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Editorial.

Arboriculture. Sylviculture is a well-known art and so is Horticulture. Between the two is Arboriculture, so important and so very little practised. In many of the United States, a day, usually a school holiday, is yearly set apart for the general planting of trees by school children. In Canada, the first Friday in May is set apart for this purpose. A similar arbor-day is called for in our own country.

Cattle manure has been proved to be of the greatest importance to Indian agriculture. This manure is now used in large quantities as dung cakes for fuel. This waste of manure should be prevented. The problem is not easy. The village needs firewood, and timber preserves should therefore be nursed round every village if cowdung has to be saved. There are vast areas of cultivable waste which remain so owing to difficulties in their being brought under crop or fruit cultivation. If a scheme of tree planting is instituted these lands round villages will tend to be well wooded in course of time and prove a blessing in many ways both to man and beast. The forest department will be wary of entering into grazing areas near villages and the problem of planting these up should be tackled locally. A planned planting by village school children will ensure its continuance and care against destruction and decadence.

Road transport is likely to figure in increasing prominance in the coming years. In the recent Road-Rail Conference, the clash of interests

between the central and local governments was evident. In the matter of vehicular tax a similar clash of interests between the local government and local boards has existed and is sought to be remedied by the reimposition of tolls on vehicles other than motor. The grip of local bodies over roads is thus tightening. Times were, when in the days of Lord Curzon he found it necessary to issue his famous despatch on Arboriculture. The ancient roads with their hoary avenue trees excited his innate imagination, and the decadence of the endeavour of his days in this direction stimulated his interest, and he impressed on all local governments the need for the systematic maintainance of road avenues. Years have gone by and decentralisation has rapidly taken place. To any one who is touring over the country it is becoming increasingly evident that the activity in this direction is becoming slack if not altogether stopping. Even the few trees by the road side, remnants of an older zeal, are miserably mangled. Public opinion is not strong enough to check the vandalism that continuously and quietly goes on over practically all the roads. The banyan benevolently opening out its tender buds and spreading out its green foliage, is the butt of goat feeders and leaf-plate manufacturers. On many festive days the neem is ruthlessly defoliated. It is a pitiable sight to see bullocks and pedestrians trudging along a shadeless road. The timber needs of the country side have stimulated daring larceny among the avenue branches. In certain areas the cheap quickness of growth has resulted in the planting of rapid growing trees, many of which have succumbed to the recent cyclone, or show signs of physiological drought. The scarcity of green leaf often leads to the defoliation of many trees by the road side for green manure. The only noticeable exception has been the tamarind which has not much leaf to spare. Moreover, its fruit is a source of revenue and is auctioned off like those of the mango and gets in the bidder an interested caretaker.

It behoves local bodies who are the custodians of the opening up and maintenance of rural communications that they should hand in hand with the laying down of such communications plant, rear up and maintain suitable avenues, so that both man and beast may have some shelter. It is a common and pitiful sight to see a couple of cows competing for the scant shade of an odd and mangled tree by the way side. It is very well to get offers of financial help and consider whether such help is to be utilised to extend the length of road or increase its surface convenience, but it is the paramount duty of all interested in rural welfare, that the raising and maintenance of avenues should be made a *sine quo non* of all road grants and road activities. We suggest that effective steps be taken to stop the ruthless destruction that is now going on and that a constructive endeavour similar to that initiated by Lord Curzon will be forthcoming without delay. The awakening rural consciousness demands this.

A conjoint endeavour by all rural reconstruction centres in initiating an Arbor-Day is indicated and we trust that a move will begin in the most pioneering centre.

Rice Imports. Rice is the most important cereal in India and in Madras its position is paramount. The economic depression and the consequent fall in price and slump in trade has caused an alarm of the first magnitude among the rice cultivators of this Presidency. This became chronic when recently there were imports of rice from Siam adding to the difficulties of the situation. Every cloud has a silver lining and thanks to this depth of probing into our economic situation, we have been made alive to the ignorance of our rice economies with the resultant appointment of Mr. C. R. Srinivasan, Superintendent of the Paddy Station, Maruteru, as a special officer to make a study of the rice trade in Madras. He will examine the conditions of the marketing of rice and make recommendations to Government, with reference to the following points:— (1) The production in each district, its requirements, how surplus, if any, is disposed off, and how deficit is made up. (2) the quantity transported internally, the means and the cost of such transport; (3) the relative selling price of local and imported rice and paddy; (4) the nature of treatment given to paddy (i. e., whether it is marketed as paddy or raw rice or part-boiled rice) at the places where surplus is available, the agency and methods employed for such treatment and the cost thereof; (5) the difference in quality of a particular type or types of paddy grown in different districts and whether it affects the price and to what extent; and (6) the agency existing and necessary for improving the internal trade as well as to maintain and expand the outside markets. The above is a string of vital points on which any well organised economic intelligence could lay its finger. We have never been sound or alert at this intelligence, a point which that well-wisher of Indian finance, Sir George Schuster, has recently made a point of stressing.

It is urged in mitigation of these imports that the quantity is insignificant and that the imported broken rice is cheap and caters to the needs of the poor labouring classes. In times of depression when prices of food stuffs are low any the least disturbance from outside sets on a nervousness that demoralises the trade beyond all proportion to its real magnitude. To urge imports in favour of the poor labourer is fallacious in as much as there is a wealth of cheap alternative cereals like millets which are the mainstay of the workman.

Another difficulty in the situation is the delicacy incidental to the dealing with foreign states like Siam and Indo-china. There are currents and cross currents both in business and in politics and the recent successful negotiations with powerful Japan show that where there is strength, weakness is also innate and the extent to which we balance

both is the measure of relief obtained. Our strong position with reference to opium and gunnies give us a lever with which to lift this passing trouble with Rice.

We trust that this beginning made with the appointment of an officer for the Rice trade though born of a specific distress, will lead to the early maturing of a comprehensive scheme of economic enquiry.

Directorship of Agriculture, Mysore. With the retirement of Dr. L. C. Coleman, M.A , l h. D., C. l. E. on the 22nd of March last, the Mysore Department of Agriculture, have lost a very valuable officer, and a personality who not only by his administrative capacity, but by his high scientific attainments, made a reputation for himself in the field of scientific workers engaged in Agricultural Research in this country and elsewhere. We wish him in his retirement, sound health and many more years of devotion to scientific pursuits.

To his successor in office Mr. A. K. Yegnanarayana Iyer, M. A., Dip. Agri., we offer our felicitations. A distinguished graduate of the Madras University, Mr. Iyer has had the experience of foreign travel and training, and besides being a chemist, is a reputed authority on Dairying and Economics. He is one of those, who have been taking interest in our Journal and readers will recall his valuable paper on "A century and a quarter of Mysore Agriculture—A retrospect" which he read before the College Day and Conference in 1926. We offer him our best wishes.

A RESUME OF THE INVESTIGATIONS INTO THE SECOND CROP PROBLEM OF THE GODAVARY DELTA*

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Introduction. The Godavary irrigation system comprises the delta portions of the two revenue districts of the East and West Godavary and it supplies water annually for raising two crops of paddy. In most of the irrigation projects of the southern Presidency, a short first crop is closely followed by a long duration second crop; while in the Godavary delta a long duration variety is cultivated between June to November and is followed after an interval of two months by a short duration second crop of *Dalva* (as it is locally known) between February and May. Due to the insufficiency of water supply in the river, between the months of February and April, the area allowed for the *dalva* cultivation is about 28 per cent. of the first

* Paper read at the 22nd Agricultural College Day and Conference, October 1933.

crop and on the whole comes to about 200,000 of acres, of which the Western Delta alone contributes 125,000 acres.

2. Development of second crop paddy cultivation. *Dalva* cultivation has been in vogue in the district confined to the margin of the Collair lake long before the canal system came into existence in the delta, and was introduced into the delta tract about fifty years ago. As a result of the experience gained by the cultivators from year to year in the early days, the ideal planting season for a good *dalva* crop got fixed to the period between *Bhisma Ekadasi* or as is locally known as *Antervedi Ekadasi* and *Mahasivaratri* corresponding to the second and third weeks of February. A glance at Fig. I. would indicate that this period marks a definite beginning for a favourable change in the weather conditions. Also this period is conspicuous by the steady setting in of the beneficial *pyru gali* (Corn-wind). The crops planted before this crucial stage in the weather conditions either wholly or partly succumb to pests and diseases or at best re ult in an uneven and poor harvest. By the adoption of late planting in the early days, when dearth for water was unknown due to the comparatively smaller extent under cultivation, bumper harvests were being obtained. Consequently, the area cultivated under the second crop went on steadily increasing to the extent that it passed beyond the safe limits of the average supply in the canal. The great war of 1914–18 and the high price period thereafter, gave a further impetus to the extension of the second crop area in the delta. Naturally, in recent years especially under high level canals and channels, regular and adequate water supply for the crop has begun to be keenly felt.

