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Editorial

Rain — A Life Giving Gift from Nature. The Madras State, particularly the Tamilnad and the Carnatics, has had now some welcome summer showers after a portracted period of drought and widespread distressed conditions. The people in general and farmers in particular cannot but feel thankful to nature. With all the resources and achievements of man, so far there is nothing parallel to 'rains' from nature.

The people and the Press alike have expressed signs of relief. The parched up earth has quenched its thirst for a while. The fairly well distributed rain, has brought a new atmosphere of cooler air. The dried up wells have received their supplies again and in places of acute scarcity for drinking water, there is peace restored. Tillers of soil rejoice at the much needed summer showers to begin afresh their operations in the fields. The grass and the herbage begin to put forth fresh flushes. Both man and beast derive much comfort and benefit from summer showers. Good summer showers are broadly indicative of good seasonal crops for the State as a whole.

No wonder, that our ancients worshipped Nature. In spite of man with highest intellect, and his researches for centuries, the secrets of Nature, still remain not fully revealed. This is especially so, with regard to the phenomenon of 'rain'. Various attempts are being made for bringing rainfall under man's control. Animals including man depend on vegetation, and vegetation, in turn, depends on rainfall. If it rains at the will of man, it is an achievement indeed. Meteorologists and Mathematicians are striving hard to predict rainfall taking into consideration the forces that are at work in Nature. There is nothing impossible, in the present day trends of discoveries and inventions. A day is not far off, when artificial rain makers make the clouds transform into rain at desired places and periods. With increasing population and demand for more food, supply of water through rain is of inestimable value, for solving

food crisis. The prosperity of the State, is closely linked with the degree and nature of gift from Nature by way of timely, adequate and wide-spread rainfall.

The official year 1953—'54 has commenced well. Let us pray to mother Nature, for the magnificient gift of continued seasonal rainfall, which is an essential pre-requisite, for all man's efforts towards peace and prosperity in the land. Let us bow to 'Nature' and stoop to conquer her since she holds her bounties only in trust for her wise children.

Possible Methods of Maximising Agricultural Production and Development of Improved Strains and Plant Materials

By

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Introduction: Referring in appreciative terms to the valuable work done by the Madras Agricultural Department, Sir John Russel the eminent Scientist has said that "the work that is going on here offers the prospect of solving to a great extent India's food difficulty. The practical difficulty is to get better materials over to the peasant to enable him to adopt the methods suggested by Agricultural experts. There remains always the practical difficulty of getting these methods adopted and properly carried out."

This valuable remark pertaining to the practical application of the results of researches carried out and their wide adoption by the peasants is a matter that has to be thought out and planned in a manner suiting the genius of our people. Our attention must therefore be focussed on this most vital point as to how to make the majority of our peasants freely adopt the various improvements that are advocated.

Impracticability of engaging Honorary workers: We have very few men who can be relied upon to devote sufficient time and attention to honorary work as a result of their own economic conditions nor people with the necessary bias and spirit of service for this kind of work can be found in adequate numbers. Hence it is out of consideration of utilizing the services of honorary workers for any scheme of extension service intended to aim at increased agricultural production.

It is necessary that if we are to maximise production in a big way we have to think and plan out also in a big way and no useful purpose will be served by aiming at a big objective without the necessary facilities and means, e. g. if we are to cover the entire area under a particular crop in the state with improved strain within a period of five years, this cannot be done by calculating the quantity of seed required from year to year and aiming at distribution by the addition to staff of a few maistries and fieldmen or even without that. What is meant is that such colossal schemes should be conceived in a big way by taking into consideration all the factors necessary as to make all the growers take to these improved strains. Adequate staff and facilities to supply the seeds to every nook

and corner at the right time and correct and continuous propaganda to steer the scheme successfully will be necessary. All this means finance on a big scale and it is well to remember that nothing substantial can be achieved without providing adequate funds for intensification of extension service to achieve the desired results. After all the amount of money spent in the administration and organisation of the Agricultural Department in a country which is predominently agricultural, is hardly commensurate with the gigantic task it is called upon to perform.

It seems clear that the best way by which we can quicken the pace of increasing production is to :

(1) Take the knowledge of scientific agriculture in an understandable and attractive form to the ryot.

(2) To follow it up by supplying the needs of the ryot at his very door by providing necessary facilities.

Increased staff for Demonstration plots : Successful demonstration plots in ones own holding have been very effective so far as that particular grower is concerned, but the dissemination of the results of such successful demonstration has been rather slow for want of facilities. It is therefore worth the while to conduct Demonstration plots in as large a number of holdings by the appointment of adequate special staff for each taluk.

But, by far the greatest need appears to be, in the direction of educating every ryot, majority of whom are illiterate, in the art of increasing production by an attractive method. Nothing can be more attractive and effective than to educate the ryot by talkie films edited in regional languages.

Propaganda by Talkie films : It is necessary to provide each district as a preliminary step with a van equipped with a projector and talkie films relating to every item of improvement advocated in the District. The films must be edited in the regional language. This van must tour in each taluk, in as many villages as possible in accordance with a set programme. Particular care must be taken to prepare the films for each District with reference to local importance only. There must be films relating to all improvements advocated for each of the main crops of the locality. These vans must be in charge of a special officer of the grade of an Upper Subordinate. It is felt that education of ryots by this method will be more effective than by other means of leaflets, posters and personal propaganda etc.

Having thus educated the ryot in the methods of increasing production the next thing to see is that all the requirements of the ryot are made available as close to him as possible.

Depots and staff at Firka Head-quarters: The minimum that must be aimed in this direction is to have a Departmental depot with an Agricultural Demonstrator at each firka headquarters with the necessary requirements for supply to ryots.

Important role of manures in maximising production: Crop cutting experiments conducted during the last two years have definitely proved that the greatest single factor that has contributed to increased and phenomenal production is manuring. It is therefore necessary not only to educate the ryot in the supreme importance of proper manuring, but also to make the manures available at village level. Distribution of chemical manures is at present controlled through co-operative institutions and Tender firms. This system has not worked satisfactorily, particularly in Malabar District where the cry from Co-operative societies is that there is no demand from the ryots and the complaint from ryots is that there is no manure in the depots of Co-operatives. This vicious circle must be broken. While price control, as long as the commodity is in short supply is desirable, it is found desirable to abolish the license system and permit every one to deal in it and wants to sell the manure. It is very difficult to get merchant or dealer to exclusively deal with this at village level and necessarily it will be only an adjunct to their normal trade and business. I would therefore suggest that the licensing of manure dealers should be abolished and free trade allowed in the business of manures. This will make available required kinds of manures at all times and at all places and this will certainly result in remarkable increase in production.

It is hoped that with the necessary knowledge of increasing production made available to ryots in intelligent, catchy and attractive form through the medium of talkie films in regional languages, provision of expert aid and assistance at each firka with adequate staff and supply of manures at village level will greatly help in maximising production.

Utilization of trained Rural School Teachers for extension service: In this connection I wish also to repeat what I have said in my contribution to the conference held last year by utilising the services of Teachers in rural schools by a scheme of giving them adequate training and then employing them part time for extension work. This proposal was made with a view to economise expenditure on the appointment of field staff and at the same time make available a body of men like rural school teachers who have a better hold and influence on ryots than a fieldman or a demonstration maistry. According to this proposal a teacher with necessary agricultural bias is to be selected at the rate of one for about 5 villages and these men are to be trained at state expense for a period of 6 months in an agricultural Research Station and then employed in the schools from where they were originally drawn. They will only work for half a day each in that school and the other half is utilized for

agricultural propaganda work. The school Management will pay them only 50% of their pay and allowances whereas the Government will pay not only the other 50% but an additional emolument of 50% on the pay to make the job attractive. It is presumed that such a body of trained rural school teachers drawn from schools at convenient centres will provide a batch of very useful extension service workers as compared with the usual fieldmen and Demonstration maistries. This requires trial at least in one taluk of each of the regions—particularly in the west coast districts where the difficulties are great in propaganda.

Development of improved strains and plant materials: In regard to the developmental work on the evolution of improved strains, I wish particularly to draw attention to the evolution of strains of some major varieties particularly in North Malabar district. Sufficient attention has not yet been paid to the evolution of strains in some major varieties which occupy thousands of acres like Mundon and Kuttadan for low lying single crop lands, Bali and Orkayama in Saline lands and again in varieties like North Malabar Kayama, Kunhi Kayama, Alli Kannan, Thavvan etc.

Evolution of these strains must be done under North Malabar conditions and not at Agricultural Research Station, Pattambi where the conditions are not similar to that in North Malabar. South Kanara climatic conditions appear to be more allied to North Malabar than South Malabar (Pattambi) and hence the work on evolution of these strains may be better done at Paddy Breeding Station, Kankanadi.

Increasing the Production of Improved Strains of Seed

By

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The use of improved strains of seeds has been one of the chief methods of increasing the production of crops. Improved strains of seeds are evolved at the Research Stations by various methods. There are many difficulties encountered at the several stages of building up a strain. With knowledge of the behaviour of the genes and transmission of charecters and improved plant breeding technique, various charecters are

combined and suitable strains are evolved. Perhaps the greater difficulty appears after a strain is evolved. Its purity requires to be maintained at a high level, for realisation of the full potentialities of the improved strains. The evolution of the strains is done at the Research Stations and laboratories, where the plant material and the various cultivation operations are under control. The multiplication and spread of the strains in the cultivator's field are under conditions, over which effective control is not possible for various reasons.

Improved strains of seeds are required to be produced in large quantities in the cultivator's field. That itself is a problem that defies solution. For instance, rice occupies roughly 10 million acres. Taking that the improved seeds are to be changed once in 5 years in the ryot's field, 2 million acres have to be supplied with improved seeds each year. 5 lakhs of bags or about 35,700 tons of seeds raised in at least 50,000 acres are required for the purpose. It is obviously not possible to raise these seeds in Government farms. The improved paddy seeds required for distribution are therefore raised in cultivators' fields, in what are called seed farms. The seeds required for sowing the seed farms are supplied to selected cultivators under certain conditions. The cultivators are required to multiply the improved strains, under the control and guidance of the Agricultural Demonstrator. The seed farms are spread over the whole talk under his jurisdiction. With the seed farms spread out, he is not able to effect any effective supervision over the seed farms. The seeds get admixed at the various stages. The cultivators raise nurseries of other varieties by the side of seedfarm nurseries, providing chances for the contamination of the seed farm nurseries. Later the rogueing of the seed farms is done by the cultivators, under the supervision of maistries and fieldmen. The staff members are not able to effectively supervise the rogueing and off-types and other varieties of plants are left in the field. The next stage, where the strains get contaminated is the thrashing floor. Thrashing is done on earthen floors, which give room for other varieties to contaminate the strains. Precautions are no doubt taken to avoid contamination taking place in the strains, at the several stages, as far as possible. But they are not very effective in preventing the contamination of the strains. The seeds produced at the seed farms is therefore mixed up with other varieties of seeds, in small proportions. The multiplication of the strains is continued in the subsequent years and the contamination goes on increasing year after year and when the seeds are in general distribution, there are varying degrees of impurities and there are complaints from the cultivators, who purchase these seed farm seeds. It must be recognised that a certain amount of contamination is inevitable in seed farms and our objective should be to produce seeds, where the extent of contamination does not affect the character and value of the improved seeds. It is possible that this point of view may be considered

to be indefensible from the sentical considerations and that the very object of producing improved strains is defeated by allowing contamination to take place at the stage of multiplication of the improved seed material. But we have to take into consideration the fact that the contamination is there, and that it is inevitable.

Admitting facts as they are, we may suggest methods of reducing the contamination taking place in the improved strains of seeds, at the stage of multiplication in the cultivators' fields. It has been suggested off and on by individual officers that seed farms should be concentrated to facilitate intense supervision by the departmental staff. With the central idea of concentrating the seed farms, the following tentative suggestions are offered for consideration. A taluk may normally have to raise not more than 200 acres of paddy seed farms, which are now spread out over the whole taluk. The entire area should be located in one or two villages, close to the taluk headquarters, so as to facilitate the supervision of the seed farms by the Agricultural Demonstrator in an intense manner. The chances of contamination of the seeds of improved strains would be reduced considerably. One fieldman and a maistry may be specially set apart for seed farm work, who will assist the Demonstrator in arranging seedfarms, issuing seeds for seed farm sowings, supervising the raising of nurseries, planting, rogueing, harvesting and thrashing the produce. If possible, the seed farms should be in compact blocks and the co-operation of big landholders having compact areas may have to be enlisted, and their lands used as seed farms.

Individual seed farm ryots should not be asked to raise more than one strain in the season, over the holding in the village. The entire paddy area cultivated by individuals in the village should be taken in as seed farms, irrespective of the quality of the several fields, so as to avoid any seed farm ryot growing more than one variety of paddy in the season. No other strain or variety of paddy should be grown by him. This will avoid contamination of the strain at the nursery and thrashing floor to a very large extent, If in addition to this, rogueing is also done properly, under regular supervision, seeds of offtypes getting into the seed will be considerably reduced. Villages suitable for raising seedfarms in a concentrated manner may not be available in all taluks, but wherever such villages could be located and the ryots concerned could be induced to co-operate with the seed development work, the seed farms could be concentrated.

Summary: Improved strains of seeds multiplied at the various Agricultural Research Stations maintain their purity. Seeds produced in seedfarms in cultivators' lands get contaminated, and there is loss of purity. The contamination takes place in the nursey and the thrashing floor. The off types of plants that come up are also not removed properly.

It has therefore been suggested that the entire seedfarm area should be concentrated in one or two villages, so that the Agricultural Demonstrator could effectively supervise the various seed farm operations. The entire area cultivators should be brought under seed farms and one strain alone should be in the entire holding, so as to avoid contamination at the nursery and the thrashing floor.

Rural Economic Conditions of the Coimbatore District

A Study of some Cultivators

(Summary of a Report on Investigations made during 1951—'52)

By

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The Coimbatore Cultivator: The agriculturists of the Coimbatore district are noted for their industry and hard work. Of late, they are also noted for their enterprising spirit, which is exhibited by their adoption of modern farming methods. The district receives low and ill distributed rainfall and in fact, some taluks are so defective in this respect, that failures of rains often result in famine conditions. Of necessity, therefore, the cultivator has to be hard working and try to raise some crop to eke out his living. The only remedy to overcome the deficit rainfall, is to tap the underground resources of water supply and conversion of dry land into gardenlands. This process of well sinking has been going on from early times and the total number of wells in the district utilised for irrigation is 1,08,254 and the area covered for irrigation is nearly 4½ lakhs acres. However, the total area irrigated by wells is only about 17% of the total cultivated area at the present time and therefore the scope for more area coming under irrigation by wells is really very great. Of course, it is a great boon to this district, that the Lower Bhavani Project obviates the sinking of wells, which is a

difficult and costly process, in many taluks and supplies enough water to convert such a large area of dry land (as much as 2 lakhs acres) into gardenland farming. Irrigation by wells, implies the utilisation of the water to the utmost extent, without wastage. A study of the rural economic conditions of this district is of great importance and significance, because it is first a study of the cultivators themselves. It is the study of the cultivator and the circumstances and conditions under which he lives and produces. Rural Economics of Coimbatore District, is bound up inextricably with the fortunes of thousands of the small cultivators of the district. The level of seonomic prosperity of the district, can be judged truly by the level of prosperity attained by the small cultivators, at any time, and not by the outward prosperity exhibited in the urban areas.

Study of cultivators in typical villages: To start with two villages have been selected within five miles of the Agricultural College which are fairly typical of the conditions of the district. One is Vadavalli, situated north-west of the College, about two and a half miles away and the other Goundampalayam north-east about three and a half miles distant. The first can be popularly classified as a garden village some area under gardens and the second a dry village with practically no area under well irrigation. In this district, the majority of the villages in all the taluks can be classified in this manner and it is estimated that more than fifty percent of the villages may be of the dry type, having very little or negligible area under gardens. This would only show how agriculture is really a gamble in large areas of every taluk and how it is a hard task, an uphill one, to bring about agricultural improvements in such areas. These villages, therefore, may be said to represent the two types of villages that we may come across, in this district. They are situated fairly far away to have too much influences of the city and its activities on the agricultural sector. They are, however, benefitted by sale of milk and other occupations and the amenities provided in the town to some extent. A detailed study of the economic conditions of certain number of cultivators of each village would reveal in a convincing manner the economic conditions of the area represented by these cultivators and the villages. But, however, in the villages, in general, there are different types of cultivators who can be classified as small, medium and large according to the area cultivated by them or on land assessment paid by them. We find that this is the case with every village, the small and medium cultivators predominating. Either according to area or according to amount of assessment paid the small and medium cultivators are nearly 90% in each village. Hence, it is necessary to study a larger number of these cultivators to understand the economic position of the majority. The bigger ryot will hold his own in every place and does not represent the true facts of the village, On the whole,

20 cultivators were contacted in each village including one weaver, making a total of 40 for both villages. The Statement Nos. 1, 2, and 3 give details of the type of cultivators enquired into. Full information was obtained from each of them about the areas held, equipment owned, labour employed, crops grown, costs incurred, yield obtained net profits, family expenses, indebtedness position, interest rates, difficulties experienced, improvements effected, relationship with co-operative or other societies, supplementary incomes etc., etc. The information and data obtained by series of enquiries have been analysed and presented in these statements. The economic position of each class of cultivators is discussed below, separately.

