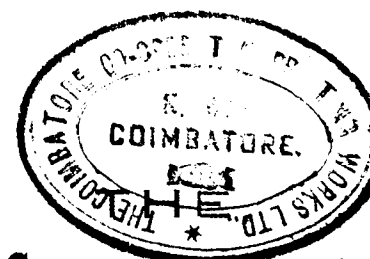


305

Regd. No. M. 5155



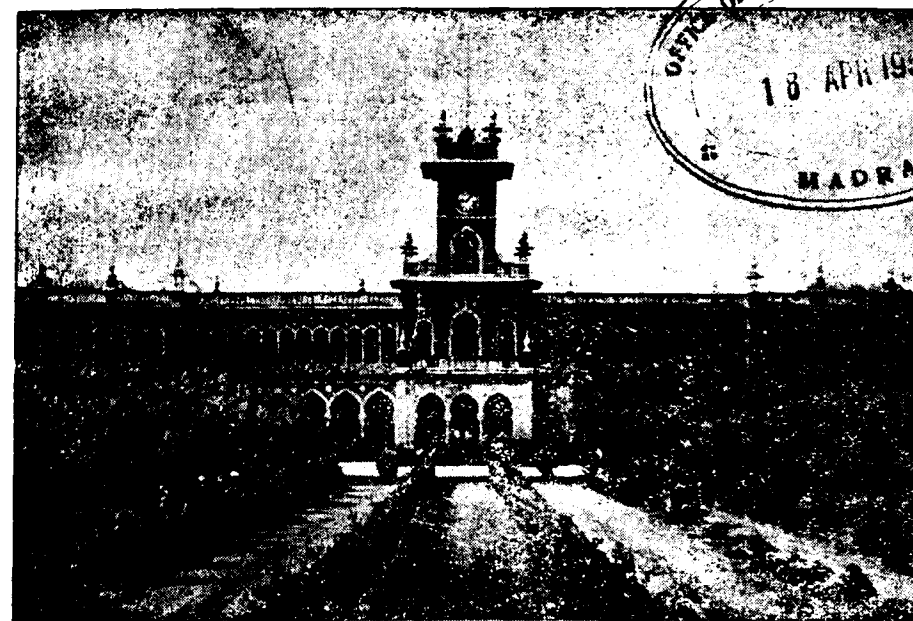
305
2-57

Madras Agricultural Journal

Vol. XLIII

September 1956 358

No. 9



AGRICULTURAL COLLEGE AND RESEARCH INSTITUTE, COIMBATORE

Published by

THE MADRAS AGRICULTURAL STUDENTS' UNION,
AGRICULTURAL COLLEGE AND RESEARCH INSTITUTE,
COIMBATORE, S. INDIA.

Annual Subscription.

Inland Rs. 6-0-0
Foreign Rs. 7-0-0

Single Copy
As. 8

358

The Madras Agricultural
Journal

1956 - September

VOL. 43. NO. 9



JL
m211, N13
N8.439
94803.

THE MADRAS AGRICULTURAL STUDENTS' UNION.

This is an association of the students, past and present, of the Madras Agricultural College, and of the officers of the Madras Agricultural Department, the Principal of the Agricultural College being the President, *ex-officio*. The Union conducts this Journal and celebrates annually the College Day, on which occasion it convenes an Agricultural Conference. The Association has Members, Associates, Honorary Members and Patrons. For detailed particulars apply to the Secretary.

THE MADRAS AGRICULTURAL JOURNAL

A Premier Agricultural Monthly in India

Editorial Board:

T. R. Narayanan, B. sc. (Ag.), M. A. (Cantab.)
 J. Saktham Rao, M. sc. Dr. N. Krishnaswami, B. sc., Ph. D. (Kiel)
 S. G. Aiyadurai, B. sc. (Ag.) T. Natarajan, B. A., B. sc. (Ag.)
 A. H. S. Sarma, B. sc. (Ag.) G. A. Sivaram (Student)
 P. Kandaswamy Gounder, Secretary, Students' Club (Ex-officio)

A monthly journal in English devoted to the study and development of Agricultural Science; contains articles of scientific as well as of general interest written in popular language. Reviews of agricultural publications and extracts from various Journals—both Indian and foreign form a special feature. Commands a wide circulation and is therefore an excellent medium for advertisements.

Rates of Subscription

Journal supplied *free* to Members, Associates and Patrons of the Union.

Annual subscription rates for others:

India and Ceylon Rs. 6-0-0, Foreign Rs. 7-0-0, Single number Rs. 0-8-0.

Rates of Advertisement:

For single insertion:

	Rs.	A.	P.
For full page	20	0	0
For half page	10	0	0
For quarter page	5	0	0

Inside cover pages 25 percent extra.

Outside cover pages 50 percent extra.

Preparation of blocks unless supplied by advertisers, charged extra.

All advertisements are subject to the approval of the M. A. S. U. Managing Committee before insertion. The charges are payable strictly in advance.

Contributions to the Journal:

Contributions on Agricultural Science, subjects of agricultural interest or pertaining to rural economics and co-operation will be accepted for publication, subject to approval by the Editorial Board. Correspondence and queries on agricultural and allied subjects are invited. Manuscripts should be sent clearly typed on *one side of the paper* only. The manuscripts should not ordinarily exceed 8 printed pages, including tables and figures.

Twenty-five copies of reprints of contributions will be presented to authors. Extra copies and printed covers for reprints, if required, can be supplied at actual cost if intimation is given when the manuscript is presented. Contributors will be charged half the actual cost of block-making.

N. B:— The Editorial Board does not hold itself responsible for the opinions expressed by the contributors.

All communications should be addressed to:

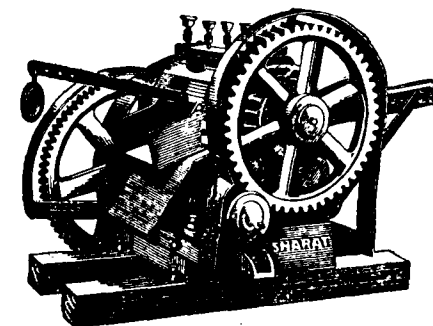
The Secretary, M. A. S. Union,
 Agricultural College, Lawley Road P. O., Coimbatore.

Kirloskar

SUGARCANE CRUSHERS

are well-known for maximum extraction capacity and reliability due to robust construction.

Available in 7 sizes:—
 4 power-driven and 3 animal-driven models.



KIRLOSKAR BROTHERS, LIMITED

KIRLOSKARVADI, DISTRICT S. SATARA.

5-33

When answering our advertisers, please mention 'The Madras Agricultural Journal'

...catches the worm!

Crores of rupees are annually lost through white ant damage of sugarcane crop. Control the sugar-hungry termite and a great advance will have been made in sugarcane cultivation. Aldrin can successfully keep this large-scale pillager at bay.

Shell's aldrin, the leading soil insecticide, offers sugarcane—as indeed all crops at all stages of their growth—the surest and most lasting protection against soil pests. What's more, it causes no taint and is not absorbed by the plant.

Shell's aldrin is available as a dust, wettable powder and emulsion to suit your particular needs. One application at 1 lb. per acre in the row (or 2-3 lbs. per acre broadcast) controls white ants, crickets, beetle grubs, wire worms and cutworms. Apply Shell's aldrin early, at planting time, and make sure that white ants, and other soil pests, do not eat away your sugarcane profits.

Your nearest *Burmah-Shell* Office can provide full details



aldrin gets at the root of the trouble

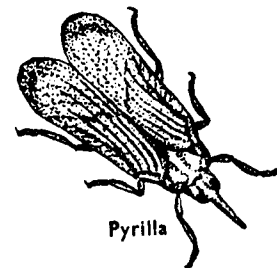
FOR PETROLEUM CHEMICALS IN AGRICULTURE **BURMAH-SHELL**

ASP/ACP 1

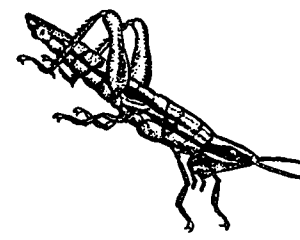
When answering our advertisers, please mention 'The Madras Agricultural Journal'

'Gammexane'
REGD.

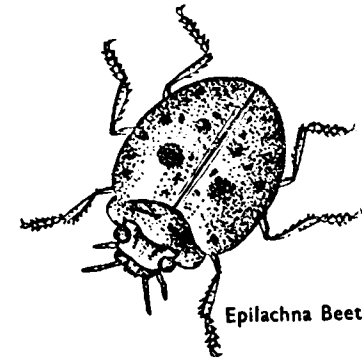
dusts destroy these
pests...



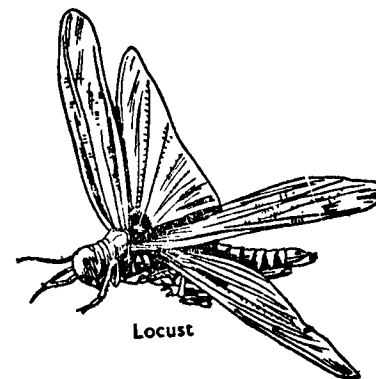
Pyrrilla



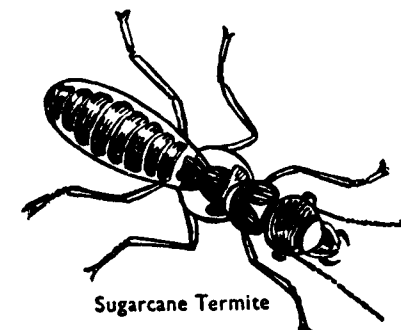
Jowar Grasshopper



Epilachna Beetle



Locust



Sugarcane Termite

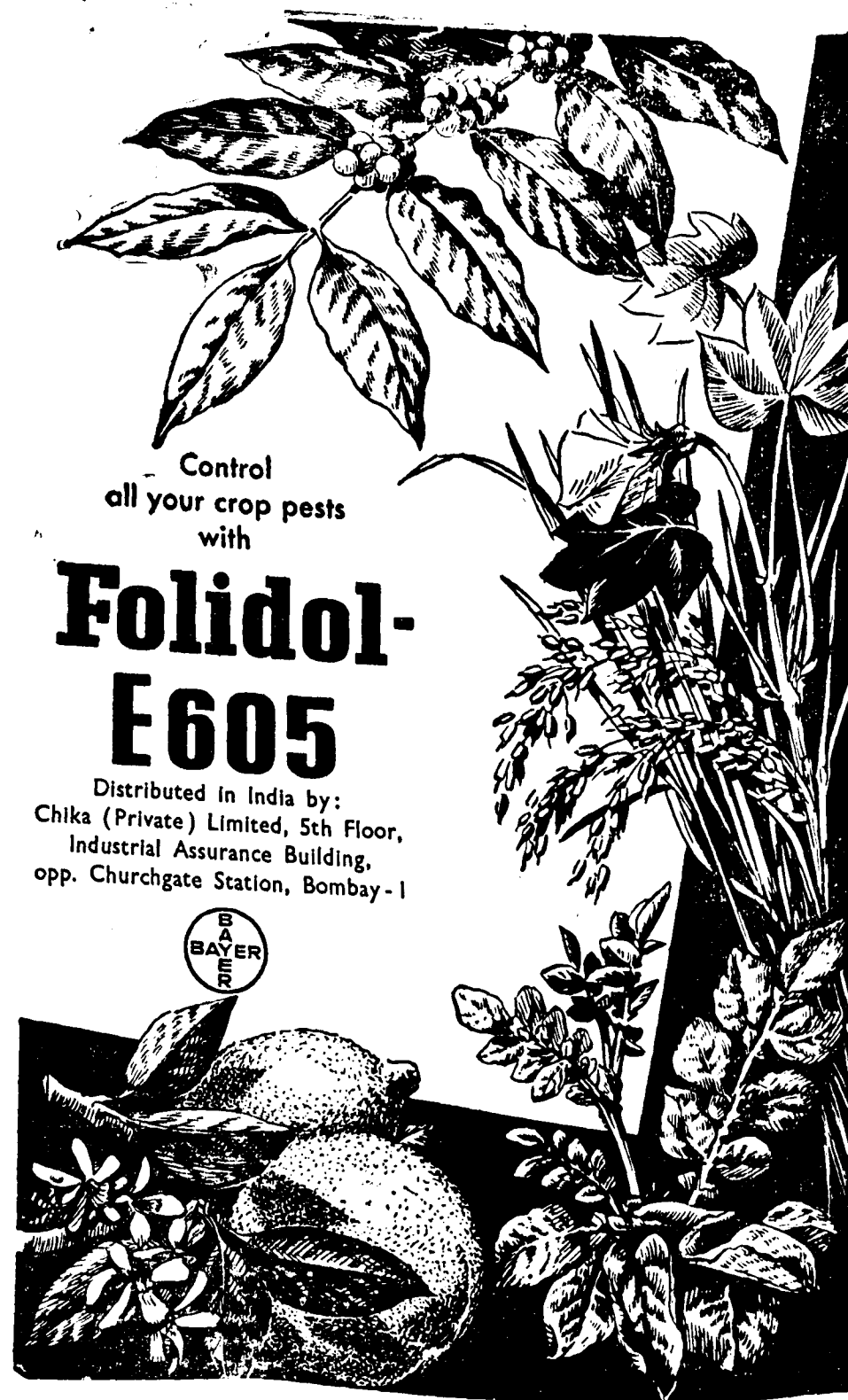
* Benzene Hexachloride, for the preparation of 'Gammexane' Insecticide Formulations, is manufactured by A. C. C. I. Ltd., at Rishra, West Bengal.

Imperial Chemical Industries
(INDIA) PRIVATE LTD.

Calcutta Bombay Madras Kanpur New Delhi
Ahmedabad Amritsar Bangalore Cochin

IX-F 250A

When answering our advertisers, please mention 'The Madras Agricultural Journal'



Control
all your crop pests
with

Folidol- E605

Distributed in India by:
Chika (Private) Limited, 5th Floor,
Industrial Assurance Building,
opp. Churchgate Station, Bombay - 1

BAYER

Regional Distributors: Messrs. A. V. THOMAS & CO., LTD., P. B. No. 47, ALLEPPEY.

NITROLIME

THE MOST SUITABLE FERTILISER
FOR SOILS AND CROPS
WHICH REQUIRE

A NON-ACID NITROGENOUS FERTILISER

358

BIGGER
CROP



MORE
PROFIT

NITROLIME

The leading Calcium Ammonium Nitrate fertiliser of
DUTCH ORIGIN

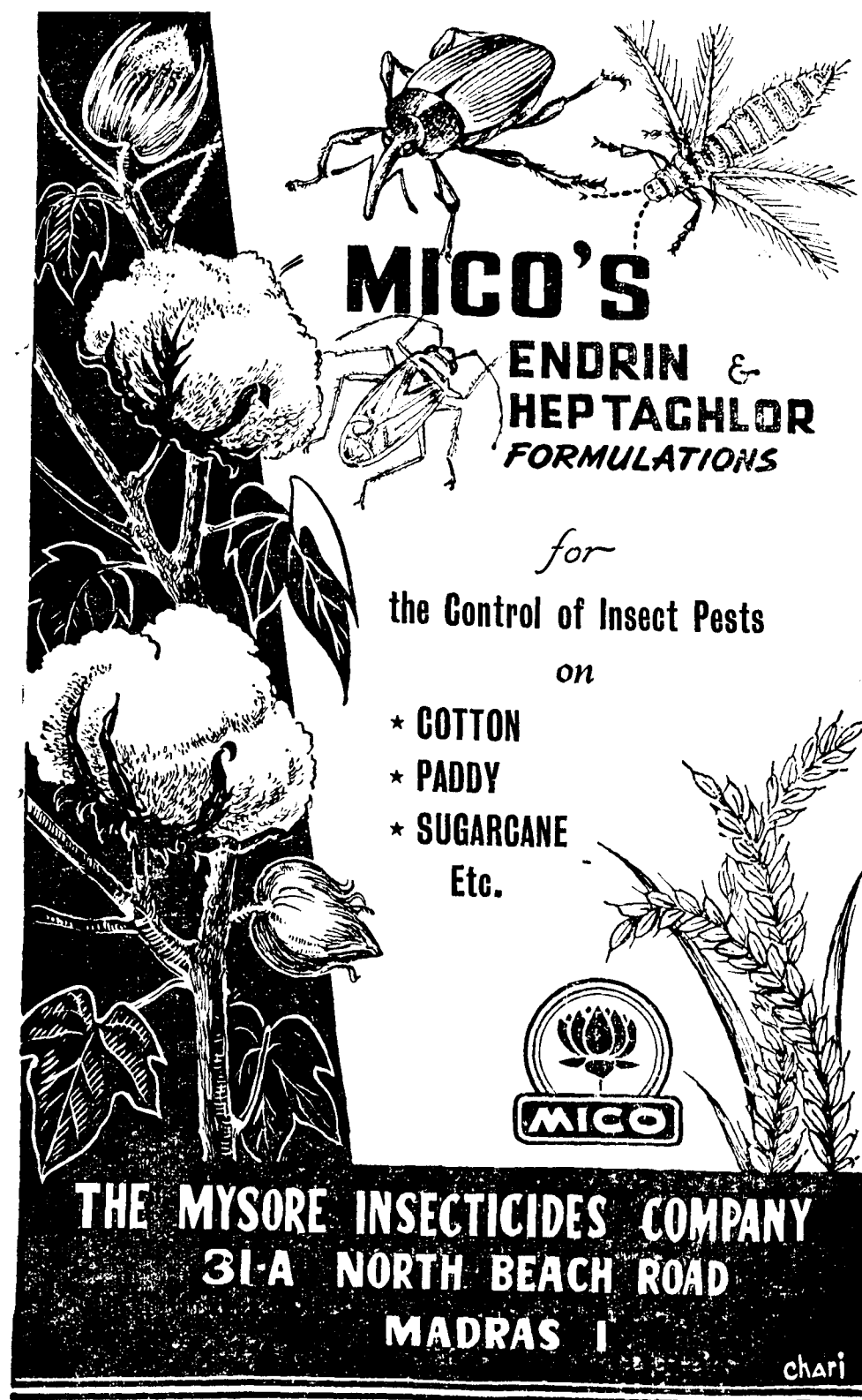
80% of all Nitrogen used in Holland is in the form of
NITROLIME

Contains : (a) 20.5% NITROGEN
half in the form of quick acting Nitrate Nitrogen
half in the form of longer lasting Ammoniacal Nitrogen
(b) 40% Calcium Carbonate, which ensures
neutral characteristics under all conditions.

