THE MADRAS AGRICULTURAL JOURNAL

Vol. XXXIX AUGUST 1952 No. 8

CONTENTS

The Madras Agricultural Journal

Vol. XXXIX August 1952 No. 8

Editorial

Thirty-Fifth College Day and Conference: This annual function of the Madras Agricultural Students' Union was celebrated this year on the 13th and 14th August. Dr. R. Nagan Gowda, M. Sc., Ph. D., (Iowa), Minister for Agriculture, Government of Madras, very kindly came down for the occasion and inaugurated the conference on the 13th August. A large gathering of departmental officers, students and members of the public were present on the occasion. In addition, the delegates from various countries of South-East Asia who are attending the International Training Centre of the Food and Agricultural Organization, were also present.

Sri P. D. Karunakar, Principal of the College, welcomed the Minister, Dr. J. G. Vermaat and the other distinguished visitors. He introduced Dr. Nagan Gowda as one who had always taken a very keen interest in the working of the College and Research Institute. He had taken the highest degree in an agricultural subject from the University of Iowa and on his return to India after foreign studies he had taken to practical agriculture. He would therefore bring to the discussions a new approach and angle of view. To Dr. Vermaat, Associate Director of the F. A. O. Training Centre in Soil Fertility, he conveyed the thanks of the Union for so readily accepting the invitation to deliver the opening address in this conference. He then introduced Dr. Vermaat to the gathering as an expert in soil science, who had gathered, after first securing a brilliant degree from the University of Wageningen (Holland) a very wide experience of the soils of Java, Sumatra, Ceylon, Europe and America. In addition to his duties at Coimbatore as Associate Director of the International Training Centre in Soil Fertility, Dr. Vermaat was now making an intensive study of the soils of Coimbatore. Referring to the College, the Principal said that out of 78 students who had appeared for the final examination in April last, 71 were successful and some of them had already been absorbed in the Agricultural Department.

The Secretary of the Union, Sri K. Kuppamuthu, then presented a report on the working of the Union during the year and stressed the vital need that existed for every old student of the two Colleges of Agriculture at Coimbatore and Bapatla to become a

member of the Union and thereby strengthen its financial position. It is encouraging to note that this appeal met with a very good response, especially from the District officers.

Dr. Nagan Gowda then distributed prizes to the students who had come out successful in the examinations. A special feature this year was the fact that Janab Ahmed Bavappa knocked away the majority of prizes as one of the outstanding students of the College. Dr. Nagan Gowda then delivered his presidential address, which is published elsewhere in this issue.

This was followed by an address on the Soils of Indonesia, by Dr. J. G. Vermaat, Associate Director of the Food and Agricultural Organization International Training Centre in Soil Fertility.

In the afternoon, the convocation of the Diploma Course in Horticulture was conducted. The Minister for Agriculture presented the diplomas to the successful trainees and Dr. T. S. Sadasivan, Director of the Botany Laboratory, University of Madras, delivered the convocation address.

The second session of the Conference was held on the 14th afternoon at 2 P. M. when papers were read, as part of a Symposium "Methods to be adopted to maximise production and development of improved strains of seeds and plant materials." The symposium was opened by the Director of Agriculture, Sri M. S. Sivaraman, I. C. S., and followed up by a thought-provoking paper by Dr. K. C. Naik, which dealt with all the possibilities and difficulties of large-scale production of improved strains of seeds and plant materials. A number of other specialists read papers after this, presenting the particular aspects relating to their special subjects. This year too, due to want of time, not all the papers that were received could be presented at the Conference, but it is hoped that it would be possible in due course to publish these papers in the Journal.

On Friday the 15th August, the General Body Meeting of the Madras Agricultural Students' Union was held at 8 A. M., to discuss the accounts and work of the Union for the previous year and elect office bearers for the new year.

The College Day Sports were held at 3 P. M. on the 15th and Sri Beeranna Bhandary of the second year class won the Athletic Championship for the year. Dr. R. Nagan Gowda very graciously distributed the prizes to the winners in the various items of sports including a new cup, styled as the Dr. Nagan Gowda Cup, which was presented by Sri P. D. Karunakar, for the winner of the 1500 metres race.

THIRTY-FIFTH COLLEGE DAY AND CONFERENCE

☆

Principal's Welcome Speech

It is my proud privilege as Principal of this Institution and the President of the Madras Agricultural Students' Union, to accord a hearty welcome to all those assembled here today on the occasion of the Thirty-fifth College Day and Conference.

The Madras Agricultural Students' Union is fortunate in securing the presence in our midst today, of Dr. R. Nagan Gowda. Minister for Agriculture, Government of Madras, who has graciously consented to inaugurate the Thirty-fifth College Day and Conference. He has, by accepting our invitation at great personal inconvenience, showed his keen interest in the working of this College and Research Institute. It is a gesture which we most gratefully appreciate.

He is no stranger to agriculture. He has taken the highest degree in an agricultural subject. Ever since his return to India, he has been practising agriculture as a landlord, but he was different from other landlords in that he personally attended to the farming of the land. It is therefore most fitting that as a trained scientist and as a practical farmer he should preside over our deliberations today and in the ensuing conferences. He will bring to the discussions a new angle of vision in view of his various attainments. We are indeed grateful that we have him as the President of our conference. We extend to him a very cordial welcome.

My grateful thanks are also due to Dr. J. Vermaat for having readily accepted our invitation to deliver the opening speech today. Dr. Vermaat is an expert in soil science of the Food and Agriculture Organisation. After obtaining a brilliant degree in soil science in the University of Wageningen (Holland) he gathered considerable experience of the soils of Java, Sumatra, Europe, America and Ceylon. In addition to the onerous duties here in the International Training Centre on Soil Fertility, he is also making an intensive study of the soils of Coimbatore. This reveals him as a keen student and always eager to learn.

We will be hearing from him about the soils of Indonesia and I am sure it will be an intellectual treat. We are indeed grateful to him.

I am glad to report that the College continues to function efficiently. Out of seventy-eight students who appeared for the Final Examination in April 1952, seventy-one came out successful. I take this opportunity of congratulating the student who came first as well as all the other students who have passed the

examination. I am glad to state that some of the passed students have already been absorbed in the Department. Unfortunately this year, the first year students are not with us at this College Day and Conference.

I extend a very cordial welcome to the ladies and gentlemen and members of the general public who have assembled here on this occasion. I trust all of you will enjoy the function and find our deliberations useful and instructive.

Annual Report of the M. A. S. Union

The Managing Committee of the Madras Agricultural Students' Union have great pleasure in presenting their report for the year 1951—1952.

The Union is very fortunate in having on this occasion Dr. R. Nagan Gowda, Minister for Agriculture, to the Government of Madras, to preside over and inaugurate the proceedings of the Conference. Apart from his interest in our affairs in his capacity as Minister for Agriculture Dr. Gowda has all along been a well-wisher of the Agricultural Department. Being a scientist and a keen agriculturist himself, he has been in close touch with the activities of the Department and is one of those who can speak with first-hand knowledge on matters pertaining to the scientist as well as to the practical agriculturist. As President of this Conference, he will bring to it his ripe experience and wisdom and we eagerly look forward to his guidance. He has agreed very kindly to spare us his valuable time and be with us on this occasion, which shows his keen interest in our activities.

The Union is also fortunate in having with us Dr. J. G. Vermaat, the Associate Director of the International Training Centre in Soil Fertility that was started at Coimbatore on 15—7—1952 under the auspices of the F. A. O. He belongs to the Netherlands but has worked for a number of years in Indonesia and is acknowledged as an authority on Indonesian soils.

The Madras Agricultural Students' Union: The Union was founded in the year 1911. It was started as an organisation to bring together the past and the present students of the Coimbatore Agricultural College as well as its predecessor, the Saidapet College of Agriculture. Since 1945, the past and present students of the Bapatla Agricultural College also have been included in our Union.

The Union has been an independent, voluntary organisation. In addition to its function as a link between the past and present students of the Colleges, the Union can also claim, through the medium of the Madras Agricultural Journal, as a centre of information on matters relating to agriculture, with special reference to Madras.

The Madras Agricultural Journal: The Journal was first started as a Year Book in 1911 and later on published as a quarterly journal. In 1915 it was converted into a monthly journal. We are glad to record that the journal continued to maintain its publication throughout the

year under report. We are proud to note that research workers in other institutions and departments have come to feel that our journal has a place among the scientific journals of the world and are seeking its aid for the publication of the results of their research activities.

The journal has also secured a place among the scientific periodicals of the world and has on its exchange list a large number of scientific publications, both Indian and Foreign. It must be admitted, however, that the present get-up of the journal still leaves considerable room for improvement.

Finance: The high cost of paper and printing charges continue to be a matter of serious concern in the annual budget of the Madras Agricultural Students' Union. In this connection the Union desires to place on record its deep sense of gratitude to the Madras Government for the special grant of Rs. 1,800/- since 1948—1949 and also during the year to meet the high cost of paper and printing and enable the supply of the journal to the students of the Agricultural Colleges at Coimbatore and Bapatla at less than the actual cost. Further, at the instance of the Government, the Symposium papers of the last College Day and Conference were all printed and published in one volume for distribution among the members of the Union and other officers of the department who are not members of the Union. The Government graciously made a subsidiary grant of Rs. 2,200/- to meet the extra cost that the Union had to incur on this account. The Union is grateful to the Government and to the Director of Agriculture, for this help and for a sum of Rs. 1,000/- towards the renovation of stage fittings of the Union.

The Managing Committee desires to make an appeal to one and all of our College students, past and present, both at Coimbatore and Bapatla, to enrol themselves as members of the Madras Agricultural Students' Union. The Committee makes a similar appeal to such of those officers of the department who are not yet members of the Union, to enrol themselves and to enlist more subscribers and thereby help the Union to become self-supporting in its activities.

College Day and Conference 1951: The celebration of the annual College Day and Conference is one of the important activities of the Union. The Thirty-Fourth College Day and Conference was celebrated last year on the 30th and the 31st of the July. It was inaugurated by Shri K. M. Munshi, who was then the Minister for Agriculture, Government of India and the subsequent sessions were presided over by Shri R. L. Sethi, Agricultural Commissioner with the Government of India. A Symposium on "Manuring of Crops" was organised and provided a subject for keen discussion; in which a number of officials and non-officials and non-official participated. Sri A. B. Shetty, then Minister for Agriculture, Madras also honoured us with his presence and was kind enough to declare open the Agricultural Exhibition that was arranged on the occasion.

A detailed account of the proceedings of the College Day and Conference and celebrations has appeared in the August 1951 number of the Madras Agricultural Journal.

Prizes: The Ramasastrulu Munagala Prize, run under the auspices of the Madras Agricultural Students' Union has been awarded to Sri P. C. Sahadevan, Assistant in Paddy, Agricultural Research Station, Pattambi, for his paper on "Studies on the problem of loss of viability of

rice seeds in storage." Our thanks are due to Messrs. V. T. Subbaiah Mudaliar, S. N. Venkataraman and R. Balasubramaniam for acting as the judges in this year's competition.

