satisfy those who seek for animal flesh."

Mr. Marcus S. Rockwood seconded the resolution.

Poholiadde Dissawe and Mudaliyar Abulcassim Marikar suggested the following amend ments which was accepted by Mudaliyar N. Wickramaratne.

> "That this Board request the authorities to stop slaughter of country cattle other than those found useless for Agricultural purposes and for purposes of milk production."

Gate Mudaliyar N. Wickramaratne said that he got the idea from the activities of the C. D. C's officers who went about collecting country cattle for slaughter. That would lead to a great scarcity of milk cattle and cattle for agricultural purposes. Already the custom of treating guests with curd and honey in the Southern Provinces was dying out.

Mr. Marcus Rockwood in agreeing with Mudaliyar Wickramaratne said that if they were going to conserve cattle for milk they should persuade the vedarala that milk caused no harm to people suffering from coughs, colds, fevers, &c. It was this taboo which prevented the drinking of milk by the masses.

Mr. Rockwood added that lack of water due to the drought was going to cause the greatest slaughter and suggested that surplus cattle from the Southern Province and the Sanctuary should be driven to areas where there was water and no cattle.

Mr. Spencer-Schrader: Who would decide which cattle were fit for agricultural work and which for milk production? Where Medical Officers of Health passed cattle for slaughter, they were concerned only with the consideration whether or not the meat was fit for consumption.

Mudaliyar Abulcassim Marikar said that the Government Agent would be the proper authority.

Madawala Dissawe said that the sale of buffaloes to Colombo was causing a scarcity of cattle for ploughing in the Wanni. He suggested that the slaughter of buffaloes should be prohibited for at least 25 to 30 years; otherwise he said the time would come when paddy cultivation would not be possible for want of plough-cattle.

Dissawe T. B. Poholiyadde said that the buffaloes that were sold for slaughter were semi-wild, which fact circumvented the prohibition of such disposal. Buffaloes went semi-wild when owners who had more animals than they could maintain turned them loose. As no cultivator would buy them in that state because they required training for a year before they were fit for work, the animals were sold for slaughter. By the time they reached Colombo, however, they were somewhat tame and a check before they were actually taken for slaughter would prevent the destruction of useful animals.

The Chairman said that the question of buffaloes was a serious one. The Government Agent, North-Central Province, had suggested that these buffaloes should be sent to the Government farms and the Department of Agriculture had undertaken to do everything possible in this matter.

The amended resolution was put to the House and was carried.

6. Gate Mudaliyar N. Wickramaratne moved the following resolution :—

> "That this Board is of opinion that the time has come to adjust more intensive methods of paddy cultivation under a uniform system of Vel Vidanes. Cultivation officer or Agricultural Instructors with an Administrative Officer possessing Scientific knowledge of the soils and cultural and manurial methods who could also act as a Liaison Officer between the Government Agents and the Department of Agriculture as such an arrangement would give far more satisfactory results to all concerned in the matter of Production of Paddy."

In support of his resolution Gate Mudaliyar Wickramaratne had sent in the following arguments :—

"I wish to state that the recent publication of statistics of Internal Purchase Scheme of paddy giving the areas under paddy during Yala and Maha seasons impressed those who are concerned with the cultivation of paddy of the efforts now being made by the authorities in the production of paddy in the Island. These statistics also revealed that the efforts would give far more satisfactory results if a uniform system is adopted in the operation of intensive methods of cultivation. Such a system would give a field commensurate with the expense and efforts of both Government and cultivator. From observations made in various parts of the country in the matter of paddy cultivation it has been my unfortunate experience that methods employed to increase the yield is haphazard and there is much room for improvement.

Mr. Marcus Rockwood seconded the resolution.

Mudaliyar Wickramaratne said that according to the latest published figure there were 850,000 acres under paddy. A proper yield from this extent would be sufficient to meet

the demands of the country. The possibilities in this direction were demonstrated by the story of the Nikaweratiya man who obtained 104 bushels of paddy from half an acre. Paddy should be completely under the Department of Agriculture and be supervised by agricultural instructors. The industry was languishing because it was not systematically organized.

Madawala Dissawe said that the North-Central and North-Western Provinces being sparsely populated areas, it was not possible for one man to cultivate ten to fifteen acres. He himself cultivated one acre and got 78 bushels, because that was the only extent he worked. Normally the villager with big fields did two ploughings and with the weeds still in the field sowed the seed and went away. He did it as a sort of rajakariya.

Poholiyadde Dissawe said he too was aware that in the North-Central Province the problem was one of manpower. Where a man stuck to his one acre and adopted improved methods he did benefit.

He said that in the North-Central Province, with the organization set apart by the Government Agent, Mr. Aluvihare, the purpose sought by this resolution had been achieved, and it was only necessary to extend the organization to other provinces.

Mudaliyar Abulcassim Marikar said that Government had done everything financially and otherwise to help paddy cultivation. There were subsidies given liberally for transplanting, manuring, &c. He did not know what the mover wanted.

The motion was put to the House and was carried.

7. ANY OTHER BUSINESS

At 1.30 P.M. the meeting adjourned for lunch. When the meeting was resumed at 3 P.M. business was deferred as there was no quorum and consequently resolutions (iii.), (iv.), (v.), (vi.), (vii.), (viii.), and (ix.) of the agenda were not taken up.