In the early years when the system was just introduced certain amount of persuasion was said to be necessary on the part of the Government to induce the ryots to take up second crop cultivation. Water was allowed to ryots who preferre l applications for cultivating in the second crop season each year before November. After some time even this restriction was withdrawn. In course of time indiscriminate cultivation ensued under the same ayacut some cultivating and some not cultivating. Consequent on this practice, fallow fields in the midst of cultivated areas were affected by the seepage water subjecting them to the ill-effects of wetting and drying, thereby leading to the accumulations of salts on the surface, more especially in saline blocks. Added to the complications of this nature, the area under the second crop was apprehended to be going beyond the commandable limits of the canal supply. To meet the situation a systematic method of allowing second crop was therefore deemed necessary. The Revenue and Public Works Departmental authorities of the district with their executive staff used to sit in conference once a year to decide the channels or portions of channels that should be opened for the next second crop, taking into consideration the legitimate claims

and appeals of representative ryots of the different tracts. Areas where first crop failed either on account of submersion or other reasons and where the first crop is impossible to be grown are always given preference. Such type of lands constitute fairly a large area in the western delta. The unceasing desire on the part of the ryot to grow a second crop, created by the prospect of a double harvest in a year, especially in the post-war period, coupled probably by a few consecutive year of abundant supply in the river, have again jointly and severally contributed to the rise of the second crop area from 66,500 acres in 1900 to 233,000 acres in 1923. In the natural course of events it is no easy task to bring down the area, that once gradually rose, without seriously affecting the economic condition of the district. But Government, however, have a few years back formulated measures to put a check in its further growth through a scheme of localising the second crop area which will be referred to later.

3. Advantages of Second-crop cultivation. Opinion as to whether the second crop cultivation has been advantageous or not is divided. Considering the pros and cons of the question broadly, the majority of ryots seem to feel that the *dalva* cultivation has done comparatively more good than harm to the delta as a whole. At the same time, it must also be admitted that certain inevitable defects are bound to arise in the double crop system of cultivation. It will be presently explained how these disadvantages have been and are being overcome gradually by experience.

It is stated on enquiry that the second crop system has undoubtedly contributed to increased yield in the main crop of the higher delta indirectly by setting up a general awakening in the matter of manuring and secondly by checking the rank growth, the first crop is liable to, when only one crop was grown year after year. Further, the second crop cultivation once in two or three years is said to counteract the *Gulla* or the looseness of the soil in certain areas brought about by either mere single cropping alternated with a long period of fallow or by garden cultivation.

(i). *Increase in cultivable area*: Again, the second crop system is really a blessing to the coastal *parra* or saline lands. But for the development of the second crop system in the delta, the cultivable area in the coastal taluks would not have increased to that extent it had during the last thirty years. It was mainly responsible for an increase in the cultivable area by about 120,000 acres in the western delta alone, during the last resettlement period. In the case of submergible lands and areas where first crop is impossible to attempt, this cultivation offers a chance to raise annually a paddy crop.

(ii). *Increase in fodder supply*: Further the second crop comes always handy to make up the fodder shortage of the cultivators, more especially those of the Eastern and Central deltas, due to the large

areas of cane crop and coconut gardens respectively, the cultivation of which necessitates the maintenance of a greater number of cattle pairs per unit area than for mere paddy cultivation.

(iii). *Increase of leases*: It is only after the introduction of the second crop cultivation that the general level of lease for the better class of wet lands is said to have risen from 6—8 bags to 10—13 bags. This high level lease is being paid by the tenants to the land-lords in the hope of getting a second crop once in two or three years. The general yield of 5 to 8 bags that most of the *parra* lands were yielding is also said to have gradually increased to a level of 10—15 bags, as a direct result of taking to *dalva* cultivation.

In the years of plentiful water supply and favourable season, an average yield of 10—12 bags in the second crop in average soils, and 15—20 bags in rich areas growing sunhemp, is usually obtained. Tenant cultivators who are on the increase get very little left (except straw) after delivering the stipulated lease amounts to the land lords and defraying cultivation expenses of the first crop. They naturally look forward eagerly to the second crop which in most cases go wholly to their share. To maintain a high level of lease the landlord is also interested to see that his lands get the second crop turn. It is therefore clear that the *dalva* cultivation was not only directly responsible for the large increase of cultivable area in the deltas but also for bettering the yields of both the higher and lower delta lands though for different reasons. As said before, if the newly reclaimed saline *parra* lands which form the bulk of the area in the coastal taluks are to be improved and maintained in good heart, they have necessarily to be cultivated in the *dalva* season at frequent intervals. Further, in the days of high price for paddy a good portion of the high level lands which was once fit for garden cultivation has been unfortunately lowered to command water supply for the second crop at high costs. As such they have now become unfit for any other cultivation than paddy in the second crop season.

4. Disadvantages of Second crop cultivation. So far we have dealt with the brighter side of the second-crop cultivation and now proceed to consider the two main objections for its continuance, viz., loss due to increase in pests and diseases and deterioration in the fertility of the land. These should always be expected in any system of double crop cultivation. Considering the amount of good that the development of the *dalva* cultivation has brought on, these inevitable defects are not of such magnitude as to decry the system altogether. We think they are within the control of the cultivators themselves to a great extent.

(a) *Pests*— The only pest of importance that the second crop may be said to aid multiplication is the Paddy Stem-borer (*Schoenobius*

incertellus). Statistical data collected by the Government Entomologist in a number of typical centres in the two deltas of the Kistna and the Godavary where single and double crops are cultivated show that the percentage of attack as indicated by the production of white ears (chaffy) varies between 1·71 to 4·37 per cent in a double crop area as compared to 0·2 to 0·58 per cent in a single crop area. This small difference in the percentages is not so alarming as is supposed to be. Study on the incidence of stem-borer carried on at the Agricultural Research Station, Maruteru, for a number of years shows that its effect on the paddy crops in the delta is largely manifested from the end of October to early February. Consequently, the first crop in ears and the second-crop seedbeds and very early planted *dalva* crops are subject to the attack of this pest.

(i) *Effect of stem-borer attack in the first crop season*—In the first crop season the loss is due to earheads turning chaffy or (what is called white ears) if the flowering time of the variety synchronises with the emergence of the borer, while in the *dalva* season the seedbeds and very early transplantations suffer from casualities very often resulting in shortage of seedlings or necessitating a second planting. It will however be interesting to know, how shrewd the delta cultivators by experience have been and are trying to reduce these losses caused by this pest. With the development of the second crop system, some of the late varieties like *Pedda Konamani*, *Gammasari*, *Prayaga* and *Pedda Atragada* that were then extensively grown in the main crop were found to be badly infested with this pest. These have gradually given place to varieties of medium duration such as *Basangi*, *Rasangi*, *Punasa Konamani*, *Akkullu*, *Pala Gummisari* and *Krishnakatukulu* so that the flowering of the crop may just escape the critical period of high infestation. Observations on the appearance of white ears in the first crop season for the last 5 or 6 years at the Research Station show that short duration varieties that flower in August or early September are practically free from the attack. Very stray patches of attack are noticed in varieties that flower about the end of September or early October. With every week thereafter, the percentage of attack becomes more pronounced. A variety susceptible to an attack of 3·13 per cent when flowering on the 29th October showed as high as 26 per cent when it flowered on 12th November. Fig. II representing the emergence of stem-borer moths for a period of one year explains the above phenomena. It is seen that high periodic broods commence to emerge from the very end of October and continue till the end of January or early February.

