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COLLEGE AND ESTATE NEWS

Curzon Lecture Sponsored by the Maharaja of Travancore:

Dr. G. Rangaswamy, B. Sc. (Ag.), Assoc. I. A. R. I., Ph. D., Professor and Head of the Department of Agriculture, Annamalai University delivered a lecture on " Antibiotics ".

Students' Club Day and Hostel Day:

The Hostel Day was celebrated on 13th March. Sri T. N. Palaniswamy, M. A., presided. The Hostel Rag was presented by Sri G. Thulasidas.

The Club Day was celebrated on 14th March under the presidentship of Dr. Sivanandam, M. L. C. Sri K. S. Sundaresan, Club Secretary, presented the report of the activities of the Club and Sri K. Ramaswamy, Games Secretary, reviewed the games activities. There was a Variety entertainment.

Tour to America under T. C. M.:

Sri V. Rajagopal, B.Sc. (Ag.), M. A., Sri J. Sakharam Rao, M.Sc. and Sri D. John Durairaj, M. Sc. left for the States under the T. C. M. aid. Professor Ivan Fay, Agricultural Extension Expert, who was in our College under the T. C. M. aid returned to the States.

Tours:

The post-graduate trainees of the Horticulture Faculty went on an educational tour to Eruvadi, Pattiveeranpatti and Periakulam from 14th to 25th March.

National Cadet Corps' Day:

The N. C. C. Day was celebrated with pomp and splendour. There was parade by the cadets and Sri A. Venkatesan, Director of Agriculture, took the salute. Later there was sports.

Training in Mountain Climbing to N. C. C. Cadets:

Sri Rajendran, Ramesh, Medappa and Chandru were selected for the six weeks' training in mountain climbing at Darjeeling and they are now in the Himalayas.

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Editorial

The Co-operative way in Agriculture: Farmers in India, nay in other countries, were carrying on farming for centries in the Co-operative way. Mutual aid is still seen in villeges where cattle, equipment and human resources are pooled for cultivation in peak seasons. In the cultivation of betel vine, one finds the basic principles of Co-operative tenant-farming in practice. Sugarcane cultivation in Godavari district of Andhra Pradesh furnishes yet another example of Co-operative tenant farming. The landlord, plants the cane and hands it over to a group of labourers to carry on the rest of the cultivation operations till harvest; manures, bamboos, cane crushing and boiling equipment alone being furnished by him. The produce at harvest is shared on an agreed basis between land lord and the group of labourers. There are several instances of such Co-operation and mutual aid practices still in vogue but, yet Co-operatives in the real sense as economic instituions have not yet fully, nor successfully taken root in Indian soil.

Rural Co-operative credit, which is essentially agricultural credit in India, received attention from Government and others interested in the welfare of the Agricultural classes from 1892, when Sir Frederic Nichelson was placed on special duty to enquire into the possibilities of introducing a system of Agricultural or other land banks. Since that year, Co-operative credit societies for supply of credit to Agriculturists developed rapidly and covered about a third of the villages in the State. These institutions, fared better in boom periods than in depressions. Besides credit Co-operatives, other forms of Co-operative endeavour are sale and Marketing societies, consumers' Co-operatives and a few societies for Agricultural improvement, land colonisation, land reclamation, kudimaramath and irrigation, cattle breeding and sugarcane growers and fruit growers societies. The progress in these non credit institutions is very limited indeed. Several times, special committees investigated the causes for the slow and poor progress in Co-operation in the

State and valuable suggestions were offerred for reform. The recommendation for starting of multi-purpose Co-operative societies is a notable one to tackle the several phases of the Peasants' life, as it has felt credit alone will not solve their problems. Later came the suggestions for starting of larger banks in the place of small credit societies, for a group of villages. In the Second National Five Year Plan, the development of Co-operation will mainly be along credit, marketing and to a small extent on processing Co-operatives. Large sized Co-operative banks for credit for a group villages linked with marketing, with storage and warchouse facilities is the goal. Training institutions for Co-operative personnel are also provided for in the plan.

All these plans for development are in the right direction for improvement of Agriculture, while the large sized banks are likely to be more effective Co-operative institutions, they require greater control and well tarined personnel for supervision The members are however likely to be far apart lacking in mutual knowledge. The officers of the Co-operative movement will become more and more important and the voluntary non official effort getting less a danger to be guarded against at all cost to avoid the loss of the Democratic principle in Co-operation.

Service Co-operatives, already existing in the form of sugar cane growers Co-operatives, Co-operative sale and marketing societies, Tenant farming societies are to be fully studied, and their development attended to before large scale start is made to introduce them. Though it is a fact that Co-operatives are the only solution to Peasants' problems and for stepping up Agricultural production, yet it is necessary to go slow in their development. Peasants have to learn to work them and appreciate their utility. The peasants' improved economic condition should gradually enable these institutions to develop in their turn for better service. And a large body of officials and non officials required for organising and running the service Co-operative efficiently are also to be trained in their work. All these would require time. Better to be slow and be sure of success. Real good progress with less numbers, will be a sure propaganda for greater and greater developmet of service Co-operatives in the country.

Antibiotics in Agriculture * (Part I)

by

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Annamalai Nagar

Introduction : The earliest knowledge of the antogonistic properties of microbes can be traced to ancient times. Folklores, stories abound among several peoples, to the effect that cheese, mouldy bread and other spoiled food products can be used for controlling human and animal infections. But specific references to antagonistic effect of one microorganism on other could be found in the literature only during the later half of last century. Vuillemin appears to have been the first to use the word 'antibiosis' in the year 1889 to describe the phenomenon of 'the survival of the fittest' among microbes. Marshall Ward in 1899 adopted the word to describe microbial antagonism. Since then people have been using the words 'antibiotic substance' 'toxic substance', 'lethal principle', 'inhibitory principle', 'staling product', 'bacteriostatic substance', 'antimicrobial substance', etc, to denote the chemical action, now known to be due to antibiotics. The word 'antibiotic' was used as an adjective in the early years to designate 'processes which are against life'. Starting from 1941 Waksman and his collaborators used the word 'antibiotic' to denote the chemical substance. In the year 1945 Waksman cleared the confusion that existed in the definition of the word 'antibiotic' by enunciating a clear cut definition. According to him '*an antibiotic is a chemical substance which is produced by a microorganism and which has the capacity, in dilute solutions, to inhibit the growth of and even to destroy other microorganisms*'. Since then this definition has been well accepted by scientists throughout the world and the word antibiotic has firmly established even in the lay minds. In recent time this word has been used to include chemical substances produced by plant and animal tissues, but such expansions of the definition are to be discounted as they will lead again to confusion. The chemicals from plants which possess antagonistic effect on microbes can be called 'plant antibiotics' or 'antibiotic-like sustances' as suggested by Waksman.

During the past two decades antibiotics have revolutionized the medical science. Several deadly diseases are now successfully cured by administering these substances. The achievements with antibiotic

* Lord Curzon Endowment lectures 1959 — delivered under the auspices of the University of Madras and kindly permitted to be published by the University

substances have been so remarkable that, medically speaking, the present age is called 'antibiotic age' or 'antibiotic era' and the antibiotic sustance the 'miracle drug' or 'wonder drug'. With the establishment of antibiotics in medicine, their use in other fields have been explored with all vigour. The results obtained so far indicate that antibiotics have come to occupy a prominent place in animal nutrition, agriculture and in many of the biological and chemial sciences.

Historical Review: Though there is a tendency to attribute the discovery of antibiotic substances to certain individuals, the historical background goes to show that our present knowledge of antibiotics has accumulated from a complex origin. The efforts of scientists working on the microbiology of man and animal systems, the soil, water and sanitation and plant diseases laid the foundation for the science. The advances in chemotherapy brought to light the selective activity of chemical substances on microorganisms; salvarsan and sulfa drugs were successfully used for eradicating the parasite without affecting the host. The progress made in the chemistry of isolation of natural and fermentation products also contributed to the development of isolation procedures for antibiotic substances. So, unlike in other fields, no one person can be called 'Father of antibiotics'.

As early as in 1871 Lister used bacterial cultures for treating wounds. Roberts in 1874 observed that liquids in which *Penicillium glaucum* was growing luxuriently could with difficulty be artificially inoculated with bacteria. In 1876 Tyndall came out with the 'struggle for existence' theory among organisms growing in a mixed population. He found that bacteria which produced green pigments were highly inhibitory to *Penicillium*. The following year, in 1877, Pasteur and Joubert made very important observations; they found that artificial reproduction of anthrax in susceptible animals could be repressed by the simultaneous inoculation with various saprophytic bacteria. On the basis of these observations Pasteur suggested: "One can infect abundantly an animal with anthrax without the animal becoming diseased; it is sufficient that the fluid contains in suspension simultaneously the anthrax organism and a common or harmless bacterium. These facts perhaps justify the highest hopes for therapeutics". In 1879, de Bary, who is considered to be father of Plant Pathology, emphasized the significance of mutualistic and antatgonistic relationships among fungi occurring in nature.