It was agreed that the next meeting of the Executive Committee of the Board of Agriculture take place on November 9, 1946, and that the 11th meeting of the Board will take place on November 18, 1946, at 9 A.M.

The meeting terminated at 4.30 P.M. after tea, provided by the Chairman.

M. J. PERERA,
Secretary, Central Board of Agriculture.

Peradeniya, August 27, 1946.

COCONUT RESEARCH SCHEME

MINUTES OF THE EIGHTY-THIRD MEETING OF THE BOARD OF MANAGEMENT, COCONUT RESEARCH SCHEME, HELD AT 10.30 A.M. ON MONDAY, NOVEMBER 4, 1946, AT BANDIRIPPUWA ESTATE, LUNUWILA.

BOARD OF MANAGEMENT

Present.—Mr. L. J. de S. Seneviratne, C.C.S. (Chairman), Acting Director of Agriculture, Mr. C. A. M. de Silva, Chairman, L.C. P.A., Mr. Stanley Dias, Representing the L.C. P.A., Mr. Vernon Rajapakse, Representing the L.C. P.A., Mr. E. Muttukumaru, Representing the P.A. of Ceylon, Mr. A. Pearson, Representing the P.A. of Ceylon, Mr. Graham Panditteseker a, J.P., U.M., Representing the Small Holders, Mr. D. D. Karunaratne, J.P., Representing the Small Holders, Mr. Thomas Amarasuriya, M.S.C., Representing the State Council, Dr. Reginald Child, Director, Mr. S. C. Kahawita, Secretary-Accountant.

Apologies for absence were received from Mr. H. E. Peries, C.C.S., the Acting Deputy Financial Secretary, and Mr. J. Tyagaraja, M.S.C.

1. MINUTES

The minutes of the previous meeting held on September 30, 1946, which had been circulated (C. P. No. 620) were confirmed.

2. STAFF

Proposed appointment of a Field Assistant and Nursery Attendant to Geneticist.—The Board authorised the Director to advertise and make the appointment of a Field Assistant and Nursery Attendant to the Department of Genetics. A supplementary vote of Rs. 900 under personal emoluments was also approved.

3. ESTATES

(*a*) *Minutes of the Estate Sub-Committee.*—The Board approved of the proposals contained in the minutes of the meeting held on August 30, 1946, which had been circulated (C. P. No. 613) subject to the amendment to paragraph 5. Labour (*a*) to read as 'that temporary cottages should be replaced by permanent structures at the rate of two (one single and one double roomed) per year.

(*b*) Mr. Stanley Dias was elected as a member of the Estate Sub-Committee in place of Mr. E. Muttukumaru who resigned from the Sub-Committee due to pressure of other work.

(*c*) & (*d*) *V. A.'s and Progress Reports of the Estates.*—The Board made the following decisions :—

(1) The Estate Sub-Committee should meet immediately after the V. A.'s visit and consider the V. A.'s report.

(2) The Estate Sub-Committee should take up the matter of the Superintendent's Bungalow at Ratmalagara Estate at its next meeting and make its recommendations.

(3) The Estate Sub-Committee should consider the under planting of Bandirippuwa Estate as recommended by the V. A. in his latest report.

4. FINANCE

(*a*) The Statements of Receipts and Payments for the 2nd and 3rd Quarters were approved.

(*b*) *Price of Seedlings and Seednuts.*—After much discussion, the Board gave retrospective sanction to the following prices for planting material as stated in C. P. No. 624, paragraph 7 :—

Seednuts Grade I	..	20 cents per nut
Seednuts Grade II	..	15 cents per nut
Seedlings Grade I	..	60 cents per seedling
Seedling Grade II	..	40 cents per seedling

The Board also approved the payment of 10 cents per seednut to estate owners as from October 1, 1946.

5. ANY OTHER BUSINESS

(1) The Board decided that the Director should expand his talk to the the L.C.P.A. given on July 18, 1946, without making it too technical and circulate it to the Board.

(2) The Chairman read a letter he had received from the Principal of the Farm School Peradeniya, wherein the Principal asked for facilities to send some of his final year students to the Coconut Research Scheme for training before leaving the school. The Board was in sympathy with the request and the Chairman was authorised as the Director of Agriculture to take up the matter with the Director of the Coconut Research Scheme.

By Order,
S. C. KAHAWITA,
Secretary,
Coconut Research Scheme.

COCONUT RESEARCH SCHEME.

MINUTES OF THE EIGHTY-FIFTH MEETING OF THE BOARD OF MANAGEMENT, COCONUT RESEARCH SCHEME, HELD AT 2.30 P.M. ON MONDAY, MARCH 3, 1947, IN ROOM NO. 202, NEW SECRETARIAT, COLOMBO

BOARD OF MANAGEMENT

Present.—Mr. L. J. de S. Seneviratne, C.C.S. (Chairman), Acting Director of Agriculture, Mr. H. E. Peries, C.C.S., Acting Deputy Financial Secretary, Mr. C. A. M. de Silva (Chairman, L.C.P.A.), Mr. Vernon Rajapakse, Mr. E. Muttukumaru, Col. W. G. Mack, O.B.E., E.D., Mr. D. D. Karunaratne, J.P., Mr. G. Panditteseкera, J.P., U.M., Mr. T. Amarasuriya, M.S.C., Dr. R. Child, Director, C.R.S., Mr. S. C. Kahawita, Secretary-Accountant.

