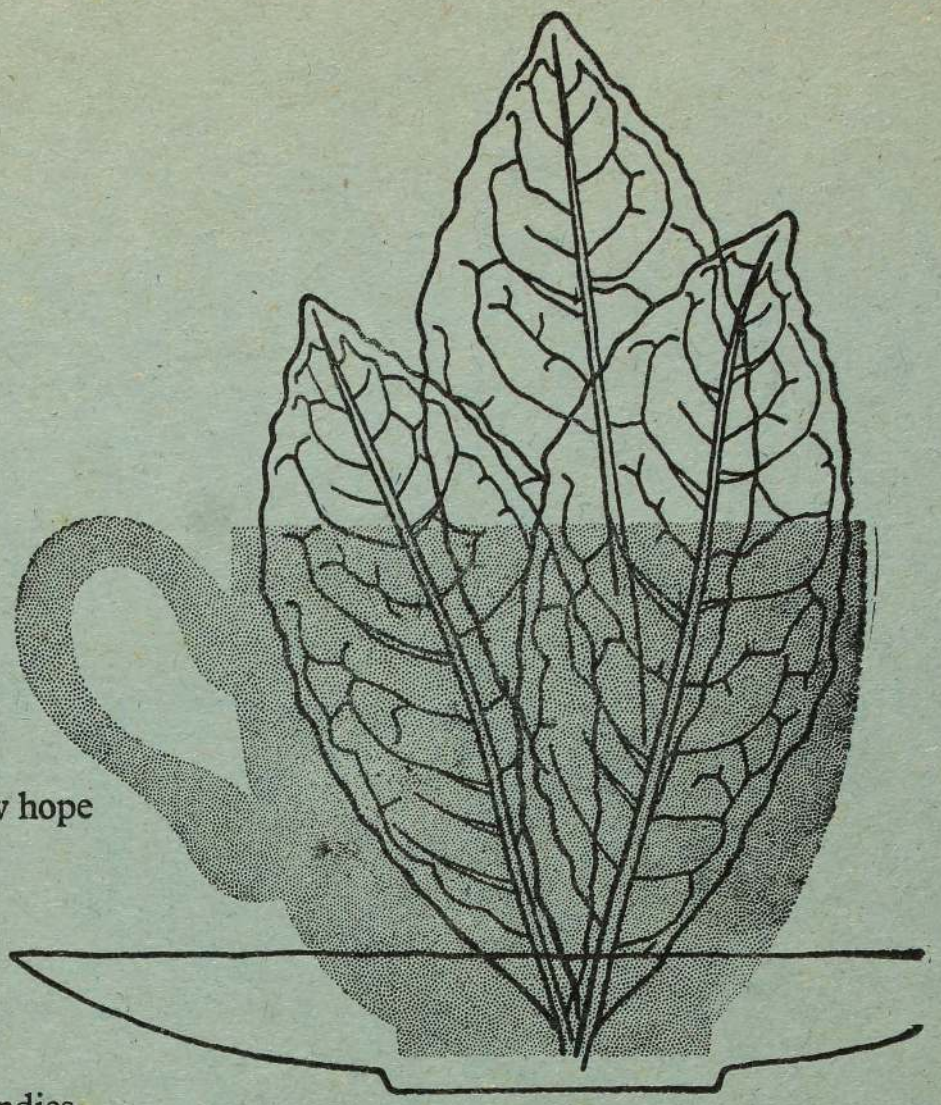
TROPICAL AGRICULTURIST

AGRICULTURAL JOURNAL OF CEYLON

VOLUME CXI
NUMBER 1
JANUARY TO MARCH, 1955

DEPARTMENT OF AGRICULTURE
CEYLON



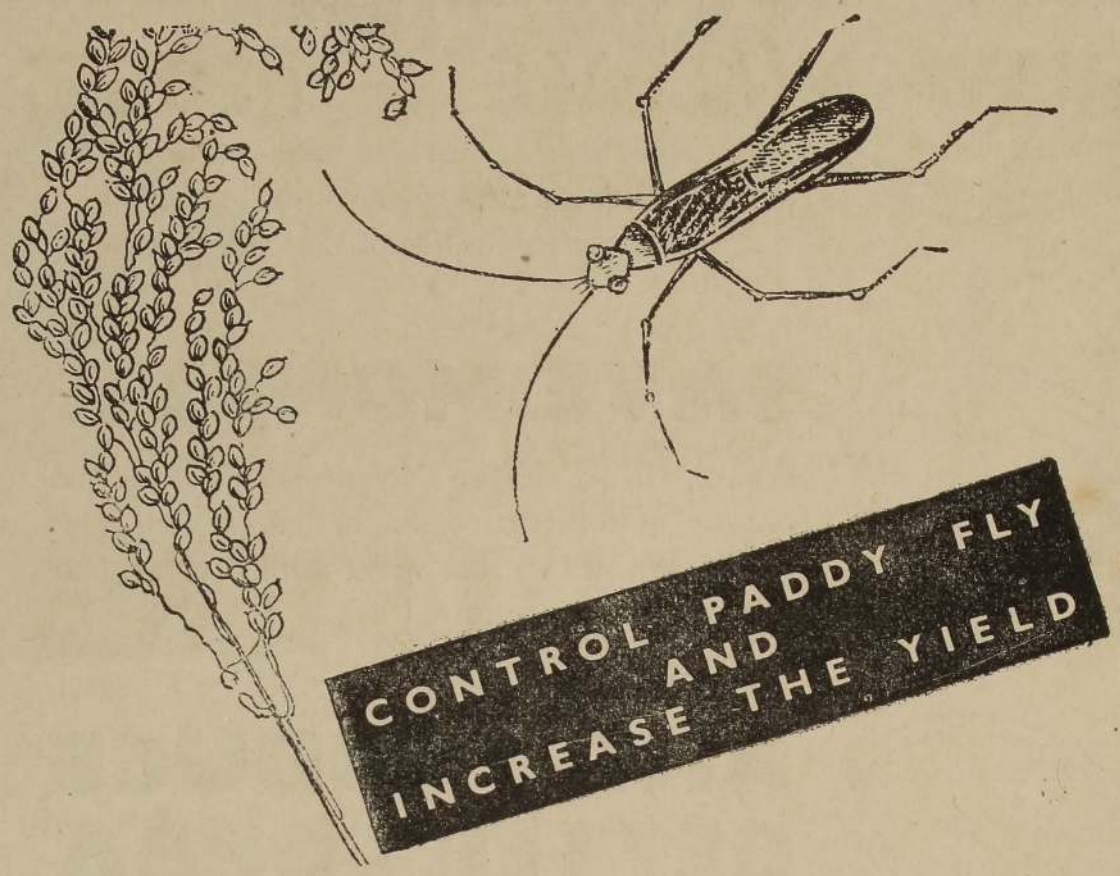
A band of experts took succour and new hope
to the pineapple growers of Hawaii . .
Tobacco yields went up as much as
eight and even ten-fold in Rhodesia . .
Sugar cane sprang luxuriant
and green and towering
in lately threatened fields of the West Indies . .
Famine threatened from the skies —
and then the exulting peasants of Pakistan,
India, Iran and other countries
swept into heaps the lifeless bodies of
myriad locusts which had so recently promised doom . .

The heartening story of Shell success
against agricultural pests and diseases
strides around the world.

**Shell fungicides, nematicides,
selective weed killers
and insecticides are at the service
of all mankind**

SHELL *an island-wide service*

2—J. N. B 44294—1,550 (5/55).



Practical field tests, carried out in Ceylon, have shown that the loss of paddy may be averted by the use of 'Gammexane' Dust D. 025.

'GAMMEXANE' REGD.
D. 025

10 lb. of the Dust applied by hand or with a hand operated dusting machine will destroy the pest at a cost of only about Rs. 5/- per acre. A second application may be necessary when attack is very severe.

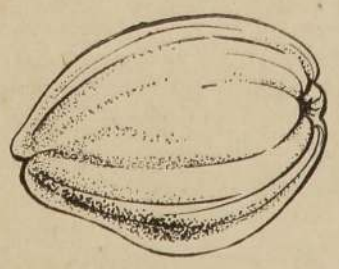
Price details and technical advice from

IMPERIAL CHEMICAL INDUSTRIES (EXPORT) LTD.

(A subsidiary company of Imperial Chemical Industries Ltd. Incorporated in England. Liability of members is limited.)

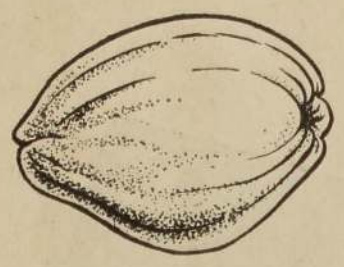
P. O. BOX 352, COLOMBO

IX-F(E) 133



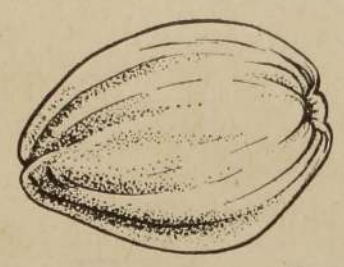
SAVE TIME..

'Chula' Copra Dryers are graded in capacity and output to suit any size of plantation, ensuring regulated and constant production. The machines operate continuously in all weathers.



SAVE MONEY..

Using 'Chula' Copra Dryers, labour costs are cut by at least 40% and one man can keep four machines in full operation. Virtually no maintenance is required.



AND PRODUCE BETTER COPRA

Only the highest grade copra is produced. Write to us for full details of 'Chula' Copra Dryers and other coconut processing machinery.

And if you grow rubber . . .

. . . we will be pleased to show you how the latest Huttenbach Rubber Machinery can help you to improve quality and increase output.

TYNESIDE FOUNDRY & ENGINEERING CO. LTD

Patentees and Sole Manufacturers *Established 1898*

Elswick • Newcastle upon Tyne • England

Cables: "Foundry, Newcastle-on-Tyne." Codes: ABC 5th and 6th Editions.

International Committee of Agricultural Librarians and Documentalists

At a meeting in Frankfurt, March, 1955, attended by agricultural librarians from seven countries and F. A. O., preliminary arrangements were made for the formation of this *Committee*, with the purpose of reviving and extending the work of the pre-war Comité International des Bibliothêcaires Agricoles. Plans were made for the holding of an International Congress of Agricultural Librarians and Documentalists on September 10 and 11, 1955, probably at the Rijkslandbouwhogeschool at Ghent, at which the formal constitution of the *Committee* is to be followed by papers and discussion.

Anyone interested in making contact with the *Committee* is invited to write to one of the following addresses : Dr. S. V. Frauendorfer, Hochschule für Bodenkultur, Vienna 18/110, Austria ; Mr. Th. P. Loosjes, Centrum voor Landbouwdocumentatie, Rijksstraatweg 1A, Wageningen, Holland ; Mr. D. H. Boalch, Rothamsted Experimental Station, Harpenden, Herts., England.

TROPICAL AGRICULTURIST

Volume III January - March, 1955 Number 1

Published Quarterly By

DEPARTMENT OF AGRICULTURE
PERADENIYA, CEYLON

Subscription Rates

(*Inclusive of Postage*)

	Annual	*Single copy*
Local	.. Rs. 5·00 ..	1·50
India, Burma and Pakistan	.. Rs. 6·50 ..	2·00
Abroad	.. Rs. 8·00 ..	2·50

Exchanges should be addressed to the LIBRARIAN

Advertisement Rates

(*Per Insertion*)

	Contract	*Casual*
Full Page	.. Rs. 30·00 ..	35·00
Half Page	.. Rs. 17·00 ..	19·00
Quarter Page	.. Rs. 8·50 ..	10·00
Back Cover	.. Rs. 40·00 ..	50·00
Inside Back	.. Rs. 35·00 ..	40·00
Inside Front	.. Rs. 35·00 ..	40·00

All correspondence and payments should be addressed to AGRICULTURAL OFFICER (PUBLICITY), DEPARTMENT OF AGRICULTURE, PERADENIYA, CEYLON.

Registered as a newspaper in Ceylon.

NOTE TO CONTRIBUTORS

(1) Manuscripts for publication should be typewritten on one side of the paper at double spacing and sent in duplicate to the *Editor, Tropical Agriculturist, Department of Agriculture, Peradeniya, Ceylon.*

(2) Articles should be divided into sections, each headed by a caption, and concluded with a brief summary, if necessary.

(3) Text figures and photographs must be (*a*) suitable for reproduction, (*b*) supplied with legends typed on separate sheets of paper, and (*c*) separate from the text but allocated to sections of the text.

(4) References should be numbered in the order quoted in text, and should contain names and initials of authors and title of book or paper.

(5) Titles of manuscripts should be brief.

Vol. 111 No. 1

CONTENTS

Jan.–Mar., 1955

EDITORIAL

Horticultural Development in the Island

THE CULTIVATION of economic varieties of fruits in the Island may be said to date from the early days of the Royal Botanic Gardens and of the Ceylon Agricultural Society. A large number of economic fruit trees, e.g., durian, cherimoyer, avocado pear, tree tomato and temperate fruits suited to upcountry areas were introduced into the Island at that period, but no systematic trials were conducted in horticultural problems until the creation of a Division of Horticulture in 1941 following on the recommendations of a Committee appointed by Government to report on the development of the fruit industry in the Island in 1938. It should be stated, however, that some experimental work had been done in the years immediately preceding this development on the vegetative propagation of citrus and mango.

Since the establishment of the Horticultural Division a considerable amount of work has been carried out on the selection of outstanding mother trees of varieties of fruit for supply of clonal budwood, the development of suitable root stocks, stock-scion relationship and improvements in bud-grafting technique. As a result of these studies selections of a high standard of different types of fruit were made, notable among them being the Seedless Bibile sweet orange, which is believed to have originated as a bud sport of the Bibile Sweet orange, and the Omantai mandarin which is not unlike the famous Nagpur Santara. Of recent introductions which have proved a success the following may be mentioned: *neelam* mango, Pollock avocado, Malayan rambutan, Gros Michael banana, the seedless guava, the mammoth sapodilla and the Hawaian solo papaw.

Despite a ready market for good fruits in the Island and the availability of information on their successful cultivation as a result of the investigational work undertaken, there has been comparatively little development in the commercial production of fruits except in regard to plantains which are cultivated fairly extensively in many parts of the Island. Of other fruits which are cultivated on a commercial scale in localised areas mention should be made of the plantain in the Neervelli area of the Jaffna Peninsula, citrus in Bibile and other areas of lower Uva, and pineapple in the Gampaha District. The Department of Agriculture has encouraged the cultivation of mangoes on a large scale and has established orchards of varying extents on its farms in the dry zone, the largest being at Hingurakgoda where 100 acres are under the crop. Mangoes of excellent quality are, however, cultivated extensively in the Jaffna Peninsula though in small holdings.

With the extension of the canning industry in the Island, there will be scope for the establishment of a number of commercial orchards under crops such as mangoes and pineapples. The Land Utilization Committee of 1952 makes reference in its report to this subject and there is little doubt that well-organised orchards of mango and citrus could be made to pay if they are run in conjunction with some animal husbandry enterprise, e.g., poultry.

The citrus industry in the Island has not met with the success which the efforts put into it have led one to anticipate. The causes for this are not yet satisfactorily unravelled, and the parlous condition of the citrus industry of lower Uva gives occasion for anxiety because it was at one time a flourishing industry. A disease of virus or fungus origin is taking its toll and the industry is fast declining. Steps, however, are now being taken to resuscitate it and the services of an expert on citrus culture with particular reference to the control of pests and diseases are being requisitioned for studying the problems involved and re-establishing the industry on its former basis. There is little doubt, however, that one cause for the decline of the industry is the scanty attention given to the crop by the cultivator. Unlike coconut which stands up to a great deal of neglect, citrus is a delicate crop and needs constant attention if it is to produce results commensurate with the cost of establishment. A point which must be stressed is the absolute importance in citrus culture of regular manuring with cattle manure for supplying the minor nutrient elements which are so essential for the healthy growth of the crop.

In order, however, to utilise the present crop to full advantage, an officer of the Department trained in Australia in Food Technology is being stationed in the citrus district to organise the growers to obtain the best returns from their produce by preservation as fruit juices and cordials or by refrigeration. It is envisaged that these measures will before long help to resuscitate an industry which has been the economic mainstay of the people of these areas in the past.

In order to make the people of the Island more fruit conscious and to impress on them the value of fruit as an article of diet, opportunity was taken of the recent Tree Planting Campaign to issue large quantities of planting material of improved varieties to interested growers all over the Island. It is hoped by this means to ensure that the public are not deprived of an essential article of food. Any "Eat more fruit" Campaign will be of little avail unless there is an adequate supply of the commodity and it should, therefore, be incumbent on every land owner to have in his own garden, however small, a few trees from which he can derive, from time to time at any rate, life-giving sustenance for himself and his family.

The scope of the work of the Horticultural Division of the Department of Agriculture has within recent years been extended to include other horticultural crops such as cacao, pepper, betel, &c., but reference to these

will be made in a separate editorial when the question of minor agricultural products is being discussed. It suffices to say, however, that fruit culture is continuing and will continue to receive the importance which a subject of this nature should warrant. Additional staff has been added to the Division and in due course further increases will be made to it. Attention has also been given to augmenting the staff concerned with the question of the control of pests and diseases as it is realised that the effective control of these and the production of resistant varieties are major factors which merit consideration in the successful rehabilitation of horticultural crops.

Errata

Tropical Agriculturist, Vol. CX, No. 2, 1954, p. 75, line 7—1922 should read 1822.

Tropical Agriculturist, Vol. CX, No. 4, 1954, p. 256, column 1, line 25—'husked' should read 'unhusked'.

A Survey of Agricultural Conditions in the North-Central Division

H. E. NANAYAKKARA

THE North-Central Division consists of two Districts, namely, the Anuradhapura District or Nuwara Kalawiya (the latter name being derived from the three large tanks Nuwarawewa, Kalawewa and Padawiya), and the Polonnaruwa District or Tamankaduwa. The Anuradhapura District has a total area of 2,808 5/8 square miles, while the Polonnaruwa District is 1,331 5/8 square miles in extent. Twenty-one-and-half miles of the former and 17 9/20 square miles of the latter consist of large inland waters. Thus, of the total area of 4,140¼ square miles or 2,649,760 acres in the two Districts, the total land area constitutes 2,624,862 acres, The extent cultivated at present is 170,032 acres comprising 6.67 per cent. of the total land area. Approximately 80 per cent. of this consists of paddy land, while land under coconuts form 1½ per cent. and the rest of the area consists of chenas, garden cultivations, &c.

Climate and Rainfall

There is a seasonal variation of temperature of about 8°F, the lowest being recorded during the months of November and December. Then there is a gradual rise through the months of February, March and April till May, when the temperature reaches a maximum and begins to drop in September to a minimum in November and December.

The rainfall too is markedly seasonal. The average monthly rainfall in various parts of the Division for the period 1943 to 1953 is given below.

Table showing Average Monthly Rainfall in the Division

	Anuradhapura District—Rainfall in inches				*Polonnaruwa District—Rainfall in inches*		
	Anuradhapura	*Medawachchiya*	*Mahailluppallama*	*Horowpotana*	*Kahatagasdigiliya*	*Hingurakgoda*	*Topawewa*
January	3·94	5·18	4·53	7·06	5·52	8·89	10·54
February	2·23	2·17	2·23	2·36	3·74	3·98	4·85
March	3·29	2·35	3·04	1·94	2·26	4·19	4·72
April	6·45	5·91	6·95	5·54	3·45	5·73	4·48
May	2·95	3·26	3·23	5·83	3·81	3·47	2·67
June	·61	·21	·74	·16	·31	·20	·27
July	1·12	1·68	1·17	1·77	1·73	1·84	1·47
August	1·54	3·50	2·43	3·55	2·28	2·38	2·19
September	2·47	3·24	3·04	3·34	3·55	2·45	3·76
October	10·04	9·26	10·73	8·33	8·26	8·27	7·87
November	10·27	10·33	10·00	11·59	10·61	10·62	10·78
December	10·17	9·79	8·51	13·87	12·08	12·92	13·42

There is a major wet period from October to January which comprises the North-East Monsoon season followed by a relatively dry period from February to March. April is a wet month which is followed by a major dry period from May to September during which intermittent light showers do normally occur, while strong dry winds are experienced in June to July.

There have been years when the total rainfall has been as low as 25 inches resulting in acute and prolonged droughts. The frequency of their occurrence has increased in recent years.

Rural Set Up

There are in the North-Central Province over 2,000 villages some of which are uninhabited. Each village consists of the village tank (from which the village derives its name) the paddy allotment or *wel-yaya*, the housing allotment or *gangoda* with permanent fruit trees and the surrounding jungle which is periodically cleared for chena-cropping. The *gangoda* lies in close proximity to and almost immediately above the tank. This position is the most suitable one as the villagers depend on the water stored in the tank for their domestic water supply. Sometimes the tank also supplies fish.

Population and Labour

According to the 1953 Census the population of the Province is given as 229,174. The population figure for each District together with the density per square mile is given below :—

ANURADHAPURA			
Land area	..	..	2,787⅛ sq. miles
Population	..	..	171,105
Density per sq. mile	..	..	61
TAMANKADUWA			
Land area	..	..	1,214 7/40 sq. miles
Population	..	..	58,069
Density per sq. mile	..	..	47

The paucity of the population in the Province is all too clearly indicated, and is a major factor contributing to the relatively low level of agricultural development. The absence of any form of intensive cultivation, particularly in the case of highland crops can also, in the main, be attributed to the lack of manpower. Tractors and other mechanical equipment should alleviate the position considerably.

Agricultural Holdings

The total number of agricultural holdings and the cultivable extent (as given in the Census of Agriculture—1946) are given below :—

Number of holdings—169,319.

Cultivable extent—127,853 acres.

Approximately 75 per cent. of the holdings consists of paddy covering about the same proportion of land. Paddy holdings classified according to size are enumerated below (as given in the Census of Agriculture—1946).

Less than ½ acre	..	51,901	holdings
½—1 acre	..	42,066	,,
1—2 acres	..	22,029	,,
2—5 acres	..	8,660	,,
5—10 acres	..	1,629	,,
Above 10 acres	..	345	,,

Thus, 74.2 per cent. of the paddy holdings are less than one acre in extent, while only 15.6 per cent. are above 5 acres. Over 50 per cent. in the group of holdings less than 1 acre are nearer ½ acre.

Transport and Marketing

Means of transport in the rural areas of the Province leave much to be desired. In most cases the only available transport is that provided by the bullock-cart. During wet weather even this is rather uncertain. In some cases even bullock-carts are ruled out as the only available means of access is the foot path. As far as the urban areas are concerned, road and rail transport facilities can be considered fair.

The marketing of produce for which there is a guaranteed price, is done through C. A. P. & S. Societies and private traders, although the latter pay much less than the guaranteed price. As regards other produce, Marketing Department lorries call regularly on fixed dates and buy whatever produce that is brought at fixed prices.

Fairs are also held on fixed days of the week at the following centres: Rambawewa, Nochchiyagama, Tambuttegama, Eppawala, Maha Illuppallama and Sangilikanadarawa.

Irrigation

The methods of surface storage devised in ancient times form the back-bone of the irrigation system of today. There are in the Province a large number of these storage reservoirs or tanks, a few of which are capable of storing water to irrigate extents of 10,000 acres and more. The most noteworthy among them are the Kalawewa, irrigating 11,565 acres, the Prakrama Samudra, irrigating 18,000 acres, and the Hurulu-wewa, irrigating 10,000 acres.

There are a few more tanks which come under the category of major tanks. The names of these tanks together with the extents that could be irrigated are as follows:—

Name of Tank	*Irrigable Extent (acres)*
Minneriya	7,344
Nachchaduwa	6,067
Devahuwa	2,336
Nuwarawewa	1,505
Sangilikanadarawa	840
Giritale	786
Tissawewa	765
Basawakkulama	528
Kattiyawa	569
Maha Illuppallama	364

There are over 2,000 minor tanks scattered over the Province. Of these, 1,741 are in good order and have capacities to irrigate extents varying from 50 to 150 acres. The remaining minor tanks and a few large ones such as Maha Kanadarawa and Maha Willachchiya are awaiting restoration. Padawiya, another large tank, is being restored.

Paddy Cultivation

There are 143,673 acres of paddy land in the Province. 61,235 acres are under major tanks and 82,438 acres under minor tanks. A small extent is grown under rainfed conditions in chenas. In a normal year, about 80 per cent. of the total acreage is cultivated for the *maha* season and less during *yala*. Lack of sufficient irrigation water, shortage of buffaloes and the paucity of the population are, in the main, responsible for a large extent of paddy land being uncultivated.

There are two main planting seasons which coincide with the two rainy seasons—the *maha* during the North-East Monsoon period and the *yala* during the South-West Monsoon. Of these the *maha* is always the major season. There is a third season known as *meda* which, as the term implies, comes in between the *maha* and *yala*, and is generally preceded by a delay in the onset of the North-East Monsoon. Thus, the *meda* season takes the place of the normal *maha*. Where a *meda* crop is sown the *yala* is delayed.

Improved Methods

(i) *Light Iron Plough.* The light-iron plough can be used successfully only in areas where the soil is light and sandy. Some headway has been made in persuading cultivators to use this implement, but the problem of breaking down the barriers created by hundreds of years of tradition still exists.

(ii) *Pure-line Seed.* Roughly 25 per cent. of the cultivated acreage is under pure-line paddy. The two pure-line varieties *Vellai Illankalayan* (for *maha*) and *Pachchai Perumal* (for *yala*) are not favoured much by cultivators in the Province. These are to be eventually replaced with better pure-lines such as H. M. C. 20, *Mas* and *Murungakayan* for *maha*, and *Heenati* and *Murunga* for *yala*.

(iii) *Manuring.* The use of inorganic fertilizers is very limited, while appreciable extents are manured with cattle manure and green manure. The need for some form of manuring is keenly felt, particularly in the older paddy lands (*purana fields*), while there is no doubt that the new lands too will respond to the application of fertilizers.

(iv.) *Transplanting.* Although the benefits derived from transplanting are known to practically every farmer in the Province, efforts to extend this practice have met with very little success. The main drawback is the shortage of labour.

(v.) *Harrowing the Standing Crop.* This practice has gained ground rapidly and is a very good alternative to transplanting. However, the lack of an adequate supply of irrigation water at the time of harrowing acts as a limiting factor at times.

(vi.) *Weeding.* Weeding is by no means a widespread practice; but appreciable extents are weeded every season with the help of school children, Young Farmers' Clubs, &c.

Pests and Diseases

The common pests prevalent in the North-Central Province are the paddy fly and the paddy swarming caterpillar. The present method of control, i.e., spraying with D.D.T. or Arcotine in the

case of the swarming catepillar, and dusting with Gammexane against the paddy fly have been found to be quite adequate. Paddy cultivators are very efficient in detecting the occurrence of both these pests, but they are seldom equally efficient in the application of the remedy without the assistance of the Extension Staff.

No serious diseases have been reported, but evidence of the occurrence of *Helminthosporium oryzae* and *Curvularia lunata* has been brought to light recently. It is reasonable to assume that the effects of these two diseases may have been sufficiently reduced by environmental factors unfavourable to the progress of the disease so as to have escaped detection under normal circumstances.

Highland Cultivation

Perennial Crops. Coconuts, citrus and mangoes constitute the main perennial crops grown in the Division, while the tamarind is of frequent occurrence though not systematically cultivated.

Coconuts are found mainly in small patches near and around some of the major tanks and water courses. Citrus and mango occur in the highland allotments of colonization schemes and in the unirrigable lots near village tanks.

Miscellaneous fruit trees such as jak and arecanut are found scattered in a few villages.

Annual Crops. Annuals corps are cultivated mainly in chenas under rainfed conditions; a very small extent being grown in home gardens where rainfall is supplemented by hand-watering from wells. Encouragement towards a settled type of intensive cultivation is given by the alienation of allotments (1 to 2 acres in extent) under the L. D. O. permits.

Chena Cultivation. The clearing and burning of the jungle is done during the months of July and August, and sowing commences after the first rains which normally occur towards the latter part of September. Mixed cropping with kurakkan, mustard, maize and vegetables (among which pumpkin, brinjal and bandakka are the most popular) is the general rule. In recent years there has been a tendency to grow these crops in pure stands. Paddy is also very frequently cultivated as a chena crop whenever the weather conditions are favourable.

The extents cultivated under the various crops during the last year are given below. Practically all the crops have been grown under rainfed conditions.

Crop	*Acreage*
Kurakkan	8,420
Maize	4,682
Sorghum	2,375
Chillie	5,878
Gingelly	6,856
Bombay cowpea	1,635
Green Gram	1,077
Vegetables	5,000
Manioc	2,141

Land, Land Tenure and Capital

At present only 6.67 per cent. of the total land area in the Province is being cultivated. A much bigger percentage can be brought under cultivation by increasing the available water supply and settling more people on the land.