(ii). *Effect of stem-borer in the second crop season*: To counteract the loss of seedlings in the second crop nursery ryots generally sow more than their usual requirements, as then, the area of nursery to be prepared is not a limiting factor; while to get over the heavy casualities

in the transplants they definitely delay planting till the setting in of steady *Pyru-gali* or corn-wind. It has been found by experience that this delayed planting is practically free from the pest. It is also interesting to note that the reasons for a sharp decline and a sudden disappearance of the pest from the middle of February seem to be mostly biological in nature. Egg masses of the pest collected in the month of January under normal conditions hatched out catterpillers, while later collections gradually showed a mixed population of catterpillars and minute Hymenoptrous insects, the proportion of the latter to the former increasing with the advance of the season. Two kinds of insects (*Tetrastichus* and *Trichogramma*) are usually obtained from the collections. The grubs of these wasps are the natural parasites living on the stem-borer egg-masses and the weather conditions alluded to above are perhaps ideal for their rapid multiplication, thereby keeping the pest under control for the time being. It will therefore be seen that the ryots have been admirably adjusting their cultural practices to the altered conditions brought about by the two crop system to dodge the pest by gradually taking to *Punasa* types for the first crop season, and delaying the second crop planting till the pests are biologically brought under control by changed weather conditions.

(b). *Deterioration in soil fertility and increase in alkalinity*: It is admitted on all hands that deterioration in the fertility of the soil is bound to take place in any system of continuous cropping, season after season, with the same crop, without paying adequate regard to manuring, rotation and occasional rest or fallow.

It will be presently seen that the conditions under which the second crop cultivation in the Godavary delta is carried on are such that should not normally prove harmful to the land. The proportion of the area that is cultivated during the second crop season is hardly a third of the area in the main crop and as such only a particular area will get a chance for the second crop cultivation once in three years. This kind of taking an occasional second crop, should, I think, not deplete the soils of their fertility to the extent apprehended by some. In fact, it will give the necessary tone to the texture and structure of the soil for paddy cultivation. Secondly, as pointed out at the outset, the first and the second crops do not closely follow each other in quick succession as in some of the other projects. There is always a fair interval of six to eight weeks between the first and second crop or vice versa. The intense heat of the Circars between 2nd and 1st crops is enough to act beneficially for the following first crop, while the period between 1st and 2nd crop conveniently allows in most of the areas, the taking of a leguminous crop either for manure or for fodder. As a rule, ryots who grow sunhemp after the first crop, turn it down wholly or partly for manuring their second crop. In the case of areas that cannot support a sunhemp crop, *Patti-mannu* or cattle-manure

specially accumulated for the second crop seasons is very largely made use of. Appallingly large and deep excavations of *Patti*-earth deposits in most of the delta villages are in themselves a striking proof of how the ryots have been alert to maintain and increase the fertility of their lands. It has now been definitely ascertained that the interval between the second and the first crop is eminently suited for growing daincha by intersowing before the final draining of the *dalva* crop. A growth of six weeks should be enough to give at least three to four thousand pounds of green matter for incorporation into the soil for the following first crop. This is one of the chief items of Departmental propaganda in the delta. However, it must be stated that the progress in this line is not as much as one should expect due to the frequent set back it receives on account of shortage in water supply to the second crop especially at the end of the season. It is thus evident that under the present system of the *dalva* cultivation in the delta, facilities do exist for maintaining the fertility of the land by way of manuring and rotation with a leguminous crop after a cereal. At the Maruter Agricultural Research Station, two sets of four plots each, are being cultivated with two crops of paddy under manured and unmanured conditions and a review of the yields for three consecutive years represented in Fig. III will show that the yields are being maintained at the optimum level when proper care is taken to supply manure for both the crops. In the case of the unmanured plots, as one should expect, the return in the second crop is poor.

It may then be questioned why then there is still an apprehension in the minds of some people that the second crop system brings about deterioration in the fertility of the land, and increases alkalinity. With the increasing area on the one hand and the anxiety to get a better return by late planting, the second crop could not get an adequate supply of water in the months of March and April especially when the supply in the river was low. Saline soils if subjected to such alternate wetting and drying, would necessarily give rise to an accumulation of salts at the surface of the soil, detrimental to the next crop. Secondly the inadequate water supply at the end of the season does not allow a chance to sow a green manure crop. If in order to get over the shortage of water supply early planting is attempted as in the central delta, the yields get considerably reduced. When the cultivation is carried on under such adverse conditions it cannot but be unremunerative. All the same it cannot be admitted that the dalva system is directly responsible for the adverse effects on the land and yield; only the system as adopted should be responsible, and needs mending.

Having so far reviewed the different aspects of the second crop system in the Godavary delta at some length, the problem arising out of the present mode of cultivation will next be discussed.

5. The problem of second-crop cultivation. The cultivation of second crop under the conditions now obtained in the delta suffers from a number of disabilities. Attempts at early planting expose the crops to severe borer attack. The survivals take a long time to establish themselves and do not bush out till the weather conditions change for the better. Very often replanting may be necessary or at best may give a very uneven and poor harvest. The crops then are in fact under the mercy of a very fickle season. Seasonal plantings carried on at the Maruter Agricultural Research Station in the beginning of the investigations on the problem strongly confirm the ryots' belief that it is better not to cultivate a *dalva* crop than to attempt at early planting. Marked differences could very easily be observed between the early planted and the late planted crops and the yield figures in Table 1 will bear testimony to this fact.

On the other hand late plantings give a good harvest if water supply is assured. But it is often the experience that most of the areas are said to meet with shortage of water supply at the critical stage of the crop's growth. Sometimes the flowering period may also synchronise with the dry hot westerly winds of Circars if they set in early in the season. Indifferent water supply as pointed out earlier in the paper may contribute to increase the salanity of the soil which in turn adversely affects the following first crop besides a reduction in the second crop yields.

Regular sowings for the second crop do not commence till Christmas or first week of January except in the central delta where ryots are compelled to do so out of necessity as the main canal closes a fortnight earlier there than in the western delta. Planting in its turn could only start briskly from the first or second week of February. Comparitively late planting is still persisted in the higher delta, and that rightly, for three obvious agriculturally sound reasons, viz. (1) the beneficial "corn-wind" that keeps down the stem-borer pest under check, does not steady itself till the beginning of February; (2) the intersown sunhemp crops grown for either fodder or for green manure do not bloom earlier than end of January or early February, and (3) it allows a fair period of interval between the two crops of paddy. Crops planted as late as second and third weeks of February do require water till the end of April. But the supply under Public Works Department regulations, is cut off for *dalva* crop by the 14th of April, in order to fill up village and seed-bed tanks and to irrigate garden crops to tide over the closure month of May. It is in April that the whole trouble is acute as then the demand for water supply is made for a number of purposes, when the supply in the river also runs short and low.

On the other hand the P. W. D. authorities find plenty of supply in the months of December to February and would welcome the

commencement of the second crop cultivation immediately the first crop is over. But Nature is against such a pious wish. Considerable experimental work on the intersown cropping was carried out at the Agricultural Research Station, Samalkot, for a number of years. It was finally concluded that a paddy crop could not be successfully grown in the months of November to January. The problem therefore resolves itself into an attempt at an early harvest, say, by at least a fortnight without prejudice to the stand and yield of the crop at the same time relieving the strain on the canal supply for a free and full distribution to the various other requirements mentioned above, in addition to the further extension of fodder and green manure cultivation during the later part of April.

6. **Regulation of the area as a partial solution of the problem.** The shortage of the water supply for the second crop would become a permanent feature in the delta if the area under the *dalva* crop is to go on increasing without limit. The Government perceiving this aspect of the question in 1928 formulated definite proposals for localising the second crop area in two main zones in the western division which commands the largest area under the Godavary Irrigation System as detailed hereunder.

i. *Excluded zone*—This constitutes areas permanently excluded for second crop cultivation. They are mostly high level lands difficult to command irrigation under low water conditions.

ii. *Rotation zone*—Areas that should get the turn once in three years.

iii. *Permanent zone*—Areas that are allowed second crop cultivation every year. They are mostly either liable to submersion or those that are not fit for cultivation in the first crop season.

This scheme has been under operation for the past three seasons and has gone far to make up for the disabilities on that account. It now remains for the cultivators also to co-operate in the matter and find ways and means to appreciably hasten their harvest as not to interfere with the supply for other more needy purposes and at the same time ensure a normal average crop for themselves. It is in this matter Agricultural Research should come in to help the cultivator.

7. **Lines of work pursued at the Maruter Agricultural Research Station.** Soon after the opening of the Maruter Agricultural Research Station in 1915, the study of this important problem was taken up for investigation through breeding, culture and manuring.