1. MINUTES

The minutes of the previous meeting held on January 6, 1947, which had been circulated were confirmed.

2. BOARD OF MANAGEMENT

The Chairman welcomed Col. W. G. Mack, O.B.E., E.D., who had been nominated by the P.A. of Ceylon as their representative on the Board of Management during the absence of Mr. A. Pearson on furlough.

3. SUB-COMMITTEES

For Staff Matters.—The following recommendation of this Sub-Committee which stood postponed from the 84th meeting of the Board were considered :

(i.) *Provident Fund.*—As recommended by the Sub-Committee for Staff Matters, at its 1st Meeting held on August 21, 1946, the Board resolved that the rate of Members' Contributions and Scheme's Bonus each be increased from 7½ per cent. of basic salary to 10 per cent. with effect from January 1, 1947.

(ii.) *Field Assistants.*—After discussion, the Board decided to revert to the proposals outlined in the Memorandum on the Future of the Scheme (page 16). It was resolved that there should be one Senior Field Assistant in each of the Divisions of Genetics and Soils. The salary scale of these posts was fixed at Rs. 96—12 of Rs. 9 to Rs. 204 *per mensem*... The qualification of the Diploma of the School of Agriculture, Peradeniya, would as a rule be insisted on ; and the posts could be filled either by recruitment or by promotion of suitably qualified candidates from the Field Staff. The Director was authorised to make suitable appointments, any promotions of Field Assistants now in service to be with effect from January 1, 1947.

4. STAFF

Botanist.—The Board decided that the Director be authorised to write to two candidates in India requesting them to present themselves for an interview with the Chairman and the Director on a date to be fixed by the Director. They were to be paid their travelling expenses according to current rates.

The Director was also authorised to obtain confidential reports on the suitability of these two candidates for the post of Botanist from the Head of the Institutes in which they are now working.

Field Attendant to Soil Chemist.—This appointment was approved as from January 1, 1947.

5. RESEARCH

Proposed experiment on methods of Fertilizer applications.

The Board unanimously accepted the offer of Messrs. H. L. de Mel made in their letter No. 27/46 of February 19, 1946. The Soil Chemist was authorised to conduct an experiment at Marandawila Estate, Bingiriya, on the methods of fertilizer application as decided at the 78th meeting of the Board.

6. FINANCE

(1) *Planting Material.*—Increased prices as recommended in C. P. 637, which had been circulated to the Board were approved as follows :—

Grade I Seednuts	..	25 cents each
Grade II Seednuts	..	18 cents each
Grade I Seedlings	..	75 cents each
Grade II Seedlings	..	50 cents each

Other prices varieties &c., unchanged.

The rates payable to Co-operating Estates for seednuts supplied to be increased from 10 cents to 13 cents each as from February 1, 1947.

(2) *All-Ceylon Coconut Conference.*—The payment of Rs. 250 towards the expenses of the proposed All-Ceylon Coconut Conference was approved subject to the ruling of the Attorney-General that such a contribution is not *ultra vires.*

7. ESTATES

(*a*) *The monthly Reports* on the two Estates which had been circulated (C. P. 636) were approved.

(*b*) *The Visiting Agent's Reports* (C. P. 638 and 638A) were referred to the Estates Sub-Committee.

8. ANY OTHER BUSINESS

(*a*) Mr. E. Muttukumaru moved that the Coconut Research Scheme should organise periodical Conferences on matters relating to the Coconut Industry on the lines of the conferences held by the Tea and Rubber Research Institutes.

This motion was accepted in principle by the Board.

(*b*) It was decided to hold the next meeting of the Board in Colombo on April 28, 1947, at 2.30 P.M.

The meeting terminated at 4.35 P.M. with a vote of thanks proposed by Col. W. G. Mack, O.B.E., E.D.

MINUTES OF THE MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON HELD AT THE ROOMS OF THE CEYLON TEA PROPAGANDA BOARD, PRINCE STREET, COLOMBO, ON MONDAY, FEBRUARY 17, 1947, at 2.30 P.M.

Present.—The Chairman, Planters' Association of Ceylon (Mr. R. Singleton Salmon), Acting Chairman; Mr. H. E. Peries, C.C.S. (representing the Financial Secretary); The Director of Agriculture (Mr. L. J. de S. Seneviratne, C.C.S.); The Chairman, Ceylon Estates Proprietary Association (Mr. C. A. Meakin); Messrs. W. H. Attfield, S. Vytilingam, M.S.C., F. Amarasuriya, H. de T. Wilkinson Kay, E. G. Groves, F. A. Bond, H. S. Hurst and Dr. C. H. Gadd (Acting Director and Secretary.)

1. The Notice convening the Meeting was read.
2. The Minutes of the Meeting held on December 13, 1946, were confirmed.

After a short discussion of a suggestion by Mr. Wilkinson Kay that the Minutes should contain fuller reports of discussions, it was decided that no alteration be made at present, and that the subject be reconsidered after the Planters' Association Headquarters have moved to Colombo when arrangements might possibly be made for a stenographer to attend the Meetings.

3. MEMBERSHIP OF THE BOARD AND COMMITTEES

Reported that Mr. W. H. Gourlay had been appointed by the Ceylon Estates Proprietary Association to act for their representative Mr. J. C. Kelly during his absence on leave.