INQUIRIES

SHAW WALLACE & COMPANY LIMITED.
CUTTACK • MADRAS • BOMBAY • NEW DELHI • DIBRUGARH.
KARAMADAI • BEZWADA • NILGIRIS ETC.

When answering our advertisers, please mention 'The Madras Agricultural Journal'



MICO'S
ENDRIN &
HEPTACHLOR
FORMULATIONS

for
 the Control of Insect Pests
on

★ COTTON
 ★ PADDY
 ★ SUGARCANE
 Etc.



THE MYSORE INSECTICIDES COMPANY
31-A NORTH BEACH ROAD
MADRAS 1

chari

The Madras Agricultural Journal

Vol. XLIII

SEPTEMBER 1956

No. 9

CONTENTS

	PAGE
Editorial ...	427
Original Articles:	
1. Variability in Size and Frequency of Stomata in Leaves of Rice Varieties and its Correlation in Drought Resistance by K. Rajagopalan	429
2. Agriculture in Australia — I by C. L. Sundararajan	444
3. Rice Hispa (Hispa Armigera Ol.) by Dr. M. Q. Khan & D. V. Murthy	450
4. Some Facts about Arecanut by Shama Bhat Khandige, N. Balakrishna & N. R. Adyanthaya	456
Research Note	464
Gleanings	466
Weather Review	470
Departmental Notifications	471
Market Committees' Chronicle	472

**"Star brand means
bigger harvests
for you-
more food for India**



We recommend for Paddy:

% ANALYSIS			
	Nitrogen	Phos. Acid	Potash
P. S. Fertiliser Mixture	16	4	Nil
Packing	80 lb. New Sealed Gunnies		
A. P. Special Fertiliser Mixture	14	7	Nil
Packing	80 lb. New Sealed Gunnies		
N. P. K. Paddy Fertiliser Mixture	12	6	6
Packing	80 lb. New Sealed Gunnies		
Improved A. P. Special Fertiliser Mixture	10	10	Nil
Packing	80 lb. New Sealed Gunnies		
N. P. K. Paddy Special Fertiliser Mixture	8	8	8
Packing	80 lb. New Sealed Gunnies		

**IT PAYS TO USE
"STAR" BRAND RANGE COMPOUNDS
FOR ALL YOUR CROPPING NEEDS**

SHAW WALLACE & COMPANY LIMITED

P. O. BOX 14, MADRAS

Guaranteed Analysis

Free Scientific Advice.

When answering our advertisers, please mention 'The Madras Agricultural Journal'

The Madras Agricultural Journal

Vol. XLIII

September 1956

No. 9

Editorial

Fifty years ago on the 24th September 1906, Sir Arthur Lawley, the then Governor of Fort St. George laid the foundation stone of the Coimbatore Agricultural College and Research Institute. In doing so, Sir Arthur, not only laid the foundation of this great Institute, but laid the real foundations for agricultural progress of our country. It was an event of great significance that had far reaching results on the farming community of not only Madras but the whole of India. We take pride in recording the event in this issue, as our Journal is but a part of the life of this Institute.

Fifty years is but a short period in the history of a nation, but is a sufficiently long period for an institution of this kind, for, these fifty years can aptly be described as the period of Renaissance for Indian Agriculture. These fifty years have brought about many achievements as well as amazing possibilities in the application of science in the field of Agriculture. Indeed, science has indicated solutions for quite a formidable array of problems that confront the farmer.

Verily, when we look round this era of technological progress, the picture is incredibly complex. Here is progress in the management of the soil. We know more about the soil and its behaviour to cultivation operations. Our knowledge about the nutrient requirements of crop plants and the nutrient levels necessary for higher productivity has become more definite. Here are better bred varieties of crops that can yield more, resist diseases better and tolerate adverse environments. The 'know-how' to control pests and diseases has become more clear cut and certain, and no longer need the farmer worry so about the enemies

of his crops as he used to previously. Indeed, Agricultural Research has multiplied the yields of crops and banished hunger for the fast-growing populations.

The continuity of research and its translation into practice need the creation of a class of men who have received the education and training in farming methods on modern lines. The Coimbatore Agricultural College has contributed the necessary personnel and during these fifty years has produced several diploma holders in the early years of its existence and 1476 B. Sc. (Ag.) graduates since the institution of the degree course in 1920.

Here then is a great Institute and the band of enlightened workers-past and present, who have their place in the roll of honour set out by Swift. They made it possible to grow two ears of corn or two blades of grass where only one grew before and thus did essential service to the country and deserved much of mankind.

Even so, there is reason not to be complacent. More progress brings in more problems. Our systems themselves may be imperfect, there are many gaps in our knowledge, but they are always improving and always capable of further improvement. We, on this great occasion of the fiftieth year of Agricultural College and Research Institute at Coimbatore dedicate ourselves to this new task—to the achievement of greater progress—watched by the Founders but leaving the judgement to posterity.

Variability in Size and Frequency of Stomata in Leaves of Rice Varieties and its Correlation in Drought Resistance *

by

K. RAJAGOPALAN, B. Sc. (Ag.), M. Sc.,
Agricultural Research Institute, Coimbatore

Introduction: For an understanding of water economy in the rice plant it is essential to study the mechanism by which water is transpired in the plant. Transpiration takes place through the cuticle as well as through the stomata. In general it is recognised that in mesophytes, stomatal transpiration is 80 to 97 percent whereas cuticular transpiration is only 2 to 3 percent. The total stomatal apertures in spite of their large number, occupy only one to two per cent of the total leaf surface. 'The epidermis along with the stomata possesses the physical properties of a multi-perforate septum and the diffusion of gases through these minute apertures proceeds almost at the same rate as if the cutinised epidermis were actually removed and the cells of the mesophyll were in direct contact with the external atmosphere'. It may be seen therefore that the stomata do play a very great part in the water balance of plants. The present study is restricted to stomatal sizes and their frequency in leaves of rice varieties.

Review of Literature: Darwin (1898) (quoted by Knight, 1917) considered that stomata play a predominant part in the control of transpiration. Lloyd (1908) concluded that though the change in the stomatal dimension is small, this does not exclude the possibility of the stomatal opening exerting any regulatory effect upon transpiration. Knight (1917) found no agreement between stomatal aperture and the rate of transpiration and concluded that the water content of the leaf was an important factor involved in the control of transpiration. Loftfield (1921) after an elaborate study of the behaviour of stomata under a variety of external conditions found that at certain specific aperture, the stomata control transpiration.

Eckerson (1908) found that marked variations in number and size of stomata occur not only in different varieties of the same species of common green house plants, but also in the same varieties grown under different conditions. Zalenski (1904) (reviewed by Maximov, 1929) studied the anatomical differences in leaves at

* Paper awarded the Ramasastrulu Munagala Prize for 1956.

different levels in the stem and found that the higher the leaf, the greater the number of stomata per unit area of the leaf surface. Yapp (1912) reports that the upper xeromorphic leaves of *Spiraea ulmaria* have 1300 stomata per square millimeter whereas the mesomorphic leaves of the same plant had about 300 stomata per square mm. Salisbury (1927) in an extensive study of the stomatal frequency of the woodland flora of England concluded that stomatal frequency is mainly dependent on the humidity of the environment, dry exposed conditions being associated with high frequencies and humid conditions with low frequencies. Miller (1938) found that the number of stomata varies greatly from year to year and most of the plants have more stomata on the lower surface than on the upper surface, when stomata occur on both surfaces.

Hirano (1931) found that the hardier varieties and species of *Citrus* trees are characterised by lower stomatal density, though there were some exceptions. In the material studied by him it was found that the density of stomata is governed by genetic factors. Yocum (1935) reported a maximum of 1900 stomata per sq. mm. in Spanish oaks and suggests that the action of stomata is very important in trees, where the soil water is limited. Kolkunov (1905) (reviewed by Maximov, 1929) and Pavlov (1931) found that the less drought resistant wheats had longer stomata than the most resistant wheats. Whiteside (1941) observed that the leaf size, the distance between the stomata and other morphological characters were affected when plants were grown under low moisture supply. Evans (1939) working on the drought resistance in sugarcane varieties did not find any correlation between the rate of transpiration and the density of stomata. He found approximately double the number of stomata per unit area on the lower epidermis as compared to the upper epidermis. Lal and Mehrotra (1949) studying the 12 varieties of sugarcane with varying degrees of drought resistance measured the length, width and number of stomata and found the stomatal index. They suggest that the lower the index, the greater was the drought resistant capacity of the cane.

Differences in anatomical structures have been observed in rice varieties which differed in their degree of resistance to drought. Yasuda (1924) studied the relation between amount of transpiration and the development of vascular system. He found that the most important internal factors concerned are the structure, the number

and the function of stomata and the nature of the epidermal cells. Onodera (1930) observed that in lowland rice the 'Sterome' or mechanical tissue is well developed on the lower side of the leaf while in some of the upland rices its development is much feebler. Alam (1939) observed that the varieties which stood drought when grown under artificial conditions of irrigation had fewer stomata and in them the stomatal cells were also smaller.

Materials and Methods: The present study was made to find out the variability in stomatal size and stomatal frequency in rice varieties which exhibited different degrees of resistance to drought. Two parents and one drought resistant F₁ progeny have also been studied in detail for the same purpose. The arrangement of the stomata, the size of the stomata, length and breadth and the frequency of the stomata have been studied.

Fourteen varieties of rice viz., CEB. 24, Co. 13 (wet rices), MTU. 17, MTU. 18, Vedurusannam, PTB. 28, PTB. 29, PTB. 30, TKM. 1, TKM. 2 and Bairuvadlu (dry rices), T. 129, T. 740 and T. 1702 (Wild rices, *Oryza sativa* forma *spontanea*), were grown under uniform conditions in a wet field. The plants were 60 days old and the fixing of the material was done between 9 A. M. and 10 A. M. as followed by Eckerson (1908) when the stomatal pores would be wide open. For a detailed study of the stomata in parents and their progeny, the cross Co. 13 × T. 129 was chosen. These were grown under restricted irrigation and were 53 days old when the material was taken.

Formalin acetic alcohol (70% alcohol-90 c.c.; acetic acid 4 c.c. and formalin 6 c.c.) was used for fixing the samples. Leaf portions from the middle of the leaf blade were cut and quickly dropped into the fixative to avoid any alterations in the stomatal dimensions. For the varietal study the first leaf from the top of the plant was taken and for intensive study with the two parents and a progeny the first, second and third leaf from the top were fixed. Scrapping with a sharp scalpel as done by Prat (1932) was followed in obtaining the epidermal peel. Acetic orcein (1 gm. orcein dissolved in hot 42 per cent acetic acid) was used as the mounting medium. This medium has the tendency to expand the stomata which would have undergone shrinkage while getting fixed. A Spencer's microscope with eye piece 10 × fitted with a micrometer with 100 divisions and objective with 4 M. M. - N.A.O. 6-44 × was used. Readings were taken to the nearest micrometer division.

In a preliminary study it was found that in the regions adjacent to the mid rib the parenchymatous cells are more and the veins are far apart, whereas towards the margin the parenchymatous cells are fewer in rows and the veins are closer. Moreover, it was found that the epidermal peels, both of the lower and upper epidermis, were easily obtained in the mid-rib region. Hence uniformly in all the samples epidermal peels in the mid-rib region alone were taken for study. Both the upper and lower epidermis were studied in all the varieties since stomata are found in both the epidermis. For obtaining the upper epidermis the scraping was begun from the lower layer and vice versa for the lower epidermis.

Size of the stomata was determined by measuring both length and breadth of the guard cells. Hundred stomata were measured for their length and breadth in each of the variety studied and the means calculated. The frequency of the stomata was measured by counting the number of stomata which are included in 100 divisions of the micrometer in a row. Twenty five readings were taken in the lower and the upper epidermis for each variety and the mean calculated. Rows of stomata adjacent to the mid-rib were taken for measuring the frequency. The arrangement of the stomata was studied with a view to find the distance between the stomatal rows, as they occur in linear rows alternating with longitudinal cells. The distance between the two veins was measured in three places where the stomatal rows were counted and the mean calculated. The distance between individual rows was found by dividing the number of rows.

Observation: In the internal structure of the rice leaf, which is exposed to the light of the sun on both sides, the mesophyll presents no differentiation into palisade and spongy parenchyma. The whole of the mesophyll consists of compactly arranged parenchymatous cells. The cells of the upper epidermis have large motor cells which help in the rolling of the leaf (plate No. 1). The epidermis is a continuous layer consisting of flattened cells with their cell walls distinctly cutinised. The continuity of the epidermis is interrupted by stomata, the guard cells of which are dumbbell shaped.

Rice leaf being an isobilateral monocot leaf has stomata on both lower and upper epidermis. This feature introduces a special problem in the study, as to which surface is more important for comparison. Therefore for comparing the varieties in their size and number of stomata, details have been given for both the sides separately.

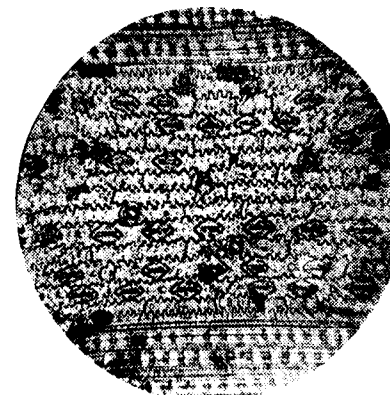


PLATE 1

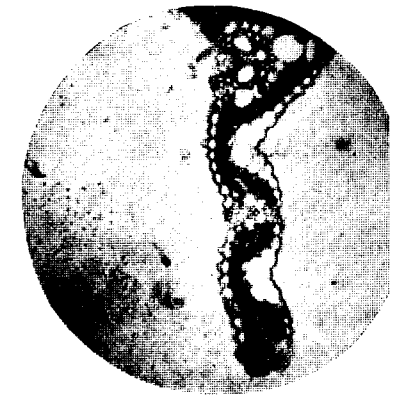


PLATE 2

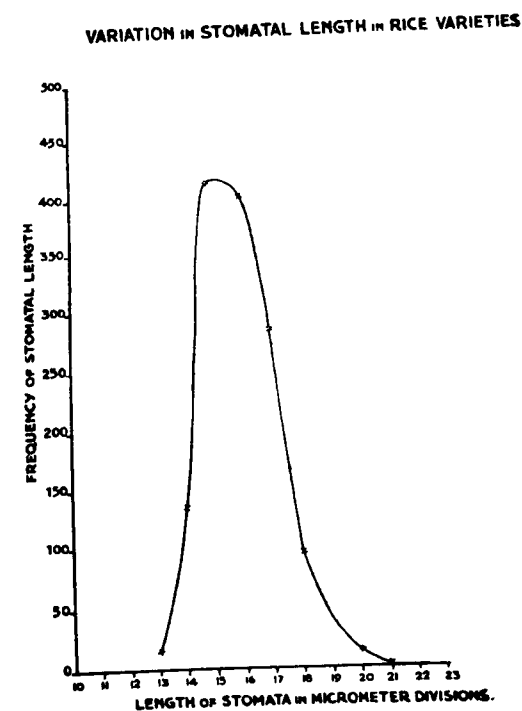


PLATE 3

The epidermis of the rice leaf shows veins running parallel to each other. The main conducting vessel is the midrib and the veins are parallel to the midrib. In between two veins, stomata are found in rows alternating with bands of long cells which have distinctive ripple walls (plate No. 2). The distance between two veins is larger in the midrib region and gets reduced towards the margin of the leaf.

The number of rows of stomata depends upon the distance between the two adjacent veins where they are distributed. Table 1 gives the distance between the two veins and the number of rows of stomata in between the two veins in the 14 rice varieties studied. The distance between the two rows of stomata is greater in the upper epidermis than in the lower epidermis showing that there are fewer rows of stomata in the upper epidermis than in the lower epidermis. This fact was observed in all the varieties studied. Table 3 which gives the data for the two parents and the F. 4 progeny also indicate the same features in the first, second and third leaf of the rice plant. Hence it is confirmed that the upper epidermis has fewer stomata than the lower epidermis in the rice leaf.

The distance between the rows of stomata varies and there are indications that some of the varieties have their stomata in rows farther apart. In the short duration varieties, it is seen, that some of the drought resistant types have their stomatal rows farther apart in both the epidermis. In the medium duration group it is noticed that except in the case of the lower epidermis of the wild rice T. 740, all the other drought resistant types have fewer stomatal rows than in the case of the drought susceptible type CEB. 24.

Similarly, the drought resistant progeny No. 3115 and the parent T. 129 have their stomatal rows farther apart than in the case of the drought susceptible parent Co. 13 as seen in table 3. (I leaf).