(a) *Breeding—pure line selection*—It is said that *Nallarlu* was the popular variety in early years when the system was newly introduced in the delta. The increase in area in the two previous decades, which in its train caused crop failures on account of early planting to get

over the inadequate water supply, forced the ryots to look for another variety that could stand comparatively early planting. A variety known as *garikisannavari* found its way into the delta and soon replaced *Nallarlu* throughout the tract except for stray areas in the margins of Collair lake and eastern delta. The local *Garikisannavari* seed is however found to be a bad shedder with very prolonged flowering ranging up to a fortnight. This is a great draw-back in a short duration variety and much more so in one liable to shedding. The early flowering populations would be ripe when the lates are still green. It would keep the ryot undecided about the time for draining the plot for harvest. In order to improve the yield and at the same time bring down the range of flowering to a minimum limit, a number of pure line selections ranging in duration from very early to late were made and studied batch after batch. Along with the yield trials, seasonal trials of the strains were also conducted Very early maturing strains and introduced short duration varieties like Adt. 3, Adt. 4, *Chitrakali* and *Swarnavari* were at their best only when sown and planted later than *Garikisannavari*. Therefore their trial was out of the question for achieving the purpose of an early harvest. Yield trials of strains for five years have resulted in the isolation of a strain, No. 925, which combines better yield and earliness by a week over the local seed. It is in great appreciation even in the trial stage in the district.

(b) *Modifications in cultural practices.*—Periodical plantings conducted altering the rate of sowing, age of seedlings, the method of raising seed bed and spacing in planting gave some valuable information regarding their effect on the flowering of the crop. Planting seedlings from a thin sown nursery, sown at a third of the ryots' rate, was found to hasten the flowering of the crop by about 3 days. As the age of the seedlings sown under swamp conditions increased, the flowering also hastened, but of course, at the expense of yield. However, when the nursery was raised under semi-wet conditions, the stand and yield of the crop were good, with a delay in the flowering. At this stage of these seasonal and cultural trials in 1931, an interesting piece of observation threw further light on the use of aged seedlings, grown under quite adverse conditions.

In the first crop season, a small plot of this variety could not be harvested in time in October due to continuous rains. By then, the crop lodged and its grains germinated on the ears. It was drained late in November for the harvest of the other lots in the plot. Volunteer seedlings appeared as a regular seedbed and were then about nine inches in height. By the end of December, the plot cracked well and the seedlings presented a dried up yellow appearance as though quite unfit for use. On closer examination, however, it was found that within the dried up afle sheaths the seedlings were found to be green. It

was therefore considered desirable to observe the seedlings after planting. Accordingly the seedlings which were then probably over 70 days old, were planted in portion of the nursery area. In spite of such an early planting, as 12th January, and agedness and poor quality of the seedlings, their establishment was remarkable and further growth was quite normal. In the two previous seasons, seedlings that grew under normal conditions when planted at the same time, failed miserably. The crop flowered by the middle of March about a month in advance of the regular delta crop and the final stand also was not below average. From this observation it became evident that seedlings sown in advance and reared under restricted water supply seem to stand the adverse weather conditions and pests better than normal healthy seedlings. Encouraged by this interesting piece of observation, extended trials in the use of seedlings reared semi-dry were conducted in the 1932 season to find the limits of sowing and planting time that would help us to achieve the desired earliness in harvest and at the same time fit in with the existing agricultural practices of the tract without much prejudice to yield. Details of the sowing, planting and flowering data confirm the previous observations made on the crop reared with the volunteer seedlings that such seedlings resist the adverse weather conditions and pests much better than well grown succulent seedlings reared under swamp conditions and also give the expected earliness. Sowings however have to be done quite early to give the seedlings the required hardiness and protective appearance. As the stand of such early planted *dalva* crops depends much upon how the seedbeds are raised and reared, elaboration of this method to suit the season will be pertinent at this stage.

As usual, sprouted seeds are sown in a well puddled and manured nursery. It is reared just like any other normal seedbed up to the time of giving the sprout irrigation, the plot being kept moist up to a period of three or four weeks when enough growth for convenience in pulling (say 9—12 inches) is obtained. Thereafter water supply is cut off completely and the seed beds are allowed to crack to that extent that the seedlings present an yellowish parched up appearance. The chief advantages of drying the nursery in this manner are the seedlings by turning yellow do not seem to attract the moths in such proportion as in a swamp nursery. Casual observations of the egg-mass collections from a dry reared seedbed reveal the preponderance of parasitic wasps. The adverse effects of elongated internodes, that are normally formed when seedlings are not planted in time from a wet seedbed do not manifest themselves under this treatment. On the other hand the nodes get congested. These congested nodes help in the quick rooting and tiller formation soon after planting; and lastly seedlings that are brought up under such adverse weather conditions, when planted in a well prepared puddle strike roots with such rapidity that the crop gets established in a comparatively short time; and even

if the main shoot should be attacked by the borer after planting, secondary shoots are ready to be put forth and thus the heavy casualties that are commonly experienced in early planting of seedlings from a swamp nursery, are considerably minimised.

In the delta soils, pulling seedlings in this type of seedbed is easily and efficiently done without letting in water. The seedlings are better kept over-night in mire for the next day's planting. If in any case, it is apprehended that seedlings are liable to be broken by dry pulling, water may as usual be allowed into the bed before pulling. But it would be necessary to finish the pulling of the whole plot that was so wetted, in a day or two; otherwise the delay would increase the pulling cost, as an irrigation given to the over-dried nursery would induce the seedlings to root quick and deep.

At this juncture, a note of warning is required to a phenomenon that may be observed in planting overaged dry-reared seedlings. Occasionally, a few days after planting, the main shoot may sometimes begin to throw out dwarf ears especially in short-duration varieties. This habit need not be worried about. Vigorous secondary shoots from the congested nodes appear very soon and make up a good stand with a well-covered crop. This method of raising seedbeds is invaluable to tracts where planting time is somewhat indefinite. The common saying that seedlings should be kept in the nursery for as many weeks as the number of months for the duration of the variety would hold good only when the nursery is raised under normal swamp conditions. It can very well be transgressed with suitable modifications when local or seasonal conditions warrant a departure from the normal procedure.

In the second year (1933 season) these trials were, in addition to the repetition of the programme of 1932, extended to bulk scale and regular yield trials with very satisfactory results. The results confirmed the first year's trial and the following tentative conclusions could also be arrived at.

(i) Permanent *dalva* areas that are not cultivated in the first crop season or areas where the first crop is damaged by submersion, can be planted in the first or second week of January with seedlings sown in November and treated above. Irrigation may be cut off by the end of March.

(ii) Areas that are cultivated in the first crop season, but kept under *muraga-thammu* (continuous puddle) require a short period of rest before planting the second crop. They are fit for planting only after *Pongal* in the second week of January. Sowing for these areas should be done by about the end of November or early December.

The harvest would take place in the second week of April and water may be cut off by the first week of April.

(iii). Areas that usually grow catch crops of sunhemp may wait till the end of January or first week of February for sunhemp to grow well and planting begun in the first or second week of February, provided the seed beds are sown early in December and kept in a dormant condition till planting. The crop may come for harvest by the third week of April and the irrigation for these areas may be cut off by the second week of April. Comparative yield data of a crop planted by the new method with that of the normal practice are presented in Table 2.

(c). *Manuring*—In agricultural practice, the output of any crop is invariably sought to be increased by means of manuring. However, it is not uncommon to hear of disappointments in taking to a particular manurial practice due to the yields having fallen short of expectations. Ascertained increases in yield due to a particular manurial treatment for a crop in one place cannot always be expected in another place. Manuring has therefore to be regulated to the nature of the soil, season, crop and varieties.