Patrons: We are happy to welcome Sri C. V. Bhashyam as one of our new patrons.

Retirements: Since our last report the following members have retired from service: Sri N. Subramanya Iyer, Deputy Director of Agriculture, Sri K. Krishna Menon, Plant Protection Officer (Mycology) and Sri S. Ramachandra Iyer, Government Entomologist. The Union records the services rendered by these gentlemen while they were in service, in various capacities as members of the Union.

Obituary: We record with deep sorrow the death of the following members, P. V. Ramiah, C. S. Krishnaswami Iyer, (Sugarcane Inspector), P. N. Raghavan, Dr. T. V. Ramakrishna Iyer and K. Srinivasan.

Sri P. V. Ramiah, who started his career as an Assistant Chemist in 1920, was for a number of years one of our most active and enthusiastic members and was always a source of encouragement and help in arranging the dramatic entertainments in the Annual College Day celebrations. Thereafter he occupied the posts of Agricultural Chemist and Principal and for a short period in 1943, as Director of Agriculture also. It is sad to record that Mr. Ramiah, who was due to retire in December 1951, did not live to enjoy his retirement after his long and meritorious service in the department.

Dr. T. V. Ramakrishna Iyer, who died in February 1952, was one of the oldest members of the Agricultural Department and was always closely associated with the Madras Agricultural Students' Union, being the Editor of the Madras Agricultural Journal for two years and Vice-President for one year.

The Union records with deep sorrow the death of two of its senior patrons, Sri T. A. Ramalingam Chettiar, Coimbatore and Sri V. Arumugam Pillai, Sundaikamuthur, Coimbatore. We take this opportunity to convey our condolences to the members of the bereaved families.

Acknowledgements: It is now our pleasent duty to record our thanks to all those who have helped the Union during the year. To Shri K. M. Munshi, the Union owes a debt of gratitude for inaugurating the last year's Conference and to Shri R. L. Sethi for presiding over the sessions of the symposium. To Sri A. B. Shetty, the Union is very grateful for his sympathetic interest in the affairs of the Union and encouragement of its activities. To Sri M. S. Sivaraman, I. C. S., the Director of Agriculture, the Committee tenders its grateful thanks for the never-failing help and guidance so freely given to the Union. To Sri P. D. Karunakar, Principal, Agricultural College, Coimbatore the committee offers its heartfelt thanks for his help in guiding the affairs of the Union and to Sri R. Balasubramania Iyer, Principal, Agricultural College, Bapatla for his sustained interest in the welfare of the Union. To all those ladies and gentlemen who helped to make the last College Day and Conference a success and helped the committee during the year in various ways, our heart-felt thanks are tendered.

K. Kuppamuthu,
Secretary.

Dr. Nagan Gowda's Address

Dr. Nagan Gowda said that as a cultivator he had derived great benefit by the work that was being done at this College and Research Institute and that he always looked with interest to the deliberations that took place every year at their conference. He was glad that the Madras Agricultural Students' Union called itself an independent voluntary organisation and he hoped it would keep its independence. He was also glad to note that its journal was ranked among the scientific journals of the world. As long as the journal was not able to maintain itself, Government would come forward to support it, but sooner or later it must make itself self-supporting, he said.

Dr. Nagan Gowda paid a tribute to Dr. Vermaat, Associate Director of F. A. O. who was present there, for his attainments in the field of soil research and hoped his presence would serve as an inspiration to young men studying and doing research work in agricultural science in this Institution. He also appreciated the presence of Dr. Shingo Mitsui of Japan and said his presence would help them to solve their problem of rice production and increase the yield per acre as was done in Japan.

Referring to the running of the International Training Centre on Soil Fertility at the Agricultural College, the Minister said that it was a recognition by the F. A. O. of the work done at the College. He hoped that the presence of the trainees from different countries in South-East Asia would bring about a closer relationship between India and her neighbours and said that a similar service had been rendered by India more than a thousand years ago when intellectual savants from India travelled over to South-East Asian countries and taught there.

Touching on the rice problem facing the country and the Madras State in particular, the Minister said they were depending mainly on the illiterate cultivator to solve this problem. He would be able to solve it if they gave him training in scientific agriculture and rice production. He was glad to note that this College had sent out 71 graduates this year and also that some of them had already been absorbed by the Department. He hoped it was only a few, because he was expecting that a great majority of others that had graduated would find a more lucrative and more pleasant occupation in farming. He knew of some people who tried to avoid taking up farming but he believed that the day was fast disappearing. Agriculture was like any other profession but the ordinary agriculturist in the last few years had done pretty well. With decontrol of foodgrains, for which they must thank the Government and Rajaji, the production of crops must increase. There had been some fear among graduates that agriculture would not pay. He supposed that was why graduates were afraid of it. Illiterate cultivators had been able to stand their ground all these many years and some of them had made a decent and respectable living and why should not graduates with every kind of training and knowledge at their command take to farming, he asked.

It was only in India that agricultural graduates sometimes refused to take up farming, said the Minister and added : It did not happen in other countries where a large number of graduates went back to their farms. He did not know whether service in a department was as attractive as practical farming. They in India, had a very good market

for all their agricultural produce. Now they were importing from outside also. He was not unaware of the fact that they should produce all their foodstuffs including sugar, more economically and try to export them to other countries, which he hoped they would be able to do when agricultural graduates took to farming. They had very many serious and difficult problems facing the Indian cultivator in the field of agriculture, in the field of animal husbandry, in marketing of produce and it was the future agricultural graduates who would have to come to the help of the illiterate cultivators to solve all these problems. They would have to plunge into this business and take all chances and hazards but along with these risks and hazards, there were also rewards. A great majority of the population of this country were farmers and adult suffrage had been introduced in this country today. It would not be very long before this country would be ruled by the vote of the farmer. He, as an agricultural graduate, would ask them whether they wanted to be left out of that great farming community. The Minister thanked the Principal and the Union for the honour done to him in inviting him to participate in the annual function.

Symposium on "Methods to be adopted to maximise production, and development of improved strains of seeds and plant materials"

Opening of Symposium by Sivaraman, I. C. S., Director of Agriculture, Madras.

It has been usual in the annual conferences of the Departmental Officers to discuss some agricultural subject of topical significance. Faced as we are with the problem of stepping up agricultural production in the State, we have been selecting subjects pertaining to this matter and last year we talked of manuring of crops, a factor of utmost fundamental importance in increasing crop production. This year we are to discuss a natural corollary to last year's subject viz., Maximisation of agricultural production through improved seeds and plant materials.

2. One of the outstanding achievements of the Agricultural Department has been the evolution and distribution of improved strains of paddy, millets, oil-seeds, cotton, sugarcane and fruit plants suited to the different tracts of the country. Of the breeding sections in this Institute, paddy is the oldest and therefore great progress has been made in this crop. We have released strains to suit about 80% of the paddy area in this State and the strains have already spread to 40% of the area. The improved millets cover 15% of the area and can be extended to 40% of the area with the existing releases, leaving roughly about 60% of the area for which improved strains have yet to be released. In respect of cotton, superior strains have been evolved for all the commercial zones in the State and these cover about 51·6% of the cotton acreage in 1950—'51. In respect of sugarcane, the Department has spread improved types developed at the Coimbatore Sugarcane Breeding Station to cover 90% of the area under cane. Progress in the case of oil seeds has not been spectacular. Improved groundnuts cover about 11%, gingelly 13% and castor about less than 2%.

3. There are many mis-informed critics who think that the Agricultural Department has not so far justified its existence. It is

therefore necessary to emphasis that in terms of monetary value, the annual value of the increased production by spread of improved seeds and plant materials amounts on a modest computation to 12·5 crores of rupees for paddy, 2·1 crores for millets, 4·38 crores for sugarcane, 4·58 crores for cotton, 1·90 crores for groundnut, 1·39 crores for coconut, 3 crores for fruits and over 10 lakhs of rupees for gingelly and castor, which totals to about 29·95 crores by spread of improved strains, not to speak of the extra yield realised by the adoption of improved agronomic practices and the use of scientific pesticides.

4. We can therefore be proud of our achievement so far, but as I have indicated already, there is still considerable scope to exploit the existing strains to their maximum possibilities by spreading them to the areas for which they are even now suitable. Some of the strains available with the Department can be spread to a further 40 lakhs of acres under paddy, 30 lakhs of acres under millets, 8 lakhs of acres under cotton. The problems are (1) how best we can spread the improved strains to areas to which they are suitable and at the same time maintain the purity and performance of the strains, (2) What steps we should take to develop improved strains (a) in respect of the remaining areas; and (b) with regard to the areas for which suitable strains have already been developed. The latter is a long-range problem and as we are concerned with the existing resources in the way of seed and plant materials, we have to devote our attention mainly to the first problem for the present.

5. The evolution of improved seeds has been so far a monopoly of the State and this is not likely to change for some years to come. The distribution of improved seeds has also been virtually a State monopoly. The Agricultural Department distributes the nucleus seeds produced at the Research Stations, multiplies them in the primary seed farms and further develops them on the secondary farms for distribution to the ryots. This entails a good deal of extra expenditure, as the crop has to be rogued and the seeds cleaned and dried more carefully than in the case of grain for consumption. The seed has therefore to be sold at a higher price and so far the State has borne a good part of this extra expenditure and recovered only a small extra from the ryots. For instance, the State expenditure on this account in 1950—'51 was about 6 lakhs of rupees for distribution of 9·578 tons of paddy seeds. to cover an area of 4·31 lakhs or about 4·8% of the paddy area. If this work is to be intensified so that at least 25% of the area can be brought under improved seeds once in four years, the Department will have to handle 57,900 tons of seeds and the extra expenditure to Government will be in the order of 53·6 lakhs. This is a stupendous task which will be difficult to undertake efficiently with our existing resources of men and materials in the Department.

6. The question which I have to ask all of you is whether the distribution mainly by the State is a rational way of doing things when cultivators are aware of the utility of the improved seeds. Is it not possible to develep other methods of spreading seeds of assured purity on a commercial or co-operative basis through other agencies like village committees or recognised or licensed seed-farm growers.