Since these early observations, several workers have attempted to explore the possibilities of utilizing the phenomenon of antibiosis for the benefit of mankind. Cantani, in 1885, found that patients suffering from tuberculosis benefited from treatment with a saprophyte, *Bacterium thermo*. Babes' in the same year observed that certain microbes could produce chemical substances both in liquid and solid media, which had the capacity to inhibit other organisms and he suggested that a study of the chemical might lead to treating one bacterium with another. Garre in 1887, and later other workers, isolated antagonistic pyocyaneous organisms and used them to check infections by pathogens. In 1889, Charrin and Guiguard demonstrated that *Pseudomonas pyocyanea* produced a soluble product that destroyed anthrax bacillus but did not affect red blood cells, thus bringing out the selectively inhibitory property of the chemical substance. In 1899 Emerich and Low for the first time isolated a chemical substance, named by them as pyocyanase, from an old culture of *P. pyocyanea*, which had a marked inhibitory effect on numerous bacteria, but had no injurious effect upon animals when injected intravenously. But they believed that the chemical was an enzyme and not a distinct antibiotic substance as known at present. The interest in pyocyanase grew rapidly but several attempts made to put it into practical utility failed because of its toxicity. In the meantime, in 1907, Nicolle established that filtrates of *Bacillus subtilis* cultures had lytic effect on various pathogenic bacteria including pneumococci. Rappin, in 1912, reported that *B. mescntericus* types of bacteria were active against tuberculosis organism. Much, in 1925, obtained a substance from *B. mycoides* which was used with limited success for treating various infectious diseases.

As early as in 1896 Gosio recorded the isolation of a crystalline compound from cultures of *Penicillium brevicompactum* type which inhibited the growth of *B. anthracis*. In 1897, Duchesne demonstrated *in vitro* and *in vivo* the beneficial effects of inoculating *P. glaucum* against pathogenic bacteria. But these two important observations on the antagonistic property of fungi were not pursued any further at that time.

In 1890, Gasperini for the first time reported on the inhibitory effect of actinomycetes on bacteria. Greig-Smith, in 1917, observed that certain actinomycetes inhibited both bacteria and fungi. Lieske, in 1921, reported on certain actinomycetes antagonistic to bacteria, and pathogenic to man. Thus it can be seen that prior to the report

of Fleming on penicillin in 1929 there were several observations and serious attempts to make use of the phenomenon of antibiosis. In 1929, Fleming published his 'chance' observations on the effect of a fungal contaminant, later on identified as *Penicillium notatum*, upon the growth of bacteria in an agar plate. The fungus brought about lysis of neighbouring staphylococcal colonies. The culture broth had the capacity to kill or inhibit the growth of a number of human pathogens. Fleming named the antibacterial agent as pencillin and also suggested that the substance may be valuable in treating bacterial infections. This import work was burried in the literature for nearly 10 years. During this ten year period, however, attempts were made by Clutterbuck and his associates and Reid to isolate the chemical substance but they failed mainly because of the thermolabile nature of the substance.

In 1939, Dubos, one of the early students of Waksman working at the Rockefeller Institute in New York, isolated from *Bacillus brevis* the antibacterial polypeptide, tyrothricin complex, and clearly demonstrated the antibiotic properties of the substance and its possible use. Simultaneously, the Oxford team of workers headed by Chain and Florey, who were searching for a chemical substance active against *Staphylococcus* and *Streptococcus* infections decided to investigate penicillin and after a great struggle succeeded in their attempts to isolate the substance. Considering the meager quantity of the antibiotic produced by the strain in liquid broth, and its thermolabile nature, it is to be appreciated that the investigators did commendable work in establishing the usefulness of the substance in medical science. Subsequently, in 1940—'41, in a systematic study undertaken at the Northern Regional Research Laboratory in U. S. A., strains of *Penicillium chrysogenum*, which are better yielders of penicillin, were obtained. It was in that laboratory the submerged culture technique and other improvements in the methods of production and isolation processes, were developed. Due to the painstaking work of several investigators high yielding strains of *P. chrysogenum* were obtained and at present the strains used in the industry are capable of producing over 4000 units/ml as against about 100 units/ml produced by the strain isolated by Fleming. All these improvements lead to its wide spread use in medicine and subsequently in other fields.

Though Waksman and Foster recorded in 1937 their observations on antagonistic action of some actinomycetes against fungi and bacteria, it was only in 1939 that Waksman and his

students launched an organized search for actinomycetes active against gram-negative and acid-fast bacteria. They found, early in their studies, that soil actinomycetes formed a great potential source for antibiotic production as 20 to 30 per cent of the isolates examined by them were found to inhibit bacteria or fungi or both. Between the years 1939 to 1943 many soil actinomycetes were screened by this group of workers and several antibiotics including actinomycin, clavacin, fumagacin, micromonosporin, and streptothricin, were isolated but all of them proved too toxic for use in the animal body. However they continued their work with all enthusiasm and in January 1944 announced, the isolation of streptomycin with activity against gram-positive, gram-negative and acid-fast bacteria, including *Mycobacterium tuberculosis*, and with relatively low toxicity to animal. In the early stages of its development as a chemotherapeutic agent, the workers on streptomycin had to face many odds but very soon its importance was realized and a one-million dollar programme was launched by the industrial concerns to establish it in the medical field. At present streptomycin, together with para amino salycilic acid and isoniazid, forms the formidable weapon to fight tuberculosis throughout the world. Streptomycin and dihydrostreptomycin (a catalytic hydrogenation product of streptomycin) are generally administered for treatment against several gram-positive and acid-fast organisms.

The great success attained by streptomycin gave incentive for an extensive screening programme by industrial concerns to isolate soil actinomycetes with antagonistic properties. Thousands of soil samples have so far been tested and millions of actinomycetes screened for activity against other microbes. In all, nearly 150 antibiotics have been reported from this group, of which the important ones are chloramphenicol, aureomycin, terramycin, tetracycline, neomycin, erythromycin, carbomycin, azoserine, sarkomycin, thiolutin, nystatin and candicidin. Besides these, bacteria and fungi have yielded over 200 antibiotic substances. The potentialities of many of these substances have not been thoroughly investigated. Actinomycin which was isolated in 1940 by Waksman and Woodruff and rejected by them because of its high toxicity, has now been found useful against neoplastic tissues like lymphatic system. It is believed that with more and more work newer and better antibiotics will be and wider use for them isolated discovered.

Isolation of Antibiotics: Among the microorganisms, the most important antibiotic producing groups are bacteria, actinomycetes and fungi. They are all distributed in nature, in the soil, air and

water, but soil forms the main source for most of these organisms. Except a few fungi and bacteria, all other antibiotic producing microorganisms have originated from the soil. Among the bacteria, members of the genus *Bacillus*, and *Pseudomonas*, spore formers and non-spore formers, respectively, are extensive producers of antibiotics: nearly 25 antibiotic preparations have been isolated so far from strains of *B. subtilis* alone. Among the fungi, species of *Penicillium* and *Aspergillus* are particularly important as several of their strains produce penicillin. Among the actinomycetes, species of *Streptomyces* are of great importance because of their potentialities to produce antibiotic substances. So far they have yielded over a dozen antibiotics of high pharmaceutical value.

Though penicillin was discovered by the 'chance' observation of Fleming, subsequent workers have evolved, by constant research, several new techniques for secreening microorganisms for antibiotic production. With the help of these techniques it has been made possible to test millions of isolates of microorganisms for antibiotic properties. When once an organism has been selected for the production of an antibiotic the subsequent steps, comprise of the development of suitable media, study of the conditions favourable for the growth and production of the antibiotic in the laboratory and subsequently in the fermentation tanks, improvements in the method of isolation and purification processes, etc. The antibiotic thus obtained is then tested for its biological, chemical and physical properties, and if found encouraging, put for animal test. It is not within the purview of this paper to go into the details of various animal tests that are to be conducted before an antibiotic is tested for therapeutic purposes.

Chemical and Physical properties of Antibiotics: Antibiotics vary greatly in their chemical composition. Some of them are simple substances containing C, H and O, such as clavacin ($C_7H_6O_4$) and kojic acid ($C_6H_6O_4$). Others are more complex and contain nitrogen as in streptomycin ($C_{21}H_{37}O_{12}N_7$) or nitrogen and sulfur, as in penicillin ($C_9H_{11}O_4SN_2R$), or nigtrogen and clorine as in chloramphenicol ($C_{11}H_{12}O_5N_2Cl_2$). Because of their great complexity, the chemistry of most antibiotics offers a real challenge to the students of organic chemistry. On the basis of what we know about their chemistry we can broadly classify antibiotics into following groups:

1. Amphotcric substances, eg., the penicillins.
2. Basic substances, eg., streptomycin, neomycin.
3. Polypeptides, eg., polymyxin, gramicidin.

4. Quinones, eg., rhodomycin, xanthomycin.
5. Polyenes, eg., candidin, nystatin.
6. Tetracyclines, eg., aureomycin, terramycin.
7. Phenolic substances, eg., griseofulvin, gliotoxin.

Some of the important antibiotics have been studied in detail and their molecular structure elucidated. Of these only three antibiotics have so far been synthesized, namely, penicillin, clavacin, and chloramphenicol. Most of the antibiotics are single chemical entities, while others are made up of several closely related compounds, eg., geomycin complex, mycothricin complex, polymyxin complex.

The physical properties of these antibiotics also vary to a great extent; while some are colourless others are coloured with absorption maxima between 290 to 400 hh. The polypeptide antibiotics are highly stable while the penicillins are less resistant to heat. The stability of antibiotics at various hydrogen-ion concentrations in aqueous solutions vary to a great extent. Most of the antibiotics are stable in sunlight but a few like filipin disintegrate quickly in the light. Melting point of antibiotics also vary to a great extent and forms a basis for identifying some of the better known substances.