The small or the lower class cultivators : Twenty-four out of forty examined belonged to this class. These form about 80% of the total pattadars of the villages and own on the average about 5 acres of dry lands. They pay a kist of Rs. 10 or less. It is revealed that one cultivating actually 5 acres of dry land in these villages is on the border, i.e. when rains are normal he is just able to make both ends meet, otherwise he becomes submarginal as has been in the case for the last few years when there had been partial or complete failure of the seasonal rains. Just 10 miles away, in the valley of Thadagam village, it is a different picture where the dryland crops seldom fail as the seasonal rains have been regular and adequate. But this area is an exception, being situated in the midst of two ranges of hills and favourably placed. In the vast areas of dry lands away from the hills, the chances of the small cultivator getting a good crop is 1 to 4 or 5 judging from the situation in recent times.

Crop production : The chief crop grown is cholam on the dry land upto about 50 to 70% of the area, the balance being put under Tenai or Tenai and cotton as in the case of Goundampalayam village. When the seasonal rains are favourable, the yield of cholam grain may go upto 6 "salagais" per acre, whereas for the last few years, it has given from nothing to 3 "salagais" only. There is certainly some correlations between grain yield and stalk yield (fodder) in that when grain yields are good, fodder yields are also high. Hence during these bad seasons, the fodder yields have also gone down, though that is the only saving feature, as atleast some cartloads of fodder had been obtained for the cattle, either work or milk stock, which may last a few months in times man has to go away with nothing. This is a sad plight indeed. The black market price of cholam grain had been high as much as Rs. 45/- per salagai and it is a hard lot for these small cultivators to make efforts to obtain their grain requirements from such a market, when their own crops have failed them.

Family expenses: The essential needs of the family of the small cultivator are cholam grains for their consumption, and payment in kind to the coolies and mamools to artisans and some cash for other purchases. These can never be met fully from the dry land area held by them as the vicissitudes of the season and pests reduce the yield. Hence, they have to supplement their income by other means. The position is very much improved for the cultivator who owns a small area of garden under this classification. A well is not a natural boon but a hard won reality after spending heavily on that account, which may range from Rs. 3,000, to Rs. 5,000 or more depending upon nature of the strata and size. A well inherited by one is a good acquisition and makes matters easy for the owner to keep it in repair and fit it up with power lifts which will give the family enough grains and cash to keep going under very simple circumstances. An additional two or three acres of dry land would ensure some supply of fodder for his dairy stock. But we come across a very few of such typical cultivators. We find they have either not enough of dry land alone or they own more area of garden than required as in the case of bigger cultivators. Cultivators owning purely dry land are therefore unable to meet the expenses of the family fully from the yields of the land and therefore resort to borrowing.

Weaver - cum - cultivator: Among the small cultivators, there are some belonging to this category. There may be a total of about 100 families of weavers in both the villages and among them 20% possess a small area of land each 2 to 5 acres of dry land. It is those who own lands are slightly better off, under the present extremely unfavourable circumstances for the weavers in general. They had no doubt earned a good income during the war years and after and some had even saved and purchased lands or built houses by such savings. But at the present time, a weaver earns Rs. 30/- a month by weaving alone and with this he cannot maintain his family, unless another member in the family earns similarly or by working as a labourer. The weaving industry should be a side industry and when developed is a good source of income for the dry land cultivator, who has got only 4 months' work on land at the most even when seasonal rains are normal. Some of the weavers have also owned one or two buffaloes to augment their income by sale of milk etc. But this has not been a very successful venture as the supply of fodder and obtaining of concentrates are not an easy matter. The margin above cost of maintenance, of the animals, is not very alluring, according to opinions expressed by many of the small cultivators.

Sources of additional income: The small cultivator has to supplement his income from land, by other means, if he is to save himself from running into heavy debts. One common method of earning such additional income, is by keeping one or more buffaloes and sale of milk, to milk

vendors who are regularly taking milk to the city. Most of them are able to earn about Rs. 30/- per month, net income, by this means. But even this has a draw back. Because one cannot own any number of buffaloes to increase the income, as it is not an easy matter to supply adequate fodder to the animals, unless the season has been very favourable and a good crop has been grown on the holding. Concentrates such as cotton seed or cake are regularly fed and cost of feeding has to be kept within reasonable limits. Hence all cultivators are not in a position to own buffaloes or cows and effect sale of milk and milk products. Another way of improving the income is by owning a cart and pair and hiring the same for carting work, carting of building materials mainly to the town. But on the average one is able to get the cart hired only for 3 or 4 days in the week as there is competition even in this line. The average earning per day is about Rs. 5/-. Allowing the maintenance cost of the pair and the cart, there is a net income of about Rs. 30/- per month which will vary according to seasonal conditions and other factors in the locality. This income cannot be regular as the pairs will be utilised for cultivation work whenever there is work in the fields.

To improve their income, the small cuitivator turns into a casual labourer and works in the neighbouring areas of garden land. His family members, particularly adult males, frequently work as labourers whenever there is no work on their own land and thus improve the income for the maintenance of the family. But even with this, the family income cannot be said to be adequate because the statement of the total expenses for the month or per annum given by them, in most cases exceeds the total income received by all sources. The truth or genuineness of their statements, is proved by the debts they have incurred, in almost all cases enquired into.

The Medium cultivators: The position of these cultivators is only slightly better compared to the smaller class. The amount of assessment paid cannot be a criterion to assess the economic position of the ryot, since even these cultivators, paying an assessment of between Rs. 10/- and Rs. 30/- may not be well off, if they own purely dry lands. Even if one cultivates a hundred acres of dry land, if there had been no timely or adequate rains, there is no guarantee of a normal crop and the family thereby may be put to difficulties in the course of the year. Generally these ryots own some dairy cattle also mainly for the supply of manure and also the milk for household use. They depend upon the dryland cholam and pulse crop for supply of fodder. A few acres of garden land area owned by the medium ryot, will make his position more secure. Only four of the eleven cultivators examined own some garden land area, besides some dry land area and one of them is a tenant who is just managing to make both ends meet, having taken up 6 acres of garden on

lease. None of these cultivators have been able to save anything, as this is revealed by the fact that they have not been able to sink a well in their drylands or own more buffaloes for sale of milk to supplement their income for which there is good scope in the locality.

The bigger cultivators: These own varying areas of garden land besides some area of dryland. Their position is decidedly better and even among them those on the lower ranks i. e. paying an assessment of just over Rs. 30/- have to struggle hard in times of unfavourable seasons, as is the case, now to keep them above want throughout the year. They have to maintain not only the members of their families but also a stock of cattle, young and old, the total number of which may be anything from 10 to 30 for each cultivator. As the water level in the wells has gone down, due to lack of rains, many have been spending considerable amounts on deepening, The amount utilised for this purpose has been from their own savings in some cases and in some others from borrowings.

Indebtedness position: The total amount of indebtedness of all the 40 cultivators examined, exceeds Rs. 30,000/- as can be seen from the Statement given. Out of 24 cultivators of the smaller classes, only 5 are free from debts. This is because, the number of members of their family has not exceeded three. The average number in the family works out to 5 and the greater the number generally the greater the amount of debt. The maximum debt contracted is Rs. 4,000/- by one who owns 20 acres of dry land and who has to support 9 members in the family. Among the medium class, four out of eleven examined have got debts below Rs. 1,000/- Even among the bigger cultivators, two out of 4 examined have got debts. But in these cases, the debts have been contracted for purposes of repairs to existing wells or fitting up of electric motor and pump. The rates of interest on loans vary from 12% to 20% and loans have been obtained both on pronote basis and mortgage of lands.

There are two co-operative credit societies working in Goundampalayam village, one for the main village and the other for the hamlet of the Edayapalayam. The total amount disbursed as loans so far amounted to Rs. 8,000/- and there are 62 members in both societies. Five of the cultivators examined are members of these societies.

Conclusion: The studies during the year relate to different classes of cultivators, selected at random. It was thought essential, that we should first understand the economic position of the cultivators in general, some of the typical ones in fairly typical villages of the district. The rural economic conditions as prevalent in any area is largely those as created by the enterprise and activity of the agricultural community in general. High level of prosperity in the living conditions have been

achieved in places where the cultivators are highly enterprising. The following features as revealed in the study, are noteworthy:

1. The preponderance of the smaller cultivators in the rural areas who form over 80% of the agricultural community.

2. The majority of the cultivators own only drylands which means that they are in an unstable economic position.

3. The absence of any scope for savings in the industry of agriculture and no possibility of improvement of their economic position and the standard of living, so far as the smaller cultivators are concerned.

4. The undependability of dry lands, as the main stay of farming in this district, owning to the vagaries of the Monsoons and the narrow scope for improvements that can be effected in these lands.

5. The urgency of undertaking a drive for well sinking or tapping underground springs by boring on a long term plan, by Government help and liberal subsidies.

6. The setting apart of a certain amount of funds by Government over a series of years, whenever there is failure of rains and crops, with a view to subsidise by a scheme of crop insurance, if possible, such of the small farmers, who will be in distress due to small size holdings or large size of their families.

7. There are good and bad years and failure of the monsoon in a few years, is usually followed by one are two good years also.

8. Generally, the adverse effects of subdivision or fragmentation are not noticed to any alarming extent that they should constitute a problem to be solved urgently. At best there need be some check upon further subdivision of holdings.

9. There is necessity for liberalising of rules of Co-operative Land Mortgage Banking with reference to these areas, for the purpose of advancing loans to a larger extent to medium cultivators for specific purposes of undertaking sinking of well, in their holdings to convert part of the area into gardens and thus improve their economic position.

STATEMENT No. 1

Cultivators paying assessment of below Rs. 10/- in the two villages

Name of the cultivator	Area owned in	Approximate income from land for 1951—1952	Supplementary income per year		Approximate annual expenditure for a family	Indebtedness or not—amount	No. of members of the family
			Source	Amount			
	Acres	Rs.		Rs.	Rs.	Rs.	
1. Nanjappa Gounder ..	2 Dry	Rs. 200/-	Sale of milk cooly labour	Rs. 420/-	Rs. 480/-	..	2
2. Nataraja Gounder ..	5½ Dry	Rs. 400/-	Sale of milk cart hire	Rs. 300/-	Rs. 1,200/-	Rs. 2,000/-	6 (4 children)
3. Ravanna Gounder ..	3¾ Dry	Rs. 70/-	Boy as postman cart hire	Rs. 336/-	..	Rs. 1,200/-	7 (5 children) member in Co-op. Society
4. Maruthakutti Gounder ..	5½ Dry	Rs. 420/-	Sale of milk cart hire	Rs. 300/-	Rs. 900/-	..	2
5. C. Venkataswamy Gounder..	3¾ Dry	Rs. 200/-	Sale of milk	Rs. 900/-	Rs. 900/-	Rs. 1,000/-	5
6. Nanjakutty Konar ..	4½ Dry	Rs. 570/-	do.	Rs. 300/-	Rs. 720/-	Rs. 5,000/-	2
7. Ramaswamy Gounder ..	6 Dry	Rs. 220/-	Cart hire	Rs. 300/-	Rs. 700/-	Rs. 500/-	3
8. Ramaswami Chetti ..	2 Dry	Rs. 120/-	..	..	Rs. 180/-	Rs. 750/-	1
9. Lakshmana Gounder ..	5 Dry	Rs. 250/-	Cart hire	Rs. 480/-	Rs. 900/-	Rs. 300/-	4
10. Maradappa Gounder ..	3 Dry	nil	..	..	Rs. 1,000/-	Rs. 2,000/-	6
11. Kutti Gounder ..	2½ Dry	Rs. 100/-	Cooly work (in rubber firm employed)	Rs. 700/-	Rs. 720/-	..	6
12. Subbanna Gounder (Kaliammal) ..	2 Dry	Rs. 90/-	Road cooly work	Rs. 240/-	Rs. 420/-	Rs. 150/-	3

STATEMENT No. I—*(Continued)*

Name of cultivator	Area owned in	Approximate income from land for 1951—1952	Supplementary income per year		Approximate annual expenditure per family	Indebtedness or not—amount	No. of members of the family
			Source	Amount			
	Acre	Rs.		Rs.	Rs.	Rs.	
13. Subramanyam ..	4 Dry	Rs. 450/-	Sale of milk	Rs. 500/-	Rs. 1,800/-	Rs. 2,500/-	10 (7 children)
14. Rayakannu Mudaliar ..	1¼ Dry	Rs. 144/-	Handloom	Rs. 280/-	Rs. 720/-	Rs. 300/-	7 (5 children)
15. Rangaswamy Mudaliar ..	2 Dry	Rs. 120/-	Handloom	Rs. 280/-	Rs. 900/-	Rs. 700/-	2
16. Natesa Mudali ..	6 Dry	Rs. 744/-	do.	..	Rs. 660/-	..	3
17. Subbanna Gownder ..	2 Dry	Rs. 120/-	Cooly	Rs. 400/-	Rs. 600/-	..	3
18. Malla Gownder ..	3 Dry	Rs. 240/-	Sale of milk cooly work	Rs. 360/- Rs. 430/-	Rs. 960/-	Rs. 500/-	6
19. Marathakutti Gownder ..	6 ,,	Rs. 150/-	Sale of milk cart hire	Rs. 500/-	Rs. 1,200/-	Rs. 700/-	7
20. Kuppanna Mudaliar ..	4 Dry	Rs. 250/-	Sale of milk	Rs. 360/-	Rs. 600/-	Rs. 500/- (not for agrl.)	4
21. Ramanna Gownder ..	2 Dry	Rs. 120/-	Cart hire	Rs. 240/-	Rs. 560/-	Rs. 300/-	3
22. Rajakannu Mudaliar ..	2 Dry	Rs. 220/-	do.	Rs. 500/-	Rs. 1,100/-	Rs. 300/-	6
23. Kuppanna Mudaliar (Tenant) ..	5 Dry	Rs. 550/-	do. weaving	Rs. 480/- + Rs. 240/-	Rs. 1,800/-	..	8
24. Karuppu Gownder ..	2¼ (G. land)	Rs. 690/-	..	Rs. 700/-	..	..	3

STATEMENT No. II

Cultivators paying assessment of over Rs. 10/- and below Rs. 30/-

Name of cultivator	Area owned (acre)	Approximate income from land for 1951—1952	Supplementary income per year		Approximate annual expenditure for family	Indebtedness or not—amount	No. of members of the family
			Source	Amount			
		Rs.		Rs.	Rs.	Rs.	
1. Kallikutti Gownder ..	16 Dry	Rs. 1,700/-	Sale of milk	Rs. 750/-	Rs. 3,000/-	Rs. 2,000/-	7
2. Kallya Gownder ..	13 Dry	Rs. 600/-	,,	Rs. 350/-	Rs. 1,000/-	Rs. 600/- (for well)	3
3. Nanjappa Gownder ..	14 Dry	Rs. 500/-	..	..	Rs. 1,800/-	..	5
4. K. Palani Gownder ..	20 Dry	Rs. 1,800/-	..	..	Rs. 2,400/-	Rs. 4,000/-	9 (son College study)
5. Maradappa Gownder ..	10 Dry	Rs. 1,200/-	..	..	Rs. 1,800/-	..	5 Savings Rs. 300/-
6. Nanjappa Gownder ..	10 Dry	Rs. 1,100/-	Cart hire	Rs. 1,200/-	Rs. 1,700/-	..	5
7. Rangaswamy Gownder ..	10 (5 g. land) (5 dry land)	Rs. 2,000/-	Sale of vegetables	Rs. 800/-	Rs. 1,200/-	Rs. 500/-	4
8. Veera Naidu (tenant) ..	6 (g. land)	Rs. 4,020/-	..	..	Rs. 1,000/-	Rs. 500/-	3
9. Palaniswamy Gownder ..	10 (g. land)	Rs. 6,050/-	Sale of milk	Rs. 720/-	Rs. 2,400/-	..	6
10. Ariya Gownder ..	10 (7 g. land) (3 dry)	Rs. 1,500/-	,,	Rs. 600/-	Rs. 2,400/-	..	6
11. Ravanna Gownder ..	7 Dry	Rs. 960/-	Cart hire	Rs. 400/-	Rs. 900/-	Rs. 500/- (for marriage)	4

STATEMENT No. III

Cultivators paying assessment of over Rs. 30/-

Name of the cultivator	Area owned in acres	Approximate income from land for 1951—1952	Supplementary income per year		Approximate annual expenses per family	Indebtedness or not Amount	No. of members of the family
			Source	Amount			
		Rs.		Rs.	Rs.	Rs.	
1. Karuppa Gownder ..	23 Dry	Rs. 1,400/-	Sale of young stock	Rs. 200/-	Rs. 1,800/-	Rs. 2,000/-	11
2. Chinnaswamy Gownder ..	23 4½ acre g. land 18½ ac. Dry	Rs. 3,000/-	..	..	Rs. 5,000/-	Rs. 2,000/-	5
3. Krishnaswamy Gownder ..	22 11½ Garden 10½ Dry	Rs. 3,000/- Rs. 2,100/-	..	..	Rs. 3,000/-	..	5
4. K. Ramalinga Gownder ..	18 10 ac. Dry 8 ac. G. land	Rs. 4,400/-	..	..	Rs. 3,000/-	..	6

Improved Varieties and Plant Diseases

By

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In all discussions on crop production the importance of crop diseases as factors in reducing yields has to be recognised. Estimates of crop losses have been prepared in some countries like the U. S. A. and Germany. These show that the average annual losses from diseases vary from 10 to 12 per cent in grains, 20 to 25 per cent in potato, 10 to 12 per cent in fruits and ten percent in vegetables. All the above estimates of losses are in spite of the more or less general use of disease control measures. The losses are bound to be much more in countries where the control measures are adopted but rarely.