LIST OF PAPERS RECEIVED FOR THE 35TH COLLEGE DAY AND CONFERENCE

	SUBJECT	NAME
1.	Maximisation of seed production in improved strains and of plants in improved or superior varieties.	Dr. K. C. Naik, Headquarters Dy. Director of Agriculture, Madras.
2.	Increasing the production of improved strains of seeds.	Sri V. T. Subbaiah Mudaliar, Lecturer in Agriculture, Coimbatore.
3.	A note on the methods of maximising production of pedigree rice seed and its distribution to the cultivators.	Sri M. B. V. Narasinga Rao, Paddy Specialist, Coimbatore.
4.	Methods to be adopted to maximise production and development of improved strains of millet seeds.	Messrs. P. Krishna Rao, Millet Specialist and A. Kunhikoran Nambiar, Assistant Millet Specialist, Coimbatore.
5.	Maximising production and development of Uganda I cotton strains in Madras State.	Sri P. N. Krishnaswami Rao, Assistant Cotton Specialist.
6.	Methods to be adopted to maximise prodution and development of improved strains and plant materials with special reference to cotton.	Messrs. C. Jagannatha Rao, Cotton Extension Officer and N. Kesava Iyengar, Assistant Cotton Extension Officer, Coimbatore.
7.	Methods to be adopted to maximise production and development of improved strains and plant materials - General and Oilseeds.	Sri G. Venkatanarayana, Oilseeds Specialist and Vice - Principal, Coimbatore.
8.	Methods to be adopted to maximise the production and development of improved strains and plant materials.	Sri V. N. Madhava Rao, Asst. to Fruit Specialist, Coimbatore.
9.	Maximisation of production and development of improved strains of paddy.	Sri N. C. Thirumalacharya, Seed Development Officer (Paddy) Vellore.
10.	Methods to be adopted to maximise production and development of improved strains and plant materials - the part an entomologist can play.	Sri V. Thirumala Rao, Government Entomologist, Coimbatore.
11.	Improved varieties and plant diseases.	Sri T. S. Ramakrishna Iyer, Government Mycologist, Coimbatore.

	SUBJECT	NAME
12.	Methods to be adopted to maximise production and development of improved strains and plant materials.	Sri Bhagirathi Padhy, District Agricultural Officer, Srikakulam.
13.	Potato Improvement by multiplication of virus free seed.	Sri K. Saptharishi, Superintendent, Agricultural Research Station, Nanjanad.
14.	Possible methods of maximising agricultural production and development of improved strains and plant materials.	Sri K. Sanjiva Shetty, District Agricultural Officer, Tellicherry.
15.	Methods of maximisation of production.	Sri C. Ekambaram, Superintendent, Sugarcane Liaison Farm, Hospet.
16.	Utilisation of the Agency tracts in maximising fruit production.	Sri N. V. Ramasomayazulu, Fruit Asst., Araku Valley.
17.	Methods to be adopted to maximise production and development of improved strains and plant materials.	Sri P. V. Rajappan, Agricultural Research Station, Taliparamba.
18.	Production of improved strains of rice in Malabar and their future development.	Messrs. P. Uttaman and P. C. Sahadevan, Agricultural Research Station, Pattambi.
19.	Methods to be adopted for maximising production and development of improved strains in oilseeds.	Sri C. R. Seshadri, Oilseeds Section, Coimbatore.
20.	Methods to be adopted to maximise rice production and the development of improved strains of paddy.	Sri M. K. Venkatasubramaniam, Superintendent, Rice Research Station, Tirurkuppam.
21.	Co-operative farming essential for maximisation of production by application of improved methods and seeds.	Sri G. Seshadri Iyengar, Cotton Section, Coimbatore.
22.	Maximisation of crop production in the Ceded Districts.	Messrs. C. Balasubramaniam, Agricultural Meterologist and K. R. Ramaswami, Assistant to the Meteorologist, Coimbatore.
23.	Some successful plant introductions and how best to maximise their production.	Sri C. Rajasekhara Mudaliar, Govt. Lecturing Systematic Botanist, Coimbatore.
24.	Proper utilisation of cane material for maximising sugar production.	Sri M. Lakshmikantham, Asst. Agronomist, Sugarcane Research Station, Anakapalle.

	SUBJECT	NAME
25.	Methods to be adopted to maximise production and development of improved strains and plant materials.	Sri V. Gomathinayagam Pillai, Cardamom Specialist, Singampatti group, Tinnevelly.
26.	A note on the importance of seed multiplication work in cotton in maximising production, and suggestions to overcome the difficuties met with in the procurement of seeds.	Sri N. G. Narayanan, Assistant Cotton Specialist, Tiruppur.
27.	Composting nightsoil and farm waste as a means of maintenance of soil fertility and increased seed production.	Sri M. Sanyasi Raju, Government Agricultural Chemist, Coimbatore.
28.	A note on the methods to be adopted to maximise production and development of improved strains and plant materials.	Sri K. Satyanarayanamurthy.
29.	Methods to be adopted to maximise production and development of improved strains and plant materials.	Sri N. Sankaranarayana Reddy, Assistant Agricultural Engineer, Soil Conservation Scheme, Bellary.
30.	Methods to be adopted to maximise production and development of groundnut strains suitable for summer cropping in the Madras State.	Sri S. Varisai Muhammad, Assistant in Oilseeds, Coimbatore.
31.	Maximisation and development of selected seedlings production in Government Coconut Nurseries.	Sri S. G. Aiyadurai, Assistant Oilseeds Specialist, Coimbatore.
32.	Improvement of cane varieties in Madras State and maximisation of sugar production.	Sri S. V. Parthasarathy, Sugarcane Specialist, Anakapalle.
33.	Production and development of improved strains of vegetable seeds.	Janab S. A. Ebrahim Ali, Plant Protection Assistant, Entomology, Tanjore.

Phytohormones and Nitrogen Deficiency in Paddy

By

N. C. GOPALACHARI, M. Sc., (Agri.),
Chemistry Section, Coimbatore

Introduction: Phytohormones are growth-regulating chemicals found in minute quantities in plants. They are capable of influencing specific physiological processes at parts whither they had been transferred. Hormones influence plants in four important ways, (1) causing physiological and morphological differences in the plant parts which bear roots, leaves, flowers, and fruits, (2) determining the form of a plant (3) producing tropisms just as phototropism, geotropism etc., and (4) controlling growth. All stages of growth and especially the cell enlargement phase are greatly influenced by hormones.

Nowadays synthetic hormones are being put to a variety of uses to help the farmer and the fruit grower, as in parthenocarpy or seedless fruit-setting, prolonging or breaking of dormancy in tuber plants as and when required, prevention of lodging, prevention of pre-harvest fruit drop, rooting of cuttings and eradication of weeds. Overcoming certain nutrient deficiencies in soil was also found possible by means of synthetic growth-hormones.

Review of literature: Avery, Burkholder and Creighton (1936) showed that a deficiency of nitrogen causes reduced hormone content in plants like Helianthus and Nicotiana, but the deficiencies of Ca. Mg. S. and P. did not show such effects.

Folke Skoog (1940) showed no relationship between the deficiencies of Ca. and Mg. with hormone concentration, in tomatoes.

Eaton (1940) showed that boron deficiency affected hormones in cotton and that indole-acetic acid could be used to overcome the deficiency to some extent.

Avery et al (1937 — 45) and Riker (1939) showed similar results and observed that zinc deficiency reduced plant hormones.

The present work was planned to find out the relationship between nitrogen, hormones and growth in paddy. The work was carried out at the Plant Physiology Laboratory, in the College of Agricultural Research, Benares Hindu University.

Materials and Methods: Forty-eight cement pots were taken and waxed inside, the drainholes being closed with cement mortar. Sand washed with hydrochloric acid and water previously, was used to fill them up. Eight pots were used to grow *Sahdia* variety of paddy, applying tap water alone. When 6 inches high, the plants were transplanted (five in each) into each of the remaining 42 pots. Six pots were kept as control and were supplied with a normal nutrient solution based on Turner's formula (1922) modified by Beckenbach, Wadleigh and Shive (1936) and further modified by the author. Here the stock solution B was replaced by Hoagland and Snyder's (1933) stock solution B which possesses all the necessary minor elements (Refer Table I). The remaining 36 pots were supplied with N-deficient solution based on the same formula (refer Table II).

On 5—10—1949, a month after starting the experiment, the 36 pots supplied with N-deficient solution were divided into 6 groups. One group was given 4 times the usual amount of nitrogen according to Turner's formula. The second was given normal nutrient solution. The third was supplied with one-tenth the normal nitrogen. The fourth, fifth and sixth groups were supplied with alpha-naphthalene-acetic acid in concentrations of 1/25,000, 1/50,000 and 1/100,000 respectively (refer to table II).

The hormone content present in paddy at the shoot tips was observed at fortnightly intervals. The hormones were first extracted and the concentrations of hormones then determined by the "Pea test" and expressed in terms of degrees. The methods adopted for extraction and determination of hormones from paddy shoots were as follow :

Extraction of Hormones : This was done according to the simplified method of hormone extraction suggested by Overbeek (1938). Ether purified by shaking with ferrous sulphate, Ca O and H_2 O to remove traces of peroxide and distilled later was used. The shoot tip of paddy was cut and immediately placed in a chilled beaker and covered over by ice to inactivate enzymes from destroying auxins. After sufficient chilling nearly 1 gm. of shoot tip was weighed quickly and placed in a beaker containing 40 cc. of purified ether and allowed to stand overnight in a refrigerator. Next day this ether was evaporated till 1 or 1·5 cc. of residue was left. This was diluted to 20 cc. and used for the "Pea Test".

Assaying the hormones : F. W. Went's method (1934) of pea test was employed and the French sugar variety of peas was used. The requisite number of pea seeds were soaked in water for 6 hours and were then planted in moist sand in a dark chamber provided with a red light. The plants would be ready within 7—9 days, when they grow 10—12 cm. high, developing two nodes each bearing a scale leaf and one at the top bearing a leaf. Selection was made of such plants whose internodes between the terminal leaf and terminal bud were less than 5 cm. in length. Such plants were uprooted, washed in water and then the tops were cut 5 mm. below the terminal bud. Later, the stem was split centrally lengthwise with a sharp safety razor blade for 3 cm. length. Another cut was given a few mm. below the split stem portion and then washed in flowing tap water for 1 hour. Thus split sections of pea were obtained. At least six of them were transferred to each petri dish containing about 20 cc. of the extracted hormone solution. The acidity of this solution under test should never exceed pH 4.

Shadowgraphs were taken of these sections placed in each petri dish, separately, after 12—15 hours or overnight. The pea sections were quickly dried in the folds of a filter paper and placed on Velox or bromide paper in a dark room and exposed to 60. c. p. electric bulb for 2 seconds at four feet distance.

The angles of curvature were then measured with a transparent plastic protracter placing it on a shadowgraph. The angle to be measured is that subtended by the tangents drawn to the extreme curved tip and at that particular point on the stem where the direction of curvature changes. Thus two angles on either side of a split section were obtained and averaged.

Results: The hormone content fell markedly in N-deficient plants and reached a zero value on 4—10—1949 (refer table III) nearly a month after starting the experiment, whereas the control showed a steady increase.

When N-deficient plants were supplied with nitrogen, the hormone content showed an increase which even exceeded the control value in the case of 4N. Similarly, application of synthetic hormone increased the phytohormone, the highest concentration of it reaching a level higher than even the control value (refer table IV).