Antimicrobial Activity: The antimicrobial property of an antibiotic is of the greatest importance to us. Some antibiotics are characterized by a very narrow antibiotic spectra and others possess very wide spectra. Viomycin is active mainly upon mycobacteria and do not have much effect on other microbes, whereas gliotoxin and clavacin are active upon a large number of bacteria and fungi. Most of the other antibiotics fall between these two extremes. Penicillin is active mainly against gram-positive bacteria, streptomycin and related antibiotics upon gram-negative and gram-positive bacteria, including mycobaceria and actinomycetes. Chloramphenicol, aureomycin and terramycin are active upon rickettsial and some larger viruses, besides many bacteria, and are frequently spoken of as 'broad spectrum antibiotics'. Actidione, candicidin, etc., are active mainly upon fungi but not upon bacteria. Also, within each group of sensitive organisms there is a wide range of specificity or sensitivity to a given antibiotic. The antibiotic spectrum, therefore, forms an important basis for characterizing an antibiotic substance. Though an ideal antibiotic would be one which possess a broad spectrum against bacteria, mycobacteria, fungi, viruses etc. with low toxicity

in animal and other favourable pharmaceutical properties, from what we know now of antibiotics, the chances of isolating such a substance seem to be very remote.

Mode of Action: Most antibiotics at low concentrations exert an inhibitory effect on the sensitive organisms, and at higher concentrations a cidal or lethal effect, depending upon the duration of contact of the chemical with the organism. Streptomycin is bacteriostatic to many bacteria at low cencentrations but kills at least some of them at high concentrations. Candicidin is fungicidal to *Candida albicans* whereas griseofulvin is mainly a fungistatic agent, being incapable of killing fungi even at higher concentrations. These variations may be explained by the mode of action of the antibiotics on the cells of micro-organisms.

The nature of the agent, the stage of growth of the bacterial cell, the composition of medium or substrata, the environmental factors, all influence greately the mode of action of antibiotic on a given organism. Various theories have been proposed to explain the mechanism of action of antibiotics on microbes, but the important ones are: (1) the antibiotic enters into a competitive inhibition, substituting for one of the essential nutrients, (2) the antibiotic interferes with the assimilation mechanisms such as protein synthesis or glucose metabolism, thereby upsetting the energy mechanism of the microbe, (3) the antibiotic interferes with the enzyme system affecting notably respiratory mechanism of the bacterial cell and (4) the antibiotic may interfere with the cytoplasmic membrane of the cell. But it is bilieved by most workers that the antibiotics mainly interfere with the enzyme system. Chloromycetin, tetracyclines, streptomycin and penicillin are some of the important antibiotics so far studied for their mode of action. Chloromycetin is known to interfere with protein synthesis and utilization of fats and esters but even at high concentrations the formation of nucleic acids, polysaccharides and many processes of dissimilation are not affected. In the case of tetracyclines, it is believed that the chemicals interfere with protein synthesis and nucleic acid metabolism. The work so far carried out on streptomycin has revealed that the antibiotic interferes with nucleic acid metabolism and also with the Krebs cycle. In the case of penicillin the interference is apparently concentrated in the nitrogen metabilism of cells. Penicillin is more effective on gram-positive bacteria than on gramnegative bacteria. Gram-positive bacteria are more exacting in their nutritional requirements than the latter group. Penicillin is known to interfere with the uptake of glutamic acid by gram-positive bacteria, for which glutamic acid is essential for protein synthesis, whereas gram-negative bacteria, even in the absence of glutamic acid, can build up protein. It is also reported that penicillin is absorbed by the sensitive bacterial cell and bound with the cytoplasm which at higher concentrations killed the cell.

Development of Resistance to Antibiotics: It is known for some years that certain strains of sensitive organisms, when allowed to grow unmultiplied in the presence of high concentrations of a drug, are capable of developing resistance to the drug. This problem of bacterial resistance to chemotherapeutic agents received special attention with the increasing utilization in recent years of penicillin and streptomycin. It also gave a fillip to detailed investigations into the fundamental aspects of drug resistance. It has now been established that the phenomenon of drug resistance is a genetic character. Several new techniques were developed and important experiments were carried out during 1949 — '55. The results have thrown valuable light on the development of resistance to antibiotics.

The occurrence of resistant cells in nature has been brought out, thus establishing that antibiotics acted mainly as screening agents to detect the naturally occuring resistant cells and that they do not act as mutagenic agents. In nature the resistant cells are believed to occur in the ratio of about 10-7 to the sensitive cells. Also two distinct patterns of resistance viz., the penicillin pattern and the streptomycin pattern have been recognized. In the former case there is a stepwise increase in the development of resistance with increase in antibiotic concentration while in the latter type the resistance may not always follow any stepwise pattern, the intermediary stages being absent in the development processes.

Several theories have been formulated for the development of resistance to antibiotics. The importont ones are: (1) There is a certain degre of spontaneous mutation taking place in nature due to irradiation in the sunlight. The mutation rate in bacteria is believed to be high because of the large molecules of DNA present in the cell. (2) The antibiotic may act as a mutagenic agent, affecting the nucleus or nuclear material (3) the antibiotic may bring about a change in the cytoplasm leading to adaptation of the cell to the changed environment. Experimental evidence obtained so far indicates that there is some truth in each of the above theories, but more work is

required to understand these complicated genetic changes in bacterial cells. It has also been observed that in some cases the susceptible cell produces an adaptive enzyme to utilize the antibiotic for its nutrition. Penicillinase is produced by *Staphylococcus aureus* which enables the organism to utilize the substance. Similarly new mutants arise from susceptible species of bacteria, which are not only resistant to the antibiotic but become dependent mainly on the chemical for its growth. Streptomycin - dependent - strains of *Escherichia coli* have been isolated and used for several fundamental studies. Similar phenomenon has also been observed in the genetics of development of resistance to insecticides.

Antibiosis in Natural Processes : Natural processes due to biological reactions are largely a result of growth and activities of animals, plants and microbes inhabiting this planet. All forms of life, under certain natural conditions, produce chemical substances which are either benefical or harmful to other living beings. Thus there exists an interdependent or antagonistic relationships among various groups of living beings. But in general a system of biological equilibrium is maintained in nature, lest there be undue multiplications of one or other sets of organisms. The life span of microorganisms is relatively shorter than that of other living groups and so there exists a competition among the various microorganisms for their survival in nature, especially in the soil. Several soil microbes are now known to produce antibiotic substances in the laboratory under given sets of conditions, which are much different from those existing in the soil. Therefore, it is not clear whether antibiotics play a great role in the 'survival of the flttest' theory among soil microbes. According to Karassilnikov antibacterial substances form one of the most potent weapons in the struggle for existence among microbes. But according to Waksman these assumptions are mainly speculative on the basis of the existing knowledge. The nutritional requirements of the antibiotic producing organisms do not exist in the soil and even if traces of antibiotics are produced they are likely to be disintegrated immediately due to the complex physical, chemical and biological factors acting on them. If the reverse is true only certain type of bacteria or actinomycetes could have been expected to be predominant in the soil, and the remaining ones would have developed resistance to the antibiotics.

Recent investigations, however, have clearly indicated production of antibiotic substances by microorganisms under natural conditions.

Tveit in 1956 found that the simultaneous or prior growth of the saprophyte *Chaetomium globosum* with *Puccinia graminis* the pathogen causing rust disease in wheat, will suppress the development of the disease on the host plant. According to Brian and his co-workers *Penicillium expansum* produced the antibiotic clavacin in apple fruits under normal conditions. Wright has shown that high concentrations of gliotoxin are produced by *Trichoderma viride* in and around particles of organic matter, such as pieces of straw and seed coats burried in the soil. Good number of antibiotic-producing organisms, including *Penicillium notatum* and *P. chrysogenum* among fungi, *Bacillus subtilis*, *B. brevis* and *B. polymyxa* among the aerobic spore formers, *Streptomyces griseus*, *S. lavendulae* and *S. fradiae* among actinomycets, are found in abundance in the ordinary garden and field soils. One could argue, therefore, that such antibiotic formers, growing on plant and animal residues in the soil may produce antibiotic substances at least in a limited scale. Of what importance these antibiotics are in natural processes in maintaining the balance of microbial population ? More elaborate studies are required before any answer could be given to this question. However, it is to be understood that antibiotic production by certain micro-organisms under controlled conditions in the soil could be induced. How far this possibility can be utilized for the benefit of plant growth and for the benefit of mankind can be estimated only with more explorations in the field.

The role of the Agricultural Department in Community Development and National Extension Services with special reference to the development of local manurial resources

by

R. P. TALATI, M. Ag. Ph. D., and T. RADHAKRISHNAN,
Ministry of Food & Agriculture, New Delhi.

The Agriculture Department has an important role to play in bringing about an all round improvement in Agriculture. Our Agriculture is in villages and there is growing awareness amidst farmers for adopting all important recommendations in bringing about agricultural improvements. Earnest consideration has, therefore, to be given as to how these recommendations have to be applied on field scale so that the ryots derive full benefits in the shortest possible time. It is considered that the proper medium for application of the expert agricultural knowledge would be through Community development and National Extension Blocks.

The activities of the Department can be brodly classified under three main categories, namely, (1) Agricultural Research (2) Agricultural Education and (3) Agricultural Extension.

