The Madras Agricultural Journal

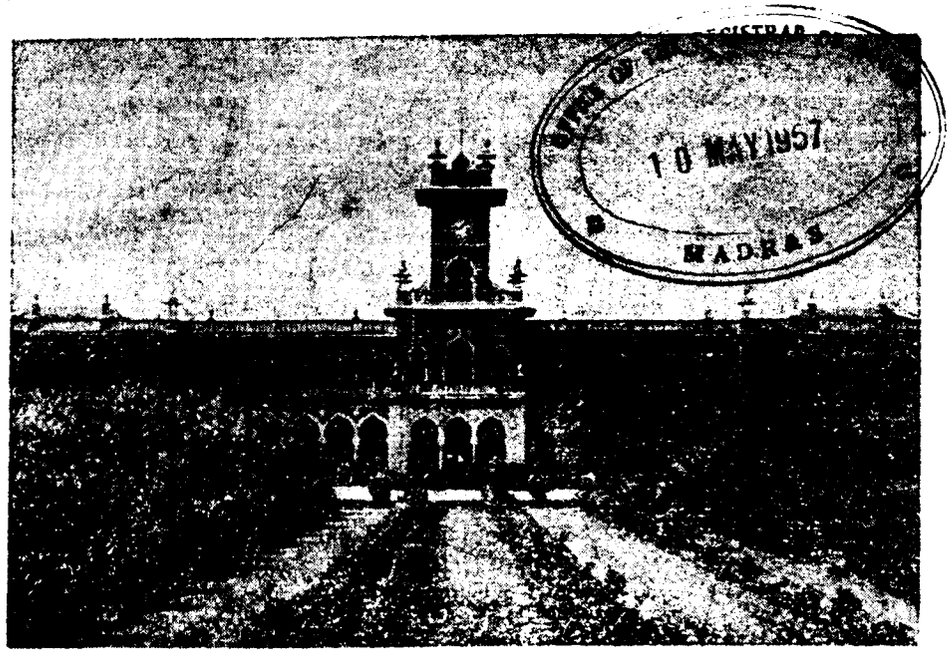
1957. March

VOL. 44. NO. 3.

Regd. No. M. 5155

Madras Agricultural Journal

Vol. XLIV March 1957 No. 3



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

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

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 Re. 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.

N. B.— 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.

The Madras Agricultural Journal

Vol. XLIV MARCH 1957 No. 3

CONTENTS

The Madras Agricultural Journal

Vol. XLIV March 1957 No. 3

Editorial

The University Education Commission as early as 1948 conceived the idea of a Rural University with a broadbased educational plan to train the much-needed personnel to meet the requirements of the rural population; to interconnect agriculture, industry and the "liberal" professions in the economic and social sphere of the villages. Indian economy is based primarily on agriculture and the future development of the country in the economic and social field is dependent on programmes to create proper leadership among the rural population and their training in modern agricultural technology, livestock improvment, public health and the home sciences. All these aspects of rural life are so closely inter-related that lasting benefits could accrue only by co-ordinated action, as epitomised in the National Extension Schemes and Community Projects programme.

One of the most important functions of the Rural University is to train men and women to function as efficient units in the great task of improving the standard of living of the rural masses. The idea is to provide a comprehensive type of education with special emphasis on agriculture and the allied sciences. It was the Commission's view that a new beginning was desirable with freedom to create a distinctive tradition as to purpose, spirit and methods. The University is to be entirely rural in its setting and bias and is to devote attention to all the three aspects of teaching, research and extension.

The conception of a Rural University at once brings to mind Coimbatore with its great traditions and excellent facilities as an obvious choice for its location. Coimbatore was chosen as an ideal location for the oldest Agricultural

College, and Research Institute in India. Fortunately we have here, almost in the same campus contiguous to each other, an Agricultural College, a College of Technology, and a Forest College. A College of Home Science is also to be shortly commenced from the next academic year. The College Farm and the Breeding Stations constitute the largest single block of land, which is the pride of the Coimbatore Agricultural College for the great traditions established in the field of Agricultural Research; unpargallelled by any other institution in India. It is but proper that it should be the venue for the location of the first Rural University.

We look forward to the day soon when the Rural University would be established in the most befitting rural sorroundings of the Agricultural College at Coimbatore, so that it would make itself the centre where our men and the women of the farms shall find light, inspiration and guidance in all aspects of their struggle for better living and a happier life.

Studies on Weed control by Herbicides: Observations on the phytocidal action of chemical herbicides on some weeds in Madras State

by

T. R. NARAYANAN AND D. MEENAKSHISUNDARAM

Agricultural College & Research Institute, Coimbatore

Introduction: That growth-regulating substances have found wide use in the field of agriculture as weedkillers in recent years, revolutionising the method of eradication of weeds is too well known to need emphasis. Among the synthetic hormones, derivatives of phenoxyacetic acid such as 2, 4-D (2,4-Dichloro-phenoxy acetic acid), MCPA (2-methyl 4-chloro phenoxyacetic acid) and 2,4,5-T (2,4,5-Trichloro phenoxy acetic acid) have proved to be the most effective. Commercial preparations of these are available in various forms such as acids, mineral salts, organic salts or amines and esters under different trade names. Against broad-leaved weeds 2, 4-D and MCPA are the most commonly used hormone weedicides. There is no great difference between these two chemicals in their biological activity. 2, 4, 5-T is also closely allied to 2, 4-D and has been found very effective in killing shrubby weeds and woody plants. It finds use also as an arboricide for killing trees and tree stumps.

Other chemicals that have gained ground as weedicides are PCP, (Pentachlorophenol), TCA, (Trichloracetic acid), IPPC, (Isopropyl N–phenyl carbamate), DNOC, (Dinitro–Ortho Cresol), Ammonium sulphamate, NIX (Sodium isopropyl xanthate), Sulfosan (Ethyl xanthogen disulphide), MH (Maleic hydrazide) and many others. DNOC is only a contact herbicide and is not translocated in plants. Ammonium sulphamate is said to be translocated in certain perennial species, particularly shrubby ones, in addition to its having a contact action. IPPC is found to be a specific toxicant on certain grasses. It acts through the soil on plant roots and is ineffective as a foliage spray. It is said to be of much promise as a herbicide to control annual grasses in clover and alfalfa fields (Robbins *et al*, 1952). TCA and MH are specifically used to control certain perennial grasses. A few others like NIX, Sulfosan and Sodium 2, 4-Dichloro-phenoxy-ethyl-sulphate (Crag Herbicide I) are best used as pre-emergence herbicides.

The action of these chemicals, inclusive of the hormone type weedicides, on different weeds has been studied by various workers all over the world. Harvey and Robbins (1947) have published lists

of weeds susceptible or resistant to 2,4-D in the United States of America. Nickell (1953) has compiled in a tabular form, all the material published from 1947 to 1951 with the treatments to be given for the control of 454 weeds. Padwick (1948) was the first to study the responses of a few weeds to hormone weedkillers under Indian conditions. Thomas and Srinivasan (1949) studied the effect of MCPA on many weeds, which they classified as resistant or susceptible. Kumar and his associates (1949) described the responses of 43 species to 2,4-D and MCPA treatment. Venkatratnam (1950) discussing the scope for herbicides in South India mentioned the crop plants that are affected by these. Kumar and Solomon (1952) mentioned the weeds of Bombay State that are readily killed by 2,4-D treatment. Ramgopal (1955) has compiled a list of weeds commonly found in India, which can be controlled by chemical means. In Madras State, a number of chemical herbicides were tried on many roadside and wasteland weeds as well as a few important weeds of cultivated lands and the observations recorded on the effects of the weedicides are summarised in this paper with the belief that this will add to the information already available on the chemical control of weeds in India.

Herbicides used in the trials : The details of the different herbicides that were tried on the various weeds are as follows :

Name of the weedicide	Name of the chemical present	Cost of the weedicide	Cost of weedicide equivalent to a pound of acid
1. Sodium salt of 2, 4—D (BCPW)	Sodium salt of 2, 4—D	Rs. 9—4—0 per lb.	
2. 2, 4—D Weedkiller	Amine salt of 2, 4—D	Rs. 17—8—0 per Gal.	Rs. 9—4—0
3. Butyl Ester—40	Butyl ester of 2, 4—D	Rs. 17—0—0 per Gal.	Rs. 6—0—0
4. Ester—44 Weedkiller	Isopropyl ester of 2, 4—D	Rs. 18—6—0 per Gal.	Rs. 18-12—0
5. Agroxone—3	Sodium salt of M. C. P. A.	Rs. 32—0—0 per Gal.	Rs. 7—9—8
6. 2, 4, 5—T Ester—43	Isopropyl ester of 2, 4, 5—T	Rs. 53—15—0 per Gal.	Rs. 10-10—6
7. Brush Weedkiller No. 22	Mixture of esters of 2. 4—D & 2, 4, 5—T	Rs 36—8—0 per Gal.	Rs. 21-12—9
8. Extar 'A'	Dinitro-ortho-cresol	Rs. 2—6—6 per lb.	Rs. 12—4—9
9. Triherbide—NIX	Sodium isopropyl Xanthate	Rs. 3. 2—0 per lb.	..
10. Sodium P.C.P.	Sodium penta-chlorophenate	Rs. 2—0—5 per lb.	..
11. Sodium salt of TCA.	Sodium salt of trichloracetic acid	Rs. 2—9—1 per lb.	..
12. Maleic Hydrazide	Maleic hydrazide	Rs. 90—7—0 per lb.	Rs. 2-13—6
			..

The above chemicals at the dosage given, were applied on weeds at a spray volume of 100 gallons per acre, using Teepol as a wetting agent.

Effect of herbicides on few troublesome weeds : The results of the trials on eradication of some of the most troublesome weeds of cultivated lands, such as *Cynodon dactylon*, *Cyperus rotundus*, *Trianthema portulacastrum* and *Aristolochia bracteata* are briefly discussed in the following paragraphs.

Cynodon dactylon : TCA and PCP even at such high dosages as 10 and 20 pounds per acre did not prove to be useful because they had only a very temporary scorching effect and there was complete regeneration of the grass within two weeks. Extar 'A' at 8 lb in 100 gallons of water per acre was not at all effective. A spray of 2, 4-D at 10 lb. and 20 lb. rate, mixed with 50 gallons of diesel oil per acre killed the aerial portions completely and prevented regrowth for a period of six to seven weeks. The isopropyl ester of 2,4-D at 2½ lb. along with 50 gallons of diesel oil per acre kept the field free of regrowths for about a month. A mixture of 2,4-D and MCPA in the form of their sodium salts at 5 and 10 lb. rates with five gallons of diesel oil per acre killed off the grass in about a fortnight under wetland conditions and regeneration was very sparse.