The yield and vegetative vigour were better in control than in the treated plants. High doses of N delayed grainsetting and increased vegetative growth. (refer tables V and VI)

Discussion: The results show that there is a definite relationship between nitrogen, auxins and the growth of the plant. Nitrogen deficiency is followed by auxin reduction which is accompanied later by decrease in growth. Application of nitrogen as well as alphanaphthalene acetic acid increased the phytohormone content. At this time application of nitrogen in higher quantities delayed grainsetting due to undue increase of vegetative growth. But the synthetic hormone increased yield, though vegetative growth was not affected by it beyond a certain extent. This can be explained by Kraus and Kraybill's hypothesis (1913) of C/N ratio, where nitrogen is increased greatly and carbohydrates are not proportionately increased. Hence a major portion of the carbohydrates are synthesised into amino-acids, leaving very little for grainsetting resulting in rank vegetative growth. Increase in phytohormone by application of nitrogen may be due to increased protoplasm and chlorophyll pigment which increase auxin synthesis, and the decrease of auxin in N-deficient plants may be due to abnormal oxidation capacity in N-deficient plants (Folke Skoog, 1940).

The increase of hormones by the synthetic substance is due to the setting free of the plant hormone from its storage form, being itself a free acid. The chemical structure of this substance is also found similar to a phytohormone.

Summary:

1. Nitrogen content, auxin production and growth are correlated.

2. N-deficiency decreases auxin production due to inactivation or destruction of plant hormones caused by increased activity of oxidising enzymes.

3. Application of alpha-naphthalene acetic acid one month after transplanting to the N-deficient plants increases plant hormones to the level of control. Yield is increased, whereas vegetative growth is not increased beyond a certain extent.

4. Nitrogen in higher doses increases vegetative growth without any favourable effect on yield when applied one month after transplanting to the N-deficient plants. Phytohormones are increased by the application of nitrogen to a level nearabout that of the control.

Acknowledgment: The author is grateful to Prof. K. Kumar, M. Sc., Professor of Plant Physiology, Shri J. C. Luthra, I. A. S. Principal, College of Agricultural Research, Benares Hindu University for guidance in the above work and to Shri M. Sanyasi Raju, M. Sc., Government Agricultural Chemist, Coimbatore for their valuable suggestions.

TABLE I.

Turner, nutrient solution

Stock solution—A.

Reagents	Gms./litre for each.	Volume molar concentration	No. of c.c. per litre.
KNO3	50·5	0·5	2
Ca (NO3) H2O	118·1	0·5	2
Mg (NO3)2 6H2O	128·1	0·5	2
KH2 PO4	68·1	0 5	2
Ca (H2 PO4) 2	126·1	0·5	2
Mg (H2 PO4)2	109 2	0·5	2
K2 SO4	87·1	0·5	2
CaSO4·2H2O	17 2	0·1	10
Mg SO4 7H2O	123·3	0·5	2
Distilled water	...	...	974

Stock solution—B.

Reagents	Gms./18 litres solution	
LiCl	0 5	1 cc. of stock '8' is added to 1 litre of stock solution 'A' and 1 cc. of freshly prepared 0·5% Ferric Tartrate solution is added to this just before application to plants.
CuSO4H2O 5H2O	1·0	
Zn SO4	1·0	
H3 BO3	11·0	
Al2 (SO4) 3	1·0	
SnCl 2. 2H2O	0 4	
MnCl2. 4H 2O	7·0	
NiSO4. 6H2O	1·0	
Co (NO3) 2. 6H 2O	1·0	
TiO2	1·0	
KI	1·0	
KBr	0·5	
Distilled water	18 litres.	

TABLE II

Composition of Nutrient solutions-cc. of Stock solution required to make 1 litre of culture solution.

Salts	Volume molar concentration of stock solution.	Gms./litre of stock solution.	N. Series 4 N.	1 N.	0·1N	0·0 N
KNO3	0·5	50·5	8·0 cc.	2 0	0 2	0·0
Ca (NO3)2	0 5	118·1	8 0 ,,	2·0	0·2	0 0
Na (NO3)	0·5	128·2	8·0	2·0	0·2	0·0
Mg2 (PO4) KH2 PO4	0·5	68·1	2·0	2·0	2·0	2·0
Ca (H2PO4)2	0·5	126·1	2·0	2·0	2·0	2 0
Mg (H2P04) 2	0·5	109·2	2·0	2·0	2·0	2·0
K2 SO4	0·5	87·1	2·0	2·0	2·0	2·0
CaSO4	0 5	17·2	10·0	10·0	10·0	10·0
MgSO4. 7H2O	0 5	123·3	2 0	2·0	2 0	2·0

TABLE III— Pea test for hormones.
Mean angle of curvature.

Date.	Control.	N. deficient.
4—9—49	29·9°	29·8°
19—9—49	58·0°	10·1°
4—10—49	73·75	0·0°

TABLE IV—Pea test for hormones

Treatments	Mean angle of curvature on 19—10—49	4—10—49
Control	91·4°	116·3°
4 N	63·3	139·0
1 N	38·8°	144·0
0·1 N	6·5°	61·3
1/25,000 naphthalene acetic acid	63·8	140·3
1/50,000 ,,	39·5°	110·3
1/100,000 ,,	7·10	65·0

TABLE V.
Fresh weight, dry weight and ash weight per plant of 20-11-49.

Treatments	Fresh wt.	Dry wt.	% dry wt.	Ash in	% ash on dry basis.
	in gms.	in gms.		gms.	
Control	1528·0	509·6	33·0	76·44	15·0
4 N	1232·5	320·4	26·1	36·90	12·6
1 N	1006·4	381·6	26·3	41·02	10·7
0 N	890·0	169·1	19·0	16·11	9·5
1/25,000 Naph.	1052·0	236 9	25·2	31·79	13·6
1/50'000 ,,	945·0	239·3	25·0	20·68	13 0
1/100,000 ,,	763 0	105·4	16·1	10:10	9·9

TABL VI.
Yield

Treatment	Yield per pot of 5 plants expressed in gms.
Control	24·0
4 N	15·5
1 N	20·4
0–1 N	17·6
1/25,000 Naphthalene acetic acid	25·5
1/50,000 ,,	22·0
1/100,000 ,,	17·9

BIBLIOGRAPHY.

1. Appleman–Sci. 48, 1918.
2. Armstrog, H.E. and E. J. Armstrong–Ann. Bot. 25, 1911.
3. Avery G. S.–Bull. Torrey Bot. Club. 62, 1935.
4. Avery Jr. G.S. and P.R. Burkholder–Bull. Torrey Bot. Club. 63-1936.
5. do. and H.B. Creighton. Ann. J. Bot. 24. 1937 (51-58)
6. do. Ann. J. Bot. 24, 1937 (226-232)
7. do. Ann. J. Bot. 24, 1937 (553-557)
8. do. Proc. Nat. Acad. Sci 22, 1936.
9. Avery and Pottorf–Ann. J. Bot. 1, 1945.
10. Avery et al–Ann. J. Bot. 28, 1941.
11. Bauguoss L. C. Ann. J. Bot. 22, 1935.
12. Bayliss. W. M. & E. Starling–Proc. Roy. Soc. 73, 1904.
13. Beckenbach J. R. Wadleigh C. H. & Shive, J.W. Soil Sci. 41, 1936.
14. Borgor and Avery–Ann. J. Bot. 21, 1944.
15. Bonner. J. – J. Gen. Physiol. 17–1933.
16. ,, Proc. Nat. Acad. Sci. 19-1933.
17. ,, Protoplasma 21-1934.
18. ,, Proc. Nat. Acad–Sci. 29–1933.
19. Bonner & K. V. Thinnann–J. Gen. Physiol. 16–1938.
20. Boysen Jensen P-Growth hormones in Plants–1936–Translated by G. S. Avery Jr. & P.R. Burkholder.
21. do. –Ann. Rev. Biochem. 7-1938.
22. Bunzel H.H.–J. Agr. Res. 2, 1914.
23. do. J. Biol. Chem. 28-1917.
24. Cailhajan M.H. Publ. Acad. Sci, USSR. 1937.
25. Clark M. A. – Plant Physiol. 1–1926.
26. Cholodny N G.–Herbage Rev. 3 – 1935.
27. Cooper W. C.–Plant Physiol. 10-1935.
28. Curtis O. F – Cornell – Univ. Agr. Expt. Sta. Mem 14-1918.
29. Dolk H.E. and Thimann K.V.–Agr. Expt. Sta. Mem. 14-1918.
30. Eaton F. M. Bot. Gaz - 101 – 1940.
31. Garden F. E. and Marth. P-C. – Bot. Gaz. 99-1937.
32. do. Sci. 90-1933.
33. Gericke W.F. – Bot. Gaz. 78 – 1924.
34. Goodwin R. H – Ann. J. Bot. 24-1937
35. Graham R.J.D. and L.B. Stewart – Proc. XI Int. Hort. Cong. 1930, 1931.
36. Greogory, F.G.–& Purvis O.N–Nature 138–1936.
37. Gustafson, F.G. – Proc. Nat. Acad. Sci. 22–1936.
38. do. Am. J. Bot. 25–1936.
39. Haagensmidt A.J. & F.W. Went-Proc. Kan. Akad. Wetendsch. 35–1935.
40. Haagensmidt A.J. – Am. J. Bot. 29—1942.
41. Havas, L. J. – Nature 157-1946.
42. Heath O.V.S. – New Phytol. 7–1949.

43. Hitchcock, A. E. W. Crocker & P.W. Zimmermann-Contr-Boyce Thomsom Inst. 6–1935.
44. Hitchcock, A. E. & P. W. Zimmermann. do.
45. Howlett F.E. Ghio Agr. Expt. Sta. Bull 1943.
46. Hurd Karrer–J. Agr. Res. 29–1939.
47. Hurd A.M – J. Agr. Res, 25 – 1923.
48. Kogl – F. Rep. Bri. Assoc. 1933.
49. Kraus E. J. & Kraybill – Ore Sta Bull. 1948-1918.
50. Leoman A. C., Pamphl. Soc Agr. Biol. Soc. 6, 1933.
51. Leomen L. H. & V. G. Lilly – Am. J. Bot. 21, 1937.
52. Lochwing W.F. & Bauguess L.C – Sci. 84-1936.
53. Marmer D.R – Am. J. Bot. 1538-1937.
54. Mc. Call A.G. J. Am. Soc. Agr. 15-1925.
55. Michenor H. D., Sci. 82-1935.
56. Miller E. C. Plant Physiology, McGraw Hill Book Co., 1938.
57. Overbeek J. Van – Proc. Nat. Acad. Sci. 21-1935.
58. ,, ,, ,, 21-1938.
59. ,, Am. J. Bot. 26-1941.
60. ,, Nature 155-1945.
61. Purvis O.N–Ann. Bot. Lond. N.S. 8–1944.
62. Purvis O. N. & Gregory F.G–Ann. Bot. 1. 1937.
63. Ramiah K – 'Rice in India' 1937.
64. Sen R. – Curr-Sci. 9–1940.
65. Skoog F–J. Gon. Physiol. 20-1937.
66. ,, Ann. J. Bot. 40-1940.
67. Snow R.– New Phytol 21-1932.
68. Southwick L – Proc. Am. Soc. Hort Sci. 42-1943.
69. Thimmana K. V. & J. Bonner - Proc. Nat. Acad. Sci. 18-1932.
70. ,, ,, Proc. Roy. Soc, 113,1933.
71. Thimmann K.V – J. Gen. Physiol. 19-1938.
72. ,, Ann. Rev. Biochem. 4, 1935.
73. ,, Ann. J. Bot. 29, 1942.
74. Thomas Swarbrick – New Biol. 5-1948.
75. Went F.A.F.C. – Nature – 132-1933.
76. Went F.W. – Proc. Kow. Akad. Wetensch. 30-1926.
77. Went F.W. ,, ,, 37-1934.
78. ,, Bot. Rev. I – 1935.
79. ,, Proc 25th Ann. Celebration Univ. Soc. Calif. 1936.
80. Went. F. W. & K. V. Thimmann – Phytohormones – Macmillan & Co, 1937.
81. Went F. W. – Ann. Rev. Biochem. 8, 1939.
82. ,, Bot. Gaz. 99-1939.
83. ,, Bull Torry – Bot. Club. 66–1939.
84. ,, Bot. Rev. 11-1945.
85. ,, Plant Physiol. 22–1947.
86. Whyte R.O. Crop Production & Environment – 1946.
87. Zimmermann – Contr. Boyce, Thompson, Inst. 19–1942.