Agricultural research: This work is carried out by different subject matter specialists incharge of sections like (a) Botany Section conducting research on plant breeding and evolving new strains of seeds (b) Entomology Section conducting research on prevention and control of insects and pests on crops (c) Plant Pathology Section for researches on prevention and control of diseases of plants (d) Agricultural Chemistry Section on soil analysis and for conducting measures for improving and maintaining soil fertility (e) Agronomy Section for evolving improved farm practices of crops and grasses. (f) Horticultural Section for conducting researches on fruits and vegetables and preservation of fruits and vegetables (g) Agricultural Engineering Section for carrying on researches on improvement of agricultural implements and tools.

Agricultural education: Educating sons of farmers and other youths through Extension Training Centres located in different regions of the country.

Agricultural extension: This section engages itself in bringing scientific methods and results of scientific researches to the doors of farmers.

In addition to above, the research stations of the Agricultural Department, carry out investigations with a view to solve the main problems of the State with special reference to local climatic conditions and types of soils. Amongst the many activities of the Agricultural department stated above, the launching of the local manurial schemes in the Community Development and National Extension Service blocks deserves special mention.

Scope for the development of local manures: Amongst the many reasons for the low average of agricultural production, the most important one is the wide spread deficiency of organic matter and soil Nitrogen under tropical conditions. At the present level of production, the major crops in India remove about 4 million tons of Nitrogen from soil while the actual quantity available for application to crops by way of cattle manure, compost, green manure, oil cakes and in-organic fertilizers is about one million ton. The net potential quantity of Nitrogen available through cattle dung and urine is about 2·82 million tons annually. There is yet another substantial source of Nitrogen through intensification of green manure practices which has yet to be fully developed. The utilisation of human excrements, village wastes through proper composting is the third source. If all these sources are adequately utilised and developed the fertility of the soils can be built up for increased food production.

Launching of manurial schemes: Two Schemes for the development of local manurial resources have been initiated by the Ministry of Food & Agriculture which are expected to result in stepping up food production in the current Five Year Plan period. Scheme No. 1 is larger and better utilisation of cattle dung and other organic wastes in Community Development and National Extension Service Blocks. Scheme No. 2 is night soil composting in bigger Panchayats. The object of scheme No. 1 is to raise the present level of compost manure production in villages estimated at about one ton per adult cattle to two tons per adult cattle and also improve the quality of manure by raising the Nitrogen content from 0·5% to 1%. Under the scheme compost inspectors are appointed after adequate training in the techiniques of composting and other organic manures - one for each block. Similarly selected farmers are also trained in these processes and these trained farmers serve as a media for demonstrating improved methods of composting to their neighbours. Scheme No. 2 relates to the production of compost manure from nightsoil in Village Panchayat areas. At present the refuse material available in Panchayats (two thousand to four thousand population group) is

not properly utilised for compost making. In order to encourage these Panchayats to prepare compost financial assistance has been provided under the scheme to enable them to purchase necessary equipment for collection of human wastes and refuse matter. This would enable each Panchayat to prepare about 350 tons of nightsoil compost manure annually. The scheme is now in progress in about 540 Community Development and N. E. S. Blocks with 418 trained Compost Inspectors and over 30,000 selected farmers trained in the techiniques of compost making.

The Demand, production and deficit for manure in Madras State: The cattle populatlon in Madras State is about 10·49 million according to the All-India Livestock Census of 1955—56. The principal manure used by ryots is farmyard manure. It is obtained not only from these cattle-yards but also from collection of droppings on the way-side village boundaries. At present there is no data to show the existing level of cattle manure production in the State. If, however, we assume that Natarajan's report (1) on manure production in Chingleput District of the Madras State apply to the conditions of the whole State, the total cattle manure production would work out to 14·27 million tons annually. If we also consider the average quantity collected per head of cattle per annum at 0·67 tons according to his report, the total quantity collected for the whole Madras State would work out to 7·03 million tons. The total production of farmyard manure in Madras State would roughly then work out to 21·30 million tons.

Adequacy of farmyard manure: If we estimate the manurial requirements @ 5 tons per acre of irrigated areas and 2 tons per acre for unirrigated areas, then according to the acreage given in the All-India Statistics of 1953—54 the total requirements of cattle manure would work out to 49·28 million tons. The deficit is thus 27·98 million tons annually.

There is another method of computing the dificiency in estimating the quantity of Nitrogen removed by cros. According to Sri M. S. Sivaraman, I. C. S., the requirements of Nitrogen in the Madras State is estimated at 2·79 lakh tons of Nitrogen. He has also stated that green manure has contributed about 33·4% of the total requirements of Nitrogen in the Madras State, in other words 0·93 lakh tons of Nitrogen is derived from green manure. The cattle dung manure estimated at 21·3 million tons annually would give 0·85 lakh tons of Nitrogen (calculated at 0·4% Nitrogen) and the

Ammonium Sulphate would supply about 0·30 lakh tons of Nitrogen of the total Nitrogen requirements. This is summarised as under:

1. Total Nitrogen requirements of the Madras State.		2·79 lakh tons.
2. Green Manure coverage	33·4% of the Nitrogen requirements.	0·93 lakh tons.
3. Farmyard manure available	21·30 million ton at 0·40% N.	0·85 lakh tons.
4. Nitrogen from Ammonium Sulphate	0·30 lakh tons Total Nitrogen available	2·08 lakh tons.

The total quantity of Nitrogen actually available is thus 2·08 lakh tons which make a dificiency of 0·71 lakh tons annually. This deficiency of 0·71 lakh tons of Nitrogen can be made up by intensifying green manuring pratices from the existing 33% to at least 50% and intensifying compost production and improving the quality of farmyard manure by about 50%.

Development of local manurial resources in Madras State: The Madras State has realised the importance of the local manurial schemes and trained 81 Compost Inspectors and about 8100 farmers who are now intensifying the work in 81 C. D. & N. E. S. Blocks. During the current year 1958–59, 25 more blocks are proposed to be covered and arrangements are being made to train additional 25 compost Inspectors and 1600 farmers.

The nightsoil composting in bigger Panchayats is also receiving careful attention and it is expected that during the current year 250 bigger Panchayats will be taking up of nightsoil compost production. If the progress is maintained at this rate there is no doubt that the deficit of organic manures will be wiped out in the very near future.

Conclusion: It will be noted from what has been discribed above that the proper medium of spreading the correct ideas will be first through the C. D. & N. E. S. Blooks where a well-knit organisation exists for giving ready help to the farmers. So far as

the local manurial schemes are concerned none can deny that our cattle wastes are not fully exploited and conserved and that concentrated drive is needed to utilise this useful fraction to the maximum possible extent. Let us hope that this important work occupies a permanent place in the activities of the Agriculture Department and its application is done through people of faith working in the C. D. & N. E. S. Blocks.

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Twin Seedlings in Sorghum

by
M. S. THANGAM
Millets Breeding Station, Coimbatore

Introduction: The Talaivirichan Cholam selection, A. S. 7657, belonging to *Sorghum roxburghii* var. hians is very interesting in its genetic behaviour as it exhibits a possible genic unbalance. Interesting mutations such as the grassy sorghums, triploids and striped plants (unpublished) were recorded in this selection. The occurrence of polyembryony in this selection is described in this paper.

Materials and Methods: Polyembryony is common among the Gramineae but the occurrence of multiple carpels is rather rare and is more prevalent in the apomictic races like that of *Poa* and other grasses. In a plot of A. S. 7657, an earhead was noted which showed stages of fusion or the fasciation of carples ranging from about complete separation of the carpels, i. e. two seeds or two ovaries occurring in the same spikelet to such extreme cases as a single seed formation, the doubleness of which is represented only by its bigger size and a slight furrow running down the middle on the embryo side of the seed. The different stages are described below:

1. Double seeds.
2. The bases fused.
3. The fusion extending to $\frac{1}{4}$ the length of the grain.
4. The fusion extending to $\frac{1}{2}$ the length of the grain.
5. The fusion extending to $\frac{3}{4}$ the length of the grain.
6. Fused completely with a furrow running down the centre of the grain.
7. One half smaller than the other.

The seeds in the earheads were counted. Out of a total of 1515 seeds, 62 appeared to be completely fused. On dissection, two embryos were found, one smaller than the other. During germination one of the radicles comes out earlier, while the other emerges a day or two later. This initial difference is maintained to the end, with the result that one of the twins is vigorous and normal while the other remains short and stunted (Fig. 1). The twin plants were examined and found to be diploid. The pollen grain measurements (average of 100 readings) are recorded below:

Plant	Diameter in Ocular division	S. D.
Normal	27·92	2·7
Twin (Tall)	27·68	3·0
Twin (Short)	27·01	4·8

Conversion factor to microns x 1·6.

The earheads were observed at the flowering stage and the following modifications were observed (Fig. 2).

1. Two ovaries completely separate.
2. Two ovaries showing different stages of fusion.
3. One ovary with three stigmatic branches.

Four progenies were raised and studied; two from completely fused seeds (A. S. 9661/1 and 2) and two from double seeds (A. S. 9662/1 and 2). The character appears to be heritable. The details are recorded below:

Selection No.	Normal	Double	Base fused	Completely fused
A. S. 9661/1 and 2	3322	38	94	99
A. S. 9662/1 and 2	3005	8	0	77

From the progeny of A. S. 9661/1, 60 heads were analysed for the number of fused, normal, double and triple seeds in each. The details are given below: (Fig. 3)

Family No.	Normal	Fused	Double	Triple
A. S. 9661/1—1	653	41	126	1
,, 1—2	1150	14	45	...
,, 1—3	1613	49	49	...
,, 1—4	2046	48	59	...
,, 1—5	2321	35	27	...
,, 1—6	572	81	264	...
,, 1—7	2475	44	127	...
,, 1—8	2985	31	56	...
,, 1—9	2132	14	47	...
,, 1—10 to 19	13869	...	...	...
,, 1—20 to 60	45476	317	205	...