The size of stomata was studied by measuring the length as well as the breadth of the guard cells. The data are presented in tables 2 and 4. It is seen that the breadth of the stomata is less variable than the length. The average breadth in the lower epidermis mostly ranges between 9.5 and 10.5 micrometer divisions, i, e. 15.2μ and 16.8μ with a few exceptions as seen in table 4, where the maximum breadth is 11.4 micrometer divisions. The

breadth of stomata is not directly proportional to the length but the trend seems to be for breadth to increase with length. The breadth of the stomata is greater in the upper epidermis than in the lower epidermis. The difference in breadth between the varieties and between the parents and progeny is not marked.

There is a great range of variation in the length of the stomata. The average length of the stomata in the lower epidermis ranges between 13 and 21 micrometer divisions which corresponds to 20.8 μ and 33.1 μ . Table 5 and the graph (plate No. 3) give the frequency of stomatal length in rice varieties, in the lower epidermis of the first leaf. It shows that most of the stomata have a length of 15 to 16 micrometer divisions or 24.0 μ to 25.6 μ . Stomata in the upper epidermis are longer than those in the lower epidermis. The differences in stomatal length between the varieties apparently show that they do not bear any relation to the drought resistant habit of the rice varieties studied. The length of the stomata in the three leaves studied in the two parents and progeny show that there is a gradual increase in length of the stomata from the first leaf to the third leaf as seen from table 4 the only exception being in the lower epidermis of T. 129. The breadth of the stomata closely follows the length in this respect.

However, the length of the stomata varies with varieties, with different leaves in the same plant and with conditions under which it is grown. The effect of change in environment of stomatal length and breadth is seen in varieties Co. 13 and T. 129 (table 2 and 4) which record different sizes. Thus it is noted that in the first instance (table 2), Co. 13 has a stomatal length of 15.7 micrometer divisions and a breadth of 10.3 micrometer divisions in the lower epidermis whereas the length is 16.5 and breadth 9.9 micrometer divisions in the first leaf of the same variety in the second case (table 4). A similar difference is noticed in the upper epidermis also. Another variety, T. 129 which was also studied in two instances (table 2 and 4) has different sizes of stomata. Leaves were taken for study from plants grown under two different conditions and the size of stomata is seen to vary in the different environments.

Apart from the environmental effect, there appears to be a genetic difference between the varieties in the size of stomata as seen from table 4, where the data for the two parents Co. 13 and T. 129 and the progeny number 3115 are given. It is seen that size of stomata of the progeny is different from that of both the parents

in the lower and the upper epidermis in all the three leaves studied. An analysis of the data of the third leaf of the lower epidermis shows that the progeny number 3115 has significantly greater stomatal length than both the parents. The difference of length of stomata in the progeny is highly significant when compared to the parents (table 6). The progeny has a mean stomatal length of 19.10 micrometer divisions as compared to a mean length of 16.81 micrometer divisions in the cultivated rice, Co. 13 and a mean length of 15.70 micrometer divisions in the case of the wild rice T. 129. The length of stomata in Co. 13 is also significantly greater than that of T. 129 which shows that in this case the drought resistant rice has smaller stomata.

The frequency of stomata was measured by counting the number of stomata in 100 divisions of the micrometer at 25 places which is given in columns 5 and 8 of table 2 and 4. The varieties studied do not show that the difference in frequency between them has any bearing on their drought resistant and drought susceptible habits.

The frequencies of stomata in the first, second and third leaf in the two parents and the progeny (table 4) clearly show that there are definitely fewer stomata per unit length in the third leaf than in the top leaf of the same plant. The number stomata per unit length gets reduced gradually from the top leaf to the third leaf in almost all the cases in both the epidermis. An exception is noticed in the upper epidermis of T. 129. As the size of stomata becomes larger from the top leaf to the bottom leaf, the number gets reduced and this fact is noticed from the data presented. A typical example of this is noticed in the progeny number 3115. In the lower epidermis, the length of stomata is 16.2, 18.8 and 19.1 micrometer divisions in the first, second and third leaf respectively whereas the number of stomata in 25 $\times$ 100 micrometer divisions are 74, 67 and 60 which shows a gradual reduction from the top leaf to the third leaf.

Discussion: Among the anatomical features which characterise drought resistance are the structure and size of cells, hairiness of stem and leaves and development of 'Sterome' or mechanical tissue. Differences in anatomical structures in rice varieties which differed in their degree of resistance to drought have been observed by Onodera (1930) and Alam (1939).

In the present investigation the stomatal studies in rice have been made on fairly large samples. The study has been made in

one of the drought resistant hybrid progenies, its parents and some of the reputed drought resistant rice varieties.

The results obtained show that stomata are fewer in the upper epidermis because of the stomatal rows being fewer and farther apart in the upper epidermis than in the corresponding lower epidermis. Rice leaf bears stomata on both the upper and lower epidermis since it is equally illuminated on both the sides owing to the isobilateral disposition of the leaf. The general arrangement of the stomata in rows parallel to veins has facilitated the adoption of a definite method in studying them. The distance between the two rows gives an idea whether the stomatal rows are closer or farther apart. When the distance between rows is more, there are fewer rows of stomata in between two adjacent veins. Thus it has been possible to find out that the upper epidermis has fewer stomata than the lower epidermis. The differences between the drought resistant and susceptible rice varieties as well between the two parents their progeny are not constant though some of the reputed dry rices and wild rices have their stomata farther apart. Hence it has not been possible to associate their drought resistance with fewer stomata.

In the detailed study of the two parents and their progeny where the first, second and third leaf of the same plant have been examined, it has been found that the distance between rows in the lower and upper epidermis has a constant variability. The distance was the least in the wet rice Co. 13 and the wild parent and the drought resistant progeny have their stomatal rows very far apart compared to the wet rice. In both the epidermis the drought resistant progeny has fewer rows of stomata.

In studying the size, both length and breadth have been taken into account. It has been found that the breadth is less variable than the length. Though the breadth is not directly proportional to length, the tendency is for it to increase with the length. There is a greater variation in length of the stomata as shown in tables 2 and 4. The length ranges from 20.8μ to 33.1μ in the lower epidermis of the 14 rice varieties studied. The study of the first, second and third leaf of the rice plant revealed that in the same plant, the length of stomata increases from the top leaf to the third leaf in both the lower and upper epidermis. This corresponds to what zalenski (1905) (quoted by Maximov 1929) and Yapp (1912) found in their studies on stomata in relation to the height of insertion. They came to the conclusion that the upper leaves are more Xeromorphic than the lower ones.

Size of stomata seems to be a varietal character and the variation in size is due to the genetic make-up of the plant. A comparison of the stomatal length in the lower epidermis of the third leaf of Co. 13, T. 129 and the hybrid progeny No. 3115 has shown that the progeny has a significantly longer stomata than both the parents. The study has shown that the size of stomata does not indicate the drought resistance in the rice plant. It varies from leaf to leaf and between varieties.

The frequency of stomatal distribution in the epidermis of the rice plant shows that the number of stomata in an unit distance decreases from the top to the bottom leaf in both the epidermis. This is due to the fact that the size of the stomata increases from the top leaf to the bottom leaf as has already been stated. The study of the varieties has not given any indication to signify their varietal drought resistance.

Summary: The arrangement, size and frequency of stomata in two parents and a progeny and 14 varieties studied showed that the stomata are fewer in the upper epidermis than in the lower epidermis. No significant difference in stomatal size is noticed between the drought resistant and drought susceptible types though it has been observed that the progeny has a significantly greater stomatal length than both the parents. It has also been established that the size of stomata is a genetic character and found to be affected by environments. The size of stomata was also found to increase from the top leaf to the third leaf whereas the frequency decreased and this is in confirmation with what other workers have found in some other crops.

Acknowledgements: I am extremely grateful to Sri. M. B. V. Narasinga Rao, B. A., B. Sc. Ag., Associate I. A. R. I., former Paddy Specialist to the Government of Madras for valuable guidance, help and encouragement throughout the progress of the work. My grateful thanks are also due to Sri. S. Sampath, M. A., former Cytogeneticist, Agricultural College and Research Institute, Coimbatore for the kindly interest in the work and encouragement.

REFERENCES

- Alam, M., (1939) Detailed scientific report of Rice Research Schemes, Bihar, Sabour, 1938-'39 and 1939-'40.
- Eckerson, S. H., (1908) The number and size of stomata. *Bot. Gaz.*, 46: 221-24.
- Evans, H., (1939) Some aspects of the problem of drought resistance in sugarcane. *Proc. 6th Congr. Int. Soc. Sugarcane. Tech., La: (1938):* 802-808.

- Hirano, E., (1931) Relative abundance of stomata in *Citrus* and some related genera. Bot. Gaz.: 92: 296-311.
- Knight, R. C., (1917) The inter-relations of stomatal aperture, leaf water-content and transpiration rate. Ann. Bot.: 31: 221-240.
- Lal, K. N. & Mehrotra, C. N., (1949) Physiological basis of drought resistance in sugarcane. Bot. Gaz.: III: 193-210.
- Lloyd, F. E., (1908) The physiology of stomata. Carnegie Inst. Wash. Pub. 82.
- Loftfield, J. V. C., (1921) The behaviour of stomata. Carnegie Inst. Wash. Pub. 314.
- Maximov, N. A., (1929) The plant in relation to water. Edited by R. H. Yapp. George Alan & Unwin, Ltd., London.
- Miller, E. C., (1938) Plant Physiology. McGraw-Hill Book Co., Inc.
- Onodera, J., (1930) Variability and development of mechanical tissue in leaves of rice plants and its correlation in drought resistance. Jap. J. Bot.: 5: Abs. 61.
- Pavlov, K., (1931) Results of investigations on the number, size of stomata and osmotic pressure as an aid in the determination of the physiological properties of wheat and oat varieties produced by the breeder with the particular reference to their resistance to drought. P. B. A., II. 396.
- Prat, H., (1932) Ann. Des. Sci. Nat. Bot. 10th Ser., 116. (original not consulted).
- Salisbury, E. J., (1927) On the causes and ecological significance of stomatal frequency, with special reference to the woodland flora. Phill Trans. Roy. Soc. B. 216: 1-65.
- Whiteside, A. C. O., (1941) Effect of soil drought on wheat plants. Sci. Agric.: 21: 320-34.
- Yapp, R. H., (1912) *Spiraea ulmaria*, L., and its bearing on the problem of Xeromorphy in marsh plants. Ann. Bot. 26: 815-871.
- Yasuda, S., (1924) On the relation between the amount of transpiration and the development of the vascular system in rice plant. Jap. J. Bot. 2, 1924-25. Abs. 196, p. 68.
- Yocum, L. E., (1935) The stomata and transpiration of oaks. Plant Physiol., 10: 795-801.

TABLE 1
Spacing of Stomatal rows in Rice Varieties
(Mean values)

S. No.	Name of variety	Lower epidermis				Upper epidermis			
		Number of rows of stomata between two veins	Distance between two veins (Micro-meter divisions)	Number of rows of stomata between two veins	Distance between two rows of stomata (Micro-meter divisions)	Number of rows of stomata between two veins	Distance between two rows of stomata (Micro-meter divisions)	Number of rows of stomata between two veins	Distance between two rows of stomata (Micro-meter divisions)
1	2	3	4	5	6	7	8		
<i>Short Duration:</i>									
1.	Co. 13 (wet rice)	8.1	110	13.8	6.0	120	20.0		
2.	MTU. 17 (dry rice)	14.0	200	14.3	6.7	183	27.4		
3.	MTU. 18 do.	8.7	120	13.8	7.0	170	24.3		
4.	PTB. 28 do.	10.0	110	11.0	8.5	135	15.9		
5.	PTB. 29 do.	10.3	140	14.0	6.7	160	23.9		
6.	PTB. 30 do.	8.3	150	18.0	5.3	136	25.5		
7.	Vedurusannam do.	8.5	185	21.8	3.7	130	35.4		
<i>Medium Duration:</i>									
8.	GFB. 24 (wet rice)	8.0	115	14.4	7.0	115	16.4		
9.	TKM. 1 (dry rice)	8.5	135	15.9	8.5	150	17.7		
10.	TKM. 2 do.	7.0	159	21.4	4.0	115	28.8		
11.	Bairuvadla do.	7.7	115	14.9	6.3	115	18.2		
12.	T. 129 (wild rice)	6.7	135	20.4	4.3	117	27.0		
<i>Oryza sativa forma spontanea</i>									
13.	T. 740 do.	11.3	138	12.2	6.3	130	20.5		
14.	T. 1792 do.	6.0	125	20.8	5.3	152	28.5		

Agriculture in Australia — I

by
C. L. SUNDARARAJAN, B. Sc. (Ag.)

The world wide distress that prevailed in the wake of World War II compelled the major powers to institute in 1950 what is known as the Colombo Plan, to render monetary and technical assistance to the South East Asian countries, to improve their living standards. Development work has been carried out so far at a cost of nearly two million pounds, of which four fifths is provided by the participating countries themselves and the balance is contributed by the United Kingdom, Canada and Australia. Under this Colombo Plan, a part of Indian Farmers were enabled to make an educational tour of Australia to see how far the methods adopted by the Australian farmers, who are reported to be the most progressive in the world could be utilised to improve the farming practices and crop production in India.

It was under this scheme that we, a party of Indian farmers, were sent to Australia. Most of the nominees are graduates in agriculture and are also practising farmers, representative of various parts of India. We arrived in Australia in the middle of November 1955 and stayed on till the first week of June 1956.

We were taken first to Canberra where we were given a series of lectures on all aspects of Australian farming. From then on, we were taken on a conducted tour to the various parts of New South Wales and Victoria, where we visited sheep stations, dairy farms, wheat farms and orchard areas. We visited a few of the Agricultural Colleges, Research Institutes, and Experiment Stations of the Department of Agriculture and of The Council of Scientific and Industrial Research Organisation. For a period of five weeks we were privileged to stay as guests, in the homes of private farmers in the fertile Murrumbidgee Irrigation Areas. This unique opportunity enabled us to come in close contact and work with the Australian farmer. After a detailed visit to the Royal Agricultural Show at Sydney, where we were given training in judging farm and animal produce and animals the party dispersed to different areas to specialise in the subjects of their choice. A few of us went to Queensland to study the cultivation of tropical crops, especially sugarcane.

INDIAN FARMERS SEE THE VARIETY OF AUSTRALIA'S AGRICULTURE



A party of 15 Indian farmers who were in Australia for six months under the Colombo Plan to study farm methods visited Hawkesbury Agricultural College at Richmond, about 40 miles from Sydney, the capital of the State of New South Wales. The farmers inspected citrus growing, canning, bee-keeping, vineyards and other crops. Mr. J. M. Mead, an instructor at Hawkesbury Agricultural College, showing honeycombs in the bee-keeping section to the Indian farmers.

(Left to right) Messrs. C. S. Gelda (Jaipur), Satwant Singh (Pepsu), C. L. Sundararajan (Madras), K. K. Bhargava (Jabalpur) and L. N. Kolhe (Bombay State).



Farmers from India, in discussion with Australian scientists, at the Royal Agricultural Show, Sydney.