It is common experience that response to manuring is better perceived in soils of low fertility than otherwise and will therefore pay to manure soils of low fertility. The effect of a manurial treatment in the first crop season in the Godavary delta is invariably masked in a favourable season, say, rainless summer followed by early freshes in the canal with periodic wet weather in the growing period of the crop. In soils of average fertility an unmanured plot gives then almost as much as a manured plot, and the slight differences that exist will be but negligible. In such good seasons it is more likely that manuring will affect the crop adversely due to the rank growth it may cause. Crops highly manured require topping as otherwise they prelodge if left to themselves, with consequent reduction in yield and quality of the produce. It is in years of unfavourable weather and late planted conditions that the effect of manure is seen in the first crop season in the delta. Again, the effect of manure under similar conditions is bound to vary with the varieties of the same crop of differnt durations. It is a matter of common experience in the delta that short duration varieties in the first crop season respond to manuring or to the inherently high fertility in a soil better than a long duration variety. The yields of *Basangi*, a 5 months variety, have been ranging between 3,500 to 4,500 lbs., while that of late varieties as *Kristnakatukulu*, *Atragada* and G.E.B. 24 of 6 to 6½ months' duration varied between 2,800 to 3,500 lbs. per acre. It is for this purpose that ryots prefer to cultivate *Basangi or Rasangi* in both the rich and early planted areas. Seasonal factor thus plays a very prominent part in determining the yield of the first crop of the Godavary delta much more than manuring.

In the second crop season the story is entirely different. All the three factors favourable for the manure to play its part namely, the shortness of the duration of the variety cultivated in the second crop season, the absence of favourable seasonal influence and the exhausted condition of the soil after the removal of the first crop paddy, exist. A review of the two years' yield data presented in Table 3 for both the crops strongly point out the very good effect of manuring directly for the second crop. In this connection attention is drawn to Fig. III registering the striking differences in the bulk yields of manured and unmanured plots in the second crop season compared to the first crop. In further corroboration of the big differences that are obtained by manuring the second crop, the two-year results of a preliminary manurial experiment with green-manure and ammonium sulphate are set out in Table 4.

It should therefore be our effort to recommend to the delta cultivators to conserve their manurial resources for the second crop or short-duration varieties and late planted crops in the first crop season to obtain the maximum return for their use. In the higher delta and in the better class of lands in the lower delta, sunhemp is grown between the first crop and the second crop season for fodder purposes. Careful ryots who have realised the advantages of manuring their *dalva*, turn under this catch crop wholly or partly and they are sometimes said to obtain better yields than in the first crop season.

It would be really valuable to the delta ryots who annually cultivate nearly 200,000 acres in the second crop season to know which of the large group of manures that are now available in the market is going to give them a maximum profit with the minimum outlay. The necessity for starting a comprehensive manurial scheme in the second crop season is apparent and proposals for the same were put up and the continuance of the "Subsidized Manurial Trials" for another three years is very desirable.

(d). *Seed preservation*: So far improvements in the cultural and manurial aspects of the second crop cultivation have been detailed and the problem connected with its seed preservation and supply will be hereafter considered. The seed of the second crop harvested in May is not kept over for the next second crop sowing. An intermediate seed crop is as a rule raised in the first crop (June—October). This seed crop invariably suffers from a wet harvest. On this account it is not every body that ventures on taking a seed crop and even if one does, he cannot command the harvest of large areas in the monsoon months. It is therefore confined to those favoured few who have facilities for harvesting and threshing the crop in the short spells of clear weather. The area grown being thus limited and the demand being large, the price of *Garikisannavari* seed harvested in October goes up to 5 or 6

rupees per bag when ordinary paddy is being sold between 2½ to 3 rupees, even in these days of acute depression.

In spite of the fact that the price to be paid for seed is exhorbitantly high and knowing that the seed that has not had a sufficient period of rest gives a comparatively less uniform growth than the old seed, ryots prefer to go in for the seed from the new harvest. The reason for this practice is said to be due mainly to the very low percentage of germination obtained in seed stored through the two monsoons (June - December) under ordinary methods of storing. Vitality experiments of such a seed conducted on the station bear clear testimony to the above observation. Impaired vitality being the chief concern in the problem, it should be possible to reduce the outlay on the seed in the cost of the second crop cultivation, if better methods of preserving the cheaply available seed of the May harvest are found out. Experiments on the different methods of seed preservation were taken up along with the varietal, cultural and manurial experiments dealt so far. A perusal of the results of the storage and vitality experiments set forth in Table 5 will clearly show that seed preserved in metallic receptacles (Kerosine tin and Galvanized bins) maintain their vitality quite well until required for sowing through the monsoon months. On the other hand, seed stored in gunnies either single, double and even treble or fourfold begin to lose their vitality from about the fifth month. The basket bin and *mudicatta* (bundle made of straw twists) are intermediate between the two extremes very often depending upon the material and the make. Incidentally, it was noticed that longer initial soaking of seed material improves the percentage of germination. Side by side, comparative yield trials of new seed versus old seed preserved properly were conducted. They have given very clear proof that old seed is not in any way inferior in its yields, but combines with it an even harvest which is a great desideratum in a short-duration shedding variety. However, the initial cost on the purchase of the metallic receptacles (though in most cases it would be equal to the first year's saving in the cost of the seed) may stand in the way of their extended use. But a short reflection on their permanent utility compared to the more common articles of storage should clear this doubt. In the course of these experiments it was also noted that when seed preserved in gunnies was given occasional dryings, an improvement by way of increased percentage of germination (vide Table 6) was obtained. It does not however approach the percentages secured in the seed preserved in metallic receptacles. It is hoped that further, observations in the number and the frequency of dryings that should be given to improve the quality of seed material may help to bring the solution of the problem within the range of practical utility by the ryots.

(e) *Prophylactic measures against "Foot-rot" disease of paddy*— During the course of these investigations just mentioned, a disease

identified as "Foot-rot" of paddy made its appearance in the 1930 second crop in an epidemic form affecting nearly fifty per cent of the transplanted population. Preliminary studies on this disease showed that it could be easily brought under control with some precautions. In bulk crops where planting is mostly done in doubles or trebles due to the poor growths of *dalva* seedlings in the nursery, the appearance of the disease is not very much felt on the yield. In a clump where one of the seedlings is affected the second plant is invariably observed to be free from infection. Therefore the uninfected plants make up the final yield. As a result of some preliminary experiments conducted by the Government Mycologist at the Station, steeping seed in 2 % copper-sulphate solution for 30 minutes was found to be most efficacious of all the treatments, considering the cost, facility of handling, etc. Ever since, seed treatment has been adopted as a routine measure for all the sowings on the station, and it could not be said that systematic seed treatment has brought the disease sufficiently under check. Detailed investigations on this disease in search of a still better control measure than the above are being carried on by the Government Mycologist at his headquarters.

8. Summary. Commencing with a comparison of the two crop system of the Godavary irrigation with some of the other projects of the south, the paper traces its growth and its effects on the economics of the delta. It points out how the benefits by way of increases in yields, rates of leases, fodder supply and the cultivable area, outweigh some of the inevitable and remediable disadvantages as continued multiplication of pests in the tracts, deterioration of soil fertility, and increase in alkalinity.

Thereafter the problem of obtaining an early harvest without prejudice to yields to get over the two main limiting factors, adverse seasons and pests for early planting, and shortage of water supply for late plantings, is discussed. If this should be possible it would incidentally encourage an extension of garden, fodder and green manure cultivation in the delta.

Finally, the various lines of work taken up to tackle the problem are detailed trials of very early maturing strains and short duration varieties like Adt. 3, Adt. 4, *Chitraka'i* and *Swarnavari*, proved a failure. A promising strain of *Garikisannavari*, No. 925, which combines a week's earliness and better yield than the local has been isolated. Trials in the modification of raising seedbeds initially under semi-wet and later under dry conditions have so far been found to be encouraging. Seedlings thus raised stand early planting and come for early harvest without prejudice to yields. The results of a few experiments with green manure are concisely brought out to show that it is more remunerative to manure the second crop than the first crop. Dealing with seed preservation, it is found that the May-harvested

seed is quite viable to be fit for next second crop sowing in December only when preserved in metallic receptacles. The very poor quality of seed stored in gunnies is found to improve to some extent in their viability by occasional dryings during the period of storage. The paper concludes with a remark on the efficacy of seed treatment with 2% copper-sulphate as a prophylactic measure against "Foot-rot" of paddy.

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Table 1.

Statement showing the effect of early and late planting in the second crop season on the final yield.

Dates of sowing.	Dates of planting	Age of seedlings.	Average yield in decagrams per strip of 40′ × 4′.
16th December	19th January	35	454
23rd ,,	27th ,,	,,	631
31st ,,	4th February	,,	676
14th January	14th ,,	30	752

Table 2.

Statement showing that yields are not affected by agedness of seedlings by comparison of bulk yields of crops raised by the modified methods of seed-bed culture against normal practice.