Cyperus rotundus : Treatments with Sodium pentachlorophenate, TCA and Extar 'A' were not effective beyond an initial scorching of aerial portions from which the plants recovered. All formulations of 2,4—D that were tried on this weed brought about a complete kill of the aerial portions within a week after application. A mixture of sodium salts of 2,4—D and MCPA at 5 lb. each per acre was very effective in killing this species and keeping the field free from regrowths for about three months under dryland conditions.

Trianthema portulacastrum : A dose of 4 lb. per acre of 2,4-D in the form of Sodium salt, or amine salt or ester and MCPA as Sodium salt was able to kill off this weed. The esters could effect the kill in seven days while other formulations required about 15 days. This weed was very easily killed in the seedling stage by herbicidal applications.

Aristolochia bracteata : A cent per cent kill was obtained when this species was sprayed with (1) Sodium salt of 2,4—D or MCPA at 5 lb. per acre (2) 2,4,5—T ester at one per cent concentration and (3) a combination of Sodium salts of 2,4—D and MCPA at 5 lb. each per acre. Under field conditions, regrowths from the underground parts were observed to some extent within a month of treatment, necessitating repeated spray applications. Soil applications

of TCA and IPC at 20 lb. per acre, after clipping off the aerial portions. did not have any inhibitory effect on the regeneration of the weed.

Effect of weedicides on different weeds

(Observations recorded)

Scientific Name of Weed	Chemical herbicides tried	Dose per acre in lb. (Acid equivalent) or % concentration	Effect
Abutilon Indicum (Malvaceae)	Sodium 2, 4-D	5 lb.	Completely killed in a week
Acanthospermum hispidum (Compositae)	Sodium M.C.P.A.	2 lb.	Killed within 20 days
	Amine 2, 4-D	2 lb.	
	Extar 'A' (DNOC)	8 lb.	Dried up in 7 days
	Triherbide NIX	8 lb.	Dried up in 2 days
Achyranthes aspera (Amarantaceae)	Sodium 2, 4-D	5 lb.	Killed in a Week's time
Aloe vera (Liliaceae)	2, 4, 5-T Ester	5 lb.	Only a temporary scorching
Alternanthera echinata (Amarantaceae)	Sodium MCPA	2½ lb.	Effective kill in 20 days
Amarantus viridis (Amarantaceae)	2, 4 - D Ester	5 lb.	Killed in 7 days
	Extar - A	8 lb.	Only a temporary scorching
Ammania baccifera (Lythraceae)	Sodium 2, 4-D	5 lb.	Complete kill in a week
Argemone mexicana (Papaveraceae)	Sodium 2, 4-D	5 lb.	Killed in a week to 15 days
Aristolochia bracteata (Aristolochiaceae)	Sodium 2, 4-D	5 lb.	Aerial portions completely dried up in 2 days
	Mixture of Na2, 4-D & MCPA.	5 lb.	
Asteracantha longifolia (Acanthaceae)	Sodium 2, 4-D	5 lb.	Killed in a week to 15 days
Azima tetracantha (Salvadoraceae)	Sodium 2, 4-D, 2-4-5 T ester	5 lb.	Scorching of foliage in 20 days
Bidens pilosa (Compositae)	Sodium 2, 4-D	5 lb.	Complete kill in 7 days
Calotropis gigantea (Asclepiadaceae)	Sodium MCPA	2 %	Dried up in a week
	Amine 2, 4-D	2 %	
Blepharis molluginifolia (Acanthaceae)	Triherbide NIX	8 lb.	Complete kill in 7 days
Cardiospermum helicacabrum (Sapindaceae)	Amine 2, 4-D	1%	Killed in 7 days
Capparis zeylanica Capparis stylosa (Capparidaceae)	2, 4, 5-T ester	5 lb.	Complete kill in 30 days
Celosia polygonoides (Amarantaceae)	Triherbide NIX	8 lb.	Complete kill in 7 days
Centella asiatica (Umbelliferae)	Amine 2, 4-D	1%	Complete kill in 7 days
Commelina forskalei (Commelinaceae)	Extar 'A'	8 lb.	Only temporary scorching
Corchorus trilocularis (Tiliaceae)	Amine 2, 4-D	3 lb.	Epinasty and swelling of stem tips in 7 days

Scientific Name of Weed	Chemical herbicides tried	Dose per acre in lb. (Acid equivalent) or % concentration	Effect
Cyanotis axillaris (Commelinaceae)	Isopropyl ester of 2, 4-D & 2, 4, 5-T	2%	Killed in about 10 days
Cytisus scoparius (Leguminosae)	Brush killer	5 lb.	Effective kill secured in 80 days
Datura fastuosa (Solanaceae)	Sodium 2, 4-D	5 lb.	Killed in a week to 15 days
Digera arvensis (Amarantaceae)	Sodium MCPA	2%	Dried up in 10 days
	Sodium 2, 4-D	2%	,, ,, 15 days
	2, 4-D ester	2%	,, ,, 6 days
Eupatorium glandulosum (Compositae)	2, 4, 5-T ester	5 lb.	Not killed, resistant, Mortality very slow
	Brush kilier	5 lb.	
Euphorbia geniculata (Euphorbiaceae)	Sodium 2, 4-D	5 lb.	Killed in a week
Flaveria australasica (Compositae)	Sodium 2, 4—D Sodium MCPA	5%	Dried up in about 7 days
Gynandropsis pentaphylla (Capparidaceae)	Extar 'A'	8 lb.	Complete kill in 15 days
Helichrysum bracteatum (Compositae)	Brush killer	5 lb.	Effective kill in 80 days
Ipomoea sepiaria (Convolvulaceae)	Amine 2, 4—D	2%	Dried up in a week
Justicia tranquebarensis (Acanthaceae)	2, 4, 5—T ester	5 lb.	Only partial scorching
Lagasca mollis (Compositae)	Amine 2, 4—D	1%	Killed in a fortnight
Leucas urticaefolia (Labiatae)	Triherbide NIX	8 lb.	Very good kill in seven days
Lippia nodiflora (Verbenaceae)	Sodium MCPA	3 lb.	Killed in about two weeks
	Sodium 2, 4—D		
	2, 4—D ester		
Malvastrum coromandelianum (Malvaceae)	Isopropyl ester 2, 4—D	10 lb.	Killed in about a month
Millingtonia hortensis (Shrubby growth from roots) (Bignoniaceae)	Butyl ester of 2, 4—D	10 lb.	Dried up in about a fortnight and no regrowths up to 8 months
Mollugo cerviana (Aizoaceae)	Isopropyl ester of 2, 4—D	5 lb.	Completely killed in a week
	Extar 'A'	8 lb.	
Morinda tinctoria (Shrubby growths) (Rubiaceae)	Isopropyl ester of 2, 4—D	10 lb.	Fully dried up in 30 days
Orthosiphon glabratus (Labiatae)	Sodium 2, 4—D	5 lb.	Killed in a week
Oxalis latifolia (Geraniaceae)	Butyl ester of 2, 4—D	5 lb.	Aerial parts killed in a week
	Extar 'A'	8 lb.	
Portulaca quadrifida (Portulacaceae)	Amine 2, 4—D	10 lb.	Killed within a week
	Extar 'A'	8 lb.	Dried up in 2 weeks
Ruellia prostrata (Acanthaceae)	Sodium 2, 4—D	5 lb.	Killed in a week to 15 days

Scientific Name of Weed	Chemical herbicides tried	Dose per acre in lb. (Acid equivalent) or % concentration	Effect
Solanum olaeagnifolium (Solanaceae)	Isopropyl ester of 2, 4—D	10 lb.	Dried up in 15 days but spraying is to be repeated after three months
Sonchus oleraceus (Compositae)	Sodium MCPA	2%	Dried in a week
Spergula arvensis (Caryophyllaceae)	Triherbide NIX Extar 'A'	8 lb.	Complete kill in a week
Sphaeranthus indicus (Compositae)	Sodium 2, 4-D	5 lb.	Killed in a week to 15 days
Stachytarpheta indica (Verbenaceae)	Sodium MCPA	1%	Dried up in 10 days
Stemodia viscosa (Scrophulariaceae)	Sodium 2, 4-D	5 lb.	Completely killed in 7 to 15 days
Tragia cannabina (Euphorbiaceae)	Sodium 2, 4-D	5 lb.	Satisfactory kill
Trianthema decandra (Aizoaceae)	Extar 'A'	8 lb.	Only temporary scorching
Trianthema portulacastrum (Aizoaceae)	Sodium 2, 4-D Sodium MCPA	4 lb. 4 lb.	Killed in 15 days
	Isopropyl ester of 2, 4-D	4 lb.	Killed in 7 days
Tribulus terrestris (Zygophyllaceae)	Extar 'A'	8 lb.	Dried up within 15 days
Wedelia calendulacea (Compositae)	Sodium MCPA	1%	Dried up in a week to 10 days

Discussion: Of the various herbicides tried, 2.4–D and MCPA have been found to be very effective in killing many of the herbaceous broad-leaved weeds. Though a minimum dose of two pounds acid equivalent of the herbicide per acre is quite sufficient, a higher dose of 5 pounds also gives the same result but within a much shorter time. Thus with a lower dose of the chemical, the time taken to effect a complete kill is more. Further, the nature of the stems and leaves also decides the efficacy of the weedicides as well as the dosage required for a complete kill of the weed. To cite an example, *Portulaca oleracea*, a gardenland weed with fairly broad leaves and herbaceous stems could be killed by spraying 2,4-D at $2\frac{1}{2}$ lb. per acre while for *Portulaca quadrifida*, a creeping herbaceous weed with small, thick and succulent leaves and thin stems, 5 to 10 lb. per acre were required to give the same result. The stage of growth of the weeds is also an important factor in the chemical method of weed control. In general, weeds in the seedling stage when they are vigorously growing, are the most susceptible to hormone weedicides. This is because of the fact that the spray can more easily penetrate the leaf surfaces of young plants than those of older plants.