The restoration of the larger tanks such as Padawiya, Maha Kanadarawa and Maha Willachchiya and the numerous minor tanks should add considerably to the extent that could be brought under cultivation.

Although assistance is given by Government for the purpose of opening up and developing more land, the rate of progress is very slow. Lack of capital is keenly felt. Attempts to attract capital from other parts of the Island have so far had no response, presumably because of the very high cost of development.

Absentee land-lordism to some extent and insecurity of tenure are also responsible for retarding any possible investment even on a small scale. The main system of tenure prevailing in the Province is the so-called *ande* system wherein the lessee has to pay the land-owner in kind. In some cases the latter provides the seed paddy, buffaloes for ploughing, &c., and fertilizers, and also gives cash advances to the lessee during the cultivating season. In other cases no interest is shown by the land owner except in ensuring that he gets his dues from the lessee.

A small amount of capital is made available to cultivators through C.A.P. & S. Societies. This has certainly served to ameliorate the position to some extent. In addition, financial assistance is given by Government for the purpose of constructing houses and wells on land alienated to villagers on L. D. O. permits.

Colonization Schemes

There are in the Province, a number of colonization schemes, namely, the Kagama Scheme, the Huruluwewa Scheme, Sangilikandarawa and the Dewahuwa Schemes in the Anuradhapura District, and Minneriya, Giritale and the Parakrama Samudra Schemes in the Polonnaruwa District.

Under these schemes approximately 40,000 acres of paddy land and 24,000 acres of highland have been alienated, each colonist being given 5 acres of paddy land and 3 acres of highland together with a type-plan cottage situated in the highland allotment. Each colonist pays a land rent of Rs. 10 per acre per year and a water rate of Rs. 5 per acre per year of paddy land adding up to a total of Rs. 105 per year.

All the paddy land except in the recently and partly settled Huruluwewa Scheme has been fully developed, but it is not always that the full extent is cultivated. In this respect, the schemes in the Polonnaruwa District are more fortunate as a greater percentage of paddy land is cultivated there than in those in the Anuradhapura District where mainly due to restrictions imposed by the lack of sufficient irrigation water the extent cultivated is reduced. The completion of the Nalanda Oya Scheme will tend to improve the position considerably in the latter case. Lack of an adequate number of buffaloes for ploughing and mudding operations and a shortage in man-power too limit the extent of paddy land cultivated. In some cases the colonists start by sowing a 4-month variety for *maha* and end up with a 3-month variety when he is unable to prepare all the land in

time. The use of the tractor in preparatory tillage operations can change the picture into a happier one.

The highland allotments have not been developed on the lines envisaged. Coconut seedlings and fruit trees such as mango and citrus have been given free to all colonists, but few have so far obtained the full benefits of these concessions. Plantains appear to be the most popular cash crop grown in the highland allotments and good incomes are obtained.

Dry Farming Schemes

There are two Dry Farming Schemes in the Division, one at Kurundamkulama which is situated south of the Trincomalee-Anuradhapura road and about 5 miles from the Anuradhapura town and the other at Ralapanawa, situated south of the Anuradhapura-Puttalam road about 12 miles from Anuradhapura town. The total extent of land at Ralapanawa is 667 acres while Kurundankulama occupies 1,068 acres.

In each scheme a number of colonists have been settled in much the same way as in the colonization schemes administered by the Revenue Officers.

Each colonist is provided with a house consisting of a verandah, bedroom, dining room and kitchen together with two acres of land which comprise the homestead. Here the colonist grows his permanent crops such as coconuts and fruits trees, and chillies, onions and vegetables required for his home consumption.

The homesteads are grouped into units of five each and there is a well for each unit.

Apart from the homestead each colonist is given 12 acres of highland which have to be cultivated co-operatively with the allotments of a number of other colonists, who are grouped into one unit. Only half the extent is cultivated at a time, the other half being rested—the resting period being 4 years.

The crops usually grown are kurakkan, maize, chillies, cowpea and groundnuts for the *maha* season and gingelly and greengram for the *yala*.

The profits derived by the sale of the produce are divided amongst the colonists in proportion to the quantity of work put in by each.

Soils

Physically the soils in the Province vary from sandy loams to very heavy clays. The major part of the paddy soils consist of the latter type.

The fertility of the paddy soils particularly in the so-called *purana* fields is rather low. The highland soils too lose their natural fertility very soon after the forest has been felled and the land has been cropped for two or three seasons.

A number of soil types have been recognised. First, we get the chocolate brown loam that occurs in a greater part of the Anuradhapura District. This type of soil is suitable for the cultivation of dry zone annuals, perennial crops and fruits under irrigation. Another type is the reddish-brown loam which occurs in the Habarana area. These soils have a gravelly subsoil layer which permits the rapid percolation of water with the result that a very good supply of irrigation water is necessary for the cultivation of the

usual dry zone crops. A third type is the *damana* soils of the Minneriya area. These soils are generally shallow and the underlying strata consist of partly decomposed rock that are not quite suitable for paddy, but fodder grass could be grown under irrigation.

Cattle

The majority of the cattle belong to the so-called Sinhala breed. They are generally of very poor quality due to under feeding and lack of care and management. Bulls are allowed to run with the rest of the herd thereby causing indiscriminate and promiscuous breeding. Very often the cows give birth in the jungle unknown to the owners. Only in a very few cases are the cows milked. However, cattle are a ready source of income to the owner. They are rounded up periodically and sold for slaughter. The question of feed becomes very serious during periods of prolonged drought. There is no doubt that better feeding, management and housing will bring about a marked improvement in the general standard of the cattle. Crossing with a better type of animal such as the Scindi can bring about a further improvement in quality.

As a rule buffaloes do not even get the little attention received by neat cattle. They are rounded up by the owners during periods when their services are needed for ploughing and mudding operations and threshing paddy. In between these periods they are allowed to roam at will and fend for themselves.

Poultry

Poultry keeping is also practised mainly by Muslims, but in recent years other sections of the population have also shown some interest in this direction. Most of the birds are of the country-bred type, while there is a small proportion of pure-bred types of the Rhode-Island-Red, Australorp and White Leghorn breeds. Proper feeding, housing and management are practised by only a few of the more enlightened poultry farmers.

Vegetative Propagation of Betel and Pepper Vine

A. V. RICHARDS

Received 5.4.55

Summary

Both betel and pepper are normally propagated from cuttings. Trials with different rooting media have shown that in the case of betel both single leaf cuttings and stem cuttings produced significantly more roots within two to three weeks in a medium of coir dust and fibre than in either sand or soil, and more shoots in soil than in sand which is relatively infertile. Stem cuttings produced more roots and shoots than single leaf cuttings in each of the four different rooting media under study.

But in the case of pepper single leaf cuttings gave better results than stem cuttings which are generally used, and both types produced more roots and shoots in coir dust and fibre than in sand or soil.

Introduction

Betel (*Piper betel*) and pepper (*Piper nigrum*) are money crops grown in Ceylon which play an important role in the village economy. Owing to the incidence of Bacterial Leaf Spot and Collar Rot diseases which are difficult to control the local production of betel leaf is likely to become inadequate to meet the demand which has increased considerably in recent years. Although fair quantities are imported from India almost daily to meet a specialised demand for certain varieties of betel there is an appreciable export trade with Aden as indicated in the following statement of imports and exports for the last five years which also shows a tendency for exports to rise.

Export and Import Trade in Betel Leaves

Year	*Imports*		*Exports*		
	Quantity in Cwt.	*Value in Rs.*	*Quantity in Cwt.*	*Value in Rs.*	*Excess of Exports over Imports in cwt.*
1950..	478	56,101	922	46,668	444
1951..	293	25,622	1,344	67,658	1,051
1952..	360	39,359	1,298	84,124	938
1953..	277	33,813	1,345	76,919	1,068
1954..	388	45,584	1,409	77,928	1,021

Pepper is produced in sufficient quantities for export, and the favourable prices under the Government Guaranteed Purchase Scheme have in no small measure helped to stimulate increased production in recent years. The following is a statement of the exports of pepper for the last five years :—

Export Trade in Pepper (Black)

Year	*Export cwt.*	*Value Rs.*
1950	.. 3,744 ..	2,325,855
1951	.. 4,690 ..	3,870,550
1952	.. 5,630 ..	4,154,087
1953	.. 3,685 ..	2,225,760
1954	.. 4,683 ..	1,413,938

Betel is grown almost exclusively in home gardens in villages in the wet zone, and in parts of the dry zone in Mannar and the Jaffna Peninsula where the crop is irrigated from wells. The cultivation of the crop in the Northern Province has been described in detail by Paul *et al.* (1937). The plants are trained on live supports such as *Erythrina Indica* Lam (T. *mullumurukku*) and *murunga* (*Moringa oleifera* Lam.) which are lopped periodically to provide the necessary light shade, but in the wet zone only dead supports are used for commercial betel varieties, although semi-wild types such as *Gasbulath* and *Galbulath* are allowed to climb jak and other live supports.

The cultivation of pepper is confined to the wet and semi-dry zones where it is grown both as a village garden crop, and as a subsidiary plantation crop in tea and rubber estates. The vines are trained on kapok and other suitable trees alongside the boundary fence and on shade trees such as Grevillea and jak.

Hardwood supports which last 15 years or more are used in commercial plantations in Sarawak where owing to the prevailing conditions of high rainfall and low sunshine the vines tend to run to leaf and are less productive under the shade of live supports which also compete for plant nutrients in the soil. Picking costs are less with vines trained at a reasonable height on dead supports spaced uniformly in the field.

Propagation of Betel

The normal practice in Ceylon is to propagate betel and pepper vegetatively from cuttings since plants raised from seed are weak and slow in growth. In the case of betel the cuttings are planted directly in the field during the rainy season, but many growers in Jaffna, especially in the Silalai area, prefer to strike the cuttings under shade in nurseries and plant the rooted material in the field in April and May because of the high incidence of Bacterial Leaf Spot disease during the wet season.

The type of cutting used in Jaffna for planting in the field is the stem cutting with three nodes and three leaves of which the lowest leaf is removed before planting, the middle leaf is rolled round the upper stem and the top leaf is wrapped round it to prevent dessication. These cuttings are taken from the main vine and primary vegetative branches known as *saippu* in which adventitious

roots occur at the nodes. Shoots of the *mathu* type which furnish the commercial leaf of high quality are not used for the purpose ; they have no adventitious roots at the nodes, but often produce catkins in the leaf axils. Skilful and judicious pruning is necessary nearly every two months from planting for the production of *mathu* shoots which may take a year or more to appear.

The cuttings are planted with the lowest node below and the middle node at soil level. After about three weeks the leaves are unwrapped in the evenings and tied again four to five days later till they become hardened. With cuttings planted directly in the field casualities can be so heavy as to necessitate replanting of the entire area. Rooted plants from nurseries are more easily established and make more uniform growth than cuttings. Trials were therefore undertaken to determine the best type of cutting to be used and the most suitable rooting medium for the propagation of the cuttings in nurseries.

The following materials were selected :—

Type of cuttings.

(*a*) Stem cutting with at least 3 nodes and leaves.

(*b*) Single leaf cuttings with a suitable node and leaf.

Rooting media.

(*a*) Coir dust and fibre.
(*b*) Sand.
(*c*) Soil.
(*d*) Sand and soil in equal parts.

The design of the experiment was a 4 × 4 Latin square with split plots containing 20 cuttings each, of which ten were stem cuttings and the rest single leaf cuttings, the total number being 320. The four different rooting media were randomized in the plots. The whole experimental nursery area was provided with overhead shade and hand-watered regularly. The cuttings were all planted on 14th July 1954, and observations on growth were recorded weekly. Most of the stem cuttings remained fresh and began to produce new shoots from the leaf axils in three to four weeks but quite a few of the leaf cuttings showed signs of wilting. All the cuttings were uprooted on September 27, 1954, for examination of the root system and records were taken of the weight of the new shoots and roots produced on each cutting. The relevant data are given in Table I.

Table I—Weight of new shoots and roots produced in different media

Rooting Medium	*Stem Cuttings*			*Single Leaf Cuttings*			*Av. wt. in grms. of shoots of both stem and leaf cuttings*	
	Per cent. strike	*wt. in grms. of new shoots*	*wt. in grms. of new roots*	*Per cent. strike*	*wt. in grms. of new shoots*	*wt. in grms. of new roots*	*New shoots*	*New roots*
1. Coir	92·5	48·4	36·9	80·0	23·8	17·8	36·1	27·4
2. Sand	92·5	29·2	15·1	85·0	20·3	10·4	24·8	12·8
3. Soil	100·0	53·3	14·6	87·5	33·0	8·4	43·1	11·5
4. Sand and soil	97·5	43·2	15·5	92·5	25·9	7·6	34·5	11·6

Although stem cuttings have shown a slightly higher percentage of rooting than leaf cuttings in all the different media both types have made significantly more root growth in coir dust and fibre than in either sand or soil, and more vegetative growth in soil than in the relatively infertile sand. Stem cuttings have shown more growth of roots and shoots than leaf cuttings in each of the four different rooting media under study ; they are the best type of material for planting in the field or the nursery. They strike root even more readily in glass or cloth covered propagators of the type used for rooting cacao cuttings in which high humidity is maintained by the constant drip of water from an overhead pipe line during day time.

Imported shoots of the Deccan betel variety from Poona which produces light coloured leaves of high quality, and the *Katpuram* and *Pachchai* varieties from Trichy, South India, developed numerous adventitious roots from nearly every node in the humid atmosphere inside the propagator within a week, and were successfully multiplied by further subdivision.

Table II—Analysis of Variance Weight of Betel Roots in Grammes)

Factors	*Degrees of Freedom*	*Sum of Squares*	*Variance*	*F*	*P = ·05*	*P = ·01*
Columns ..	.. 3	.. 313·6	.. 104·5	..		
Rows ..	.. 3	.. 148·3	.. 49·4			
Rooting medium ..	.. 3	.. 1,434·9	.. 478·3	.. 7·4	.. 4·76	.. 9·78
Error (*a*) ..	.. 6	.. 387·0	.. 64·5			
Type of cuttings ..	.. 1	.. 721·1	.. 721·1	.. 20·1	.. 4·75	.. 9·33
Interaction ..	.. 3	.. 259·2	.. 83·1			
Error (*b*) ..	.. 12	.. 429·8	.. 35·8			
Total ..	31	3,693·9				

Average weight of roots in gms.

Rooting medium	*Coir*	*Sand*	*Soil*	*Soil and Sand*
	27·4 ..	12·8 ..	11·5 ..	11·6

Significant difference 10·0

Type of cuttings	*Stem cutting*	*Leaf cutting*
	20·6	11·1

Significant difference 6·5

Table III—Analysis of Variance (Weight of Betel Shoots in Grammes)

Factors	*Degrees of Freedom*	*Sum of Squares*	*Variance*	*F*	*P* = ·05	*P* = ·01
Columns	3 ..	1,152·7 ..	384·2			
Rows	3 ..	2,328·5 ..	776·2			
Rooting medium	3 ..	1,375·9 ..	458·6 ..	7·2 ..	4·76 ..	9·73
Error (*a*)	6 ..	381·2 ..	63·5			
Type of cutting	1 ..	2,525·8 ..	2,525·8 ..	15·5 ..	4·75 ..	9·33
Interaction	3 ..	264·8 ..	88·3			
Error (*b*)	12 ..	1,976·7 ..	164·7			
Total ..	31					

Average weight of shoots in gms.

Rooting medium	*Sand*	*Soil and Sand*	*Coir*	*Soil*
	24·8 ..	34·6 ..	36·4 ..	43·2

Significant difference 10·0

Type of cutting	*Stem cutting*	*Leaf cutting*
	43·5 ..	25·8

Significant difference 14·0

Propagation of Pepper

Similar trials were carried out with pepper which is generally propagated from stem cuttings taken from the terminal branches of young vigorous vines. Lateral branches are not suitable for propagation. Sandford (1952) has described the method of selection and preparation of cuttings in Sarawak where they are taken from immature vines which receive regular pruning during the first two years. Cuttings from mature vines do not strike root easily and are slow in growth. The cuttings are prepared in advance by pinching the terminal bud and removing the leaves and side branches from about the third to the seventh node from the top. The cutting is removed for planting 7 to 10 days later when the new terminal bud has begun to grow. Each cutting will have about 6 to 7 nodes of which 4 are buried when the cutting is planted slantwise at a shallow depth in the ground and shaded with bracken.

No attempt is made to prepare cuttings in this manner in Ceylon. They are taken with 6 to 7 nodes from healthy productive vines and planted with 3 to 4 nodes below ground level in nurseries. The basal cut is made about one inch below the node and the cuttings are provided with overhead shade and handwatered regularly during the drought.

Both stem and single leaf cuttings were used in the trials with different

rooting media. The leaf cuttings consists of a single leaf with sections of the internode at the two ends, the basal cut being made just below the lower node which is defoliated. These single leaf cuttings showed 70 per cent. rooting compared to 44 per cent. by stem cuttings. They produced more roots like stem cuttings in coir than in sand or soil. Most of them remained green for a long period and developed shoots from the leaf axils, but in the case of stem cuttings quite a number dropped the leaves and died back. Stem cuttings which were defoliated at the time of planting completely failed to strike root.

Apart from the ease with which single leaf cuttings strike root they are available in larger numbers than stem cuttings and are easier to transplant. Further trials are in progress to determine the suitability of leaf cuttings taken from vigorous inmature vines of the type used in Sarawak. It is expected that with such material the percentage strike may be even higher than 70.

References

1. Paul W. R. C., Gunaratnam, S. C., Chelvenayagam, V. V. (1937) The Betel Vine in the Northern Province. *Tropical Agriculturist* LXXXIX. pp 281—298.

2. Sandford, H. (1952) Pepper in Sarawak. *Malayan Agricultural Journal* XXXV pp. 208—214.

Training and Pruning the Passion Vine

E. P. BUELL

Received 14.12.54

TWELVE YEARS of passion vine (*Passiflora edulis* Sims.) culture produced little or no fruit at the Experiment Station, Peradeniya. The vines ran into leaf and formed a tangled mass of foliage and wood in a very short period. This was aided by uniform soil moisture content and a high level of fertility, particularly, nitrogen. The vines were all trained on live and dead fences as well as on roofs of old huts. The vines received little or no sunlight and the circulation of air was impeded. As a result, local temperature and humidity were fairly high to stimulate a greater vegetative phase. No systematic pruning or manuring was done except severe cutting, annually, to reduce the vegetative phase. This treatment, on the contrary, encouraged greater vegetative activity due to the decrease in the relative amount of carbohydrates (Naik 1947). This really emphasises the maxim that " everybody cuts but few prune ". A method of pruning had therefore to be studied in relation to the vine and its environment under mid-country wet zone conditions. A particular method of pruning, might restrict crop production under one type of soil and climate, but the same method might increase yields under quite a different set of conditions (Chandler 1925). Likewise, all vines do not respond to one standard method of pruning, but methods have to be evolved to suit the characteristics of a particular type of fruit tree, in relation to its growth and its fruiting habits (Hayes 1945). If the drastic pruning of the grape-vine be given to the passion, the latter will perish although the grape vine will respond and bear abundantly. The present study is the investigation of suitable methods of pruning of passion vine, which would increase the production of fruit.

Materials Employed

Two varieties of *Passiflora* are grown in Ceylon for their fruit. The purple fruited variety is more suitable for Up-country elevations. The fruit of this variety is smaller but superior in flavour to the golden or yellow fruited variety. The golden fruited variety is preferred for the low-country wet and dry zones. The fruits of this variety are bigger and more rounded containing higher amounts of edible portion. The flavour, however, is a little inclined on the acid side. The fruits of both varieties are largely used in the preparation of 'passiona', a most popular fruit cordial. There is a great demand for this fruit drink in all parts of the world particularly in the United States of America. In Ceylon the effective demand is not fully met as the fruits are not easily and consistently obtained from the vines and no large-scale cultivation is found, owing to the absence of certain cultural practices that promote fruit production. For Peradeniya conditions therefore the yellow or golden fruited variety was selected for

purposes of this study. This variety is protandrous and the seedling progeny would therefore exhibit a stream of variation amongst themselves. To eliminate this variability among the plants, cuttings obtained from one individual vine were used. Stem cuttings of the standard material, from matured lateral branches were first raised in nursery beds and were subsequently transplanted in the field when they were three to four months old. They may be planted even earlier provided they have rooted sufficiently and grown to a height of nine inches to a foot.

Lay Out and Design

All vines, with the exception of a few, have to be trained on to some support for satisfactory growth and production (Ebbot 1948). In this study the cheapest and the most convenient method was adopted. Vertical double cordon system trellises were erected to a length of 120′ to accommodate ten vines. The height of the trellises was 7′ with strands of wire at intervals of 3′, 2′ and 2′ starting from ground level. The wires were well stretched through the supports at every 12′. Trellises were constructed 8′ apart in a north-south direction to secure the advantage of greater duration of solar insolation. Vines were then planted out at the centre of two supports giving thereby a spacing of 12′ in the rows and 8′ between the rows. They were trained to a single stem by pinching off the laterals till they reached a height of 7½′. At this height the terminal bud was pinched off to encourage the production of laterals. Two vigorous laterals directly opposite each other were allowed for training on the two upper strands of wire. The lowest strand was left free for subsequent securing of fruiting spurs in order to keep them well spaced in an orderly manner. The laterals were trained as leaders on the strands in opposite directions by tying them to the strands by stages as growth proceeded. The terminal buds of leaders on the strands were pinched off at 6′ to encourage the growth of vigorous foundation spurs, which produce fruit in the first season (see Fig. I). The design of the experiment was the simple randomised block where each block is a single trellis consisting of a group of ten vines. Treatments were imposed on them at random (Cochram and Cox 1950).

Treatments

Treatments imposed formed two parts of the experiment. The first part consisted in establishing the significance of pruning as opposed to control or no pruning. Some growers claim that pruning gives bigger and better crops, while others are of opinion that just as big crops are obtained from unpruned vines, but both schools of thought have admitted that the quality of fruit obtained from unpruned vines is inferior (Willis 1948). The object of the first part of this experiment was to test whether pruning encouraged bigger crops of better quality. There were three treatments, namely, three node, seven node and no pruning of the foundation spurs. The foundation spurs are the normal tertiaries that give rise to flowers. The fixation of the severity of pruning namely three and seven nodes was arbitary and not in a regular succession. The second part of the experiment consisted of pruning treatment in regular succession of severity beginning

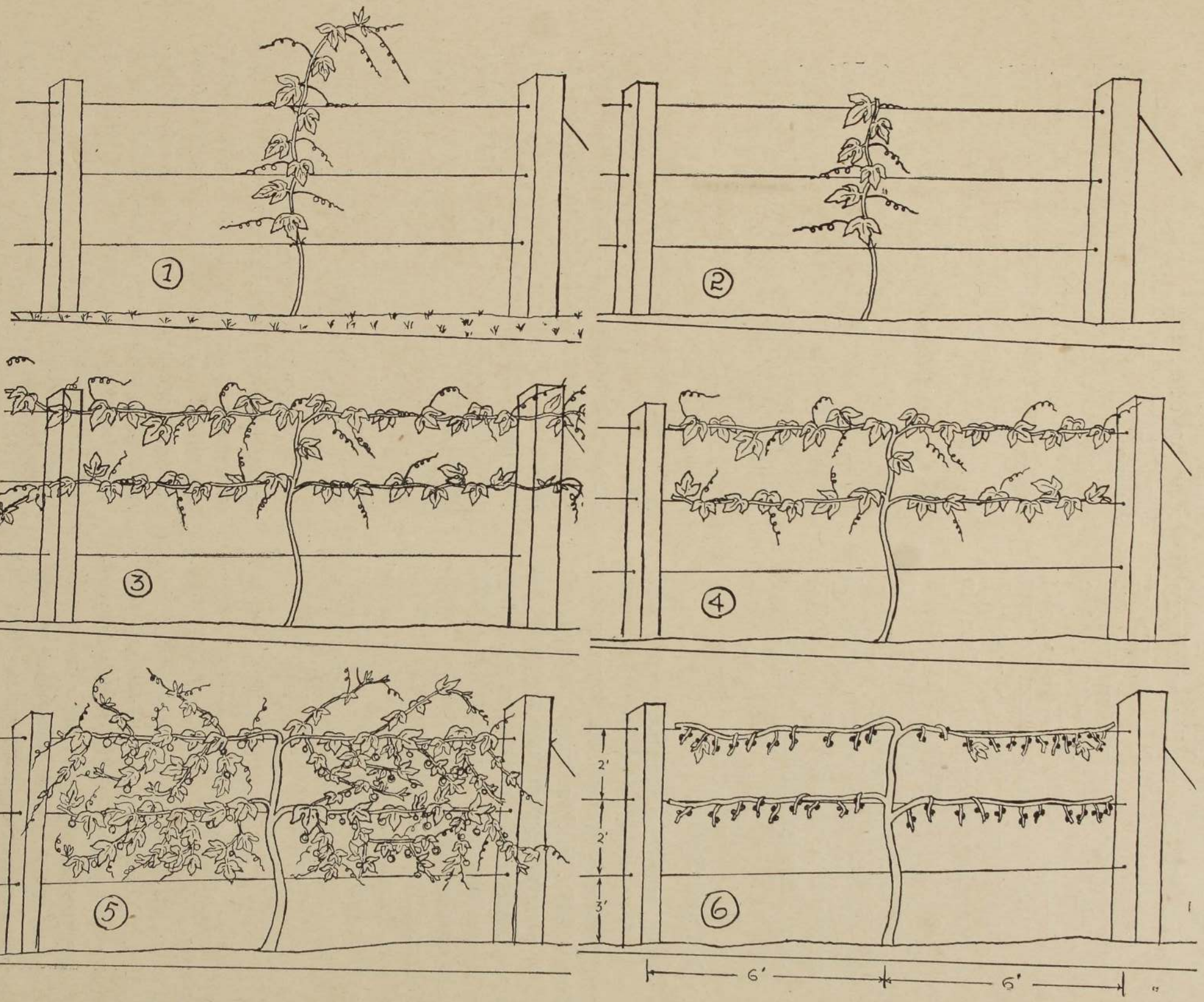


FIG I.—Training the Passion Vine. 1. Trained to a single stem. 2. Terminal bud nipped at 7½ feet. 3. Laterals trained on upper strands of wire as leaders. 4. Leaders nipped at 6 feet. to encourage growth of foundation spurs. 5. Foundation spurs develop on laterals. 6. Fruits form on foundation spurs.

with the first node of the fruiting spur and ending up with the fifth node together with control or no pruning. The same design was used with an increase in the number of treatments (Pearce 1953).

Season for Treatments

The season of pruning has been found to influence the 'effect'. The response has been found to be variable with the season in respect of yield of fruits, their quality and the vigour of fruiting spurs produced. During dry periods as well as wet periods pruning has had adverse effects on the vines causing dry and wet rot respectively. Vigour of growth has also been found to be poor if pruning is done during a prolonged dry spell but excessive when treated during wet weather. For greater production of fruit the period of pruning should be adjusted with the natural flowering period of the vines which occurs during the months March-April. The fruiting spurs take two to two and half months to mature and it is only at the end of this vegetative phase that reproduction begins. Pruning during January-February was found to suit the vines from the point of view of their natural flowering habits. Flowers do not set fruit readily during heavy showers of rain, and the distribution of fruit could be controlled by supplying artificial conditions such as irrigation during the dry spells. The fruits are in season normally during the period June to December but the biggest yields are obtained from July to September. The period of pruning also determines the seasonal distribution of fruit and the number of harvests. In the first part of this experiment there were fourteen fortnightly harvests and in the second part seven monthly harvests.

Treatment Effects

Apart from the yields recorded in experiments one and two there have been other important observations. There was a general dwarfing effect on vines treated, the exception being the control which was vigorous. The production of the number of fruiting spurs decreased as the severity of pruning increased, but the reduction of fruiting spurs increased the size of fruit. The production of flowers was simultaneous and not gradual, which was reflected in the harvests. The vines gradually lost vigour and did not last long, the productive limit being four years. Controls lasted for greater periods but with a poor performance. With artificial pollination a greater number of flowers set into fruit. This was the observation in the first part of the experiment. In the second part of the experiment no hand pollination was done and the yields decreased considerably. Certain species of ants have been found to be satisfactory pollinators.

Conclusions

The analyses of the first part of the experiment showed that pruning was significantly superior to no pruning, and that of three and seven node pruning, the three node pruning gave significantly higher yields. This part of

Table I—First Experiment

Harvests	Number of Fruits Picked			
	3 Node	*7 Node*	*Control*	*Total*
1	18	4	13	35
2	50	52	3	105
3	100	136	100	336
4	65	189	205	459
5	172	108	97	377
6	278	82	53	413
7	128	72	45	245
8	72	122	50	244
9	125	36	11	172
10..	180	75	72	327
11..	163	43	61	267
12..	275	128	120	523
13..	57	14	18	89
14..	34	0	0	34
Total ..	1,717	1,061	848	3,626

Table II—Second Experiment

Harvests	*Number of Fruits picked*						
	Control	*1 Node*	*2 Node*	*3 Node*	*4 Node*	*5 Node*	*Total*
1 ..	38	92	184	171	163	138	786
2 ..	15	73	95	127	65	35	410
3 ..	27	55	105	56	60	41	344
4 ..	7	4	5	4	14	0	34
5 ..	9	10	25	13	12	16	85
6 ..	0	10	22	16	0	0	48
7 ..	16	13	12	19	17	22	99
Total ..	112	257	448	406	331	252	1,806

the experiment was in the nature of a pilot trial and the choice of three and seven nodes for pruning treatments was arbitrary.