Discussion: The term polyembryony is applied to the condition where more than one embryo arises out of a single nucellus from different embryo sacs or by the activation of either the integument or the nucellar cells which grow into the embryo sac and behave like normal embryos. The latter are diploid and completely maternal in their character. The several types of polyembryony

have developed more out of perenniality, the latter inducing tendency to apomixis. Interspecific hybridisations which in the earlier stages show a higher degree of incompatibility are apt to give these peculiarities especially in their polyploid progeny. This *Sorghum roxburghii* selection though a diploid, shows as much disturbance in its genic balance as any of the interspecific hybrids. It may be that this variety has cryptic structural hybridity in its chromosomes or certain modifying genes probably, which bring about these variations since this selection, A. S. 7657 was isolated from a cross between A. S. 5495 (an extracted type with juicy stalks) and A. S. 1093 (Talaivirichan Cholam selection from Chittoor) and has been maintained in a homozygous condition by selfing through generations. Alternately it may also be due to the peculiar condition in which the genes are higly unstable.

The occurrence of double seeds in a variety of *Sorghum (S. roxburghii* var. *hians)* has been reported (Ayyangar and Ayyar, 1929). Later Ayyangar and Rao (1936) recorded the incidence of doubleness in *S. durra*, the different kinds of doubleness resulting in twins, triplets, quadruplet seeds and in extreme cases of five and six grains. In crosses between double seeded and single seeded varieties, the first generation plants were reported to be double seeded. In this paper is discussed the occurrence of the fusion or fasciation of carpels ranging from almost complete separation to complete fusion, the doubleness of which is indicated by its bigger size and the furrow running down the embryo side. Thousands of fused seeds were sown and in all the cases, the twins that were obtained were diploid.

Summary: The occurrence of fused seeds in a pure line of *Sorghum roxburghii* is described.

Different stages of fasciation of carpels ranging from complete separation to complete fusion are described.

All the pairs of twins examined were found to be diploids.

Acknowledgments: The help and guidance given by the Millets and Pulses Specialist are gratefully acknowledged.

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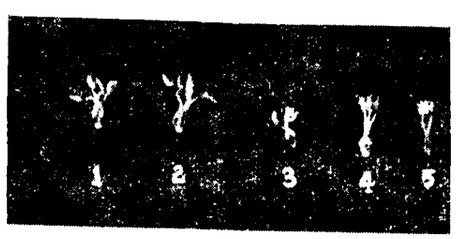
Rangaswami Ayyangar, G. N. and Panduranga Rao, V. 1936 Multiple seededness in Sorghum and consequent repercussions. Madras Agric. J. XXIV. 1.

FIG. 1

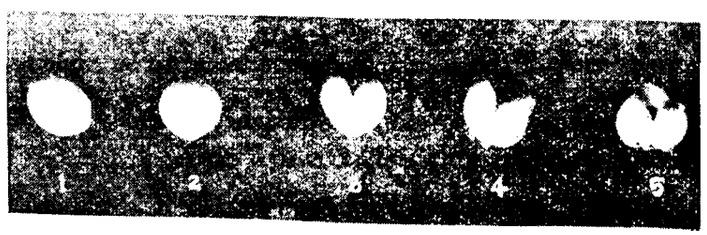
Twin seedling.

FIG. 2



1 & 2. Two ovaries showing different stages of fusion.
3 Two ovaries completely fused.
4 One ovary with three stigmas.
5 Normal ovary.

FIG. 3



1 Normal seed.
2 Completely fused.
3 & 4. Different stages of fusion.
5 Triple seed.

Research Notes

Phyllody in Bengalgram *(Cicer arietinum* L.*)*

Bengalgram *(Cicer arietinum* L.*)* is a short duration crop raised between the (cold season) months of November and February in the district of Coimbatore. In the crop of 1955—56 season, a floral abnormality was observed on strain Co. 1 (a seed of local origin) and also on other types originally obtained for observation from outside Madras State. The abnormality observed was phyllody, a condition in which the floral parts are transformed into leafy structures. The occurrence might have escaped notice but for the apparent protrusion of the ovary as borne on a stalk above the flower. Closer examination revealed the incidence of phyllody in varying degrees, in more than one type that was being raised for study. Only isolated plants within each type exhibited the phenomenon and such plants appeared to be slightly darker in hue than the normal plants. Due to foliar substitutes in the floral parts, the affected plants presented a proliferated and somewhat bunchy 'look'.

Two photographs are furnished to illustrate the phenomenon recorded in this note. In photograph 'A', the terminal portions of two branches from an affected plant containing the abnormal flowers in axilary position may be seen. Photograph 'B' shows the various degrees of expression of phyllody in floral parts in comparison with a normal flower (top left-end). It will be interesting to note the progresslve elongation of the base of the ovary into a rachis, the gradual splitting and exposition of the monocarpellary capsule in to a foliar lamina, the occurrence of a whole leaf with leaflets in the place of the gynoecium, and, the partial or complete transformation of the perianth parts and androecium in to leafy structures (with or without the lateral leaflets of a normal leaf). Most of the affected plants produced no seed. A few pods were obtained from some of the plants, but they were poorly developed and contained only shrivelled and inviable seeds. Due to this and other circumstances, more academic or economic observations could not be made on this phenomenon, from subsequent generations of the affected types.

The occurrence of phyllody has also been reported in gingelly, another economic crop of Madras State (Aiyadurai S. G, and Srinivasalu N. 1956). It has been descsibed as a virus disease, possibly aided in its expression in susceptible types by seasonal conditions and late-sowing. In the present instance also, with Bengalgram, the phenomenon appeared to be caused by virus and influenced by seasonal factors. The differents degrees of phyllody as have occurred, seem to constitute a 'flash-back' on the evolutionary development of the flower in this plant. That a physiological imbalance, obviously created by the affecting virus and over-riding the normal phenotypic expression, has resulted in a degenerate

condition in the essential parts of the plant is interesting. If the exact nature of such virus action is known, it may perhaps be significantly helpful in evolutionary studies, since developmental or reversionary reactions in plant or animal organs might possibly be induced by the use of specific viruses.

Regional Millet Station,
Tirupathur, N. A.
19—9—1958.

K. VENKATARAMAN.

1. Aiyadurai, S. G., and Srinivasalu, N. 1956 A note on the observations on the occurrence of the phyllody disease in certain Sesame (Sesamum oriental L.) types and their behaviour: Madras Agric. J. 43: 114-116.

PLATE: A.

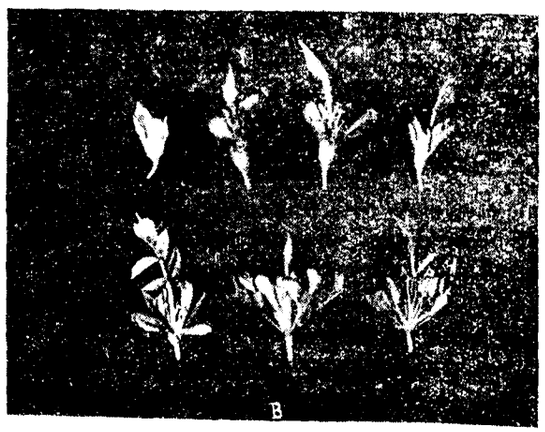


PLATE: B.

Influence of early sowings on the incidence of "Red gram pod fly" (Agromyza obtusa, Mall.) on redgram (Cajanus indicus, Spreng.).

Redgram (*Cajanus Cajan* Linn.) is one of the most widely cultivated pulses in India. Contributing to its popularity are good yields, high quality dhall, wide adaptation and easy culture. In the Madras State, two varieties of redgram viz., (i) short term (4½ months) *Tenkasi* variety and (ii) long duration (6½ months) *Tirupathur* variety are commonly grown under rainfed conditions, the sowing season being June—July.

When redgram is in the pod setting stage, the crop is affected by several insect pests and among them, the "Redgram pod fly" (*Agromyza obtusa*, Mall.) is the most destructive and widespread. The principal damage caused by this fiy is due to its larvae feeding on the soft grains within the pods, thus rendering them unfit for consumption or germination (Fig. 1. b and 2. b). In severe cases, as much as eighty percent of pods and sixty percent of grains are damaged (Ahmad. 1938) and the only outward sign of attack being the minute punctures on the pods. Since this pest is an internal feeder during its destructive stage, the insecticidal methods of control are not very effective.

At the Millets Breeding Station, Coimbatore, in the course of certain agronomical trials, redgram culture No. 1141 (short term *Tenkasi* variety) was sown as a bulk crop on 10th May, 1958, as against the normal sowing season of July. Usual agricultural operations were given and the season was fairly normal. In spite of advancing the sowing season by about two months, the normal duration of the crop (4½ months) remained the same (Viz., period bound) and the vegetative growth, flowering, pod setting and grain yield were very good and the crop was harvested on 25th September, 1958.

It is very interesting to record that this early sown crop was found to be almost free from the attack of "Redgram pod fly", the extent of damage to the pods and grains being as low as 13·2 per cent and 5·4 per cent respectively, while in the normal July sown crop, 47 per cent of the pods and 32 per cent of the grains were damaged.