Treatment.	Dates of			Yield per acre in lbs.
	Sowing.	Planting.	Flowering.	
Normal practice of late sowing and late planting.	3rd Jan.	10th Feb.	12th–16th April.	2684
By the modified seedbed culture, early sowing & planting.	30th Nov.	2nd Feb.	23rd Mar.	2846

Table 3. Results of the experiments with green manure on the first and second crop showing the significant increases in yields in the Second-crop season.

Particulars of treatment.	Results in the 1st crop.				Results in the 2nd crop.				Remarks.
	Total yield in ozs. of 5 repts.	%age increase over no manure.	%age of grand mean.	Standard error as %age of grand mean	Total yield in ozs. of 5 repts.	%age increase over no manure.	%age of grand mean.	Standard error as %age of grand mean	
1931—32.									
Both crops green manured at 4000 lbs. each.	799	98·4	98·4	7·1	714	148	126	3·75	
Main crop alone green manured at 4000 lbs.	838	103	103		510	106	90		
No manure for both the crops.	815	100	100		481	100	85		
1932–33.									
Both crops green manured at 4000 lbs. each.	766	108	108	3·6	752	136	122	3·12	
Main crop alone green manured at 4000 lbs.	643	90·6	90·6		542	98	88		
No manure for both the crops.	709	100	100		553	100	90		

Table 4. Results of manurial experiments in the second crop season under different treatments.

Treatment.	1931—32.				1932—33.				Remarks.
	Average yield in decagrams per plot.	% with reference to no manure.	% of grand mean.	Std. error as % of grand mean.	Average yield in decagrams per plot.	% with reference to no manure	% of grand mean.	Std. error as % of grand mean.	
1. No manure.	516	100·0	85·4	1·79	428·2	100·0	79·11	2·72	
2. Dry sunhemp at 2000 lbs. per acre.	636	123·3	105·3		571·7	133·6	105·6		
3. Ammonium sulphate at 100 lb. per acre.	568	110·0	93·9		510·7	119·3	94·36		
4. Sunhemp green at 2000 lbs. plus Ammonium sulphate at 100 lb. per acre.	673	130·4	111·3		610·2	142·5	112·7		
5. Sunhemp green at 2000 lbs. plus Ammonium sulphate at 100 lb. in two doses per acre	663	128·4	109·6		606·0	141·6	111·9		
6. Ammonium sulphate at 100 lb. per acre in two doses.	571	110·6	94·4		521·0	121·7	96·25		

Table 5. Results of germination tests of *Garikisannavari* seed under different methods of storage.

1930—31.

Mode of storing	Percentages of germination.			
	Laboratory test.		Field test January 1931.	
	6th Nov. 1930.	14th Dec. 1930.	Seed soaked for 24 hours before draining and keeping for germination.	Seed soaked for 36 hours before draining and keeping for germination.
Second crop seed—May harvest—				
Bin-made of galvanised sheet.	—	99	63	80
Kerosine tin.	—	98	63	86
Basket bin.	—	99	30	22
"Mudikatta" plastered.	—	89	36	54
Do. non-plastered.	—	90	38	54
Gunny—single.	81	—	10	11
„ double.	84	—	13	10
„ treble.	92	—	12	10
„ fourfold.	90	—	10	8
Control—October harvest—	—	—	86	—

1931—32.

Bin-made of galvanised sheet, stored full.	—	99	77	86
Do. to a fourth.	—	95	70	92
Kerosine-tin-stored full.	—	98	75	92
Do. to a fourth.	—	91	60	86
Basket-bin.	—	90	37	57
"Mudikatta" plastered.	—	12	1	3
Do. non-plastered.	—	71	11	30
Control—seed harvested in October.	—	—	59	73

Table 6. Results of the vitality test of *Garikisannavari* seed stored in gunnies with and without drying during the period of storage.

Particulars of treatment.	Percentage of germination conducted in January					
	Laboratory test			Field test.		
	Single gunney	Double gunney	Treble gunney	Single gunney	Double gunney	Treble gunney
Second crop seed–May harvest.						
Non-dried during the period of storage.	28	32	34	12	14	11
Dried once.	32	80	82	29	36	37
„ twice.	67	71	92	31	37	31
„ thrice.	78	87	86	31	34	34
Main crop seed–Oct. harvest. Control.	95	—	—	55	—	—

LOW PRICES AND THE PLIGHT OF THE LOWLY RYOTS *

(with special reference to Coimbatore Dt.)

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In recent times much has been said and written on this world epidemic of low prices, trade depression and economic suffering. Among those who got the worst of it, undoubtedly the agriculturists rank the first. The State and the corporate association of farmers in various countries have been making strenuous attempts to tide over the catastrophe but with only partial success so far. The sufferings of the mirasdars and the cultivators of the Tanjore delta have come into prominence more than any others in South India. The situation has been equally worse in other districts also, though this year on account of fair prices of cotton it has not been so acute in some of the cotton growing tracts. The cultivating class as a whole have been hard hit and this period of depression has dawned upon them at a time when they are already cowed down by heavy indebtedness. It is not enough if we know that the agricultural class is suffering. To get at the magnitude of their distress and to form a clear conception of the conditions under which they labour and to formulate possible and practical schemes of amelioration, it will be necessary to examine in detail the economics of the average and typical cultivator working under different conditions. I mean the consideration of the actual income and expenditure, both in kind and money, of certain cultivators elected in representative tracts. The economics of five cultivators have been worked out in this paper, representing the garden and dry tracts of the Coimbatore district, as types of three important classes of cultivators; viz., (1) Proprietor-cultivator, (2) Tenant on money rent and (3) Tenant on share system-*Varam*.

The following table gives details about the cultivators selected:—

Village	Type of cultivation	class of cultivator	Area in acres.
Avanashi	Garden	Proprietor 1	2
		Tenant on *Varam* 1	4
		Tenant on money rent 1	6
Andiyur	Dry (Black-soil)	Proprietor 1	20
		Prop.—Tenant 1	15

The receipts, in kind and cash and the consumption and expenditure per annum of each cultivator are given below in the order shown in the above table. Details are given in appendix A to show how these figures have been worked out on enquiry.

1) • Marappa Gounden. Owner, cultivates 2 acres garden and 5½ acres dry area of poor fertility.

* Paper read at the 22nd Agricultural College Day & Conference—October 1933

Family— Wife, three girls—(8, 12 and 8 years) (1st married and therefore not living with him).

Possesses one pair working cattle, one buffalo and one cow.

Receipts.		Consumption and expenditure.	
	lb.		lb.
Kind— *Ragi*	3700	For food	2500
Cumbu *Cholam* & Grams	350	To chuckler, carpenter and coolies	650
	4050		3150
	Rs.		Rs.
Cash— Sale of Kapas (5 Pothies)	135	Salt, oil and other food adjuncts	36
		Cultivation expenses	40
Sale of milk, curd, ghee, from Buffalo and cow	130	Maintenanee of cattle	150
		Clothing	30
		Social expenses	30
Miscellaneous	10	Land tax and Miscellaneous	20
	275		306

Has a previous debt of Rs. 500 to clear.

Sometimes purchases fodder when Ragi and Cholam crops have been poor.

2. Kolandai Goundan. Tenant on equal share system. Cultivates 4 acres garden and 1 acre dry of poor quality. Possesses two pairs of work cattle and two buffaloes.

Family— Wife, two sons (20 & 10 years) and two daughters (17 & 6 years); 1st son married.

Receipts.		Consumption and expenditure.	
	lb.		lb.
Kind— *Ragi*	7700	For food	3330
Cholam	800	Share to Landlord	4450
Cumbu or *Tenai*	300	One Permanent Labourer	2300
		To chuckler, carpenter & other *mamools*	400
	8800		10480
	Rs.		Rs.
Cash— Sale of Kapas (5 Pothies. Another 5 Pothies given to Landlord.)	135	Food adjuncts	48
		Cultivation expenses	80
		Clothing	40
		Social expenses	40
Sale of milk etc., from buffaloes	160	Maintenance of cattle	240
Miscellaneous	10	Miscellaneous	0
	305		458

Has a previous debt of Rs. 200 to clear.

3. Kaliappa Goundan. Tenant on money rent system. Cultivates 6 acres garden. Possesses two pairs of work cattle and two buffaloes.