Even among the various formulations of 2,4-D there are differences in phytocidal effect. The esters are the most effective as they are capable of quick penetration of the foliage while the amine salt and sodium salt are comparatively slow in their action. The sodium salt of 2,4-D and 2,4-D ester when sprayed on *Digera arvensis*, a very common Amarantaceous weed in the garden lands, at 2 percent concentration killed the weed in 12 days and 6 days respectively. It was also observed that *Trianthema portulacastrum* was killed in 15 days when sprayed with sodium 2,4-D at 4 lb. per acre while the isopropyl ester at the same dose took only 7 days to kill it. With pernicious perennial weeds with deep, creeping roots, rhizomes or stolons which serve as efficient organs of vegetative reproduction, complete eradication is a difficult problem. The more important weeds under this category, are *Cyperus rotundus*, *Cynodon dactylon* and *Aristolochia bracteata*. The various well-known mechanical methods of weed control are helpful only to some extent. at the same time being costly and laborious. Spraying of chemicals, especially of the hormone type, translocated herbicides, is of much promise in this regard. Although the aerial parts of these weeds can be readily destroyed by weedicide sprays, the underground parts are not effectively and completely killed. Until and unless all the vestiges of the underground system are killed, complete freedom from the menace of these weeds cannot be achieved. Further, the nature and extent of the underground parts of such weeds vary with different species and decide to a large extent, the degree of control by chemical herbicides. In the case of *Cyperus rotundus*, the first rhizome is easily killed and the viability of the second rhizomes is affected slightly by herbicidal sprays of 2,4-D while those in the deeper layers of the soil are least affected and they give rise to fresh growths after some time. Puttarudriah (1956) experimenting with a few herbicides on this weed, reports that there is relief only for about four months in the plots sprayed with Kathon M-7 (Amine 2,4-D). Phenoxylene (Sodium MCPA) and Hedonal (sodium salt of 2,4-D) in order of their merit. This is almost in conformity with the finding at Coimbatore that spraying of a mixture of sodium salts of 2,4-D and MCPA at 5 lb. each per acre was helpful in keeping the field free from regrowths for a period of three months. Similarly with *Cynodon dactylon* and *Aristolochia bracteata*, only temporary relief could be acheived with herbicidal sprays and repeated sprayings were found necessary. Thus it appears, that it will be desirable to have a combination of cultural and herbicidal methods of control for these weeds. By suitable tillage operations we can aim at the destruction of the

underground parts that are left undamaged by herbicidal applications and in the course of one or two seasons, the weed population can be very much reduced.

Summary: Over a dozen chemical herbicides were tried on a total of 53 weeds and few important weeds of cultivated lands in and round about Coimbatore and the observations recorded are briefly summarised.

Many of the common dicotyledonous weeds of wastelands could be easily killed by a single spraying of 2, 4-D or MCPA at 2 to 5 lb. per acre while 2, 4, 5-T and Brush killer were found to be very effective against shrubby weeds such as *Capparis zeylanica*, *Azima tetracantha*, *Morinda tinctoria* and *Millingtonia hortensis* (root suckers) at the rate of 5 to 10 lb. per acre.

In the case of perennial weeds like *Cyperus*, *Cynodon* etc., repeated spray applications were necessary.

The efficacy of the weedicides is determined by the nature of the formulation, the concentration of the spray, the growth stage of the weeds and their morphological features and the weather conditions.

Acknowledgment: The authors wish to acknowledge the financial aid rendered by the Indian Council of Agricultural Research, by means of which these investigations were carried out.

REFERENCES

1. Harvey, W. A. and Robbins, W. W. (1947) Calif. Agri. Ext. Serv. Circular 133.
2. Kumar, L. S. S., Solomon, S. and Rao, V. V. (1949) Proc. Indian Acad. Sci. 30(B); 243–248.
3. Kumar, L. S. S. and Solomon, S. (1952) Poona Agric. Coll. Mag. 43; 61–65.
4. Nickell, Louis, G. (1953) Michigan State College Bull.,
5. Padwick, G. W. (1948) Indian Farming **8**; 497–500
6. Puttarudriah, M. (1956) Mysore Agric. J: **31**, 3: 146–151.
7. Ramgopal (1955) Indian Farming, **4**: **10**; 23.
8. Robbins, W. etal (1952) Weed control. McGraw Hill Book Co. p. 156.
9. Thomas, K. M. and Srinivasan, A. R. (1949) Indian Farming **10**; 101–106.
10. Venkataratnam, L. (1950) Madras Agric. J. **37**; 400–413.

Tetraploid Grain Sorghum

by

N. KRISHNASWAMY

Cytogenetics Laboratory, Agricultural College & Research Institute
Coimbatore

There are well over a thousand races of Grain Sorghums under cultivation all over the world. Without an exception all of them are diploid with 2n = 20 chromosomes. Haploids and triploids have been reported as rare occurrents (Brown 1943; Price and Ross 1955). Under experimental conditions Chin (1946) by colchicine treatment produced autotetraploids and octaploids. But these were partial steriles. There have been no naturally occurring tetraploids of Grain Sorghums reported so far.

In this laboratory numerous attempts were made to induce colchiploidy in Grain Sorghums. Though very promising initial responses characteristic of colchicine effect were observed it was found that no permanent changes had been produced and all later shoots were only diploid.

It was sought, therefore, to try to induce polyploidy by hybridization and for this purpose the interspecific hybrid of *S. halepense* (2n = 40) and *S. durra* (2n–20), (Krishnaswamy *et al* 1953) was utilized. This hybrid is triploid with 2n = 30 chromosomes. All of them exhibited pronounced *halepense* characters with loose panicles, elliptic spikelets and elliptic-ovate, brown grains. The stems were thin and leaves though long were more like the *halepense*. The F_2, of the 40-chromosomed plants behaved pure as to the chromosome number and remained essentially *halepense*-like.

Attempts were made to cross the hybrid back to the cultivated grain sorghums. In this, a sterile plant in which the sterility was induced by desynapsis (Krishnaswamy and Meenakshi 1957), was largely made us of as the stigma parent. Six plants were obtained which possessed thick stems, broad wavy leaves just as in the grain sorghum *durra (Peria manjal cholam)* type (Fig. 1). The plants are perennial and exhibit hybrid vigour. The estimation of the chromosome numbers gave 2n = 40 as the diploid number. This was therefore, an allotetraploid with several characteristics including grain size and shape like that of the grain sorghums combined with some *halepense* traits like perenniality, many tillers, deep purple pigment and loose panicle.

F_2 and F_3 progenies of those six back-cross hybrids were grown. The F_{2_1} population was pure for the tetraploid number of $2n = 40$ but segregated for a number of Mendelian factors. Different degrees of recombinations of *halepense* and grain sorghum characters occurred. However, there were no plants fully like the *durra* or the *halepense* parents (Figs. 2 & 3). The F_3 of fiftysix selected plants again was pure for the tetraploid number but a number of recombinations approaching to the cultivated grain sorghums were obtained. These have yellow, bold grains, non-shattering, stems thick and leaves broad but pegrennial and tillering. Hybrid vigour has been evident in these progenies also.

Some of the selected 40-chromosomed back-cross F_2 plants were again crossed with another desynaptic grain sorghum plant *(Sen Cholum)*, the latter being used as the stigma parent (Krishnaswamy and Meenakshi l.c.). From these hybridisations a number of plants have been obtained all 40-chromosomed, perennial, rhizomatous, bold umbonate grained with vegetative characters like the common cultivated grain sorghums (Fig. 4). These also exhibit to a very large degree hybrid vigour, some of the plants being extra thick stemmed and 20 ft.-tall.

Thus by a series of selective back crosses to the cultivated grain sorghums a tetraploid grain sorghum plant has been evolved. This apart a number of useful fodder types has also been selected. The plants are all highly fertile. Hadley and Mahan (1956) recommended as an excellent project the establishment of 40-chromosomed cytoplasmic male sterile lines so that 40-chromosomed hybrid grass sorghums could be produced and compared with 20-chromosome hybrids and that perennial types would be more easily established on the 40-chromosome level. In this study by utilizing certain sterile plants with peculiar cytological behaviour the establishment of a tetraploid, perennial grain and also fodder sorghum has been achieved.

The detailed account of the cytogenetics of these hybrids will be reported elsewhere. This general account is given here in order to draw the attention of the sorghum breeders to the potentialities of these remarkable nucleus plants from which it is possible to evolve by series of intercrossings economic types which may be suited to more diverse ecological conditions and fertility levels than are common with the diploid sorghums and solve some of the problems