TABLE 2
Size and frequency of stomata in rice varieties
(Mean values)

S. No.	Name of variety	Lower epidermis				Upper epidermis			
		Length of stomata (Micro-meter divisions)	Breadth of stomata (Micro-meter divisions)	Number of stomata in 25 x 100 (Micro-meter divisions)	Length of stomata (Micro-meter divisions)	Breadth of stomata (Micro-meter divisions)	Number of stomata in 25 x 100 (Micro-meter divisions)		
1	2	3	4	5	6	7	8		
<i>Short Duration:</i>									
1.	Co. 13 (wet rice)	15.7	10.3	74	15.7	10.4	79		
2.	MTU. 17 (dry rice)	15.2	9.9	60	15.3	10.1	68		
3.	MTU. 18 do.	14.9	9.8	69	16.4	9.9	64		
4.	PTB. 28 do.	14.5	9.5	74	14.8	9.9	64		
5.	PTB. 29 do.	14.7	9.8	79	15.6	9.9	76		
6.	PTB. 30 do.	16.2	10.2	70	15.5	10.3	77		
7.	Vedurusannam do.	18.5	10.3	68	17.6	10.0	71		
<i>Medium Duration:</i>									
8.	GEB. 24 (wet rice)	15.8	9.9	70	14.7	10.2	64		
9.	TKM. 1 (dry rice)	16.4	10.1	70	15.9	10.2	74		
10.	TKM. 2 do.	16.8	10.3	69	16.7	10.3	67		
11.	Bairuvadlu do.	15.2	9.4	64	15.5	9.8	72		
12.	T. 129 (wild rice)	15.9	10.0	65	16.4	10.3	59		
<i>Oryza sativa forma spontanea</i>									
13.	T. 740 do.	15.3	9.7	75	15.2	9.9	81		
14.	T. 1702 do.	16.7	10.1	78	16.4	10.0	72		

TABLE 3
Spacing of stomatal rows in parents and progeny of drought resistant cross Co. 13 X T. 129
(Mean values)

S. No.	Name of variety	Lower epidermis				Upper epidermis			
		Number of rows of stomata between two veins	Distance between two veins (Micro-meter divisions)	Number of rows of stomata between two veins	Distance between two veins (Micro-meter divisions)	Number of rows of stomata between two veins	Distance between two veins (Micro-meter divisions)	Number of rows of stomata between two veins	Distance between two veins (Micro-meter divisions)
1	2	3	4	5	6	7	8		
1. Co. 13 (wet rice):									
	I leaf	7.3	125	17.1	6.0	100	16.7		
	II leaf	8.0	140	17.5	4.5	110	24.4		
	III leaf	5.7	125	21.9	3.0	110	36.7		
2. 3115 (P ₁ progeny):									
	I leaf	3.0	105	35.0	2.0	80	40.0		
	II leaf	6.5	155	23.9	2.7	125	46.8		
	III leaf	7.5	115	15.3	3.0	115	38.3		
3. T. 129 (wild rice)									
<i>Oryza sativa forma spontanea:</i>									
	I leaf	3.8	105	28.0	4.0	115	28.8		
	II leaf	7.7	130	16.9	2.0	67	33.5		
	III leaf	4.3	119	25.4	4.0	110	27.5		

TABLE 4
Size and frequency of stomata in parents and progeny of drought resistant cross Co. 13 x T. 129
(Mean values)

S. No.	Name of variety	Lower epidermis			Upper epidermis		
		Length of stomata (Micro-meter divisions)	Breadth of stomata (Micro-meter divisions)	Number of stomata in 25 x 100 (Micro-meter divisions)	Length of stomata (Micro-meter divisions)	Breadth of stomata (Micro-meter divisions)	Number of stomata in 25 x 100 (Micro-meter divisions)
1	2	3	4	5	6	7	8
1. Co. 13 (wet rice):							
	I leaf	16.5	9.9	73	16.0	10.1	79
	II leaf	16.7	10.1	67	17.1	10.2	79
	III leaf	16.8	11.4	64	17.3	10.4	75
2. 3115 (F ₁ progeny):							
	I leaf	16.2	10.4	74	15.8	10.2	86
	II leaf	18.8	10.8	67	16.9	10.1	77
	III leaf	19.1	11.0	60	18.7	11.2	70
3. T. 129 (wild rice)							
<i>Oryza sativa</i> forma <i>spontanea</i> :							
	I leaf	13.2	9.3	81	17.4	10.0	60
	II leaf	17.3	10.8	69	17.7	10.6	57
	III leaf	15.7	9.9	68	18.9	10.7	60

TABLE 5
Frequencies of stomata length in rice varieties
First leaf—Lower epidermis

Serial No.	Name of variety	Length of stomata in micrometer divisions								
		13	14	15	16	17	18	19	20	21
1.	Co. 13			5	23	61	11			
2.	MTU. 17		11	59	29	1				
3.	MTU. 18		18	69	11	2				
4.	PTB. 28	10	46	43	1					
5.	PTB. 29	4	30	58	8					
6.	PTB. 30		2	8	42	39	8	1		
7.	Vedurusannum				3	16	35	33	12	1
8.	GEB. 24			29	60	11				
9.	TKM. 1			7	49	39	5			
10.	TKM. 2			4	24	52	18	2		
11.	Bairuvadlu		12	56	28	4				
12.	T. 129		6	27	44	20	3			
13.	T. 740		10	45	43	2				
14.	T. 1702			5	37	39	17	2		
Total ..		14	135	415	402	286	97	38	12	1

TABLE 6
Comparison of length of stomata between parents and a progeny of drought resistant cross Co. 13 x T. 129

Mean length of stomata in micro-meter divisions:

Co. 13 (cultivated parent)	= 16.81
T. 129 (wild parent)	= 15.70
F ₁ progeny No. 3115	= 19.10

S. No.	Particulars of comparison	Difference between means (d)	Standard error of the difference between means (Ed)	$\frac{d}{Ed}$
1.	Co. 13 and 3115	2.29	0.131	17.46*
2.	Co. 13 and T. 129	1.11	0.123	9.06*
3.	3115 and T. 129	3.40	0.130	26.08*

* Highly significant

The Government of Australia had taken great pains to draw up our programme and carry it out to detail. There was nothing lacking by way of amenities provided or the facilities given for study of the problems, social and economic. The general public gave us a spontaneous welcome and our grateful thanks are due to the Government and people of Australia who did their best to make our stay both enjoyable and instructive.

Geographical Features: Australia is the smallest continent and the biggest island. It has an area of 2·97 million sq. miles — almost as large as the U. S. A., or 2½ times bigger than India. Geographically, Australia is the oldest continent. It has the most level surface and has no towering peaks, the highest peak being the Mount Kosciusko in New South Wales (7328 ft.)

On the whole, Australia is a continent of scanty rainfall. The North East Coast of Queensland receives the highest rainfall (160") and is of the monsoon type (summer rains). The Westerly winds skirt the Southern shores and bring reliable light to moderate rains to the southern part of the continent. This is the winter rainfall area. 37% of the entire area has a rainfall less than 10 inches and is, in effect, a desert. The main river system is that of the Murray and its tributaries the Murrumbidgee, the Lachlan and Darling. This area is highly developed due to extensive development of irrigation works.

Dense forests are found in the tropical North and open park-like forests abound the Eastern sea board. Beyond the mountains are the grass land zones with Acacias. Eucalyptus is the national tree and 600 species of it inhabit the different zones.

The average density of population is 3·02 persons per square mile, and is, therefore, the most sparsely populated of all the civilized countries of the world. The density is the highest in Victoria with 27·9 persons per square mile. 53·9% of all the population live near the coasts in 6 capital cities with a further 24·8% in other urban areas. The rural areas account for only 21% of the population. Most Australians live near the coasts mainly in south and south east and relatively few live in the north and in centre. The large population in the urban areas is an index of the growing importance of industry and commerce in the economy of the country.

The population of Australia is about 9 millions, 16% of which is engaged in agriculture and primary industries, 28·2% in the manufacturing and 55·3% in the tertiary industries.

Australia is mainly a pastoral and agricultural country though, of late, many new industries have sprung up and she is bidding to become an exporter of manufactured articles. The net value of primary production in primary industries in 1953—1954 was £ 1092 millions as opposed to that of £ 1231 millions from secondary industries.

Australia's greatest rural industry is wool growing, followed by wheat, cattle and sugarcane. Other important products are fruits and vegetables.

General Conditions of farming: Australia is truly blessed with a variety of soils in different climatic regions. Land is available in plenty and man has the option to pick and choose the type of land best suited to his type of farming. Since the population is small, each farmer is assured of an acreage as would give him a good standard of living. The acreage, of course, depends upon the type of farming and fertility of the land. Fallowing and green manuring are extensively practised and the modern tendency in many of the farms is to have a harmonious combination of sheep and beef cattle raising in conjunction with cereal farming. A 3 to 5 year rotation is followed and use of nitrogenous fertilisers is almost wholly restricted to sugarcane and other commercial crops, while use of superphosphate and of minor elements, wherever necessary, is widely prevalent. Each individual farm is enclosed by barbed wire fencing and each farm is self-contained with its own farm house, quarters for the employees, (permanent and seasonal) and buildings to house the machinery. Scarcity of water is the bane of the country and water for domestic use is collected and stored off in tanks from the corrugated iron sheet roofs of the homestead.

Agricultural Labour: Shortage of labour is an expression one hears often. Labour, as understood in the densely populated parts of the world, is unknown, and the farmer has to rely on his own strength and ingenuity for carrying out all the operations on the farm. He needs not only to be a good tiller of the soil but must be a skilled mechanic, an efficient veterinarian, an able engineer and to a lesser extent these days, a good cobbler too. No job is too big and nothing too mean for him. A number of labour-saving devices and implements are perforce devised and utilised on the farm and in the house to minimise the drudgery of every-day operations. The farmer works long hours during the season and constructs or repairs farm buildings or machinery during the off

season. A few hands are employed during the harvest season to assist the farmer in his work. The farmer's wife knows of no help to assist her in housekeeping.

The farmer reads the latest journals and text books on subjects of his choice and is thoroughly conversant with the latest developments. It often happens that a farmer is well ahead of the Experimental stations in the adoption of improved cultural methods or of new varieties of crops.

Employee-labour is not very efficient. All employees are by law compelled to be members of the Australian Workers' Union, and their conditions of service, scales of pay, work-load etc. are governed by various awards of Industrial tribunals. Each one is assured of a basic or living wage and it is illegal to offer or accept any wage lower than the basic wage. This basic wage is revised every quarter according to the cost of living Index. The basic wage is defined "as the minimum wage for unskilled labourers at a standard appropriate to the normal needs of the average employee regarded as a human being living in a civilized community." At present the basic wage is about £ 13/- for a 40 hours week. The disparity in income between different strata of society is small and hence the standard of living of the population as a whole is high. No home, not even of a labourer is complete without a radio, frigidaire and many other equipments.

Agricultural Education: No village, as known in India, exists here. Each farmer lives on his own farm for the efficient management of it. The Government does not grudge spending any amount on the provision of amenities to the rural areas. Rural electrification is highly developed and extension of telephone and other means of communication have made rapid strides. Primary and secondary schools have been started in rural areas and the State-organised transport for children attending these rural schools have alone cost the treasury £ 2½ millions in 1953—1954. Medical aid is available in every area though the need for it is limited because of the robust health of the population.

The farmers' children grow in natural surroundings, develop a liking for farming and, in a few instances, complete their education by attending one of the colleges of Agriculture. More than 60% of the products of the college go back to land and the Nation is the better for having a set of practical farmers well versed with the theory of it.

Agriculture is given a prominent place in the curriculum of rural schools. In the colleges of Agriculture greater emphasis is laid on the practical training with the minimum of theory. These colleges award diplomas and students having an appetite for scientific research go up to Schools of Agriculture in the Universities for their degree courses.

Farm finance: The Australian farmer is not handicapped for want of capital to carry on the farming operations. Government agencies like the Rural Bank of New South Wales advance appreciable amounts to the farmers on the security of their lands. Merchant houses and Banking Institutions have branches in all rural areas and advance loans to farmers at reasonable rates of interest (5 to 6% per annum). Co-operative Banks are conspicuous by their absence. The whole structure of rural finance is based on solid foundations of mutual trust and confidence.

Speculative buying of farms in many of the closely settled areas is prohibited by a system of supervision on all sales of farms, and this has the healthy effect of preventing over-capitalisation of farms.

Agricultural Extension: The organisations responsible for the advancement of farming in all its phases are far too many to mention in detail. The Department of Agriculture is highly organised in each state and it works in the same way as its counterpart in India, except that the Australian Department has, by the confidence reposed on it by the farmers, become a force to be reckoned with while handling any rural problems. The Department works in close liaison with C. S. I. R. O. and Universities who initiate works of fundamental importance. Because of the smaller number of farmers to deal with, the staff of the department know each farmer personally and this leads to better understanding of mutual problems. In certain areas like the Murrumbidgee Irrigation areas or in certain industries like the sugar industry, the farmers are under the immediate guidance of special agencies like the Water Conservation & Irrigation Commission or the Bureau of Sugar Experiment Stations.

Commercial Specialist Services to carry out engineering works like levelling and to supply pedigree seeds and pedigree stud animals, insecticides, fungicides, and, in fact, every requirement of the farmer are found in every corner of the country and the Department of Agriculture is not bothered with this sort of service.

The Farmers' organisations are scattered throughout the country. They have sprung up from among the farming public and are well patronised by them. They have regular meetings in which they discuss their problems, exchange notes and submit their considered views and demands to the proper quarters. Each centre of population has got its own show ground, often owned by the farmers' organisation, where the local Agricultural Society holds its annual exhibition and awards prizes to the winners in the competitions. The agricultural Clubs, the Farmers' & Settlers' Association and other similar organisations are the watchdogs of the interests of the farmers and they issue weekly and monthly journals for the benefit of the farmers. The Royal Agricultural Societies are the premier organisations and they have as their object, the exhibition of agricultural, livestock and other products of individual States and to conduct contests in agricultural production in different parts of the State. The Royal Easter show conducted by the Royal Agricultural Society of N. S. W. is truly the greatest show on earth, where, in 1956, 20,000 pedigree livestock and 900 agricultural and livestock products were exhibited. About a million people were estimated to have visited the shows and the prize money given away to prize winning exhibits amounted to £ 30,000/-. The Department of Agriculture lends the services of its staff for judging the exhibits.

The stock of the farmer in the public life is very high and his influence in the Government of the day is immense.

Agricultural Production: Volume of agricultural production is neither controlled nor under any restrictive practices, except in the case of sugarcane and, to a lesser extent, in case of rice. But the marketing of all commodities is controlled by various Marketing Boards constituted under the Marketing of Primary Products Act. A singular exception is wool which is sold in the free markets by public auctions. Representatives of producers have an effective voice in these boards and it is this body which is responsible for laying down standards of production, fixing up local and export prices and ensuring the orderly marketing of the products. The Commonwealth Bureau of Agricultural Economics carries out surveys of cost of production of various commodities and, based on its reports, the Commonwealth Government grants subsidies from out the general revenues in suitable cases. The whole aim is to prevent the exploitation of farmers by middle men, stabilise the prices of agricultural commodities on a scale of parity with the cost of industrial goods and ensure the farmer a decent standard of living.

The system of giving Income-Tax rebates and depreciation allowances to investments made in farms are intended to attract sufficient capital to the rural areas.

The action taken by the farmers themselves in organising gigantic Co-operatives for the processing of their products—Ardmony Coop. Canery, Leeton Co-op. Cannery, the Rice Growers' Co-op. Mills and various butter factories—and for supply of their requirements at reasonable cost, has the effect of ensuring to the farmer a fair deal in all his transactions. These co-operatives, it must be understood, have sprung from below and not super-imposed on the farmers by any Government agency.

Rice Hispa (*Hispa Armigera* Ol.)

by

DR. M. Q. KHAN, M. Sc., Ph. D. (London), D. I. C.

and

D. V. MURTHY, Dip. Agric.,

Assistant Entomologist, Hyderabad Agricultural Dept.

Introduction: Rice Hispa (*Hispa armigera* Ol.) is one of the major pests of Rice crop in the Hyderabad State causing an average loss of 10% in yield. Occurring on both the seasonal crops, the winter sown crop, known as *Tabi*, planted in December-January is more attacked than the monsoon crop known as *Abi*, sown during the months of June-July. In years when the south-west monsoon rains are late, *Abi* crop also is damaged to a very considerable extent. In Hyderabad State the pest is found in all the rice growing districts. It is locally called "*Nalla Purugu*" (Black Insect). The annual average infestation of Rice Hispa is 15,000 acres on an area of 14.5 lakhs of acres grown in the State.

Padwick (1948) in his review on Plant Protection and Food crops in India mentions that in 1946, Rice Hispa caused a heavy loss on 20,000 acres of Rice crop in Madhya Pradesh. Trehan and

Rice Hispa

94803

Pingle (1946) reports that it is a major pest in Karwar and Belgaum districts of Bombay State and that both the *Kharif* and *Rabi* crops of paddy are damaged. It is also a serious pest of rice crop in Assam, West Bengal, Bihar, Orissa and Madhya States. Outside the Indian sub continent, it is a serious pest of rice crop in China (Chu, 1938) and Formosa (Shen and Kung, 1954).

Description: Rice Hispa belongs to the genus *Hispa*, sub-family *Hispinae*, Family *Chrysomelidae*, of the natural order *Coleoptera*. The body of the insect is small and shining, blue-black in colour. On each side of the thorax are found which originate from a common point on the posterior one which is smaller. The elytra are small with a number of strong erect spines. The adult beetles are on an average 4.7 mm long and 1.97 mm broad, whereas the corresponding figures for the male beetles are 3.7 mm and 1.7 mm. The adult beetles can fly long distances mostly in the direction of the wind. They usually fly in the evening hours and are observed in large numbers on the plants in the morning hours.

Nature of Damage and Loss Caused to the Crop: The damage to the rice crop is done by both the adult beetles and the grubs. The adult beetles scrape the leaves and devour the mesophyll while the upper and lower epidermis are not touched. In cases of severe infestation the leaves wither and dry up. In large fields of 50-60 acres extent, the infestation is found in patches in the centre of the field. These affected patches present a bowl-like depression due to the stunted growth of the crop. These 'bowls' act as foci for further infestation.

Infestation in the field not being uniform in all places, great difficulty is experienced in the estimation of loss in yield caused by the Rice Hispa. Sweeps with a hand net of 18" diameter have shown that the population in *Abi* season varies from 3-4 beetles per sweep whereas in *Tabi* it varies from 14-16 beetles per sweep. The population of adult beetles per plant in the transplanted crop varies from 25-30 beetles in cases of severe infestation. To determine the injury caused to the paddy plants, detailed observations have been made on the individual plants in both the affected and healthy patches of the same field, all the other set of crop conditions being uniform for both. Records have been taken of the number of culms per clump, average height of

the culms, length of panicles and numbers of sound and abortive panicles. The details are shown in the Table I.

TABLE I.

Table showing the Individual Plant Characteristics of
Hispa affected and unaffected Paddy Plants.

Type of clump	No. of culms per clump	Average height of clump	Average No. of sound panicles	Average No. of abortive panicles
VARIETY: Banswadalu LOCALITY: Bodhan				
Healthy	3.7	2' - 6"	3.0	0.8
Very severely infested with hispa	1.4	1' - 10"	—	9.8
VARIETY: HR. 35 LOCALITY: Bodhan				
Healthy	3.9	5' - 0"	2.8	0.2
Hispa affected	1.4	4' - 2"	1.2	0.6
VARIETY: Rajagarkal LOCALITY: Bodhan				
Healthy	3.0	4' - 1"	1.7	0.3
Hispa affected	2.2	4' - 1"	1.7	0.3

It will be seen from the table that the main effect of injury by *Hispa* is on tiller formation and also on the formation of the panicles. The maturity of most of the culms in affected plants is delayed.