General control measures consist of seed treatment with chemicals, protection of plants with fungicides usually as a preventive measure and cultivation of disease resistant varieties. The last mentioned method if practicable is the most economical of all the methods and this alone will be considered here. From ancient times farmers have recognised the existence of differences between plant and plant or variety and variety in their reaction to diseases. An unconscious selection has been in progress for centuries in all countries where agriculture has been established as an ancient industry. In the course of successive generations the susceptible types have succumbed to one or other of the diseases. Consequently, the well established varieties of our crops in any locality are those which have a considerable degree of resistance to the common diseases prevalent in that area.

Since the beginning of this century, especially after the rediscovery of Mendel's work, considerable attention has been devoted to breeding superior and improved varieties of cultivated plants and notable achievements have been made in a number of crops. But more often the breeders have concentrated on characters affecting yield, quality, duration etc. Outbreaks of severe epiphytotics in the improved varieties have necessitated purposeful selection and breeding for resistance to specific diseases as a measure of control. Biffen's discovery that factors influencing resistance are inherited in Mendelian fashion gave an impetus to this aspect of breeding. It must be recognised that unless resistance to the major diseases in the locality is also infused into improved varieties disastrous results may follow after years of labour and expenses due to the incidence of destructive diseases wiping out the improved varieties. Very often the incidence of some of the common diseases is more in the newly developed varieties or in the breeding plots. Rice varieties Adt. 10 and Co. 13 are examples of improved varieties developed for their high

yields. If there is no disease they yield well but when conditions become favourable for blast infection these varieties are completely destroyed. The samba wheat on the Nilgiris is highly resistant to black rust but the yield is not satisfactory. Improved varieties like N. P. 111 giving higher yields were introduced but these became heavily rusted. Several other examples like these where improvement has not included resistance to diseases can be cited. Therefore it is emphasized that before attempting to spread the cultivation of a new variety its reaction to the diseases prevalent in the new area should be ascertained and the variety allowed to spread only when it exhibits reasonable resistance.

Resistance to diseases is a complex phenomenon influenced by genetical, cultural and other environmental factors. A variety resistant to a disease in one locality need not behave in a similar manner when cultivated in another environment. Conditions in the new home may be different from those prevalent in its original home. The soil and weather in the new locality may be such as to be favourable for the onset of the disease. Or the strains of pathogen present in the new surroundings may be more virulent. One or other or all these factors may contribute to the break down of the resistance in the new area. Numerous instances of this type have been recorded. In Sudan a number of strains of cotton resistant to black arm have been evolved. Some of these when grown at Coimbatore were so badly infected that the plants were completely knocked out when they were about six weeks old. Russian experiments have indicated that disease resistance in cotton is not constant and that it can be greatly influenced by the environment not only in the present generation but in the preceding generations also (Moskovetz, 1950). The variety of rice Co. 25 is highly resistant to 'blast' and has behaved uniformly so in Tanjore, Tiruchirapalli, Mathurai and Coimbatore. But when grown in Wynaad (a place of higher altitude i. e. about 2500 feet) its resistance broke down. In sugarcane the varieties Co. 210 and Co. 213 enjoyed a wide distribution and were outstanding commercial canes of North India. In 1939—'40 a severe epiphytotic of red rot completely destroyed these varieties in Bihar. This is attributed to infection by a highly virulent strain of the causal fungus in that area. In its home district however this variety had actually pushed out of cultivation some of the susceptible varieties *(Vellai* and *Poovan).* This again indicates the limitation to the spread of the improved varieties imposed by diseases.

The extention of cultivation of any variety (though agronomically satisfactory), over a large area without testing its resistance to the major diseases of the crop prevalent in the area is beset with danger. When millions of plants of a variety bred for yield or other characters without regard to its resistance to diseases occupy a compact area it gives ample scope for the pathogens to multiply and spread rapidly. Ultimately this leads to large scale destruction of the crop. Banana cultivation was

extended on a large scale in the West Indies and Central America. Gros Michel, a variety with good commercial possibilities was preferred to others. Unfortunately this variety was susceptible to wilt disease. In a few years whole plantations were wiped out. In South India the same disease is prevalent in a mild form and has been reported from many districts. In some parts of Tirunelveli the variety locally known as *Peyan* is highly susceptible to this and its cultivation may have to be given up sooner or later. The variety Gros Michel is being recommended to be tried in different districts. It would be better to remember its history in the West Indies before it is taken up for large scale cultivation in this State. The restricted incidence of this disease in our State may be due to the large number of varieties under cultivation which differ in their susceptibility to wilt. In Tirunelveli itself three or four varieties are cultivated. Of these only *Peyan* appears to suffer badly. Even in modern forestry pure stands of trees are not favoured but mixed planting is advocated so that diseases do not spread rapidly but are checked in their progress by the intervening inhospitable plants.

The large scale spread of proven resistant varieties even does not result in freedom from disease after the lapse of few years. It is true that a respite is obtained for some time but it is always a race between the host and the pathogen. If the parasitic organisms remain unalterable the breeding of resistant varieties will be quite simple and quickly accomplished. But in nature changes are taking place alike in lower and higher organisms in their struggle for survival. The cultivation of resistant varieties of plants is followed by the development of new strains of the pathogen capable of infecting the varieties which were previously free. These new strains arise by mutation or hybridisation. It is possible that these are continuously being formed but are not detected until the appropriate genotypes of the host are available. Breeding varieties resistant to all known biotypes of the pathogen is well nigh impossible. There is usually an interval between the time of introduction of a new resistant variety and the development of new strains of parasites capable of readily infecting them. This may vary from one or two years to a decade or more. This time factor determines the practical usefulness of any improved variety. The presence of the improved resistant varieties helps to build up the virulence of the pathogen. Reddick (in Sansome 1938) has shown how the virulence of *Phytophthora infestans* can be stepped up by repeated inoculations on a resistant variety of potato. In similar manner the host range of *Colletotrichum capaici* can be enlarged (Ramakrishnan, 1941) by cultivation of the organism on the particular host tissue.

The story of the spread of rust resistant wheats in America forms interesting reading. The ravages of the rust led to intensive breeding of resistant wheat. The first commercial rust resistant variety

was Ceres which began to spread from about 1926. By 1935 this variety succumbed to a race of the rust (56) which had only a limited distribution before. With the spread of Ceres, this race multiplied rapidly and the new variety went down. Another improved variety Thatcher was brought in to replace Ceres. In its turn the new variety became severely infected by the race 15 B. Still later the variety Newthatch has been evolved to replace Thatcher. A continuous struggle is maintained.

A similar loss of resistance in course of time has been observed in potato with reference to late blight. A great handicap has been the existence of several strains of the pathogen. Furthermore this pathogen has been observed to improve its virulence when in association with resistant varieties. Originally only one strain of the fungus was known and varieties of potato resistant to this were multiplied. Soon a second strain capable of attacking these varieties appeared. Promising varieties resistant to both these strains were bred but again the work was checked by a third strain. Thus the story goes on and the end of these reverses is not yet in sight, but in the meanwhile the fight goes on with undiminished vigour.

Every crop is susceptible to more than one disease. Resistance to one disease does not necessarily imply resistance to other diseases also. To combine resistance to all diseases in one variety is asking for the impossible. Very often varieties resistant to one disease easily fall victims to another disease. The rice variety Co. 25 is resistant to blast but not to leaf spot (*Helminthosporium oryzae*). Several varieties of oats were bred and introduced over a wide area in America. These were highly resistant to crown rust and smut. But unfortunately they were damaged by a leaf blight and culm rot caused by *Helminthosporium victoriae*. These examples show that the introduction of a new variety of even a widely cultivated crop may be followed by wholly unexpected disease developments.

About thirty years ago black arm of cotton was an unimportant disease in Madras State. Numerous varieties of American and Egyptian cottons were introduced with the object of improving the quality of cotton. Many new varieties have also been produced and have spread into cultivation. Black arm has also become a major problem in cotton cultivation now.

In the twenties of this century powdery mildew was the most serious disease of grape vines in Mathurai district and downy mildew was rare. From time to time other varieties have been introduced into cultivation and it is now found that downy mildew has assumed greater improtance and has spread to different districts where grape vine cultivation has been undertaken. In both cases it is quite possible that the pathogens were present in the country but did not assume importance

as the host varieties were not congenial. With the introduction of more susceptible varieties into cultivation the pathogens have multiplied and spread rapidly. Or more virulent strains of the pathogens may have been introduced into the country along with the new varieties of host plants.

The introduction of planting material or live plants from one country to another or from one part of the country to another may sometimes be followed by the introduction of new diseases with disastrous consequence. The blister blight of tea is an instance. This disease has been prevalent in Assam and its neighbourhood for nearly a century. Yet it did not occur in South India till 1946. The causal fungus is easily killed by exposure to unfavourable environment of higher temperature, bright sun, etc. Prior to the introduction of air transport the planting material took a long time in its journey from Assam to South India and had to pass through warm country. Therefore there was no possibility of the pathogen remaining viable when it reached its destination in S. India. But with quick air transport between Assam, Ceylon and South India the chances of the transference of viable fungal material were established. The new fungus found suitable hosts and favourable climatic conditions in South India and so quickly spread throughtout the tea districts.

The necessity for combining resistance to diseases in improved varieties of perennial plants is obvious. The loss caused by outbreaks of diseases will be considerable and several years of labour spent in raising the plantation will go to nothing if proper tests on the resistance of the varieties or stionic combinations had not been carried out before the variety was sponsored. Sometimes new diseases may occur which could not have been anticipated but resistance to known diseases should be taken into consideration. We could also benefit from the experiences of other countries. For example sweet oranges are susceptible to various types of root diseases. This is sought to be controlled by the use of resistant root stocks. In Brazil and the U. S. A. sour orange was found to be resistant to brown root rot. Therefore plantations were largely grown with sweet orange on sour orange root stocks. In the course of a few years a new virus disease called 'quick decline' appeared and caused the death of millions of sweet oranges on sour orange stocks. The sour orange tree on its own roots is not however affected. Recently it has been found in West Africa, that die back traceable to virus infection is prevalent in seedling limes. Great caution and rigorous tests in as many places as feasible are therefore necessary before we can recommend these and other root stocks for wider adoption. Very often the infection remains latent and exhibits itself only at a late stage.

In the development of improved varieties more attention should be devoted to the inclusion of disease resistance besides other charaters which go to make a variety commercially successful. This may be neither easy nor certain of achievement. On the other hand it is often very difficult

to combine resistance with other desirable characters. The complexity of the factors governing resistance to many diseases is becoming more and more apparent as the studies are extended. The earlier plant breeders were confident that they could eliminate the diseases by breeding resistant varieties; but their enthusiasm has been damped by the magnitude of the problem and numerous reverses experienced. Neverthless the production and use of resistant varieties offer the most economical and satisfactory method of control to be hoped for against certain diseases. In this the need for a diversity of germ plasm has been recognised. Numerous observations have shown that the more uniform a plant is the more vulnerable it is to outbreaks of disease. Higher losses caused by diseases are to be found among self pollinated crops as wheat, oats, flax and rice than among cross pollinated ones like maize and rye. The 'clones' used by the horticulturists may sometimes be the weakest of all types in their susceptibility to attack as they actually represent but one plant.

There is an increasing tendency among breeders to hold in reserve supplies of germ plasm that may be needed in the future. The breeding programmes are designed for the maintenance of variability instead of for the isolation of pure lines. The factors for resistance are often found in related wild species. These are coming into greater use in breeding. Sterility problems often limit the scope of inter-specific or inter-generic crossing but these are got over by subsequent treatment of the hybrids by repeated back crossing and other methods. The advantages gained by hybridisation with wild species are well illustrated in sugarcane and potato. Explorations into the original homes of some of the cultivated plants have been undertaken to obtain valuable plant material exhibiting high resistance to important diseases affecting those crops. Andes and Chile for potato and the Pacific islands for sugarcane have been surveyed for this purpose.

The breeder and the pathologist should work in close co-operation in selecting the resistant varieties. If the elimination of susceptible material takes place in the initial stages alone much time and labour can be saved. The efforts should not be weakened when one or two resistant varieties are obtained but should be continued unabated so that better varieties will always be ready at hand when the earlier ones exhibit loss of resistance. The breeding of celery, resistant to *Fusarium* yellows is a good example. In the pathogen *Fusarium*, variations occur rapidly. Therefore new selections of resistant plants are made every year from those grown in heavily infected soil. The seed is multiplied in another station and returned to the original district to grow the commercial crop.

In the foregoing paragraphs the importance of breeding for disease resistance has been indicated. The first step in this is the search for suitable germ plasm carrying resistance. Adequate tests of the selections or progeny have to be made after heavy bombardment with the

pathogens to enable the selection of desirable ones. For this the active collaboration of the plant pathologist is essential. The real test is obtained when the variety is grown in a number of places under a variety of conditions to enable the selection of desirable ones. The most tedious and the most uncertain part of the programme is to obtain a variety combining resistance to the major diseases with other characters which go to make the variety acceptable to the farmer. But this should work as an incentive to concerted and continuous efforts on the part of the breeder and the plant pathologist. The necessity for resistant varieties is more for combating certain types of diseases than others. Resistance to diseases which can be easily controlled by cheap protective methods like seed treatment need not be sought after. But more attention should be devoted to breed for resistance to diseases which are not amenable to economic protective measures. Wilt diseases, root rots, rusts and similar diseases affecting extensive field crops are examples of diseases for which production of resistant varieties will be desirable.

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Methods to be Adopted to Maximise Production and Development of Groundnut Strain Suitable for Summer Cropping in the Madras State

By

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Introduction: The Groundnut (Arachis hypogaea Linn.) reported to have been introduced into India in the 16th century has now become well established in the country. It has obtained a high status for the country in the international market for oilseeds and it is the first money crop among the few important crops which earn plenty of dollars for this country at a time when she needs them most. It has also become an important food crop for men and cattle, builder of soil and its protector and on top of all an important industrial crop. India is the largest producer of groundnut in the world contributing more than 40%. In Madras the area under this crop is about four million acres (40% of the

area in India) accounting for 46% of the Indian production. Out of this the area under summer groundnut in the State is 1,65,656 acres which is 4 7 % of the total area of the State.

Realising the importance of the crop in the agricultural economy of the country and more especially of the Madras State, the State Government organised an Oilseeds wing and opened an Oilseeds Research Station at Tindivanam in the year 1935. As a result of intensive breeding work, so far carried out, five improved strains have been evolved and they are under distribution in the State and outside. Out of them, TMV. 2 (A. H. 32) representing the bunch type of groundnut and TMV. 4 (A. H. 334) representing the spreading type were tried in number of centres and found suitable and profitable for cultivation during the summer months. It is more than ten years since the supply of seeds of these strains to the cultivators have been undertaken but their multiplication and spread have been rather slow. To step up production of these two improved strains for summer cropping, the following suggestions are made.