A more sensitive experiment to determine exactly what severity of pruning would give the highest yields formed the second part of this investigation. Pruning treatment ranged at all node intervals beginning with one and ending with five. It was not considered necessary to continue beyond the fifth node as three node pruning had already given the highest yields in the first part of the experiment.

The analyses of the second part of the experiment also revealed that pruning was superior to no pruning. It was also found that there was no significant difference between one, three, four and five node prunings. Two node pruning however gave a significant yield. The conclusion appears to be that the best interval of pruning treatment is at the second node. The yields were calculated by 'fruit count' but the significance would have been still more intensified if the calculation was based on the weight of fruits or still better on the weight of edible pulp. The analyses of variance and the data on which these calculations were based are given at the end of this article.

Summary

The results of experiments on pruning of passion vine for fruit, conducted at the Experiment Station, Peradeniya, have been discussed. Increases in yield obtained by pruning have also been statistically analysed. The response to two node pruning was found to be significantly greater than others. The system of training to facilitate pruning has been dealt with.

Acknowledgments

I am greatful to Mr. A. V. Richards for useful criticism and to Mr. P. Canapathipillai for the statistical analyses.

References

GARDNER, BRADFORD and HOOKER JR.—*Fundamentals of Fruit Production*—Mc Graw—Hill, Book Co., London.

K. C. NAIK—*South Indian Fruits and their Culture*—P. Varadachary & Co., Madras.

W. B. HAYES—*Fruit Growing in India*—Kitabistan, Allahabad.

W. H. CHANDLER—*Principles of Fruit Growing*—Hanghton Miffin, Boston and New York.

H. W. EASTWOOD—Pruning Passion Fruit Vines—*Agricultural Gazette, New South Wales*, Vol. 51.

I. E. EBBOT—Passion Fruit Growing—*Journal of Agriculture, Victoria, November* 1948.

W. G. COCHRAN and G. M. Cox—*Experimental Designs*—John Wileys & Sons, London.

S. C. PEARCE—Field Experimentation with Fruit Trees and other Perennial Plants—*Technical Communication No.* 23, *Commonwealth Bureau, East Malling.*

K. D. Mc GILLIVORY—Passion Fruit and Culture—*Agricultural Gazette, New South Wales, Vol.* 58.

J. M. WILLIS—Passion Fruit Growing in Southern Queensland—*Queensland Agricultural Journal, Vol.* 66.

ANALYSIS OF VARIANCE

To Compare 3 and 7 Node Pruning and No Pruning
(First Experiment)

	DF.	*S. S.*	*M. S.*	*F.*
BETWEEN HARVESTS	13	106,453	8,189	
BETWEEN NODES				
Control *vs.* Pruning	1	13,937	13,937	5·59*
Between Prunings	1	15,369	15,369	6·17*
ERROR	26	64,744	2,490	
Total	41	200,503		

Standard Error per plot = $\sqrt{2{,}490}$ with 26 d.f.

Standard Error of Mean Difference = $\sqrt{2{,}490\ (1/14 + 1/14)} = 18{\cdot}8$

	Mean Yields
3-Node Pruning	123
7-Node Pruning	76
Difference	47

t — 47/18·8 = 2, 50* on 26 d.f.
i.e. 0·01 < P < 0·02

ANALYSIS OF VARIANCE

To Compare 1, 2, 3, 4, and 5 Node Pruning and No Pruning.
(Second Experiment)

	DF.	*S. S.*	*M. S.*	*F.*
BETWEEN HARVESTS	6	76,462	12,744	
BETWEEN NODES				
Control *vs.* Pruning	1	4,092	4,092	6·99**
Between Prunings	4	6,421	1,605	2·74*
ERROR	30	17,559	585	
Total	41	104,534		

Standard Error per plot = $\sqrt{585}$

Standard Error of Mean Difference = $\sqrt{585\ (1/7 + 1/7)} = \sqrt{167} = 12{\cdot}9$

Significant Difference between Means (5% level) = 2,042 × 12·9 = 26·3

	5-Node	*1-Node*	*4-Node*	*3-Node*	*2-Node*
Mean Yields	36	37	47	58	64

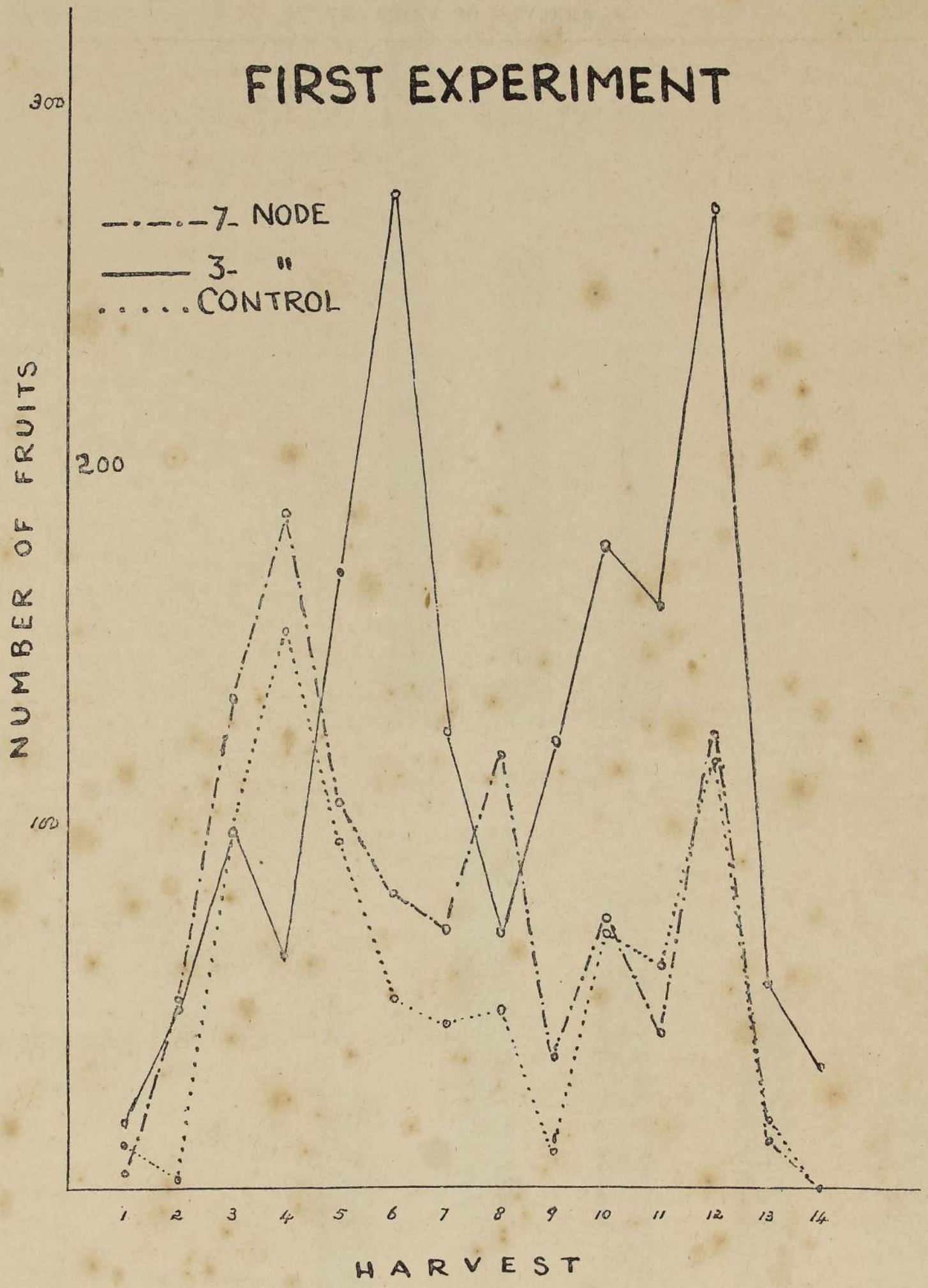


FIG. II.—Graph showing number of fruits picked per harvest 'n each treatment of Experiment 1.

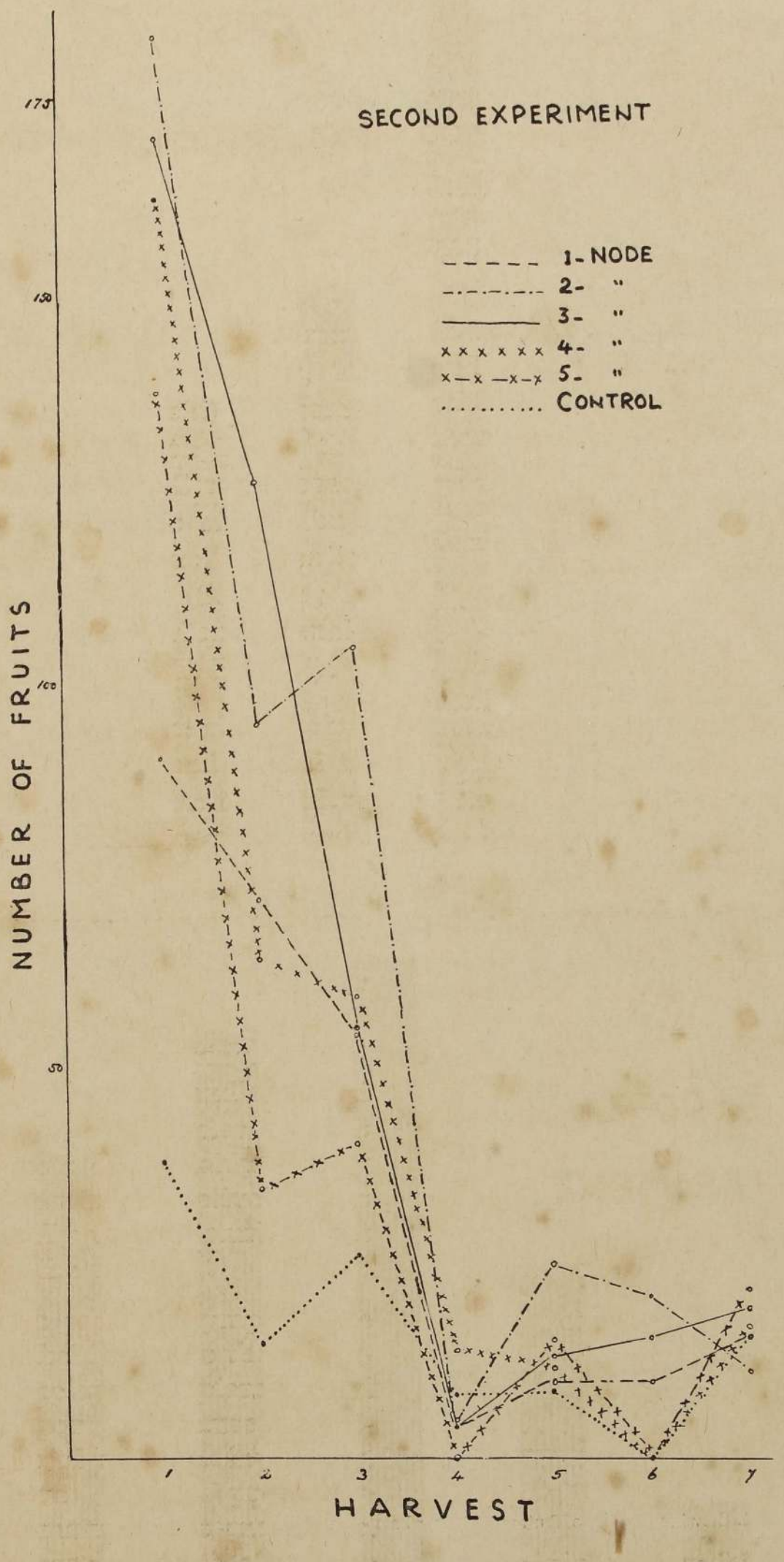
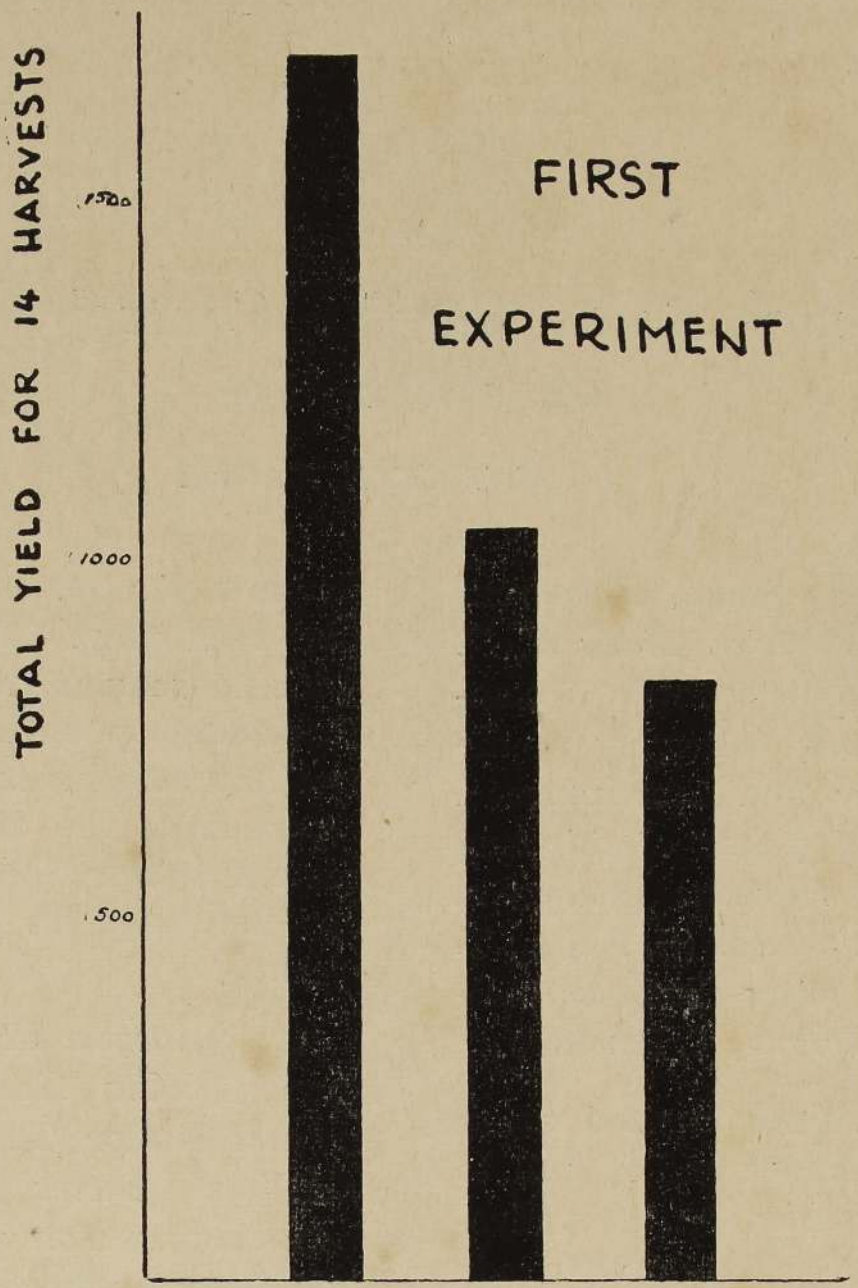


FIG. III.—Graph showing numbers of fruits picked per harvest in each treatment of Experiment 2.



3- NODE 7- NODE CONTROL

FIG. IV.—Comparative study of the total yield of fruits for each treatment in Experiment 1.

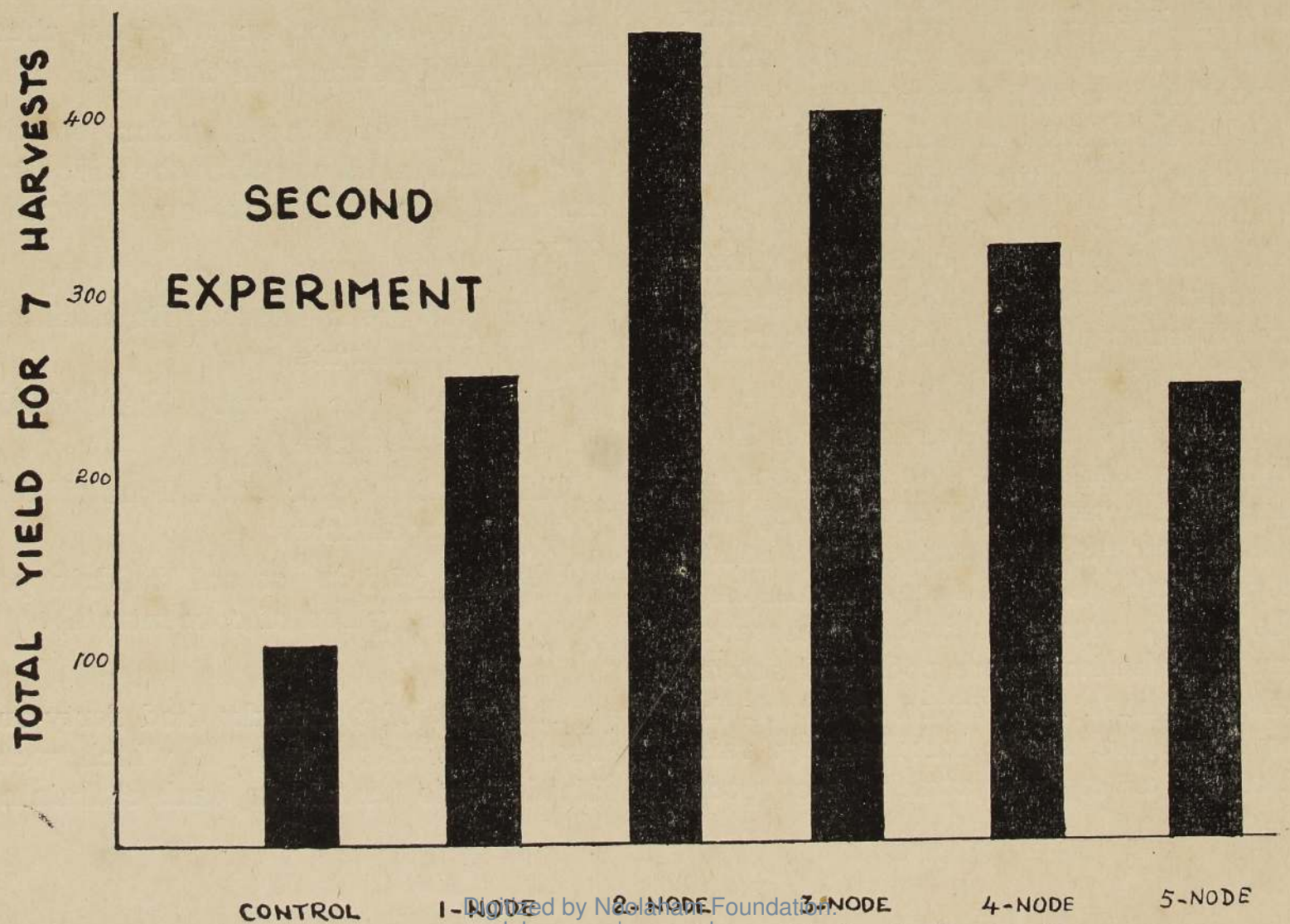


FIG. V.—Comparative study of the total yield of fruits for each treatment in Experiment 2.

A Preliminary Study on the Control of Red Bug of Bandakka

P. MANICKAVASAGAR

Received 28.8.54

THE RED BUG of Bandakka, *Dysdercus cingulatus* (S. *Bandakka Makuna,* T. *Vendich-Chev-Maddu-Poochi*) commonly attacks plants belonging to the families Malvaceae and Sterculiaceae. The favourite food plants of this bug besides bandakka *Hibiscus esculentis,* are cotton *Gossypium* Sp. (S. *Kapu ;* T. *Paruthi*) and red cotton *Bombax malbaricum* (S. *Katu Imbul ;* T. *Paruthi*).

The adult bug is medium sized, being about 20 mm. in length and is dull to bright orange in colour. On the underside of its body are white cross bands and spots. The first pair of its wings, which covers the folded membraneous second pair, has the distal ends black and proximal portions coloured either orange red or dull straw with a black spot in the middle of each wing. Several of these bugs in the adult and nymphal stages may be seen to cluster on pods and tender shoots of bandakka during feeding. The adults are active insects which run rapidly when disturbed, but seldom take to the wing.

The adults as well as nymphs have similar feeding habits due to the possession of the same type of piercing and sucking mouth parts and cause a considerable amount of damage. In feeding, the bugs have shown preference towards the immature pods and shoots, but they have been found to attack the hard mature seeds softened by rain. During a severe attack the pods, flower buds and shoots may shrivel up and even drop. The plants get stunted with consequent reduction in yield of marketable pods. This pest has proved itself to be a worse menace on cotton. Apart from the direct damage due to feeding habits, the staining of the lint by the bugs at harvest, lowers its quality.

An outbreak of this pest occurred during *maha* 1953-54 at the Experimental Station, Thirunelvelli, Jaffna, in about a quarter of an acre plot of bandakka, which was a varietal trial laid down by the Agricultural Research Officer, Jaffna. In the absence of parasitic flies, and the most effective predaceous bug, *Antilochus nigripes,* there was a rapid build up of the pest.

A preliminary investigation on the control of the red bug with the following chemical formulations was carried out :—

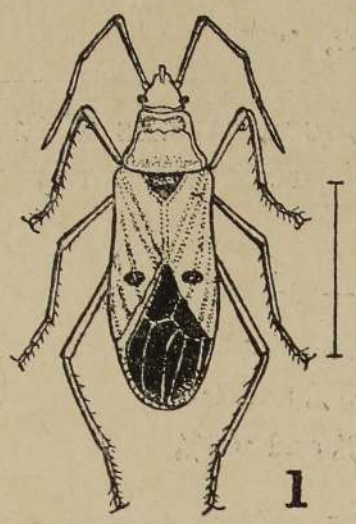
DDT 18 per cent. Emulsifiable concentrate

BHC 10 per cent. Emulsifiable concentrate

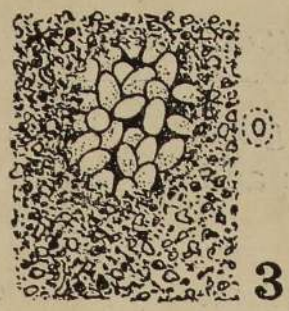
Chlordane 74 per cent. Emulsifiable concentrate

Dieldrin (1.5 lb. actual dieldrin per U.S. gallon of concentrate).

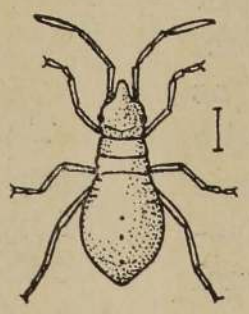
The plot of bandakka had forty-one rows of plants, forty of which were divided into ten blocks, each containing



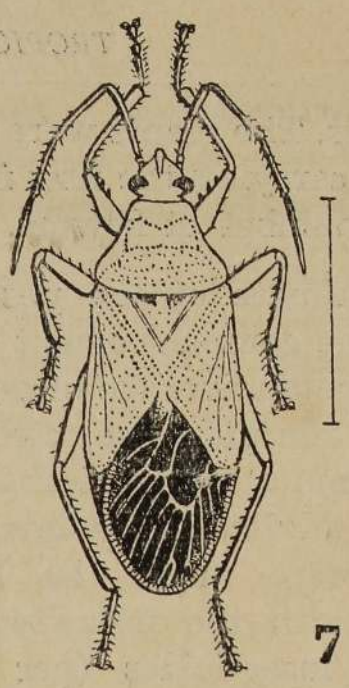
1



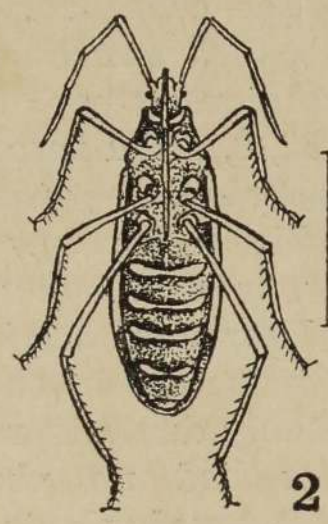
3



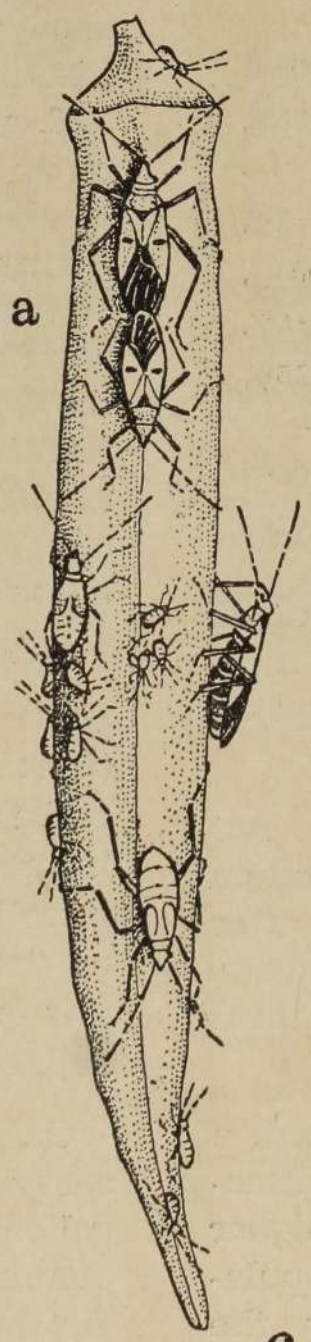
4



7

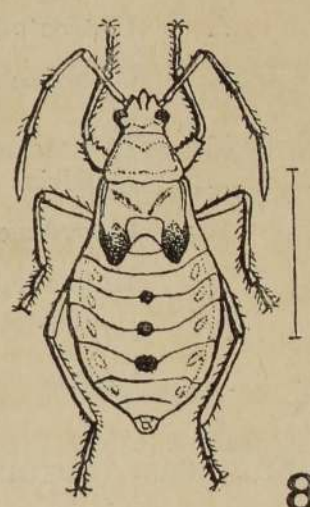


2

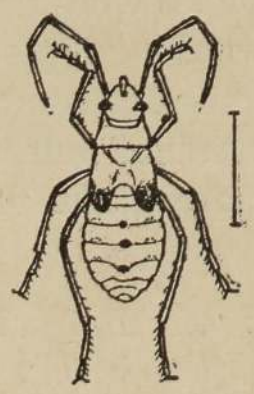


a

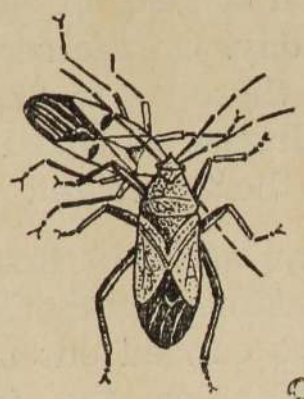
6



8



5



9

C de S. 2·6·39

BLOCK BY SURVEY DEPT. CEYLON

1. Dorsal aspect of adult Red Cotton Bug. 2. Ventral aspect of same. 3. Mass of eggs laid in soil. 4. Second stage cotton bug. 5. Fifth stage bug showing wingpads. 6. Bandakka pod showing a mating pair of bugs at *a*, and other stages of bug feeding. 7. Adult predaceous bug. 8. Fifth stage predaceous bug, showing wingpads. 9. Predaceous bug feeding on cotton bug.

6 and 9 are natural size. The lines near others show natural sizes

four rows. The plants were of very good growth, carrying the first few pods and a large number of flowers.

An estimate of the pest infestation before the commencement of the treatment gave an average of eight bugs per plant on ten plants selected at random. These counts included the nymphs as well as adults. Immediately after the counts were made the blocks were treated with the following concentrations of insecticides (per cent. actual insecticide in prepared spray), and the treatments were randomised :—

Block 1	..	DDT	..	·03%
Block 2	..	Dieldrin	..	·75%
Block 3	..	Untreated check		—
Block 4	..	Chlordane	..	·2%
Block 5	..	BHC	..	·003%
Block 6	..	Dieldrin	..	·5%
Block 7	..	Chlordane	..	·15%
Block 8	..	Untreated check		—
Block 9	..	DDT	..	·05%
Block 10	..	BHC	..	·02%

Each plant was thoroughly sprayed at the rate of 1½ gallons of spray solution per treatment on each block, using a knapsack sprayer.