4. FINANCE

General Finance.—Reported that the Acting Director had prepared a report on the financial position showing the need for an increase in the tea cess, and had forwarded it to the Minister of Agriculture and Lands in response to his request of January 13. In that report the need for a 50 per cent. increase in the cess was shown, *i.e.*, an increase of 7 cents, raising it from 14 to 21 cents per 100 lb. tea exported.

The Acting Director was instructed to send a copy of the report to the Director of Agriculture.

Audit Fees.—Reported that in a letter dated January 5, Messrs. Ford, Rhodes, Thornton & Co. had asked for increased audit fees for 1946, and future audits. The Chairman stated that the fees had remained unchanged for many years although salaries had increased to more than double pre-war rates.

After some discussion Mr. Hurst proposed and Mr. Bond seconded that the new rates be approved. The motion was carried *nem. con.*

Insurance.—The Board approved the recommendation of the Estate and Experimental Sub-Committee to make the following alterations to the insured values in the Estate Policy:—

(1) *Tea Stocks.*—Increase from Rs. 20,000 to Rs. 26,000. Extra cover to be obtained should stocks or tea values increase.

(2) *Factory Building.*—The cost of the Sprinkler system less outside works to be added to the present value.

(3) *Packing Materials.*—Reduce from Rs. 20,000 to Rs. 10,000.

(4) *Firewood.*—Reduce from Rs. 2,000 to Rs. 750.

(5) *Rice and Food Stocks.*—Reduce from Rs. 12,000 to Rs. 8,000.

(6) *Dispensary Stocks.*—Eliminate as the stocks are no longer held in the factory building.

SUPPLEMENTARY ESTIMATES

(i.) *Research Capital—Water Scheme.*—The Chairman stated that in order to provide a satisfactory water service to the site of the 3 bungalows approved at the last Meeting, an alteration to the existing sch eme and the provision of about 4,500 feet of 2 inch piping would be necessary.

A vote of Rs. 12,000 was sanctioned for the work.

(ii.) *Research Revenue—Replacements in Senior Staff Bungalows.*—A vote of Rs. 3,000 was sanctioned for necessary replacements and repairs of floor covers and furniture, as approved at the last Meeting.

5. SENIOR STAFF

Biochemist.—Reported that Mr. J. Lamb returned to duty in Ceylon on January 13, 1947. While on leave Mr. Lamb had spent considerable time with blenders, other trade interests and engineering firms discussing matters in connection with his work on tea manufacture.

The Board wished to place on record their appreciation of Mr. Lamb's work while on leave.

Acting Director.—The Board sanctioned the application by the Acting Director (Dr. Gadd) for 8 months' leave out of Ceylon, to count from his sailing, probably in May.

The Board appointed Dr. T. Eden to act as Director during any intervals that may occur between Dr. Gadd's departure and the Director's (Dr. Norris) return from leave.

Reported that Dr. F. R. Tubbs would take charge of the Entomological Division during Dr. Gadd's absence on leave.

6. JUNIOR STAFF

Dr. H. B. Sreerangachar.—Reported that Dr. Sreerangachar, Research Assistant to the Biochemist, had resigned to take up an appointment with Sarabai Chemicals, Ltd., India, and that his services would terminate on March 5th.

Mr. M. H. E. Koch.—Reported that Mr. Koch's services as Technical Assistant to the Physiologist terminated on February 7th.

7. BOARD MEETINGS

The date of the August Meeting was altered from the 18th to the 19th. It was also decided to hold the Meeting of December 8th at St. Coombs. The Meetings of May 19 and August 19 would be held in Colombo.

8. MINUTES OF THE ESTATE AND EXPERIMENTAL SUB-COMMITTEE OF FEBRUARY 18, 1947

Visiting Agent's Reports.—The Board accepted the Committee's recommendation that no change should be made in the form of the Visiting Agent's Reports. The work of the Committee was appreciated.

Agricultural Policy.—The Director of Agriculture said that he was very interested in the remarks under agricultural policy and wished to know whether the measures represented practices prevalent in plantations in the area or were adopted after due experimentation. He also said that it would be very useful for new members if a summary were prepared showing a classification on the above lines.

In the case of item (*f*), Soil Erosion, he will be glad to be informed to what extent the measures are successful in preventing soil erosion and in maintaining soil fertility; and whether, at least, accurate observations had been kept in order to give an authoritative answer on these points.

Manufacture.—The Board approved the recommendations concerning experiments to determine whether a rubber roller can be adopted for use in tea manufacture and approved the purchase of a suitable roller should the results of the experiments warrant it. The purchase of a small hand-machine for the manufacture of small quantities of clonal leaf for testing was sanctioned.

Freezing Process.—The Board agreed that investigational work on this process should cease and that Messrs. Lyons be approached regarding exchange of research information.

Legge Process.—Approval was given for the study of this process to be included in the research programme at St. Coombs.

CONFERENCE

In reply to Mr. Vytilingam, the Acting Director stated that judging from the acceptances already received a large attendance was assured.

The Meeting then concluded with a vote of thanks to the Chair.

Tea Research Institute of Ceylon,
St. Coombs,
Talawakelle, March 24, 1947.