Methods of Maximisation:

(i) *Supply of Quality seeds for the single crop wetlands:* One of the important means of maximising production is the utilisation of single crop wetlands in the State (nearly 8 million acres) more especially in the delta areas. Of late, the growing of groundnut under such conditions has become popular due to the high price prevailing for the commodity and to the interest evinced by the Department. This source can be utilised to the maximum in order to increase the area under groundnut in the State and incidentally to develop the improved strains. In these areas cultivation of the bunch groundnut is mainly preferred. The TMV. 2 bunch strain has been found suitable and definitely profitable and it is already being cultivated over a large area particularly in Krishna and Godavari districts. Large quantities of seeds of the strain were supplied to these areas but the seeds multiplied every year are not made use of for further sowings. Usually in the single crop wetlands of the delta area the groundnut crop is cultivated in December–January to April–May season. The seeds which are produced in this period do not stand storing till the next irrigated season on account of the heavy monsoon rains that follow. During the rainy period, the seeds of TMV. 2 groundnut which are non-dormant, absorb moisture from the atmosphere and lose their viability to a considerable extent (upto 50%). Even after careful drying and preservation the germination has been found to get affected by 10 to 20%. This factor discourages cultivators from extending cultivation of groundnut because they have to procure large quantity of seeds and at a high cost from the dry areas. This can be easily solved by organising certified private agencies or the Agricultural Department to procure the seed material from these regions,

multiplying in the drylands of the upland taluks of the delta area under rainfed conditions during July–October season and making it available to the cultivators of the delta region in large quantities. The strain has been found to give good yields even in the dry lands of upland taluks when grown in the rainfed season. Hence the seeds of the strain multiplied as a rainfed crop may be procured by the same agencies and made available to the low lying single crop areas for sowing from November onwards. Thus a proper organisation is necessary to utilise effectively the multiplication of the strain that is actually going on in the cultivators' fields in the normal course. If quality seeds are not made available, it is likely that the area under groundnut more particularly under short duration bunch strain TMV. 2 in single crop wetlands of the delta may go down considerably.

(ii) *Use of summer produce for seed:* Another important suggestion for maximising the production of the strains is the utilisation of summer produce for seed purposes. Usually the groundnut produce obtained from a summer crop grown under irrigated conditions is marketed at once for industrial use and no attempt is being made at present in the irrigated tracts to preserve the produce for seed purposes. It is felt, that the seeds out of the summer produce lose rapidly their viability on account of the high intitial moisture content present in the produce. Therefore, for every irrigated crop, seed material is procured afresh from the produce of preceding rainfed crop. In the case of the bunch type the seed materials obtained from the rainfed season can be immediately used for sowing on account of the nondormant nature of its seeds and no difficulty is experienced with regard to this type of groundnut. But in the case of the spreading type the seeds are dormant and do not germinate immediately. At least a period of about two to two and a half months should elapse before the seeds become suitable for sowing. Normally the spreading variety grown in the rainfed season comes up for harvest in December–January and its seeds will be fit for sowing only in March–April. By this time the season for summer sowing becomes fairly advanced and any late sowing in practice, results in severe incidence of pests and diseases, reduction in yield and delay for the subsequent cropping in the field. To avoid such late sowings in summer and the consequent disadvantages seeds from the previous rainfed season are obtained and sown. This means, the seeds are to be preserved for more than 12 months which is fairly a long period and which results in rapid deterioration in quality due to absorption of moisture and insect damage.

These difficulties are easily overcome by utilising the seeds obtained from irrigated season taking sufficient care in harvesting fully matured pods, thoroughly drying the produce immediately after harvest and preserving them carefully. Experience at the Agricultural Research Station, Palur (South Arcot District) where facilities exist for the cultivation of groundnut under irrigated conditions and which is a

representative tract for irrigated groundnut in the State has shown that well matured, thoroughly dried and well preserved produce of the spreading type of groundnut grown during summer can be utilised for sowing in the next irrigated season without any adverse effects. In such cases the period of preservation is only short (six to eight months) and the deterioration in viability is practically negligible. If this method were to be adopted there would not be any necessity to have recourse to the use of rainfed produce as seed material for the irrigated season.

The TMV. 4 a spreading strain of groundnut best suited to the irrigated cropping has given record yields in the important irrigated tract of South Arcot District. But unfortunately the strain has not developed to the extent desired because in every season even though it is largely grown under irrigated conditions almost the entire produce is marketed owing to the fear that the deterioration in quality would set in if preserved for seed purposes. But with a certain amount of precaution and care in harvesting fully matured pods, drying them thoroughly immediately after harvest and properly preserving the seeds, the deterioration in quality can be prevented and a huge waste of seed material of an important strain can be avoided. The strain that is best suited to irrigated conditions can thus be rapidly multiplied and the area under it can be considerably extended in the State.

Conclusion: The methods suggested would improve the production of the strains TMV. 2 and TMV. 4 which are most suitable for cultivation in the single crop wetlands and other irrigated areas in the State during summer months.

Summary: In the Madras State, the Oilseeds wing established by the State Government has evolved five improved strains of which TMV. 2 and TMV. 4 are found suited for being grown as a summer crop in single crop wetlands of the delta areas and other irrigated areas of the State. But their multiplication and spread are rather slow and hence the following suggestions are made to step up production of these strains.

(i) TMV. 2 strain which has proved successful in the State and more especially in the delta areas may be developed by arranging supply of quality seed material of the strain by multiplying in the neighbouring upland taluks in the preceding rainfed season and procuring the produce with the aid of certified agencies or departmental staff.

(ii) The seed material of the spreading strain TMV. 4 obtained from the summer crop can be utilised for the next summer sowing by taking adequate precautions in harvesting pods when fully mature, thorough drying immediately after harvest and subsequent preservation. By this method, the multiplication and development of TMV. 4 strain specially suited to irrigated conditions may be achieved at a more rapid pace.

Methods to be Adopted to Maximise Production and Development of Improved Strains and Plant Materials

By

BHAGIRATHI PADHI

Maximisation of production depends upon three factors, namely cultural, Manurial and Varietal of crop material dealt with.

Cultural: So long as the improved Agricultural implements are beyond the scope of the anvil of the village smithy, either for repair or for replacement, it is impossible to introduce improved Agricultural implements on a large scale for bringing in the desired cultural development of the soil designed for improving the fertility and enhancing productivity of the soil. The Engineers of the State are very hopeful to start a large number of engineering Colleges and workshops to bring in improvements which could replace the time-honoured wooden implements with ease and profit. While considering the question of improvements of Agricultural implements the draft has to be improved in the same ratio to keep up the pace of such improvements in the working of the implements. For instance, the Gumsar Breed of Srikakulam District is of too short a stature for the plough and unless a better type of cattle can be bred the implements cannot be worked easily. Breeding stations for livestock improvement must definitely improve the local breed. The alternative is mechanical cultivation by power. There is demand throughout the country for more machinery but how long this demand would continue is problematic. Gradually waste lands are being used up, inch by inch, and cropped. Waste lands, if they are given to poor ryots, can never be brought into the best state of cultivation because of the poverty of the owners. Therefore many of the landlords owning large extent of waste areas are hesitating to utilise this opportunity to help the State in the maximisation of production to free India from famine through such doubtful methods. Secondly these machines come to repairs very often and there is the lack of sufficient engineering skill locally besides non-availability of parts to replace the worn-out or damaged parts. As such the targets fixed for each unit or for each District are difficult of being attained.

Vast forests are being deforested allowing denudation and soil erosion on a large scale. This also affects the seasonal conditions of timely and sufficient rainfall. The above consequences, although not felt immediately are cumulative and are responsible for the reduced output per unit area and consequently the total output of the State. Therefore, legislation should come to the rescue for preventing merciless felling of forests.

Vast areas of land are available in the interior of the so-called unhealthy tracts and these have to be reclaimed and brought under the plough, either for growing food grains or for planting fruit trees or for converting them into pastures, all of which are essential for the maximisation of Production. Cutting of useful forests for selfish motives often mar the bonafide aims of States. Methods of prevention of soil erosion and conservation of soil moisture in extensive areas should mean floating of state loans for the purpose as for projects.

Land colonisation schemes when introduced in areas like Araku Valley and managed by experienced retired technical men can be expected to utilise the land for the best benefit of the state besides providing a decent living for such enterprising individual.

Manurial: The conditions prevalent in India do not appear to be encouraging for large scale use of chemical manures. Enervating seasonal conditions, the poverty of the cultivating class as a rule and the backwardness of the cultivators in general appear to be the main reason for this. Besides, the use of these manures involve certain conditions which are necessary for increased production. The most important factor is water. But this is lacking in many places and the high temperature helps to aggravate the common drought conditions, which instead of increasing productivity must therefore decrease production to the minimum. Therefore, unless and until the ryot realises the scope and limitations of utilising the fertilisers, it is not desirable to tamper with the healthy soils and thereby poisoning its very life resulting in its reduced productivity. Therefore, soils in India must be maintained in good heart through conditions of natural living, creating conditions suitable for harnessing the wealth from all the material sources available in and from nature. This is the most fundamental and organic side of the manure whether we speak of green leaf or excretion of animals or human beings or the so called waste material of all flora and fauna. These, if utilised, are going to keep India free from famine. The devil of drought will be kept at bay and the land maintained well in the matter of conservation of soil and so on besides improving soil texture itself by correcting acidity and salinity through adequate supply of organic matter for opening natural drains for the free drainage of water or maintaining soil moisture at an optimum for creating all the necessary conditions for increased production. The department has planned well for the improvement of organic manures through compost programmes and intensified this propaganda with due emphasis on the role of concentrated artificial manures and fertilisers.

Varietal: The importance is obvious and as such it has been realised fully by one and all without the need to stress the necessity for the evolution and multiplication of improved strains for increased production. But this subject also requires a master touch and that is, the

importance of the maintenance of the purity of the particular strain or strains. The maintenance of the purity of the seed has to be observed from the flowering stage of the crop till it is harvested to keep it free from contamination or mixture. In the threshing floor and the store room due care in the art of preserving the purity of the seed has to be kept up.

The last item of vital importance in crop production is the needful protection to crops against pests and diseases for a healthy growth. The crop and plant protection service deals in detail with all this problem to help our departmental activities to maximise production through its improved strains and plant materials, which otherwise may not exhibit their maximum potentialities, not withstanding the adoption of correct cultural and manurial methods.

Utilisation of Agency Tracts in Maximising Fruit Production*

By

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Introduction: Several schemes are under way to extend the area under food crops in this State. A comprehensive plan for the development of fruit of this State is yet to emerge. The hillmen of the Agency tracts are yet to understand that fruit should supplement the normal diet for better health. With the cry for more fruit to supplement rice for a well balanced diet, the hill ryot may now usefully divert his attention to the innumerable patches of uncultivated wastes fit for orcharding, at a time when the prices of fruit are attractive. At a time like this, the recommendations of the Royal Commission on Agriculture in 1928 as well as the National Planning Committee, have to be considered seriously. Cheema[1] observed that the development of the horticultural crops in this country has been neglected to a very great extent as compared with the development of cotton, sugarcane, oil seed and such other crops. Round about Anantagiri in Visakhapatnam district, stray trees of common pear, rose apple and coffee bushes were introduced long back. Mandarin, jack,

* Paper contributed for College Day & Conference, 1952.

mango, pomegranate, rose apple are some of the important fruits raised in the Agency tracts with practically no attention bestowed on them. Acid lime trees exist in the interior agencies. Naik[2] states that to 'provide a significantly higher standard of life and a more diversified, pleasurable, all-the-year-round occupation, to more especially those in the rural parts, the role of fruit industry cannot fail to compel attention.' The result is that the area under fruit is yet to expand. To achieve this, a study of the Agency tracts where more marginal land and cultivable wastes are available, should be carefully made, to keep pace with the modern development and progress in Agriculture. Inferences drawn without such a study will lead to wrong horticultural programmes and policies. It is the purpose of this contribution to outline some of the notable peculiarities of the Agency tracts and how best they can be utilised in maximising fruit production.

Material and Methods: In the desire to make this symposium as comprehensive as possible, free use has been made of several publications and reports relating to the subject. A list of such references referred to, is appended at the end of this Paper.

Data and Discussion: The following data and the findings discussed are based on the knowledge gained by a critical study of the literature, of work done in this direction and correlating at with the experiences of the author who has considerable experience of the Agency tracts of Godavari and Visakhapatnam districts. The data has been divided into the following sections to enable the author to present the subject in a cogent and systematic manner.

Planning the Fruit Industry: (1) *Tract and topography:* Most of these Agency tracts are characterised by a rolling topography. Tracts with elevations of about 4,000 feet above sea-level are not uncommon in Visakhapatnam Agency. Forests alternate uncultivable wastes and marginal lands which are unsuited for arable farming. "Podu" cultivation through deforestation present naked patches. The average annual rainfall received in these regions is about fifty inches. The maximum and minimum temperatures range from about 36°F in winter to about 100°F in summer in Araku Valley. The aspect and topography of land differs from village to village. The severity of the south-west monsoon followed by severe winter conditions and drought and the gradual deforestation of the tract by the ignorant hillmen tend the climate erratic. Perennial hill streams emerging through subterranean springs of forests cause soil erosion and waste waters. Some of the Agency tracts of Visakhapatnam district are susceptible to frost hazard. Considering all these, the choice of the variety of fruit is to be decided. Most of the uncultivated wastes and marginal lands consist of reasonably deep and well drained soils varying from a friable sandy loam to red loam with

uniform texture, but they are deficient in organic matter. Such soils which are fit for growing fruit have to be corrected by frequent applications of large quantities of bulky organic manures. Very slopy lands have to be terraced to avoid leaching of manures applied, during heavy rains. Drainage is not an important problem of these regions. Elevated plots with adjoining lower slopes to drain off cold air during winter are ideal for commercial orchards.

(2) *Harnessing water sources for irrigation:* Alexander Joss of the United States Bureau of Agricultural Economics, states that benefits from irrigation arise only through increased production which the irrigation water makes possible. Several perennial hill streams with plentiful supply of sweet water scattered all over the Agencies, exist. These can be harnessed for feeding the adjoining cultivable wastes to which water if necessary, can be pumped for orchard enterprise. Well sinking, utilisation of the available springs and provision of filter points will benefit the commercial orchards in these tracts. For most of the sites which cannot command irrigation facilities, a variety of hardy fruits such as pomegranate, jujube, Phyllanthus, wood apple, tamarind and the like can be recommended.

(3) *Aspect of manuring:* Narasinga Rau[3] suggests building up of a fruit landscape by a merging of fruit bearing trees into the accessible fringes of forests near and around the villages. Fruit trees when set out on the high humus content of such forest soils, need no larger stocks of bulky organic manures as hardy varieties of fruit can best fit into such a plan of orcharding. Green manuring, green leaf manuring, and cover cropping of orchards with leguminous crops will solve most of the manure problem in these tracts. The latter, will also help in encountering the fodder problem prevalent in some parts of these tracts. Leaf-mould, peat and compost manures can also be thought off to enrich the soil in Agencies.

(4) *Choice of variety:* Investigations carried out in the Government Orchard at Araku Valley for over a period of six years have so far indicated the suitability of the following * varieties for extension in most of these tracts.

It was observed at Araku Valley that Kodur type of acid lime tolerates frost conditions obtaining in the region. Lemon plants need a supplement to the natural rainfall by hand watering during periods of of drought, in the first year of orchard life. Orchards for lemon production should be located near sources of assured water supply. Sweet

* Mandarin: Budded plants of Nagpur santra; Acid lime: Kodur type; Banana:— Sirumalai, Amritapani and Bontha; Grape-fruit:— Poona, Duncan and Special; Guava:— Lucknow No. 49; Pomegranate:— Michaelpatti; Grape:— Red Muscadel; Passion fruit:— Purple fruited; Tree tomato; Cape gooseberry and dwarf types of papaya.

orange and grape fruit varieties detailed above have been observed to withstand the weather conditions prevalent in Araku Valley. Pre-bearing orchards can be intensively inter cropped with bush fruits and vegetables. Fruits tolerant of drought such as pomegranate and jujube can be planted away from water sources, in lands where their culture is possible. Next, but of greater utility, are the backyards and vacant spaces which are a common feature of the villages of these hill regions. These can best be utilised for growing passion fruit, tree tomato and lemon which have proved beyond doubt as suitable for the conditions obtaining in these localities. Banana varieties can be extended to villages which are situated near perennial hill streams.

Problems of Marketing and Transport: As most of these regions are far away from towns or markets where there is a continuous demand for fruit, the problem of marketing takes shape. Transport again is another limiting factor. A co-operative combine has therefore to function in these regions for collective purchase of fruit that is produced and arrange for its transport. Narasinga Rau[8] suggests 'some organisation such as an Indian Horticultural Council that would possess the authority and bargaining power' to safeguard the interests of the fruit growers.

State Aid and Horticultural Policy: It is therefore essential that a horticultural policy should be formulated by the State and immediate steps should be taken to develop the fruit industry utilising Agency tracts in maximising fruit production. To help the fruit growers in these regions, trained horticulturists have an important role to play. The State should establish regional fruit experiment stations in these tracts for studying the local problems and train personnel for organising the villages to take up the development works, leading to an extension of area under fruit. Organisation of fruit growers is also essential for the furtherance of the fruit industry of these regions. Cheema[1] rightly remarked that this is the age of 'co-operative efforts and the growers must organise themselves as prime movers of all activities' which tend to benefit them in the maximisation of fruit production.

Summary and Conclusions:

(i) The immediate need for the expansion of the fruit industry by utilising suitable marginal lands and cultivable wastes for growing fruit is discussed.

(ii) In the planning of fruit industry in these regions, the location of site, topography of the tract, aspect of manuring, problem of irrigation and choice of the variety have all been discussed with the experience obtaining in Araku Valley.

(iii) The problems of marketing and transport and how best they can be encountered are detailed.