There was very bright and hot weather on the day of spraying and on the next day. On the second day after spraying there were heavy showers, while a drizzle persisted on the third day after the treatment.

Five days after the first treatment, a second treatment with the same insecticides was carried out using a higher concentration as the insect population had not been affected by the first treatment. The second treatment was carried out using the same equipment and the same volume of spray per block. The concentrations of the insecticides in the prepared spray were as follows :—

Chlordane—·9% and ·4%
DDT—·2% and ·1%
Dieldrin—3% and 1·5%
BHC—·1% and ·06%

Three hours after treatment a complete paralysis was noticed in the case of nymphs, and twitching of the limbs in the adults. On the second day after the second treatment, a representative random count of the insect population showed a 100 per cent. mortality in blocks 1, 2, 4, 5, 6, 7, and 9. In blocks 3, 8, and 10 the intensity per plant was on an average 12, 8, and 1 respectively. In all the treatments except those with Benzene hexa chloride at a low concentration, there was complete freedom from the pest. Unsprayed check blocks too showed a reduction in the insect population probably due to spray drift. The insecticides had no phytotoxic effects on the sprayed plants at the concentrations used.

Eighteen days after the second treatment a reinfestation of the plants by these bugs was noticed. Mostly nymphs and a very few adults were found in this instance. This would suggest that the insecticides under Jaffna conditions have no impertant residual effects against this pest for more than fourteen to eighteen days.

On the basis of the gallonage of spray required per block, about 40 gallons of spray liquid will be required per acre using a knapsack sprayer. Of all the chemical treatments employed DDT has proved the cheapest, while it is as effective as any of the other chemicals used. For complete control of

Mortality of Red Bugs 24 hours after spraying with a Series of Insecticides at various Concentrations

Plot No.	*Concentration of Insecticide*	*Dilution Rate in 1 Gallon of Water of Formulation*	*Average Infestation of Bugs per Plant*					
			Prior to spraying			*24 hrs. after spraying*		
			ADULTS	NYMPHS	TOTAL	ADULTS	NYMPHS	TOTAL
1	D. D. T. ·1%	1 fl. oz.	9	5	14	—	—	—
2	Dieldrin 3%	2 ,, ,,	5	4	9	—	—	—
3	Control	—	7	7	14	11	1	12
4	Chlordane ·9%	2 fl. oz.	5	—	5	—	—	—
5	B. H. C. ·06%	1 ,, ,,	10	5	15	—	—	—
6	Dieldrin 1·5%	1 ,, ,,	5	7	12	—	—	—
7	Chlordane ·4%	1 ,, ,,	8	5	13	—	—	—
8	Control	—	8	12	20	8	—	8
9	D. D. T. ·2%	2 fl. oz.	5	3	8	—	—	—
10	B. H. C. ·1%	2 ,, ,,	8	4	12	1	—	1

an infestation of red bugs on bandakka, about two pints of a 15 per cent. to 25 per cent. DDT emulsifiable concentrate will be required. This would work out at a cost of about Rs. 4.25 for insecticide alone per acre. In addition to its cheapness and its effectiveness it presents about the least hazard to human beings if harvesting is avoided for three weeks to a month after the last spraying with DDT.

Acknowledgment

I thank Dr. H. E. Fernando, Entomologist, for valuable help in the preparation of this paper.

A Feeding Trial with Chickens under Backyard Conditions

J. S. L. WHITE

Received 20.8.54.

No DATA are available in Ceylon on the value of local feeding stuffs in poultry feeding. We measure the nutritive value of feeds largely by their chemical composition, but their biological values can only be determined by actual feeding trials and by results obtained with respect to such factors as growth, maintenance and reproduction.

In order to obtain some practical information on feeding of chickens under backyard conditions this trial was set up. Local feeding stuffs with the exception of a small percentage of wheat bran which was used in the chick mash only, were used in this trial.

The duration of the trial was 500 days, from February 18, 1953, to July 3, 1954.

Source of Stock

102 pure-bred Australorp eggs of average size and sound shell were obtained from the Coconut Research Institute, Lunuwila, and set in a Hearson's incubator. The birds in this Institute were originally obtained from the Government Farm, Ambepussa and hence are representative of the Australorps found in all the Government Farms in this country. Details of eggs set, fertility, hatchability, &c., are given in Table I.

Table I

No. of eggs set	102
Date set	28.1.53
Breed	Australorp
Fertility	91%
No. of chicks hatched ..	76
Date hatched	18.2.54
Hatchability of fertile eggs ..	81·8%
No. of deaths (1st month) ..	12
No. of deaths (after 1st month) ...	Nil
No. culled (2nd month) ..	6
No. of cockerels sold ..	31
No. of pullets culled (before housing)	10
No. of males housed (6th month) ..	2
No. of females housed (6th month)	15

Pullets that were stunted, out of condition, lacking in vitality and showing very poor development of secondary sexual characters were culled between the fourth and sixth months, in the same way as any intelligent poultryman will do if he wishes to eliminate in time birds that will increase his feed bill and give little or nothing in return. All excess cockerels were disposed of by the sixth month.

Management

All details of feeding and management were attended to personally by the writer. The chicks were reared up to one and a half months of age on a wire-netting 'sun porch' 10 × 4 × 1 feet with a house 4 × 4 × 1½ feet attached. The source of heat was an ordinary kerosene oil hurricane lantern. Thereafter, they were reared on the ground

in strict confinement within a wire-netting run approximately 65 square yards in extent. The house which had wire-netting sides and bottom, was supplied with closely spaced slats till the birds were four months old and then suitable perches were substituted. The runs had no vegetation at all.

All the birds were innoculated against Ranikhet disease at three months and a week later the sexes were separated. Neglect in vaccinating birds against 'Fowl Pox' resulted in the birds contracting this disease when they were five months old. By careful individual attention the disease was overcome but no doubt it affected sexual maturity and consequently egg production for about two weeks.

The majority of deaths among chicks under one month old was due to Pullorum (Bacillary White Diarrhoea). Thereafter, mortality was nil and the 15 pullets and 2 cockerels housed are all surviving at seventeen months of age.

The flock was treated for worms once a month with Phenothiazin beginning with the fifth month.

Feeding

Dry mash was fed *ad libitum*. Whole grain was not fed at all. Ingredients were purchased from a leading dealer in feedstuffs and mixed at home. Feed wastage by 'billing off' was eliminated by construction of simple feed troughs made of wood with 'lips' along the edges. The appetites of the birds were maintained by occasionally allowing the feed troughs to be emptied and leaving them empty for a short time. During very hot and dry weather if birds appeared to be going off feed, a little water was sprinkled on top of the mash. This helped to maintain feed consumption at a satisfactory level. Table II gives the mash mixtures used.

Table II

Ingredients	*% Mash Mixtures by Wt.*		
	0–8 wks.	*8 wks. to 4½ mths.*	*Pullets and hens*
Yellow Maize Meal	50	44	47
Coconut Poonac (Expeller 8.5% fat)	6	15	18
Fish Meal	22	18	12
Rice Bran (Gr. I)	15	20	20
Wheat Bran	5	—	—
Skim Milk Powder	2	1	—
Sterilized Bone Meal	—	1½	2½
Salt	—	½	½
Analyses of Mash—			
Protein (Approx.)	19	17·5	16
Calcium (Approx.)	1	1·3	1·35
Phosphorus (Approx.)	0·65	0·8	0·8

These mashes were compounded having reasonable regard for the recommended levels of protein, calcium and phosphorous for the different age groups. The other mineral and vitamin requirements were not considered important as the diet fed in this trial was presumed to contain these in sufficient quantities. Veterinary codliver oil containing 750 Vit. A. I. U. per gram and 75 Vit. D. I. U. per gram was mixed with the mash three times a week at 1 ounce per 5 pounds mash. Tender fresh green material such as *Ipomaea aquatica* (S. *Kankun*) and *Alternathera triandra* (S. *Mukunuwenna*) was also supplied three times a week at 1 pound per 100 chicks from two weeks to two months of age; at 2 pounds per 100 birds from two to four months; at 4 pounds per 100 birds from four to six months and at 6 pounds per 100 birds from six months onwards. No grit of any kind was provided up to one and a half months. Thereafter, birds had access to grit and sand found under natural conditions in the run, while shell grit was supplied *ad libitum*. Ample clean water in suitable water fountains was kept before the birds at all times.

Table III gives the average composition for practical purposes of all feedstuffs mentioned in this article.

Table III—Analyses of Feedstuffs (Per cent.)

Feedstuffs	*Crude Protein*	*Fat*	*Fibre*	*Calcium*	*Phosphorus*
Yellow Maize Meal	8	5	3	0·03	0·14
Rice Bran (Grade I)	12	15	10	0·08	0·4
Coconut Poonac (Expeller)	22	8·5	10	0·21	0·15
Fish Meal	45	4·5	—	4	2·5
Sterilized Bone Meal	—	—	—	29	15
Wheat Bran	17	4·5	9	0·15	1·3
Skim Milk Powder	35	1	0·2	1·3	1

Mash consumption. A record of the total monthly mash consumption of the whole flock was kept and details of approximate daily and monthly mash consumption per bird, and costs were calculated on the following basis :

Chick mash at 25 cents per pound.
Grower's mash at 24 cents per pound.
Layer's mash at 23 cents per pound.

The above rates include the cost of the cod-liver oil and green leaves. Table IV gives this information.

Table IV—Feed Consumption and Cost per Bird for seventeen Months

Mash Consumption		*Cost per Month*
Monthly (lb.)	*Daily (oz.)*	*Rs. c.*
1·2	·6	0 30
2·0	1·0	0 50
4·0	2·0	0 96
5·0	2·5	1 20
7·0	3·5	1 65
7·3	3·75	1 68
7·3	3·75	1 68
8·0	4·0	1 84
8·0	4·0	1 84
7·0	3·5	1 61
7·0	3·5	1 61
7·0	3·5	1 61
7·0	3·3	1 61
8·0	4·0	1 84
7·0	3·5	1 61
7·2	3·6	1 66
8·4	4·2	1 93

NOTE.—Costs are high as the feedstuffs were purchased from a forage dealer and include cost of transport by rail.

Results and Observations

The growth and feathering of chicks were very satisfactory. No deficiency symptoms were observed. There were only two cases of cannibalism. This was arrested by segregating the victims and hanging bundles of tender green material to keep the chicks occupied. Birds did not suffer from colds or any respiratory diseases.

Table V gives ages at first egg for 10 pullets. These data were obtained by observation of the birds and by examination per cloaca. The average age at sexual maturity for these 10 pullets was 170.4 days.

Table V—Sexual Maturity and Weight

Hen No.	*Age at 1st Egg (Days)*	*Wt. at 14 months (Pounds)*
4	154	3·75
2	159	4·25
6	160	4·50
17	161	4·25
23	165	5·00
3	171	3·75
1	174	4·75
7	185	5·00
5	185	5·25
10	190	4·75
8	—	4·25
13	—	5·00
21	—	4·25
20	—	5·00
15	—	3·75

The average weight of first egg was 1.5 ounces while the average weight of an egg three months later was 2.03 ounces, the highest being 2.4 ounces and the lowest 1.5 ounces.

Judging from the health and appearance of birds and egg production, it is unlikely that the pullets were forced into too early production, even if body weights appear to be below standard. This, however, is a matter that needs further experimentation because it

depends on the strain and parent stock too. One thing is certain, however, and that is, that sexual maturity of pullets in this country is considerably delayed due to poor feeding and, perhaps, due to indifferent management.

'All Mash' and No Grain system of Feeding

The following are some facts on the 'all mash' feeding system adopted in this trial :—

(*i*) It requires less skill on the part of the feeder than does a grain and mash system, which requires good judgment in regulating the proportions of grain and mash intake, hence even inexperienced labour will be suitable.

(*ii*) It requires less labour as weighing (if dry mash is fed) and feeding according to a schedule are not necessary.

(*iii*) If dry mash is fed it is more sanitary than wet mash feeding which attracts flies and favours spread of disease.

(*iv*) Birds are kept more contented throughout the day, but will not over eat as the mash is dry.

(*v*) Dry mash requires only half as much feed trough space as that required in wet mash feeding.

(*vi*) The mash in the 'all mash' system requires about 25 per cent. less protein than the mash in the 'mash plus grain' system. Hence making up a mash in the 'all mash' system presents less practical difficulties, as many feedstuffs high in protein are not required.

(*vii*) The poultryman must be alert to see whether feed consumption is maintained at a satisfactory level. If not, it will be necessary to adopt such devices as sprinkling a little water on the mash or withholding feed for short intervals.

Egg Production

Table VI gives the monthly total egg production records of the 15 pullets up to July 3, 1954. Egg production was maintained at 50 per cent. and over for eight consecutive months (Fig. I).

The total number of eggs produced by the 15 pullets during this period was 2,678. Mortality was nil. The average egg production per bird on the hen housed basis calculated by dividing the total number of eggs laid during the period by the number of pullets in the flock at the beginning of the period was 178.5.

Out of the 2,678 eggs produced, 1,305 were sold to a hatchery and to poultrymen for hatching. From reports received it appears that the fertility and hatchability and livability of chicks were very good which shows that the ration fed was suitable both for commercial layers as well as for breeding stock.

Table VI—Monthly Egg Production Record

Month	*Monthly Total*	*Daily Range*	*Average No. per Day*
1953			
July (9 days)	16	—	—
August	123	1–7	3·97
September	235	2–12	7·83
October	310	6–12	10·0
November	327	7–15	10·90
December	244	3–12	7·87
1954			
January	268	4–14	8·64
February	257	5–13	9·17
March	261	5–11	8·42
April	226	5–12	7·63
May	182	3–9	5·87
June	213	3–1	7· 1
July (3 days)	6	—	—

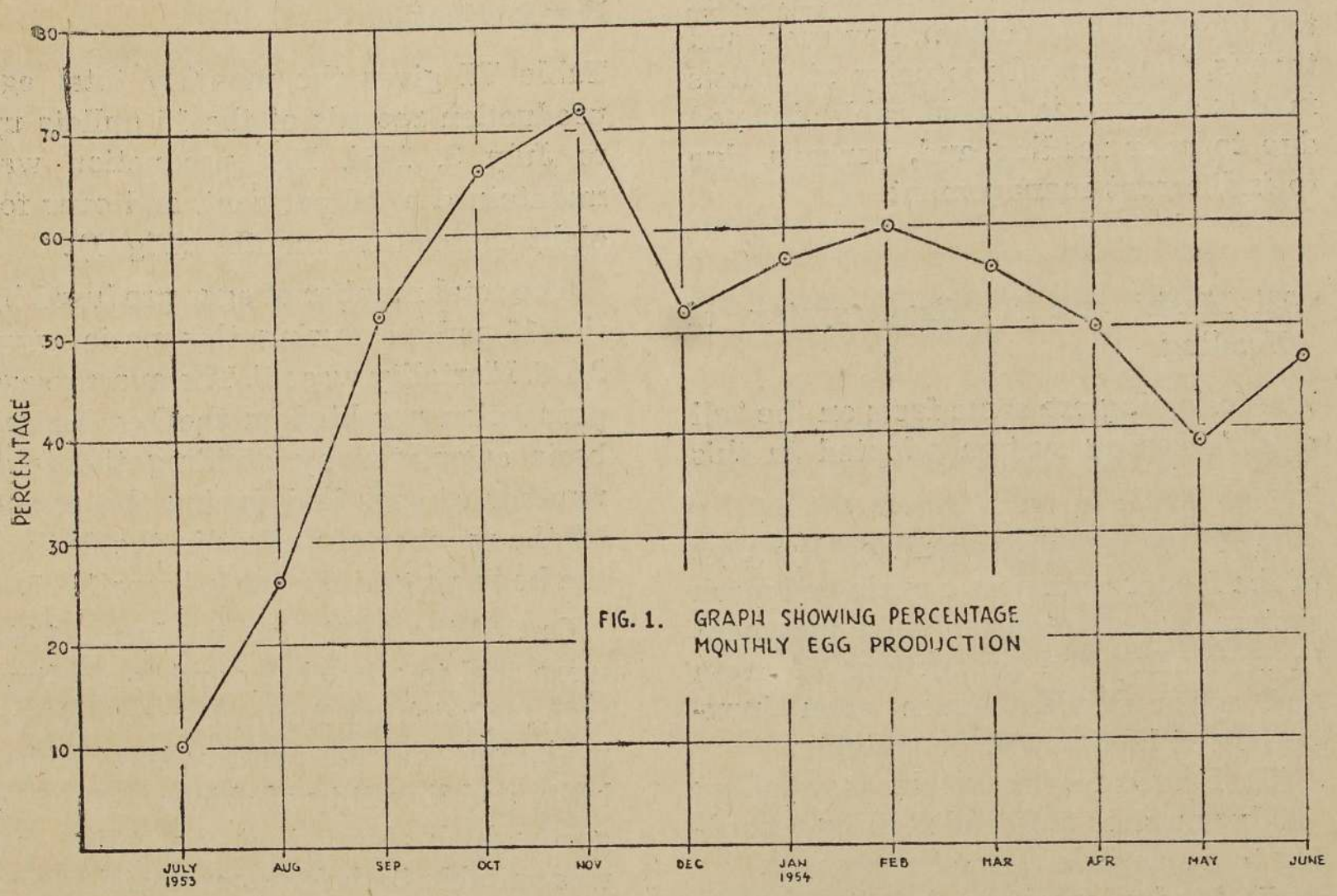


FIG. 1. GRAPH SHOWING PERCENTAGE MONTHLY EGG PRODUCTION

Conclusion

This trial indicates that :—

(*i*) The Australorp in this country has the capacity for fairly high egg production.

(*ii*) The main factor limiting egg production in Ceylon appears to be improper feeding and management and if this is overlooked there will be little use in importing better strains of chickens.

(*iii*) Up to 20 per cent. at least of fair quality rice bran can be used in the grower and layer mashes and 15 per cent. at least in, the chick mash without ill effects.

(*iv*) A fairly high percentage of fish meal of good quality can be used in a chick mash with advantage when vegetable protein feeds such as green gram, cowpea and gingelly poonac are comparatively more expensive.

(*v*) Suitable rations can be compounded without green gram and cowpea which are useful human foods.

(*vi*) Late sexual maturity that is commonly found in Ceylon is quite probably due to bad feeding and, perhaps, bad management too.

(*vii*) The backyard poultryman with a flock of 10 to 15 production bred birds, well fed and managed, can contribute very materially towards making this country self sufficient in eggs. In fact this trial indicates that for this country to be self-sufficient in eggs many large-scale poultry farms are not absolutely necessary. 15,000 more backyarders each producing 2,070 eggs per year with 15 hens will make up the deficit of 31 million eggs, which were imported in 1952.

Investigations on the Canning of Bananas

D. P. DIAS, N. L. JAIN AND GIRDHARI LAL

Received 29.4.55

BANANA IS one of the most important of the tropical fruits. In India it is widely cultivated in the States of Madras, Bombay, Bengal, Assam, Bihar, Travancore and Mysore. Large quantities of surplus fruit, particularly during the peak season, do not fetch reasonable returns to the growers, and occasionally go to waste. Economic utilization of such fruit should, however, be possible by suitably processing and preserving it.

A number of products are reported to have been prepared from both the ripe and unripe fruit (Anon, 1943 ; Von Loesecke, 1949 ; Anon, 1950). Some work on the canning of banana puree as a baby food and banana chunks in syrup, has also been reported recently (Guyer and Erickson, 1954 ; Board & Seale, 1954). Investigations undertaken at the Central Food Technological Research Institute, Mysore (India) on the canning of bananas in syrup alone or in combination with other fruits to form salads have shown that the product obtained in either case is of satisfactory quality and appears to have great possibilities for export to places where fresh bananas are not available. The present paper deals briefly with the experiments carried out in this connection, and the methods finally standardized.

Experimental

Raw Material. Bananas for these experiments were obtained from the local fruit market. Fully ripe yet firm fruit was used. Banana bunches are normally harvested by the growers when fully developed and mature but still green and hard. This green fruit is artificially ripened in different ways (Von Loesecke, 1949). At the fully ripe stage, the fruit pulp softens and the skin becomes loose and develops yellow, yellowish green, reddish grey or yellowish grey, &c., colour, depending upon varietal characteristics. In most cases, greyish or brownish flecks also start appearing on the surface.

The common varieties available in Mysore market, viz., *Rasbale, Salembale, Pache-bale* and *Chander-bale,* were used in the present studies. Some relevant data collected on a few typical lots of the ripe fruit of these varieties are given in Table I. The usual A. O. A. C. (1950) methods of analysis were employed.

Preparation for Canning. The fruit was peeled with hand and cut transversely into slices of $\frac{1}{2}$ to $\frac{3}{4}$ inch thickness, with stainless steel knives.

Bigger pieces of about 2 inches long and small sized whole fruits (3-4 inches) as such after peeling, or cut lengthwise into halves, were also used in some packs.

Pre-treatment. The fruit was canned as such, as well as after treatment in $CaCl_2$ solution (2.5 per cent.) and lime water (saturated, clear solution of calcium hydroxide) for different periods

varying from 15 to 45 minutes. The fruit after treatment in lime water was rinsed in 0.05 per cent. citric acid solution.

Table I—Analysis of Ripe Bananas

Analysis Factor	*Variety Pachebale*	*Variety Rasbale*	*Variety Salem-bale*	*Variety Chanderbale*
Wt. of 1,000 fruits (lb.)	280 ..	100 ..	160 ..	195
Wt. of peels (lb.)	100 ..	20 ..	40 ..	70
Proportion of prepared (peeled) fruit % ..	64·3 ..	80·0 ..	75·0 ..	64.1
Analysis of pulp.				
Reducing sugar %	6·3 ..	10·4 ..	11·4 ..	—
Total sugar as reducing	15·8 ..	19·0 ..	18·6 ..	—
Total soluble solids by refractometer % ..	18·0 ..	22·0 ..	22·5 ..	25·0
*p*H	5·3 ..	4·7 ..	4·5 ..	4·8
Acidity (as malic acid) %	0·31	0·42 ..	0·50 ..	—
Ascorbic acd mg. %	2·0 ..	6·7 ..	8·2 ..	3·5

Canning Syrup. Cane sugar syrup of concentrations from 20 to 75 * per cent., and inverted sugar syrup of 80° Brix, were used as the liquid canning medium. In some solid packs, crystalline cane sugar and in salad packs, orange syrup were also used. The *p*H of the fruit being rather high, citric acid was added to the canning syrup to bring down the *p*H of the packs.

To determine the amount of acid required to be added, sugar syrup was acidified to different levels from no acid to 0.50 per cent. Banana slices and acidified sugar syrup were mixed in a waring blendor in the ratio † of 2 : 1, and *p*H of the resultant mixture was determined in each case with a glass electrode. Results are presented in Table II. Final packs, to determine the maximum palate tolerance limit, were prepared using canning syrup containing 0.15, 0.2, 0.25, 0.30, 0.40 and 0.50 per cent. citric acid. In one lot, 1.0 per cent. calcium chloride was added to the syrup to find the effect on texture and appearance of the canned product. Amyl acetate (0.01 to 0.05 per cent.) and a banana essence (0.05 to 1.0 per cent.) were also added separately to the canning syrup to see if the flavour of the canned product could be improved.

Table II—Addition of Citric Acid to the Canning Syrup to bring down the pH of the Canned Product

Citric Acid added to Syrup %	*pH of the Mixture of Fruit and Syrup (in the ratio of 2:1)*
0·00 ..	4·80
0·05 ..	4·70
0·10 ..	4·65
0·15 ..	4·52
0·20 ..	4·40
0·30 ..	4·30
0·40 ..	4·15
0·50 ..	4·00

** 75 per cent. sugar syrup was prepared by taking sugar and water in the ratio of 3:1 and bringing the mixture to a boil to dissolve the sugar. The boiling hot syrup obtained was added immediately to the fruit in the cans.*

† In actual canning experiments, fruit and syrup were packed in the ratio of 3:2. In the preliminary tests to determine the amount of acid required to be added to syrup, the fruit and syrup were taken in the ratio of 2:1 to allow for a safe margin.

Filling and Syruping. The fruit after peeling was found to discolour and become brownish if kept exposed. This was found to be due to a strong oxidase action. In the preparation of canned packs, therefore, the fruit slices were cut immediately after peeling, put directly into the cans and covered with hot syrup in the usual way. Plain tin cans of sizes 1 lb. short (301 × 309), A2½ (401 × 411) and 1 lb. squat form (401 × 300) were used in these experiments. Amount of fruit packed in each of these cans was 8 oz., 20 oz., and 12 oz. respectively. Enough canning syrup was added to fill the cans within about ¼″ headspace. This gave roughly a fruit syrup ratio of 3 : 2 in the final packs.

Solid packs in 1 lb. short cans were prepared with 11 oz. fruit and 1-2 oz. syrup of concentrations from 60 to 80 per cent. (sucrose or invert sugar), and containing 0.2 per cent. added citric acid. Sugar syrup in some packs was replaced with 1 oz. crystalline sugar.

Exhausting. The filled cans were exhausted as usual in boiling water to get a temperature of about 175°F in the centre of the cans. It took about 5, 8 and 7 minutes respectively, in case of 1 lb. short, A2½ and 1 lb. squat cans to attain the above temperature.

Processing. Processing temperature employed ranged between 207°F (Boiling point of water at about 2,700 ft. altitude, at Mysore) and 240°F. Normally, fruits are processed in boiling water (212°F). Processing temperatures higher than this were employed in these studies because in some cases the quantity of acid added was not enough to bring the *p*H below the border line value of 4.5. Times of processing employed ranged between 15 and 45 minutes, for different temperatures and can sizes. After processing, the cans were cooled as usual in running cold water.

Testing and Examination of the Canned Product. The canned product prepared under each of the treatments employed in these studies was stored at room temperature (25-30°C) and tested periodically during a storage period of over one year, by the cut out technique of Hirst and Adam (1932). Incubation tests of the product prepared by the method finally evolved and as recommended in this article, were carried out at 37° and 50°C for 6 weeks. Microbiological examination was also conducted to test the sterility of the packs.

Results and Discussion. Due to the presence of tannins in the fruit, the peeled and cut fruit darkens if allowed to come in contact with iron. It is, therefore, very important to avoid iron from all equipment coming in contact with the fruit. To prevent enzymic discolouration, the peeled and cut fruit should be immediately put in the can and covered with hot syrup. This is not difficult in commercial practice where the entire canning process is a continuous one.

Sugar syrup of 25-30° Brix (i.e., about 5° higher than the soluble solids content of the fruit pulp), acidified with 0.15 to 0.2 per cent. added citric acid, is regarded as the best canning medium. No adverse effect on the natural flavour of the fruit could be detected under these conditions. With higher propor-

tion of acid, the flavour became rather unnatural. With canning syrup of higher sugar concentrations, there was no material improvement in the quality of the packs. Solid packs with regard to flavour were slightly superior to the product packed under specifications given above. At the same time, these were regarded as too sweet and also suffered from gelation and clot formation, turbidity of syrup and disintegration of fruit.

Packs of all the four varieties in 1 lb. squat and 1 lb. short cans, employing canning syrup of 0.15 to 0.20 per cent. acidity (citric acid), and processed for 15 minutes at 228°F did not show any spoilage in incubation tests carried out for six weeks at 37° and 50°C. Microbiological examination also did not reveal the presence of any spoilage organisms. Higher processing temperatures in which case the amount of acid necessary could be reduced further, produced pinkish discolouration in the product during 15 minutes process.

A process of 15 minutes in boiling water (at 2,700 ft. altitude of Mysore corresponding to about 10 minutes at sea level) for 1 lb. short cans, or 20 minutes (about 15 minutes at sea level) for 1 lb. squat cans, was found adequate, when the fresh fruit had a *p*H of 4.8 or less and the canning syrup an acidity of 0.2 per cent. These packs had a maximum equilibrium *p*H of 4.4.

Out of the four varieties used in these experiments, *Pachebale* and *Chanderbale* were found to be good canners. *Salembale* and *Rasbale* did not yield canned products of good texture and flavour, although the latter is a good table variety. When fruit of a suitable variety was used, the overall quality of the product packed and processed according to the details recommended in this article was good; the flavour closely resembled that of the fresh fruit. Results of a typical cut out test of the canned product of all the varieties after 12 months storage are presented in Table III.

Treatment of the fruit in lime water or $CaCl_2$ solution prior to canning, as also addition of $CaCl_2$ to the canning syrup, did not materially improve the quality of the final packs with regard to texture. As the texture of the packs without any of these treatments was quite satisfactory, none of these treatments is regarded as necessary in the canning of bananas. Addition of amyl acetate to the canning syrup at 0.03 per cent. was found to improve the flavour of the product and thus guard considerably against adverse changes in flavour during storage. Plain tin cans proved quite satisfactory for canning.