To determine the loss in yield of paddy due to *Hispa* infestation, records of the average yields obtained from the individual cultivators during the years of heavy *hispa* infestation and during normal years when there has been no *hispa* attack are given below. The crop under study was the *Tabi* crop sown in December-January. The data recorded is given in Table II.

TABLE II.

Table showing the average yields obtained during the years of severe
Hispa infestation and during normal years (*Hispa* free).

Name of cultivator	Normal average yield in the per acre	Average yield when heavily attacked by <i>Hispa</i> in lbs. per acre
1. Korna Bhoomanna	1,600	500
2. Begari Sayiga	1,840	1,120
3. Magdonm Sahob	1,840	800
4. Lacchi	1,200	640
5. Sadasivam	2,400	1,280

From the table it will be seen that there is a reduction in yield ranging from 39-65%.

Seasonal History: After the harvest of the *Tabi* crop in May, stray adult beetles are observed on the sprouted stubbles and the early nurseries raised for the transplantation of the *Abi* crop in June. The first brood adults emerge by 3rd week of July and spread over to the neighbouring fields. The 2nd brood adults emerge by 3rd week of August. This brood is the most widespread and destructive especially if the rainfall is not normal, the attack continues up to end of September. Stray adults of the 3rd brood migrate by 2nd week of December to sprouted stubble and *Tabi* nurseries. The 4th brood adults emerge by last week of January and spread over to neighbouring fields. The 5th brood emerge by the 3rd week of February, and is very widespread and destructive to the *Tabi* crop. By last week of March the 6th brood adults emerge but the damage is negligible as the crop is advanced in maturity.

Eggs are laid in the leaf tip which hatch out in about a week's time. The grub stage lasts for 15-20 days, the grub feeding throughout in the same leaf mines and has never been observed crawling to other leaves as reported by Logothetis (1951). When two or more grubs attack a single leaf the different mines often coalesce into one. Pupation takes place inside the leaf mine between the two epidermal layers of the leaf and lasts for 6-10 days. The adult beetles in confinement have a longevity of a week to ten days. The complete life cycle occupies 30-35 days and does not vary much from year to year.

Natural Enemies: Logothetis (*Loc. cit*) in reviewing the information available on Rice *Hispa* does not mention of any natural enemies noted on it. In Hyderabad State the following parasites have been recorded.

- (1) *Bracon* Sp. (*Braconidae*: *Hymenoptera*) - Larval parasite.
- (2) *Eupteromalus* Sp. nr *nidulans* Forst. (*Chalcidoidea*: *Pteromalus*) - mostly a secondary parasite on *Bracon* Sp. and sometimes a primary larval parasite on *hispa* grub.
- (3) An unidentified *Cecidomyiid* larval parasite.

A brief account of *Bracon* Sp. has already been given by Khan and Murthy (1954.) Detailed observations have shown that the incidence of parasitism ranges from 15% to 82%. The parasite appears very promising and its potentialities have been observed in Bodhan Taluka of the Nizamabad district which used to be an endemic area of hispa infestation formerly. It may be mentioned that since the past three years, Rice Hispa has never been observed in a pest form in Bodhan Taluka. *Bracon* Sp. however, has the following two hyperparasites, which exercise a considerable check on it.

- | | |
|---|--|
| (1) <i>Dimmockia</i> Sp. | } (<i>Chalcidoidea</i> :
<i>Eulophidae</i>) |
| (2) <i>Achrysocharis cardigaster</i> Masi | |

Control Measures: A number of remedies have so far been tried for the control of this insect pest. While it could be easily controlled in nurseries, it is more difficult when once the pest spread to the transplanted crop. Amongst the methods of control tried against the pest were bagging of adult beetles by hand nets and clipping of affected leaves. Clipping of affected leaves, although effective at the time of transplanting, is not favoured by the local cultivator who fears a set back in growth and yield of the crop which, however is not the case.

Amongst the earlier chemical methods experimented, spraying with Lead Arsenate deserves mention. Lead Arsenate spraying @ one oz. per gallon of water was found quite effective comparing well with DDT. But spraying with Lead Arsenate and DDT was found very tedious and also costly, the cost of the Chemical itself amounting to 7-8 Rupees per acre for each spraying. Further, the area that could be covered was also considerably less. In view of the above, the need of a satisfactory insecticidal dust was felt. Both BHC and 'Pyrodust' were experimented with and found equally effective. However, BHC is found more economical. Uptill now, an area of over 50,000 acres of paddy has been dusted with BHC 5% dust against hispa attack.

While passing it may be pointed out that while in earlier years 10-12 lbs of BHC 5% dust was effectively controlling this insect pest, of late, it has been found essential to increase the dosage to more than 15 lbs per acre in endemic areas where dusting is being carried out season after season by the Plant Protection Organisation. The biological assay results show that there has

been no loss in the potency of the insecticide. It appears that the pest is slowly gaining a perceptible resistance to the insecticide, which, however remains further to be investigated.

Summary: Hispa (*Hispa armigera*, Oliver) is one of the major pests of Rice crop in Hyderabad. It is observed on both the 1st and 2nd crops in the Telengana area but the damage is more on the 2nd crop. The main effect of injury is on the formation of culms and also the delay in normal emergence of panicles thus contributing to low yields. Three larval parasites have been observed of which *Bracon* Sp. (*Braconidae*: *Hymenoptera*) appears very effective. Amongst the control measures tested and adopted on a large scale is the dusting of BHC 5%. Brief notes on the biology and seasonal history are given.

Acknowledgements: Our sincere thanks are due to the Director, Commonwealth Institute of Entomology, London for identification of the natural enemies mentioned in the paper.

REFERENCES

1. Chu, C. V., (1938) *Lingnan Science Journal*, 17, 1, 106-07 (Original not seen).
2. Khan, M. Q., & Murthy, D. V., (1954) *Ind. Jour. Ent* 16, 3.
3. Logothetis, C., (1951) Report of 2nd meeting of working party on rice breeding (F. A. O.) Bogor, Indonesia pp. 38-53.
4. Padwick, G. W., (1948) *Empire Jour. Exptl. Agri.* 16, 61, 55-64.
5. Shen, T. H., & Kung, Peter, (1954) *IRC News letter*, (F. A. O.) 2, 4-17.
6. Trehan, K. N., & Pingle, S. V., (1946) *J. B. N. H.* S. 46, 139-53.

Some Facts about Arecanut

by

SHAMA BHAT KHANDIGE, N. BALAKRISHNA
and
N. R. ADYANTHAYA,
Senior Assistants, Arecanut Research Station, Vittal

Introduction: Arecanut is grown in India, under varied conditions of soil, climate and altitude and it is needless to say that its agriculture is also carried out in diversified methods and practices. Hence it is difficult to generalise on the method of cultivation of the crop. But it is the duty of scientific workers, especially at this hour, when maximum production per unit of labour and soil is aimed at, to find out the best and most economic method of cultivation of this crop. The attempts made at the Arecanut Research Station at Vittal of South Kanara along the above lines are described in this paper. The Arecanut Research Station at Vittal comprises 4.75 acres of garden taken on lease and has the conditions of semi-malnad parts of South Kanara. The work of the station is primarily on the pathological aspects of the areca palms but work was also carried out, side by side, on other lines such as agronomical and certain fundamental facts also. The age of the garden is about 34 years.

Details of work: The cultivation practices that are followed at this station are described below:

Seeds and sowing: With a view to select trees of very high performance, the yields obtained from all the palms in the garden are recorded separately with full details of number of bunches harvested, number of nuts per bunch, weight, size, shape and colour of nuts etc. Seed nuts are selected from trees which are high yielders and healthy. Care is also taken to follow the methods of selecting seed nuts that are locally adopted, such as harvesting middle portions of bunches, nuts which are medium sized etc. The methods of raising seedlings are also those followed locally, viz. dibbling small sprouts which were allowed to germinate in baskets or straw bundles. Seedlings of $1\frac{1}{2}$ to $2\frac{1}{2}$ years of age are used for planting in the main field. The cost of raising such seedlings comes to about 9 pies to an anna per seedling.

Planting: At the Arecanut Research Station, the seedlings are planted wherever gaps are formed by the mortality of the palms due to various causes. The stumps of dead areca trees are

dug out and pits $3' \times 3' \times 3'$ are formed. The pits are refilled to a height of about one foot from their bottom level. Care is taken to see that refilling is done in such a manner as to form a cone of earth at the centre of the pit. Then the seedling which is removed from the nursery with a ball of earth is placed over the cone so formed and some more earth is added and the plant is firmly fixed to the soil by pressing the sides of the cone. The formation of cone and planting the seedling prevents stagnation of water at the collar region of the plant facilitating its early establishment. No manure is added while planting, except spreading some green leaf round the base of the seedling to prevent the soil splashing to the tender spindle during heavy rains. About a fortnight after planting they are manured with cattle manure or compost and ash. Planting is usually done either in the beginning or end of August. But it has been the experience that they can be planted during other months also if good irrigation and drainage facilities are available.

Leaf-fall and Flowering: Under best conditions, the palm is said to flower in about 4 to 5 years after planting, though normally it takes about 6 to 8 years. Flowering is seen throughout the year but the peak period is between the months of November and April which is evidenced by the following table:

TABLE I
Number of spadices produced during 1954 - '55 at the Research Station, Vittal

Month	Number of inflorescences developed in 1953 - '54	Number of inflorescences developed during 1954 - '55	Average	Percentage of the total production in the month
July	52	150	101.0	1.5
August	36	137	86.5	1.3
September	83	154	118.5	1.9
October	182	390	286.0	4.5
November	342	763	552.5	8.3
December	533	824	678.5	10.3
January	646	1451	1048.5	16.0
February	816	1310	1063.0	16.2
March	948	1301	1124.5	17.1
April	854	878	866.0	13.2
May	685	298	491.5	7.5
June	228	68	148.0	2.3
Total	5405	7724	6561.5	100.0

TABLE II

Average number of leaves shed and the number of inflorescences developed during the years 1953 - '54 and 1954 - '55

Month	Average number of leaves shed from 1575 trees	Average number of inflorescences developed in 1575 trees	Percentage of inflorescences to the leaf-fall
1 July	549.5	101.0	18.5
2 August	543.5	86.5	15.9
3 September	541.5	118.5	21.9
4 October	871.5	286.0	32.8
5 November	1014.0	552.5	54.5
6 December	891.5	678.5	76.1
7 January	1205.5	1048.5	87.0
8 February	1208.5	1063.0	88.0
9 March	1206.5	1124.5	93.2
10 April	1006.0	866.0	86.1
11 May	851.0	491.5	57.8
12 June	611.5	148.0	24.2
Total	10500.5	6564.5	62.5

Even though the leaf-fall is seen during all the months of the year, yet the percentage of inflorescences to the leaf-fall is observed to be more during the months of October to May than in other months (as evidenced in table II above) and more than 80% of the inflorescence is developed during the months of November to April (as is evidenced in table I). The average number of leaves shed per palm per year was recorded to be 6.7 and the number of inflorescences produced was only 4.2.

After cultivation: This consists of weeding whenever found necessary, digging to about 6 to 8 inches deep with mammuti fork during the month of November and attending to the general cleanliness of the farm by picking 'sogais' (dry leaves) and removing dead inflorescences etc. Another important operation that is included under after-cultivation is the spraying of areca bunches against Fruit-rot or Kolesoga with 1% Bordeaux mixture twice during a year, once towards end of May or early June and for a second time during the middle of July. The tender palms are protected by tying areca leaf-sheaths or leaves over them which helps to minimise

the sunscorch of stems. The life of older trees with cavities or fissures can be prolonged by tying split pieces of areca stems over such portions.

Manurial Practices: The method of manuring adopted at the station was slightly different from that which is generally practised by local growers. The manure is applied in a circular trench 1 foot wide and 9"-10" inches deep, dug 2 feet away from the base of the tree. Half a pound of Superphosphate per tree is spread at the bottom and over this 20 lb each of green leaf and 20 lb of cattle manure or compost is spread and 1½ lb of wood ash is also applied at the top layer and the manures are finally covered up with earth. Manuring is usually taken up during August of every year. Compost required for the farm was prepared from materials available in the farm itself such as dry leaves of areca, banana and other farm rubbish.

Attempts were also made to make the farm self-sufficient with respect to its green manure requirements. For this purpose plants of *Gliricidia maculata* and *Indigofera teysmanni* were planted in the marginal areas of the garden. *Gliricidia* was also planted as a hedge crop on the fence line of the garden which gave a good portion of the green leaf requirement of the station. Besides these, cover crops such as *Peuraria javanica*, *Centrosema pubescens* and *Calopogoninm mucunoides* were tried with success. Seeds of the above cover crops are sown in between rows of areca trees during the month of January. The advantages of sowing the seeds during January are as follows:

- (1) The crop gets itself well established before the beating South-West monsoon rains commence in June or July.
- (2) the crop gives good protection to the surface of the ground from the direct rays of sun during the summer months.
- (3) the crop prevents the surface erosion of manurial ingredients during the rainy season.
- (4) it improves the texture of the soil and finally a good green manure crop becomes available at the month of August for manuring.

Irrigation: The garden needs to be irrigated from the middle of November to the end of May or till the onset of South-West monsoon rains. The tanks and irrigation channels are to be rectified during October and November. Water is let in through the channels from the middle of November or early December and

splashed to the surface of the garden by using a small bucket made out of the leaf sheath of areca. Irrigation is given once in 5 or 6 days.

Harvesting and curing: (a) Nuts are harvested when they are fully mature i.e. when they change to orange red or yellow or crimson in colour. The bunch becomes ready for harvest on an average, after eleven months of the leaf-fall and appearance of inflorescence, though the period varies from 9 1/3 months to 13 1/2 months (as is evidenced in table III given below).

TABLE III
Showing the dates of appearance of inflorescence and harvesting of bunch.

Tree No.	Date of leaf-fall or appearance of spadix.	Date of harvest or ripe bunches.	Period taken for maturity in months and days.
1	14-4-1954	10-3-1955	10 months - 27 days.
	28-5-'54	1-4-'55	10 " 3 "
2	13-1-'54	21-12-'54	11 " 8 "
	3-3-'54	18-1-'55	10 " 15 "
	4-4-'54	17-2-'55	10 " 13 "
	8-5-'54	10-3-'55	10 " 2 "
3	13-1-'54	17-11-'54	10 " 4 "
	8-3-'54	19-1-'55	10 " 11 "
	30-3-'54	18-2-'55	10 " 16 "
	10-5-'54	10-3-'55	10 " 0 "
4	22-9-'53	18-11-'54	13 " 26 "
	22-10-'53	18-11-'54	12 " 26 "
	27-12-'53	22-12-'54	11 " 26 "
	7-2-'54	20-1-'55	11 " 13 "
	14-3-'54	18-2-'55	11 " 4 "
5	17-11-'53	18-11-'54	12 " 1 "
	25-12-'53	23-12-'54	11 " 29 "
	6-3-'54	20-1-'55	10 " 14 "
	10-5-'54	19-2-'55	9 " 9 "

(b) *Size and shape of nuts:* The size and shape of nuts are found to vary within the same bunch and in different bunches of the same tree. The length of nuts varies from 3.2 cms to 6.8 cms.

and breadth (at the widest point) from 2.9 cms to 5.3 cms. Different shapes viz. oval, oblong, spherical and pyriform are also seen, but colour is a more or less consistent factor for fruits of individual trees.

(c) *Period of harvest:* Harvesting of ripe arecanuts is done in almost all the months, but the bulk or major harvests are made between October and March. During other months only stray bunches become available for harvest. The percentage of the number of nuts harvested at each month to the total harvest of the year at the Research Station, Vittal is given below:

TABLE IV
Percentage of total for the year.

S. No.	Month	1953-'54	1954-'55	Average
1.	July	0.10	0.04	0.07
2.	August	0.65	0.30	0.48
3.	September	1.35	1.25	1.30
4.	October	9.52	1.87	5.70
5.	November	12.94	16.20	14.57
6.	December	20.06	34.79	27.42
7.	January	35.10	24.83	29.97
8.	February	15.10	15.42	15.26
9.	March	4.90	4.01	4.45
10.	April	0.19	1.16	0.67
11.	May	..	0.13	0.06
12.	June	0.09	..	0.05
Total ..		100.00	100.00	100.00

From the above table it is also gathered that more than 87% of the total produce is harvested between November and February.

(d) *Curing of arecanuts:* The ripe arecanuts are harvested from the trees by using bamboo poles. After harvest the nuts are spread in the sun for drying in the specially prepared curing yards. They are allowed to dry in the sun for about 35 to 40 days. To ensure uniform drying and easy separation of kernel from husk, the fruits are turned upsidedown once in 3 days. They are then husked by using special knives called 'Mettukathies' and sorted. The

superior nuts form the 'Billigotu' portion and the inferior ones are separated as 'Koka'. The relation between the nuts at different stages of curing is furnished in table V.

TABLE V

S. No.	Particulars	1952-53	1953-54	1954-55	Average
1.	Average number of fruits (wet) per lb.	14	14	13	13.7 or 14.0
2.	Average number of dry nuts (with husk) per lb.	35.5	35.2	34.2	35.0
3.	Percentage of drying (after 40 days of drying)	59.7	59.9	62.2	60.6
4.	Average number of cured and husked nuts per lb.	59.0	57.7	57.2	58.0
5.	Percentage of 'Koka' in husked nuts by weight	3.7	4.5	3.2	3.8
6.	Percentage of husked nuts over total wet weight of nuts	23.5	24.4	22.5	23.5
7.	Percentage of husked nuts over dry weight (nuts with husk)	58.3	60.9	59.7	60.0

From the above table it is estimated that on an average 100 pounds of fruits give after drying, 39.4 lb. of dried areca, which, after dehusking, gives 15.9 lb. of husk and 23.5 lb. of husked nuts of which 0.9 lb. will be 'Koka' and 22.6 lb. will be 'Billigotu'.