Fig. 1 Fig. 2 Fig. 4

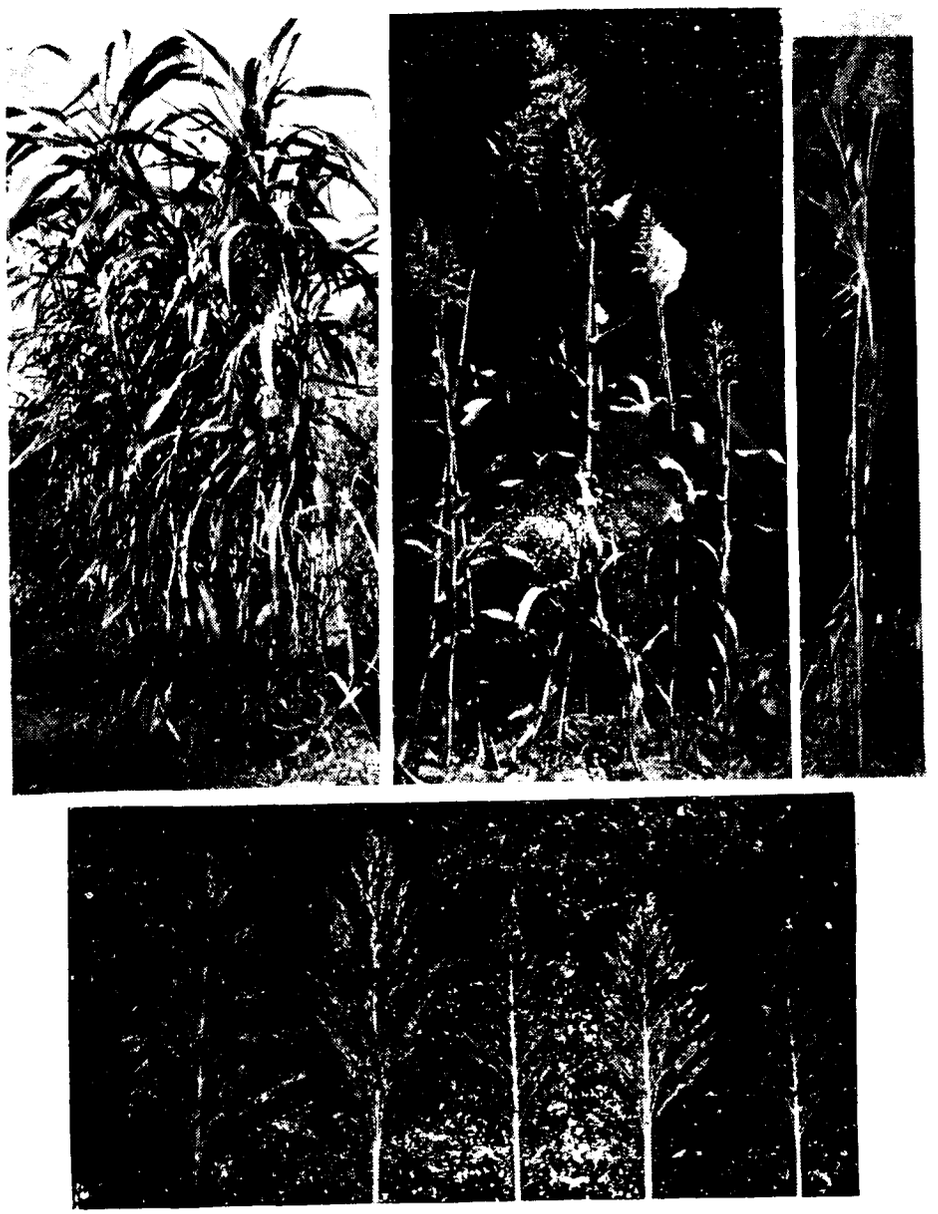


Fig. 3

EXPLANATION OF PLATES

Fig. 1. The first back-cross F_1 showing hybrid vigour. (1 27 Nat. Size).
Fig. 2. Some of the back-cross 40-chromosomed F_{2_1} plants. (1 20 Nat. Size).
Fig. 3. Some of the panicles of the back cross 40-chromosomed F_2 plants. (1/4·5 Nat. Size).
Fig. 4. Plant with panicle from the second back-cross. (1 27 Nat. Size).

connected with the millets breeding programme since the hybrid vigour is kept on so long as the plant is allowed to grow and the possibility of their multiplication by asexual means. These plants are growing at the Millets Breeding Station, Agricultural College and Research Institute, Coimbatore.

I acknowledge the help given by my colleagues connected with this investigation.

Summary: The building up of a tetraploid grain producing sorghum plant by a series of hybridisations and the description of some of its characteristics have been given. These are perennial and serve dual purpose of grain and fodder plants.

LITERATURE CITED

Brown, M. S. 1943: Haploid plants in Sorghum. J. Hered. **34**; Pp 163—166.

Chin, T. C. 1946: The cytology of polyploid sorghum. Am. J. Bot. **33**; Pp. 610—614.

Hadley, H. H. and J. L. Mahan. 1956: The cytogenetic behaviour of the progeny from a back cross *(Sorghum vulgare* X *S halepense* X *S. vulgare)*. Agronomy J. **48**; Pp. 102—106.

Krishnaswamy, N., V. Durairaj and M. S. Thangam. 1953: A note on a hybrid between grain sorghum and Johnson grass. Curr. Sc. **22**; P. 311.

Krishnaswamy, N. and K. Meenakshi 1957: *Abnormal meiosis in Grain Sorghums* —Desynapsis. (In press).

Price, M. E. and W. M. Ross 1955: The occurrence of trisomics and other aneuploids in a cross of triploid and diploid *Sorghum vulgare*. Agronomy J. **47**. No. 12.

ERRATA

(Madras Agricultural Journal: February, 1957)

Page 59, Para 2, line 15, for 'ut of alarge' — Read as out of a large number.
,, ,, ,, ,, 21, for 'and Selection' — Read as and the section.
,, 60, ,, ,, 6, for 'Standard. Though — Read as standard as though.
,, 61, Below the tabie Para 1, line 6, for average 21 — Read as average 21, 23.
,, 62, Para 1, line 1, for Food rain — Read as food grain.
,, ,, ,, ,, 7, for Selection has been S. 1. — Read as Selection 4894.
,, ,, ,, ,, 13, for yield over the — Read as yield on an average over the under Reference cited.
, ,, ,, ,, 4, for Rood anatomy — Read as Root anatomy.

A Short note on Ginger Cultivation in the West Coast

by

K. BALAKRISHNA RAO, B. Sc. (Ag.),
Assistant, Paddy Breeding Station, Mangalore

Ginger is one of the cash crops of the dryland farmer on the west coast occupying about 15,000 acres, with about 13,000 acres in Malabar district and about 2,000 acres in South Kanara district. Even though this is raised purely as a monsoon crop under somewhat similar conditions of soil and climate, the system of cultivation adopted in these two districts differs very widely. While the Malabar system is well known and has been published in departmental leaflets, the system adopted in South Kanara is practically unknown. This short note therefore attempts to describe briefly the two systems of cultivation.

Malabar System: With the receipt of summer showers in April the dry land receives four to six ploughings and the soil is brought to a fine state of tilth. Small raised beds 3 ft. wide and about 10 ft. in length are formed with 1 ft. space between beds. Small shallow pits are made on the bed 9" apart either way for planting seed material. In the month of May, a handful of mixture of cattle manure and ash is laid in each hole on which ginger bit weighing about 1/2 oz. with two sprouts is placed and covered with soil. The quantity of mixture applied comes to about 8 to 10 tons of cattle manure and 2,000 lb. of ash per acre and the seed rate varies from 800 to 1,200 lb. per acre. The beds are immediately provided with a thick layer of mulch with green leaves-preferably *Nuxvomica* at about 10,000 to 15,000 lb. per acre.

One weeding is done when the crop is about one and half months old and the beds are again mulched and earthed up slightly. The practice of giving a third mulching and slight earthing up is also in vogue when the crop is about three months old. The crop comes to harvest in December when the leaves start withering. All the dry twigs about the plant are removed and the rhizomes are lifted with mammutties or digging forks and cleaned free of mud and roots.

During the harvest, good healthy rhizomes are selected carefully for use as seed for the next years' crop. This seed is generally preserved in small pits dug in shade. A layer of sand or paddy husk is spread at the bottom and the rhizomes are packed over it.

The mouth of the pit is closed with a plank providing some empty space and the pit is sealed with mud plaster. A small outlet is sometimes provided for aeration. The pit is opened in May before sowing when rhizomes would have germinated well and be ready for planting. It is stated that under this method of storage, sometimes there is considerable loss due to soft rot.

The produce intended for sale is generally cured, bleached, dried and sold in the market as dry ginger. The process consists of removing the outskin on the surface of rhizomes, washing and soaking in water for a day, washing in clear lime water and drying for a week in the sun. By this process ginger of white colour is obtained. About 20–25% of the wet produce is recovered as dry ginger after curing and drying. This process of curing and drying is generally done by the farmers and the major portion brought to the market in the form of dry ginger known as Chukku.

South Kanara System: As in Malabar, in this district also the land receives four to six ploughings with the receipt of summer showers in April and the soil is brought to a fine state of tilth. Just before the onset of monsoon in May, a mixture of cattle manure and burnt earth is applied in lines 3½ to 4 ft. apart in the form of a layer about 2 inches thick and rhizomes weighing about 1—1½ oz. each with about half a dozen sprouts, are placed 12 inches apart in the line with all the sprouts lying along the line, and earthed up, the ridge being about 6—8 inches high. The rate of mixture applied initially consists of about 4 tons of powdered cattle manure and 2 tons of burnt earth or sudumannu. A second earthing up is given 4—5 weeks after the first, in the sixth leaf stage after a top dressing of burnt earth at 1 ton per acre – when the ridges are 15—18 inches high. A third and final earthing up is given applying about 1 ton of burnt earth when the ridges are raised by another 6 inches bringing the total height of the ridge to about 2 ft. As in Malabar the crop is ready for harvest by December when the leaves begin to dry up.

The crop is harvested in three stages according to the nature of the produce required. A small portion is harvested in September in a tender stage when the produce is sold for the preparation of ginger preserves, which industry has considerably developed in this district and for which there is a good demand. The major area is harvested in December and sold and shipped to Bombay in the green state. There is no regular system of curing and drying by the

growers. But a few merchants take to curing the produce in the method adopted in Malabar whenever there is no demand from Bombay for the green produce, and a very small percentage of the total produce is cured in this district.

The produce intended as seed for next year's crop is retained in the ground and harvested in February when it is considered to be fully mature and packed loosely in coconut-frond baskets with a lining of spear grass inside. The baskets are kept in the open air under shade on a raised platform to ward off white ants. Though there is some loss due to dryage, the seed keeps well by this method and the rhizomes develop good sprouts by the end of May when it is required for planting.

The total yield of green rhizomes ranges from 8000 to 10000 lb. per acre under both the systems of cultivation and after curing and drying it ranges from 1600 to 2000 lb. per acre.

The main differences between the two systems of cultivation described above are summerised below.

	Malabar system.	*South Kanara system.*
Planting	In small raised beds with 9"x9" spacing using ½ oz. ginger bits.	In ridges with 1' in the row of 3½–4 ft. between rows using ginger bits of 1-1½ oz.
After cultivation	Providing a heavy mulch of green leaves twice or thrice at intervals with slight earthing up.	Earthing up twice to form high ridges with no mulching at all.
Manuring	Only initial manuring at planting	Besides initial manuring, applying burnt earth twice before each earthing up.
Storing seeds	In closed pits.	In baskets kept open under shade.

Besides the main differences in the system of cultivation noted above, the South Kanara system offers the following advantage:

(1) The preparatory cultivation is easier in the absence of bed formation.

(2) Lower seed rate involving a saving of about 200-300 lb.

(iii) *Platyedra gossypiella, S.:* This is found to appear in in the late stage of he crop in a mild form. The caterpillar feeds inside the bolls as in the case of *Earias fabia, S.* Control is same as the other boll-worms.

II **Stem Borers:**

(i) *Alcidodes mysticus F:* This is a dark brown weevil measuring about 9 mm. in length with two transverse bands formed of small short ashy grey hairs just beyond the middle on the elytra. It was first noticed by the author attacking this variety of cotton at Pattambi in October 1951. It occurs for the first time in a pest form on cotton in South India. It causes serious damage to this crop. The grubs of this weevil which are of dull yellow colour with a dark brown head bore into the leaf petiole and stem and feed on the contents as a result of which the plants look sickly and stunted in growth. In early stages of the crop the attack can be made out by the wilting of tender leaves which gradually dry up and fall down. In a still later stage the attack can be easily made out by the presence of exit holes at the sides of the stem and petiole plugged with brownish powdery frass. Further it has been noted that the attack by this weevil on this cotton also results in poor flowering and setting of bolls. Folidol spray at 1 oz. in 12½ gallons eradicates this weevil.