C. H. GADD,
Acting Secretary.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED JANUARY 31, 1947

Province	Disease	Cases up to date since Jan. 1, 1946	Fresh cases during the month	Deaths	Recoveries	Balance ill	No. shot
Western Province	Foot-and-mouth	20	20	—	8	12	—
Colombo Municipality	Foot-and-mouth	2	2	—	2	—	—
	Piroplasmosis	2	2	2	—	—	—
	Rabies	8	8	8	—	—	—
Cattle Quarantine Station	Foot-and-mouth	9	9	—	9	—	—
	Anthrax	8	8	8	—	—	—
Northern Province	Foot-and-mouth	180	180	—	101	79	—
North-Western Province	Rabies	1	1	1	—	—	—
	Goat mange	26	26	14	—	12	—
North-Central Province	Foot-and-mouth	44	44	—	4	40	—
Sabaragamuwa Province	Nil	—	—	—	—	—	—
Southern Province	Nil	—	—	—	—	—	—
Eastern Province	Foot-and-mouth	2,565	2,565	135	620	1,810	—
Central Province	Foot-and-mouth	131	131	1	47	83	—
	Anthrax	3	3	3	—	—	—
Uva Province	Foot-and-mouth	1,270	1,270	18	589	663	—

T. M. Z. MAHAMOOTH,
Acting Deputy Director (Animal Husbandry), and
Government Veterinary Surgeon.

Peradeniya, March 1, 1947.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED FEBRUARY 28, 1947

Province	Disease	Fresh cases during the month	Cases up to date since Jan. 1, 1947	Deaths	Recoveries	Balance ill	No. shot
Western Province	Foot-and-mouth	58	73	8	42	28	—
Colombo Municipality	Foot-and-mouth	1	3	—	3	—	—
	Rabies	15	23	23	—	—	—
	Piroplamosis	—	2	2	—	—	—
Colombo Cattle Quarantine Station	Foot-and-mouth	—	9	—	9	—	—
	Anthrax	8	16	16	—	—	—
Northern Province	Foot-and-mouth	55	235	12	155	68	—
North-Western Province	Rabies	—	1	1	—	—	—
	Mange (goats)	—	26	14	—	12	—
	Foot-and-mouth	22	22	17	—	5	—
North-Central Province	Foot-and-mouth	94	138	—	84	54	—
Sabaragamuwa Province		—	—	—	—	—	—
Eastern Province	Foot-and-mouth	132	2,697	135	2,425	137	—
Central Province	Foot-and-mouth	185	316	4	137	175	—
	Anthrax	—	3	3	—	—	—
Uva Province	Foot-and-mouth	426	1,696	34	1,347	315	—

Peradeniya, April 8, 1946.

T. M. Z. MAHAMOOTH,
Deputy Director (Animal Husbandry), and
Government Veterinary Surgeon.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED MARCH 31, 1947

Province	Disease	Fresh cases during the month	Cases up to date since Jan. 1, 1947	Deaths	Recoveries	Balance ill	No. shot
Western Province	Foot-and-mouth	114	192	16	158	18	—
Colombo Municipality	Piroplasmosis	—	2	2	—	—	—
	Foot-and mouth	—	—	3	3	—	—
	Tuberculosis	1	1	1	—	—	—
	Rabies	19	42	42	—	—	—
Cattle Quarantine Station	Foot-and mouth	9	18	—	18	—	—
	Anthrax	5	21	21	—	—	—
Northern Province	Foot-and mouth	12	247	12	223	12	—
North-Western Province	Rabies	—	1	1	—	—	—
	Mange	—	26	14	—	12	—
	Foot-and mouth	2	24	22	2	—	—
North-Central Province	Foot-and-mouth	3	141	—	138	3	—
Sabaragamuwa Province	Nil	—	—	—	—	—	—
Southern Province	Foot-and-mouth	109	109	—	27	82	—
	Rabies	4	4	1	—	—	3
Eastern Province	Foot-and mouth	85	2 782	135	2 562	85	—
Central Province	Foot-and-mouth	638	954	7	552	395	—
	Anthrax	—	3	3	—	—	—
	Rabies	2	2	—	—	—	2
Uva Province	Foot-and-mouth	90	1,786	54	1,624	108	—

T. M. Z. MAHAMOOTH,
Acting Deputy Director (Animal Husbandry), and
Government Veterinary Surgeon.

Peradeniya, May 18, 1947.

3—J. N. A 72805 (7/47)