(e) *Yield*: The average yield per acre of the garden (with only 338 bearing trees per acre) was 1,132 pounds of cured and husked nuts. The details regarding the yields per tree of bearing age recorded at the Research Station during the last three years is given below:

TABLE VI
Average yield per Tree.

S. No.	Particulars	1952-53	1953-54	1954-55	Average
1.	Average number of bunches per palm	2.2	2.4	2.9	2.5
2.	Average number of fruits per bunch	96.0	68.7	72.5	79.0
3.	Average yield of arecanuts with husk per palm (Nos.)	298.0	164.9	210.0	194.0
		lb.	lb.	lb.	lb.
4.	Average yield (cured and husked nuts) per palm by weight	3.5	2.8	3.6	3.3

From the foregoing figures it is gathered that only 2.5 bunches per palm are available for harvest even though the spadices produced is 4.2 and the average under of leaves shed is 6.7 per palm per year. Hence it is evident that 37.3% of the leaves that shed are barren without spadices and out of the 62.7% which produce spadices 25.4% are infertile spadices and get dried up and only 37.3% of the spadices get fertilised and develop into good bunches.

Subsidiary Crops: Several subsidiary crops like coconuts, banana, pine apples, peppervines etc. are grown primarily with the object of providing shade to the garden and also to increase the revenue.

Summary: The method of raising arecanut varies from tract to tract. One such method as followed at the Arecanut Research Station, Vittal, is explained in detail. An attempt has also been made in this paper to record the various fundamental facts and figures gathered at the above mentioned Station during its 3 years of existence.

Acknowledgment: We are highly grateful to the Indian Central Arecanut Committee for having partly financed the scheme under whose auspices this work was carried out. We also wish to express our deep sense of gratitude to Sri T. S. Ramakrishnan and Sri M. Kandaswamy former and present Mycologists respectively, under whose guidance this work was carried out. Thanks are also due to our Colleagues Sri K. M. Vijayan and Sri N. Thirumaleshwara Bhat, who were also associated in the working of the scheme. Finally we wish to record our appreciation of the work rendered by all other members of the staff engaged in the work.

Research Note

Observations on Germination of Dry Seed Coconuts

Coconut is a perennial palm which is seed-propagated. The fruit of the palm is itself the seed when mature. The fruit is botanically a drupe. It consists of a hard, leathery epicarp, a fibrous mesocarp and a hard, stony endocarp called "the shell" of the husked nut, which encloses the seed. The seed itself is made up of an endosperm which lines the entire inner surface of the shell and is one centimeter or more in thickness in a normal fully matured nut of the ordinary tall variety of coconut. The embryo which is small and somewhat button-shaped lies embedded in a small cavity within the endosperm, towards the stalk end of the nut. There is a single cotyledon which is situated just below the embryo. The endosperm which is popularly known as the kernel is sweet and forms the edible part of the nut generally containing about 60 to 75 percent of oil. It is this oil in the endosperm that is utilised by the germinating nut for the development of the seedling. The endosperm encloses a cavity which contains a sweet water popularly known as "Milk". This liquid practically fills up the entire cavity in the early stages of development of the nut, but later gets reduced in quantity as the nut matures. Generally in a fully matured nut (11 or 12 months old), the water gets reduced to fill up nearly half the cavity. If such nuts are stored for a long time (say for more than 2 or 3 months) after harvest, the water inside them gets reduced rapidly especially during hot weather. The water content can however be kept up without any appreciable reduction in volume for a longer period (say about 6 to 8 months) if the nuts are carefully preserved in sand. It may thus be seen that the seed of the coconut is different from that of the other plants in that it is hollow inside and contains a liquid which should be present in sufficient quantity for the proper germination of the nuts. The role of this water in the germination of the nut has not, however, been investigated. But it has been reported by some workers that it has the capacity to hasten the germination of certain seeds kept soaked in it. The water in the mature nut contains about 2 percent sugars consisting mainly of reducing sugars and sucrose.

Experiment: In 1953, as a measure of rehabilitation, about a lakh of seed coconuts were procured from the gardens on the West Coast for supply to the growers in the cyclone devastated areas in

Tanjore district. During storage of these seed nuts at the distribution centres a large number of them became completely dried up (without any water inside) rendering them unsuitable for planting to raise seedlings.

An observational trial was conducted in the coconut nursery at the Agricultural Research Station, Pattukottai in 1953, to study the germination of these dry nuts in comparison with those of normal nuts. One hundred seednuts with sufficient quantity of water and a large number of dry nuts (without any water inside) were soaked in water for a week. The soaking was done by immersing the nuts in rectangular pits (10'×4'×4') filled with water. Among the dry nuts soaked, some were found to have become heavy due to absorption of water while others remained light. One hundred nuts were selected at random from each of the 'heavy' and 'light' groups and planted in the nursery along with the 100 normal nuts. The planting was done on 17th September, 1953. The germination of the nuts under each lot was recorded. Most of the seednuts in the different groups germinated within 4½ months after planting. The percentages of germination are as given below:

<i>Treatments.</i>	<i>Percentage of germination.</i>
(1) Nuts with water (normal)	93
(2) Dry nuts (heavy after soaking)	64
(3) Dry nuts (light after soaking)	31

From the figures furnished it would be clear that the drying up of the water ('Milk') affects the germination of nuts considerably. As against 93 percent germination recorded by the normal nuts, only 64 percent and 31 percent were recorded by the two groups of dry nuts. However, it shows the possibility of germinating even the "dry" nuts by soaking them in water, provided the water in the nut has just then dried up, as this was the condition of dry nuts used in the present experiment. Yet another conclusion that can be drawn from this study is that the dry nuts which absorb a large quantity of water and thereby become heavy after soaking is capable of giving a higher percentage of germination than those which remain "light" after soaking. Further it was observed that the seedlings raised from them are in no way inferior to those obtained from the normal nuts. Selection of seedlings on the basis of established criteria is also necessary in their case as is usually done.

In nursery practice it is usually to reject all the seednuts which are found without water at the time of planting them in the seedbeds. But from the present experiment it appears possible to utilise some of them for producing seedlings by soaking them in water for a week and selecting only those which become heavy after the treatment. This is an important and useful hint to nursery men who produce quality seedlings for supply to coconut growers and who are likely to discard 'dry' seed nuts altogether from planting.

Agricultural College & Research
Institute, Lawley Road P. O.
30th April, 1956.

S. G. AIYADURAI,
Assistant Oilseeds Specialist.

Gleanings

Mould Board Plough: Gives better puddle: The mould board plough is more advantageous to work in rice fields in swampy conditions. In trials conducted in Madras State, the mould board plough was compared with the wooden plough under wet land conditions. Two sets of adjoining fields, identical in all respects, were used for the trials. In one set, an iron plough was used. All operations such as manuring, sowing, planting, weeding and harvesting were done simultaneously in the two sets of fields. The number of ploughings given to each set was restricted to four.

It was found that in the fields where the iron plough was used the yield increased from 4 to 9 per cent. This is probably because of the better puddle obtained. The inversion of the soil and the burial of weeds and stubbles were most satisfactory in the fields where the iron plough was used. To get a similar puddle with a wooden plough more ploughings would have been necessary. But this would have added to the cost of operations.

— ICAR

Plough injury to animals: First Aid: Many a time, while ploughing, the iron point of the plough injures the back of the fetlock of the hind limbs of the bullocks. Farmers tend to neglect this, as a result of which dung, clay and dust particles enter the wound and infection (sepsis) sets in. Because of inflammation, swelling develops above the fetlock. The animal becomes lame and unfit for work. The plough injury should receive prompt attention of the farmer. If neglected, the animal will not be fit for work for a long time. Immediately any injury to the limb is noticed, it is better to take the animal out of the field, and wash the wound with a dilute phenyl or permanganate lotion. Thereafter, the wound should be well covered by a temporary bandage consisting of a clean piece

of cloth. The animal can then be walked to the nearest veterinary hospital for treatment. With proper treatment, the animal can be fit for work again in a short time.

— ICAR

Small-sized Coconuts: Convert them into ball-copra: It is better to convert the small-sized coconuts harvested during the rainy season into ball copra. The conversion of the nuts into the ordinary copra during the rains is not easy, and hence the grower sells these nuts at low prices. But, if the nuts are stored in lofts on raised platforms and exposed to smoke, ball copra can be obtained in due course. Ball-copra fetches a premium in the North Indian Markets.

— ICAR

Storing Potatoes—Reserve Well in Cold Storage: Results of cold storage trials with potatoes in Bombay State show that potatoes can be preserved in good condition for more than a year at 35°F. But at this temperature, the tubers gradually become sweet and lose their value as table potatoes. But, if they are kept at 40°F, it is possible to store them for about nine months without fear of their losing table quality. The seed value is not affected by cold storage either at 35°F or 40°F for the periods shown above.

— ICAR

Nagpur Orange—Cold Storage Trials: Cold storage trials conducted in Bombay State with Nagpur oranges or *santras* show that it is possible to keep fully ripe yellow fruits in good marketable condition for 3 months by storing them at 40°F. During storage the taste of the fruits remains practically unaltered. If the oranges are carefully selected before storing and all injured fruits rejected, very little loss of fruit occurs in storage. The Mosambi is best stored at 42°F. The appearance and quality of the juice improve in cold storage. Malta oranges and *kagadi* limes can be stored in good condition for four months and two months at 40°F and 52°F respectively.

— ICAR

Hybrid Coconut Seedlings—Good Performance: Coconut-growers can now have a coconut palm that combines the good qualities of both the tall and dwarf palms. The tall type of palm gives high yields with large nuts and superior quality copra. But it bears late. The dwarf palm, on the other hand, begins to bear early, but the nut and copra contents are inferior. Hybrid seedlings of the tall and the dwarf type of coconuts have been found to bear early like the dwarf and have the good nut and copra qualities of the tall. A small number of these hybrid seedlings are now being produced at the Central Coconut Research Station, Kasargod and the Agricultural Research Station, Nileshwar (Madras State) for supply to coconut-growers.

— ICAR

Some observations on growth and yield of potatoes raised on bench terraces at the Agricultural Research Station, Nanjanad: An extent of 80 acres of cultivated slopes at the Agricultural Research Station, Nanjanad, was progressively bench-terraced during the years 1954 and 1955, to effect soil conservation measures. In the main crop season of 1955, an area of 10.89 acres of potatoes was planted in the newly terraced blocks and another 12.54 acres in the old slopy area. The mean acre yields of tubers were as follows:

Terraces	..	11,441 lb.
Slopes	..	9,554 lb.

A marked increase in the yield of tubers, amounting to 1,887 lb. (about 9 bags, valued at Rs. 225/- per acre at Rs. 25/- per bag of 200 lb.) was obtained even in the first year of cropping after terracing.

It was initially felt that the first crop taken immediately after terracing would be below normal, due to the mass displacement of the old top soil and the need for the new top soil to get weathered and mellow in course of time and after a season or two of cropping. But, the yield values as above, have clearly indicated that conservation of soil, moisture and the fertilisers against wash-down as a result of terracing had off-set the expected shortcomings of the fresh soil on the terraces.

Another general observation was that while the soil in the slopy blocks particularly on the tops, tended to dry up appreciably in dry spells, the benches continued to remain moist for longer periods. This advantage of better retention of moisture over the terrace was clearly reflected in the plant growth, the development of which were more vigorous than that of the crop raised over the slopes.

— (MANL)

Improvement of the keeping quality of Ghee: Although ghee is one of the most stable dairy products of the tropics, it undergoes deterioration both in market quality and nutritional value due to the prevailing high temperature, exposure to air and light, and various other environmental conditions besides improper methods of manufacture and storage of butter prior to the preparation of ghee. Studies carried out at the Agricultural Research Institute, Coimbatore show that ghee of good keeping quality can be prepared directly from cream by re-separating the sweet cream obtained from milk (after mixing it with five times its weight of water), ripening the re-separated cream to 0.15% acidity (as lactic acid) and melting the ripened product at 135°C.

Certain plant materials and chemicals were found to impart a higher keeping quality to ghee. Addition of 0.5% curry leaf (*Murraya Koenigi*) towards the close of melting markedly enhanced its storage life. A petroleum ether extract prepared from the alcohol soluble portion of the leaf had powerful antioxidant effect when added at 0.05% level. Carbohydrate materials like cane, palmirah and coconut jaggeries also improved ghee by reducing the acidity when added at 0.85% towards the end of the melting. Chemical antioxidants like N. D. G. A., propylgallate, when added at 0.02% level to the prepared ghee were also useful in preventing the deterioration for a considerable length of time. A mixture of propylgallate and butylated hydroxy anisole (at 0.01% each) had a very good preservative effect. The action of the chemical antioxidants was enhanced by the addition of citric acid (at 0.01% level).

Vacuum packing appeared to be the best form of packing ghee when intended for long storage.

— (MANL)

Blackarm Disease in Karunganni Cotton: At the Agricultural Research Station, Koilpatti, incidence of blackarm was noticed during the year 1955-'56 in the one month old Karunganni Cotton Crop. Examination made on the crops located in the elevated and low lying areas indicated that the attack was more in the latter case where the plants were subjected to stress of excess moisture causing poor growth.

(MANL)

Cultivation of P. 216 F Cotton in Rice Fallows: P. 216 F cotton raised during the year 1954 and 1955 at the Agricultural Research Station, Aduthurai and Coimbatore, representing the deltaic and non-deltaic rice fallows, respectively, registered 270 and 462 lb. of lint per acre. The samples of Aduthurai were adjudged to spin 41's while those of Coimbatore to 34's. The cash return per acre at Aduthurai and Coimbatore was Rs. 366/- and Rs. 648/- and the cost of cultivation was estimated at about Rs. 250/- and Rs. 350/- respectively.

(MANL)

The Jassid and the Fulgorid pests of paddy: Among the more important pests of paddy, the green jassid-*Nephotitix bipunctatus* and the fulgorid *Nilaparvata lugens* deserve special mention. These hoppers have been noted to assume serious proportions during recent years, particularly on the kuruvai crop, in the Tanjore delta. Research on the bionomics and control of these pests has been in progress at the Agricultural Research Station, Aduthurai for the past three years (1953-'55). The jassid and the fulgorid may occur independently or in association with each other. They lay other eggs inside the leaf sheath. The eggs hatch out in about five to six days & one completed life cycle occupies 24 days in the case of the former and 20 days in the case of the latter. Generally three to five broods occur during the crop season. The jassid usually makes its appearance soon after transplantation and continues to infect the crop till harvest. The fulgorid on the other hand, restricts its activity mostly to the later stages of the crop. Fields showing water stagnation and a consequent lodging of the crop offer ideal situation for the rapid multiplication of this hopper. Both these hoppers suck up the plant sap, causing varying degrees of stunted growth, premature yellowing and comparatively weak earheads. The damage is serious, if the infestation manifest itself at the shot blade stage of the crop. The earheads are rendered chaffy and the yield is affected. Amongst the two hoppers, the fulgorid is more serious.

The use of a mixture of DDT 5% dust and BHC 20% in equal proportions, has been found to give appreciable relief in controlling a combined infestation of the jassid and the fulgorid. With a view to find out a more efficient method of control, a fair trial was given to some of the newer formulations of pesticides. The variants comprised BHC, Taxaphene, Folidol, Indrin, and a mixture of DDT and BHC dusts. Quantitative data on the insect infestation as well as yield were gathered. Folidol spray (One ounce of Folidol E. 905 in 6½ gallons of Water) applied twice, the first at the shot blade stage and the second at the milky stage of the ears, has given the best results as judged by a lowering of the pest incidents and on increase in yield. Similar treatments either with Taxaphene 20% dust or Endrin spray (one ounce of 19.5% emulsion in 12½ gallons of water) took the next place in the order of efficiency.

It is thus evident that the use of two rounds of folidol spray or taxaphene 20% dust of endrin spray is a further improvement at the control measures previously adopted viz. dust of a mixture of DDT 5% and BHC 30% and may be adopted with advantage.

Activated Paddy Husk Increases Water Holding Capacity of Malabar Laterite Soil: In an effort to increase the water holding capacity of the highly porous laterite soils of Malabar, an experiment was conducted by the addition of 1% paddy husk charcoal (activated) to laterite soil and the water holding capacity estimated after allowing the soil to drain for twenty one hours. The results are as below:

Untreated laterite Soil	Laterite soil mixed with 1% animal charcoal	Laterite soil mixed with 1% activated paddy husk
Water holding capacity 56.4%	60.2%	65.8%

With animal charcoal the increase in the water holding capacity is not significant but with paddy husk there is an increase of about 18% over the untreated soil.