(ii) *Zeuzera coffea, N:* This insect was noted by the author attacking a few plants at Pattambi during November 1955. The adult is a pretty moth white in colour having blue black spots at the edges of the wings. The head and thorax are grey with black spots and the abdomen is black with white hairs. The caterpillar is stout and red brown in colour measuring about two inches in length with black thoracic shield. It bores the thick main stem of the plant and feeds on the contents. The attacked plants show withering of leaves and the shoots also will be seen drying up from one end. The presence of the larva in the field is indicated by the oval shaped yellowish white castings of the caterpillar that have been ejected out through exit hole at the side of the stem, lying accumulated at the bottom of the plants on the ground. Injection of cholorosol or chloroform through the exit hole will kill the caterpillar inside.

III **Leaf Feeders:**

(i) *Sylepta derogata, F:* This is often found serious on this cotton. The adult is a medium sized moth having yellowish wings with brown wavy markings. The elongated, slender and dark green

caterpillar rolls the leaves, lives inside these peculiar rolls and feeds on the green matter. Infested plants can be made out by the presence of such numerous leaf rolls. Collection of leaf rolls and destroying the caterpillars and spraying with Endrin of Folidol will control this insect.

(ii) *Euproctis fraterna, M:* This hairy caterpillar has been noted occassionally defoliating this cotton. Collection of caterpillars or spraying with BHC or Folidol controls it.

(iii) *Cosmophila erosa, H:* This is also found fairly in serious form. The caterpillar is a semilooper, bright leaf green in colour. It voraciously feeds on the leaves and leaves only the midrib. BHC or Folidol can be sprayed for controlling it.

IV **Sucking Insects:**

(i) *Aphis gossypii, G:* This is found in a fairly serious form on this variety of cotton. It occurs in colonies of hundreds on the tender portions of the plant and sucks up the sap. Folidol spray controls them effectively.

(ii) *Empoasca devastens, D:* This jassid occurs in large numbers and sucks up the sap of the plant causing curling and withering of leaves. DDT or Folidol spray checks this insect.

(iii) *Dysdercus cingulates, F:* This is commonly known as the Red Cotton Bug. This is found in a mild form puncturing the bolls. Folidol spray kills these bugs.

(iv) *Saissetia nigra. N:* This scale has been noted occurring only on a very mild form on this Cotton. Folidol spray controls this scale.

(v) *Ferrisiana virgata, C:* This mealy bug is noted only on stray plants as in the case of the scale. The same control measure adopted for the scale can be adopted in this case also.

V **Surface Insects:**

(i) *Chrotogonus saussurei, B:* This surface grasshopper feeds on young seedlings. It is easily controlled by the application of BHC dust.

(ii) *Ataclogaster finitimus, F:* This is a stout greyish weevil which causes same damage as the grasshopper. Control is by hand-picking of weevils or dusting BHC dust.

Among the various pests attacking Sea-Island cotton only a few insects namely the bollworms, the stem weevil *Alcidodes mysticus*, *F*, the leaf roller *Sylepta derogata*, *F* aphid, jassid etc. are noted to cause some appreciable damage to the crop. The other insects mentioned in the list occur only in a mild form. But there is every possibility of these minor insects also becoming a major pest some time or other in that particular climatic conditions prevailing in that tract. Most of these insects are easily controlled by either Endrin or Folidol treatment. As the cotton plant is affected by one or other of these insects even from the very early stage of the crop, it is advisable to have a spray schedule from the early stage of the crop, to have effective control. To begin with the crop can be sprayed with Endrin at 1 oz. in 12½ gallons from the sixth or eighth week stage and repeated at convenient intervals of fifteen or twenty days. Two rounds of Endrin in the beginning followed by one or two rounds of Folidol spray at 1 oz. in 12½ gallons will be quite sufficient for saving the crop from all these pests. The use of Endrin spray alone for all the rounds of sprayings occasionally gives rise to the secondary infestation by mites or mealy bugs. Hence the use of Folidol at the latter stage of the crop is recommended, which controls also mites and mealy bugs. The cost of one round of treatment per acre will work out to about Rs. 10/- acre

Acknowledgements :

The author is highly thankful to the Cotton Specialist and the Assistant Cotton Specialist, Winter Cambodia Scheme, and the Government Entomologist of the Agricultural College and Research Institute for giving all facilities to study the pests of this variety of cotton. He is also thankful to the Assistant Paddy Specialist Pattambi for the facilities given by him to the author during his tour to Pattambi in this connection.

Preliminary Study of the Variation of Soil Moisture

by

R. GOPALAKRISHNAN, B. sc. (Ag.),
Meteorology Assistant, Pattambi

and

C. BALASUBRAMANIAN, B. A., B. sc. (ag.),
Agricultural Meteorologist, Coimbatore

Agricultural Research Station, Pattambi, South Malabar, Madras

With a view to study the variation in soil moisture, soil samples from surface to 3″, 6″ to 12, 12″ to 18′ and from 18″ to 24′ depths are being taken weekly by means of a soil auger set from the observatory area at the Agricultural Research Station, Pattambi from 15—9—1950 onwards and the moisture percentages at different depths were determined in duplicate by the method of weighing.

The observatory area which itself was a single crop paddy land is situated in the midst of single crop paddy fields and is a flat ground of half an acre. The soil of the observatory in common with the rest of the soil of Malabar is red loam of lateritic origin and is subject to constant depletion of finer fraction of the soil and soluble plant foods in the torrential rains during the South West Monsoon period when 60″ to 80″ of rain are received within 2 months, June and July. The mechanical analysis of the soil of single crop paddy lands on which the observatory is situated is given below :

Clay	32·78%
Silt	11·79%
Fine silt	12·90%
Coarse sand	42·53%

The soil moisture data gathered from a total number of 146 soil moisture estimations carried out at regular weekly intervals during the period 15—9—1950 to 26—6—1953 were analysed statistically in the following manner :—

(a) The data collected during the whole period, that is, from 15—9—1950 to 26—6—1953.

(b) The whole period was divided into three seasons namely, Hot weather period (February to June) South West Monsoon (June to September) and North-East Monsoon period (September to January) and the data gathered during these three different periods were analysed separately.

(c) The data pertaining to the different months of the calendar year.

The summary of results of the above analyses are given below :—

Summary af results for the whole Period
(15—9—1950 to 26—6—1953)

Particulars	DEPTHS 3″ (A)	6″ (B)	12″ (C)	18″ (D)	24″ (E)	G. M.	"Z" Test Satisfied or not	C. D. P. : 0·05
Moisture percentage	9·40	11·02	12·22	13·20	13·41	11·85	Yes, both for depths and dates	4·03
Percentage on general mean	79·0	93.0	103·2	111·4	113·1	100		

Conclusion : E D C B A

4. In the North-East Monsoon period the moisture percentage increases as the depth increases; but the variation in soil moisture between 24′ and 18″ is not significant.

5. From the month-war analyses the following conclusions are drawn :

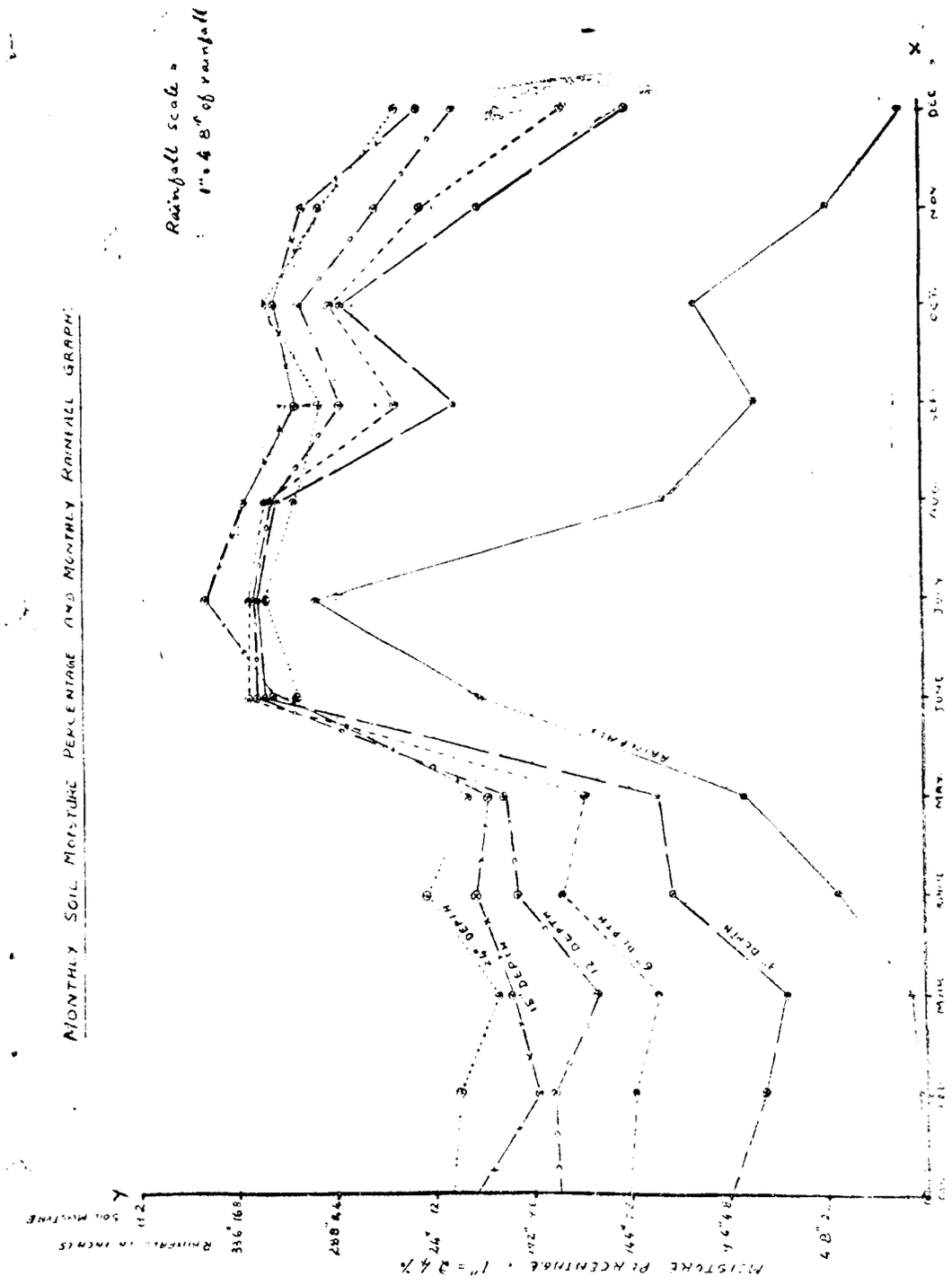
(a) In all the months except, in the months when the South-West Monsoon is active (June, July and August) the moisture percentage generally increases as the depth increases.