METEOROLOGICAL REPORT, JANUARY, 1947

STATION	TEMPERATURE				HUMIDITY		Amount of Cloud	RAINFALL		
	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night [from Minimum]		Amount	No. of Rainy Days	Offset
	°	°	°	°	%	%		Ins.		Ins.
Agalawatta	87·4	—0·7	70·8	+0·3	85	97	7·0	12·45	18	+ 5·17
Anuradhapura	84·8	+1·6	72·3	+3·3	80	95	5·8	8·51	12	+ 2·71
Badulla	77·7	+1·4	65·7	+2·2	84	95	6·5	9·56	17	— 0·76
Batticaloa	82·3	+0·8	75·3	+1·9	82	88	7·5	11·88	15	— 1·00
Colombo	85·4	—1·1	72·9	+1·2	84	98	6·7	3·13	13	— 0·83
Diyatalawa	72·4	+0·5	59·5	+2·2	86	97	7·8	6·63	18	— 0·01
Galle	84·6	+0·7	73·7	+0·8	86	95	5·2	6·44	12	+ 2·56
Hakgala	67·4	+0·3	53·9	+2·7	88	91	8·2	11·92	15	— 0·51
Hambantota	84·4	—0·6	73·7	+1·2	84	93	7·4	2·50	8	— 1·50
Jaffna	83·7	+0·7	73·3	+1·3	78	90	4·9	3·52	12	— 0·89
Kandy	83·4	—0·2	68·4	+1·5	78	90	6·2	10·40	10	+ 4·06
Kurunegala	86·7	+0·2	72·0	+2·4	77	93	6·4	10·00	12	+ 4·89
Lunuwila	86·0	—1·8	72·8	+2·0	82	95	6·0	5·79	11	+ 2·20
Mannar	83·4	0	75·5	+1·4	82	86	6·1	9·95	11	+ 6·11
Nuwara Eliya	67·2	—0·7	50·3	+4·0	80	87	8·0	7·04	15	+ 0·08
Puttalam	85·3	—0·2	72·2	+2·4	82	95	6·1	6·01	10	+ 2·58
Ratnapura	87·1	—2·4	72·5	+1·5	80	93	7·2	13·01	18	+ 6·75
Talawakele	74·5	+0·3	56·8	+1·6	76	85	5·8	3·71	15	— 0·16
Trincomalee	81·7	+1·2	75·4	+0·3	82	88	6·8	17·07	12	+ 8·76

Rainfall in January was above average over the greater part of the Island. Deficits of 2–5 inches occurred in a few places, in a small coastal area south of Batticaloa on the east coast (*e.g.* Thumpenkeni, —4·82 inches), in the Maradankadawala—Minneriya—Pelwehera area to the north of the Central Province (*e.g.* Pelwehera, —4·17 inches), and in the Lugal Oya—Ledgerwatta—Bandara Eliya area in the Province of Uva (*e.g.* Bandara Eliya, —4·07 inches). Largest excesses include Horaborawewa 17·41 inches, Kobonella 16·33 inches and Deanstone 15·32 inches, all in the Knuckles Range. Stations recording 5–10 inches above their respective averages were scattered over a wide area in the Central, North-Western and Sabaragamuwa Provinces. Similar excesses were also found in the south-western corner of the Island, and in the Trincomalee-Allai area.

The distribution of the heavier rainfall was typically north-east monsoonal, and monthly totals of 30 inches and above were confined to the eastern and north-eastern slopes of the main hill ranges, and include St. Martin's (Lower) 43·62 inches, St. Martin's (Upper) 42·41 inches, Deanstone 39·87 inches, Kobonella 39·47 inches and Korahana 37·90 inches. Lowest totals for the month, of the order of 2–3 inches, occurred along the south-east coast.

There were altogether 76 daily falls of 5 inches and above, the largest being 11·52 inches at Illuktenna, 11·50 inches at St. Martin's (Lower), 11·25 inches at Dooroomadella and 11·00 inches at Korahana, all on the 11th, on which day more than two-thirds of these falls occurred.

There was an appreciable amount of well-distributed rainfall up to the 13th, of the monsoonal type in the north and east, and of mainly local thunderstorm origin elsewhere. During the last three days of this period the rain was particularly widespread and heavy. From the 14th to 25th, there was a spell of practically rainless weather. Rain was experienced again during the last few days of the month.

Temperatures were on the whole above average. The highest recorded shade temperature was 92·8° at Ratnapura on the 25th, while the lowest air temperature was 41·9° at Nuwara Eliya on the 17th. Humidities were above average, and cloud amounts generally in excess. The prevailing wind direction was north-easterly.

D. T. E. DASSANAYAKE,
Superintendent Observatory.

METEOROLOGICAL REPORT, FEBRUARY, 1947

STATION	TEMPERATURE				HUMIDITY		Amount of Cloud	RAINFALL		
	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night (from Minimum)		Amount	No. of Rainy Days	Offset
	°	°	°	°	%	%		Ins.		Ins.
Agalawatta	90·6	+0·8	70·0	—1·2	75	97	5·7	6·02	4	+ 0·53
Anuradhapura	86·2	—0·7	70·2	+0·5	71	93	4·3	2·71	8	+ 0·99
Badulla	79·5	+0·5	62·5	—0·8	77	97	4·8	0·99	4	— 2·18
Batticaloa	83·3	+0·4	73·5	—0·4	78	90	6·3	1·14	7	— 3.07
Colombo	87·4	+0·2	71·9	—0·4	76	90	4·0	1·66	2	— 0·94
Diyatalawa	73·8	—0·9	56·9	0	76	91	5·8	0·53	4	— 1·84
Galle	86·4	+1·1	73.6	—0·1	79	88	4·0	3·89	4	+ 0·60
Hakgala	69·4	—0·7	49·9	—1·2	78	93	5·8	1·26	4	— 2·81
Hambantota	85·7	—0·3	72·8	—0·3	79	88	5·0	0·38	2	— 1·08
Jaffna	84·6	—1·0	71·3	—1·1	74	90	4·4	4·01	5	+ 2·55
Kandy	87·1	+0·5	66·2	—1·0	68	89	4·2	0·58	4	— 1·73
Kurunegala	89·7	—0·3	69·8	0	66	87	4·2	1·10	4	— 0·89
Lunuwila	88·4	—1·6	71·2	—0·3	74	93	3·5	4·38	4	+ 2·84
Mannar	84·7	—1·6	73·8	0	74	86	3·8	1·26	3	— 0·44
Nuwara Eliya	68·8	—0·8	43·8	—1·3	72	85	5·5	0·49	3	— 1·50
Puttalam	86·7	—1·7	70·4	0	75	90	4·2	4·11	3	+ 2·74
Ratnapura	91·3	—0·3	71·6	+0.2	68	90	5·1	1·34	6	— 3·96
Talawakele	76·2	—0·2	52·5	—2·3	68	84	4·2	0·48	3	— 1·49
Trincomalee	82·3	—0·2	75·0	—0·9	78	82	5·1	7·58	7	+ 4·93