Family— Wife, three sons (14, 12 & 8 years), one daughter, unmarried.

Receipts		Consumption and expenditure.	
	lb.		lb.
Kind— *Ragi*	11000	For food	3330
Cholam	1400	One permanent labourer	1800
Cumbu or *Tenai*	400	Chuckler, carpenter and other *mamools*	500
	12800		5630
		Quantity sold	7170
	12800		12800
	Rs.		Rs.
Cash— Sale of Kapas (16½ Pothies)	446	Lease rent on land	425
		Food adjuncts	50
Sale of surplus Grain	281	Cultivation expenses	120
		Clothing	40
Sale of milk etc.	145	Social expenses	50
		Maintenance of cattle	240
From 50 coconut trees	20	Miscellaneous	10
Miscellaneous	10		
	902		935

Has a previous debt of Rs. 150 to clear.

4. Velappa Naidu. Proprietor. Cultivates 20 acres of dry black soil of good Fertility. Possesses no cattle.

Family— Wife, mother, two boys (11 & 6 years), one girl (14 years).

	Rs.		Rs.
Cash— By sale of Kapas (15 Pothies)	375	Food expenses (including everything)	200
		Cultivation expenses	160
Sale of Coriander and Bengal gram	80	Clothing	40
		Social expenses	30
		Land tax	40
		Miscellaneous including presents to Washerman, Barber and *mamool*	20
	455		490

Has no previous debts.

5. Gopalasami Naidu. Owner—Tenant. Cultivates own—8 acres and on lease 7 acres of black soil (dry) of good fertility. Possesses no work cattle, but one cow.

Family— Wife and mother.

	Rs.		Rs.
Cash — By sale of Kapas (12 Pothies)	300	Food expenses (including everything)	125
		Cultivation expenses	120
Coriander and Bengal gram	70	Social expenses	20
		Clothing	20
		Land tax	16
		Miscellaneous including *mamools* to washerman, barber etc.	20
		Lease rent on 7 acres	90
	370		411

Has a previous debt of Rs. 300 to clear.

Consolidated statement showing receipts, expenditure and consumption per annum for all the ryots and details of deficit and loss with debts.

Cultivators.	Area cultivation in acres.	Family members.	Receipt in kind.	Consn. distri. & sale.	Excess or deficit.	Receipt in cash.	Expenditure.	Gain or loss.	Debts to clear.
		No.	lb.	lb.	lb.	Rs.	Rs.	Rs.	Rs.
1. Owner	2 (gard)	4	4050	3150	+900	275	306	—31	500
2. Share Tenant	4 (gard)	6	8800	10480	—1680	305	458	—53	200
3. Tenant On Rent	6 (gard)	6	12800	12800	...	902	935	—33	150
4. Owner	20 (dry)	6	...	...	...	455	490	—35	...
5. Owner Tenant	15 (dry)	3	...	...	...	370	411	—59	300

The above statement shows at a glance how the cultivators stand at the end of one year when all the produce and cash have been disposed off in various ways. The figures have been compiled after careful and searching enquiries of the cultivators concerned and the estimates are likely to be very modest rather than exaggerated. Calculations have been made on the present prevailing prices. In the calculation for cultivation expenses allowances have been made for family labour and all theoritical values have been excluded. Under the item miantenance of cattle actual cash expenditure made by the ryot in purchasing bran, cake, cotton seed, etc., has been included, as the fodder is supplied from his own land. The cost of fodder that may be purchased during shortage has not also been included.

The position of the owner cultivator seems to be better, as one can expect it to be, provided he has just the area that will keep him from loss and is already free of debts. There is only some grain left after consumption in the case of the garden ryot and this has to be set off for the loss in cash. The same man in the dry area, though possesses 20 acres, has to face a loss of Rs. 35 and he can probably just get on as he is not encumbered with debts. The circumstances of those possessing less than 20 acres can better be imagined. The case of the tenant on equal share system seems to be the worst, though apparently one may imagine that tenancy on equal share system may be more favourable than his colleague on the rent system. This share tenant has to make up a deficit of 1680 lb. of grain for his comsumption and a loss of Rs. 53. The tenant on the rent system, on the other hand experiences a loss of Rs. 33 in spite of the fact that he has to sell away all surplus grain to meet the cash expenditure. The tenant in the dry tract experiences a much worse situation, cultivating about 15 acres. When the season is, abnormal and the yields are poor the economic

suffering would be worse undoubtedly. It is noteworthy that the ryots of the garden tract possess buffaloes and cows to supply the demands in milk and its products at the town nearby, thereby earning a little extra. Only a little extra, as the margin over that for the maintenance of the animals has now-a-days been found to be small owing to the same cause, viz., low prices of milk and its products. If there is no town nearby even this extra is not available.

Except one, all the other ryots are indebted, luckily to a moderate extent. When their agricultural industry is working at a loss, it is inconceivable how they can clear off even this moderate amount of debt within a reasonable period. There are many others in the village whose debts are much greater, but which were contracted some years ago, mainly for purchase of lands, sinking wells or other permanent improvements or for marriages and other functions, when prices of products were high. Such debts may be taken to be abnormal as differentiated from those contracted by the average ryot for his own living expenditure, purchase of implements or cattle. It is for this reason that the above five cultivators have been chosen, since they have not gone 'headlong' in contracting debts and have lived within reasonable means.

Two of these ryots alone are 'entangled' in litigation in connection with some old debt and partition affair in the family and this would mean a steady source of drain on the slender resources. With about 50% of the ryots in the garden areas and about 30% of those in the dry areas, constantly engaged in litigation in one form or another, it is no wonder that debts accumulate and the basic industry suffers on account of neglect and want of adequate finance.

The case of the owner-cultivator in general. Provided his wants are few and he lives just in the simple style of the cultivator with a small family, he will experience no deficits or loss if he has at least 3 acres of good garden area or about 30 acres of dryland of good fertility. Even then it is not possible to save anything for purposes of reducing debts or for expenses during marriages and special occasions. Perhaps if prices rise by at least 50% it may be possible to save something. The actual situation is that the bigger the area possessed by the ryot the greater the debt and greater the expenses of living and establishment. Compared to the position of the tenants, that of the owners should be above board, but actually we find that they (the average owner) are also in equally sad plight, worried over old debts and present needs. There is no difficulty, however, for a sufficient supply of grain for their own consumption throughout the year, but their income in cash is generally short of their legitimate requirements under the present circumstances.

The case of the Tenants. The conditions of the occupancy tenant has become worse. Rents have not gone down proportionate to the

fall in prices (and this will be vouchsafed by all absentee landlords) and what with competition even in this profession, the tenant finds it a herculean task to make both ends meet. Landless residents of the villages compete with one another for the taking up of lands for cultivation on rent and as everyone knows, it is far from paying now to cultivate on such high rents. There is therefore frequent change of hands. The landlords, as is well known, do not very much care for the steady improvement of their lands, but only for the maximum rent that can possibly be realised. We often come across tenants who have taken up lands in different places; small bits most of them. Within certain limits, whatever the area taken up on rent or share, the difficulties exprienced are the same as with the increase in area the rent or share increases while the margin of profit does not proportionately increase. In any case the tenant has to be pitied and sympathised with by the landlord rather than victimised for exploitation for one's own ends in these hard days.

The tenant on money rent has to sell away all available surplus grain to pay the rent and then go in for a loan in addition, for cash expenditure, while the other on share system has to purchase additional stock of grain for his own consumption for which purpose he may have to borrow money. It would be relieving the tenants a great deal if the landlords take rent in kind at a proportion which is not unfavourable to the tenant. This system exists in many of the wetland tracts. Where cotton or other commercial crop is grown, the tendency is to demand cash rent and needless to say, during the years when prices were phenomenally high, the rent and values of land rose up to dizzy heights Now while the prices have fallen by more than half, the rents have only by about a third. Many of the landlords who are heavily indebted have been found to demand comparatively high rents, burdened as they are by accumulated debts. The situation from the tenants' point of view is certainly gloomy, but if the landlords are relieved of their debt-burdens by some means and if they are induced to stick up to particular tenants without frequent change the situation might improve even though prices continue low. It is possible that rents may also come down proportionate to the prevailing low prices.