Evidently, this condition of low degree of infestation in the May sown crop, seems to be a direct result of advancing the usual sowing season (July) and consequently the pod setting season also (October-November) by about two months. In support of this inference, it is worth while mentioning here, that Ahmad (1938) records October-November as a peak period in the seasonal breeding activity of this pest, when maximum damage takes place to redgram.

In the light of the above observations made under Coimbatore conditions, which however await confirmation, it appears quite probable that the extent of damage by "Redgram pod fly" can be effectively reduced by introducing certain suitable modifications in the cropping programe of redgram.

Agricultural College and Research Institute, Coimbatore.

R. VEERASWAMY.

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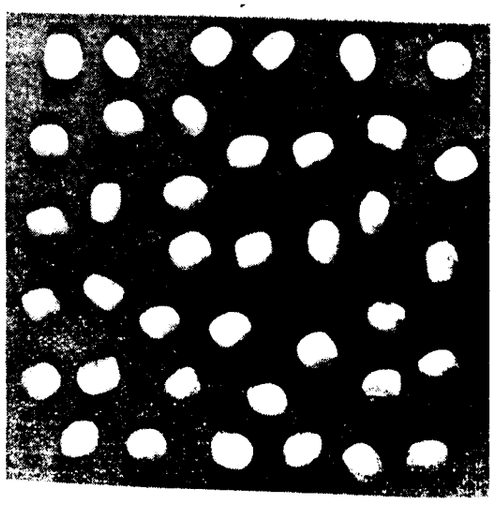
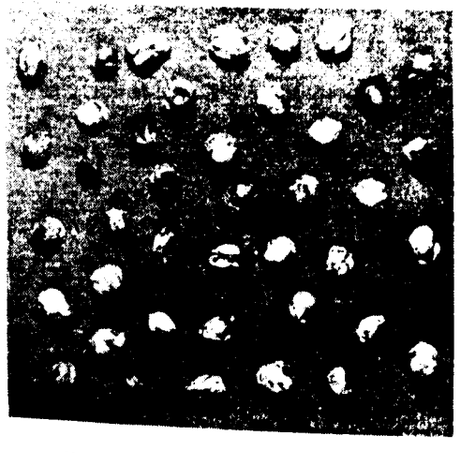
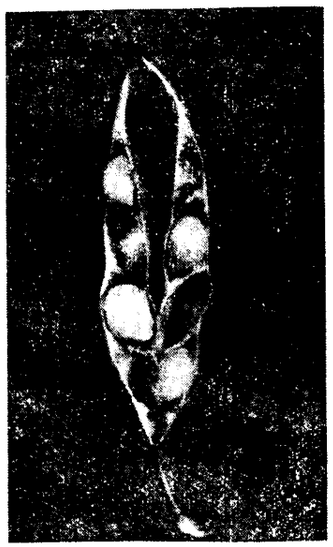


Figure 1. **Grains of redgram** ***(Cajanus indicus)***.
A. Normal.



B. **Damaged by** ***Agromyza obtusa***

Figure 2. **Pods of redgram** ***(Cajanus indicus)***.



A. Normal.

B. Damaged by *Agromyza obtusa*.

Weather Review — for February, 1959.

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January 1959
North	Madras (Meenambakkam)	1·0	+ 0·6	1·0
	Tirurkuppam*	0·8	+ 0·1	0·8
	Vellore	3·8	+ 3·4	3·8
	Gudiyatham*			
East Coast	Palur*	1·0	+ 0·8	1·0
	Tindivanam*	3·8	+ 3·5	3·9
	Cuddalore	1·8	+ 0·9	2·0
	Nagapattinam	0·0	— 0·8	0·4
	Aduthurai*	0·2	— 0·4	0·5
	Pattukkottai*	1·3	+ 0·3	2·2
Central	Salem	3·4	+ 3·1	3·4
	Coimbatore (A. M. O.)* ..	0·4	+ 0·1	0·4
	Coimbatore	0·3	— 0·1	0·3
	Tiruchirapalli	0·1	— 0·2	0·4
South	Mathurai	2·2	+ 1·7	2·3
	Pamban	0·2	— 0·7	1·7
	Koilpatti*	1·9	+ 0·8	2·3
	Palayamcottai	1·0	— 0·2	1·7
	Ambasamudram*	1·6	+ 0·2	2·3
	Nagercoil*	1·5	+ 0·5	1·5
Hills	Kodaikanal	0·4	— 1·1	1·9
	Coonoor*	1·0	— 1·7	1·8
	Ootacamund*	0·1	— 0·5	0·1
	Nanjanad*	0·0	— 0·7	0·0

* Meteorological Stations of the Madras Agricultural Department.

During the first four days of the month local showers occurred in Madras State due to the movement of a low presure wave across the extreme south of the Peninsula. Thereafter weather was mainly dry till the end of the month.

Night temperature was above normal for the first ten days of the month and after an interval of six days it again rose above normal. On 21st February, 1959 night temperature fell generally in Madras State and continued to be so till 26—2—59. But on 27—2—59, night temperature rose above normal and remained so till the end of the month.

The noteworthy rainfalls for February 59 are furnished hereunder.

Noteworthy rainfalls.

S. No.	Date	Name of Place	Rainfall in inches
1.	3—2—1959	Madurai	1·84″
2.	3—2—1959	Salem	1·88″

Zonal rainfall (in inches)

Name of Zone	Rainfall for February, 1959	Departure from normal	Remarks.
North			
East Coast	1·4″	+ 0·7″	Above normal
Central	1·0″	+ 0·7″	,,
South	1·4″	+ 0·4″	,,
Hills	0·4″	— 1·0″	Far below normal

Agricultural Meteorology Section,
Lawley Road Post, Coimbatore-3.
10th February, 1959.

C. B. M., M. V. J. & R. V.

Departmental Notifications

Upper Subordinates—Agricultural Department
Postings and Transfers during the month of March 1959.

Name and Designation	Posted or Transfered to
Sri K. Radhakrishna Monon, Farm Manager, Central Farm, Coimbatore	Service Loaned as Farm Assistant to the Indian Central Arecanut committee
Srimathi Kalyanikutty, Assistant in Paddy, Coimbatore	Do. Do., as Research Assistant
Sri M. P. John	Appointed as Assistant in Oil Seeds
,, N. T. Sabastian	Do. as Assistant in Entomology
,, T. G. Ramamurthy, Millets Asst., Ariyalur	Tobacco Asst. A. R. S., Bhavanisagar
,, M. Charles Ratnaswamy, Tobacco Asst., A. R. S., Bhavanisagar	Millets Asst. A. C. & R. I., Coimbatore
,, D. R. Parthasarathy, Soil Conservation Asst., Kadambuliyur Scheme	Soil conservation Asst., Kodaikanal scheme
,, S. Pandiperumal Do. Do.	Do. Attur Scheme, Madurai
,, G. Varadarajan, Ent. Assistant, Coimbatore	Grain Purchase Office, Erode
,, V. Ganesan, Plant Protection Asst., Tanjore.	Do. Tanjore
,, S. Kandaswami, Agrl. Demonstrator, Gandharvakottai, Tanjore	Do. Do.
,, K. Rajamani, Plant protection Asst., Mayuram	Do. Mayuram
,, Jainulabudin, Agrl. Demonstrator, Ramnad	Do. Do.
,, G. Ramalingam, Agrl. Demonstrator, Choyyar, N. Arcot Dt.	Do. in the Office of the Collector of South Arcot
,, S. Iyemperumal, Asst. in cotton, Palur.	Asst. in cotton, Srivilliputhur
,, H. Bhoominathan, Asst. in cotton, Srivilliputhur	Do. Palur
,, C. M. Pitcha Muthu, Millet Asst., Coimbatore	Farm Manager, Bhavanisagar
,, Syed Rukmudin, Coimbatore Do.	Do. Do. (Satyamangalam)
,, P. Ramaswamy, Coimbatore Do.	Spl. Agrl. Domonstrator, Sugarcane Udumalpet
,, R. Appadurai, Koilpatti Do.	Millets Asst, Koilpatti, Vice V. Srinivasam
Kumari K. Meenakshi, (on leave) Do.	Do. Coimbatore, Vice Srimathi P. Meenakshi transfered
Srimathi P. Meenakshi, Coimbatore Do.	Paddy Asst., Coimbatore