Heterosis Effects in 'Crinkled Leaf' Heterozygotes in *Gossypium arboreum* L.

By

V. SANTHANAM, M. Sc.,
(Assistant in Cotton, Coimbatore)

Introduction: The inheritance of 'crinkled leaf'—a new abnormal mutant spotted as a rogue in the seventh generation of an inter-racial cross in *G. arboreum* L. viz. *indicum* x *cernuum* was reported earlier (Balasubrahmanyan and Santhanam, 1951). This type which was characterised by abnormal leaf crinkles, gave monofactorial inheritance in crosses with normal-leaved parents. The F.1 exhibited partial dominance for leaf crinkling with intermediate grades of crinkled leaves and the F.2 segregated in the ratio of 1:2:1 respectively for normal, F. 1 and crinkled phenotypes. Both the parental classes bred true in the F. 3 while the 'intermediates' again threw out the three phenotypes in the ratio of 1:2:1.

It was sought to study heterosis effects, if any, in a segregating population drawn from the 'crinkled leaf' crosses, as the three genotypes were morphologically distinguishable here. In wheat, Granhall (1949) utilised a similar advantage in recognising heterozygous 'half-bearded' plants in a population for the 'beardness' factor and found that the heterozygotes in the F.2 were on an average more vigorous than the 'beardless' and 'bearded', parental class of segregates.

Material and Methods: Two crosses of the 'crinkled leaf' mutant with normal-leaved types CST 3 and '1274', both belonging to *G. arboreum* race *indicum* were taken up for study. In the case of CST 3 cross, the first backcross of the F. 1 to the normal leaved-parent was also utilised in addition to the F. 2 which was studied in both the crosses. In all the hybrid populations, the three genotypes could be easily marked out.

Data were gathered on final height and fresh weight of plants. The height measurements were made with a metre scale and reckoned to the nearest millimetre. The plants were then cut at the cotyledonary node and the weights recorded immediately. The weight of *kapas* collected from each of the plants was added to their respective fresh plant weights for obtaining total weight data.

Heterosis effects were sought to be recognised in terms of both these attributes viz. final plant height and total weight. The individual plant values under each of the three pheno and genotypes viz. homozygous normal (like parent); heterozygous (partially) 'crinkled' (like F. 1); and homozygous 'crinkled' (like parent) were tabulated separately and the respective means of population and errors of distribution worked out. The differences between the mean values of the heterozygote and the homozygotes were tested for significance with reference to *t* values of Fisher (1938).

Experimental Results: The data obtained from the first backcross and second generation hybrids of CST 3 x 'crinkled' and F.2 of 'crinkled' x '1274' are furnished in Table 1.

TABLE I.

Heterosis effects in 'crinkled leaf' heterozygotes

		Plant height in cm.	Total weight in gm.
I.	*(CST 3 x crinkled) F1 x CST 3 :*		
	Pheno and Genotypes — Heterozygous like F.1	49·3	93·2
	Pheno and Genotypes — Homozygous normal	46·1	72·6
	Difference of heterozygote from normal	+ 3·2	+ 20·6
	Significance of difference	No	Yes
II.	*CST 3 x Crinkled F 2 :*		
	Pheno and Genotypes — Homozygous crinkled	41·0	26·7
	Pheno and Genotypes — Heterozygous like F·1	56·7	73·6
	Pheno and Genotypes — Homozygous normal	52·7	67·2
	Difference of heterozygote from : (1) Crinkled	+ 15·7	+ 46·9
	(2) Normal	+ 4·0	+ 6·4
	Significance of difference : (1)	Yes	Yes
	(2)	No	No
III.	*Crinkled x 1274 F2 :*		
	Pheno and Genotypes — Homozygous crinkled	37·2	18·0
	Pheno and Genotypes — Heterozygous like F·1	59·2	53·8
	Pheno and Genotypes — Homozygous normal	45·5	45·1
	Difference of heterozygote from : (1) Crinkled	+ 22·0	+ 35·8
	(2) Normal	+ 13·7	+ 8·7
	Significance of difference : (1)	Yes	Yes
	(2)	No	No

It is interesting to note that in the case of plant height as well as total weight, the heterozygotes have uniformly recorded higher values than the two homozygotes in all the segregating populations. However, the increase over the 'normal' is significant only in the case of total weight in the backcross population, while the positive differences of the 'heterozygote' from the 'crinkled' are significant in all cases.

Discussion: In many crop plants like *Sorghum*, barley, maize and wheat, instances of heterozygote superiority have been recorded. The term monohybrid heterosis has usually been applied to such manifestations of hybrid vigour in crosses between biotypes, genetically known to differ by a single allelic alteration.

In *Pisum*, Ramusson (1927) reported better germination for seeds harvested from plants heterozygous for the anthocyanin factor than those from the respective homozygous parents. Karper (1930) measured the height of plants in a segregating progeny of an *albina* cross in *Sorghum* and found the heterozygotes to be visibly, although slightly more vigorous than their normal sister plants. Dealing with barley crosses involving

white and yellow seedling lethals, Robertson and Austin (1935), found significant increases in length of culm or length of head in the heterozygous green plants. Jones (1945) found heterosis in several maize crosses involving recessive variations with the respective normal parent lines. Gustaffson (1946) reviewed the earlier results in both plants and animals and presented interesting examples of improved viability in heterozygotes from chlorophyll-deficient and other lethals in many barley crosses. The same author (1947) extended the study to dihybrid off-springs from *albina* and *xantha* crosses in barley and found them to be distinctly superior to their normal sister plants in yield characters.

It has generally been postulated that the above phenomena resulted either from multiple effects possessed by the gene, known as pleiotropism or due to linkage with other growth, yield and physiological factors. These effects may further not be mutually exclusive.

The 'crinkled' type used in the present study is an abnormal variation, late in maturity with a high 'node number' and carries with it chlorotic patches on the leaves and consequent lowered yield. The parents involved in its crosses are known to differ from the same in a major gene viz. *crA* and possibly in other minor modifiers as well, in view of their divergent sources of origin. Types CST 3 and '1274' are Cocanada (*indicum*) lines from the Godavari tract, while the 'crinkled' mutant originated from an *indicum* x *cernuum* hybrid complex. The consistent intensification in height and weight exhibited by the 'crinkled heterozygote' may therefore be explained as due to pleiotropic effects of the *crA* gene and interaction of different modifier complexes contributed by either parent.

Summary: Two crosses of the 'crinkled leaf' mutant with normal leaved types in *Gossypium arboreum* L were studied for heterosis effects. The hybrid material offered the advantage of phenotypic distinction between the hetero and homozygotes.

The 'crinkled heterozygote' recorded uniformly higher values for plant height and total weight in all the segregating populations. However the increase over the 'normal' was significant in one instance only, while the positive differences of the 'heterozygote' from the 'crinkled' were significant in all cases.

Pleiotropic effects of *crA* gene and interaction of different modifier complexes are suggested as possible causes for the 'heterozygote vigour'.

Acknowledgements: My grateful thanks are due to Sri R. Balasubrahmanyan, B. A., B. Sc. (Ag.), Principal, Agricultural College, Bapatla, for helpful guidance and valuable suggestions in carrying out the investigations. I am also thankful to Sri C. Jagannatha Rao, B. A., M. Sc., Cotton Specialist, for his kind interest and encouragement.

REFERENCES

1. Balasubrahmanyam, R. and Santhanam, V. (1951) Inheritance of *crinkled leaf*, a new abnormal mutant in Asiatic cotton. Curr. Sci. *20:* 46.
2. Fisher, R. A. (1938) Statistical methods for research workers. Oliver and Boyd (1938).
3. Granhall, I. (1946) On heterosis effects in *Triticum vulgare*. Hereditas *32 :* 287-93.
4. Gustaffson, A. (1946) The effect of heterozygosity on viability and vigour. Hereditas *32 :* 263 86.
5. Gustaffson, A. (1947) The advantageous effect of deleterious mutations. Hereditas *33 :* 573-575.
6. Jones, D. F. (1645) Heterosis resulting from degenerative changes. Genet. *30 :* 527.
7. Karper, R. E. (1930) The effect of a single gene upon developmennt in the heterozygote in Sorghum. J. Hered. *21 :* 187.
8. Ramusson, J. (1927) Genetically changed linkage values in Pisum. Hereditas. *X :*
9. Roberston, D. W. and Austin, W. W. (1935) The effect of one and of two seedling lethals in the heterozygous condition on barley development. J. Agri. Res. *51 :* 435.

Rainfall in the Ceded Districts

By

SRI K. R. RAMASWAMY,
Assistant in Meteorology

AND

SRI C. BALASUBRAMANIAN,
Agricultural Meteorologist, Coimbatore

Introduction: The districts of Anantapur, Bellary, Cuddapah and Kurnool form the zone known as the "Ceded Districts" in the Madras State. This zone is a typical dry-farming tract. Barring a few pockets of garden-lands, the major portion of the area under cultivation in these four districts is rainfed. Hence the nature of precipitation decides the success or failure of farming in this tract. The tract is situated between longitude 3° 4' to 16° 25' and latitude 75° 40' to 79° 33' and at an altitude that varies from 500 to 2500 feet. Bellary and Anantapur form the northern and North-Eastern extremity of the Mysore plateau and Kurnool and Cuddapah touch the East coast districts of Nellore and Guntur.