There were only four days in February with any appreciable rain, 19th and 20th, 27th and 28th. Of these rainfall on the first two days was widespread, and considerably heavy in places, a number of stations recording falls over 3 inches. Kanana Estate, Bentota recorded a torrential downpour of eight inches on the 20th a very rare occurrence for any station in February. It is a February record for Kanana Estate which has observations extending over 36 years. Rainfall on the last two days of the month was chiefly confined to the northern half of the Island, and was most intense in the neighbourhood of Mullaittivu, Kanukkeni recording 9.75 inches on the 28th, also a February record for this station with 36 years observations.

Rainfall for the month was above normal in the north and north-east, and in parts of western, north-western and north-central provinces, and generally below normal elsewhere. The largest excesses were 12.56 inches at Kanukkeni, 9.08 inches at Mullaittivu and 8.61 inches at Kankesanturai. Larger deficits, of the order of 2 to 5 inches, occurred among and around the central hills, the highest being 9.84 inches at Hendon Estate 8.64 inches at St. Martin's (Upper) Estate and 8.61 inches at St. Martin's (Lower) Estate, all on the north-eastern slopes of the hills. Deficits of 2–5 inches also occurred in parts of western and southern mid-country, and in an east-coastal strip extending from Batticaloa southwards.

Monthly totals generally ranged from 0 to 2 or 2 to 5 inches, but in the north and the east and in some places in the south-western low country there were several totals which exceeded 5 inches. The highest were 14.18 inches at Kanukkeni, 10.41 inches at Mullaittivu, 10.31 inches at Palampodda and 9.69 inches at Kankesanturai. Less than half a dozen stations sent in nil returns.

There were only six daily falls of five inches or over for the month, the highest being 9.75 inches at Kunukkeni on the 28th, and 8.00 inches at Kanana on the 20th.

Temperatures were generally a little below average. The highest recorded shade temperature was 94.7° at Ratnapura on the 16th, while the lowest air temperature was 33.0° at Nuwara Eliya on the 9th. Humidities were above average by day, and chiefly below average by night. Cloud amounts were generally in excess. Winds were predominantly north-easterly, and above average strength.

D. T. E. DASSANAYAKE,
Superintendent Observatory.

METEOROLOGICAL REPORT, MARCH, 1947

STATION	TEMPERATURE				HUMIDITY		Amount of Cloud	RAINFALL		
	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night (from Minimum)		Amount	No. of Rainy Days	Offset
	°	°	°	°	%	%		Ins.		Ins.
Agalawatta	90·0	+0·1	72·1	—0·1	78	98	6·4	15·40	20	+ 5·27
Anuradhapura	90·6	—0·4	73·2	+1·7	70	93	4·4	3·32	8	— 0·83
Badulla	82·5	+0·3	65·8	+1·6	78	95	4·5	6·23	14	+ 1·18
Batticaloa	85·5	+0·2	75·3	+0·4	80	91	6·2	3·69	8	+ 0·22
Colombo	88·5	+0·6	74·5	+0·5	78	93	5·9	6·45	12	+ 1·79
Diyatalawa	77·1	0	60·3	+2·2	79	91	6·0	6·84	17	+ 1·95
Galle	86·6	+0·4	75·8	+0·8	83	91	5·1	6·18	13	+ 0·87
Hakgala	72·5	—0·5	54·0	+2·1	76	91	6·2	5·36	16	— 0·96
Hambantota	87·4	+0·6	74·8	+0·6	82	93	7·0	5·60	10	+ 2·21
Jaffna	88·2	—0·3	75·7	—0·1	75	88	3·2	3·06	8	+ 1·48
Kandy	88·7	+0·2	69·3	+0·9	75	92	5·4	6·84	15	+ 1·00
Kurunegala	91·3	—1·3	73·2	+1·2	72	93	5·3	10·61	13	+ 4·33
Lunuwila	88·7	—1·1	73·9	—0·5	78	93	4·9	5·36	10	+ 0·05
Mannar	88·1	—1·2	75·4	+0·3	76	88	4·2	4·76	7	+ 2·92
Nuwara Eliya	70·9	+0·1	48·2	+2·0	80	87	6·8	5·10	14	+ 1·01
Puttalam	88·2	—1·5	73·3	+0·4	76	93	3·6	4·60	8	+ 1·52
Ratnapura	91·4	—0·4	73·5	+1·0	76	90	7·1	17·79	21	+ 7·41
Talawakele	77·2	—0·5	56·4	+1·1	78	88	5·2	6·20	15	+ 1·58
Trincomalee	84·9	—0·5	76·0	—0·4	80	88	4·8	1·02	4	— 1·28

Rainfall in March was above normal over a large portion of the Island, deficits, generally small, being found in limited areas chiefly near Colombo, in Anuradhapura-Trincomalee area and to south of Batticaloa. Larger excesses, of the order of 10 to 15 inches, occurred in the south-western and south-eastern foot-hills, the highest being 18.91 inches at Keragala Estate, 17.96 inches at Udugama, 15.69 inches at West Haputale Estate and 15.27 inches at Blackwood Estate. The largest deficits were 3.15 inches at Pindeniya, 2.93 inches at Hanwella and 2.75 inches at Kadukkamunai.