Name and Designation	Posted or Transferred to
Sri C. K. Rajagopal, Tirupattur Do.	Millets Asst., Coimbatore
,, S. Amirthalingam, Coimbatore Do.	Cotton Certification Officer, Rajapalayam
,, K. Venkataraman, Tirupattur Do.	Millets Asst., Coimbatore
,, Nazeer Ahmed, Coimbatore Do.	Horticultural Asst., Coimbatore
,, V. Srinivasan, Koilpatti Do.	Millets Asst., Satyamangalam
,, S. Nagappan, Satyamangalam Do.	Extension officer for Agri., Veppanapalli, Salem District
,, A. K. Nagaratnam, Millets Asst., Ariyalur	Millets Asst., Coimbatore
,, P. Rangaswamy, Coimbatore Do.	Oil seed Development Asst., Udamalpet.
,, Javad Hussain, Cotton Asst., Coimbatore	Cotton Asst. Coimbatore Vice S. S. Anantanarayanan applid for leave.
,, K. K. Palaniappan, Cotton Asst., Coimbatore	Spl. Agrl. Demonstrator, (Cotton) Coimbatore
,, D. V. Ranganathan, Spl. Agrl. Dem. (Cotton), Coimbatore.	Do. (Khadi) Udamalpet
,, M. Bagavandass, Cotton Asst., Coimbatore	Cotton Asst. Cotton Breeding Station, Coimbatore. Vice L. Robinson transfered
,, L. Robinson, Cotton Asst., Cotton Breeding Station, Coimbatore	Spl. Agrl. Demonstrator, Khadi Sulur
,, N. Tulasi Rao, Cotton Asst., Bhavanisagar	Cotton Asst., Srivilliputhur
,, T. Parthasarathy, Agrl. Demonstrator, Manachanalloro, Trichy Dt.	Marketing Assistant in the office of the Collector of Tinnevelly
,, A. Vellaichamy, Spl. Agrl. Demonstrator, (Cotton) Srivilliputhur	Do. Collector of Madurai
,, N. R. Subramaniam, Agrl. Dem. Keeranur, Trichy District	Do. Do. Kanyakumari at Nagarcoil
,, P. Venkatanarayanan, Agrl. Dem. Palakode, Salem District	Do. Do. North Arcot
,, G. S. Jayagopal, Plant Protecton Asst., Salem District	Do. Do. Chinglepet
,, S. V. Kuppuswami, Chemistry Asst. (Stores)	Research Assistant, Chemistry Section
,, S. Kolandaswamy, Farm Manager, State Seed Farm, Thirukalampur	Plant Protection Asst., Trichy
,, H. S. Velayutham, Plant Production Asst., Trichy	State Seed Farm Manager, Kondathur
,, V. Rajagopal, Economics Section	Deputed to U. S. A.

Gazetted Officers—Madras Agricultural Department.

Postings and Transfers during the month of March 1959.

Name and Designation	Posted or Transfered to
Sri D. John Durairaj, Reader in Soil Science Post Graduate Research Institute, Coimbatore and ,, J. Sakharama Rao, Addl. Lecturer in Botany, Coimbatore	Deputed to U. S. A., under the Technical Co-operation Mission Programme for advanced training. Relieved on 28-2-'59 A. N.,
,, S. Raju, on completion of this training at the Soil Conservation Research, Demonstration and Training Centre, Dehra-dun on 28—2—'59	Posted as Asst. Agrl. Engineer (Inspection) Trichy
,, C. D. Sivasankaran, on the expiry of his Leave	Asst. Director, Government Industrial Engineering Workshops Madras reverting Sri K. Lingannan
,, T. M. Venkataram, Asst. in Fruits	To act temporarily as Asst. Horticulturist (Development Scheme Coimbatore)
Dr. A. Mariakulandai, Professor of Soil Science, Regional post graduate Research Institute, Coimbatore	Promoted temporarily to act as Principal, Agricultural College and Research Institute, Coimbatore
Sri D. Danial Sundararaj, Lecturer in Botany, Coimbatore	Promoted temporarily as Systematic Botanist and Professor of Botany, Coimbatore
,, S. Kamalanathan, Asst. Cotton Specialist, (Winter Cambodia scheme) Coimbatore.	Asst. Cotton Extension officer, Coimbatore
,, A. Raghavan, Asst. Cotton Extension Officer, Coimbatore	Asst. Cotton Extension Officer, Madurai
,, S. M. Sulaiman, Deputy Development Commissioner, Madurai	Promoted to act as Joint Director of Agriculture (Extension)
,, K. Santhanam, Dy. Director of Agriculture, Madras	Campaign Officer in Category of the Madras Agrl. Service

Review on market conditions of commercial crops in the notified areas for the month of February, 1959.

Cotton: In this section, lint: Candy of 784 lbs.
Kapas: Pothi of 280 lbs.

Tirupur: Coimbatore District: Season: There was a little rainfall in the district during the month and it was beneficial to some extent to the standing crop of cotton. Standing crop of Karunganni cotton in Palladam taluk was in need of some more rains. In Coimbatore taluk, due to pest attack and insufficient water, the crops of Karunganni was reported to be withering. However attacks of insect pests were reported to have been controlled effectively by application of insecticides.

Arrivals and transactions: Lint: During the month under report the market started with an opening balance of 3155 candies of Cambodia and 244 candies of Karunganni lint. The total arrivals in to the market were 3572 candies of Cambodia and 546 candies of Karunganni lint which included 729 candies of Cambodia lint locally ginned. Despatches from Tirupur accounted for 3441 candies of Cambodia and 575 candies of Karunganni lint. At the end of the month there was a closing balance of 3286 candies of Cambodia and 215 candies of Karunganni lint.

Kapas: The market for kapas started with an opening balance of 2752 pothies of Cambodia and 10 pothies of Karunganni kapas. The total arrivals into market were 11,117 pothies of Cambodia and 86 pothies of Karunganni kapas. The disposals during the month were 9521 pothies of Cambodia and 35 pothies of Karunganni kapas. At the end of the month there was closing balance of 4348 pothies of Cambodia and 61 pothies of Karunganni kapas.

Prices: The average prices of Cambodia and Karunganni lint during the February 1959 and January 1959 were as follows:

	Lint in candies of 784 lbs.	
	February 1959	*January, 1959.*
Cambodia superior quality	Rs. 900—926	Rs. 981—00
,, average ,,	Rs. ...	Rs. ...
Karunganni superior ,,	Rs. 850—871	Rs. 866—00
	Kapas in pothies of 280 lbs.	
Cambodia superior quality	Rs. 131—145	Rs. 145—00
,, average ,,	Rs. 120—130	Rs. 120—00
Karunganni superior ,,	Rs. 105—112	Rs. ...
,, average ,,	Rs. 87·37—97·37	Rs. ...

Ramanathapuram district: Seaons: There were good rains during the first week of the month and dry conditions prevailed during the rest of the month. Pickings of kapas are in progress. The rain received during the month were greatly beneficial to Karunganni cotton crop.

Arrivals and transactions: The following were the opening stocks, arrivals, disposals disposals and closing stocks of kapas and lint in the important markets in the district.

Kapas in pothies of 280 lbs.

Name of Market	Opening balance	Arrivals	Disposals	Closing balance
Virudhunagar	... ...	10900	10900	...
Sattur	... ...	1500	1500	...
Rajapalayam	... ...	2250	2250	...
Total	... ...	14650	14650	...
Lint in candies of 784 lbs.				
Virudhunagar	... 50	790	810	30
Sattur	... ...	150	150	...
Rajapalayam	... 100	375	385	90
Total	... 150	1315	1345	120

Prices: prices of kapas, lint and seeds in the district during the month as compared to that of last month were as extracted below:

Kapas	*February 1959.*	*January 1959.*
Karunganni ...	Rs. 83—106	Rs. 103—110
Tinny Karunganni ...	Rs. 80—95	Rs. 84—112

Lint					
Karunganni	...	Rs. 760—810	Rs.	676—771	
Tinny Karunganni	...	Rs. 660—736	Rs.	...	
Tinny	...	Rs. 545—661	Rs.	621—666	
Uganda Certified	...	Rs. 1376	Rs.	1400	
Uganda Uncertified	...	Rs. N. T.	Rs.	N. T.	
Cambodia	...	Rs. 696—736	Rs.	900—971	
Cotton Seeds in Maund of 82 2/7 lbs.					
Karunganni	...	Rs. 10·44—14.36	Rs.	13·72—17·95	
Cambodia	...	Rs. 10·52—12.41	Rs.	12·09—12·41	

N. B.:— N. T = No Transaction.

Groundnut: (In this section kernels are in candy of 531 lbs and pods in tons).

South Arcot District: Groundnut Kernels: Arrivals from the district produce amounted to 2484 tons and receipts from other districts to 761 tons. 24 tons were imported from other districts. Exports to other States came to 7 tons. The despatches to other districts amounted to 868 tons. Consumption in oil mills and country chekkus came to 1903 and 263 tons respectively. Wastages were calculated to 245 tons. The trade closed with a stock of 1475 tons at the end of the month.

The prices improved slightly on the whole due to the decreased arrivals of kernals. The fluctuation in the prices in the several markets varied from Rs. 156·15 to 171·38 per candy of 531 lbs. and the average price of Ginelly worked out to Rs. 65/- per bag of 168 lbs.

North Arcot District: Season: There was no rainfall during the month under report. It is reported that sowings of summer crop of groundnuts round about Tiruvannamalai and in parts of Vellore were completed and the area under groundnut was reported to have increased due to the availability of water in Tiruvannamalai area from Sathanur Dam project.

Arrivals and transactions: The Opening stocks, arrivals, disposals and closing stocks were as detailed below:

Quantity in Matric Tons:

Kind of Crop	Opening stock	Arrivals	Disposals	Closing stock
Groundnut pods ...	1104·011	974·492	1843·911	875·407
Groundnut kernels ...	270·269	1688·671	1587·144	372·990

(N. B: 1·016 metric ton = 1 ton).

Prices: The following were the range in price of groundnut pods, kernals, oil in defferent markets in the district during the month.

	February 1959	January 1959.
Groundnut pods (per bag of 80 lbs.)	12·50 to 18·50	8·25 to 22·00
Groundnut kernels (per cdy. of 531 lbs.)	140 to 174	113 to 178
Groundnut Oil (per candy of 500 lbs.)	284 to 330	275 to 335
Groundnut cake	—	8·12 to 21

Ramanathapuram District: Arrivals and Transactions: The following were the arrivals and disposals of pods and kernels during February, 1959.