Climate of this Zone: The average annual rainfall in this zone varies from 22″ to 28 inches, spread over a period of 45 to 65 days. This tract experiences extremes of temperature; the mean maximum temperature ranging from 84° to 104 F. and the minimum temperature from 62° to 80° F. In summer the maximum temperature goes up to 114° F and in winter the lowest minimum temperature is even 44 F. The humidity is also comparatively low, with a mean range of 55 per cent to 79 per cent. Another feature of the tract is that a year of good rains is invariably followed by two or three years of scarcity.

Soils: In Kurnool the soil is red with different grades of fertility and with patches of black cotton soil on the western portion where it touches the Bellary district. Bellary with its numerous detached rocky hills has got stretches of black cotton soil with a general slope from west to east. The district of Anantapur has arid red soils of poor fertility and deficient rainfall; treelessness and general poverty of the soil are the chief features of this district. Cuddapah may be regarded as an oasis in this zone, in that the soil is quite fertile, being covered by the river Pennar and its tributaries.

Material and Methods: The rainfall of this tract is considered in all its aspects, as the entire agriculture in this tract depends on its rainfall. The data were collected for a period of 81 years from 1870 to 1950, both inclusive, from the "Season and Crop Reports", published by the Board of Revenue, and were analysed statistically.

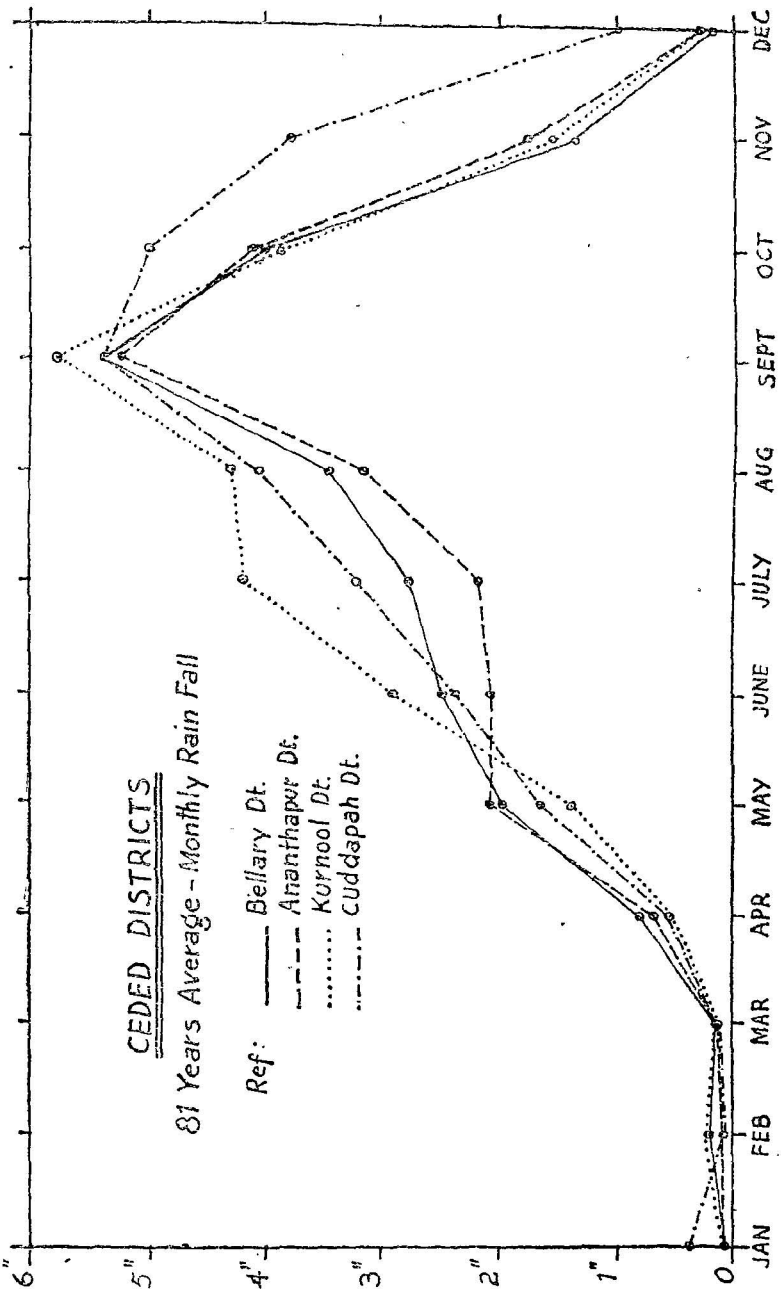
Justification for Considering the Four Districts as One Unit: A study of the graph drawn with eighty-one sets of total annual precipitation for these four districts will reveal that the variations are well defined, barring the periods 1880—1890 and 1940—1950. In regard to the latter period, 1940—1950, it may be stated that the variation is very wide not only in these districts but in the Madras State as a whole.

In regard to the intensity of seasonal showers it may be inferred from the data that it is similar in all the four districts. In September and October it is high, except in Kurnool and soil erosion is likely to occur.

Statistical Analysis: In Table II particulars are given regarding the monthly distribution of the annual precipitaion with the number of rainy days in each month and the percentage of drought years.

Characteristics of Monthly Preciptation: The data are also graphically represented to bring out the inter-relations among the monthly precipitations of the four districts. To find out the nature of fluctuations and deviations of the monthly preciptation between the periods of ten years, the 81 years' rainfall data have been considered in eight units, (10 years data for one unit) and four graphs drawn, one for each district. From the graphs, it can be concluded (1) that September is the wettest month in the year; (2) More variations and fluctuations are seen between August and October and (3) in all the four districts the dry season remains unchanged.

To get an idea of the inter-relationship between the monthly precipitations, 66 inter-monthly correlations were worked out for each of these four districts. The number of positive and significant inter-monthly correlations are five for Kurnool district, three for Cuddapah, two for Anantapur and one for Bellary. But it is interesting



to note that the correlation existing between the precipitation in the months of June and October is positive and significant in every one of these four districts. So it can be concluded that if the precipitation in June is normal in any one year, the ryots of this zone irrespective of the

district to which they belong, can hope to have normal rains in October of that year. Normal rains in October in this tract means a favourable agricultural season for the year as a whole.

Likewise, the total seasonal precipitations have also been considered apportioning the seasons as :

Summer :	February to May.
South-West Monsoon :	June to August.
North-East Monsoon :	September to January of next year.

Though September is generally included in the South-West monsoon period, a deviation has been effected in regard to the present data, since September happens to be the transition period. Further, agriculturally, September is an important month when the major portion of sowings are done, if the rains are favourable. There is nothing special regarding the relationship between the seasonal showers except the positive significant correlation between South-West monsoon and the North-East monsoon showers in Kurnool. This sort of weak and insignificant relationship of varying nature is perhaps the justification for the fear in the minds of the farmers of the tract that the season in the zone is very unreliable. But one noteworthy feature is that the rains received in the months of September and October have a positive significant relation with the total annual precipitation in every one of the four districts. The November rainfall also is similarly related, except in Kurnool. This finding is in conformity with the local agricultural practice. In fact September and October form the main sowing season in the tract. If the rains are very late and disappointing, sowings may be done even in November. Rains received in each of these three months have been found to be positively and significantly correlated with the total annual precipitation. If rains in these three months are normal, the year as a whole is likely to be a prosperous one for the tiller of the soil.

Receding of Monsons : There is a general complaint in this tract that the monsoon is becoming weak year by year. To know whether the data on hand support this belief, the period of 81 years was divided into spans of ten years, the first one being for the period of 11 years. Ten years' duration is taken as one span length. For the sake of brevity only the annual rainfall data are presented in Table III.

It is interesting to note that isolated heavy falls that go to enhance the total precipitation in certain years will not make all the years in that span similar. Further, the monsoons are not receding and becoming weak year by year. The fluctuations noted, have been in existence for the past many years. Besides, even in the recent years 1947–50 the rainfall variation in this zone was not so very marked as in other parts of the State.

Floods and Droughts : Because of the uncertain nature of the agriculturally important North-East monsoon in this tract, the possibility of floods and droughts was worked out on the lines adopted by Ramdas

(3). According to him, a year is to be considered as one of 'Floods' or 'Drought', if the deviation of the actual rainfall in that year is more than or less than twice the mean deviation. The data have been analysed on this principle and presented in Table IV.

The number of floods and droughts are too few to draw any definite conclusions regarding the periodicity of occurrence. The first flood in 1874 was followed by a drought in 1876 in all the four districts. In the remaining years even though there is no regular occurrence of either flood or drought in the four districts, there is a tendency that when one or two districts are experiencing either flood or drought, the rainfall in other districts tend to approach the flood or drought stage, except in 1904 and 1933.

But a perusal of the "Season and Crop Reports" indicates that the remission of kist in these districts either in some taluks or even the district as a whole, had been more frequently granted than could be actually justified by the particulars given in Table IV. But the distribution of the rainfall in such years might have been very unfavourable, particularly during the critical periods of cropping and also during the months of September to November, justifying such remissions on the whole.

Conclusions: (i) The four districts of Anantapur, Bellary, Cuddapah and Kurnool can be considered as one unit for any analysis of the rainfall data in view of the similarities of seasonal conditions.

(ii) If the rainfall in June in any one year is normal, it is an indication that the rainfall in October in that year will also be normal and a prosperous one for the farmers.

(iii) The general feeling that the rainfall is unreliable in this zone is supported by weak correlations existing among the various seasonal showers in the tract.

(iv) If the rains in September and October of any year are normal, it is an indication that that year will be a prosperous agricultural year. Manifestly these have no influence on the precipitations of the succeeding year.

(v) It is noted that the monsoon is not receding in this tract. Geographically it is so situated that in both the monsoons only the residual effects are felt and as such a general feeling of unreliability is inevitable, with frequent partial failures of rains, as the tract is mainly dependent on its seasonal rain fall for its cropping practices.

(vi) The data in a way support the belief that a year of plenty is followed by two or three years of scarcity. But there appears to be more of flood years than years of drought. This is perhaps the

reason why soil erosion is a serious problem in the tract, particularly in the Bellary district, which has a general slope of the soil from west to east.

Acknowledgment: The authors are grateful to Sri M. B. V. Narasinga Rao., Paddy Specialist, for his very valuable help and guidance in the preparation of the paper. Their thanks are also due to Kumari T. P. Anna, for help in the computation of the data and to all those responsible for the collection of the data forming the basic material for this paper.

BIBLIOGRAPHY:

1. Narasinga Rao, M. B. V. and Balasubramanian, C. (1949) Forty-two years rainfall data collected in the observatory attached to the Agricultural College and Research Institute, Coimbatore. The Indian Geographical Journal., Vol. No. XXIV. No.

2. Ramdas, L. A., (Dr.) (1950) Rainfall and Agriculture – Indian Journal of Meteorology and Geophysics. Vol. I. No. 4.

3. Ramdas. L.A., (Dr.) et al (1950) Is the Monsoon Receding? – The Farmer. Vol. I. No. 8.

4. Statistical Atlas of the Madras Presidency. *Government of Madras.*

TABLE I.