(b) In the months of June and July the soil moisture status at different depths is the same though it varies at different dates during these months.

(c) In the month of August the soil moisture status is same at all depths and also on different dates.

(d) The differences in soil moisture percentages are not significant among some depths during certain months as shown in the table given below :

A. No.	Depths	Months in which the variations are not significant
1.	24″ and 18″	In all the months except in the month of February.
2.	18″ and 12″	February, April, May, September, October and December.
3.	12″ and 6″	April, September, October and November.
4.	6″ and 3″	September and October.
5.	24″, 18″ and 12″	May, September and October.
6.	12″, 6″ and 3′	October.



6. The soil moisture at different depths is generally at the lowest in the month of March and is at the highest in the month of July.

7. From the month of May onwards there is a tendency for the soil moisture at different depths to go in line with the trend of the rainfall. That is the soil moisture increases progressively from the month of May upto the month of July (the peak of the South-West Monsoon) and decreases from the month of July upto the month of October (the peak of the North-East Monsoon) and again it decreases thereafter (vide graph).

Acknowledgment: The authors are gratefully indebted to Sri P. A. Venkateswara Ayyar, Agronomist and Professor of Agriculture for his invaluable guidance in the preparation of this note and to the Assistant Paddy Specialist, Pattambi for all the facilities given for the collection of the soil moisture data forming the basic material for this paper.

2. Summary of results for Hot Weather Period.

Particulars	DEPTHS 3″ (A)	6″ (B)	12″ (C)	18″ (D)	24″ (E)	G. M.	"Z" Test Satisfied or not	C. D. P. 0·05
Moisture percentage	5·43	8·06	9·59	10·49	11·43	9·00	Yes, both for depths and dates	7·23
Percentage on general mean	60·3	89·5	106·6	116·6	127·0	100·0		

Conclusion: E, D, C, B, A

3. Summary of results for the South West Monsoon Period.

Particulars	DEPTHS 3″ (A)	6″ (B)	12″ (C)	18″ (D)	24″ (E)	G. M.	"Z" Test Satisfied or not	C. D. P. 0·05
Moisture percentage	14·95	15·58	15·82	16·44	15·61	15·68	Yes, both for depths and dates	5·44
Percentage on general mean	95·37	99·33	100·90	104·95	99·55	100		

Conclusion: D C E B C

4. Summary of results for the North East Monsoon Period.

Particulars	DEPTHS 3″ (A)	6″ (B)	12″ (C)	18″ (D)	24″ (E)	G. M.	"Z" Test Satisfied or not	C. D. P. 0·05
Moisture percentage	9·63	10·93	12·45	13·76	13·92	12·14	"Z" Test for depths and dates	6·34
Percentage on general mean	79·36	90·07	102·51	113·35	114·68	100		

Conclusion: E D C B A

Summary of Results Month-Wise

Month	Soil Moisture Percentage 3″	6″	12″	18″	24″	Percentage on General Mean 3″	6″	12″	18″	24″	General Mean	C. D. P. 0·05	Summary of results
January	4·93	7·34	9·04	11·09	11·55	56·0	83·5	103·0	126·0	131·5	8·79	9·56	E D C B A
February	3·91	7·07	9·08	9·54	11·36	47·8	86·4	110·1	116·7	139·0	8·19	17·39	E D C B A
March	3·39	6·52	7·93	10·05	10·35	44·3	85·1	104·2	131·2	135·2	7·66	16·04	E D C B A
April	6·13	8·87	9·97	10·99	12·17	63·7	92·2	103·6	114·1	126·4	9·63	15·81	E D C B A
May	6.45	8·33	10·25	10 67	11·23	68·3	88·2	108·5	113·3	119·0	9·39	18·66	E D C B A
June	16·19	16·62	16·28	15·97	15·42	100·5	103·3	101·2	99·2	95·8	16·10	8 13	Satisfied only for dates
July	16·40	16·55	16·45	17·59	16·17	98·6	99·5	98·9	105·8	97·2	16·63	9·04	Satisfied only for dates
August	15·91	16·24	16·11	16·69	15·54	98·8	100·9	100·1	103 7	96·5	16·10		Not Satisfied both for depths & dates
September	11·50	12·91	14·30	15·39	14·69	83·6	93·9	103·9	111·9	106·7	13·76	11·99	D E C B A Yes. Both for depths & dates
October	14·28	14·45	15·27	15 94	16·17	93·7	94·9	100·7	104·6	106·1	15·22	7·29	E D C B A Yes. Both for depths & dates
November	10·92	12·30	13·44	15·15	14·89	81·7	92·2	100 8	113·6	111·7	13·44	9·48	D E C B A Yes. Both for depths & dates
December	7·24	8 77	11·45	12·28	12·88	63·8	83·3	108·8	116·7	122·4	10·52	10·45	E D C B A Yes. Both for depths & dates

The following conclusions are drawn from the above results:

1. During the year there are marked variations in the soil moisture contents increasing as the depth increases. However the difference between the soil moisture percentage at 18″ and 24″ is not significant.

2. In the Hot Weather period (February to June) the moisture percentage increases as the depth increases. The variations of soil moisture at each depth are significant.

3. During the South West Monsoon period the moisture percentage at 18″ depth is the highest followed by 12″, 24″, 6″ and 3″ depths. But the difference in soil moisture between 18″ and 12″ and 3″ and 6″, and 3″ are not significant.

Research Notes

Diamond Leaf Spot of Banana

During February 1947, there were reports of diseases on bananas from Mettupalayam and Chikkarapalayam (near Karamadai) in Coimbatore District. On examination of the crops, the diamond leaf spot disease, caused by *Cordana musae* (Zimm.) Hoehn. was observed in these places, in addition to other diseases. In the initial stages of the disease oval spots appear on the leaf and later on these become large, brown elliptical oval patches. Sometimes small crescentic areas appear on the leaf margins producing strips of diseased tissues extending to the midribs. Usually the affected tissue is surrounded by a brilliant yellow to orange coloured band particularly in the adaxial surface. At the initial stages the spots show brown colouration with delicate concentric zonation and a border of warm brown colour merging into green colour of the leaf. The underside of the leafspots are greyish-brown, the zonation and the border being not so well defined. The leafspots on the undersurface produce large number of conidiophores which impart a smoky-greyish appearance to the spots.

The fungus has dark brown, septate, slightly nodulose conidiophores. The conidia are one or two celled, hyaline, obovate. The conidial measurements range from 9·9 to 15·5 x 6·2 to 9·9 μ. The conidiophores are solitary or subfasciculate.

The fungus was brought into culture and pathogenicity tests were conducted. The inoculated leaves developed the characteristic leaf blotches after about ten days of inoculation. The tests were repeated on ten leaves with suitable controls. All the inoculated leaves took infection.

The disease has been found to be currently present in the following banana varieties now standing in the Wetlands, Central Farm; 1. Malaivazhai: 2. Kuribontha; 3. Tellabontha; 4. Neymannan; 5. Chenkadali; 6. Poovan; 7. Kali and 8. Vellavazhai. The disease symptoms were not found on: 1. Booditha Montha Bathees; 2. Ayiramka Rasthali: 3. Thattilla Kunnan; 4. Neypoovan: 5. Peyan: and 6. Kunnan. Two other varieties, Poovan and Monthan, in a local garden were also found affected by the disease. Further studies on the fungus are under progress.

The author is indebted to Dr. K. Ramakrishnan, Government Mycologist, for his guidance and valuable suggestions in the preparation of this short paper.

Mycology Section,
Agri. Coll. & Res. Inst.
Lawley Road, Coimbatore.
January 9, 1957.

T. V. SUBRAMANIAN.

REFERENCES

Mardlaw, C. W. (1935): Diseases of the Bananas and of the Manila Hemp plant.
Mardlaw, C. W. (1937): Banana Diseases. *Trop. Agri. Trin.* **14**: 279-280.

Propagation of *Rauwolfia Serpentina*-*Benth* by Split Stumps.

The demand for the the roots of *Rauwolfia serpentina*, the source of reserpine and other alkaloids used widely in medicine, is reported to be on the increase. The natural sources which are being exploited to meet the demand are understood to be dwindling rapidly, and steps are being taken in a number of localities to cultivate the plant.

Raghavan Nair (1) reports that the plant can be propagated from seeds and shoot and root-cuttings, and that, the shoot cuttings with bit of root appear to be significantly the best. According to Badhwar (2) the plant is best propagated by seed, though vegetative methods by means of stem and root cuttings are also possible. In the Government Cinchona Plantation on the Anamallais, high success has been obtained by all the above methods, propagation by shoot cutting with a bit of root attached proving the best.

In the course of the above propagation work undertaken at this station, certain trials were conducted to find out if the plant can be propagated by halved stumps, as is reported to be done sometimes in Teak (3) and Cinchona (4).

Twentyseven well rooted cuttings, about a year old, and standing in the nursery were uprooted and after removing all available roots, were stumped at a height of 1 to 1½" leaving one or two nodes. The stumps were then split up into two longitudinal halves by means of a sharp knife. 52 halves were obtained, two being damaged during the splitting operations. They were then planted in the nurseries. Observation after 105 days showed that there were 48 survivals, and all these had produced sufficient roots to be able to stand field-planting.

Multiplication by halved stumps can therefore be successfully adopted in this crop, specially when there is dearth for material as is being experienced now.

Govt. Cinchona Plantations, Cinchona P. O.