(iv) The establishment of regional fruit experiment stations in these tracts for studying the fruit growing problems and also for training personnel for horticultural extension work have been suggested.

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A Review of the Methods of Crop Estimation and Forecast

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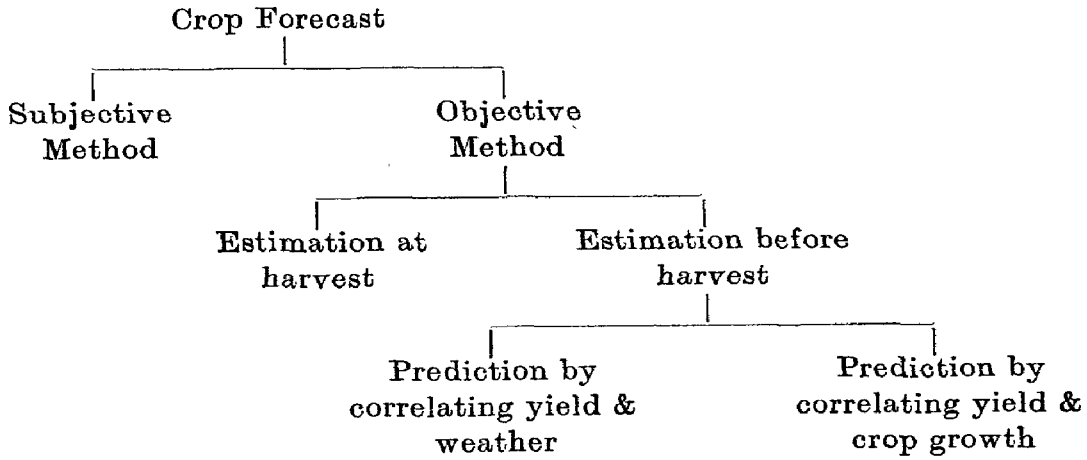
"It is of primary importance to an agricultural country like India, that it should possess accurate agricultural Statistics which would give at any time a reliable indication of the country's requirements of each agricultural commodity, its exportable surplus if any and its economic position as indicated by supply and demand." (11). A continuous supply of precise and accurate statistical information is a crying need of the modern industrial and economic activities.

Statistics of production engaged the attention of the Board of Agriculture in India, for the first time in the year 1919 when it dealt with the subject of forecast and estimation of crops. Forecasts and estimation of crops, commercial as well as agricultural are of considerable importance to the country. Information of the most probable production

of non-food crops much in advance of the actual harvest is of commercial importance since for trade and industry the availability of raw materials is the basis of all calculations of manufacturing processes. Again for ensuring self sufficiency in food and their equitable distribution reliable estimates of agricultural crops are of great value. For a country like India, where tax from lands is a principal source of revenue, correct estimate of the produce is much more essential for administrative purposes.

The forecasts of important crops are issued at suitable intervals in our country as well as in others, so that the markets of India and other countries may know what quantity each crop is likely to produce at different periods. "Such information when timely and accurate discourages wild speculation and reduces the risk of market panic" (11). The outturn of a crop in a particular year is estimated by each of the Provinces and States and the total gives the production for the whole Country.

Methods of forecasting: The main methods of forecasting can broadly be divided into two kinds, subjective and objective.



Subjective Method of forecast: The subjective method of forecast is based on the crop reporters' opinion of the prospects of growing crop after inspection. Usually they take into account their previous experience and the effect of previous weather conditions on them. This method has been prevalent in India as well as in other countries like England and America. In England, it is said (5) that during 1929 there were 300 crop reporters from whom the Government obtained the estimates of produce. Of the two essential factors to determine the produce viz. acreage and yield per acre, the crop reports of England had no difficulty in obtaining the precise figure of acreage since under the Agricultural Returns Act, information regarding this was made easily available to the crop reporters. In United States also such crop reporters

were employed. They gave the acreage figure as a percentage of the usual acreage and estimated the conditions of the crop in terms of the percentage normal. In India the forecast is based on the figures supplied by the village officials and is made on the basis of the following formula:—

Yield = Area × Standard or Normal outturn per acre × condition factor.

Of these three factors brought in for framing an estimate, the acreage figures in India are considered to be very accurate in most of the provinces, except in permanently settled areas, as the register maintained by every village contains the area brought under actual cultivation every year. For the second factor, the official definition of normal yields is the yield of "that crop which past experience has shown to be the most generally recurring crop in a series of years, the typical crop of the area, the crop which the cultivator has a right to expect and with which he should be content, while if he gets more he has reason to rejoice and if less he has reason to complain." The Manual of crop forecasts defines the normal yield as "the average yield on average soil in a year of average character". In statistical term it is the 'mode' and not the arithmetical mean of the figures of a number of years. By means of the third factor, an estimate is made of the current season in terms of the normal and is usually expressed as percentage of the normal crop.

This method of forecast though not free from defects, has come to stay through practice from a long time. The element of personal bias invariably creeps into all these estimates. The forecast of even the most experienced observer, who is well acquainted with all aspects of the growth of the crop has been found to be an over or under estimate. The crop which is reported at present in anna proportion is based upon the idea that yields should be expressed in sixteenths of the normal. But a normal crop is not regarded as sixteen anna crop at all. A sixteen anna crop is considered to be a crop of remarkable excellence. A twelve anna crop or thirteen anna crop is usually taken for normal crop. This conception of normal crop varies from province to province and for lack of uniformity in the adoption of this, forecast of the country as a whole cannot ensure sufficient accuracy. "Considered as a scale for measuring the condition of the crop, anna valuation suffers from the service limitation, that the officials concerned usually tend to give anna values which are within a fairly narrow range on either side of the normal figure and to avoid more extreme deviations. The result is that the yield is over estimated when the crop is poor and under estimated when the crop is really good." (7). Hence it has been suggested that these figures are to be worked out scientifically, taking into consideration all factors that influence the yield. A proper classification of soil together with a statistical study and analysis of the yield for a number of years may be

expected to lead to a more reliable figure. It is also important that these figures have to be checked and revised periodically.

Objective Method: Apart from the subjective method of forecast depending purely on personal inspection and experience only the objective method has been shown to be not only more accurate but in many cases available considerably earlier. This method is now receiving greater attention. It is based upon the fact that greater part of the variation of yield from year to year is due to variations in meteorological conditions. Certain measureable characteristics are also studied to predict the yield. But these characteristics of the plant or crop are allied to many factors like cultural practice employed, manurial treatment involved, soil fertility and above all the growth habits of the crop. As a consequence this method demands a preliminary programme of research extending over several years. The Crop Weather Scheme on wheat of the Ministry of Agriculture in England is an example of the scientific attempt towards predicting the yield from the standing crop.

This method divides itself into two parts according as estimates are required before harvest or at harvest. The former presents more difficulty but has the advantage of predicting the yield earlier than the other.

Estimates before harvest: The theory of correlation is extensively made use of in studying the yield before harvest. The principle is, the greater the co-efficient of correlation between two quantities, the more is the dependence of the one on the other and consequently from a known value of the one, corresponding value of the other quantity can be determined accurately, the degree of accuracy depending upon the magnitude of the co-efficient. By correlating yield and weather prevailing during the growth of a crop or yield and certain measurable characteristics of the plant the yield can be estimated before harvest.

The work on yield and weather has begun as early as 1874 when Rawson examined the relation between sugar crop and rainfall in the island of Barbados. The relation between winter rainfall and wheat yield was studied by Gilbert in 1880. At the beginning of the twentieth century Hooker applied for the first time statistical methods for such studies. In 1918 Prof. Fisher did the pioneer work in the same line. During 1917 Moore in America studied cotton yield in relation to weather and " this was the first scientific criticism of official methods of forecasting crops. (2) Work on the same subject has been done to a great extent by Smith 1927, Kincer in 1915 and Maltice in 1928. In all their study, the knowledge of Agricultural Meteorology found ready application.

In India interesting work has been done by Mr. Jacob correlating rainfall and yield and established the prediction formula based upon the

data for thirty years. The Royal Commission on Agriculture has remarked "Very little attempt has been made to correlate the two sets of data, the two valuable studies published so far by Mr. Jacob, I. C. S. (Retd.) represent so far as we are aware the only instances of this kind". In 1929 Unaker studied the relation between weather and crops with special reference to Punjab wheat.

The prediction of yield is established in the form of regress in equations, after analysing statistically, meteorological figures and yield for a number of previous years. Thus the prediction equation for the paddy yield has been worked out (1) to be

$$x_0 = 3{\cdot}179x_1 + {\cdot}033x_2 - 1{\cdot}459x_3 - 73{\cdot}25$$

where x_0 stands for yield, x_1 for area, x_2 for rainfall, and x_3 for temperature. In the same way the yield of cotton (11) is given by

$$x_0 = 524{\cdot}77 + 0{\cdot}129x_1 - 4{\cdot}32x_3 - 0{\cdot}013x_4$$

where x_0 represents the yield, x_1 September rainfall x_3 November temperature, and x_4 harvest rainfall.

Again correlating yield and measurements of the growing crop, Cochran has established (3) the production formula for wheat. He has expressed yield in terms of the shoot height, plant and ear numbers. This is a more promising result since the changes in soil fertility, amount of manuring and cultivation may all reflect themselves in the condition of a crop at a given stage.

Estimation of yield at harvest—crop cutting experiments: When the crop is ready for harvest the produce can be estimated by harvesting a sample of the harvesting crop and weighing the produce. The earliest experiments based on this principle were carried out by Mr. Hubback in India between years 1923 and 1925. These methods were subsequently applied by Deshmukh in Central Provinces.

As early as 1919 the Board of Agriculture while considering the possibility of improving crop forecasts, recommended that crop cutting experiments should continue to be the basis on which the normal or standard yield should be worked out. The subject was considered again in 1924 and the need for increasing the number of experiments and the adoption of the random selection was stressed. Random sampling is a procedure based on laws of chance, of selecting a part of the material to represent the whole. The method is entirely objective and rules out the possibility that the the outcome of the draw in the sample will be influenced by the experimenter. The great advantage of random selection has been illustrated by Dr. Yates in his paper on "Some examples of biassed sampling". To determine whether the sampling is adequate or not, an estimate of the sampling error is necessary which can be worked

out only for random samples. For example, if the estimate is to be correct within one error or r% and the co-efficient of variation of the estimate is v the number of experiments (n) to be conducted is given by

$$\frac{v}{\sqrt{n}} = r \text{ or } n = \frac{v^2}{r^2}$$

which shows the number of experiments is directly proportional to the sampling error. Prof. Mahalanobis has devised a sampling technique to find the area under jute in Bengal and Dr. Panse has adopted a similar method in estimating the yield of cotton in Akola district. Sufficient number of experiments, homogeneous zones and strictly random selection are the essential features of a crop-cutting experiment soundly devised. Such experiments lead to an unbiassed estimate of the normal yield which in turn results in reliable estimates of the total produce.

"Post-mortem examinations": In order to find how far the figures given by the forecast reflected the actual produce of a crop, it is of great importance and necessity that intensive efforts should be made to examine the crop actually harvested. The figures thus obtained, placed in comparison with the forecast figures afford a measure of precision of the forecast. In order to trace the sources of error and improve the subsequent forecasts, the Indian Central Cotton Committee has been subjecting the official forecasts of cotton to a 'post mortem examination' and the discrepencies noticed are brought to the attention of forecasting authorities for remedial measures. For crops such as cotton and jute an independent estimate is possible since detailed statistics can be obtained from traders, mill owners etc. who handle the crop in bulk. Similarly for plantation crops like coffee and rubber, statistics of production can be ascertained as these materials pass thro' manufacturing processess at definite places. But in the cases of commodities produced primarily for consumption there is a difficulty in arriving at independent estimate. However since the inception of the National Sample Survey by the Government of India this has become possible, for from the consumption figures which they gather on random sampling basis, the output of food grains can be deduced. This affords an excellent facility for the comparison of figures obtained by entirely differant approaches. The official forecast of foodgrains for the year 1949—'50 was 45 million tons. But the report of the National Sample Survey recently published shows that, as a result of its study of consumption on stratified random sampling basis, the figure of output as 60 million tons. This again is a challenge to the official forecast. However as Prof. Mahalanobis has stated too much faith on the first round of survey alone should not be placed, and as such, the results of the other three rounds of its survey are eagerly awaited. A scientific comparison of the two sets of data and evaluation of results will go a long way for assessing the production estimate with reasonable degree of accuracy.

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Methods to be Adopted to Maximise Production and Development of Improved Strains and Plant Materials*

Cardamoms

By

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Cardamom is an indigenous spice of South India. It is cultivated in about 1,08,000 acres on the hills as a plantation crop. It is a perennial, yielding about 33-35 pounds of dry capsules per acre per annum. About 80% of the total production is exported mostly to the hard currency area. Though this crop does not contribute directly to the food wealth of South India, it is definitely a good dollar earning crop. The price of cardamom has risen up high recently to about Rs. 10/- per pound. Hence, there is now an urge on the part of the planters for manuring their cardamom crop to maximise production. Usually the cardamom crop is not manured.

* Paper contributed for College Day & Conference 1952.

Except in parts of Coorg where the holdings are small and where the individual owners can pay concentrated attention, nowhere else are cardamom crops usually manured on a plantation scale. The reason for this is due to this crop managing to give a fair yield without any application of manure. The fertility of the soil is maintained by the compost naturally formed by the leaves that fall from shade trees from time to time. The old leaves rot and are decomposed while new ones cover the surface again.

Determination of a suitable manure mixture is engaging the attention of the cardamom scheme. Soil samples taken at random from the cardamom plantations on these hills were analysed by the Government Agricultural Chemist, Coimbatore, who was kind enough to suggest, on the basis of the analysis, trials with organic and inorganic manures mentioned below. The Statistical Adviser of the Indian Council of Agricultural Research has given a plan of lay out for the experiment. The sanction of the Indian Council of Agricultural Research and the State Government to include these trials in the Technical Programme of the Scheme was obtained in June 1952. The experiment will be started in the coming August.

The manures to be tried are: (1) Nitrogen in two forms i. e. as Ammonium Sulphate and Groundnut Cake at the rate 40 pounds, (2) Super Phosphate to supply 40 pounds of P_2O_5, (3) Potassium Sulphate to supply 80 pounds K_2O and (4) Lime at the rate of 1 ton per acre.

The lay out proposed by the Statistician is a confounded factorial experiment with 32 treatment combinations of the five factors each at 2 levels i. e. (1) N *versus* no N, (2) P *versus* no P, (3) K *versus* no K, (4) Lime *versus* no Lime and (5) Supplying Nitrogen in the form of Groundnut Cake *versus* supplying Nitrogen as Ammonium Sulphate, all taken together. The treatments have been randomised and replicated five times.

After the experiments are conducted and the results obtained, we will be in a position to recommend suitable manurial mixtures to maximise production of cardamoms. Though it is not the custom to manure this crop, the above experiment has been laid out to meet the demand that has just arisen.

To improve production by evolving strains, the cardamom scheme has been doing work at the Cardamom Research Station, Singampatti Hills. About 120 single plant selection from the Singampatti variety were tested for their yield for three seasons. The best twenty two among them have been advanced to replicated yield trials on a field scale. They have just started yielding. After studying their performance further, the best among them will be released for dirtribution. It may be noted that

the life cycle of cardamoms from seed to seed varies from 5 to 7 years. As such, the breeding work in this perennial crop is bound to be slow.

Another method by which production can be improved is by reducing loss caused by pests and diseases. The cardamom thrips (*Taeniothrips cardmoni*, 'Ramakrishna') was responsible for a considerable loss in the production of cardamoms. Experiments conducted by this scheme have proved that Nicotine sulphate (0·05%) as a spray and Gammexane D. 025 as a dust are quite effective in controlling the pest. These measures are advocated and are popular. A paper on the control measures was presented at the College Day and Conference 1951 and has been published in the April 1952 issue of the Madras Agricultural Journal.

Growing of Kolukkattai Grass *(Cenchruss ciliaris)* Under Irrigated Conditions

By

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Introduction: Kolukkattai grass is an indegenous popular fodder grass of the Madras State. It is the staple pasture grass for the Kangayam breed of cattle. (Chandrasekara Iyer & Daniel Sundararaj — 1950). The grass has spread throughout the state either through the Agricultural Department or private agencies.

Although the value of the grass is known as a pasture grass under rainfed conditions, its economic worth as an irrigated crop has not been studied so far. This paper presents the yield-behaviour of this grass under irrigated conditions as compared to the three other popular grasses of the state over a period of three consequtive years.

Materials and Methods: The seed material for the trial were obtained from the Government Lecturing and Systematic Botanist, Agricultural College and Research Institute, Coimbatore. Four popular grasses of the state, namely, (i) Kolukkattai grass *(Cenchrus ciliaris)*

(ii) Buffalo grass *(Brachiaria mutica)*, (iii) Guinea grass *(Panicum maximum)* and (iv) Australian grass *(Panicum antidotale)*, were grown at the Agricultural Research Station, Koilpatti. The area occupied by each grass was nearly 10 cents. The soil on which it was grown, was medium-fertile red-loam. The depth of soil of the field was only one foot and that of sub-soil, two feet, which consisted mostly of gravel. Immediately below the gravel layer, hard granite-rock was found.