Canning of Fruit Salads. Banana slices canned in combination with orange segments, papaya slices and jack fruit segments, employing sugar syrups of 45°, 40° and 35° Brix, respectively gave fruit salads of good quality with mixed flavours. Orange juice, of which the Brix had been raised to 45 degrees with added sugar, when added as canning syrup for banana slices, did not give a good product, mainly due to the development of bitterness in orange juice.

Recommendations. On the basis of investigations reported in this paper, the following method is recommended for the canning of bananas both on a small and large scale.

Table III—Cut-out Data on Canned Bananas (1 lb. short plain cans) after 12 Months' Storage at 25-30°C

Variety	Vacuum (Inch.)	Drained weight		Strength of Syrup (Deg. Brix)	Appearance		Texture	Taste and odour
		Fruit (oz.)	Syrup (oz.)		Fruit	Syrup		
Pachebale	8·0	7·0	6·0	22	Normal, creamy white	Slightly turbid	Good soft texture; no fibrous peel	Pleasant taste and odour
Chanderbale	8·5	7·0	5·5	23	Normal, pinkish white	Cloudy	Fairly soft; no fibrous peel	Good taste; odour rather weak
Salembale	9·5	7·5	5·25	24	Normal colour	Cloudy	Rough and somewhat fibry	Starchy taste; very weak odour
Rasbale	6·5	7·25	5·5	26	Good colour; rough appearance	Cloudy..	Fibrous; natural creamy texture completely changed	Starchy taste; odour weak and unnatural

Note.—The condition of the cans in all cases was sound : there was only light feathering of the tinplate.

1. Select fully ripe but firm and sound fruit of a suitable variety. *
2. Peel the fruit by hand and cut immediately into slices of $\frac{1}{2}''$ to $\frac{3}{4}''$ thickness. Contact of the fruit with iron should be avoided at all stages to prevent darkening.
3. As soon as the fruit is cut, put it in the cans. In case of 1 lb. squat cans, 12 to 13 oz. slices may be packed in each can. Fill in boiling hot syrup of 25-30° Brix, containing 0.2 per cent. added citric acid, leaving about $\frac{1}{4}''$ head space.
4. Exhaust the filled cans in boiling water for 6-7 minutes (until the temperature in the centre of the can reaches 175°F).
5. Seal the cans immediately in a double seamer and process them for 15 minutes in steam at 5 lbs. pressure (sea level) ; or in boiling water, if the *p*H of the fresh fruit is not more than 4.8.
6. After processing, cool the cans immediately in running cold water, dry and store in a cool dry place.

Summary

Banana is an important tropical fruit of India and many other countries. Investigations carried out at the Central Food Technological Research Institute, Mysore (India), revealed that banana slices can be successfully canned like any other fruit. Details of the method of canning have been standardized. To bring down the high *p*H of the fruit for safe processing conditions consistent with the quality of the final pack, addition of 0.2 per cent. citric acid to the canning syrup is necessary.

Acknowledgements

The authors wish to thank Dr. V. Subrahmanyan, for his keen interest in the investigation and Shri D. S. Johar for the microbiological analysis of the samples of canned bananas.

References

1. Anon., *Leaflet No.* 117, (1943). Department of Agric., Madras.
2. Von Loesecke, H. W., *Bananas ; Economic crops, Vol. I.* Interscience publishers, Inc., New York (1949).
3. Anon., Dried Banana Products (note)—*Colonial Plant and Animal Products*, 1950, I, 237-241.
4. Guyer Richard, B. & Erickson, F. B.—Canning of Acidified Banana Puree—*Food Tech.*, 1954, VIII, 165-167.
5. Board, P. W. and Seale, P. E.—Canning Bananas—*Food Preservation Quarterly*, 1954, XIV, 2—3.
6. Hirst, F. and Adam, N. B., *The Factory Inspection of Canned Fruits.* The University of Bristol Research St., Campden, Gloucestershire (1932).

* *Variety trials on a number of important varieties grown in important banana growing regions of India are in progress and will be reported elsewhere in due course.*

RESEARCH NOTES

The Effect of Stock-Scion Combination in the Custard Apple

THE CUSTARD APPLE (*Annona squamosa*) is a popular dessert fruit which grows almost wild up to an elevation of 3000′ in Ceylon. It is abundant in the coastal dry areas, and very good quality fruits are often found in the market during the season. In 1941 an experiment was laid down at the Experiment Station, Peradeniya, to study stock-scion relationships in custard apple. The scion material was obtained from Gampaha from a selected parent and the method of propagation used was 'patch budding'. The stock materials were *Annona squamosa* (Custard apple), *Annona reticulata* (Bullock's heart), *Annona muricata* (Sour sop), and *Annona palustris* (Alligator apple or Pond apple).

A. squamosa on A. squamosa. The plants showed high grafting affinity and vigorous growth in the early stages. There was a gradual decline in vigour after about five years. Defoliation and die-back started; ten plants out of eighteen were dead in 1949 and by 1952 all were dead. No stock over growth was noticed. The yield was fair but the fruits were too seedy with little pulp attached to them. The mean weight of fruit was 1/8 lb. Though there was absolute compatibility in the early stages the trees were short-lived as compared to seedlings and budgrafts on bullock's heart stock.

A. squamosa on A. reticulata. Plants showed great grafting affinity and vigour, but were difficult to transplant owing to the paucity of lateral roots. Once established they grew well and only six out of eighteen showed symptoms of decline in 1952. The fruits were less seedy with more pulp which was hard and granular, and the mean weight was ¼ lb. They had better storage qualities than fruits on custard apple stocks. A very slight stock over-growth was noticed on the trees.

A. squamosa on A. muricata. Incompatibility was observed from the start. The 'bud take' was poor; the scions grew for a short period and died off within six months.

A. squamosa on A. palustris. The 'bud take' was fair but the scion shoots died off at different growth lengths. The maximum reached was about 18″.

E. P. BUELL.

DEPARTMENTAL NOTES

Development of the Cacao Industry in Ceylon

(Address given by Mr. A. V. Richards, M.Sc. (Calif.), B.Sc. (Lond.), Dip. Agric. (Cantab), A.I.C.T.A. (Trinidad), Horticultural Officer, Department of Agriculture, Peradeniya, to the Kurunegala P. A., on Saturday, November 27, 1954.)

CACAO is one of the major commodities of the world trade for which there has been a steady increase in demand in recent years. The total word production, which has fluctuated from about 625,000 to 785,000 metric tons in recent years, has however been unable to keep pace with the demand, and as a result there have been spectacular increases in the price of this commodity which a few months ago reached a peak of about Rs. 350 per cwt. The following is a statement of the total world production of cacao during the last five years:

Crop year	*World production of Cacao in metric tons*
1948-49 ..	762,900
1949-50 ..	776,100
1950-51 ..	785,300
1951-52 ..	690,400
1952-53 ..	753,800

About 67 per cent. of the total word production in 1952-53 and the preceding ten years was from countries in Africa, 32 per cent. from America and only 1 per cent. from Asia and Oceania. The largest producer of cacao was the Gold Coast with 248,000 metric tons amounting to 32.9 per cent. of the total world production, followed by Brazil with 14.9 per cent., Nigeria 14.6 per cent., Ivory Coast 8 per cent. and Cameroons 7.3 per cent. Ceylon and Western Samoa were the principal producers of cacao in Asia and Oceania, each producing approximately 3,000 tons or 0.4 per cent. of the total world production. The cacao industry is however threatened with extinction in Africa by the ravages of the swollen shoot virus disease which has already caused considerable damage, and in America by the spread of Witches Broom disease against which there is no effective control. It is indeed fortunate that cacao in Ceylon is free from such destructive diseases.

The actual quantity of Cacao exported from Ceylon in 1953 was 55,010 cwt. valued at Rs. 9,700,351. Of this quantity no less than 20,339 cwt. valued at Rs. 3,825,739 went to the Philippines, and 6,497 cwt. valued at Rs. 136,896 to the United Kingdom. The total exports for the six months ending June this year were 35,230 cwt. valued at Rs. 8,990,009 of which 7,103 cwt. went to the Philippines where cacao is used largely for chewing, 5,448 cwt. to Holland and 11,274 cwt. to the United Kingdom. Although Ceylon produces only a tiny fraction of the total world output of cacao she is perhaps the most important producer of fine quality cacao in the whole of Asia and Oceania, her production being over six times that of Java where cacao was introduced by the Dutch in the early years.

It was also the Dutch who introduced Cacao into Ceylon in 1819, but it was left to the British to develop the industry on a commercial scale from 1878 onwards when the first consignment of 10 cwt. of cured cacao was exported. Since then the acreage under cacao has increased to a great extent particularly in the Kandy and Matale districts which contain about 55 per cent. and 33 per cent. respectively of the total acreage. The productive acreage under Cacao is estimated to be about 19,700 acres in the Ceylon Year Book for 1952-53, but with the large scale underplanting of marginal rubber areas in cacao in recent years the total extent is probably not less than 50,000 acres.

Climate and Soil—Cacao grows well in sheltered situations at an elevation of 500 to 2,000 ft. with a fairly well distributed rainfall of not less than 60 inches per annum and temperature not below 60°F. It is able to stand drought to some extent under shade in the Dumbara Valley but prolonged dry spells depress yields and cause dieback. Excessive rainfall and long wet spells are also harmful since they favour the spread of Phytophthora disease which attacks the pods and main stems and make it difficult to cure the beans properly.

Deep alluvial soils of high fertility which are well drained are the best for cacao. They should be rich in humus, free from high acidity and contain fair amount of calcium, magnesium, iron, zinc, and other trace elements in available form. Trace element deficiencies are believed to be responsible for the occurrence of sickle leaf disease and other nutritional disorders on cacao in the Dumbara valley. Excess of certain elements such as potash may also interfere with the absorption of magnesium and other essential elements.

Cacao varieties.—The variety of cacao originally grown in Ceylon, consisted almost entirely of the Criollo Cacao which produces plump beans, nearly white in colour when cut and cinnamon coloured when cured. With the subsequent introduction of the more vigorous Forastero types producing small flat beans, deep purple when cut and chocolate brown when cured, the relatively weak pure Criollo has disappeared, and the cacao now produced is an admixture of Criollo and Forastero which is not unlike the Trinitario Cacao of Trinidad. The beans are fairly plump, purlpe in the pod and red-brown when cured.

Both Criollo and Trinitario produced the so-called 'fine' cacaos of commerce which constitute 5 to 10 per cent. of the total world production. They are used for flavouring the ordinary or bulk cacao produced by the

Forastero Types which amount to 90 to 95 per cent. of the world's supply. The fine quality cacao produced in Ceylon commands a premium which however is not high enough to justify the sacrifice of yield for quality. Moreover recent improvements in processing technique make it possible for manufacturers to produce chocolate of reasonably good quality from ordinary cacao. The emphasis has to be therefore more on the various factors, both hereditary and environmental which influence yield than on quality provided the latter is reasonably good. Improvements in yield are possible by the use of high yielding local and imported clones, manuring with balanced fertilizer mixtures and organic manure to correct nutritional disorders, improved cultural practices such as pruning, mulching and shading, and effective control of pests and diseases.

Local Selections.—Good progress has been made in the selection of high yielding trees at Kundasale and elsewhere, and individual yield records are being maintained in respect of over 90 trees of which 9 were selected tentatively in 1952/53. Many of these trees have consistently yielded over 100 pods each year for the last two years and have a potential yield of over a ton of cured cacao per acre after making due allowance for spacing, border effect, tree size, freedom from pests and diseases, pod size, &c. One tree in particular which is of the Amelanado type has yielded 230 pods in one year and 359 in the following year. Further tree to tree surveys are being made to locate trees which yield regularly over 100 pods per season and show pod values of 8 or less, the pod value being the number of pods to a pound of cured cacao assuming a loss of weight of 63 per cent. in curing. Careful studies of the performance of the tentatively selected trees have to be made over a period of five years or so before final selections are recommended.

Imported Clones.—Meanwhile excellent progress has been made in the introduction of selected high yielding clones from Trinidad, West Africa and New Guinea after a satisfactory period of quarantine at Kew and Heneratgoda. No less than 20 of the best Trinidad clones consisting of I.C.S. 1, I.C.S. 6, I.C.S. 8, I.C.S. 16, I.C.S. 25, I.C.S. 39, I.C.S. 40, I.C.S. 45, I.C.S. 60, I.C.S. 84, I.C.S. 89, I.C.S. 95, I.C.S. 98, N.A. 32, N.A. 33, N.A. 34, P.A. 7, P.A. 35, I.M.C. 60 and Herrania species have been successfully raised from bare root cuttings received by air freight. In many of these clones less than 7 pods yield a pound of cured cacao but it remains to be seen whether their performance would be equally good if not better under local conditions. The New Guinea selections consist of 8 of the best from Keravat cacao experiment station which are reputed to yield from 15 to 18 pounds of cacao per tree, the average yield in Ceylon being only about a pound of cacao per tree. The West African Amelanado is a highly productive variety of cacao which is recommended in Malaya for cultivation in village holdings since it breeds true from seed. It produces the ordinary bulk cacao of commerce for which there is a good demand.

The high yielding clones are propagated vegetatively as rooted cuttings or budgrafts on seedling cacao rootstocks. A suitable technique has been developed for the propagation of cacao from stem and single leaf cuttings in inexpensive cloth covered propagators in which there is provision for water to drip continuously and saturate the air inside with moisture. The best rooting medium is a mixture of coir dust and fibre which holds the roots in position when develop.

Under favourable conditions the cuttings strike root in three to four weeks and are potted in baskets and gradually hardened inside the propagator by reducing the water supply and allowing more light and air into the propagator. The difficulty however is to establish the rooted cuttings in the field, since they require careful nursing. Attempts to supply vacancies in old cacao with rooted cuttings have not been successful owing to heavy casualties caused by drought in spite of hand watering. Seedlings of comparable age grown from seed sown at stake showed greater resistance to drought. But it is feasible to establish these rooted cuttings in newly opened areas which have adequate primary and secondary shade. The plants have to be hand watered during dry spells until they become well established. Their low branching habit of growth is not so satisfactory as that of the budgraft which

is more easily raised in the field by planting seed at stake during the rainy season and budgrafting the seedling stocks *in situ* the following year with compatible clonal budwood. Genetic variability is reduced to a minimum by using varieties such as the Amelanado which breed nearly true to type from seed.

Manuring.—Cacao responds to application of compost and other organic manure, particularly well rotted cattle or pig manure. The leaf fall from both the shade trees and cacao should be allowed to remain as a mulch under the trees and later become incorporated as humus into the soil. It is estimated in Trinidad that a crop of 500 lb. of cacao per acre removes from the soil as much as 12 lb. of Nitrogen, 6 lb. of phosphoric acid and 9½ lb. of potash. These nutrients have to be replaced by judicious manuring. Cacao at Kundasale has shown a striking response to application of phosphates in the manurial trials now being carried out there. There is some indication that potash has caused a depressing effect on the yield. The soils are sufficiently rich in potash which in excess is believed to cause the sickle leaf disease that occurs so widely in the Dumbara valley. On the results of this trial the manurial programme which provided for an application of 100 lb. sulphate of ammonia, 200 lb. saphos and 125 lb. muriate potash per acre at Kundasale has been tentatively modified by the chemist and only phosphates are being applied at the rate of 2 lb. per tree of a mixture consisting of ½ lb. superphosphate and 1½ lb. saphosphosphate.

Pruning.—Much of the success in cacao production depends on the care and attention given to pruning which has to be done judiciously at the correct time in February-March after the main crop is harvested. Pruning should not be too drastic ; it should be done to remove all dead and diseased wood as well as pods attacked by Phytophthora. The crown of the tree should be thinned out by the removal of chupons and small unproductive fan branches to let in more light and air. Pruning has an invigorating effect and causes the production of a new flush of leaves followed by a mass of flowers all along the main stem and branches.

The shade tree should also be lopped at the correct time and allowed to produce just enough foliage to shade the cacao. Effective control of Helopeltis and other pests is said to be possible by the provision of adequate shade. In Africa capsid attack has been found to occur first in patches where the overhead canopy of shade is broken.

Underplanting of Marginal Rubber in Cacao.—Many growers are interested in the practice of planting cacao under rubber which has become popular in parts of Matale, Galagedera, Moneragala and Passara. The pioneer in this field was Mr. Atkinson of Kepitigalla Estate who planted cacao under rubber to increase the atmospheric humidity of the understorey and thereby promote the early renewal of bark on the tapping panel and stimulate the flow of latex. Not only has this object been achieved but the cacao itself has grown well and produced a subsidiary crop. Weed growth is kept well under control by the accumulation of a thick mulch of leaves under the cacao. The success of this practice however depends on the intensity of shade provided by the rubber, the inherent fertility of the land, the distribution of rainfall, and other factors such as weed competition, incidence of root diseases and pests, &c.

At Kepitigalla cacao has failed to grow under certain rubber clones which provide heavy shade by forming a thick overhead canopy. Excessive rainfall of over 100 inches in wet areas is also detrimental to cacao. The failure under rubber in Malaya and New Guinea is probably due to the heavy rainfall there. But in those marginal areas in Ceylon where the rainfall is not excessive the growth of cacao under rubber is certainly vigorous and promising.

Diseases and Pest Control.—The major disease of cacao in Ceylon is Phytophthora which attacks the main stem and branches as well as the pods in various stages of maturity. The disease is particularly severe in wet areas but can be kept well under control by prompt treatment of the affected trees in the early stages. Spraying with copper fungicide is effective. One combined spray with a suitable insecticide such as D.D.T. may be necessary for the control of

both Phytophthora and Helopeltis which is the major pest of cacao in the Dumbara valley. The pest attacks both the young flush as well as the cherelles and pods causing dieback of shoots and wilting of the cherelles. Numerous black spots appear on the attacked pods and these provide points of entry for the Phytophthora disease which causes pod rot although a good number do ripen and provide sound beans in spite of the pest attack.

Organisation for Cacao Research.—Research on cacao has been in progress in Trinidad since 1931 when the Cacao Research Scheme was first inaugurated at the Imperial College of Tropical Agriculture. The scheme was originally financed by the cacao and chocolate manufacturers in the United Kingdom but since 1947 it has been financed jointly by the British Government and the Cacao, Chocolate and Confectionary Alliance of London, and administered and directed by the College authorities. The full-time graduate staff consists of two plant breeders, two plant physiologists, two soil chemists, one biochemist, one entomologist, one pathologist and two field officers besides the professors and senior lecturers of the college staff who were closely associated with the scheme since its inception. A similar research institute for cacao exists at Tafo in West Africa.

It is only just over a year ago that research on cacao received serious attention in Ceylon with the appointment of a Departmental Cacao Research Committee consisting of the Assistant Director of Agriculture (Technical), Chairman, the Chemist, Entomologist, Plant Pathologist, Botanist and the Horticultural Officer who was made responsible for the supervision in addition to his duties of all investigational work at the Cacao Research Station, Kundasale, which may be regarded as the nucleus of the Cacao Research Institute of the future. The experience of other countries indicates that it is by team work that much progress can be achieved in the solution of the various problems relating to the cultivation and production of cacao, and the progress made so far, with the limited staff and facilities at our disposal augurs well for the future.

Speech by the Hon. J. R. Jayewardene, Minister of Agriculture and Food, at the All-Ceylon Stock Breeders' Show, Negombo, on March 4, 1955

IT GIVES me great pleasure to declare open this Show organised by the All-Ceylon Stock Breeders' Association. I also wish to extend a warm welcome to Sardar Mabadur Sir Datar Singh who has come over from India to judge the exhibits. We are all extremely grateful to him for having found the time in spite of his multifarious duties to come so far to assist us.

It has been the custom among all developed countries engaged in agriculture to foster and develop livestock industry. Our early ancestors also elevated the cow to the position of sanctity it has occupied among the Indian people. Unfortunately, due to the disruption of our agricultural systems in the last three centuries in particular, livestock development had not been carefully attended to or, if fostered, was carried out only at brief intervals. In the last few years the Government has been able to focus the attention of the general public to this important part of agricultural development, and has responded to the demands of the livestock associations in actively assisting and planning out the development of animal husbandry in the Island.

The Department of Agriculture has expanded its extension services by the creation of a large number of posts of Veterinary Surgeons to cover almost every district by introducing artificial insemination centres, and actively engaging in research and production of stock. We always welcome and encourage the utilisation of the Department's services by members of the public and it is heartening to see the response among agriculturists in every district.

A Milk Board has recently bee established to co-ordinate the production, distribution and sale of milk, and when it starts its operations there is no doubt whatsoever that the pace of development will be accelerated.

The Food Production Department has formulated a scheme to give relief to estate

owners under the Food Production Ordinance in cases where they are actively engaged in planned livestock development. I hope that those among you who have the good fortune of owning estates would, both in your own interests and of the nation at large, avail yourselves of the opportunities afforded by this scheme.

In the interests of the younger generation, in whose hands the responsibilities of the future will lie, and from whom the Government expects a lead in agricultural activity, we have set up a network of Young Farmers' Clubs by which their activities could be co-ordinated, and through which the requisite technical information could be disseminated. It is heartening to see the enthusiasm with which these Clubs are being supported and the perceptible improvements that have been brought about.

There are two problems pertaining to livestock development which I would like to stress. Firstly, I would like to impress upon all of you here that Government can encourage and direct, but organised and sustained effort should come from the people. In proper care and maintenance, in correct breeding and in organisation for the marketing of your produce, we expect a great deal of initiative from you. It is sometimes tragic to note the almost inhuman neglect of animals in this country, especially in the case of cattle. It is no excuse to say that there is no pasture land available. Against this I can mention the example of cattle belonging to labourers of estates, and examples of genuine animal lovers in various parts of the Island where, even at great inconvenience to themselves, the owners have fed and maintained animals on fodder grass.

Secondly, I would like to urge on owners of cattle the need for correct branding of animals. There is no doubt that a large percentage of hide produced in Ceylon is completely useless due to improper branding. Correct thigh branding has always been urged by the Department of Agriculture and we hope that cattle breeders, wherever possible, will help to propagate this requirement.

I hope that when the next Show is held the All-Ceylon Stock Breeders' Association would have gone on from strength to strength and embraced through its affiliated societies in each district the whole Island in the scope of its work, and that Co-operative Milk Production and Sales Societies would have sprung up to serve the interests of the genuine livestock breeders.

It is very encouraging to see that the Show is being held in a rural area, and that too in one where exist some of the most enthusiastic agriculturists in Ceylon. Your Organizing Committee and your energetic President, Mr. Clement Dias, deserve our special congratulations on the success of the Show.

The Contribution of the Department of Agriculture to Animal Husbandry Development in the Island

A Review by Dr. A. W. R. Joachim prepared for the All-Ceylon Stock Breeders' Show, Negombo, on March 4, 1955

WITH THE amalgamation of the erstwhile Veterinary Department with the Department of Agriculture in 1936, when the late Mr. D. S. Senanayake was Minister of Agriculture and Lands, a planned programme for the development of animal husbandry was drawn up by Mr. Edmund Rodrigo, then Director of Agriculture, with the advice of Dr. M. Crawford, Deputy Director (Animal Husbandry) and Government Veterinary Surgeon, and considered by a Special Committee of the Central Board of Agriculture. This Special Committee's report together with a memorandum from the Director of Agriculture was published as Sessional Paper 5 of 1938. Many of the recommendations of the 1938 report were given effect to by Mr. Rodrigo and by Messrs. L. J. Seneviratne and D. Rhind who succeeded him. These related particularly to the establishment of farms in different parts of the Island for the breeding of suitable types of livestock, the training of personnel abroad and the intensification of extension activities in animal husbandry through the agency of veterinary officers and agricultural instructors under the direction of divisional agricultural officers. Such activities included the establishment of stud centres, the castration of scrub bulls, the issue of poultry and eggs to breeders and villagers for grading up their stock, the issue of planting material of

fodders and pasture grasses, innoculation against Raniket and other diseases, the establishment of dairy units on all school farms to serve as demonstration centres to students and the public, &c.

In 1945 Dr. Norman Wright, Director of the Hannah Dairy Research Institute in the U. K., was invited by the Ceylon Government to advise on measures which had been adopted or were contemplated for expanding the production of milk in Ceylon and, in particular, on the desirability of increasing the importation of European types of cattle and establishing dairy farms. In his valuable report published as Sessional Paper 20 of 1945, Wright pointed out some of the deficiencies in the then existing organization for the development of animal husbandry in the Island and how these could be remedied. One proposal which resulted from his report was the appointment of a Specialist in Animal Husbandry in the person of Mr. C. R. Turbet to take unified control of the five major animal husbandry farms which were then being developed. Turbet served in this capacity till 1949 and his report on the Development of Cattle Farms published as Sessional Paper 2 of 1949, is a useful record of the development of these farms and the problems confronting the pioneers in this field of work, and offers helpful suggestions for their efficient management. One serious criticism which Wright made was the lack up to then, of any fundamental research in animal breeding. This was soon rectified. Dr. P. Mahadevan, Livestock Research Officer, was sent out for specialized training in this important aspect of animal husbandry, and the valuable work he has done since his return in analysing the genetic structure of our cattle and poultry populations and in carrying out suitable breeding programmes and experiments for improving their productivity by such methods as progeny-testing of sires, selection of high yielding cows and cross-breeding, is the strongest justification for Wright's criticism.

Turbet was followed by the present holder of the office, now designated General Manager of Farms, Mr. A. V. Anker, who with his wide academic training and practical experience of dairying in Denmark has achieved remarkable success with the management of the ten animal husbandry farms now under his control. Although the primary object of most of these farms is the breeding of livestock suited to the area for issue to breeders or for grading up indigenous stock, it is gratifying to record that nearly all of them are giving an income in excess of expenditure. The income is derived mainly from the sale of milk, livestock and eggs. Last year over 374,000 gallons of milk were supplied to hospitals and milk feeding centres from these farms, and 691 head of livestock were issued in one way or another for breeding purposes. It would be interesting to state here that the total sales of milk from all Departmental farms in 1954 amounted to 416,600 gallons of cows milk and 61,270 gallons of buffalo milk.

Within the past few years there has been under the direction of Mr. Dudley Senanayake, Sir Oliver Goonetilleke, and the present Minister of Agriculture and Food, Mr. J. R. Jayewardene, an intensification of the programme of animal husbandry development drawn up against the background of Norman Wright's report and on the suggestions of Mr. H. Hirst, F. A. O. Adviser in Animal Husbandry from 1951 to 1953. These activities are under the general supervision of Dr. T. M. Z. Mahamooth, Deputy Director of Agriculture (Animal Husbandry) and Government Veterinary Surgeon. Some of the advances made are as follows :—

1. The staff concerned with animal husbandry has been appreciably increased. A fairly large number of officers have been sent abroad for training and are now manning various animal husbandry units and extension activities. Further increases in the field staff will be necessary to promote adequate extension activities in animal husbandry.

2. A clear-cut policy has been laid down for each of the major animal husbandry farms. These are briefly as follows :—

(i) Bopatalawa : to breed cattle of European breeds, particularly Friesians and Jerseys, for the purpose of supplying breeding stock and to carry out investigations on breeding, feeding, dairy

management, and fodder production under prevailing conditions.

(ii) Ambawela : as for Bopatalawa but with Aryshire cattle.

(iii) Polonnaruwa : for pure-bred Indian breeds of cattle and goats and to establish pasture and fodder suited to dry zone conditions.

(iv) Ridiyagama in the Tangalle District : to breed Murrah buffaloes, to conduct cross breeding experiments with local buffaloes, and to meet the local demand for stud animals.

(v) Nikaweratiya : to breed pure-bred draught cattle of Indian breeds, viz., Khillari and Kangayam.

(vi) Karagoda-Uyangoda to conduct breeding experiments with Sinhala cattle for improving the milking capacity of the breed.

(vii) & (viii) Narahenpita and Welisara : to be run as commercial dairies until they are taken over, when needed, by the Milk Board.

(ix) Undugoda in the Kegalle District : now run as a dairy, is likely to be utilized as a centre for rearing bull calves.

(x) Ambepussa Farm : has been the chief poultry breeding centre, and will be utilized for dry cows and heifers. A new poultry centre has been started at Karandagolla on the Kundasale cacao estate where conditions are more favourable than Ambepussa for poultry.

3. A scheme of exchange of bull calves has been introduced with the ultimate object of grading up local animals and incidentally eliminating useless scrub bulls on the principle that a bull calf of improved breed will be exchanged for local scrub animals more or less on a weight for weight basis. A similar scheme is in operation in regard to the improvement of poultry in villages. All extension activities are co-ordinated in the Animal Husbandry Division by the Livestock Officer, Mr. W. D. E. Perera.

4. A large number of stud centres have been established. These are either under departmental control or are run by private parties. The latter have been subsidized at the rate of Rs. 15 per mensem per stud bull. There are 235 stud centres at present in the Island of which 123 are under the control of the Department. These carry 405 stud bulls and 116 stud goats. Recently a drive to intensify the cattle up-grading policy in localized areas was started in the Kegalle District. The Department gave the Revenue Officer such assistance as was possible in the pursuance of this objective.