(MANL)

Weather Review — For August, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenam-bakkam)	8.0	+ 3.4	20.1	South	Madurai	6.3	+ 2.2	12.4
	Tirur-kuppam*	8.7	+ 3.6	18.5		Pamban	Nil	- 0.6	2.2
	Vellore	4.6	- 1.2	20.6		Koilpatti*	1.6	- 0.5	8.7
	Gudiyatham*	4.6	+ 0.5	14.9		Palayam-cottai	2.0	+ 1.3	6.5
						Amba-samudram*	0.5	+ 0.1	7.5
East Coast	Palur*	7.0	+ 1.5	18.7	West Coast	Trivandrum*	4.2	- 2.5	33.3
	Tindivanam*	8.9	+ 4.1	18.0		Fort Cochin	9.3	- 4.7	92.5
	Cuddalore	5.2	+ 0.4	14.5		Pattambi*	10.6	- 2.6	67.2
	Naga-pattinam	3.9	+ 0.8	10.5		Kozhikode	12.6	- 4.5	98.0
	Aduthurai*	2.5	- 2.4	11.0		Taliparamba*	21.4	- 4.2	114.5
Central	Pattukottai*	3.7	- 0.8	11.9		Wynand*	10.2	- 3.0	60.6
	Salem	3.6	- 3.0	13.9	Hills	Nileshtar*	15.9	- 14.5	124.9
	Coimbatore (A. M. O.)*	1.3	£	9.1		Pilicode*	13.0	- 9.4	101.2
	Coimbatore	2.6	+ 1.4	9.1		Mangalore	18.3	- 7.2	123.3
	Tiruchirappalli	2.0	- 2.1	5.9		Kankanady*	18.0	- 6.9	126.4
						Kotekar*	18.6	- 5.9	@
						Kodaikanal	7.1	- 0.1	25.2
						Coonoor*	2.5	- 0.9	15.4
						Ootacamund*	2.5	- 2.4	21.2
						Nanjanad*	3.6	- 3.7	27.5

- Note:— 1. * Meteorological Stations of the Madras Agric. Dept.
 2. £ Actual Deviation is -0.04"
 3. @ = It is a new station. The rain gauge was installed in March 1956.

The month began with a shallow depression in the Northwest Bay of Bengal. In the first six days of the month Malabar and South Kanara had fairly widespread rains while the weather was mainly dry elsewhere with the exception of some scattered and localised showers in Travancore-Cochin on 2-8-56 and 3-8-56. On 7-8-56 rains were widespread in Malabar and South Kanara and scattered in Tamilnad. For three days from 8-8-1956 rains were fairly widespread in the West Coast and scattered in Tamilnad. There was a temporary break in the monsoon rains over the major part of the country on 11-8-56. For two days from 11-8-56 rains were fairly widespread in the West Coast and scattered elsewhere. On 13-8-1956 conditions became favourable for the strengthening of the monsoon along the West Coast. For three days from 13-8-1956 rains were fairly widespread in the West Coast and scattered in Tamilnad. Monsoon gained strength along and off Malabar Coast on 16-8-1956. For six days from 16-8-1956 rains were widespread in Malabar and South Kanara, fairly so in Travancore-Cochin and scattered and localised in Tamilnad. On 22-8-1956 Tamilnad had fairly widespread rains and the West Coast had only localised showers.

For two days from 23-8-1956 the weather was mainly dry in the West Coast while Tamilnad had some localised showers. On 25-8-1956 the weather became dry throughout the State. Localised thunder-showers were received in the State on 26-8-1956. Malabar and South Kanara had dry weather for three days from 27-8-1956 while showers were localised in the rest of the State. On 30-8-1956 rains were fairly widespread in Travancore-Cochin and localised in Tamilnad. On the last day of the month rains were fairly widespread in the West Coast and localised in Tamilnad.

Considering the month as a whole, rains in August, 1956 were sub-normal in the West Coast and Hills and also in the districts of North Arcot, Tanjore, Salem, Tiruchirappalli and Ramanathapuram. In other districts they were fairly above normal.

The noteworthy rainfall and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall		
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Remarks
8/8/56	Fort Cochin	3.0	North	6.5	+ 1.6 Above normal
16/8/56	Mercara	4.0	East Coast	5.2	+ 0.6 do
16/8/56	Palghat	4.0	Central	2.4	- 0.9 Below normal
22/8/56	Nagapattinam	3.0	South	2.1	+ 0.5 Above normal
30/8/56	Madras (Meenam-bakkam)	3.0	West Coast	13.8	- 6.0 Below normal
			Hills	3.9	- 1.8 do

Agricultural Meteorology Section,
 Lawley Road P. O.,
 Coimbatore, 10-9-1956

C. B. M. & M. V. J.

Departmental Notifications

Upper Subordinates — Postings and Transfers

Name and present post	Posted as
Muthukrishnan, C. R., Foreign Service,	Fruit Assistant, Coimbatore
Sundaram, N., Oddarpalayam,	Oil Seeds Assistant, Tindivanam
Srinivasan, T. R., on deputation	Chemistry Assistant, Coimbatore
Satyamurthy, C. S.,	Assistant in Mycology, Coimbatore
Thulasi Das, G., Cane Assistant, Palur,	Assistant in Botany, Coimbatore
Venkataramanan, C. R., on deputation	Chemistry Assistant, Coimbatore



Review of Market Conditions of Commercial Crops in the Areas of Market Committees for the month of July, 1956

Cotton: (In this Section: Candy = 784 lb. Pothies = 280 lb.)

Cotton Stocks: Tirupur: Lint: The Cotton Market in Tirupur started with an opening stock of 7,067 candies of Cambodia and 1,492 candies of Karunganni lint. Arrivals during the month amounted to 6,219 candies of Cambodia and 671 candies of Karunganni lint produced from ginneries. Despatches from Tirupur accounted for 5,430 candies of Cambodia and 447 candies of Karunganni which include 1,407 candies of lint sent to Travancore-Cochin State, Ahmedabad, Bombay, Calcutta and Madurai. The month closed with a stock of 7,847 candies of Cambodia and 1,716 candies of Karunganni lint.

Kapas: The kapas market in Tirupur started with an opening balance of 22,325 pothies of Cambodia 1,331 pothies of Karunganni. Arrivals during the month amounted to 12,800 pothies and 1,128 pothies of Karunganni kapas. These arrivals include 3,124 pothies of kapas received from Salem, Madurai and Tanjore. 18,611 pothies of Cambodia and 1,838 pothies of Karunganni kapas were disposed after leaving a balance of 16,154 pothies of Cambodia and 621 pothies of Karunganni kapas.

Koilpatti: Lint: The cotton market opened with a stock of 98 candies of Karunganni lint, 500 candies were received from the surrounding areas. Disposals amounted to 450 candies and leaving closing balance of 148 candies towards the close of the month.

Kapas: The kapas market started with an opening stock of 1,100 pothies of kapas. Arrivals amounted to 2,500 pothies from the surrounding villages out of which 3,000 pothies were disposed after

leaving a closing stock of 600 pothies at the end of the month. Arrivals of Uganda cotton were in full swing during the month and about 5,000 pothies were received at Sankarankoil market. Merchants from Bombay and dealers from Rajapalayam and Virudhunagar are reported to be the main buyers in the market. The market closed with a stock of 1,500 pothies.

Ramanathapuram: Lint: The Karunganni lint market in all the markets continued to be dull during the month but firm. The stock at the beginning of the month in the chief markets of Virudhunagar and Sathur markets of this district was 1,245 candies, 2,370 candies were received. 2,430 candies were disposed of after leaving a balance of 1,165 candies at the end of the month.

Kapas: The markets for Karunganni at Virudhunagar and Sathur continued to be dull and steady throughout the month with moderate arrivals and limited transactions. It is observed that nearly 5,000 pothies at Virudhunagar and 2,000 pothies at Sathur still remain unsold with the producers who are reported to be hoarding up the stock in the hope of getting better prices. The arrivals of Uganda kapas were fair and it is estimated by the trade that the production will be in the region of 15,000 to 20,000 bales during this year in Ramanathapuram district. The three markets started with an opening stock of 2,300 pothies, 16,200 pothies were arrived into the market, 16,800 pothies were disposed of after leaving a closing balance of 1,700 pothies at the end of the month.

South Arcot District: Kapas: About 32 pothies of cotton kapas were received at Villupuram market. There were no despatches at all during the month. The stock with the trade at the end of the month stood at 63 pothies.

Cotton Prices: Tirupur: Lint: The prices of Cambodia lint showed a slight decline while the Karunganni lint exhibited an upward trend due to parity of stock.

Kapas: The prices of Cambodia kapas exhibited a receding trend while the kapas of Karunganni tended to be on the gaining trend.

Koilpatti: Lint: The prices remained steady at Rs. 800 to 820 till last week of the month due to the resistance offered by the mills. The prices sputed to Rs. 830 to 860 during the last week, when the mills revived their purchases. The market closed firm since the stock left with the producers and trade is estimated only at about, 1,500 candies. Uganda lint continued to be more or less steady round about Rs. 980 to 1,000 for the uncertified quality.

Kapas: The karunganni kapas remained more or less steady fluctuating between Rs. 100 to 105 per pothi. The prices of Uganda kapas

opened at 115 to 125 per pothi continued to be steady. The prices slightly increased in last week and ruled at 120 to 130 per pothi.

Cotton Seeds: The prices of Karunganni cotton seeds continued to be firm at Rs. 37 to 39 per pothi.

Ramanathapuram: Lint: The prices of lint in all the three markets of this district continued to remain steady except in Karunganni lint where the prices revealed an increase. The opening and closing prices of different varieties of cotton lint per candy are given below:

	Opening Rates	Closing Rates
	Rate per candy	
Karunganni	... Rs. 830 to 850	Rs. 868 to 945
Tinny Karunganni	... Rs. 820 to 830	Rs. 815 to 830
Tinny	... Rs. 786 to 815	Rs. 786 to 815
Uganda Rajapalayam	... Rs. 970 to 990	Rs. 971 to 991

Kapas: More or less steady price conditions prevailed during the month within marginal limits of fluctuations. The opening and closing prices of kapas during the month were as follows:

	Rate per pothi	
	Opening rates	Closing rates
Karunganni	... Rs. 103 to 110	Rs. 106 to 110
Tinny Karunganni	... Rs. 94 to 101	Rs. 93 to 103
Tinny	... Rs. 71 to 93	Rs. 88 to 92
Uganda Rajapalayam	... Rs. 104 to 118	Rs. 108 to 122

Cotton seeds: The prices of cotton seeds for different varieties were as follows during the month.

	Opening rates	Closing rates
	Price per Std. Md.	
Karunganni	12/5 to 12/8	11/8 to 12/4
Uganda	10/- to 10/10	9/- to 9/4

South Arcot: Kapas: The prices of cotton kapas in South Arcot district ranged between Rs. 88-14-0 to 91-6-0 per pothi.

II. **Groundnut:** (In this section: Tons = 2240 lbs.
Candy = 531 lbs.
Bag = 80 lbs.)

South Arcot district: Stocks: Arrivals of Groundnuts in all the markets of the district were fair on account of accelerated harvest of

summer crop. The transactions of Groundnut that took place during this month in the district were as indicated below:

Opening balance at the beginning of the month	... 3,471 tons.
Arrivals into all the markets	... 6,380 „
Receipts from North Arcot, Salem, Tanjore } and Tiruchirapalli, districts	... 618 „
Despatches to districts like Salem, Tanjore } Madras etc.	... 2,212 „
Exports to other States	... 191 „
Consumption by local mills	... 2,787 „
Consumption by chekkus	... 244 „
Appropriate wastage	... 175 „
Closing stock at the end	... 3,471 „

Prices: The average prices of Groundnut kernels in the several markets ruled around Rs. 174 per candy in the first week and after a gradual increase in arrivals the prices declined to Rs. 165 in the last week of the month.

North Arcot district: Stocks: Arrivals were very poor due to negligible stock with the producers and traders. Off-take also went down and merchants were not keen in crushing as all of them are waiting the concession granted in the payment of oil cess. The markets opened with 1,487 tons of pods and 890 tons of kernels. Receipts during the month accounted for 89 tons of pods and 241 tons of kernels, while 417 tons of pods and 535 tons of kernels were disposed. The market closed with a balance of 1,159 tons of pods and 596 tons of kernels.

Prices: The prices of Groundnut kernels in North Arcot district have not greatly changed during the month. Prices were quoted around Rs. 160 - 165 per candy while during the same period of last year it stood around Rs. 115 - 120 per candy.

Ramanathapuram district: The markets of Ramanathapuram started with an opening stock of 500 tons of kernels alone with which 750 tons of Pods and 4,750 tons of kernels were added. Disposals amounted to 750 tons of pods and 3,950 tons of kernels leaving a closing balance of 1,300 tons of kernels alone.

The opening and closing prices of Groundnut kernels during the month were quoted at Rs. 160 - 180 and 160 - 173 respectively.

III. **Gingelly:** (In this section: Bag = 168 lb.)

South Arcot District: Arrivals into the five markets of the district amounted to 452 bags besides 222 bags held as closing balance of last month. Receipts from neighbouring districts totalled 174 bags. 587

bags were utilised for crushing. Despatches to Tanjore district amounted 105 bags after leaving a closing balance of 156 bags.

Prices: Market at Virudhachalam opening at Rs. 78 per bag and gradually improved till the middle of the month. The prices declined from third week and came down to Rs. 56/5 per bag at the end of the month as a result of increased arrivals and availability.

IV. Coconut and its products: (In this section: Cdy = 700 lb.)

Coconuts: Stocks: The arrivals were low due to rainy seasonal conditions. The transactions of coconuts in Malabar and South Kanara were as follows:

		(In thousands)			
		Opening balance	Arrivals	Disposals	Closing balance
<i>Malabar District:</i>					
Kozhikode	...	7,665	3,832	4,000	7,497
Badagara	...	818	2,600	2,814	604
Ponnani	...	Not Reported (N.R.)			
Tellicherry & Dharmadam	...	612	978	1073	517
<i>South Kanara District:</i>					
Mangalore	...	80	130	135	...

Prices: The prices continued to be low with slight fluctuation in Kozhikode market in Malabar and South Kanara districts. The maximum and minimum prices of coconuts in the markets of Malabar and South Kanara are given below.

Malabar District: (Husked, per 1000.)

	Minimum	Maximum
Kozhikode	...	Rs. 98
Badagara	...	Rs. 85
Tellicherry & Dharmadam	...	Rs. 100

South Kanara District: (per 1000 nuts.)

	Maximum	Minimum
Mangalore, Raw	Rs. 140	Rs. 115
do. Dry	Rs. 180	Rs. 135

Copra: The market arrivals were restricted due to monsoon weather. There was a good demand from Bombay and local millers.

The stock particulars of copra in Malabar and South Kanara districts are extracted below:

Market	Opening balance	Receipts	Disposals	Closing balance
<i>Malabar district: (In edys.)</i>				
Kozhikode	... 5,263	2,650	2,990	4,923
Badagara	... 650	2,000	11,845	805
<i>South Kanara District:</i>				
Mangalore (In tons)...	85	422	390	117

Prices: The prices advanced mildly due to good demand. The prices of different varieties of copra in the markets of Malabar district are extracted below.

		(Prices per candy)			
		Kozhikode		Badagara	
Variety		Minimum	Maximum	Minimum	Maximum
Office	...	Rs. 295	Rs. 290	Rs. 290	Rs. 280
Edible	...	.. 310	.. 300	.. 305	.. 300
Madras	...	.. 300	.. 300	.. 300	.. 300
Rajpur	...	.. 325	.. 320	.. 320	.. 320

The prices in Mangalore market ranged between Rs. 275 to 300 per candy.

V. Arecanuts: (In this section Bag = 100 lbs)

Stocks: Curing is in full swing in all important centres. Transactions in Raw arecanut continued to be brisk in the Regulated market at Thalakkadathur. The stock particulars of arecanut in the markets of Malabar and South Kanara district are given below:

District.	Opening balance.	Receipts	Disposals	Closing Stock.
<i>Malabar District: (In Bag 100 lb.)</i>				
Kozhikode	...	163	1,512	1,385
<i>South Kanara District:</i>				
Mangalore (in cwts.)	...	10,312	3,400	5,400
				8,312

Prices: The prices at Mangalore and Kozhikode market were more or less steady and are furnished below :

<i>Mangalore:</i> (per cwt.)		<i>Minimum</i>	<i>Maximum</i>
Koka	...	Rs. 125	Rs. 80
Choll	...	" 169	" 155
Malabar Supari	...	No stock.	
Mangalore "	...	" 172	" 145
<i>Malabar:</i> (115½ lbs.)			
Kozhikode	...	" 76.8	" 56/12

VI. Tobacco: (In this section candy = 500 lbs.)

Tirupur: Stocks: The tobacco market started with an opening of 24,330 candies of chewing tobacco and 2,500 candies of cheroot varieties. About 50 candies of chewing tobacco from Madurai and 100 candy of bidi tobacco from Bombay, Gujarat were imported. Despatches during the month amounted to 3,870 candies of chewing 600 candies of cheroot varieties made to place like Palghat, Pudukottai, Karaikudi, Aleppy, Tiruchirapalli, Kottar, Dindigul, Madurai, Chingleput, North Arcot and South Arcot.

Prices: The prices of different varieties of tobacco in Tirupur market during the month were as extracted below.

(Prices in Rs. per cdy of 500 lb.)

<i>Variety</i>	<i>I grade</i>	<i>II grade</i>	<i>III grade</i>
1. <i>Chewing Tobacco, (Sun-cured):</i>			
a. Meenampalayam	... 350 — 420	230 — 320	150 — 200
b. Other varieties	... 260 — 305	175 — 220	90 — 120
2. <i>Cheroot varieties.</i>			
Sun-cured (grown in Erode and Bhavani Taluks.)	... 280 — 340	220 — 270	110 — 155
3. <i>Chewing varieties:</i>			
Pit-cured (grown in Palladam and Sullur areas.)	... 250 — 350	175 — 250	100 — 150

Review of the Administrative Activities of the Market Committees during July 1956

All the Market Committees continued to function during the month under Section 6A of the Madras Commercial Crops Markets Act under the respective district revenue authorities except the Coimbatore Market Committee which is functioning under an elected body. Conduct of fresh elections in the other Market Committees is also being done. The stalemate in the Tirunelveli Market Committee and the Ramanathapuram Market Committee is yet to be cleared awaiting the judgment of the Supreme Court.