The date of sowing, seed-rate and method of planting are presented in Table I.

TABLE I

Name of grass	Date of sowing	Seed material used	Seed-rate per acre	Method of planting
1. Kolukattai grass	14–10–1948	Seeds	10 lb.	Beds 6′ x 6′
2. Buffalo grass	6–11–1947	Cuttings 6″ long	28,000 cuttings	Beds 6′ x 6′ (Planted 1′–3″ apart either side)
3. Guinea grass	7–11–1947	Slips	10,000 slips	On ridges 3′ apart. Distance between plants 1′–6″.
4. Australian grass	6–10–1948	Seeds	5 lb.	Beds 6′ x 6′

As the grasses were planted on different dates, a common date namely, 1st July, 1949 was taken as the starting point for the study of yields. The particular date was fixed as at that time all the four types of grasses had reached their full productivity. The yield data for the three consequtive years from 1949 are presented here-under.

TABLE II

Years	Koluk-kattai grass	Buffalo grass	Guinea grass	Australian grass	Annual * rain-fall
1949—'50	1,73,970	89,700	95,245	79,000	28·12″
1950—'51	1,06,860	61,925	53,495	53,300	19·64″
1951—'52	92,550@	99,625	91,495	61,900	21·24″
Average	1,24,426	83,750	80,078	64,733	
Average No. of cuttings per year	11	9	11	9	

Note: * The average annual rainfall for the station is 30″

@ During the year 1951 – '52, Kolukkattai grass had to be renovated in patches.

Records of yields obtained in the various cuttings were maintained.

The normal height of Kolukkattai grass under rainfed condition is only about a foot. Under irrigation, it was found to reach a height of two and a half feet when conditions were favourable.

Regarding manuring, farm yard manure at the rate of 20 tons per acre was applied annually, uniformly to all the four grasses, during the months of October. Irrigation was given once a week during summer months and once in every ten days in winter months. When there were heavy rains, no irrigation was given. Weeding was periodically done in all the four grass plots. The Guinea grass was quarted and earthed up annually during the manuring time. The other three grasses received hand hoeing once annually to incorporate the farm yard manure.

The quality of Kolukkattai grass was analysed by the Government Agricultural Chemist, Coimbatore. The data and the remarks by the Government Agricultural Chemist, are presented below.

TABLE III

The feeding value of Kolukkattai grass grown under different conditions
(Results on air-dry basis)

Lab. No. 148 – 49.

No. head of analysis		Irrigated red soil area	Rainfed red soil area	Rainfed black soil area
1. Moisture		8·62	5·93	4·99
2. Ash		12·72	11·91	14·92
3. Crude Proteins		12·15	9·23	9·04
4. Ether extractives		2·92	2·65	2·46
5. Crude Fibre		22·66	26·81	41·73
6. Carbohydrates (by difference)		40·93	43·47	27·36
7. Total		100·00	100·00	100·00
8. Lime (Ca O)	Per cent	0·412	0·445	0·610
9. Phosphoric acid (P_2O_5)	,,	0·519	0·573	0·560

Goverement Agricultural Chemist's Remarks: "Compared to samples of the same grass taken from Kangayam tract, the Koilpatti farm samples contain higher percentages of proteins and also minerals especially phosphoric acid. Kolukkattai grass raised on the red soil area under irrigated conditions has higher content of proteins and ether-extractives and less of fibre. That grown in the black-soil area under rainfed conditions contains higher proportion of lime and fibre. There is not much variation in the P_2O_5 contents of the three samples.

All the three samples are of good quality from the point of view of the protein and mineral content. The grass grown in the red soil area under irrigated conditions is the best, containing as it does more of proteins, and less of fibre."

The grasses were cut as the panicles emerged. The Buffalo grass did not flower. The Guinea grass flowered but did not set seeds. The Kolukkattai grass and Australian grass were found to set seeds; but they were not allowed to do so in the experimental plots.

Discussions: A study of the yield for the past three years shows that Kolukkattai grass gives more yield than either Guinea grass or Buffalo grass. It also gives an average of 11 cuttings annually which is the same as that of Guinea grass. The Kolukkattai grass even when grown under rainfed conditions yields a fodder of high quality. This quality is further improved by irrigation as seen from the Government Agricultural Ceemist's remarks. According to him under irrigated conditions the protein and ether-extractives are increased and the quantity of fibres get reduced.

From Table II it can be seen that the productivity of the Kolukkattai grass gets steadily decreased year after year. This may be either due to the exhaustive nature of the crop or due to the drought that prevailed during the subsequent years. This has to be confirmed.

Summary and conclusions: Whenever copious irrigation facilities exist it is possible to grow Kolukkattai grass and get a higher yield than the popular Guinea grass. Three consequtive years of trial at the Agricultural Research Station, Koilpatti has shown that Kolukkattai grass yields 1,24,426 lb. of green fodder as against Buffalo grass, Guinea grass, and Australian grass, which have given 83,800 lb. and 64,700 lb. of green fodder respectively.

Acknowledgements: The authors are indebted to Sri. S. M. Kalyanaraman, Cotton Specialist, Agricultural College and Research Institute, Coimbatore who commenced this experiments and gave helpful suggestions throughout the course of it. The authors are also thankful to the Government Agricultural Chemist in analysing the grass samples and offering a candid opinion on the quality of the fodder.

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Proper Utilisation of Cane Material for Maximising Sugar Production*

By

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Cane stalks are primarily used for milling for sugar or gur and preparing cuttings for planting. For maximising production of cane and sugar, appropriate use of cane material is essential. The top portions of canes (especially unarrowed canes) are less mature than the remaining parts and contain less sucrose. But these germinate best and give a good stand of the crop and facilitate realisation of high cane yields. The effect of removal of one three budded sett from top of canes as prepared for milling at present on juice quality was studied from January to April in Co. 527 and Co. 419. Removal of a sett instead of a particular length was adopted so that the cutting can be directly used for planting without further manipulation. By planting such top setts $\frac{1}{2}$ to $\frac{2}{3}$ the weight of cane material now being used for planting could be saved. This would also mean, burying underground less sugar, than when stalk cuttings are planted. The improvement in sucrose content of juices due to removal top setts was marked in the earlier months when canes were less mature. Similar was the case with recoverable sugar also. Results were consistent in the case of Co. 419 and indicated that when canes were at peak maturity improvement in sucrose or recoverable sugar by the removal of top setts was least. However, there was significant increase in calculated C. C. S. percent in all the months. Even this increase was negligible when canes were at their peak maturity indicating that canes can be fed to mills as they are prepared at present. Results from Co. 527 were not so consistent though there was significant improvement in calculated C. C. S. percent in all the months in the case of this variety also.

The Farmers should not harvest cane stalks and feed them to mills or use them for planting as they are. In the interest of maximisation of production the canes should be properly dressed after harvest. It is desirable to remove one three budded sett each from the tops of canes and utilise the same for planting. The remaining stalks are best used for manufacture of jaggery or sugar. This will mean proper utilisation of cane material and results in increased cane and sugar yields.

7. **Acknowledgement**: Thanks are due to the Indian Central Sugarcane Committee, partly financing the Research Scheme at this Station.

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Maximasation of Production and Development of Improved Strains of Paddy*

By

N. C. THIRUMALACHARYA, B. Sc. (Ag.), M. Sc.

Development and distribution of improved paddy varieties form an important item of the Grow More Food Campaign. Nearly 148 paddy strains have been released, so far, by the Department to suit varied soil and seasonal conditions. But, maximisation of production of these seeds and distribution on a large scale to cover the whole paddy area and thereby increase the production by about 10% seems to be a problem.

Running of State Seed Farms on a large scale for four years and distributing seeds at the doors of villagers to cover one-fourth area each year, as a short-range policy; and limiting the sphere of activity to raising Primary Seed-farms and producing just enough seeds to maintain the purity of blood as a permanent and long-range policy, afterwards, appear to be the only solution to achieve the object.

The goal of self-sufficiency in food will largely depend upon a happy combination of tradition and technology in this wide and baffling field of Agriculture. Seed production and distribution form the main item. The time is crucial, and every attempt should therefore be made to hasten the process. It is hoped that with the development of Paddy seed on a rationalised and re-organised basis, side by side with the production of green manure seeds and green-leaf manures, a new era of peace and plenty would be ushered in, and the problem of food famine is once for all solved.

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* Summary of paper contribution for College Day & Conference 1952.

Methods to be adopted to Maximise Production and Development of Improved Strains and Plant Materials *

By

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Soil Conservation for maximising production: It need be hardly stressed that soil conservation has direct bearing on maximising production. Generally soil conservation is understood as prevention of soil erosion. But in fact soil conservation is itself defined as maximising production without depleting soil fertility. Soil conservation is good land husbandry-use of land according to its potentiality, prevention of soil erosion, manuring to maintain soil fertility and adoption of all improved agricultural practices. This soil conservation is the ideal means to maximise production and it is particularly important for dry lands. As major portion of our cultivable lands do not have adequate irrigation facilities, soil conservation is the only means to maximise production.

Work done in the field of soil conservation in this State: With a view to evolve suitable dry farming practices to assure crop production in the semi arid and famine affected zones of this State, a Dry Farming Scheme and Dry Farming Developmental Scheme were in operation during the years 1939—'48 at the Agricultural Research Station, Hagari and it was partly financed by the Indian Council of Agricultural Research. Among the recommendations adopted (as a result of these schemes) for dry farming, such as wider spacing, inter cultivation, manuring, fallowing etc., contour bunding was included for prevention of soil erosion and conservation of moisture to improve the dry lands permanently. The recommendations were identical to the similar conclusions arrived at other dry farming stations like Sholapur and Bijapur in Bombay, Rohtak in the Punjab and Raichur in Hyderabad. The State Government, therefore, desired to take up large scale contour bunding works, even as early as 1946. But the State had not got the necessary legislation empowering the Executive departments to take up contour bunding or any other land improvement measures in private holdings. The Madras Land Improvement Schemes Act, was enacted only in 1949. In the meantime, the Bombay Government had taken up large scale contour bunding and had covered over 6,00,000 acres as a famine relief measure. Later the Bombay Agricultural Department took up the schemes as a regular part of their departmental activities. During the initial stages, there were certain draw backs and defects in the work and later after modifications the work is being pushed through. A few Officers of this department were deputed for training in soil conservation in Bombay in 1948—'49 and since then batches of two or three men are being deputed periodically.

* Summary of paper contributed for College Day & Conference, 1952.

State Soil Conservation Board: The Soil Conservation Experts to the Government of India who visited this state during 1948 had INTER ALIA suggested the creation of a High Level State Soil Conservation Board to initiate and co-ordinate soil conservation, land utilisation and ground water investigation schemes in this State. The State Government had accordingly constituted a thirteen member State Soil Conservation Board with the Director of Agriculture, Joint Director of Agriculture and other heads of departments as members with the Honourable Minister for Agriculture as Chairman. The Board has met thrice after its constitution and all the soil conservation schemes were discussed, at the said Board meetings and were duly recommended.

Tree Planting — Selection of Plants to Aid Beekeeping

By

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AND
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The importance of plants for bird, beast and man is sufficiently realised even from time immemorial and did not fail to get sufficient attention in any good administration of a country or management of villages. Tree planting, probably obtained the maximum effort during King Asoka's reign and to this day is talked of as having secured the maximum benefit to India. It should be the common experience of everybody to find a stately avenue tree giving shelter to men and beasts that seek protection under it in the burning sun. In this appreciation of service we are getting out of a humble plant life we may miss the several birds and animals that get an equal amount of protection on the tree itself from the rigours of the weather.

With the dawn of independence in India the subject of tree planting has rightly come to prominence again and the Government of India has inaugurated a tree planting week, "Vanamahotsavam" to be observed in the first week of July every year, when all the Government Departments, public institutions and workers contribute their mite for tree planting for the year. This tree planting securing the effort of many can be put on a rational basis especially in areas where beekeeping proves promising and deserves to be encouraged. Instead of selecting any tree for planting taking into consideration its economic importance only, we

have now enough information with us about bee-pasturages, as to enable us to have a wide selection of plants that can, in addition to serving some economic gain, can also help the beekeeping industry. With this in view a list is furnished below of different plants that can be used for tree planting and still prove useful for apiculture. It is fortunate that the list includes most of the trees that are now being used for tree planting and the exclusion may only be confined to a few. The planting of the trees should, however, be so adjusted as to benefit the beekeeping industry. It is the intention of the authors that the tree planting should be so adjusted in the selection of plants as not only to benefit birds, beasts and men but also the bees. In this connection, it may be intersting to know that recently two trees growing near one another in Chinnathadagam village in Coimbatore Taluk showed as many as 105 *Apis dorsta* F colonies. What all is required is some attention for proper selection of trees and to give a wide scope for it. A fairly exhaustive list has been got up with details to help the readers in the selection of plants as avenues, hedges, etc. It is the earnest wish of the authors that the subject may get due attention at the hands of everybody taking part in tree planting weeks especially the Highways Department that is to plant many an avenue tree.

LIST OF TREES RECOMMENDED FOR TREE PLANTING

I. (Nectar yielders)

Serial No.	Botanical name	Period of flowering	Remarks
Avenues:			
1.	Albizzia lebbeck	March	Suited to the plains
2.	Creteva religiosa	do.	Thrives along river banks.
3.	Pungamia glabra	do.	..
4.	Dalbergia paniculata	April	Suited to dry districts.
5.	Entrolobium saman	March	..
6.	Sapindus emarginatus	October	Suited to low hilly tracts of dry evergreen forests.
Hedges:			
1.	Dombeya sp.	November	..
2.	Eriodendron anfractuosum	March	Suited to West Coast.
3.	Prosopis juliflora	March	..
4.	Prosopis glandulosa	March	..
5.	Acacia alba	September	..
Ornamental:			
1.	Cithroxylum subserratum	November	Propagated by cuttings.
2.	Mimusops elangi	May	Suitable for dry and hilly tracts upto 4000 ft.
Timber:			
1.	Gliricidia maculata	March	Good source of green manure. Establishes quickly.
2.	Azadirachta indica	March	Suitable for black soils,
3.	Santalum album	December	..

Serial No.	Botanical name	Period of Flowering	Remarks
Vegetables and Fruits:			
1.	Sesbania grandiflora	January	Suited for plains.
2.	Moringa pterygosperma	February	Suited to dry sandy soils.
3.	Tamarindus indica	May – June	Evergreen avenue tree of much economic use.
	II. (Pollen yielders)		
Avenues:			
1.	Castonospernum australe	March	Exotic plant.
2.	Delonix regia	May – June	Garden, ornamental and shade plants.
3.	Delonix elata	December — January	Green manure.
4.	Holoptelea integrifolia	February	Fuel tree.
5.	Peltophorum ferrugineum	do.	Exotic, flowers twice a year suited to dry as well as moist areas.
Hedges:			
1.	Pethecolobium dulce	January	..
Ornamental:			
1.	Parkia biglandulosa	November — January	..
Timber:			
1.	Acacia arabica	July	Suited to dry localities especially in black cotton soils.
2.	Morinda tinctoria	March	Suited to dry regions especially in black cotton soils.
3.	Ailanthus excelsa	January	Wood very light.
4.	Borassus flabellifer	March	Tree of very economic importance.
5.	Thespesia populnea	January	Evergreen avenue.
	III. Pollen and Nectar yielders		
Avenues:			
1.	Alangium salvifolium	March	Suited to dry regions — a good timber.
Hedges:			
1.	Agave americana	January	Fibre and ornamental suited to dry, gravel and sandy soils.
2.	Aegle marmelos	March to May	Suited to plains — medicinal
Vegetable and Fruits:			
1.	Cocos nucifera	Throughout the year	Highly economical, valued for timber.
2.	Feronia elephantum	March	Fruit and medicinal.

Plant Introduction and Improvement of Grasses and Legumes. *

By

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PART — I

General: Improvements of crops in general and food crops in particular are engaging the attention of research workers in India and all the world over. But in many States of India we are faced with deficit in the matter of the production of food crops. Several attempts are being made to make up this deficit by evolving high yielding strains, and conducting manurial and cultural investigations to find out the best method of improving the yield. Plant Introduction as a means of crop improvement is only a recent approach in India. Improvement of cereal food crops received first attention and in the early stages of crop improvement the search for new types was confined to places within our country and the desirable types were isolated and grown. With the introduction of new plants, one has to guard against the introduction of dangerous pests and diseases also. To this end plant quarantine measures are being adopted in all advanced countries.