S. KALYANASUNDARAM, B. sc.
A. P. JAYALAKSHMI, B. sc.

REFERENCES

1. Raghavan Nair. K. N. *Rauwolfia serpentina* Benth — Its importance and cultivation — Indian Forester Vol. 81, March 1955.
2. Badhwar R. L. *et al Rauwolfia serpentina* — The wonder drug of India. Indian Forester, Vol. 81: April 1955.
3. The effect of longitudinal splitting of Teak Stumps Forest Research, India and Burma — 1946—47, (1950)
4. Unpublished data of the Propagation Section of the Madras Cinchona Department, (1952)

Weather Review — For February, 1957

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January 1956
North	Madras (Meenambakkam)	Tr	— 0·4	Tr
	Tirurkuppam*	Nil	— 0·2	Nil
	Vellore	Tr	— 0·2	Tr
	Gudiyatham*	Nil	— 0·2	Nil
East Coast	Palur*	0·1	— 0·2	0·1
	Tindivanam*	0·2	— 0·1	0·2
	Cuddalore	0·4	— 0·5	0·4
	Nagapattinam	0·4	— 0·4	0·4
	Aduthurai*	0·7	— 0·1	0·8
	Pattukottai*	1·1	+ 0·1	1·1
Central	Salem	Tr	— 0·3	Tr
	Coimbatore (A. M. O.)* ..	0·5	— 0·2	0·5
	Coimbatore	0·4	+ £$_1$	0·4
	Tiruchirapalli	Tr	— 0·3	Tr
South	Madurai	Tr	— 0·5	Tr
	Pamban	0·7	— 0·2	1·2
	Koilpatti*	1·5	+ 0·2	1·5
	Palayamcottai ..	0·8	— 0·4	0·8
	Ambasamudram* ..	1·0	— 0·6	1·0
	Nagarcoil	Nil	— 0·7	0·3
Hills	Kodaikanal	1·1	— 0·4	1·2
	Coonoor*	3·4	+ 0·8	3·4
	Ootacamund*	0.4	— 0·1	0·4
	Nanjanad*	0·3	— 0·3	0·3
West Coast	Pattambi*	0·4	— 0·6	0·4

Note:— 1. * Meteorological Stations of the Madras Agric. Dept.
2. Tr. Trace (0·01″ to 0·04″ inches of rain)
3. + £$_1$ = above normal by 0·04″

The month began with a dry weather practically throughout the State. For three days from 2—2—1957 mild, localised and isolated showers were received in some parts of the Madras State. From 5—2—1957 to 15—2—1957, both days inclusive, the weather was mainly dry in the State. But during this period there were fluctuations in the night temperature, which generally remained above normal. On 16—2—1957 scattered rains were received in South Madras, while the weather elsewhere was mainly dry. From 17—2—1957 to 27—2—1957, both days inclusive, the State experienced only a dry weather. In this period the night temperatures were unsteady, sometimes being below normal and sometimes above normal. On 28—2—1957, the last day of the month, scattered showers were received in Tamilnad and the night temperature also was practically steady.

There was no noteworthy rainfall in any place in Madras State. The receipt of sub-normal rains practically throughout the State and that too just before the commencement of the Hot Weather Period (March to May) foretells only the severity of the ensuing summer and the consequential water scarcity. Particularly the rainfed cotton crop is being affected adversely by this sort of continuous dry weather.

Zonal Rainfall in inches are furnished below:—

Name of Zone	Rainfall for the month	Departure from Normal	Remarks
North	Nil	— 0·3	below normal
East Coast	0.5	— 0·2	do
Central	0.2	— 0·2	do
South	0·7	— 0·4	do
Hills	1·3	J. N.	J. N. Just normal

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 12—3—1957

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

Departmental Notifications

Gazetted Officers — Postings and Transfers.

Name and present post	Posted as
Doraiswami G., Block Development Officer, Dharapuram	D. A. O. Kangayam Dt. Nagarcoil.
Muthuswami Iyer, S., D. A. O. Sattur.	Gazetted Asst. to the D. A. Madras.
Muthuswami S., Teaching Asst., Agricultural College, Coimbatore.	D. A. O. Cuddalore.
Natarajan T. Gazetted Asst. to D. A. Madras.	Agronomist and Prof. of Agriculture, Agricultural College, Cbe.

Tirumalacharya N. C. Posted as D. A. O. Kanyakumari, has been cancelled.

STATEMENT ABOUT OWNERSHIP & OTHER PARTICULARS REGARDING THE MADRAS AGRICULTURAL JOURNAL.

FORM IV.

Rule 8 of the Press and Registration of Books Act, 1867.

1.	Place of publication	:	Coimbatore.
2.	Periodicity of its publication	:	Monthly.
3.	Printer's Name	:	A. Subramaniam.
	Nationality	:	Indian.
	Address	:	Secretary, The Coimbatore Co-operative Printing Works, Ltd., Coimbatore.
4.	Publisher's Name	:	T. R. Narayanan.
	Nationality	:	Indian.
	Address	:	Plant Physiologist, Agricultural College, Lawley Road P. O., Coimbatore.
5.	Editor's Name	:	T. R. Narayanan.
	Nationality	:	(As given above).
	Address	:	.....
6.	Names and addresses of individuals who own the newspaper and partners or share-holders holding more than one per cent of of the total capital	:	The Madras Agricultural Students' Union, Agricultural College, Coimbatore.

I, Sri T. R. Narayanan, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date: 25—2—1957. *Signature of Publisher:* **T. R. NARAYANAN.**

Review of Market Conditions of Commercial Crops in the Areas of Market Committees for the Month of January, 1957.

Cotton: (In this section: Candy = 784 lbs. Pothi = 280 lbs.).

Tiruppur: The condition of the standing crops of cotton is satisfactory even though some attacks of aphids are reported here and there. Arrivals of new crops have not yet commenced. The estimate of yield during this season is reported to be just below normal. This market started with an opening balance of 4343 cdys of Cambodia and 785 cdys of Karunganni lint with which were added 2160 cdys of Cambodia and 55 cdys of Karunganni by way of receipts. The arrivals included 477 cdys of Cambodia and 20 cdys of Karunganni lint locally ginned. Total despatches from Tiruppur accounted for 3602 cdys of Cambodia and 747 cdys of Karunganni Lint which included 450 cdys sent in all to Kerala, North Arcot, South Arcot, Tanjore, Madras, Tirunelveli and Orissa. There was a closing stock of 2901 cdys of Cambodia and 93 cdys of Karunganni.

The Kapas market started with an opening balance of 4079 pothis of Cambodia and 28 pothis of Karunganni. Arrivals during the month amounted to 4743 pothis of Cambodia and 234 pothis of Karunganni. Disposals were 6939 pothis of Cambodia and 204 pothis of Karunganni Kapas leaving a closing stock of 1883 pothis of Cambodia and 54 pothis of Karunganni at the close of the month. The Cotton market in Tiruppur was not active, as the buyers are awaiting the arrivals of the new crop. The prices however brightened somewhat, by about Rs. 5 - per pothi of kapas and Rs. 30/- per Cdy of lint.

Ramanathapuram District: (a) The arrivals of Karunganni and transactions in the Cotton market at Virudhunagar continued to be practically negligible and the market also remained dull during the month. New crop season is expected to commence by the middle of February. The three markets at Sattur, Rajapalayam and Virudhunagar together

opened with a stock of 2350 pothis of Kapas and 2985 Cdys of lint at the beginning of the month. About 75 pothis of Kapas and 915 Cdys of lint were received. Disposals were 825 pothis of Kapas and 1815 Cdys of lint during the month. The markets closed with a stock of 1600 pothis of Kapas and 2085 Cdys of lint.

The prices of Kapas picked from early sown crop that were brought for sale in these markets were quoted at Rs. 88 to 104 per pothi. Transactions in lint included, the purchase of new Crop Karunganni lint at Rs. 740/- (per Cdy 6-4-6 variety) for April delivery,. The closing prices of MU2 Uganda and MU1 Uganda were at Rs. 1046-1065 and Rs. 1025-1035 respectively.

South Arcot District: At the commencement of the month the trade had a stock of 150 pothis of Cotton. Arrivals to Villupuram and Panruti markets amounted to 844 pothis. The stock with the trade at the end of the month stood at 140 pothis.

The average price per pothi of 280 lb. of Kapas was quoted at Rs. 54—11—0.

Groundnuts: (In this Section: Cdy = 531 lb. of Kernels.
Bag = 82 lb. of Pods.)

South Arcot District: All the nine markets of this district started with an opening balance of 4119 tons of groudnut kernels. As the harvest of winter crop was concluding, the acre yield was below 30% normal. Local arrivals to the markets decreased which amounted to 3149 tons. Receipts from North Arcot, Tanjore and Trichi etc. have accounted for 2412 tons. The decreased arrivals gave a fillip to imports from Andhra State amounting to 1590 tons. Crushing in mills declined and stood at 5162 tons while crushing in country chekkus improved to 205 tons. Despatches to other districts like Madras, Salem, Tanjore, Trichy, Coimbatore, fell down to 1073 tons. Wastages have been calculated to be 330 tons. There was a balance stock of 4500 tons left with the trade at the end of the month.

The prices were steady in the first three weeks of the month and improved during the fourth week. The average prices ranged from Rs. 121—4—0 to 162—6—0 per Cdy in the several markets depending upon the quality.

North Arcot: The groundnut trade during this year in this district, unlike last year, began very well with the prices ruling higher than last year. Despite the high prices, neither the sellers nor buyers were anxious to transact large quantities. Sellers withheld their stock in expectation of further spurt in the prices. While big buyers were handicapped largely due to absence of export quota for oil, the market was left to small scale

crushers and transactions were not heavy. The regulated markets in the district also did not attract any arrivals for the reason that the sellers were reluctant to part with their produce in expection of better prices The regulated markets at Vellore and Arcot received 476 bags and 14 bags respectively during the month. The market started with 943 tons of pods and 2965 tons of kernels with which 2131 tons of pods and 1001 tons of kernels were added by way of receipts. Total disposals came to 483 tons of pods and 3660 tons of kernels leaving a closing stock of 2591 tons of pods and 306 tons of kernels.

Till the last week of January it was reported that there was great demand for oil at Madras from Bombay and Calcutta interests. Hence the markets exhibited a buoyant tone. Afterwards there was not much activity though the prices ruled more or less steady. The price of kernels ruled around Rs. 160—164 per Cdy. while that of oil around Rs. 320—330 per Cdy. of 500 lb. Groundnut pods were done around Rs. 16—18 per bag of 80 lb.

Ramanathapuram District: The harvests of Groundnut in this district came to a close during the third week of the month and as a result of this, arrivals of pods to the markets have declined. The total production of the district is also expected to be a little higher than the normal one. The market at Virudhunagar opened with a stock of 80 tons of pods and about 1125 tons of pods and 1465 Cdys. of kernels were added from the receipts. Disposals during the month amounted to 1110 tons of pods and 1465 Cdys. of kernels leaving a closing stock of 95 tons of pods alone at the end of the month.

The closing prices of Groundnut kernels were quoted at Rs. 170—176 per Cdy. that of pods at rate 16—18 per maund of 82 2 7 lb. that of oil at Rs. 23/- per tin of 35 lb. and Rs. 9—9 per standard maund for Cake.