Rainfall in the Ceded districts

S. No.	Particulars	Anantapur	Bellary	Cuddapah	Kurnool
1,	Total annual rainfall with number of rainy days.	22·3″ 37	22·9″ 40	26·8″ 41	25·7″ 41
2.	Summer Showers (Feb-May) with number of rainy days and % of the total precipitation.	3·2″ 5 14	3·1″ 6 14	2·6″ 3 10	2·4″ 4 10
3.	South – west Monsoon (June-August) with same particulars as for summer showers.	7·6″ 14 34	8·8″ 18 38	9·7″ 17 36	11·4″ 21 44
4.	North-east Monsoon (September-January) with same particulars as for summer showers.	11·6″ 18 52	11·0″ 16 48	14·5″ 21 54	11·7″ 16 46

Note:—Number of rainy days is the average of the period (1870–1937).

TABLE II

Monthly precipitation in the Ceded districts (81 Years' Data).

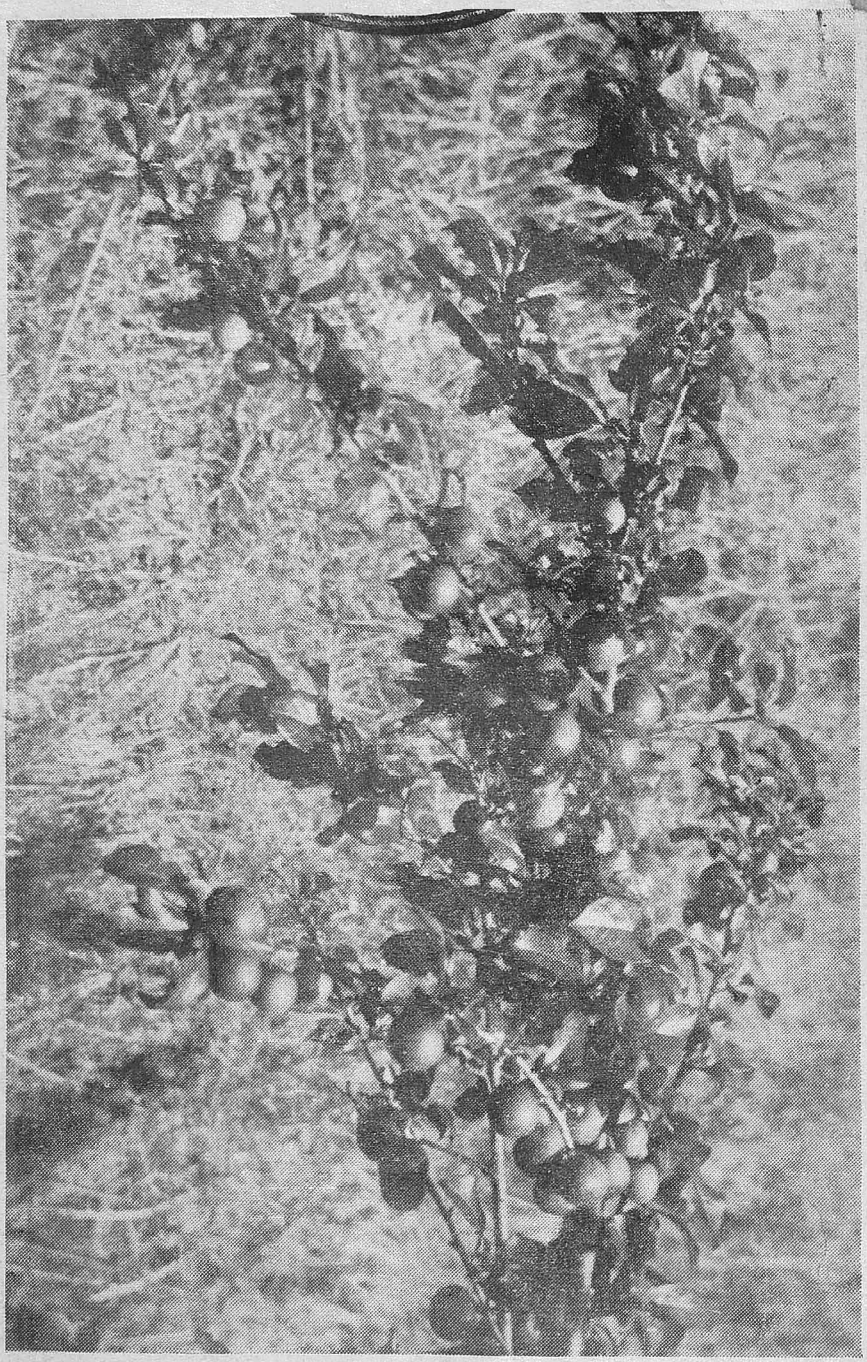
S. No.	Month	Anantapur				Bellary				Cuddapah				Kurnool			
		Mean in inches	Range in inches	No. of rainy days	% of drought.	Mean in inches	Range in inches	No. of rainy days	% of drought.	Mean in inches	Range in inches	No. of rainy days	% of drought.	Mean in inches	Range in inches	No. of rainy days	% of drought
1.	January	0·1''	0·0'' to 1·6''	...	65	0·1''	0·0'' to 0 8''	...	74	0·4''	0·0'' to 0·5''	...	57	0·1''	0·1'' to 0·9''	...	67
2.	February	0·1''	0·0'' to 3·2''	...	72	0·2''	0 0'' to 2·2''	...	70	0·1''	0·0'' to 2·0''	...	73	0·2''	0·0'' to 2·2''	...	68
3.	March	0·2''	0·0'' to 1·6''	...	52	0·2''	0·0'' to 2·1''	...	47	0·2''	0·0'' to 3·2''	...	52	0·2''	0·0'' to 3·1''	...	49
4.	April	0·7''	0·0'' to 3·4''	1	5	0·8''	0 0'' to 2·6''	2	43	0·6''	0·0'' to 3·5''	1	12	0·6''	0·0'' to 2·2''	1	7
5.	May	2·1''	0·2'' to 8·2''	4	...	2·0''	0·1'' to 6 2''	4	3	1·7''	0·1'' to 9·0''	2	...	1·4''	0·0'' to 4·9''	3	1
6.	June	2·1''	0·5'' to 6·6''	4	...	2·5''	0·5'' to 6·5''	5	...	2·4''	0·3'' to 7·2''	4	...	2 9''	0·7'' to 6·1''	5	...
7.	July	2·2''	0·2'' to 8·4''	5	...	2·8''	0·4'' to 7·0''	6	...	3·2''	0·1'' to 8·9''	6	...	4·2''	0·6'' to 9.2''	8	...
8.	August	3·2''	0·4'' to 12·9''	5	...	3·5''	0·6'' to 9·1''	7	...	4·1''	0·4'' to 12·4''	7	...	4·3''	0 7'' to 12·2''	8	...
9.	September	5·3''	0·2'' to 13·0''	8	...	5·4''	0·7'' to 14·5''	8	...	5·4''	0·6'' to 17·0''	7	...	5·8''	0·8'' to 20 1''	8	...
10.	October	4·1''	0·0'' to 11·5''	6	1	4·0''	0·1'' to 11·6''	6	...	5·0''	0·1'' to 12·2''	7	...	4·0''	0·0'' to 15·7''	5	1
11.	November	1·8''	00·' to 8·0''	3	6	1·4''	0 0'' to 5 6''	2	11	3·8''	0·0'' to 13·4''	5	1	1·7''	0·0'' to 7·2''	3	10
12.	December	0·3''	0·0'' to 3 9'/	1	44	0·2''	0 0'' to 1·8''	...	58	1 0''	0·0'' to 7·2''	2	21	0·3''	0·0'' to 4·8''	...	58

TABLE III

Ten-year normal rainfall in the Ceded Districts

S. No.	Details of the period considered	Ceded districts as a whole.		Ananthapur		Bellary		Cuddapah		Kurnool	
		Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal
1.	1870 to 1950 (81)	24·7	38/43	22·3	38/43	22·9	37/44	27·8	37/44	25·7	33/48
2.	1870 to 1880 (11)	26·3	4/7	25·4	4/7	23·5	5/6	28·3	5/6	27 5	4/7
3.	1881 to 1890 (10)	25·4	4/6	21·2	5/5	21·9	6/4	30·2	4/6	26·8	5/5
4.	1891 to 1900 (10)	23·3	5/5	20·9	6/4	22·2	6/4	25·4	5/5	24·2	6/4
5.	1901 to 1910 (10)	25 0	5/5	22·7	4/6	22·9	5/5	28·5	5/5	25·1	3/7
6.	1911 to 1920 (10)	25·8	5/5	23·7	5/5	24·6	5/5	28·4	5/5	26·4	4/6
7.	1921 to 1930 (10)	23·3	6/4	21·4	5/5	21·6	6/4	27·2	4/6	22 7	4/6
8.	1931 to 1940 (10)	24·7	4/6	22 3	4/6	24·5	4/6	26·3	5/5	25·7	4/6
9.	1941 to 1950 (10)	23·9	5/5	19·5	4/6	21·7	5/5	28·1	5/5	26·9	5/5

Note:—Numerator indicates the number of years above normal. Denominator indicates the number of years below normal.



Offseason Bearing in plums, and unusual Phenomenon at the Agricultural Research Station, Nanjanad.

TABLE IV
Floods and droughts in the Ceded districts.

Year	Bellary Mean Rainfall 22·9″		Anantapur Mean Rainfall 22 3″		Cuddapah Mean Rainfall 26·8″		Kurnool Mean Rainfall 25·7″	
	Flood 34·2″	Drought 11·8″	Flood 34·6″	Drought 10·2″	Flood 42·1″	Drought 13·3″	Flood 39·8″	Drought 11·4″
1874	F		F		F		F	
1876		D		D		D		D
1878	27·5″		F		38·0″		F	
1891		D		10·8″		14·8″		14·9″
1903	30·5″		32·7″		F		34·7″	
1904		18·8″		17·9″		D		16·2″
1916	F		33·5″		40·1″		F	
1917	F		32·8″		38·1″		31·5″	
1933	F		26·4″		23·4″		27·8″	

Note:— 'F' Indicates flood year.
'D' Indicates drought year.

Research Note

Offseason Bearing in Plums, and Unusual Phenomenon at the Agricultural Research Station, Nanjanad

At the Agricultural Research Station, Nanjanad, an area of about twenty-five cents of uncultivated waste land was cleared and terraced, and varieties of fruit plants consisting of plums, apples, peaches and pears of different varieties were planted in October, 1941. Four kinds of plums, viz., Shiro, Hale, Rubio and Gaviota formed part of the collection.

The normal fruiting season for these plants on the Nilgiris is May-June. During winter, the trees remain dormant and the growth stays arrested.

In the winter (November-December) of the year, 1950, two of the varieties, Rubio and Hale, flowered and developed stray fruits. This phenomenon was repeated in December, 1951, and a fairly sizable crop of fruits, averaging 300 per plant, was obtained. This unusual feature had not been observed before in any other part of the Nilgiris, so far as the writers are aware.