America: America is the first country to start Plant Introduction work; and the history of Plant Introduction and the different phases of this work is interesting. Bailey (1922), records that in 1838, United State Congress made its first allotment in aid of Agriculture in the form of a grant of one town-ship of land in South Florida to Dr. Henry Perrine for the purpose of encouraging the introduction and cultivation of Tropical plants in the U. S. A. In 1839, Mr. Ellsworth, Commissioner of Patents, appealed to the diplomatic crops of United States residing abroad and also to the officers of the Navy to collect valuable plants and seeds for trial in U. S. A. The diplomatic Crops and officers of the Navy took up this work with patriotism and cheerfulness. In 1840, the work of plant introduction, coupled with that of gathering statistics in Agriculture, received a sum of 452 dollars from the State; in 65 years this sum reached a figure of 6,000,000 dollars. The pioneers in Plant Introduction work were not men trained in the Agricultural needs of the Country, with the result that no proper records were kept, and even the introductions sometimes did not suit the purpose. For example, as early as 1870, the Government introduced useful scions of Russian apples; besides this the

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Officer of the Government, private nurserymen and seedsmen have long been in the habit of introducing interesting plants from other Countries, but for want of popular enthusiasm, these introductions have disappeared.

It was not until 1897 that the work of Seed and Plant Introduction was put on a Scientific basis. The Bureau of Plant Industry was then formed which included the Divisions of Plant Introduction, and Division of Forage crops and Diseases. Ever since the Bureau of Plant Industry was organised, it has done systematic work on economic plants including grasses and other forage plants.

The Council of American Genetic Association awarded the Mayor medal, periodically for distinguished services in Plant Introduction. One of the receipients of the medal was Mr. H. N. Riddy, who was responsible for the introduction of para rubber into East Indies. Another receipient, Dorselt, was responsible for the introduction of Soyabeans into U. S. A., he explored China and made more than 2000 collections. He also made expeditions in Brazil and introduced many varieties of Citrus and ornamental plants.

Some of the interesting plants that formed the first arrivals in the work of plant introduction in America will be of interest. The largest collection of date varieties were grown in the gardens of Arizona and California. A very large collection of tropical mangoes which were first raised in green houses have been distributed to Florida, Porto Rico and Hawaii. Thousands of Japanese rush plants (reeds) used in matting industry, of which the Country was importing several million dollars worth every year, have been successfully introduced in South Carolina. Berseem *(Trifolium alexandrinum)* one of the best winter forage crops has been introduced from the Nile valley into the irrigated tracts of South West of U. S. A. Likewise, the Kaffir Corus from the uplands of Abyssinia the East Coast of Africa and India were first tested in Kansas and naturalised. A newly found Oat from Northern Finland was found to be superior to those in Alaska.

One of the most far reaching in its possibilities of all the introductions is the drought resistant durum wheat, which yielded Crops, where all ordinary wheats have failed for want of water; this was unknown in the American markets in 1898, but since then has been grown in such large quantities that the U. S. exports several million bushels to other Countries.

Another important introduction was the Japanese Kiushu rice, which was partly responsible for the extensive rice areas of Texas and Louisiana.

The author (Bailey, loc. cit.) concluded that the plant introduction of a Country must be in the hands of Government to guard against the

danger of introducing noxious weeds, insect pests and fungal parasites. In some countries like Italy, Greece, prohibitive quarantines have been placed against the introduction of foreign plants. Possibilities of organised plant introduction are almost unlimited. Interchange of plants between countries must be taken up on a large scale; the author is of opinion that the building up of new plant industries in a country will one day rank with greatest of national duties.

Technique of Plant Introduction adopted in America: Morrison (1943) records the technique of plant introduction in U. S. A. Plant introduction involves the preparation of plants for shipment and special care to restore them to full growth and vigour in a new environment. The stage of the plant which will bear transport without much damage, is its dormant condition, namely, the seed, bulb or the dormant shoot etc.

Thousands of plant introductions received in Washington in the form of seeds, cuttings, plants etc., are unpacked and immediately given an identification number in the specially equipped Plant Introduction-laboratory; these are examined by competent inspectors of the sanitary branch of the service, to prove and record their freedom from disease and insect pests. The Officers of the Bureau of Crops, act in colloboration with the Plant Pathologists and Entomologists. The staff entrusted with the duty of field exploration in any part of the World consists of Botanists and Horticulturists who collect whatever material that may be needed to diversity or improve Agriculture. This also includes a unit in Washington, whose function is to plan the work and maintain the historical records of each enterprise. Another important activity of the Division is to develop the service of exchange of Plant Introduction.

If a new introduction is found free from insects and diseases it is given a clean bill of health which permits it to be forwarded to the Specialist of the Department for whom its was specially secured, or to the Plant Introduction gardens, for propagation, cultivation, preliminary tests, and finally if found suitable to be grown for distribution. If an introduction is found to be affected with insect or other pests, it is ordered to be kept into quarantine and the necessary treatment prescribed.

It is at these plant introduction field stations, that the experts determine which of the new plants show promise of being of economic importance.

To mention an example of Plant Introduction service let us take the case of *Cinchona ledgeriana*. As soon as it is received from the ship, it is examined by the Bureau of Entomologists and Plant Pathologists, is given a serial number and delivered to the Botany Division; the correct nomenclature is given by the Botanists; a sample is reserved of the seed against any future verification and the seed sent to Plant Introduction

garden; here it is grown under best conditions; if the seeds are fresh, within three weeks there must be good germination; the seedlings are watched with care. If carefully transplanted, normally in six months time the seedlings are sufficiently grown up for transport to any other place of trial. Before transporting to other centres, special fumigation is given, the necessary sanitary certificates are issued. The receipient of these plants from the Introduction gardens must be well trained to prepare them for nursery growth and latter for field planting. He must have known all about the plant in its native habitat; this is more or less the story of each plant that arrives the Plant Introduction Garden and leaves it.

Sufficient care must be bestowed in selecting a Plant Introduction Garden, it must have good soil, desirable slope and drainage facilities. Special green houses are erected which fall under three categories:— (1) Those intended for Plant Quarantine, (2) those that serve as propagation house, and (3) those used for continued growth. David Fairchild (1917) records that every one who is keenly interested in introducing new plants should correspond with the Officers in charge of Plant Introduction Gardens and get small samples of successful new introductions.

Benefit derived from Plant Introduction in America: Plant Introduction has given to the United States practically all of its commercial crops. The Plant Introduction Field Station of the Department of Agriculture situated in Miami is most advantageous for the preliminary testing of a wide range of new Plant Introductions from tropical and sub-tropical countries, this Station is almost free from frost, and is a very near approach to the tropical countries. The Department of Agriculture has six such Introduction Gardens situated all over the U. S. A. The following are a few selected examples which give an idea of range of new Plant Introductions:—

(1) The jujube *(Zizyphus jujuba)*, from china is as promising a crop commercially for California and the semi arid regions, as any of the other crops or ornamental plants.

(2) *Aleuritis fordii* was introduced sucessfully in N. California, N. Florida and other parts. The oil obtained from the seeds of this plant is one of the drying oils and can be used for the paint industry. The United States has been importing several million dollars worth of paint oil.

(3) The Chinese variety of Persimmon (*Diaspyros kaki*) can be sucessfully grown in California and the south. It may be of interest that Persimmon is one of the sucessful fruit trees grown in the Nilgiris now.

(4) The Chinese Chestnut *(Castanea mollissima)* is a very interesting introduction; in the Plant Introduction Gardens this plant

was observed to be resistant to Chestnut bark disease so common in American Chestnuts. After trials in these field testing centres, the seeds were distributed to disease infested areas.

Most of the major agricultural crops, namely, Maize, Tobacco, Squash, Pumpkins etc. had been introduced by the migrating Indians from more Tropical regions of America. More than 95% of the cultivated crop plants of the United States are of exotic origin and more than three fourths of them are natives of the Old World. The wild relatives of these Old World crop plants have been used in breeding crop plants resistant to disease etc. No fewer than 17 genera and 23 species have been introduced and grown successfully in America, but there still remain no fewer than 9 genera and 164 species not growing in the New World. Thus introduction of plants had been a fundamental factor in the Agricultural Improvement of United States, and will continue to be so to meet with the new situations and problems that may arise. To determine which of the World regions are most likely to supply new material, requires an intimate knowledge of the climates and soils of the World in relation to those of the U. S. A. Materials needed for specific needs in the U. S. A. should be obtained from as nearly similar climates as possible, in order that the plants may grow as naturally as possible. Usually, most plants tolerate varying growing conditions, otherwise many plant immigrants will succumb. Generally too severe summers or winters, wide range of variations in humidity, drought and other factors have a tendency to stunt the growth of plants. Sometimes the plant may grow well but fail to set viable seed. The experiences we meet with in the common 'Kikyu' grass *(Pennisetum clandestinum)* growing luxuriantly in the Nilgiris, is an example. This grass is a native of Kenya, it is probable that in its new environment it has not got the requirements of light, heat, humidity, etc. which it has in its native home. Some plants may require lime in the soil, while others may do well in acid soils. Some plants may tolerate alkali or salinity, but majority of them do not. As instances of grasses and legumes, and other plants tolerating salinity mention may be made of a few plants recorded by Chandrasekhara Ayyar, et al (1949) the authors have recorded that *Crotalaria verrucosa, Crotalaria striata* and *Rothia trifoliata* among the legumes have been observed to withstand salinity to a remarkable degree. One must have at least a general knowledge if the introduction is to receive a fair trial.

Russia: The study of plant geography is now receiving more and more attention by those who want to intensify the work of Plant Introduction. Vavilov and his co-workers made intensive explorations into the foot-hills of the mountains of Asia and have located several primary centres of origin of cultivated plants as for instance the Hindukush mountains, the Caucasus, the Himalayas etc. which were found to possess wild ancestors of several fruit trees, Wheat, Rye etc.

Vavilov quoted by Julian Huxley (1940) records that "cultivated species, as well as their closely allied wild relatives, in their evolution, during the course of their distribution from the primary centres of species-formation, have been differentiated into definite ecological and geographical groups". Conducting expeditions to various primary regions of the origin of cultivated plants, Vavilov says that an enormous diversity of species and varieties formerly unknown were recorded. For Wheat alone 800 botanical varieties were recorded by the Soviet Expeditions, while the previous workers have recorded only 191 varieties; similarly in the case of potato *(Solanum tuberosum)* only one species was recorded, but the Soviet Expeditions have discovered 18 new species of cultivated potatoes, some of them comprising many varieties. By a comparative study, under various environmental conditions, of the Agro-ecological groups of the most important annual crop plants of the Old World by the Russian works, Vavilov (loc. cit.) says that definite agro-ecological and geographical groups can be formed of these plants; he records 19 such groups with reference to cereals such as wheat, barley, rye, oats and grain Leguminosae such as peas, lentils, chick-peas, etc. and flax, both seed and fibre forms. From a study of these groups one is struck by the diversity of forms brought about by the ecological factors. It varies from the small seeded, arrow leaved, early, xerophytic types of the *American Xerophytic Mountain group* to the giant forms of wheat, rye, barley, peas etc., of the *Caucasian Mesophytic High-Mountain group.* The former group occupies the region of the arid, mountainous steppes of Soviet and Turkish Armenia, while the latter comprises the large territory formed by the high plateaux in mountainous Daghestan and Georgia. Between these two extremes of diversity we meet with various types, each representative of a definite ecological group. Vavilov (loc. cit.) says that *Indian group* on the whole is comparatively uniform, notwithstanding the diversity of conditions; in general, all spring varieties of cereals, as well as flax and grain Leguminosae, are distinguished by non-bushy habit, small narrow leaves, thin stiff stems, resistance to drought, rapid filling out of seeds and small seeds. In the *Chinese - Japanese* group Vavilov (loc. cit.) records that the entire group is characterised by low or medium height, extremely small seeds and rapid filling out of the grain and that many varieties of wheat have been proved to be resistant to brown and yellow rust. One noteworthy feature of the *Mediterranean group* has been observed to be the presence of a great many varieties resistant to *fungus diseases*, such as leaf-rust, smut and many other parastic diseases.

By a detailed study of these geographical groups, the Russian workers have discovered the Xerophytic, non-shattering forms of *Triticum vavilovianum*, Jacubz. in Soviet and Turkish Armenia. *Triticum persicum*, var, a 28-chromosome species and *Secale montanum*, Guss, a Xerophytic wild mountain rye in the neighbourhood of the Caucasian

mountains. Likewise, several useful cultivated and wild forms of Cereals, grain Leguminosae etc. were discovered.

A knowledge of these agro-ecological and geographical groups, opens out to the Scientists a wide range of plants of diverse characters to choose and introduce in suitable areas. Vavilov (loc. cit.) says that for many important cultivated plants of the Old World, the Caucasus, South-eastern and South-western Asia is the place where one must look to for diversity of forms; similarly for the New World, Southern Mexico, Central America, and the South American Andes must be the place to search for new forms of cultivated plants. In these regions of the Old World one can come across all intermediate forms between wild and cultivated types in the case of such crops as almonds, figs, pistachios, walnuts, grapes, wheat, rye, oats etc. In the unexplored regions of the New World enumerated above, one can come across similar forms in the case of cottons, potatoes etc. Vavilov finally concludes that "there are vast areas in South America, Central America, and Southern Asia with enormously rich floras, which have not yet been studied even superficially, thousands and thousands of new species have yet to be discovered; the lack of even such superficial knowledge is a great hindrance to our general knowledge (understanding) of the flora of the World. The basic biological work which must embrace a knowledge of the entire flora is not yet finished, even in its first approach, namely, in the Linnean understanding of the species". In the words of Vavilov "The most remarkable regions of the World, the cradles of primitive civilizations — the mountainous regions of Southern Asia, Central and South America — are still in need of investigation even as to their resources of cultivated plants".

Australia: Australia being a comparatively new country, and isolated from the more advanced Agricultural countries of the World, has no Agricultural crops of importance indigenous to the country. All the chief cultivated plants, fruits, vegetable, crops etc., grown in Australia to-day had originally to be introduced from some other part of the World. It was recognized that the best chance of success in plant introduction, lay in turning more to those countries which had similar climatic conditions to those of Australia. Wenholz (1929) records that maize from Africa was of much greater success than wheat from England, in the coastal districts of New South Wales. In Australia, for many years it was purely a question of crop introduction without any great regard for the variety or kind of crop. It was only after the State Departments of Agriculture took a hand in economic plant introduction that there was much discrimination as to the variety or kind of crop introduced; and much more rapid headway was made after the more expert handling of the work.

Many valuable introductions have been made; the late William Farrier was one of the first in Australia to recognise the all important

value of wheat introduction from India, Canada and other countries; for, without which he could not have evolved "Federation Wheat" into the breeding of which Indian and Canadian wheat entered. A careful and systematic study of certain areas of South Wales and their climatic counter parts in the United States led to the introduction of important maize varieties such as Funk's Yellow Dent and Golden Glow, Saccaline, Collier, and White African Sorghums are introductions far superior to the old "Planters' Friends" which was the best yielding forage variety for many years in New South Wales. 'White Burley Tobacco' from America has been used by the tobacco expert when crosses were made with local tobacco varieties; from these crosses 'Dinbai', a superior variety for 'flu' curing was evolved. Most of the valuable introductions are the result of ceaseless search for plants from current literature.

With the establishment of the Plant Breeding Bureau in 1927, the work of Plant Introduction was placed on a more systematic basis; this branch was specifically charged with the duty of plant introduction in consultation with Crop Specialists, as it is of considerable importance to Plant Breeders.

In the introduction of seeds and plants, Australia like U. S. A. has adopted very strict measures to prevent entry of injurious insects and diseases into the country. All quarantine regulations were meticulously followed, every parcel of seed or plant introduced was fumigated and examined by Entomologists and Plant Pathologists. After this strict examination the Crop Specialists tried them under strict quarantine conditions, where close watch was kept.

Wenholz (loc. cit.) states that plant introduction may be carried on more or less successfully between organised services, but when carried on between individuals who are mutually interested in a particular phase of work in a crop, it is lifted from a routine study to a level of greatest possible value, and this plan is being adopted by the Department of Agriculture in Australia. It is argued that the large measure of success of U. S. Department of Agriculture lies in the efficient organisation backed by the more expert advice of Crop Specialists and Plant Breeders; without such organisation and backing, plant introduction becomes costly hit and very often proves a failure.

Cereals: From a study of similar climatic conditions of the World, it has been observed that early maturing wheats from some of the warmer parts of the World such as India, Italy, North Africa, and Iraq may be of possible direct value to the direr parts of Australia. Many of these are also being used in cross breeding. Wheats resistant to rust, smut, and other diseases have been introduced from America, Africa, Germany etc. The rice industry is being served through important introductions from Louisiana, California etc.

Fodder Crops: With regard to fodder crops new sorghum varieties from America, India and Africa have been under observation; some promising lucerns have already been introduced from Spain and South America. A new field pea from U. S. A. has been observed to be one of the outstanding introductions.

Similarly with regard to fruits and vegetables, many promising plants have been introduced from U. S. A.

Gleanings

Cottonseed has multiple uses: Four types of products are derived from cottonseed: Linters, hulls, oil and meal.