The following progress was made by the Market Committees in the issue of licenses under the provisions of the Madras Commercial Crops Markets Act.

	Section 5 (1)		Section 5 (3)		Weighmen		Broker	
	A	B	A	B	A	B	A	B
North Arcot Market Committee	143	882	48	578	18	350	1	7
South Arcot Market Committee	218	1393	180	1208	159	1113	1	9
Coimbatore Market Committee	87	735	76	768	49	543	—	12
Ramanathapuram Market Committee	9	29	8	28	5	5	—	—
Tirunelveli Market Committee	3	13	4	16	5	7	—	—
Malabar Market Committee	33	314	107	1328	55	280	—	5
South Kanara Market Committee	38	136	4	62	—	56	—	—

A : During the month.

B : Upto the end of the month from January.

Meetings: A meeting of the Coimbatore Market Committee was held during the month when nine subjects were discussed. Some of the resolutions passed at the meeting are extracted below :

1. The lease period of Erode yard was extended for a further period of one year from 21—8—56.

2. The Secretary was authorised to take legal action against groundnut Merchants and Groundnut Oil Mill Owners who have not paid the cess due to the Committee as per the amended act.

3. It was resolved to invest the sum of Rs. 17,100 being the amount of unexpended balance of 1955 in South Indian Bank, Ltd., Tirupur for a period of one year instead of in the Co-operative Bank Coimbatore.

Quality appraisal: The South Arcot Market Committee continued its work on the analysis of groundnut kernels marketed in

that district. During the month 172 samples were drawn and analysed in five markets from out of arrivals of 39,903 bags of groundnut kernels in 3,125 lots. The total common refraction was below 4% in 171 samples — 5 to 8% in one sample. Damages were below 2% in 126 samples while it was above 2% and within 4% in 21 samples and above 4% in 25 samples. The details of such analysis are extracted below :

Particulars	Cuddalore	Villupuram	Tirukoilur	Virudhachalam	Panruti
1. Dryage:					
2% and below	.. —	1	3	44	1
above 2% and upto 3%	.. 3	—	2	8	—
above 3% and upto 4%	.. 1	1	4	3	2
above 4% and upto 5%	.. 2	4	4	3	1
above 5% and upto 10%	.. 10	11	10	—	10
above 10%	.. 1	—	—	—	24
2. Total common refraction:					
4% and below	.. 13	1	11	51	33
above 4% and upto 8%	.. 14	—	11	7	5
above 8%	.. 2	18	1	—	—

Quality competition: The particulars of entries secured by the South Arcot Market Committee for summer crop quality competition which commenced on 1—6—56 are furnished below :

During the month	86
Upto the month from 1—6—1956	106

Crop and Trade Reports

Varagu — Madras State — 1955-'56 — Third or Final Forecast: The area sown with varagu (*Paspalum Scrobiculatum*) in the Madras State in 1955-'56 is estimated at 837,800 acres. Compared with the provisional area of 849,000 acres in the previous year according to the Season and Crop Report, the current year's estimate is a decrease by 1.3 per cent. Compared with the average area of 735,400 acres calculated for the five years ended 1954-'55, the present estimate is an increase of 13.9 per cent. The crop is grown on a negligible extent in the Nilgiris district and is not grown in South Kanara district. Compared with the previous year, an increase in area is estimated in the current year in the districts of South Arcot, North Arcot, Salem, Coimbatore and Tanjore and a decrease in area in the other districts, except Malabar where the area estimated is the same as that of last year.

The bulk of the crop has been harvested. The yield per acre of kharif crop is estimated to be normal in Chingleput and South Arcot districts and below normal in the other districts of the State. The yield per acre of rabi crop is estimated to be below normal in all the districts of the State. The condition factors for the State as a whole work out to 93 percent of normal for the Kharif crop and 95 percent for the Rabi crop as against 98 percent and 94 percent respectively in the previous year. The total yield of both Kharif and Rabi crops works out to 338,100 tons of unhusked grain or 202,900 tons of cleaned grain. Compared with the provisional estimate of 354,900 tons of unhusked grain or 212,900 tons of cleaned grain according to the Season and Crop Report for the previous year, the current year's estimate shows a decrease of 4.7 percent. The present estimate shows an increase of 20.4 percent as compared with the average production of 280,900 tons of unhusked grain or 168,500 tons of cleaned grain calculated for the five years ended 1954-'55.

Cotton - 1955-'56 - Fifth and Final Forest Report - Madras State: The area under cotton in year for 1955-'56 for the Madras State is estimated at 978,500 acres. Compared with the estimated area of 871,700 acres for the previous year and an average area of 816,800 acres calculated for the five years ending with 1954-'55, this is an increase of 12.3 per cent respectively. An increase in area is estimated in all the districts of the State except in Chingleput, South Kanara and the Nilgiris. A decrease in area is estimated in the district of Chingleput. The area estimated is the same as that of last year in South Kanara district and the area in the Nilgiris district is little or negligible.

Picking of cotton is in progress. The crop was affected by inadequate rains in Salem district. The crop was affected by cyclone in Ramanathapuram district. Withering of crop was reported from parts of Salem district. The crop was affected by pest in parts of Coimbatore and Tirunelveli district. The condition of the crop in other districts was generally satisfactory. The seasonal factor for the State as a whole works out to 86 per cent of the normal as against 92 per cent for the previous year. On this basis the total yield works out to 300,000 bales of 392 lbs. lint as against 270,500 bales of 392 lbs. lint for the previous year and an average yield of 254,900 bales for the five years ending with 1954-'55, representing an increase of 10.9 per cent and 17.7 per cent respectively. It is however too early to estimate the yield with accuracy as much will depend upon the future weather conditions and their effect on the crop.

The estimated area and yield of cotton by varieties in the current year together with the corresponding figures for the previous year are given below :

VARIETY	Area in "00" Acres		Yield in "00" bales of 392 lbs. lint	
	1955-'56	1954-'55	1955-'56	1954-'55
Madras American } Irrigated	1,780	1,101	1,153	729
Cambodia } Unirrigated	1,582	1,047	385	279
Madras American } Irrigated	336	477	190	310
Cambodia (Uganda) } Unirrigated	465	758	106	188
Total Cambodia	4,163	3,383	1,834	1,515
Uppum (including Nadam and Bourban)	708	646	106	104
Karunganni	4,069	3,613	859	821
Karunganni (Ordinary)	845	1,075	201	255
Total	4,914	4,688	1,060	1,085
Grand Total	9,785	8,717	3,000	2,705

Korra - Madras State - 1955-'56 - Third or Final Forecast: The area sown with korra or tenai (*Setaria Italica*) in the Madras State in 1955-'56 is estimated at 85,100 acres. Compared with the provisional area of 82,100 acres in the previous year according to the season and crop report, the current year's estimate shows an increase of 3.7 per cent. Compared with the average area of 90,400 acres calculated for the five years ended 1954-'55, the present estimate is a decrease by 5.9 per cent. The crop is not grown in South Kanara district. The area estimated is the same as that for the previous year in the districts of North Arcot, Tanjore, Tirunelveli and the Nilgiris. An increase in area is estimated in the districts of South Arcot, Coimbatore, Madurai, Ramanathapuram and Malabar and a decrease in area in the other districts viz., Chingleput, Salem and Tiruchirapalli.

The bulk of the crop has been harvested. The yield per acre of kharif crop is estimated to be normal in South Arcot and Tirunelveli districts, and below normal in the other districts of the State. The yield per acre of rabi crop is estimated to be below normal in all the districts of the State. The condition factor for both kharif and rabi crops for the State as a whole works out to 95 per cent of the normal, as against 96 per cent for the kharif crop and 93 per cent for the rabi crop in the previous year. The total yield of both kharif and rabi crops works out to 26,300 tons of unhusked grain or 21,000 tons of cleaned grain. Compared with the provisional estimate of 25,400 tons of unhusked grain or 20,300 tons of cleaned grain according to the season and crop report for the previous year, the current year's estimate shows an increase of 3.5 per cent. The present estimate is an increase of 8.7 per cent as compared with the average

production of 24,200 tons of unhusked grain or 19,400 tons of cleaned grain calculated for the five years ended 1954-'55.

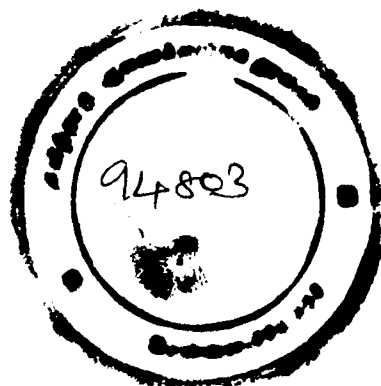
Sugarcane—Fourth and Final Forecast Report—1955-'56 Madras State: The area under sugarcane in Madras State during 1955-'56 is estimated at 1,30,900 acres (1,14,790 acres under planted crop and 16,110 acres under ratoon crop). Compared with the finally recorded area of 1,34,630 acres (1,19,700 acres under planted crop and 14,870 acres under ratoon crop) for the previous year, this is a decrease of 2.8 per cent. Compared with the average area of 1,08,200 acres calculated for the previous five years ending 1954-'55, the present estimate is an increase of 21.0 per cent. A decrease in area is estimated in the districts of South Arcot, Salem, Coimbatore, Madurai, Ramanathapuram, Tirunelveli and Malabar and an increase in the other districts of the State except Chingleput and the Nilgiris. The acreage under the crop in Chingleput district is the same as that of last year and the area in the Nilgiris district is little or negligible. The seasonal factor for the State as a whole works out to 94 per cent of the normal as against 96 per cent of the normal estimated for the previous year. On this basis, the total yield works out to 33,18,590 tons of cane, the gur equivalent of which is 3,61,960 as against 3,512,150 tons of cane with a gur equivalent of 3,83,880 tons estimated for the previous year representing an increase of 5.7 per cent. Compared with a average yield of 26,46,120 tons of cane with a gur equivalent of 2,90,259 tons calculated for the previous five years ending with 1954-'55, the present estimate shows an increase of 24.7 per cent.

Tobacco—Third and Final Forecast Report—1955-'56— Madras State: The area sown with tobacco in the Madras State in 1955-'56 is estimated at 45,400 acres. Compared with the actual area of 43,300 acres for the previous year and the average area of 44,500 acres calculated for the previous five years ending with 1954-'55, the present estimate shows an increase of 4.8 per cent respectively. An increase in area is estimated in all the districts of the State in Chingleput, North Arcot, Salem, Tanjore, Madurai, Tirunelveli and the Nilgiri districts. In North Arcot, Salem, Tanjore and Tirunelveli districts the area under the crop is the same as in last year.

The crop has been harvested or is being harvested in parts of the State. The seasonal factor for the State as a whole works out to 92 per cent of the normal for *Nicotiana Rustica*, 91 per cent of the normal for Virginia variety of *Nicotiana* *Tobacum* and 90 per cent of the normal for all other types of *Nicotiana* *Tobacum* as against 94, 93 and 91 per cent of the normals respectively estimated for the previous year. On this basis the total yield works out to 24,300 tons of cured leaf as against 23,000 tons of cured leaf estimated for the previous year representing an increase of 5.7 per cent. Compared within the average yield of 20,200 tons calculated for the five years ending with 1954-'55, the present estimate is an increase of 20.3 per cent.

Samai crop — Third and Final Report — 1955-'56 — Madras State: The area sown with Samai (*Panicum Miliare*) in the Madras State in 1955-'56 is estimated at 5,38,800 acres under the crop in the previous year, the current year's estimate is a decrease of 3.4 per cent. It however, shows an increase of 6.5 per cent over the average area of 5,05,700 acres estimated for the five years ended 1954-'55. The area estimated is the same as that of the previous year in the districts of Tanjore and South Kanara. An increase in area is estimated in the districts of Coimbatore, Tirunelveli and the Nilgiris and a decrease in the other districts of the State.

The crop has been or is being harvested in most districts. The yield per acre in respect of the kharif crop is estimated to be normal in the districts of South Arcot, Malabar, South Kanara and the Nilgiris and that of the Rabi crop in the Nilgiris district. In the other districts, the yield per acre is expected to be below normal. The seasonal factor for the kharif crop for the State as a whole works out to 95 per cent of the normal and that of the Rabi crop to 92 per cent as against 96 per cent for the kharif crop and 98 per cent for the Rabi crop in the previous year. On this basis, the total yield works out to 99,000 tons of unhusked grain or 54,500 tons in terms of cleaned grain. This shows a decrease of 4.6 per cent when compared with 103,800 tons of unhusked grain or 57,100 tons in terms of cleaned grains estimated for the previous year and an increase of 19.9 per cent over the average production of 82,600 tons of unhusked grain or 4,400 ton in respect of cleaned grain for the five years ended 1954-'55.



The Madras Agricultural Students' Union.

PATRONS.

1. Dewan Bahadur C. Arunachala Mudaliar, Zamindar of Chunampet
2. Raja Sri Krishnachandra Gajapathi Narayana Dev, Maharaja of Parlakimidi
3. Sri V. C. Palaniswami Gounder, M. L. A., Vellaikinar, Coimbatore
4. Sri C. P. Ramaswami Ayyar, Ootacamund
5. Sri R. Jeevandass, Varnasi, Parlakimidi
6. G. R. Hilson Esq., Norwich, England
7. Sri Ramachandra Ananga Bhima Dev, Kesari Gajapathi, Raja Saheb of Budokhemidi, Berhampore, Ganjam
8. Rao Bahadur K. T. Alwa, Mangalore
9. Sri Gurdial Singh Sidhur, C/o Sri S. Sant Singh Sidhu, Algom Khurd, Lahore
10. Sri R. K. Kandaswamy, "Brindavan", Tiruchi Road, Coimbatore
11. " G. D. Naidu, "Gopal Bagh", Avanashi Road, Coimbatore
12. " K. Thiruvengkata Mudaliar, Munniyur, Andankarai P. O., (Via) Alattambadi, S. R.
13. " S. Ramamurthy Iyer of Kunnam, Land-Holder and Secretary, South Rajan Mirasdars' Association, "Vibrajee", Alangad
14. " P. G. Karuthiruman, M. L. A., Nanjai Puliampatti, Thukkanaickanpalayam, (Via) Anthiyur
15. " K. Venkataswami Naidu, B. A., B. L., Gopalapuram, Coimbatore
16. " C. V. Bashyam, "Dharma Vilas", College Road, Coimbatore
17. " V. C. Subbaiya Gounder, Gnanambika Mills P. O., Coimbatore
18. " M. S. Palaniappa Mudaliar, 125, Rajah Street, Coimbatore
19. " A. K. D. Balaramaraju, Land-Lord, Rajapalayam
20. " N. S. Vydianatha Iyer, Sengalipuram, (Via) Kodavasal, Tanjore
21. " K. P. Amrithanatha Iyer, President, Co-operative Union Ltd., Ambalapuzha Taluk, Monkompur P. O., T. C. State
22. " M. Subba Reddy B. Sc., (Ag.) Mango Range, P. O. Nilgiris
23. " M. R. Balakrishnan, F. A. O., Irrigation Agronomist, Thailand
24. " S. Raja Iyengar, Landlord and Agriculturist, Madurai
25. " K. Rangachari, Landlord, 16, Old Munsiff's Court Street, Saidapet, Vellore
26. " R. Ramakrishna Naidu, Palamalai Ranganathar Mills, Perianaickanpalayam
27. " C. M. John, Agricultural Advisor, The Potash Scheme, India, 10, Kilpauk Garden Road, Madras - 10
28. " S. N. Venkataraman, 33, Third Main Road, Gandhinagar, Madras - 20
29. " Dr. T. S. Sadasivan, Director, Botany Laboratory, Madras University, Triplicane, Madras
30. " W. P. A. Soundira Pandian, Pattiveeranpatti, Batlagundu P. O., (Via) Kodai Road.

OFFICE-BEARERS FOR 1955-'56.

Dr. K. C. Naik, President (ex-officio)
 Dr. A. Mariakulandai, Resident Vice-President
 T. R. Narayanan, Editor
 J. Saktharam Rao, Secretary

Council (16 Members)

President
 Resident Vice-President
 Editor
 Secretary

Mofussil Vice-Presidents

S. N. Venkataraman
 K. Varadaachari
 K. Sanjeeva Shetty

Mofussil Members

Mayandi Pillai
 Santhanakrishna Naidu
 K. Hanumantha Rao
 N. S. Rajagopal
 K. C. Thomas

Resident Members

M. A. Sankara Iyer
 Obeidulla Shah
 G. Ramanathan (Student)
 P. Kandaswamy Gounder, Secretary, Students' Club (ex-officio)

Managing Committee (10 Members)

Resident Vice-President
 Editor
 Secretary
 P. Madhava Menon (Manager)
 K. Shivarama Shetty (Treasurer)
 S. G. Aiyadurai Member
 C. Balasubramaniam "
 P. C. Sahadevan "
 T. S. Theetharappan (Student)
 P. Kandaswamy Gounder, Secretary, Students' Club (ex-officio)

Editorial Board (8 Members)

Editor
 Secretary
 Manager
 A. H. S. Sarma Member
 Dr. N. Krishnaswami "
 T. Natarajan "
 G. A. Sivaram (Student) "
 P. Kandaswamy Gounder, Secretary, Students' Club (ex-officio)


FAVRE-LEUBA
 AND COMPANY PRIVATE LIMITED
 P. O. Box 845 BOMBAY ★ P. O. Box 474 CALCUTTA ★ P. O. Box 2016 DELHI

[illegible]