5. A small milk collecting scheme was started at Polonnaruwa in March last year in order to encourage producers to market their commodity. The milk is pasteurized and supplied to milk feeding centres. With the establishment of the Milk Marketing Board this work will come under the control of the latter.

6. Encouragement was given to the formation of district Livestock Breeders' Associations in different parts of the country. There are now seven such associations. It is pleasing to record that the Stock Breeders' Association of Ceylon which was started in 1938 with the fullest support of the Department of Agriculture had in its earlier years the Director of Agriculture as its President.

7. Considerable success has met the Department's efforts to find suitable varieties of pasture and legumes for forage purposes. Molasses grass (*Melinis minutiflora*) for the wet zone, and *Brachiaria brizantha* for the wet and dry zones have proved to be very successful species. The legume *Stylosanthes gracilis* (Queensland lucerne) has been found useful in many parts of the country.

8. Twenty-one artificial insemination centres have been established in various parts of the country. The rates charged for services are low in order to popularize the practice. More units will be started as the need arises.

9. Poultry production was given a fillip by the start of a backyard poultry scheme in Colombo and the introduction of the deep litter system at a number of schools. The campaigns for vaccination against poultry diseases have been intensified. The number of eggs produced and issued from our farms last year for hatching purposes was 79,000 approximately.

10. Intensive work has been organized on the nutritive value of home-grown feeding-stuffs. Digestibility trials with cattle and

statistically designed feeding experiments with poultry and cattle are now well under way and the results therefrom should prove economically beneficial to local farmers.

11. The work on disease control under the direction of Dr. P. G. Malkani has made considerable headway and that on goat paralysis by Dr. C. Perumalpillai is noteworthy. The personnel of the Veterinary Research Laboratory has been increased very appreciably, and the laboratory now manufactures nearly all the vaccines it requires. Approval has been obtained for the inclusion in the next five-year programme of a sum of Rs. 1.4 million for the establishment of a new veterinary research laboratory and hospital, &c.

It will be agreed that in Ceylon our animal husbandry activities should be directed mainly to the production of milk, which at present is deplorably low. This has been largely due to the lack of suitable marketing facilities. There is little doubt that with the establishment of the Milk Marketing Board this defect will be remedied and there will be a rapid increase in the production of this valuable food in the country. Incentives offered to estates under the Food Production (Estates) Act will also contribute appreciably towards the greater production of milk and other animal food. With the facilities now offered by the Department of Agriculture and the Milk Board, and with the steady availability of trained personnel from the Ceylon University and other sources, there is no reason why considerable advances should not be made in the next few years in the intensification, promotion and development of animal husbandry in the Island.

CENTRAL BOARD OF AGRICULTURE

PROCEEDINGS OF THE EIGHTH MEETING OF THE CENTRAL BOARD OF AGRICULTURE HELD AT THE SCHOOL OF AGRICULTURE, PERADENIYA, ON JANUARY 21, 1955, AT 2.30 P.M.

Mr. C. A. M. de Silva, Vice-Chairman, presided till Dr. A. W. R. Joachim, Director of Agriculture and Chairman, arrived a few minutes later as he had to meet the Australian Prime Minister at the Royal Botanic Gardens, Peradeniya.

The following members of the Board were present :—

Mr. N. Manicka Idaikkadar, C.C.S., Director of Food Production ; Mr. S. Arumugam, Assistant Director of Irrigation ; Gate Muhandiram Arthur D. S. Jayasinghe ; Mr. R. T. Chelliah ; Sir J. P. Obeyesekera ; Mr. S. C. Fernando, C.C.S., Commissioner of Co-operative Development ; Mr. W. M. Cumarasamy ; Gate Mudaliyar N. Wickremaratne ; Dr. H. E. Young, Director, Rubber Research Institute ; Mr. S. Pathmanathan ; Mr. R. H. de Mel ; Mr. D. G. Dayaratne, C.C.S., Director of Rural Development ; Mr. S. L. Bandara Dharmakirti ; Mr. S. A. Selvanayagam, O.B.E. ; Mr. J. A. de Silva, Conservator of Forests ; Mr. P. B. Bandaranayake, D. R. O. ; Mudaliyar N. M. Abulcassim Maraikar ; Mudaliyar S. Armstrong ; Mr. J. M. Saravaratnam, D. R. O. ; Mr. A. Divitotawela ; Mr. A. W. R. Perera, Assistant Commissioner for the Development of Marketing ; S. A. I. Elapata Dissawa ; Mr. A. D. Paranavitane ; Mr. C. Wijesinghe ; Mr. C. J. Strachan ; Mr. M. B. Samarakoon, D. R. O.; Major E. C. de Fonseka, M.B.E., E.D. ; Mr. F. A. Wickramasuriya ; Mr. Ray Wijewardena ; Mr. Anton C. Ponnampalam ; Mr. H. A. Pieris and Mr. N. P. Wijeyeratne, C.C.S. (Secretary).

The following visitors were present by invitation :—

Mr. C. J. Serasinghe, C.C.S., A. G. A., Nuwara Eliya ; Dr. D. T. E. Dassanayake, Director of Meteorology ; Dr. K. Ramiah, F. A. O. ; and Professor Evan A. Hardy, F. A. O., Technical Assistance Mission.

The following officers of the Department were also present :—

Dr. T. M. Z. Mahamooth, Deputy Director (Veterinary Services) ; Mr. C. N. E. J. de Mel, Deputy Director of Agriculture ; Dr. W. R. C. Paul, Assistant Director of Agriculture (Technical) ; Dr. M. F. Chandraratne, Chief Research Officer ; Mr. A. V. Richards, Horticultural Officer ; Mr. D. M. Ratnatunga, Chief Agricultural Engineer ; and Mr. T. Wickremesinghe, Soil Conservation Officer.

Letters and telegrams regretting inability to attend were received from the following :—

Mr. T. B. Naranpanawa, D. R. O. ; Mr. K. Morford, C.B.E. ; Mr. Gladwin Kotalawala, M.B.E. ; Mr. A. Hensman ; Mr. Albert Godamune ; Mr. V. G. W. Ratnayake, M.P. ; Mr. A. M. Clement Dias ; Mr. H. S. Hurst ; Mr. T. C. Rajaratnam, C.B.E. ; Mr. G. K. Newton ; Mr. S. Pararajasingam ; Mr. M. Atkinson ; Mr. J. Lamb, Director, Tea Research Institute ; Sir Wilfred de Soysa ; Mr. A. F. R. Goonewardena ; Mr. N. H. Keerthiratne, M.P. ; Senator Justin Kotalawala ; Senator Lady Molamure, O.B.E. ; Mr. U. B. Dedigama ; Mr. Vernon Rajapakse ; Mr. Marcus Rockwood ; Mr. N. R. Rajavarothiam, M.P. ; Senator Thos. Amarasuriya ; Sydney Ellawala Dissawe ; Mr. M. Senanayake, M.P. ; Mr. Henry Abeywickrema, M.P.; and Mudaliyar M. M. Ebrahim, M.B.E., M.P.

I—Confirmation of the Minutes of the last Meeting

The minutes of the previous meeting of the Central Board of Agriculture were unanimously confirmed.

II—Resolution moved by Mr. Ray Wijewardena

The Chairman read the resolution to the Board and requested Mr. Wijewardena to formally move it.

Mr. Ray Wijewardena—"Mr. Chairman and fellow agriculturists—You will all, I feel certain, agree with me that the importance of this Board makes it essential for as much business to be conducted at every meeting as is humanly possible.

This goal can only be achieved if we all endeavour to restrict our proposals, comments and discussions to the most essential points and thus say in five words what might otherwise take us fifteen or more. Business organizations throughout the world have found that the placing of a time limit upon each speaker helps tremendously to achieve very much more results in very much less time. Prompted by a sincere desire for this Board to achieve the very fine objects for which it was created I now formally propose a resolution :

> "THAT ALL SPEAKERS AT MEETINGS OF THE CENTRAL BOARD OF AGRICULTURE BE GIVEN A TIME LIMIT OF 15 MINUTES. UNDER EXCEPTIONAL CIRCUMSTANCES, SUCH AS IN THE CASE OF A VISITING SPEAKER OR LECTURER ATTENDING THE MEETING, THE CHAIRMAN MAY, AT HIS DISCRETION, EXTEND THE TIME LIMIT, WHICH WILL OTHERWISE BE RIGIDLY ADHERED TO"

Mr. C. A. M. de Silva in seconding the resolution said—"It was rather unfortunate that even with a warning members kept on their feet for long periods. Instead of probing into the past, which will never help the Board, I think if members were brief in all their comments much time could be saved".

Gate Mudaliyar N. Wickremaratne—"Mr. Chairman and Gentlemen—We have not come here to discuss the time limit of resolutions. We come only to discuss matters of agricultural importance to the State. May I ask what is the qualification for a Board of this nature to pass a resolution of this type and how the Chairman of the Board consented to put in that resolution in the Agenda. A previous Director of Agriculture said that we come here to listen to the views of enthusiastic members who attend meeting after meeting and to get something out of them. We cannot, therefore, restrict our comments to a time limit. I know the time when the Board of Agriculture had 30 odd members. Then it was increased to 60. And now the membership is 80 and, instead of extending the time for meetings from one to two days as the membership is greater, we are now trying to shorten the time. Last time when the meeting was held in Colombo it was only for two hours duration from 3 to 5 o'clock and these members have to come miles and miles to speak only for 15 minutes. At the rate of 15 minutes how many days does it take for 80 members to speak ? The previous Minister set a good example when he said—meet in the mornings and meet in the afternoons for your meetings. If you can't provide lunch we can look after ourselves, but let us continue our meetings from morning till afternoon and afternoon till evening. I have been sitting on this Board for the last 48 years and if you pass a resolution like this I will never come before this Board again".

Mudaliyar S. Armstrong—"Mr. Chairman and Gentlemen—I strongly support Gate Mudaliyar Wickremeratne's views on this resolution. I must say, Sir, that we come here all the way from Batticaloa and from Jaffna and spend only a few hours, say two to three hours, at our meetings and I do not think it is correct to limit the time allowed to us to express our opinions because within that limited time we will not be able to express ourselves frankly on matters on which we have gathered information by our experience. Most of our members here are not scholars but are farmers, and as such, we must explain what we know by experience. I feel, Sir, and I would submit that if the house is going to restrict the time for speeches and opinions of members, our meetings should be extended for a full day instead of half a day as at present".

Mudaliyar Abulcassim Maraikar—"Mr. Chairman and Gentlemen, I heartily endorse the observations made by Gate Mudaliyar Wickremeratne on this motion. Gentlemen, we have as our Chairman the Director of

Agriculture and he can use his discretion whether a speaker is exceeding his time limit either by 15 minutes or half an hour or even a day because it depends on the importance of the subject. If a member is dwelling at length on irrelevancies, the Chairman can use his discretion and ask him to restrict his remarks. It is very unfair to limit the time allowed to a speaker to 15 minutes. It depends on the importance of the subject and if a member has to speak on a subject like paddy cultivation or food production, it is impossible to state all what you have got to say in 15 minutes. If we have to take an important decision and if members are unable to say all what they have to say in 15 minutes, it will not be possible to make a fair decision. Gentlemen, instead I would suggest to the House that the Chairman be allowed to exercise his discretion in matters more or less relating to this motion if members could undertake not to be unfair by the Chairman. We will submit to the ruling of the Chairman. If the Chairman thinks that we have been unduly long and a speaker has been holding the floor for a long time or if he thinks that a speaker's remarks are not relevant to the subject under discussion, we should submit to the ruling of the Chairman ".

Mr. M. B. Samarakoon—" Mr. Chairman, it is not quite clear whether a speaker is allowed 15 minutes for one resolution or for the whole meeting. Does it mean that during the course of the whole meeting a member can speak for only 15 minutes ?"

Mr. Ray Wijewardena replied that the intention was that a speaker should be allowed 15 minutes per speech, and he accordingly altered the resolution, with the permission of the seconder, to read " 15 minutes per speech ".

Mr. M. B. Samarakoon—" I feel that there is no necessity for us to move such a resolution by the Board and, therefore, I am also opposed to it ".

Mr. Anton Ponnampalam—" Mr. Chairman—I suggest that the resolution should stand as it is for further consideration at two or three meetings that may follow subsequently. This is the 8th meeting of the Board and it is too soon to adopt the motion without a warning so that the necessity for such a resolution could be decided at a subsequent meeting ".

Chairman—" In other words you suggest that the resolution be suspended for further consideration ? "

Mr. C. A. M. de Silva—" The Chairman will use his discretion and allow a speaker to continue if he is not deviating from his point when he is addressing the Board. But the fact is that some of these members indulge in past history. We travel from distant places to attend meetings here ".

Mr. Ashmore Peiris—" Mr. Chairman, I would like to suggest that any speaker speaking on the motion proper may be allowed to speak for more than 15 minutes at your (Chairman's) discretion, but any other person who speaks in support of that motion, either for or against, may be allowed only 5 or 10 minutes. The principal speaker may be allowed more than 15 or 20 minutes ".

Chairman—" I take it, gentlemen, that you would wish to adopt the proposal suggested by Mr. Ponnampalam that this resolution be suspended for a further meeting. I do not think myself that we have any reason to complain of people speaking inordinately long, and I would recommend that we adopt Mr. Ponnampalam's proposal and suspend this motion for consideration at some future date, if necessary ".

The house unanimously agreed to this proposal and the motion was suspended for a further meeting.

III—Resolution moved by Major E. C. de Fonseka

"THAT IN VIEW OF THE TREMENDOUS DAMAGE CAUSED ANNUALLY BY FIRE TO VALUABLE PATNA LANDS AND THE DESTRUCTION OF SPRINGS AND WATER SUPPLIES IN UPPER UVA, IMMEDIATE STEPS BE TAKEN BY GOVERNMENT TO PREVENT THIS BY—

(*a*) planting up more forests,
(*b*) establishing fire lines, and

(c) requesting Headmen, Police and other Government departments to render assistance in preventing the spread of fires."

Major E. C. de Fonseka—"I do not wish to waste time of the Board by going into elementary details of damage done to the land by setting fire to patnas, but in asking the Board to support this motion, would bring to your notice one or two points. Setting fire to patnas is not of recent origin. I came across an article in the book 'Robert Knox in the Kandyan Kingdom' in which the writer refers to the question of setting fire to patnas. The period referred to was between 1660 and 1679. Thus this practice of burning patnas has been going on continuously since 1660. The first question is why our people set fire to patnas? The second is, who set fire to patnas?, and the third is what is the best way to prevent the destruction caused to the top soil by setting fire to patnas annually?

One reason is that during the dry months the grass is very coarse and the people know that there is very little for their animals to feed on. So they set fire to patnas and after the rains the grass shoots out afresh and there is enough food for the animals. Then, there is also a belief in the villages that when they set fire to patnas it helps to produce rain. It is very strange that soon after you set fire to patnas, rain does come down. It may be a coincidence, but the fact remains that it does happen and people continue to believe the story. The second question is who are the people who set fire to patnas? As I said before, cattle-keepers are the people who set fire to these patnas. There are people who own fairly extensive herds of cattle including estate cattle-keepers, and they do a tremendous lot of damage. In the area round about Diyatalawa, patna fires are also caused by some of the Services personnel who go out for a stroll and throw their cigarette stumps into the dry grass. This is peculiar only to Diyatalawa and not to any other place.

On the question of what we can do to prevent this, I suggest the planting of more forests. Government is doing a certain amount of work in reafforestation but I feel that much more can be done in this direction. There is a tremendous demand for fuel and Government should extend their activities in this direction. Another point I would like to stress is that on patna lands there should be enough fire lines so that in the event of a fire, it will not spread throughout the entire patna. Fire lines can be in small blocks cutting up or dividing an extensive patna. This is an easy method of controlling patna fires.

Another important reaction of the people to patna fires is that they take a delight in seeing the fires spread. For them it is something like a fireworks display, because the damage is on Government property and nobody is interested or worried about it. If only the people are interested it is quite simple to put out a patna fire. You have merely to beat the fire with a big stick or brushwood. I suggest that Headmen should be made responsible for putting out patna fires in their respective areas. They can always call upon Rural Volunteers or the Police or members of other Government departments in that area to help them. I know there is a law to prosecute people who are found guilty of setting fire to patnas but I do not know whether anybody has been prosecuted so far. The damage caused is very great in Upper Uva and not so much in Lower Uva where the land is not so steep and where there are no streams to get dried up.

With your permission, Gentlemen, I would like to amend my motion by deleting the words "Upper Uva" so that the whole Island may be embraced. Incidentally I would like to tell you of my experience of patna fires. My home is completely surrounded by patnas. Every year during the months of June till August I have got to employ a special man to look out for patna fires at night. Every single year I run the risk of getting my whole homestead burnt. Two years ago a fire broke out and went on spreading and it came very close to my house. I was not at home and my wife had telephoned the Police and they had said that it was not their job to put out patna fires. The time was about 3 o'clock in the morning. She had then to telephone the Naval Establishment and within 20 minutes a party of 75 British Naval Ratings came over and put out the fire".

Mr. J. A. de Silva, Conservator of Forests —" Mr. Chairman and Gentlemen—You have heard the proposals of Major Fonseka and this problem we have attempted to solve for many years. Major Fonseka has suggested reafforestation of various lands, but this land is already classified into various land use categories. At the time these areas were mapped out it was decided which area should be reafforested, which areas should be set apart for village expansion and which areas should be set out for pasture. Each Department sets out its proposals to the Settlement Officer indicating their needs in each area. The Forest Department too sets out its proposals. As you are aware, we cannot have forests of 20 and 30 acres. We try to build up forests of at least 400 to 500 acres. Growing forest trees depend entirely upon the demand made on the land by other people. So that in order to put this resolution into effect—to plant trees on patnas—first the land must be made available to the Forest Department. Unfortunately very little land has been mapped out in Uva for growing trees. Any land which has been mapped out for forestry has been planted out. There is not an acre of land which has been given to the Forest Department which has not been planted. I have been endeavouring, in the last few years, to increase the acreage under forest. Roughly about 1.3 per cent. of the land in Uva is only in forest, except the Bintenne area in the Uva District ; this is a very unfortunate position. If I ask for the balance land, the pressure is for village expansion and pasture. In the past few years I have been attempting to formulate a scheme of how we can grow trees and tackle this question of patna fires. Merely passing resolutions like this will not carry us very far, if we want to stop fires. I formulated a scheme where we can have wind belts or shelter belts combined with pasture. When the late Mr. D. S. Senanayake visited some of our plantations I think he was a bit surprised that we made such a good job of it. We were asked to plant the rest of the live land with trees and I prepared to do it and we lost about a thousand rupees worth of barbed wire that was used for fencing. My good endeavours to reafforest patnas as suggested by Major Fonseka have not proved successful without the co-operation of the people. The only other thing is to get the land mapped out and, with the assistance of the Agricultural Department or the Food Production Department, get some money allocated to the Forest Department, to combine pasture with growing of forest trees. We have been working on this problem for some little time and I think we could do it. If we tackle the problem, I think there is some hope of stopping these fires. In each village there is a large majority who do not want to give effect to this suggestion. Unless we get the co-operation of this vast majority the scheme will not work successfully. If we start growing trees without the co-operation of the majority, it will be money going down the drain. We must be sure that we get the support of every cattle owner and that he will not violate rules and regulations and that he would follow the directions of the Agricultural Instructor.

The question of cattle food in the patnas will also have to be gone into. The present scheme is that we should plant up 300 acres with wind belts which means spending Rs. 30,000 a year. As soon as it is planted, we must get the assistance of the local population. The other cause of these fires is sheer carelessness on the part of the people. Some people are in the habit of carrying burning torches in the night and flinging them carelessly thus making fires to spread. I think the good offices of this Board must be used to ask Government to spend a little money on this scheme for forestation and pasture. The votes of the Forest Department are very little and I get hardly three lakhs of rupees a year. If you want to start a big scheme like this we will have to take at least 300 acres a year. There are about 10,000 acres of patna and you will want about Rs. 30,000 in the first year and subsequent years at least half a lakh. And any scheme that we embark on must have the goodwill of the villagers. It will be found that in these villages the cattle population is spread only among a few people. Those are the people we have to consider from an economic point of view. We cannot afford in this country to waste much of our land asset. Are these people producing sufficient milk, eggs, &c. ? If not, we can utilize that land for growing

valuable trees. What are we getting in return for leaving 10,000 acres under pasture ? How much butter and milk could they produce ? In other words it will be more economical to grow some good tea on that land. If one has 10,000 acres of tea about 10,000 labourers could be employed. That is my personal view. One must answer what is the best economic use the 10,000 acres can be put to. If you are going to put it under pasture you must make sure what returns it will bring. If there are 10,000 acres of good tea land direct and indirect taxation can bring in a good revenue ".

Mr. Tissa Wickremasinghe, Soil Conservation Officer—" Mr. Chairman and Gentlemen —I would like to make a few observations on what Major Fonseka said. Major Fonseka spoke a little while ago about the burning of patnas. Mr. J. A. de Silva, Conservator of Forests, pointed out the problem of mapping out according to the needs of the people. There is at present a very strong need for pasture for the cattle owned by people. The cattle these people maintain is not for milk but purely as a source for organic matter for the type of agriculture they pursue in these areas. If cattle are kept for meat, I think we will have to bring the lower slopes into rotational pasture and the steeper slopes into forest. The scheme suggested to have trees in pasture areas so as to provide shade for cattle is a very good one ".

Mr. A. Divitotawela—" Mr. Chairman and Gentlemen—Major Fonseka has brought out the very difficult question of stopping patna fires and we have heard Mr. J. A. de Silva's views on the matter. The people living in these areas maintain herds of buffaloes for their agriculture. After their agricultural activities are over, during a part of the year, their buffaloes are sent out to these pasture lands so that such people would find it difficult if they do not have these pasture lands. Apart from these pasture lands, surely there is enough forestry being done in Uva. As you know, now the people in Uva do not have enough cattle as they used to have in the old days and if Government were to formulate a scheme of having pasture land separately and reafforestation separately, then I think a large extent of the patnas in Uva could be reafforested. Major Fonseka has pointed out that this problem of patna fires has existed in Uva for generations but I think if the area for pasture and reafforestation is mapped out properly making enough provision for pasture, this difficulty could be overcome. Of course, villagers will not appreciate the work that Government is doing in afforestation but now I do not think they are so bad as they used to be ".

Mr. C. J. Serasinghe, A. G. A., Nuwara Eliya—" This question was considered at the Nuwara Eliya District Agricultural Committee. A sub-Committee appointed to go into the question of patna fires has submitted a report and a copy has been sent to the Secretary of the Board. The main recommendation of the Sub-Committee was that it was not enough passing legislation but it was also necessary to provide an alternative grazing scheme for the villagers. They went into the question of why the villagers burnt the patnas. It has been ascertained that it is done for the purpose of getting better pasture grass.

The Forest Department has started a scheme of wind belt afforestation in Haras-bedde. There is generally no difficulty in finding land for these schemes. The Conservator of Forests explained the difficulty of obtaining land, but as far as most Revenue Officers are concerned, there is no difficulty in providing the land for this commendable purpose. In the Nuwara Eliya District, these fires occur not only on Crown land but also on private land. It is necessary to have some legislation but it is also necessary to offer the villagers with an alternative scheme. One of the first steps that should be taken to implement the scheme is to have a census of cattle population per village or group of villages together with an assessment of the patna land and then to evolve a suitable scheme to develop the areas with pasture. I have no doubt that the Central Board of Agriculture will use its good offices to get the Government to provide the necessary funds and machinery.

There is also the Soil Conservation aspect of the matter. There are the Soil Conservation regulations which are applicable to specific areas—the erodible areas. The Soil Conservation Act applies generally to the

Mahaveli Ganga catchment and upper Kelani Valley catchment. But this aspect of soil erosion applies to the areas which are eroded by the North-East monsoon as well. In fact the problem is more serious in Nuwara Eliya than in Uva because of the heavier rainfall and steeper land. Generally this problem of providing a pasture scheme exists mostly in relation to the Uva and Central Provinces. Most of you gentlemen will find that the wind belt afforestation scheme evolved will also be useful in low-country areas. One of the recommendations has been that Soil Conservation regulations should be extended to a greater extent, but I do not know to what extent the Ministry of Agriculture and Food will find the staff and funds to enforce these regulations on the people. In addition to having a plan of pasture-cum-afforestation, the Committee also recommended a certain amount of propaganda, and these were the steps they recommended :

(1) Periodically, especially before the rainy season, officers of the Forest, Revenue, Soil Conservation and Fauna and Flora Departments attend the meetings of the Rural Development Societies, Village Committees and Young Farmers' Clubs in order to explain the advantages of the Improved Pasture Scheme and the disadvantages and consequences of unrestricted grazing and fire raising, and by means of informal lectures attempt to make the villager more fire conscious by preaching the gospel of fire protection.

(2) The Education Department be requested to include in their curriculum lessons on Nature Study, Animal Husbandry, Farm Management, &c., in order to instil in the younger generation a love for the land that surrounds them and on which they depend for their existence.

(3) In the booklet 'Instructions to Headmen', a paragraph be added emphasizing that prevention and detection of wilful fire raising is a national duty. The difficulties in detection of offences are well nigh insurmountable. Nevertheless, rewards should be offered to informants and witnesses who ensure successful prosecutions. The possibility of the inclusion of the offence of wilful fire raising in the Penal Code should be explored, as it is felt that the punishment as stipulated by section 24 of the Forest Ordinance is totally insufficient as a deterrent.

(4) The Government Information Department through the Film Unit produce a documentary film illustrating the evils of patna firing and over-grazing to be shown to Schools, Village Committees, Rural Development Societies and Young Farmers' Clubs.

(5) The Department of Information conduct a poster competition for the selection, distribution and publication of the most attractive and illustrative posters in Village Halls, Resthouses, Preaching Halls, Schools, Railway Stations, &c.

Mr. Morford has been able to obtain a few posters from abroad. The problem exists in his own country too and he has been able to suggest certain ideas for the printing of posters.

(6) The Department of Information produce handbills and booklets in all the three languages for publication, outlining the principles of the Anti-Patna Firing Campaign, the gravity of their offence, the punishment, the availability of rewards to informants and witnesses, and the advantages of the Improved Pasture Scheme.

Generally the opinion of the Sub-Committee was that compulsion was only a last resort and that everything should be done to give advice on soil conservation methods, &c., and to provide free planting materials.

The report of the Sub-Committee was considered at the last meeting of the District Agricultural Committee and it was decided to request the Ministry concerned, probably, Agriculture, to see its way to implementing most of the recommendations. It was also decided to send a copy to the Central Board of Agriculture so that they could bring pressure to bear on the Government to implement these proposals and also to get certain oil companies, like the Shell Company, to publish some of the posters and booklets".

Chairman—" The A. G. A.'s observations refer to a valuable document which has been prepared by a Sub-Committee of three gentlemen who understand the problems connected with this subject. I would like to circulate this Report to all members and to continue discussions at a later meeting. Major Fonseka's resolution raises some important issues and there have also been some very useful suggestions made by other speakers. I think we should consider all these suggestions and frame appropriate resolutions to include the D. A. CC. proposals as well ".

This was agreed to.

IV (i)—Resolution by Mudaliyar S. Armstrong

" THAT IN VIEW OF THE LARGE EXTENT OF PADDY LANDS THAT ARE SITUATED BORDERING THE LAGOONS OF THE BATTICALOA DISTRICT BEING SUBMERGED AND DAMAGED BY FLOODS ANNUALLY, SUITABLE OPENINGS OF SAND BARS SHOULD BE EFFECTED DURING THE SOUTH-EAST MONSOON."

Mudaliyar S. Armstrong—" Mr. Chairman and Gentlemen—when I first read resolution No. 1 which has been brought forward by Mr. Wijewardena, I thought I might be censured, so I had to bring out what I should say in points and now I will explain those points. Anybody going towards Batticaloa will find that a large extent of paddy lands around the brim of the lagoons is submerged under flood water during the wet season. Batticaloa lagoon extends along the east coast for a length of 28 miles from Eravur on the north and Kalmunai on the south. It covers an area of 42 sq. miles with a catchment of 1,065 sq. miles. The most important openings of this lagoon are at (*a*) Batticaloa (near the lighthouse), and (*b*) at Kallar (18th mile). The Batticaloa sand bar when cut open stretches to about 800 feet in width and gets closed between the months of May and November. During the last 15 years (from 1940 to 1955) this mouth has been closed ten times so that when this mouth is closed the mouth at Kallar normally remains closed, and during the period from May to November the lagoon becomes a lake. During this period the water level of the lagoon is about 1 foot above mean sea level at most and begins to go down by evaporation and may go down as low as 9 to 12 inches below mean sea level. Taking advantage of this low level in the lagoon the farmers who possess fields south of the lagoon fringe cultivate the area comprising in width from ½ to 1 mile, occasionally using scoops to rid their lands of water for sowing during September. With the advent of the rains in October-November, the lagoon level rises and the cultivators of the upper region manage to harvest their crops. With the progress of the South-East monsoon rainy season the level of the lagoon rises because the mouth still remains closed and it does not break open by itself once it has got closed. At this stage manual labour has to be employed to cut open the sand bar which would by then be about 200 feet wide from the lagoon water edge to the sea water edge. As a result of this there is often conflict of interest and dispute about the stage at which the sand bar of the mouth should be cut open. Usually the mouth would establish itself if cut before the water level rises to 2.6 inches owing to wave action of the sea. The majority of fields in extent about 8,000 to 10,000 acres which are below 2½ feet get submerged for three to six days until the mouth is cut open and a further two to three days for the saline water to be drained off. On representations made by farmers the Government Agent requests the P. W. D. to cut open the mouth. The farmers also join hands with the P. W. D. Overseer and draw the money for employing labour. This resolution was brought in to eliminate the annual loss incurred partially or totally by those whose lands are bordering the lagoon. My opinion is that since the construction of the dam at Gal Oya more than a third of the water in the catchment area is held up to replenish the Inginiyagala Tank and as a result the flow into the lagoon takes a longer time to rise up to the 2½ feet water level causing the period of submersion of fields longer.