	Opening stock	Arrivals	Disposals	Closing balance
Pods (in tons) ...	500	500	600	400
Kernels (in cdy. of 531 lbs.)	7240	2200	3700	5740

Prices: following were the prices of pods, kernels, oils and oilcakes during the month.

	February, 1959.	
Groundnut pods (per bag. of 80 lb.)	Rs.	N. A.
Groundnut kernels (Cdy. of 531 lb.)	Rs.	165·00—178·00
Groundnut oil in tons	Rs.	21·00—22·00
Groundnut oilcake (Md. of 82 2/7 lb.)	Rs.	9·87—11·36

Gingelly: (In this section bag is 168 lbs).

South Arcot District: Arrivals of gingelly from district produce and other districts were accounted for 273 bags and 107 bags respectively. Despatches to other districts like Madras, Salem and Coimbatore amounted to 584 bags. The country chekkus consumed 754 bags. The trade closed with a closing stock of 445 bags at the end of the month.

Prices improved by 3 to 4 rupees per bag. The average price per bag of 168 lbs. worked out to Rs. 65/-.

Tobacco: (In this section tobacco is in candies of 500 lbs).

Coimbatore District: Arrivals and transactions: There was a little rainfall during the month. Harvesting of tobacco is progressing in all centres of the district and purchase of new crop tobacco by traders has just commenced.

At the end of the month under report there was a stock of 10,180 candies of chewing and 100 candies of cheroot tobacco. About 3220 candies of chewing and 200 candies of cheroot tobacco were exported to Tiruchirapalli, Tanjore, North Arcot, South Arcot, Madurai, in Madras States and to places in Kerala, Bombay and Andhra States.

The market of chewing tobacco was dull during the month. prices of cheroot tobacco continue to be steady due to good demands. The following were the prices for tobacco:

Prices in Rs. per candy of 500 lbs.

Variety	I Grade	II Grade	III Grade
1. *Chewing tobacco (Sun-cured):*			
(a) Meenampalayam	400—450	200—300	120—190
(b) Other varieties	245—340	170—230	100—165
2. *Cheroot varieties:*			
Sun-cured grown in Erode and Bhavani taluks	260—440	210—250	120—200
3. *Chewing tobacco:*			
Pit-cured grown in Palladam and Sulur areas.	250—280	160—185	90—145

Cardamom: *Madurai District:* There was rainfall in the district and it is reported to be meagre. The standing crop was reported to be fair. Picking of cardomom fruits in some places was continued during the month. Spraying and dusting operations were in progress.

Arrivals of Cardamom in different assembling markets in Madurai district were generally fair. Despatches of cardamom were mainly to places in North Indian States like Bombay, Calcutta, Delhi, Kanpur, Amirtasar etc.

There was a general increase in prices of Cardomom about 60 to 70 Np. per lb.

The following were the estimated arrivals disposals of Cardamom during February, 1959.

Quantity in lb.

Name of Market.	Estimated Arrivals.	Estimated Despatches.	Estimated closing stock.
1. Bodinaickanur ...	2,41,000	2,61,000	30,000
2. Thevaram ...	15,000	15,000	30,000
3. Pannaipuram ...	2,000	10,000	12,000
4. Kombai ...	5,000	10,000	15,000
5. Uthamapalayam ...	6,000	8,000	8,000
6. Cumbum ...	60,000	60,000	1,10,000
7. Gudaloor ...	10,000	10,000	20,000
8. Pattiveeranpatti ...	26,000	26,500	8,500
9. Virudhunagar ...	31,000	20,000	25,000
Total ...	3,96,000	4,20,500	2,58,500

The following were the prices of Cardamom in different markets during February 1959.

Name of Market	*Trade Variety*	*Prices per lb.*
(a) *Bodinaickanoor:*		
	(1) Special	Rs. 9.45 to 10.01
	(2) Superior Bulk	,, 8.98 to 9.41
	(3) Medium Bulk	,, 8.13 to 9.12
	(4) Inferior Bulk	,, 7.28 to 8.13
	(5) Seeds or rice	,, 9.17 to 10.30
(b) ***Pattiveeranpatti:***	(1) *Sun dried:*	
	Superior and Bold	,, 9.34 to 9.39
	Medium and bulk	,, 9.12 to 9.44
	Inferior and small	,, 8.58 to 9.16
	Others	,, 7.70 to 8·58
	(2) *Store green:*	
	Superior and bold	,, 9.56 to 10.10
	Medium and bulk	,, 9.29 to 9.68
	Inferior and small	,, 8.70 to 9.06
	Others	,, 7.75 to 8.68
(c) *Virudhunagar:*		
	(1) Bold quality	,, 9.50 to 10.25
	(2) Superior	,, 9.00 to 9.20
	(3) Medium	,, 8.50 to 9.00
	(4) Inferior	,, 11.50 to 12.00

Review of administrative activities of market committees during February, 1959.

General: The Market Committees of South Arcot, North Arcot, Coimbatore and Tirunelveli continued to function during the month under report. Efforts are being made to revive the activities of these Market Committees of Ramanathapuram and Tirunelveli due to disposals of the case in the Supreme Court.

Enforcement: The progress of licensing by the Market Committees during the month were as follows:

Name of the Market Committees	Section 5 (1) A	Section 5 (1) B	Section 5 (3) A	Section 5 (3) B	Weighmen A	Weighmen B
North Arcot Market Committee	204	537	185	506	117	253
South Arcot Market Committee	237	912	190	626	172	581
Coimbatore Market Committee	171	314	141	256	134	159
Tiruchi Market Committee	72	184	34	99	29	62

A = Licences issued during the month.

B = Licences issued upto the end of the month.

Meetings: A meeting of Tiruchy Market Committee held on 21—2—1959 discussed 16 subjects. No meeting was held in other Market Committees during the month under report.

Quality Analysis: Nil.

Quality Competition: Nil.

Crop and Trade Reports

Paddy — First Forecast Report — 1958 — 59 — Madras State: The area sown with paddy up to September 1958 in the Madras State is estimated at 19,79,000 acres. Compared with the area of 19,65,000 acres estimated for the corresponding period of the previous year, the current year's estimate shows an increase of 0·7 per cent. Compared with average area of 19,22,000 area calculated for the five years ended 1957–58 this is an increase of 3·0 per cent. As compared with the previous year a decrease in area is estimated in the districts of Chingleput, North Arcot and Ramanathapuram and an increase in area in all the other districts of the State except the Nilgiris district where the area estimated is the same as that for the previous year.

The first crop of paddy has been harvested on a limited area in the districts of Chingleput, South Arcot, North Arcot, Salem, Coimbatore, Tiruchirappalli, Madurai, Tirunelveli, and Kanyakumari. The outturn of these harvests is reported to be generally ranging from fair to normal. The condition of standing crops was generally fair in all the districts of the State except in certain parts of Chingleput, North Arcot, Tanjore, Madurai and Tirunelveli districts. Red Hairy catter-piller attack on crops is reported to be prevalent in one village in Wandiwash taluk of North Arcot district and in certain villages in Madurai district. Both kuruvai and samba paddy crops in Tanjore district are reported to have been affected by Jassids, In most of the areas in Tirunelveli taluk of Tirunelveli district paddy crop is reported to be affected by insect pests. More rains are reported to be needed in some districts af the State. Paddy crops in Chingleput district are reported to be withering for want of rains. The average wholesale prices of paddy second sort per standard maund of 82-2/7 lb. (or 3,200 tolas) as reported from some important market centres on 3rd October 1958, was Rs. 13·03 at Cuddalore, Rs. 13·60 at Nagercoil. Rs. 14·15 at Kumbakonam, Rs. 14·21 at Vellore and Rs. 14·96 at Madurai. Compared with the prices which prevailed during the corresponding period of the previous year, the current prices reveal a rise of 12·8 per cent at Nagarcoil, 14·7 per cent at Vellore, 14·8 per cent at Madurai, 16·2 per cent at Cuddalore and 21·3 per cent at Kumbakonam.

JUBILEE SHIELD FOR CHEMISTRY

The Golden Jubilee rolling shield of the Chemistry Section to be awarded during the College Day and Conference to the best scientific workers in the field of Agricultural Chemistry.

Rules and conditions for the award:

(1) The shield will be awarded to the best scientific worker in the field of Agricultural Chemistry. All Scientific workers and Research Students of the Chemistry Section at the Agricultural College and Research Institute, Coimbatore as well as in the Department of Agriculture, Madras State will be eligible for the award.

(2) The shield is a rolling one and will be awarded at the time of the Annual College Day and Conference of the Agricultural College and Research Institute every year.

(3) A committee to adjudge the best worker for the award shall comprise.

(1) The Principal (Chairman — Ex-Officio)

(2) The Government Agricultural Chemist (Ex-Officio)

(3) A senior officer of the Research Council elected by Research Council.

(4) The award will be made to the worker adjudged as the best on the basis of the reports or papers containing either (i) an account of original research in which the author's share is the maximum or (ii) a critical discussion or analysis of any subject related to agricultural chemistry, throwing new light on or adding new knowledge to the subject.

(5) A certificate will also be awarded to the winner of the rolling shield.

(6) The shield shall be returned to the Government Agricultural Chemist after the award for keeping in safe custody.

(7) The award will not be made more than once to the same person.

(8) The power to modify the rules to suit any situation that may arise at any time rests with the Government.

Papers and reports etc. for the award are invited on or before the 15th July 1959 by the undersigned.

Lawley Road P. O.

A. Mariakulandai,
Professor of Soil Science.

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

(1)	(2)	(1)	(2)