The plants received some attention in July 1951, by way of pruning off the dried branches. Whether the good bearing had any relation to this operation cannot be confirmed. But the fact that the plants set fruits during the preceding winter also suggests that fruiting was not due to this.

Steps are being taken to plant as much area as possible to plums, for further studies on this off-season bearing habit and on the influence of seasons and pruning practices on yield. The accompanying photograph of branches in fruit taken in December 1951 show the bearing at that time.

K. SAPTHARISHI.
M. D. AZARIAH.

Rice Production in Japan

By

DR. SHINGO MITSUI

The Coimbatore Agricultural Institue had recently the privilege of hearing, under the auspices of the Students' Club on the 25th August, a lecture on Rice Production in Japan by Dr. Shingo Mitsui, Professor of Plant Nutrition, in the Tokyo University.

The lecture was a model of brevity, clarity and completeness and it reviewed in a masterly manner how Japan, in the course of the last sixty years, succeeded in doubling her rice production, from 4·5 million to 9·5 million tons at present. This achievement was possible, first by a widespread system of mass education, coupled with a high level of scientific training to the gifted few, next by a systematic and steady progress in improving the methods of rice culture, including fertilisers, and thirdly by a systematic development of the fertiliser industry by which organic manure like compost, soybean cake and green manures, were replaced by heavy dosages of inorganic fertilisers like ammonium sulphate, and superphosphate. A fourth reason was the thoroughness with which the results of research were made available to the farmers, by an efficient and widespread extension service. For instance, more than 90 per cent of the rice varieties grown by the average Japanese farmer, were improved seeds. Rice varieties that showed definite responses to fertiliser applications, that were more resistant to insect and disease attack, and those that were more tolerent to cold, have been systematically tested over many years and systematically distributed to the farmers. Even in the northern-most parts of Japan, where the winter temperatures fall below 30° C, they could grow rice during the summer months, by using the cold-tolerant varieties.

In fertiliser application, farmers who were using organic manures sixty years back, are now applying nearly three times the dosage of nitrogen, phosphates and potash in the form of in organic fertilisers that they were using sixty years back. The farmers are now fully convinced of the greater efficacy of chemical fertilisers, as compared to organic manures like soybean cake and compost.

Another factor, was the development of the fertiliser industry itself in Japan, so as to be self-sufficient in fertilisers. The first world war stimulated Japan to establish her own factories to produce ammonium sulphate, and gradually inorganic fertilisers have now replaced organic manures, specially for rice. The quantity of fertilisers applied to the rice crop has increased year by year, until in 1940, the total annual consumption of chemical fertilisers amounted to nearly 3·6 million tons. The fertiliser industry was reduced to nearly one-fifth at the end of the Second World War, but it has now recovered and has even exceeded the prewar level. The most recent figures indicate that 2·2 million tons of ammonium sulphate and 1·6 million tons of supersulphate are being produced by some forty fertiliser firms, controlling about two hundred factories.

Further, improvements were effected not only in the quantity of chemical fertilisers used but also in the manner of using them; for instance, "deep placement" of ammonium sulphate, as deep as possible in the furrow slices of paddy fields has improved yields by 10 per cent. Also, the timely application of nitrogenous fertilisers as top dressings to paddy plants, has improved yields still further. The average Japanese farmer is now-a-days fully aware of the benefit of both these measures.

Dr. Mitsui, continuing, observed that although rice production had been doubled in Japan, the population too, had more than doubled itself, so that there is at the moment of gap of nearly 15 % to be bridged between rice production and consumption.

This, the lecturer, felt confident of achieving, by an intensification of their efforts on the scientific and extension aspects. In conclusion he emphasised that the future in both Japan and India, so far as agriculture was concerned, lay in the hands of the student population, as they were the scientists and extension workers of the future.

In this context, one cannot help contrasting the cool and robust optimism of the Japanese people, with the doubts and hesitations of our Indian counterparts. Whereas they are confident, even after doubling their yields within sixty years, of achieving another fifteen percent increase in their rice production, we in India are still unable so far to increase our average yields of rice, in spite of the fact that it is the lowest in the world.

Departmental Notifications

GAZETTED SERVICE—POSTINGS AND TRANSFERS

Names	From	To
Sri Francis, T. S.,	D. A. O., Trichinopoly,	Dy. D. A., Visakhapatnam
,, Raghavan, A.,	On leave,	Asst. Cotton Specialist, Siruguppa
,, Thirumala Rao, V.,	Crop and plant Protection Officer (Entomology), Bapatla,	Govt. Entomologist, Coimbatore

SUBORDINATE SERVICE

Names	From	To
Sri Akkaiah, N.,	Seed Dev. Asst., Paddy Amalapuram,	Spl., A. D., Peddapuram
,, Appavu Naidu, G.,	Asst., in Mycology, Bapatla,	P. P. A., (Mycology), Nellore
,, Gopala Raju, D.,	P. P. A., (Mycology) Ootacamund,	Mycology Asst., Bapatla
,, Jagannatha Rao, P.,	Soil Conservation Asst., Guntakal,	P. P. A. (Mycology), Bellary
,, Kanakaprasada Rao, K.,	F. M., Anakapalle,	Asst., in Agronomy, Anakapalle
,, Natarajan, L. R.,	Marketing Asst., Trichy,	Marketing Asst., Tanjore
,, Nagarathnam, A. K.,	On leave,	Asst. in Pulses, Dharmapuri
,, Narayana Reddy, M. L.,	Spl. A. D., Seethampeta,	A. D., Markapur
,, Narayana Iyer, N.,	A. D., Chingleput,	P. A., to D. A. O., Guindy
,, *Philips*, P. K.,	Journal Asst., Malayalam Madras,	Addl. A. D., Saidapet
,, Pinagapani, N.,	P. P. A., Entomology, Cuddalore,	P. P. A., (Entomology), Vellore
,, Rama Rao, K.,	A. D., Tiruvur,	Spl. A. D., Manures, Kaikalur
,, Rajagopalan, V. T. R.,	Dairy Manager, Coimbatore,	P. P. A., (Entomology), Cuddalore
,, Rajagopalan, C. K.,		Asst., in Pulses, Coimbatore
,, Satyanarayana Raju, V.,	Soil Conservation, Asst., Contour Bunding Scheme, Chittoor	Addl. A. D., Kurnool
,, Srinivasan, V.	F. M., A. R. S., Nanjanad,	Spl. A. D., Manures, Nannilam
,, Subbaiah Pillai, R.,	Spl. A. D., Thirumangalam,	A. D., Tenkasi
,, Subramaniam, R.,	F. M., C. F., Coimbatore,	Teaching Asst., in Agriculture, Coimbatore
,, Subramaniam, C. P.,	Asst. in Pulses, Coimbatore,	Asst. in Mycology, Coimbatore

	Names	From	To
Sri	Shahkat Ali, K. A.,	Civil Supplies, Marketing Tanjore,	Marketing Assistant, Tiruchirapalli
,,	Seshagiri Iyer, C. S.,	On leave	F. M., C. F., Coimbatore
,,	Srinivasachar, B.,	Pulses Asst., in Coimbatore,	Dairy Manager, Coimbatore
,,	Venkata Ramana Rao, G.,	Spl. A. D., Sugarcane, Peddapuram,	F. M., Manager, Anakapalle
,,	Venkata Ramana Reddy T.,	P. P. A., (Mycology), Nellore,	P. P. A., (Entomology), Nellore
,,	Vasudeva Singh, B.,	P. P. A., (Entomology), Vellore,	Asst., Fertilizer Inspector, Vellore
,,	Venkata Raman, C. N.,	Pulses Asst. Coimbatore,	Dairy Manager, Coimbatore

The following Trainees in Horticultural Diploma course 1951—'52 Coimbatore are transfered to the posts noted against each.

	Names	To
Sri	Ananthanarayanan, K. K.,	Add. A. D., Manjeri
,,	Anthoni Reddy, Y.,	Soil Conservation Asst., Guntakal
,,	Appaian, M. C.,	Fruit Asst., Banana Research Station, Aduthurai
,,	Arumugavel, M. R.,	A. D., Chingleput
,,	Balagurunathan, S.,	Fruit Asst., Orchard cum Nursery, Thimmapuram
,,	Krishnamurthy, C.,	A. D., Sriperumbudur
,,	Meenakshisundaram, D.,	Asst., in Paddy, Coimbatore
,,	Radhakrishnan Alwa, K.,	F. M., A. R. S., Nanjanad
,,	Rama Rao, D. V.,	Seed Development Asst., (Paddy Amalapuram)
,,	Ramanathan, G.,	Spl. A. D., Mewani
,,	Sankaran Kutty, N.,	Journal Asst., Malayalam Office of the D. A., Madras
,,	Sankara Reddy, G. H.,	Soil Conservation Asst., Chittoor
,,	Sanyasi Rao, U.,	A. D., Tiruvur
,,	Subramaniam, S.,	A. D., Thirumangalam
,,	Sundara Rao, Y. R.,	Fruit Asst., Kodur
,,	Venkata Rao, M.,	Fruit Asst., Kodur
,,	Viswanathan, A. R.,	Asst., in Oil Seeds, Srivilliputhur
,,	William, P.,	Plant Protection Asst., Ootacamund

DIPLOMA IN INDIAN HORTICULTURE

The following is the list of successful candidates.

	Name	Distinctions, if any	Rank
		I Class	
1	G. H. Sankara Reddy.	Individual fruit crops, fruit products, fruit diseases, fruit pests, plantation crops and ornamental gardening.	1
		II Class	
2	U. Sanyasi Rao.	Individual fruit crops, fruit products, fruit diseases and plantation crops.	2
3	D. Meenakshisundaram.	Individual fruit crops, fruit products, fruit pests and plantation crops.	3
4	G. Satyanarayana-swamy.	Fruit pests and fruit diseases.	4
5	Y. R. Sundara Rao.	Fruit products and fruit pests.	5
6	A. Subba Rao.	Plantation crops.	6
		III Class	
7	S. Balagurunathan.	Fruit pests.	7 (B)
8	T. Surendranath Singh.	Nil.	7 (B)
9	Y. Antony Reddy.	Nil.	8
10	M. C. Appaiyan.	Fruit pests.	9 (B)
11	H. Hanumantha Rao.	Nil.	9 (B)
12	A. R. Visvanathan.	Nil.	10
13	M. Venkata Rao.	Nil.	11
14	Howie David.	Nil.	12 (B)
15	C. Krishna Moorthy.	Nil.	12 (B)
16	K. Radhakrishna Alwa.	Nil.	12 (B)
17	J. William Paul.	Nil.	13
18	M. M. Sankaran Kutty.	Nil.	14 (B)
19	B. Shambushankar Shetty.	Nil.	14 (B)

Coimbatore,
13—8—1952.

U. NARASINGA RAO,
Fruit Specialist.