Therefore, gentlemen, my proposals are : (1) To construct masonry groynes to keep the mouth open at Batticaloa Bar, or (2)

for Government to have suitable equipment to cut open the sand bar with some type of hydraulic monitor pumps of high velocity with sufficient force to scour the sand away into the sea to have the mouth opened before considerable damage is done to cultivation. I submit that this work be entrusted to the Gal Oya Board or the Irrigation Department".

Mudaliyar Abulcassim Maraikar seconded the resolution.

Gate Mudaliyar N. Wickremeratne said that he had visualized the outcome of the Gal Oya Scheme long before it was inaugurated. He had visited the area some 25 years ago. He emphatically discouraged Mudaliyar Armstrong's suggestion that that work should be entrusted to the Gal Oya Board. Mudaliyar Wickremeratne was of opinion that the Gal Oya Board was very slow in their work and that no useful purpose would be served by entrusting such work to the Gal Oya Board. He vehemently stressed that the Gal Oya Board should be scrapped and that its functions should be undertaken by Revenue Officers.

Mr. S. A. Selvanayagam—"Mudaliyar Armstrong has merely gone into only one aspect of the question. People of Batticaloa as a whole depend for their fish from the Batticaloa lagoon. The implementation of Mudaliyar Armstrong's proposal would adversely affect the supply of fish from the lagoon. One has to investigate the question whether by keeping the sand bar open for long periods there would be an influx of fish from the sea to the lagoon or the lagoon to the sea. I think we should consider this aspect from the point of view of food production and, therefore, it is a matter that has to be carefully gone into. That is one aspect, the other is whether the opening of the sand bar is going to affect the growth of fish in the Batticaloa lagoon. The fishing industry is a very large one and several hundreds of people live by it. Therefore, when the Board is considering a matter of this nature they will have to be careful as to how they should decide".

Mr. S. Arumugam, Assistant Director of Irrigation—"Mr. Chairman and Gentlemen, it is not the work of the Irrigation Department to keep sand bars open, nevertheless, it is a subject of great interest particularly from an engineering point of view. This particular question of keeping sand bars open in the Batticaloa area is one of great concern and importance. I am glad my friend has brought this up for consideration. It will be interesting to ascertain exactly how this came up. Lagoons and rivers have existed all these days and what is the reason for complaint now? Formerly there was a very good drainage basin in the Batticaloa area. The rains from the North-East monsoon drain into the coastal basins; when a sufficient quantity of water is collected in the basin, heading up higher than the high tide level, the sand bar breaks open as an outlet to the sea. This is what has been happening. Now the basins are not receiving sufficient replenishment—not enough to facilitate the breaking of the sand bar. Hence the inundation.

It is the function of the Revenue Officer to keep the sand bar open. What I would suggest, if I may, is that officers of the Gal Oya Development Board, Engineers of the Irrigation Department and others interested in the subject be called upon by you or some other body to form into a Committee to consider this serious engineering problem".

Mr. C. Wijesinghe—"Mudaliyar Armstrong told us that within 3 days the water level of the lagoon rises and the fields get inundated for 6 days. Could we know the extent of the paddy fields so affected, so that we can have a correct evaluation?"

Mr. S. Arumugam, Assistant Director of Irrigation—"About the fish problem and paddy cultivation and how these will be affected if the sand bar was kept open, I would say that the two interests do not conflict with each whatever. As you know, whenever a source of fresh water enters the sea, the salt-water fish are always at the mouth. On the other hand, if the sand bar existed, the fish in the open sea will not be particularly attracted that way. So that keeping the sand bar open aids cultivation and helps fishing: that is a particular point I wish to add in view of what has been spoken on this aspect earlier".

Mudaliyar Armstrong—"The extent of paddy lands affected is about 10,000-12,000 acres. As regards the second issue of Mr. Selvanayagam, I find from my experience that as soon as the mouth is cut open the

fish not only remain by the mouth but also get into the lagoon. You will find that every time the bar is cut open people who catch fish in the lagoon often catch sharks, about 8-10 ft. in length. Not only that, Sir, fish also got in—sea fish. So that, it is a great advantage for those who enjoy the lagoon fish, which is more liable to leprosy, to have sea fish. As regards the period of flow into the lagoon, I should say that a third or more of the catchment area is held up. After the construction of the Gal Oya dam the water rises gradually. In addition to Gal Oya we are constructing another tank under the Gal Oya ".

Chairman—" It would seem that this is a local problem which can be solved by the various authorities concerned. I think the suggestion made by Mr. Arumugam is most helpful—that some authority should summon these various parties to a conference. If I may say so, the best authority to do so is the Government Agent. Being in charge of the District, he would endeavour to solve the problem in the interests of everybody concerned. May I suggest that we write to the Government Agent suggesting that the matter has come to the notice of the Board and that he take it up as suggested ? We may send him a copy of the discussions and ask him to decide on what should be done ".

Mudaliyar Armstrong agreed to the proposal of the Chairman.

IV (ii)—Resolution moved by Mudaliyar S. Armstrong

Mudaliyar S. Armstrong—" Before moving the resolution I would like to alter ' earth moving Caterpillar tractors ' to read ' earth moving tractors '. The resolution would thus read :

> 'THAT IN VIEW OF THE IMPORTANCE OF LEVELLING PADDY FIELDS IN ORDER TO INCREASE YIELDS, GOVERNMENT SHOULD PURCHASE EARTH MOVING TRACTORS AND SCRAPERS IN ORDER THAT SUCH WORKS MAY BE CARRIED OUT ON A HIRE-BASIS SYSTEM.'

While moving the resolution I must mention about the methods of levelling the fields. Most of our fields in the Eastern Province are not evenly levelled. No doubt we have extensive cultivation, but not intensive cultivation. Apart from that the levelling of fields are such that within a bay in one place there is more than enough water and in other places there is no water at all. As a result it gives a very poor yield on the average. It is for the purpose of increasing the average yield that we want to level the fields, and the C. A. P. & S. Societies are not able to carry out this function because they do not have suitable earth moving tractors. The best thing is for the Department's Engineering Section or any other Department to do the levelling and recover the cost from the owners of the fields. That is my motion. I have once before, in February, 1953, brought the same motion, but I was a bit knocked out by criticism by Mr. Ponnampalam and others. But still I say that it is not the Agricultural Produce and Sales Societies that can carry out this work ".

Gate Mudaliyar N. Wickremeratne seconded the resolution.

Chairman—" I think the Director of Food Production will be able to enlighten us on the resolution ".

Mr. A. C. Ponnampalam—" Before we proceed we might ask Mudaliyar Armstrong to add : ' Agricultural Produce and Sales Societies ' ".

Chairman—" I don't think there is anything to prevent the Agricultural Produce and Sales Societies from doing this work, but they may not be in a position to undertake it."

Mr. Ponnampalam—" I don't think Government can do it. We must get the help of the Agricultural Produce and Sales Societies. The sum involved for each person who wants the use of a tractor is a large one. I think most of the cultivators who want their lands levelled are members of C. A. P. & S. Societies, and it is up to them to press the matter through their C. A. P. & S. Societies. Then I am sure the Director of Food Production will have no objection ".

Mudaliyar S. Armstrong—" I am glad that Mr. Ponnampalam has made these proposals.

I would like to hear what the Director of Food Production has to say about these matters ".

Mr. N. Manicka Idaikkadar, Director of Food Production—" Mr. Chairman and Gentlemen—you are fully aware of the Government's policy of hiring out tractors to cultivators. At the first stage, the research work is done by the Agricultural Engineer's Branch of the Department of Agriculture, and when the Agricultural Engineer is in a position to recommend a particular research done for extension work, my Department takes it over. We are already doing tractor-ploughing and both Government and C. A. P. & S. Societies as well as Union tractors have been employed.

Regarding heavy tractors for levelling, &c., this has certainly been a long-felt need of the farmer and I am happy that Mudaliyar Armstrong has brought in this resolution. Ever since I came to the Ministry in June, 1952, my Department has been pressing for heavy machines. The former Prime Minister had mentioned to the former Minister of Agriculture and Food that heavy machines are meant for the Ministry of Lands and that the Ministry of Agriculture should confine its activities to light machines. I am not too sure whether this policy is followed now. In any case on the advice of the Agricultural Engineer my Department has asked for a gift of heavy tractors from abroad and if they are received they will be hired out to the people. Perhaps my Department will find it difficult to find the necessary funds from the Food Production Vote for the purchase of the tractors. Hence the request for a gift.

About the point raised by Mr. Ponnampalam, I am very doubtful whether even the best C. A. P. & S. Society or Union is able to handle heavy machines. We have had the unfortunate experience already of certain Societies falling into difficulties with light machines. Perhaps the Batticaloa Union is an exception and they might be able to handle heavy equipment.

If we get heavy machinery we should be able to hire out the tractors in the same way as we hire out tractors for ploughing and harrowing. I think this is a useful motion and it should be supported because this has been a long-felt need of the farmer and I heartily endorse it ".

Chairman—" May I ask Mr. Idaikkadar whether it is a fact that there are types of heavy tractors already loaned by your Department ? "

Mr. Manicka Idaikkadar, Director of Food Production—" There is a great need for this type of tractors and we have borrowed some from the Agricultural Corps and we are doing some work in Anuradhapura and Kilinochchi. The demand is so heavy that we have not been able to satisfy the requirements. But these are borrowed machines, we have to return them soon ".

Mr. C. Wijesinghe—" Right through the discussions it has been emphasized that what is required is heavy machinery like D8. I would like to point out that the U. P. Government of India has placed an order for Rs. 1 million worth of small crawler type tractors, about Rs. 13,000 each, which could do the levelling on the worst types of soil at the rate of 3 acres a day. You can verify my statement and get the necessary information from the Central or Provincial Governments of India. These tractors are manufactured by the Olive Corporation of America, who have enjoyed the monopoly of producing Agricultural machinery even during the war years. Unlike Caterpillar and other firms they have to their credit experience gained during the war years and they are the third largest producers in the world. I think the Government of India has considered all these aspects when ordering these tractors. I myself have seen them working in Hyderabad and I was amazed at their performance ".

Chairman—" I think Mr. Ratnatunga would like to make some observations ".

Mr. D. M. Ratnatunga, Chief Agricultural Engineer—" The Department has about 17 tractors of the crawler type. We are using them on our farms. We haven't enough to go round for hiring. I think the machines are about 60 h.p. About 100 cubes of earth could be moved a day, and the cost is about Rs. 2 per cube ".

Chairman—" Have you heard of the type of tractor mentioned by Mr. Wijesinghe ? "

Mr. D. M. Ratnatunga—" Yes. Unless it is 80 or 100 h.p. I don't think it can do the job well ".

Mr. C. Wijesinghe—" This is a 23 h.p. kerosene operated ".

Mr. Ratnatunga—" We have the same type —John Deere—it moves about 70 cubes a day, costs Rs. 12,000 and runs on kerosene ".

Professor Evan A. Hardy—" Mr. Chairman and Gentlemen—In regard to what Mr. Ponnampalam had said I think that we should be able to find equipment within the range of the Co-operative Societies for them to own and operate. I am also inclined to agree with Mr. Ponnampalam's view that particularly in sandy soils the rubber tyred tractors tend to reduce the amount of ware which we get on crawler equipment. In Canada we find quite a number of the larger wheel type of tractors which are able to handle a greater amount of work in a speedier manner. There is some high-speed land-levelling equipment at Gal Oya Valley which I am told had been obtained from Australia. My suggestion is that we should make a suitable study of the equipment that is available. The equipment at Gal Oya may be preferable in newly developed land for high-speed levelling but what is required here is some equipment that could be loaned. My suggestion is try a few John Deeres and see what it is worth. I think we should also make a study of all makes of equipment ".

Chairman—" I think from the discussion that has ensued there is no opposition to the motion. May I take it that you approve of the resolution ? I will send it on to Government ".

V—Resolution moved by Mr. Ray Wijewardena

" THAT THE POSSIBILITY OF A REGULAR WEATHER FORECASTING BROADCAST IN ALL LANGUAGES BE INVESTIGATED AND ALSO THAT IN VIEW OF THE IMPORTANCE OF LONG-RANGE FORECASTING—PARTICULARLY DURING HARVEST TIME —THE POSSIBILITY OF THE APPROPRIATE DEPARTMENT OF GOVERNMENT CORRELATING REPORTS FROM OTHER COUNTRIES INTO REALLY LONG-RANGE FORTNIGHTLY BROADCASTS SHOULD BE INVESTIGATED ".

Mr. Wijewardena—" Mr. Chairman, fellow agriculturists—Throughout the centuries, the weather, and particularly rainfall, has been one of the most formidable factors with which the farmer has had to contend. We cannot possibly do without rain, and yet it never comes in moderation ; it is either too heavy or too light, too early or too late. No single factor affects this country's agriculture more acutely, and yet no single factor has been more overlooked.

Arable farming, and particularly paddy, in this country is perhaps the most affected of all our agriculture. Harvests are constantly ruined because rains came too late or too heavily or not at all. Hazards such as this are keeping far too many of our young people away from the land, as Agriculture is considered by far the most uncertain of all vocations. And yet this need not be so. Scientists can nowadays at least forecast quite a long way ahead what the weather will be like, even if they are unable as yet to make rainfall any where they wish. A weekly weather forecasting service will be of considerable importance to the farmer as a means of reducing, if not yet eliminating, the major hazard of his profession.

All over the United States and the United Kingdom the Farmers' Weather Forecast is broadcast every morning at a fixed time and is religiously listened to by them all. In this country we are singularly fortunate. We do not have to contend with sudden frosts, or snows, rain being our only hazard in the weather line. A weekly forecast broadcast at a fixed time and on a fixed day will be ample for our needs provided that the necessary information can be obtained, and there is no reason why it cannot.

So far in this country we have only been given forecasts up to one or two days ahead, but with the correlation of results and

atmospheric data from all over the world, and utilizing the fine store of rainfall, temperature and wind statistics which our Meteorological Department has been compiling over the last 75 years, there is now no reason why a long-range forecast is not possible up to even one or two months ahead. In most cases it will be possible to provide a general forecast as to the probable tendencies of the monsoons up to even six months ahead. A guess based on sound scientific principles will be better than no guess at all.

If my resolution is accepted in principle, may I suggest that a committee be elected to go into this subject in detail with the appropriate Departments concerned and place their findings before the next meeting of this Board for adoption or otherwise ".

Mudaliyar Abulcassim Maraikar—" I have great pleasure in supporting this motion. I have had a lot of experience in matters like this. This motion is going to help us a great deal in the direction of food production. Owing to the vagaries of weather conditions we are unable to carry out paddy cultivation successfully. Owing to unseasonal rains, whenever we want rain we are denied it and whenever rain is not wanted we get rain, with the result that successful and methodical cultivation is not possible. Therefore, our food production suffers tremendously. I was delighted to read the motion on the Agenda and I feel that all of us should give our earnest consideration to this motion with a view to solving the problem and to making the authorities concerned conduct scientific investigations on making long-range forecasts of rainfall. This would enable farmers and cultivators to launch out on extensive cultivation and thereby increase the food production in the country. Otherwise uncertain weather conditions cripple farmers because the moment the seed is sown there is excessive rain necessitating re-sowing. Therefore, if this question is to be to some extent tackled and long-range broadcasts of weather conditions are available, we will be in a better position to do our paddy cultivation ".

Chairman—" I have had a letter sent to me by the Parliamentary Secretary to the Minister in charge of Broadcasting, which I shall now read to you :

> ' Reference the resolution regarding ' Long-Range Weather Forecast ' I have got the Director of Meteorology to give me a report regarding this resolution. I have enclosed same so that you may enlighten the members of the Board on same. The Broadcasting Department is prepared to put on the air whatever is given by the Meteorological Department. Both these Departments are under my Ministry of which I am the Parliamentary Secretary '.

Now that the Director of Meteorology is here I need not read his letter. I should also say that I have a letter from the Director-General of Broadcasting, who is prepared to put over the air any material which is forwarded by the Director of Meteorology. His letter reads as follows :—

> ' With reference to your letter of the 13th instant regarding the resolution to be moved by Mr. R. Wijewardena at the next meeting of the Central Board of Agriculture, I do not think it will be necessary for me to attend this Meeting in person because my own contribution to the discussion will have to be confined to the broadcasting side. So far as I am concerned, forecasts of the type referred to by the mover can be put over the air if the forecasts are available from the Department of Meteorology. The officer who has to be consulted in this, therefore, is Dr. Dassanayake, Director of Meteorology, who will have to say whether forecasts of that type are possible in Ceylon ' ".

Dr. D. T. E. Dassanayake, Director of Meteorology—" I think the letter that I sent the Parliamentary Secretary to the Ministry of Posts and Broadcasting really gives the outline. I quite agree with the mover of the resolution and the seconder that if we could have long-range forecasts it would help the Agriculturist considerably. There is no getting away from that. But anyone listening to the mover of the resolution would think that long-range weather forecasting is a very simple matter, and that only

nobody has so far thought of asking for it. I can assure members that forecasting weather has been attempted for at least a century. Take for instance the British Meteorological Organization, which is a very large one, where, in addition to the Director, there are 4 Deputies and 9 Assistants. Their annual expenditure is about Rs. 40 million. Their position today in regard to weather forecasting is that they can forecast the weather precisely for 12 hours, give a fair outlook for another 12-24 hours, and give a 4-day forecast on an experimental basis, after many years of experiment. Captain Douglas, who was their Senior Forecaster for many years and who retired last year, summed up the position only last year when he said that weather forecasting is very complex and that long-range forecasts will not be a success for a very long time to come.

One would think that with such a large organization and resources, it should be an easy matter. I can assure you it is not. I have been in charge of the Ceylon Meteorological service for 16 years. I had worked for 2 years under Sir David Brant, an authority on Meteorology, but weather forecasting is not easy I assure you. Weather processes take place in three dimensions : length, breadth and depth of the atmosphere, but most of the observations available are ground level. We now plot at the Forecast Centre the weather chart over a large area, from Africa to Japan and China to Australia, but England and America plot the weather chart for the whole of the Northern hemisphere. With all that they still cannot forecast the weather with any degree of confidence. It is no use putting out a forecast on a guess basis. When a Meterological Service puts out a weather forecast, the public will accept it. Unless there is some ground for giving that forecast there is no use guessing it. Anyone can guess.

Seasonal forecasting is another matter. That is giving the forecast of the coming South-West Monsoon for instance. South-West Monsoon Forecasting is a classical attempt at seasonal forecasting. It was first attempted in 1878 after the terrible Indian famine of 1877, when the Director-General of the Indian Meteorological Service was asked to forecast the coming South-West Monsoon.

I have made a careful study of this subject of long-range weather forecasting. There are really several different methods employed. Sir Charles Normand, who was Director-General of the Indian Meteorological Service for many years, as the President of the Royal Meteorological Society, gave his presidential address on the history of the forecasting of the Indian Monsoon. He said : 'there is no harm in attempting it but the people will have to take it with caution'.

I notice that the wording of the resolution is for the matter to be investigated. I am glad that Mr. Wijewardena is not asking me to put out fortnightly forecasts straight away. The matter should be investigated, and to that extent I quite agree. In fact I have been trying to convince the Government that seasonal weather forecasting should be attempted, because there is a great economic value in it. I am not going to promise, however, that it will be a success tomorrow or the next month or next year. One thing I must say is that Ceylon is at a disadvantage in comparison with European countries or America, because here we are a small Island surrounded by the ocean ; the weather comes from the ocean and till it hits us we get very little information.

I hope nobody would be optimistic enough to think that for the asking fortnightly weather forecasts could be given."

Chairman—"I take it, therefore, that you are in agreement with the substance of the resolution and that you would like to investigate matters. Actually it will serve your purpose as well as ours if the resolution were accepted and forwarded to Government because you will then be able to get the necessary staff to carry out your work. Gentlemen, we need not then proceed any further. I merely put the resolution up for your approval ".

All were in favour of the resolution.

VI (a)—Motion moved by Gate Mudaliyar N. Wickremaratne

Gate Mudaliyar N. Wickremaratne—"I move the following motion to be discussed by the Board :—

"THE SUBJECT OF THE RUBBER REPLANTING SCHEME WITH A VIEW TO ENSURING THE PREVENTION OF SOIL EROSION AND THE POSSIBILITY OF RAISING FOOD CROPS IN RUBBER LAND."

The replanting scheme should have received much more careful consideration before the scheme was launched. From what I have seen and the information I have received, the question of soil erosion has not been fully dealt with. One of the dangers that we have to face with in this country is the question of soil erosion. When the original rubber boom came between 1906 and 1914 a large area of valuable lands, forests and even paddy fields were brought under rubber without any consideration of prevention of soil erosion or other economic issue. These areas of lands in the mid-country and low-country where the population was heavy, were of greater use to the growing population. One of the acute distresses in the country is the setting of paddy fields in the clearing of these forests, another distress is the want of land for growing food crops in these areas. If one goes round the villages where rubber has been planted it would be seen that there is hardly any land left for growing any ordinary food crops such as pulses, fine grains, yams, sweet potatoes or manioc which abounded in those areas before the planting of rubber. Another loss suffered by paddy fields is the loss of fertility of the soil owing to the clearing of these forests. There is yet another loss which is even worse than those enumerated above. At the present time there is a great shortage of dwelling houses all over the country.

The northern part of Matale was really the home for food produce of various kinds. The planting of rubber put a stop to such production.

During the rubber boom many people made money and the rubber produce fetched very high prices, but when the war broke out in 1914 and the price of rubber came down to 10 cents a pound, many suffered heavy losses and ruined their future.

Subsequently there was a food shortage which was unprecedented. The rehabilitation of rubber without consideration of the other economic requirements may be a source of danger to this country. Owing to this rubber we have already got ourselves into a tangle. To dispose of our rubber we were forced to go to the Communists. If communism is bad how could their money be good ? I consider it is worse to eat their rice.

At the present time there is a great shortage of various items of food. Many of these lands can be used for growing crops which would produce such items of food, which would give a return higher than rubber. Mangoes, a fruit which was sold at 2 or 3 cents each, is now being sold at 15 to 20 cents. Oranges, a fruit which was sold at 5 cents each, is now being sold at 30 to 40 cents. Jak fruit which was sold at 25 cents is now being sold at Re. 1.50 each. Bread-fruit which was sold at 5 cents a fruit is now sold at 25 to 30 cents. Even coconuts have gone up in price from 5 cents to 20 cents each. There is thus money in these crops and such crops will relieve the scarcity of food. The planting of cacao and the raising of pepper will also give a better return to the grower, in such areas as Matale.

My suggestion is that regulations should be framed for the better protection of land from soil erosion and also for a suitable extent of land to be set apart for the raising of food crops. The owners of small areas of land, less than, say 2 acres, should be given higher compensation and allowed to grow other crops during a period of 5 to 7 years. I trust that the Ministry responsible for the Rubber Replanting Scheme will consider this matter with a view to fall in line with the life-long work of the first Minister of Agriculture, until we get our self. sufficiency".

Chairman—"You are not moving any formal resolution ?"

Gate Mudaliyar Wickremaratne—"I am against resolutions. I am really bringing it to the notice of the members and the appropriate authorities to see that some action is taken".

Chairman—" Mr. Pathmanathan, who is Chairman of the Low-Country Products Association and a member of the Rubber Replanting Board, will make some observations ".

Mr. S. Pathmanathan—" As one who is responsible for framing the regulations under the Rubber Replanting Scheme, I would like to offer a few comments. One of the reasons we are giving the smallholder such a big subsidy is to prevent intercropping. We do not like to encourage food crops on rubber land because first and foremost they affect the rubber trees, the roots of which are very susceptible to disease.

As far as soil conservation is concerned, one of the major objects under this scheme is to see that every holding should have adequate soil conservation measures. Wherever there are lands situated on slopes, it would be necessary to have drains. One of the conditions for the third instalment is that the areas should have drains situated at certain intervals and establish cover for soil protection. These are inspected by the V. A. and on his recommendation we pay the subsidy. We also help the smallholder in lining and pegging contours and send out advisers and inspectors to give every possible assistance. So that as far as soil conservation is concerned, it is one of the corner-stones of our scheme. We would like to see that every inch of the land is protected. In addition, smallholders under the Subsidy Scheme are assisted with fertilizers.

As you are aware, most of the rubber lands are situated on soils containing low fertility and it would be impossible to include food crops which require high fertility.

The Minor Products Sub-Committee has recommended 12 products which should be grown in certain areas. We have suggested that there should be a survey of the Central Province, where rubber is an uneconomic crop, with a view to introducing alternate crops and products like pepper, cardamoms, &c. Very shortly we shall place a report before the Board and also make our recommendations to Government. We have even suggested that a subsidy should be paid to those owners of rubber who wish to have their lands replanted with cacao.

We are very keen on the growing of alternate crops. But before that we would like to make a survey to ascertain suitability of climate, soil and other conditions so as to determine the appropriate crops for particular areas. We have, therefore, asked the Horticultural Officer of the Agricultural Department to collect the necessary information from the various sources so that we could put before you a real plan to help the peasants and others who desire to grow alternate crops ".

Mr. C. A. M. de Silva—" In this instance I support Gate Mudaliyar Wickremaratne. What he seems to want is that certain areas should be set apart for the growing of food crops ".

Gate Mudaliyar N. Wickremaratne—" I am glad that you are reconsidering the matter. I don't want to mix this question with the old food production scheme, which was a senseless one, and the present intercropping, which is another thing. What I want is that certain areas should be set apart for the growing of food crops. It has been said that soil erosion is being tackled by the proper opening up of drains—that is the very thing I want stopped. All the top soil is washed away by drains.

After all these people are not following the programme planned by the late Mr. D. S. Senanayake by replanting rubber. Replanting rubber for what ? To sell our rubber to Communists ! "

Chairman—" I don't think we need worry about the political implications of all this. I think, gentlemen, we know the viewpoint of the Gate Mudaliyar. He is no doubt a great enthusiast for food production. He desires that all those who grow rubber should have a certain portion reserved for food production. This Board is not, I think, competent to make any decisions in regard to the inclusion of rubber within the terms of the Estates Food Production Act ".

Mr. C. Wijesinghe—" That is not the intention of the mover. What he says is that where a subsidy is given a certain percentage of the total acreage that is being replanted should be devoted to food production. The object of the resolution must be that instead

of replanting uneconomic rubber areas, the land should be utilized for the production of food ".

Mr. Pathmanathan—" The Rubber Rehabilitation Board has itself suggested that where there is uneconomic rubber, the land should be made use of for the growing of cacoa in the mid-country ".

Chairman—" I think the object of Gate Mudaliyar Wickremaratne's resolution will be served if instead of replanting rubber in uneconomic areas, other crops such as coconuts, pepper, &c., were planted. I think the Minor Products Sub-Committee has gone into this matter and it would be best to leave it at that for the moment. The first step in any rubber replanting scheme, as Mr. Pathmanathan has pointed out, is to attend to soil conservation. From the discussions today it would appear that these objectives have been borne in mind, and I do not think any purpose will be served by our passing a resolution on the matter. Will that meet with your approval ? "

Gate Mudaliyar Wickremaratne agreed.

VI (b)—Motion by Gate Mudaliyar N. Wickremaratne

" THE ESTABLISHMENT OF MANURE DEPOTS IN VARIOUS PARTS OF THE COUNTRY TO SUPPLY FERTILIZERS TO PADDY CULTIVATORS."

Gate Mudaliyar Wickremaratne—" The fixing of a guaranteed price for paddy by Government has no doubt given an incentive to paddy cultivators to bring their lands under paddy, but a great majority of them own only a few measures of sowing extent and the resulting yield is required for their own consumption. They are also unable to improve the conditions of their paddy fields. Others who are able to sell a part of their produce do not take the trouble to find ways and means of improving paddy fields. Some others who own paddy fields have left the cultivation in the hands of the cultivators. So there is a tendency to neglect the paddy fields and its capacity to yield more. The facilities that existed for the proper cultivation of the land are fast disappearing.