The linters are the fuzzy fibers left around the seed after the cotton has been ginned. These fibres are almost pure cellulose, and are now used for stuffing mattresses and upholstery, lacquers, films, and plastics.

The hulls, which cover the seed, are excellent as a livestock feed and especially as roughage needed by dairy and beef cows. Experiments have been made in the use of the hulls for industrial products and it has been found that ground hulls filled with a resin binder can be moulded into radio cabinets, table-tops, airplane panels, and industrial gears.

The oil that is pressed from the meat of the cottonseed is valuable as a food for human beings. It is a superior oil for shortening, (vegetable cooking fat), margarine (substitute for butter), cooking oil, and salad oil.

The meal, a fine powdered substance, is valuable as a feed for livestock and as a fertiliser. It is rich in proteins — the muscle-building materials found especially in meats, eggs, cheese, and milk. As a fertiliser it is excellent for tobacco and nursery crops.

With all its many uses, today, no part of the seed from cotton is wasted. Cottonseed yields farmers in the UNITED STATES a cash income of more than £ 300,000,000

(Farmer — April 1953. Vol. IV, No. 4).

Weather Review — For the month of April 1953.

RAINFALL DATA

Division	Station	Total rainfall for the month in inches.	Departure fromnormal in inches	Total since 1st January in inches	Division	Station	Total rainfall for the month in inches.	Departure fromnormal in inches	Total since 1st January in inches
Orissa & Circars	Gopalpur	0·0	—0·7	2·3	Central Contd.	Vellore	0·8	— 0·2	0·9
	Calinga-patnam	0·0	—0·8	1·1		Gudiyatham*	4·5	+ 4·3	4·5
	Visakha-patnam	0·0	—0·7	2·1		Salem	4·0	+ 2·1	4·0
	Arakuvalley*	3·1	—1·5@	3·2@		Coimbatore (A. M. O.)*	9·0	+ 6·0	9·1
	Anakapalle*	..	..	..		Coimbatore	7 8	+ 6·2	8·0
	Samalkot*	0·6	—0·8	0·9		Tiruchirap-palli	6·0	+ 3·6	6·7
	Kakinada	0·1	—0·5	0·2					
	Maruteru*	0·0	—0·4	£	South	Naga-pattinam	2·0	+ 0·9	5·7
	Masuli-patnam	0·0	—0·7	£		Aduturai*	3·2	+ 2·3	4·8
	Guntur*	0·5	—0·7	0·5		Pattukottai*	2·1	+ 0·3	6·6
	Agrl. College, Bapatla*	0·4	+0·1	0·4		Mathurai	9·1	+ 6·9	10·0
						Pamban	1·9	+ 0·1	3·6
						Koilpatti*	4·9	+ 1·4	5·7
	Agrl. College, Farm, Bapatla*	0·9	X	0·9		Palayam-cottai	5·0	+ 2·5	7·9
	Renta-chintala	1·0	—0·2	1·1		Amba-samudram*	3·8	+ 0·1	9·2
Ceded Districts	Kurnool	0·1	—0·6	0·1	West Coast	Trivandrum	3·6	— 1·0	6·5
	Nandyal*	1·4	+0·7	1·4		Fort Cochin	10·2	+ 5·3	13·8
	Hagari*	1·1	+0·2	1·1		Kozhikode	4·0	— 0·9	5·0
	Siruguppa*	1·8	+1·2	1·8		Pattambi*	0·8	— 2·3	2·5
	Bellary	1·2	+0·4	1·2		Taliparamba*	..	..	..
	Cuddapah	0·1	—0·5	0·1		Wynaad*	5·0	— 0·8	7·2
	Kodur*	1·2	+0·7	1·3		Nileshwar*	0·9	— 1·0	1·0
	Anantapur	1·5	+0·9	1·5		Pillicode*	4·8	+ 2·9	4·9
						Mangalore	0·4	— 1·5	0·6
Carnatic	Nellore	0·0	—0·5	0·1		Kankanady*	1·4	— 0·1	1·4
	Buchireddi-palem*	0·4	—£	0·5	Mysore & Coorg	Chitaldrug	2·9	+ 1·9	2·9
	Madras (Meenam-bakkam)	0·3	—0·3	1·7		Bangalore	5·6	+ 4·0	5·8
						Mysore	5·1	+ 2·8	5·2
						Mercara	3·1	+ 0·5	3·4
	Tirur-kuppam*	1·0	—0·5	1·4	Hills	Kodaikanal	6·8	+ 2·0	11·2
	Palur*	0·9	—0·1	1·7		Coonoor*	5·4	— 0·7	21·8
	Tindivanam*	3·2	+2·3	3·7		Ootacamund*	4·1	— 0·4	5·6
	Cuddalore	1·8	+0·8	3·2		Nanjanad*	7·3	+ 2·3	8·5
Central	Arogyavaram (Chittoor dt.)	1·3	+0.2	1·4					

Note :—

1. * Meteorological Stations of the Madras Agricultural Department.
2. @ Average of eight years data for Arakuvalley is given as normal.
3. Average of ten years' data is taken as normal.
4. X The Farm was started only in 1951.
5. £ Rainfall 1 to 4 cents.

Weather Review for April 1953

A weak cyclonic circulation extended up to 3,000' above sea level off the South-Konkan-Kanara Coast on 2—4—1953 and persisted up to 6—4—1953. Incursion of moist air from the Bay of Bengal extended up to 20°N over the Peninsula, during the same period. Another cyclonic circulation existed over South-Deccan, Mysore and the adjoining areas up to 5,000′ above sea level on 4—4—1953 and became unimportant in a day. A shallow surface low appeared over east Uttar Pradesh and the adjoining areas on 10—4—1953 and became unimportant very soon. On the same day a low appeared over the South-West Punjab (P) and adjoining Rajasthan, and a low pressure wave was moving westwards across the South-east Bay of Bengal. The former passed away across the extreme north of the country on 12—4—1953 and the latter became less marked on the following day itself. A cyclonic circulation persisted over Hyderabad, Rayalaseema and the adjoining areas up to 7,000′ above sea level, on 15—4—1953 and persisted for one more day. On 17—4—1953 a surface low lay over the South Peninsula, which became unimportant on the very next day. An extended surface trough lay over the Gangetic West Bengal and the adjoining areas of Chota Nagpoor and coastal Orissa on 20—4—1953 and weakened on the succeeding day. On 25—4—1953 a shallow low pressure wave was apparently moving across South-west Bay of Bengal. This passed away westwards across the Comorin-Maldives area on the next day. Unsettled conditions were observed in the South-east Bay of Bengal on 28—4—1953, which concentrated into a severe cyclonic storm with a small core of hurricane winds in the east-central Bay, centred near about latitude 14½°N and longitude 92½°E at 0830 Hours, Indian Standard Time on 30—4—1953. A series of five Western disturbances passed over the North West India during the month with their associated secondaries.

Day temperatures, which were appreciably above normal during the last week of March, 1953 dropped quickly and were generally below normal over the Region with but only slight fluctuations.

The note worthy rainfalls and the zonal rainfall for the month are furnished hereunder.

Note-worthy Rainfalls for the Month

S. No.	Date	Name of place	Rainfall for past 24 hours
1	9—4—1953	Coimbatore (A. M. O.)	2·48″
2	11—4—1953	Pilicode	3·50″
3	11—4—1953	Tiruchi	2 30″
4	17—4—1953	Nanjanad	2·52″
5	19—4—1953	Bangalore	2·90″
6	20—4—1953	Madurai	2·70″
7	20—4—1953	Fort Cochin	2·10″
8	22—4—1953	Gannavaram	3·10″

Zonal Rainfall

S. No.	Name of zone	Rainfall for the month	Departure from normal	Remarks
1	Orissa and Circars	0·55″	— 0·58″	Below normal
2	Ceded Districts	1·35″	+ 0·38″	Just above normal
3	Carnatic	1·09″	+ 0·24″	,,
4	Central	4·77″	+ 3·17″	Far above normal
5	South	4·00″	+ 1·80″	,,
6	West Coast	3·46″	+ 0·09″	Just normal
7	Mysore and Coorg	4·18″	+ 2·30″	Far above normal
8	Hills	5·90″	+ 0·80″	Above normal

Departmental Notifications

SUBORDINATE SERVICE

Transfers and Postings

Name	From	To
Sri Angustine, K. P. R.	Asst. in Chemistry, Coimbatore	Spl. A. D. Manner, Krishna District
,, Anthony Reddy, Y.	Soil Conservation Asst., Guntakal	Fruit Asst. Model orchard Nursery Madanapalli
,, Appa Rao Reddy, B.	Field Asst. Mayavaram	A. D. Anakapalli
,, Alagiriswamy, M.	Spl. A. D. Sugarcane, Nilakottai	A. D. Kodaikanal
,, Anandacharyulu, S. V.	Mycology Asst. Coimbatore	F. M. Araku Valley
,, Bhaskara Rao, K.	Asst. in Chemistry, Coimbatore	Spl. A. D. Guntur
,, Balakrishnamurthy, S.	Do.	Do.
,, Baghavandass, M.	Asst. in Cotton, Coimbatore	Spl. A. D. Sulur
,, Basaviah, V.	Do.	Seed Development Asst., Chittore

Name	From	To
Sri Chellamiah Sastry, K. V.	Spl. A. D. Coconut Palm Disease, Kakinada	Spl. A. D., E. Godavary
,, Chandra Sekhara Reddy, D.	A. A. D. Kallakrichi	Spl. A. D., Guntur
,, Dattatrayulu	..	Spl. A. D. Sugarcane, Hindupur
,, Easwara Rao, K. M.	Spl. A. D. Cotton, Sulur	Spl. A. D., Guntur
,, Edwin Amirtha Raj	A. D. Kodaikanal	A. D. Salem
,, Gopal Rao, B. V.	A. A. D. Kakinada	Spl. A. D. West Godavary
,, Gangadhara Menon, P. K.	Do.	Fruit Asst. Taliparamba
,, Gopalakrishnan, V.	A. D. Gudiyatham	F. M. Hosur
,, Ganga Rao, G.	Do.	Seed Development Asst., Cuddapah
,, Hajee Sheriff	A. A. D. Hiramandalam	A. A. D. Parvathipuram
,, Janardhana Rao, P.	A. D. Krishnagiri	Spl. A. D. W. Godavary
,, John Knight	A. D. Wandiwash	A. A. D. Saidapet
,, Kulandaivelu Naicker, R.	A. D. Madurantakam	A. D. Ponnani
,, Kameswara Rao, G.	A. D. Anakapalli	Spl. A. D. W. Godavary
,, Koteswara Rao, K.	A. A. D. Saidapet	Spl. A. D. Krishna Dt.
,, Kamalakara Rao, M.A.	Marketing Asst. Cuddapah	Spl. A. D. Krishna
,, Krishnamurthy, K.	F. M. Gudiyattam	Spl. A. D. Sugarcane, Peddapuram
,, Kuppuswamy, N.	A. D. Cheyyur	A. D. Krishnagiri
,, Kamalanathan, S.	Certification Inspector Villuppuram	Cotton Asst. Coimbatore
,, Kader Razack	Seed Dev. Asst. Cuddapah	P. A. to D. A. O. Cuddapah
,, Lakshmipathi Rao, S.	Spl. A. D. Sugarcane, Sulur	Spl. A. D., E. Godavari
,, Lakshminarayana Rao, K.	Certification Inspector Coimbatore	Cotton Asst. Coimbatore
,, Lingiah, M. K.	A. D. Coonoor	F. M. Central Farm, Coimbatore
,, Mahadeswaran, K.	Millet Asst. Coimbatore	Millet Asst. Coimbatore
,, Mohd. Baig	Spl. A. D. Peddapuram	Asst. A. D. Hiramandalam
,, Mohd. Majaiduddin	Ent. Asst. Mettupalayam	Spl. A. D., W. Godavary
,, Mohd. Waizullah	Chemistry Asst., Mannargudi	Spl. A. D. Krishna Dt.
,, Nageswara Rao, M.	A. D. Ponneri	A. A. D., Chingalput
,, Narayana, E. L.	Spl. A. D. Sugarcane, Hindupur	Spl. A. D. Krishna Dt.
,, Narasimha Rao, S.	Ginger Asst. Pattambi	Spl. A. D. Guntur
,, Padmanabhan, S.	A. D. Alur	Soil Conservation Asst., Guntakal
,, Padmanabhan Menon, E.	Do.	Peper Asst. Taliparamba

Name	From	To
Sri Periaswamy, S.	Ent. Asst. Ootacamund	Ent. Asst. Coimbatore
,, Pappiah, B. P.	A. D. Kovur	A. D. Rajamundry
,, Ramamurthy, M. V.	F. M. Dairy-Cum-Bull Farm Vizakapatnam	A. A. D. Anakapalle
,, Ramakrishna Rao, J.	A. A. D. Anakapalle	F. M. Dairy-Cum-Bull Farm Vizakapatnam
,, Rajeswara Rao, R.	A. A. D. Parvathipuram	Spl. A. D., E. Godavary
,, Ramachandra Rao, M.	P. P. A. Ent. Anakapalle	Do. Do.
,, Ramalingam G.	Asst. Fertilizer Inspector Guntur	Do. Krishna Dt.
,, Rama Rao, P. V.	A. D. Hosur	Do. Guntur
,, Ramachandran, L.	A. A. D. Tenkasi	A. D. Alur
,, Ranganathan P. S.	Millet Asst. Ariyalur	Millet Asst. Coimbatore
,, Raghavelu, G. V.	Marketing Asst., Hyderabad	P. A. to D. A. O., Anakapalle
,, Ramanuja Neyalu, S.	Do. Do.	P. P. Asst. Anakapalle
,, Ramaswamy, N.	F. M. Hosur	A. D. Hosur
,, Rebello, N. S. P.	Paddy Asst. Mangalore	Tuber Crop Scheme, Mangalore
,, Shanmugam, M.	Asst. A. D. Tiruvellore	A. D. Madurantakam
,, Sitapathi Rao, S.	F. M. Coimbatore	Spl. A. D., E. Godavari
,, Suryanarayana-murthy Ch.	A. A. D. Rasipuram	Do. Do.
,, Srinivasa Rao, P.	A. D. Harur	Spl. A. D., W. Godavari
,, Sri Ramamurthy, G.	Ent. Asst. Coimbatore	Do. Do.
,, Sri Rama Rao	Field Asst. Nannilam	Do. Krishna Dt.
,, Subramaniam, K.	Pulses Asst. Coimbatore	Do. Do.
,, Suryanarayana Sarma, D.	Ent. Asst. Coimbatore	Spl. A. D. Guntur
,, Sheenppa, K.	Spl. A. D. Sugarcane Mangalore	Mycology Asst. Vittal
,, Subramaniam, A.	Asst. Millet Specialist Namdiyal	Asst. in Millets, Ariyalur
,, Suryanarayana-murthy, M.	Marketing Asst. Hyderabad	Marketing Asst. Cuddapah
,, Sankaraya, M.	A. D. Dindigal	A. A. D. Tenkasi
,, Sankara Narayanan, C. S.	F. M. Coimbatore	Agrl. Instructor, Palamkotta
,, Satyanarayana, G.	Seed Dev. Asst. Chittor	P. A. to D. A. O. Chittor
,, Venkateswara Rao, P.	A. A. D. Erode	Spl. A. D. Krishna Dt.

Name	From	To
Sri Venkateswara Rao, A.	Cotton Asst. Coimbatore	Do. Do.
,, Venkiah, K.	Marketing Asst. Hydrabad	P. A. to D. A. O., Anantapur
,, Vinayagam, S.	A. D. Chengam	A. D. Harur
,, Venkataswamy, S.	A. D. Aruppukottai	A. A. D. Erode
,, Venkatachalam, K.	A. D. Rajahmundry	A. D. Kovvur
,, Umamaheswara Rao, P.	A. A. D. Elluru	Spl. A. D., W. Godavari

GAZETTED SERVICE

Transfers and Postings

Name	From	To
Sri Chidambaram, G. K.	Fertilising Inspector, Madras	Asst. Agrl. Chemist Coimbatore
,, Devasigamany, T.	P. A. to D. A. O., Anantapur	Spl. D. A. O. Crop Sampling Bellary
,, Jaganadha Rao, V. V.	P. A. to D. A. O., Anakapalle	Addl. D. A. O., Kakinada
,, Md. Zainullabuddin	F. M. Arakuvalley	Do. Vijayawada
,, Mirza Anser Baig	D. A. O. Anantapur	Dy. D. A. Cuddapah
,, Rama Reddy, M.	P. A. to D. A. O., Cuddapah	Addl. D. A. O. Guntur
,, Ragunatha Reddy, K.	Secretary, Market Committee, Vijayanadu	D. A. O.
,, Somajayulu, P.	D. A. O. Nellore	Addl. A. D. O. Elluru
,, Sahadevan, P. C.	Senior Asst. in Paddy Taliparamba	Full Additional Charge of Peper Specialist Taliparamba