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

South Arcot District: The opening stock with the trade stood at 262 bags. Arrivals to the members locally have declined during the month to 394 bags of which the quota of Viruddhachalam came to 337 bags and the rest to Tindivanam market. Receipts from neighbouring districts came to 319 bags. Imports from other states amounted to 105 bags. Crushing in power driven pinto chekku came to 178 bags and in country chekku 461 bags. Despatches to Madras, and Trichy districts totalled 64 bags. The closing stock with the trade at the end of the month came to 337 tons.

The arrivals being meagre, prices improved. The average prices varied from Rs. 61—4—0 to Rs. 81 - per bag according to quality.

Tobacco: (In this section Cdy = 500 lb.)

Tirupur: Disposals of tobacco in Tirupur market amounted to 1985 Cdys of chewing and 300 Cdys of cheroot tobacco. Despatches were made to places in Madura, Ramnad, North Arcot, South Arcot, Trichy, Tirunelveli, Tanjore, and Salem districts and Palghat, Ernakulam, Quilon and other centres in Kerala State and Mysore, Andhra and Bombay States. The market closed with a stock of 11,350 Cdys of Chewing and 540 Cdys of Cheroot tobacco.

The tobacco market continued to be dull and there was no marked change in price levels during the month under report. The price ranges were as follows:—

Variety	*I Grade*	*II Grade*	*III Grade*
1. *Chewing tobacco — Sun cured:*			
(a) Meenampalayam	300—325	200—275	150—175
(b) Other varieties	225—266	140—210	75—115
2. *Cheroot Varieties:*			
Suncured (Grown in Erode and Bhavani Taluks)	260—340	200—250	120—160
3. *Chewing Varieties:*			
Pitcured (Grown in Palladam and Sattur areas)	200—250	150—200	100—150

(Prices in Rupees per Cdy.)

Review of Administrative Activities of Market Committees for January 1957

General: Except the Coimbatore Market Committee and the South Arcot Market Committee all other Market Committees are functioning under 6-A of the Act under their revenue heads of the districts concerned. The election in the case of North Arcot Market Committee is almost over and one member stands yet to be elected and two others are to be nominated by Government. This Committee will be constituted as soon as the election is over. The stalemate in the case of Tirunelveli Market Committee and Ramanathapuram Market Committee has not yet been resolved.

The following are the progress of Licencing by market Committees during the month:

	Section 5(1)		Section 5(3)		Weighmen	
	A	B	A	B	A	B
North Arcot Market Committee	178	178	160	160	97	97
South Arcot Market Committee	467	467	417	417	387	387
Coimbatore Market Committee	63	63	57	57	55	55
Ramanathapuram Market Committee	Nil	Nil	Nil	Nil	Nil	Nil
Tirunelveli Market Committee	Nil	Nil	Nil	Nil	Nil	Nil

A = During the month;

B = Up to the end of the month from January 1957.

Meetings: A meeting of the South Arcot Market Committee was held on 9—1—1957. Eleven members were present and 24 subjects were disposed at the meeting.

Quality Appraisal: The South Arcot Merket Committee continued its analysis work on the quality of Groundnut Kernels marketed. During the month 82 samples were analysed from 3358 lots taken from out of arrivals of 12025 bags of kernels. The crop marketed at Cuddalore, Tirukoilur and Virudachalam contained a large percentage of nooks than the crop marketed at Panruti. In respect of moisture the crop marketed at Virudhachalam contained less than 4% of moisture whereas the crop marketed at other markets contained moisture upto and insome cases about 10%.

Quality Competition: The South Arcot Market Committee during the month secured 87 entries in the quality competition for winter crop Groundnuts raising the total entries to 128.

Marketing of Groundnuts in Pollachi

SRI K. SRIRAMAN, B. sc. (ag.), M. sc.,
Secretary, Coimbatore Market Committee, Tirupur.

Coimbatore District commands an area of 2,90,000 acres under groundnuts, of which nearly 1,10,000 acres form the winter crop, and the rest 1,80,000 acres come under the summer crop. The summer crop is generally an irrigated crop, but peculiarly, this crop in the Pollachi Taluk is rainfed occupying an area of 1,20,000 acres. Besides, the adjoining area to the extent of 30,000 acres in Kerala State also produces groundnuts during summer and is marketed at Pollachi. This summer crop is sown in March - April and is harvested in July - August during which period sufficient rains are received. Both the bunch and spreading varieties of groundnut are cultivated in the red sandy loams and the famous commercial bunch variety called the "Pollachi Red" forms nearly three fourth of the crop produced. The rest one fourth is the white spreading variety. The unique feature of this groundnut crop is that most of the produce is assembled at Pollachi town within the short marketing period of August to November, when no groundnuts are available in any of the other areas in Madras and neighbouring States. Hence exporters from all over gather at Pollachi during this period and make purchases.

During the 1956 season it was commercially estimated that production of groundnuts in the Pollachi area was about 44,000 tons of kernels, of which 9,000 tons might have been utilised for seed and consumption purposes in the farmsteads. Out of the 35,000 tons of marketable surplus, about 31,000 tons were assembled at Pollachi town, and the rest 4,000 tons were estimated to have been transported to outside districts, directly from the villages. From Pollachi assembling centre also, about 10,000 tons kernels were exported to places outside the district leaving 21,000 tons for being utilised for crushing into oil within Coimbatore district.

The groundnut oil crushing industry in Pollachi area is also fairly well developed. There are nearly 17 expellers and 40 rotaries working at Pollachi and nearly places like Anamalai. These expellers and rotaries are capable of crushing 130 tons per day in three shifts. Enough of groundnuts can be purchased locally, to work them for almost throughout the year. Unfortunately during the 1956 season, there was no parity maintained between the prices of groundnut kernels and oil for the most part of the peak season at Pollachi. For 531 lbs. of kernels (Candy) only 227 lbs. of oil (42·75%) and 299 lbs. of groundnut cake, allowing for a wastage of 5 lbs. is obtained. At Rs. 155/- per candy of kernels, Rs. 19-8-0 for 35 lbs. oil and Rs. 16/- per bag of 160 lbs. cake, by purchasing a candy of kernels for Rs. 155/- and crushing it at a cost of Rs. 6/- as crushing charges per candy of kernels, the crusher realises only Rs. 154-12-0 from the oil and oil cake. As such the purchases by the well established firms were not heavy this year.

In former years, the agriculturists themselves used to market their groundnuts by bringing it to Pollachi town, but of late, many itinerary merchants go about the villages, purchase the pods and assemble them in the decorticators at Pollachi for shelling and selling as kernels. Very big agriculturists in villages auction their produce themselves by giving advance notice through pamphlets. In these auctions good prices are generally obtained. Such a facility is not available to all the agriculturists and hence, the itinerary merchants have begun to dominate in this area. So long as the prices of agricultural commodities rule high, the agriculturists in this area, may afford to feel satisfied with the present conditions of marketing their produce. Such high prices cannot always continue, and the need to obtain the best price for their produce would certainly be felt by them. The traders and consumers also may have to offer their best price, if only to enthuse the agriculturists, to continue producing the commodity and thereby sustain themselves. Hence, proper marketing conditions are absolutely essential both in the interests of the agriculturists and the traders.

The Madras Commercial Crops Markets Act, 1933, is intended to provide for the better regulation of buying and selling of commercial crops and the establishment of markets for commercial crops in Madras State. In Coimbatore district, the cotton, groundnuts and tobacco are the commercial crops notified and by way of better regulation of trade, all the traders are licensed and insisted upon to maintain accounts, the maximum commission and brokerage charges are fixed, unauthorised deductions are prohibited, the weights used for weighing are checked and stamped every year and the weighmen are licensed to ensure correct weighments. Regulated markets have been established at Tirupur, Gobichettipalayam, Erode and Pollachi, where the cotton, groundnuts, and tobacco can be brought and sold without incurring any charges for selling the same through the market committee staff. The secret tender bid system adopted for sale of the produce in the regulated markets, enables the sellers to realise better values for their produce and the purchasers also are enabled to pick and choose the quality and quantity of the produce required by them. Such advantages for all concerned can be realised only in the regulated markets and the trade in groundnuts in Pollachi would be best benefitted, if only the agriculturists and traders in that area try to make the best use of the regulated market established at Pollachi.

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. Thiruvenkata Mudaliar, Munniyur, Andankarai P. O., (Via) Alattambadi, S. R.
13. ,, S. Ramamurthy Iyer of Kunnam, Land-Holder and Secretary, South Rajan Mirasdars' Association, "Vibrajeo", 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, Monkompu P. O., T. C. Sta
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 & Technical Advisor, The Potash Scheme, India, 7, Lavelle Road, Banglore-1
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.
31. ,, M. A. Ayee Gounder, Kasipalayam, (Via) Gobichettipalayam.
32. ,, K. S. Vengu Chettiar, 'Kottachi House' Koranad, Mayuram.
33. ,, V. P. K. Kayarohanam Pillai, Agriculturist and Businessman, Nagapattinam.
34. ,, A. K. Srinivasa Odayar, Mirasdar, Attur Village, Nannilam Taluk.

THE MADRAS AGRICULTURAL STUDENTS' UNION.

OFFICE-BEARERS FOR 1956—'57.

Dr. K. C. Naik, President (ex-officio)
T. R. Narayanan, Resident Vice-President
A. H. S. Sarma, Editor
D. John Durairaj, Secretary

Council (16 Members)

President
Resident Vice-President
Editor
Secretary

Mofussil Vice-Presidents

C. S. Seshadri
Muhamad Ali
T. S. Francis

Mofussil Members

K. Meenakshisundaram
M. J. David
K. Saptharishi
T. Srinivasan
P. Krishnaswami

Resident Members

K. Varadachari
S. Ramaswami
G. Ramanathan (Student)
D. Paulas, Club Secretary

Managing Committee (10 Members)

Resident Vice-President
Editor
Secretary
D. Meenakshi Sundaram (Manager)
Kumari M. V. Sukanya Bai (Treasurer)
J. Sakharam Rao
K. Rajagopal
K. S. Shetty
Kalil Ahmad (Student)
Rajaguru, (Student)

Editorial Board (8 Members)

Editor
Secretary
Manager
S. Varadarajan
C. Balasubramania Mudaliar
J. Sakharam Rao
G. Ramanathan (Editor, Tatler)
D. Paulas, Club Secretary (ex-officio)

Edited and published by T. R. Narayanan, B. sc. (Ag.), M. A. (Cantab.), for the Madras Agricultural Students' Union and printed by A. Subramaniam, at The Coimbatore Co-operative Printing Works, Ltd., Coimbatore.