Cultivators who used to collect leaves and twigs of trees to form manure for their paddy fields cannot find them now. Cattle, which used to roam about grazing in paddy fields, used to give a certain amount of fertility to the soil, but now no cattle are available in the villages. Water that percolates through the forest and hills used to bring down some nitrogen to the soil, but the water that comes down from the hills now bring down silt instead of manure. The arrangements that have been made to supply manure at the present time do not meet the needs of the cultivators satisfactorily. Anybody who wants manure must be able to get it at the time of his need as one buys his requirements from a boutique or a shop. The establishment of manure depots in various parts of the country will help the cultivators to return to the soil some part of the fertility of the soil consumed by the paddy crop.

In present times we have heard so much about experts coming to the country to advise us on the improvement of paddy and other crops. Have these experts been able to give us any help ? I think not. One of them, Dr. Koshal, spent a considerable time in surveying our paddy fields to give statistics of their yield. Are these of any use to us ? I do not know what inspiration the officers of the Agricultural Department get from these visitors ".

Mr. N. Manicka Idaikkadar, Director of Food Production—" When the present Ministry was formed the former Permanent Secretary, Mr. Somasuntheram, had in mind the idea of establishing manure depots. The difficulties of storage and the fluctuations in the market price of manure have placed great hindrances in the way of C. A. P. & S. Societies, and quite a number of them have not recovered their losses. What we normally do is to ascertain the exact requirements of a Society and then send it from Colombo. This system is working fairly satisfactorily. Not more than 1,500 tons were issued in 1952. We are now issuing almost 4,000 tons per season. If we have Central Stores it may well mean that somebody will have to foot the bill for the start and the running expenses and also any losses incurred. If, for instance, we are not able to supply enough manure because of the inability of our supply depots

to cope with the orders, then I think it is a matter for consideration. But I think as the issues of manure have risen from 1,500 tons in 1952 to 8,000 tons a year now, it does not seem necessary to embark on any new ventures. Especially from the practical point of view of storage difficulties and fluctuations in market prices, I am not sure whether we should support the motion as it is. I would rather like the motion brought up about 6 months hence to see if there is any further difficulty ".

Gate Mudaliyar Wickremaratne—" It is essential that the cultivators should be able to obtain manure whenever they want. There is no reason to worry about storage, because when a certain amount of manure is required orders could be sent to the Director of Food Production, and the stocks received could be disposed of at once. As stocks are utilized more stocks could be brought in. I think some thing must be done—there must be co-operation. Without manure you cannot increase the yields of paddy. The Department is blamed for not increasing the yields. The experts who come from other countries try to explain how to increase our yields. But it is by the use of good manure in cultivation alone that we can increase our yields. You must return to the soil what you get from it. Good manures in liberal quantities should be available for the cultivators in their localities for them to purchase. This facility should be provided for them by establishing manure depots ".

Mr. M. B. Samarakoon—" In fairness to the Director of Food Production and the Registrar of Co-operative Societies I must say that the distribution of manure through C. A. P. & S. Societies is working very satisfactorily at the moment. The present position is that there are cases of even societies with overdue loans being issued with manure by the Director of Food Production because it is an essential requirement. I am the President of a C. A. P. & S. Society. Recently we assessed our requirements of manure at 350 cwt. and this was issued to us by the D. F. P. Later we found that we required another 300 cwt. and although we had no supplementary provision, this quantity too was issued to us by the D. F. P. I must say in fairness to the Director of Food Production that the consumption of manure has increased ".

Mr. S. C. Fernando, Registrar of Co-operative Societies—" Out of a possible membership of 600,000, there are at present not more than 200,000 members of C. A. P. & S. Societies. I think with an increase in membership this problem of manure distribution could be solved to a great extent ".

Mr. A. C. Ponnampalam—" If non-members are also allowed to buy even at a higher rate it would be very helpful ".

Mr. M. B. Samarakoon—" I must mention that even non-members are issued at the subsidized price. They are only not given loans ".

Chairman—" Is it a fact that manure is issued only to members ? "

Director of Food Production—" The subsidy has to be given through the C. A. P. & S. Societies. I do not think it is restricted to members ; it is given through the societies ".

Mr. Ponnampalam—" It would be helpful if a circular is sent out to all members stating it very clearly that everyone is entitled to purchase manure through the C. A. P. & S. Societies ".

Chairman—" I will commend this to the Director of Food Production and the Registrar of Co-operative Societies.

I, therefore, think that the matter may be taken up in another 6 months time. We could then see how the distribution of manure is working ".

Chairman—" Gentlemen, I would now call upon Dr. Ramiah of the F. A. O. to speak a few words to you ".

Dr. K. Ramiah—" It is very kind of you, Sir, to have given me the opportunity to be present here this afternoon and to listen to the very interesting discussion on various topics. I am concerned more as a Rice Adviser to Asian countries under the Food and Agricultural Organization. I just keep in touch with problems of production as they exist today and how production could be intensified. My chief contacts are the Technical Officers of the Department. Unfortunately I do not come in contact with politicians or others who may be directly or indirectly interested in food production.

This morning I was asked to attend a meeting of the Sub-Committee on Paddy, where the problem of production of pure seed and its supply came up for consideration. There was much work to be done by the technical officers of the Department to effect increases in production. One of them refers to the distribution of good seed to rice growers. Apart from any other measures, like for instance, the use of fertilizers, use of better implements, control of pests and diseases, and so on, and better marketing, and so many other considerations, you can easily pick out that the distribution of good seed to the farmers is a direct and most easily achieved contribution to an increase in production. It is a long-term process but at the same time it does not involve any additional investment. Now, the pureline breeders are engaged in different countries in producing new varieties either by selection or by hybridizing two varieties and thus producing an entirely new one suited to their conditions. Often in many of the countries where this breeding has been in a fairly advanced stage the benefits of such breeding work have not borne fruit. Unless the old indigenous varieties are replaced by improved varieties you would not get the full benefit of your work.

They have very well organized seed breeding programmes in certain parts of India and Burma, but they didn't get much headway for the simple reason that such programmes were not accompanied by properly organized seed multiplication and distribution programmes So the F. A. O. paid special attention to the seed schemes and brought to the notice of Governments concerned that they should pay a little more attention than they are doing at present to this aspect. The problem of maintenance of multiplication schemes for each country to suit its needs has certain requirements, but the essentials of it are that any new varieties must be maintained by the Department of Agriculture in its Experimental Stations. That responsibility must continue to remain.

The next stage is that before the seed is given to the cultivator it must be multiplied—that can be done either on the Government Farms, whether they are large or small, or by arrangement with prominent Co-operative Rice Farmers and multiplying seed on their land. But if it is done on Government Farms it is expected that there will be sufficient technical staff to supervise this work and to purify the varieties before the large-scale seed is made available to the cultivators. This is often ignored and, although it does not cost very much, it is a very necessary and important item of work. The seed at the last stage before it leaves for the farmer must be in a pure condition. Once the seed goes to the farmers themselves, however careful they may be, it is impossible to maintain their purity for a long time. It is usually considered that 3 to 4 years should be the maximum period by which the cultivators should have a chance of renewing their seed supply. After all the expenditure on the maintenance of purity is comparatively very small, and unless you incur that expenditure it very often happens that the full benefits of a breeding programme cannot be realized.

As far as new varieties are concerned, there may be certain types which are not available in Ceylon but well suited to local conditions. For instance, in Ceylon I have found that the imported varieties—one from Indonesia and one from India—are found to be doing very much better than the local varieties. Once you are sure that the variety is acceptable and brings the grower a better yield, the seed scheme must be put into effect as early as possible.

I might thus bring it to your notice that this seed distribution and multiplication programme in a country like Japan rests mostly with Farmers' Associations and Village Co-operatives, and the Central Government subsidized these Associations and Societies to the extent of 10 million dollars last year. The Central Government spends large sums in the way of subsidies to help Co-operative and Villagers' Organizations to multiply and maintain the purity of the seed so that the seed will be available to the rice farmers. This is very useful. No wonder, in Japan the seed programmes go hand-in-hand with production of new varieties with the result that over 70 per cent. of the rice areas is devoted to improved varieties. I think the next country is probably Burma which has 15-20 per cent. In Ceylon too, I think it is about 15 to 20 per cent. Once a new variety is available, all the areas suited for it must be cultivated with this new variety. If this is done there is no other easier method of increasing production.

The improved yields in various countries differ and in some countries it is declared to be 10 to 15 per cent.; this percentage is always sure. The breeder is not worth his job if he does not get at least a 10-15 per cent. increase.

I am thankful to you for this opportunity of being able to address you all. In conclusion I would request you all to co-operate in carrying out good seed programmes so that the benefits of breeding could be passed on to the farmers".

Chairman—"We have one more item on the Agenda—the reports of the Sub-Committees. I understand some of these met this morning. May I suggest that these reports be circulated to all members of the Board for discussion at the beginning of the next meeting ? I think it would perhaps be appropriate because members would then have an opportunity of making any comments they wished".

Agreed.

Chairman—"Mudaliyar Wickremaratne reminds me of the subject of Sugar Cane Cultivation. The matter has not progressed very much more than when it was last discussed. The time is not appropriate now on account of the question of finance. When the time is favourable the matter could be taken up again".

The meeting terminated at 5.30 p.m.

N. P. WIJEYERATNE,
Secretary,
Central Board of Agriculture.

Peradeniya, February 10, 1955.

GOVERNMENT NOTIFICATIONS

THE FOOD PRODUCTION (ESTATES) ACT, No. 40 OF 1954

(Extract from the " Ceylon Government Gazette " No. 10,776 of March 11, 1955)

L. D.—B. 27/54.

REGULATIONS made by the Minister of Agriculture and Food by virtue of the powers vested in him by sections 9 and 20 of the Food Production (Estates) Act, No. 40 of 1954, and approved by the Senate and the House of Representatives.

J. R. JAYEWARDENE,
Minister of Agriculture and Food.

Colombo, March 5, 1955.

Regulations

1. These regulations may be cited as the Food Production (Estates) Regulations, 1954.

2. In these regulations, unless the context otherwise requires—

" Act " means the Food Production (Estates) Act, No. 40 of 1954, and
" rubber estates " means any estate wholly cultivated with rubber.

3. The Board of the Tea Research Institute of Ceylon shall, in respect of every estate held by that Board, be exempt from the whole of the liability imposed by section 4 of the Act.

4. The Coconut Research Board shall, in respect of every estate held by that Board, be exempt from the whole of the liability imposed by section 4 of the Act.

5. The proprietor of every rubber estate shall, in respect of every such estate, be exempt from the whole of the liability imposed by section 4 of the Act.

6. Where any estate is cultivated partly with rubber and partly with any other plant or plants of any description, the proprietor of such estate shall, so far as the total area cultivated with rubber in such estate is concerned, be exempt from the whole of the liability imposed by section 4 of the Act.

7. Sections 7 and 8 of the Act shall not apply in relation—

(i) to any rubber estate, or

(ii) to the total area in any estate which is cultivated with rubber and which is referred to in regulation 6.

EXEMPTION FOR ANIMAL HUSBANDRY (MILK PRODUCTION) UNDER THE NEW FOOD PRODUCTION (ESTATES) ACT, No. 40 OF 1954

THE following Scheme has been approved with effect from January 1, 1955. The exemptions will be based on the number of Milch cows and stud bulls maintained on the estate. The exemptions will be given in accordance with the following scale:—

	Type of Cattle	*Acres*
1.	For each milch cow of any high milk-yielding breed (e.g., Ayrshire, Friesian, Red Poll or Jersey Cows) and each milch cow of any cross-bred type graded up for high yields in a scientific breeding programme	2
2.	For each milch cow of a medium milk-yielding breed (e.g., cross-bred types such as Cape cows and Indian breeds such as Sindhi cows)	1
3.	For each milch cow of a low-yielding breed (e.g., unspecified local breeds)	¼
4.	For each stud bull approved by the Veterinary Surgeon of the area—	
	(*a*) If it is an imported stud bull	5
	(*b*) If it is a local stud bull	2
5.	For female progeny of over one year of age of an approved stud bull	1

In assessing an estate for exemption under the Scheme, cattle maintained on the estate will count for exemption whether the cattle are owned by the estate or by persons permanently resident on the estate. Village cattle temporarily tethered on an estate will not count for exemption.

It is also important to note that only milch cows will count for exemption. Scrub cows which are not milked, and are not capable of yielding any appreciable quantity of milk, but which are maintained purely for manurial purposes will not count for exemption. Buffalo bulls and cows will count for exemption on the same basis as milch cattle.

Conditions for Grant of Exemption

1. In order to qualify for exemption under the Scheme, an estate must maintain a Herd Register and a Register of Cattle.

2. All cattle on the estate should be identified by brand marks or ear tags, particulars of which must be entered in the Registers referred to above.

3. Every estate which maintains a herd of over 50 cows must maintain on the estate a stud bull approved by the Veterinary Surgeon of the area; the estate must maintain one stud bull for every 50 cows. Estates which do not maintain a stud bull because they are unable to obtain one, must get their cows served either by artificial insemination at a Government centre or by a stud bull outside the estate approved by the Veterinary Surgeon of the area.

4. No bull calf over 18 months or a bull other than one that has been approved shall be kept on the estate unless it has been castrated and made unfit for crossing.

Additional Exemptions for Capital Expenditure

In addition to the exemptions mentioned above, estates which incur capital expenditure on the construction of cattle sheds, milk rooms, &c., will be entitled to certain additional exemptions, particulars of which can be obtained on application to the Director of Food Production. Approved type-plans for cattle sheds can also be obtained on application.

EXEMPTIONS FOR ANIMAL HUSBANDRY—(PIGS, GOATS, POULTRY AND SHEEP)

UNDER the Food Production (Estates) Act, No. 40 of 1954, the under-noted Scheme of exemptions under section 8 of the above Act, will come into operation with effect from January 1, 1955.

I—*Classes of Livestock*	*Rate of Exemption*
(*a*) Pigs of imported breed, per animal, irrespective of whether they are boars, sows or piglings	1/5th of an acre
Pigs of local breed, per animal, irrespective of whether they are boars, sows or piglings	1/10th of an acre
(*b*) *Poultry.*—Laying hens per hen (a minimum of 50 birds is necessary for consideration of exemption)	1/100th of an acre
(*c*) *Goats.*—Breeding goats per animal	1/10th of an acre
(*d*) *Sheep.*—For each sheep	1/10th of an acre.

II—*Additional Exemptions for Capital Expenditure incurred on Buildings such as Sties, Poultry Runs, &c.*

In addition to the exemptions listed above, an estate rearing the above classes of livestock will be allowed further extents for capital expenditure incurred on buildings of a permanent nature erected for animal husbandry purposes such as sties, poultry runs, &c. Exemptions for buildings will be granted on the following basis:

(i) 3 per cent. of the total capital expenditure incurred on buildings after January 1, 1955, will be allowed as " annual depreciation " in the year in which the buildings are erected and in each of the 15 years thereafter.

(ii) The estate will be allowed one acre of exemption for every Rs. 80 of annual depreciation on buildings in the case of tea estates and one acre of exemption for every Rs. 160 of annual depreciation in the case of coconut estates.

III. *Conditions for Grant of Exemption*

(*a*) In assessing an estate for exemption under this scheme, the above livestock maintained on an estate will count for exemption provided they are owned by the estate, or if owned by estate employees, the estate incurs an expenditure of at least Rs. 50 for each acre of exemption thus granted. For purposes of exemption, the number of relevant livestock in each class will be the average number in each variety reared on the estate in the period of 12 months preceding that for which exemption is claimed.

(*b*) In the first year of operation of the scheme (i.e., 1955), and even thereafter, exemption will be based on the number of each variety at the time of each inspection, unless records are available to show the average number reared over the previous 12 months.

(*c*) To earn exemption for capital expenditure, estates must maintain buildings to the satisfaction of the Director of Food Production.

L. D.—B. 12/36.

THE PLANT PROTECTION ORDINANCE

(Extract from the " Ceylon Government Gazette " No. 10,758 of January 28, 1955)

Notice

By virtue of the powers vested in me by regulation 12 of the regulations set out in the schedule to the Plant Protection Ordinance (Chapter 307), I do hereby amend with effect from November 1, 1955, the notice prescribing the treatment for the leaf disease of the rubber trees (*Hevea brasiliensis*) caused by the fungus *Oidium heveae* Stein, published in *Gazette Extraordinary* No. 10,448 of September 17, 1952, by the substitution, for paragraph (5) thereof, of the following new paragraph :—

" (5) The sulphur to be used for dusting shall be free-flowing dusting sulphur powder which conforms to the following specifications :—

(*a*) At least ninety-five per centum of the powder must be capable of passing through either a 300-mesh standard sieve of the British Standard Association or a 325-mesh standard sieve of the American Society of Testing Materials;

(*b*) The powder must contain at least ninety per centum of pure sulphur by weight. "

A. W. R. JOACHIM,
Director of Agriculture.

Peradeniya, January 22, 1955.

RUBBER RESEARCH (AMENDMENT) ACT, No. 3 OF 1955

L. D. O. 46/54.

An Act to amend the Rubber Research Ordinance
(Date of Assent : February 18, 1955)

Chapter (Vol. VI., page 444).

BE it enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Senate and the House of Representatives of Ceylon in this present Parliament assembled, and by the authority of the same, as follows:—

Short Title.

1. This Act may be cited as the Rubber Research (Amendment) Act, No. 3 of 1955.

Amendment of Section 4 of Chapter 302.

2. Section 4 of the Rubber Research Ordinance is hereby amended by the insertion, immediately after sub-section (3) of that section, of the following new sub-section:—

" (3A) The Board may, in such manner as it thinks fit, borrow money and secure the repayment of any money borrowed. ".

ANIMAL DISEASES RETURN
October-December, 1954

Province	Disease	Fresh Cases during the Quarter	Total Number to end of 1954				Balance ill at end of Quarter
			Cases	Deaths	Shot	Recoveries	
Western Province (excluding Colombo Municipal area)	Rabies	73	311	—	311	—	—
	Foot-and-mouth	297	1,576	19	—	1,267	290
Northern Province	Anthrax	5	296	296	—	—	—
	Rabies	3	22	—	22	—	—
	Black Quarter	—	117	117	—	—	—
North-Central Province	Foot-and-mouth	—	986	10	—	976	—
	Rabies	6	8	—	8	—	—
	Black Quarter	8	449	449	—	—	—
North-Western Province	Rabies	3	20	—	20	—	—
	Foot-and-mouth	1,419	1,949	257	—	1,553	139
	Mange	25	25	3	—	22	—
Central Province	Rabies	5	54	—	54	—	—
	Piroplasmosis	—	5	—	—	5	—
	Foot-and-mouth	—	95	—	—	95	—
Province of Sabaragamuwa	Rabies	6	16	—	16	—	—
	Foot-and-mouth	29	177	1	—	176	—
	Black Quarter	—	3	3	—	—	—
Province of Uva	Rabies	7	13	—	13	—	—
	Foot-and-mouth	400	412	—	—	412	—
	Black Quarter	—	14	11	—	3	—
Eastern Province	Foot-and-mouth	1,663	10,850	622	19	9,934	275
	Mange	—	171	40	—	131	—
	Rabies	1	3	—	3	—	—
	Black Quarter	—	36	36	—	—	—
Southern Province	Rabies	4	24	—	24	—	—
	Bovine Farcy	—	12	1	—	11	—
	Black Quarter	—	86	86	—	—	—

Department of Agriculture,
Peradeniya, February 23, 1955.

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

METEOROLOGICAL REPORT
October-December, 1954

SUMMARY

THE main feature of the weather in October was the formation of a depression, identified to north of Ceylon about the 20th, which resulted in unsettled weather with overcast skies, heavy, widespread rain, strong winds and stormy seas, mainly in the northern and western parts of the Island. The rainfall was moderately heavy during the period 17th to 21st, and local floods were experienced at many low-lying places in these regions. Kelani Ganga touched the minor flood level on the 24th. During the rest of the month, inter-monsoon conditions prevailed, with scattered evening thundershowers which were heavy in places. The rainfall was heaviest in the south-western mid-country and the adjacent hill country, where a number of stations recorded totals over 25 inches. From this region there was a gradual decrease in rainfall, monthly totals elsewhere in the south-west and in the hill country exceeding 10 inches. In the north-western parts and in Jaffna Peninsula too, the rainfall was above 10 inches. Least rain (totals below 5 inches) occurred at a few stations in the eastern and north-eastern low country. Deviation of rainfall from average has been irregular. Excesses, however, predominated, and occurred in the southern half of the Island and in the northern and north-western regions, the greater excess ranging from 10 to 20 inches. Deficits occurred mainly in the eastern and north-eastern parts, but they were not appreciably high. There were also a few slight deficits scattered in the south-western regions.

The North-East monsoon set in about the middle of November, well ahead of time. From about the 13th, moderate rain with north-eastern winds was experienced in the eastern low country and continued till the 23rd, spreading gradually to the interior. During this period afternoon and evening thundershowers were experienced over the rest of the Island. On the 18th rainfall was widespread, and moderately heavy in places. Monsoon rain occurred again from the 26th till the end of the month. During the early part of the month, the weather was mainly dry, except for some scattered thundershowers between the 3rd and 6th. On account of some north-westerly winds, the period from 7th to 12th was unusually dry; practically no rain was experienced, while nights were very cold with minimum temperatures several degrees below average. Dry weather with very cold nights occurred again on the 24th and 25th, the minimum temperature at Nuwara Eliya on the 25th being as much as 17° below average. The rainfall over the Island ranged mainly between 5 and 15 inches, while there were a few stations, scattered in the north-eastern hill country and in Kegalla District, which received more rain. Least rain was experienced in the neighbourhood of Hambantota, where the receipts at a few stations were less than 2 inches. The rainfall was below normal almost throughout the Island, deficits at many stations ranging from 2 to 10 inches. Greater deficits occurred in the Northern Province and at a few stations in the south-western hill-country. There were a few small excesses, scattered in the eastern parts.

Two depressions in the Bay of Bengal influenced the weather over the Island during December. The first, which was more severe, lasted from the 6th to the 12th, causing heavy, widespread rain and strong winds. The rainfall was heaviest on the 7th and 8th, when many stations in the northern half of the Island and on the north-eastern slopes of the hills recorded daily falls over 5 inches. Consequently, floods were experienced in several parts of Ceylon, while landslides caused much damage to house and property in the north-eastern hill country. The second depression, which lasted from 16th to 19th, was of smaller extent, heavy rain resulting therefrom on the 16th being confined to the north-central parts only. Fairly widespread rain was experienced again between the 24th and 26th, on account of a low pressure area. During the last few days weak monsoon weather prevailed, with monsoon rain in the north-eastern parts and evening thundershowers elsewhere. The first of the month was also a day of heavy, widespread rain, many stations in the north-central parts recording falls over 3 inches. The rainfall over the Island ranged mainly between 10 and 20 inches. Larger amounts occurred in the north-eastern hill country, where some stations received over 30 inches including 40.91 inches at St. Martin's (Lower) Estate. Least rain was experienced in the south eastern low country, along the south-west coast and in Puttalam District, where the monthly totals ranged from 5 to 10 inches only. The rainfall was above normal, except in the south-eastern low country and in the neighbourhood of Batticaloa. At some stations situated in the south-western mid-country, in Kegalla District and in the neighbourhood of Matale, the excesses exceeded 10 inches. The deficits were generally small.

D. T. E. DASSANAYAKE,
Director.

Station	October									November			
	Temperature				Humidity		Rainfall			Temperature			
	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night (from Minimum)	Total	Offset	No. of Days	Mean Maximum	Offset	Mean Minimum	Offset
Anuradhapura ..	89·6	+0·7	72·1	—1·4	72	95	8·56	—1·16	17	86·1	+0·3	68·9	—2·9
Badulla ..	81·4	—1·4	65·9	+0·4	74	95	8·76	—0·13	23	78·1	—1·2	64·9	—0·5
Batticaloa ..	86·0	—1·0	75·2	—0·1	76	88	7·47	+0·28	15	83·2	—1·0	73·8	—0·4
Colombo ..	83·9	—1·1	73·7	—1·1	81	93	12·96	—0·75	25	85·1	—0·2	71·8	—1·6
Diyatalawa ..	74·9	—1·4	61·0	+0·4	79	92	10·64	+1·46	22	74·8	+0·6	58·3	—1·6
Galle ..	82·3	—0·7	74·6	—0·9	82	90	16·82	+4·77	22	83·9	+0·3	73·6	—0·6
Hambantota ..	84·2	—2·0	74·3	—1·0	82	93	10.89	+6·13	17	85·5	+0·1	72·9	—1·1
Jaffna ..	84·8	—1·0	76·4	—1·2	80	88	13·83	+4·63	18	84·1	0	71·4	—3·4
Kandy ..	82·0	—3·7	67·9	—0·1	75	90	14·87	+4·33	24	82·5	—0·4	65·5	—2·1
Kankesanturai ..	86·1	—	76·1	—	76	88	13·00	+3·38	15	84·0	—	75·7	—
Kurunegala ..	86·4	—0·9	72·7	—0·5	76	93	14·41	—0·45	22	86·2	—0·8	70·4	—1·5
Mannar ..	85·9	—1·0	76·5	—0·8	79	88	19·50	+12·92	14	83·8	—0·8	76·6	+1·0
Nuwara Eliya ..	66·1	—1·5	54·0	+2·0	84	88	14·04	+4·28	23	68·3	+0·5	49·1	—2·1
Puttalam ..	86·9	+0·7	74·6	—1·0	74	90	16·80	+9·37	18	85·8	+0·2	71·7	—1·5
Ratmalana ..	84·4	—	74·5	—	76	88	11·43	—1·77	26	87·0	—	72·8	—
Ratnapura ..	87·0	—0·1	72·2	—0·6	80	95	21·34	+3·33	23	89·9	+2·2	70·9	—1·4
Talawakele ..	71·0	—2·3	58·2	+0·5	84	94	12·20	+2·14	25	73·3	0	55·4	—1·8
Trincomalee ..	86·9	—1·1	75·1	—0·5	74	86	5·43	—4·12	20	82·3	—1·3	74·8	0
Maha Illuppallama ..	88·7	—	72·6	—	69	90	9·24	—0·22	20	84·9	—	69·4	—

Station	November (contd.)					December								
	Humidity		Rainfall			Temperature				Humidity		Rainfall		
	Day	Night (from Minimum)	Total	Offset	No. of Days	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night (from Minimum)	Total	Offset	No. of days
Anuradhapura ..	76	97	5·14	—5·53	15	83·5	+0·3	71·7	+1·6	86	98	14·78	+7·26	25
Badulla ..	76	94	5·77	—4·48	20	77·5	+0·9	65·5	+1·0	84	97	11·47	+0·24	24
Batticaloa ..	75	90	14·26	+0·40	19	82·9	+1·0	74·6	+1·0	82	90	14·14	—2·85	25
Colombo ..	73	93	4·73	—8·36	13	83·4	—2·2	72·3	—0·1	80	95	13·91	+8·30	21
Diyatalawa ..	80	97	9·00	—1·42	21	73·5	+1·5	60·0	+1·4	82	91	10·87	+2·80	21
Galle ..	76	90	4·81	—7·20	14	82·8	—0·8	73·4	0	82	93	9·05	+1·83	20
Hambantota ..	75	93	3·21	—4·36	11	83·9	—0·7	73·5	+0·4	82	90	3·27	—2·34	16
Jaffna ..	72	98	5·73	—11·54	10	82·0	—0·5	74·5	+1·4	80	88	16·37	+5·98	19
Kandy ..	72	92	7·61	—3·41	16	81·0	—0·8	67·7	+1·3	78	92	15·62	+6·75	23
Kankesanturai ..	76	84	7·30	—2·66	9	81·8	—	74·5	—	86	93	10·11	+0·37	21
Kurunegala ..	72	95	3·44	—8·95	13	84·3	—1·5	70·9	+0·2	79	97	13·72	+6·94	16
Mannar ..	73	79	7·76	—2·43	10	81·9	—0·9	75·7	+0·8	80	86	15·15	+7·36	19
Nuwara Eliya ..	77	87	4 41	—4·78	16	66·4	—1·4	52·5	+3·6	82	88	13·82	+6·01	21
Puttalam ..	74	93	4 46	—5·67	14	83·9	—0·9	72·7	+1·5	82	95	6·66	+1·11	22
Ratmalana ..	67	85	5 47	—6·65	15	84·5	—	73·1	—	74	88	15·54	+8·89	16
Ratnapura ..	72	95	7·55	—7·24	12	87·6	—0·4	71·7	0	78	98	12·80	+3·68	18
Talawakele ..	76	91	3·61	—4·89	13	70·9	—2·7	57·4	+1·4	82	91	8·62	+3·44	21
Trincomalee ..	78	86	9·03	—4·91	14	81·2	+0·1	74·8	0	86	93	22·47	+9·47	26
Maha Illuppallama	74	90	10·75	—	15	82·6	—	71·6	—	80	93	15·94	+7·88	23

Government Press
Ceylon