Heaviest rain occurred in Ratnapura district and in the northern parts of Matara district where the monthly totals were generally above 20 inches, the highest being 32.41 inches at Keragala Estate, 29.09 inches at Udugama, 28.42 inches at West Haputale Estate and 28.38 inches at Gilimalay Estate. Rainfall decreased towards the north and east, monthly totals ranging from 2 to 5 inches. Parts of Jaffna Peninsula and the neighbourhood of Trincomalee received below 2 inches.

There were 14 daily falls of five inches or over for the month, the highest being 7.55 inches at Keragala Estate on the 31st.

The weather during March was essentially of the inter-monsoon type, local thunderstorm activity being markedly in evidence. Rain was fairly well distributed, the only comparatively dry periods being 11th to 15th, and 18th to 22nd. Increased rainfall occurred during the last 4 days of the month.

Temperatures were generally a little above average. The highest recorded shade temperature was 94.5° at Kurunegala on the 20th, while the lowest air temperature was 37.4° at Nuwara Eliya on the 18th. Humidities were above average, and cloud amount were in excess. Winds were variable, and below average strength.

D. T. E. DASSANAYAKE,
Superintendent Observatory.

DEPARTMENTAL INFORMATION

The following changes of staff are reported :—

(1) Mr. D. M. A. Jayaweera proceeded on study leave to England (March 4, 1947).

(2) Mr. E. S. de S. Jayasundera, Agronomical Assistant to Botanist as Agronomical Assistant and Manager, Maha Illuppallama Agricultural Station (January 6, 1947).

(3) Mr. F. D. Pieris, Assistant Ento. Division as Senior Assistant to D. A. O. S. W. D. (January 15, 1947).

(3A) Mr. A. V. Chelvanayagam, Agricultural Instructor, Kilinochchi, as Senior Assistant to D. A. O. N. D. (February 15, 1947).

(4) Mr. V. L. de S. Senaratne, Assistant Ento. Division as Senior Assistant to D. A. O. S. C. D. (January 16, 1947).

(5) Mr. R. D. Kadramer, Assistant A. O. P's Division as Agricultural Instructor, Kilinochchi (January 24, 1947).

(6) Mr. K. C. V. de Silva, Agricultural Instructor, Bibile, as Agricultural Instructor attached to R. B. G. (March 20, 1947).

(7) Mr. H. P. B. Ellegala, Farm Manager, Maha Illuppallama as Assistant to the Agricultural Engineer, Peradeniya (January 15, 1947).

(8) Mr. M. Nadarajah, Manager, Experiment Station, Anuradhapura, as Agricultural Instructor, Nikaweratiya (November 7, 1946).

(9) Mr. J. S. L. White, Agricultural Instructor, Galle, as Assistant Inspector, Colombo Fumigatorium (December 18, 1946).

(10) Mr. S. V. Manuelpillai, Agricultural Instructor, Unichchai, as Agricultural Instructor, Vavuniya (February 10, 1947).

(11) Mr. S. Thalayasingham, Agricultural Instructor, Lahugala, as Farm Manager, Kiliveddy (February 13, 1947).

(12) Mr. R. D. P. Waidiyaratne, Agricultural Instructor, Karagoda Uyangoda, proceeded on study leave to the Imperial Dairy Research, Institute, New Delhi, India (January 15, 1947).

(13) Mr. L. de A. Rajapakse, Assistant Farm Manager, Labuduwa, as Range Agricultural Instructor, Matale (January 6, 1947).

(14) Mr. B. A. Weerasooriya, Agricultural Instructor, Kurundankulam, as Agricultural Instructor, Anuradhapura (February 1, 1947).

Retirements.

(1) Mr. B. A. Pereira, Agricultural Instructor, Matara East, retired from the service (February 12, 1947).

New Appointments and Promotions.

(1) Mr. S. B. Yatawara, as Acting Agricultural Officer (Propaganda) (January 30, 1947).

As Agricultural Instructors, with effect from January 3, 1947 :—

(2) Mr. C. Rajaratnam (Puttalam).

(3) Mr. T. M. Manickavasagar (Mullaitivu).

(4) Mr. P. W. Jayasinghe (Ento. Division, Peradeniya).

(5) Mr. H. E. A. M. Jayawardena (Ambalantota).

(6) Mr. K. Skantha (Kilinochchi).

(7) Mr. L. M. Tillekeratne (Narammala).

(8) Mr. H. J. V. Manathunga (Ambawela) with effect from January 16, 1947.

(9) Mr. H. P. G. Pieris (Kegalla) with effect from March 1, 1947.

(10) Mr. A. F. Bandara, as Conductor, Ambalantota Paddy Station (February 1, 1947).

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