Need for an adjustment to altered conditions. The economic depression has aggravated a situation which was already far from satisfactory. A genuine and broadminded help from the State has long been looked forward to by the agricultural class in the matter of releiving their debt burdens, at least to some extent. If at any time the need for a great gesture of help is felt, it is only the present period. It almost seems that the low prices have come to stay. There may be indications of a slight rise here and there, but they are due to local and temporary causes. So long as there is improper adjustment between production and demand, absence of outside or wider market for our

produce and all the other manifold causes of depression, many of which are international, it is too much to expect any great rise in the prices : to the level of those in 1924–1925. There is therefore a great need for readjustment of the different systems of payment, etc., by the agricultural classes, including the tax paid to Government, to suit the altered conditions brought about by the unusual low prices. Prevailing wages for labourers should be lowered, the quantities fixed for payment in kind or cash by way of *mamools* or otherwise in the village should be reduced consistent with the prevalent conditions. The rent demanded by landlords should be considerably less. The expenses on social obligation, marriages and other functions should be considerably cut down. The cultivating and the land-owning classes should be alive to the situation and make an effort to reorientate the several modes of dealings, *mamool* and financial settlements of the agricultural industry according to the changed conditions, which is of universal character, so that the entire burden of low prices shall not fall upon only one section of the community, viz., the cultivating class.

Land-mortgage Banks : the great Saviour. In villages when mention is made of the possibility of establishment of a land-mortgage bank to serve that village, the cultivators as one man acclaim this as one of the greatest boons to be conferred on them. Oppressed as they are by debts, their interest in cultivation and its improvement is at a low level. Once they are relieved of the worry of the 'overhanging' debt and the ever-increasing interest, they may feel their position more easy and secure, and thereby are likely to improve their conditions and cultivation on their own initiative. The eagerness with which they welcome the idea of such banks being opened under Government auspices, is itself proof positive of the great need for such banks. If landlords are relieved generally from the burden of their debts, it is possible that their exploitation of the tenants may slacken. Absentee landlords may take the loan on their lands and distribute any surplus after clearing their debts, to the tenants. That land-mortgage banks can be of immense use and is a prime necessity, can only be realised after some intimate touch with many of the ryots.

It has been said that proper and responsible non-officials are not available or forthcoming to conduct such banks in some places where they could be opened in the first instance. It is unfortunate that such a view is taken, for if there is a genuine desire to help the ryots, a way must be found to open at least one bank in every taluk at a very early date. If proper non-officials are not forthcoming, then to start with, Government has to take the lead and run some banks with their own employees. In the programme of national reconstruction and rural amelioration, the scheme of the establishment of a large number of land-mortgage banks would stand foremost. This great help is already long overdue and this period of low prices has created a situation when

it is nothing short of folly to be expecting any great enterprise and push among the ryot population as perhaps one can expect from those of the Western countries. True, land-mortgage banks are being opened in many places but considering the urgency of the situation and the vastness of the area, the progress seems to be absolutely unsatisfactory.

An Economic Survey. The Punjab has given the lead in this matter. An organised and detailed economic survey of many of the important tracts of our Presidency is essential and would reveal to us in an unmistakable way the several handicaps experienced by the agricultural class and also the need for the establishment of a chain of land-mortgage banks. We are not in a position now to compare the economic conditions of tracts similar to each other nor we are in a position to know in which tract the economic suffering is greater or more acute, in the absence of specific and complete data. It is therefore worthwhile to take up this survey early, particularly during this period of low prices when the suffering of the community is at its worst. There is not plenty to eat in the villages as we suppose, as the cultivators have to sell away a large portion of the stock of grain to realise cash for other items of family expenditure and for payment to coolies. Wages are now mostly paid in cash as it is more convenient and preferred by labourers themselves. If paid in kind, generally, in apportioning to coolies the cultivators err on the side of excessive liberality, for there is no knowing how much extra one would have given as the coolies beg or bargain for more and more, and during busy seasons and scarcity of labour, payment in kind may always exceed in value to that paid in cash.

If the cultivator is not enterprising and if he grows the same crop over and over again it is not that there is no enterprising spirit in him or he is unmindful of the consequences of growing the same crop, but the whole thing is one of economic necessity. Their debts, and at present low prices and in the cotton tracts the tempting levels reached by prices of cottons some years back, have all contributed to such unfavourable practices. Several of the improvements suggested by the department are therefore uncared-for by the average cultivator. Till some time back, in the Avanashi tract three crops were raised regularly in rotation. But now tobacco has been eschewed as the preparation of the produce for the market is tedious and the prices unfavourable with unreliable fluctuations, leaving *ragi* and Cambodia cotton to be grown alternately. The former is required for consumption and the latter is easy of handling and marketing besides having an assured market. For the same reasons in the dry black-soil areas of Udamalpet taluk, cotton is grown every year, with the result the yeilds have gone down. Once in 5 or 6 years a sixth of the area is put under Bengalgram and once in a few years the variety may be changed, from *Karunganni*

cotton to *Uppam* or vice versa. The ryots do realise the evil of growing the same crop every season or of adopting a poor kind of rotation, but neither there is any convenient and money fetching crop to be included in the rotation nor the much needed cash for payment towards debt and interest is got by any other crop than cotton, without much difficulty. In all garden tracts the maximum possible area is put under any of the commercial crops like cotton, onions, garlic, tobacco, groundnut etc. In some of these two crops of the same kind are also raised in the year. It is however an economic necessity again that he should be still growing grain crop and some fodder once in the year for his own consumption and to feed his cattle. Economic causes are therefore at work for the many variations and unfavourable practices observed.

The two new Bills. From the ryots' point of view the Debts Conciliation Bill proposed to be introduced is none too soon and such Conciliation Boards when formed will be as it were, good adjuncts to land-mortgage banks. The Money-Lenders' Bill as at present drafted does not seem to bring into its purview the rural money-lenders and others connected with the agriculturists. It is also disappointing that so far we have not heard of any person or body appearing before the Select Committee on the Money Lenders' Bill, on behalf of the cultivating class. The representation, therefore, by other classes is likely to be unfavourable to the peasant class and it is possible that the Bill may be entirely opposed or modified to that extent that it may not be of any benefit to the ryot population. It is hoped that the several District Agricultural Associations will suitably represent in time so that the Bill becomes one essentially in the interest of the agriculturists.

The example of the United Provinces. The proposed relief to the agriculturists of the United Provinces by the enactment of the Agriculturists Relief Bill with two other complimentary Bills, is of a far reaching character and deserves our careful study and adaptation in our province. Some details about these Bills with the objects and Reasons are given in Appendix C. In the same province the Government is now making efforts to formulate a provisional plan by means of which the land revenue and rent remissions will be automatically arrived at without any investigation. It is but legitimate that rents and land revenue should oscillate in correlation to price levels and therefore this scheme of the United Provinces Government is laudable and worth studying with a view to evolving some such scheme for our province also, in so far as this scheme is directly connected and is the result of the present economic depression.

Conclusion. If it were not for the crushing burden of indebtedness the present depression and fall in prices would not have descended upon our ryots as such an unbearable evil as it actually is. The first and foremost problem to attend to is the provision of adequate finance to be distributed among the ryot population on a vast scale and relieve

them at least partially from their indebtedness. The efforts made in other countries in this direction, particularly in the United States of America is well known. The fundamental needs of our lowly ryots have not been systematically studied and theirs is an unenviable lot,—meagre meals and clothing, devoid of luxuries, a life of toil and moil, always struggling to keep the wolf of debts and deficits at bay. It is unmistakably the Government that has to take the lead in this matter. The Economic Depression Committee, though restricted in its sphere of enquiries, has recommended among others, the grant of small loans to small ryots for cultivation expenses. Nothing can be more welcome than this and it is hoped that the Government will take into serious consideration the desirability of giving effect to this suggestion at a very early date. For this purpose the surplus of about three crores of rupees lying idle with the Co-operative Banks may come in handy.

Appendix A

The following are the details with which the estimates of receipts and expenditure and consumption of the cultivators have been worked out. (Yields noted are the actual average ones got by the ryots).

Yield of *Ragi* crop—2200 lb. per acre of gram.

Yield of cotton in garden—2½ Pothies per acre. (Pothi—260 lb.)

Yield of cotton in dryland—¾ Pothi per acre.

Price of grain—25 lbs. per rupee.

Price of Cambodia Kapas—Rs. 27. per Pothi.

Price of *Karunganni* Kapas—Rs. 25. per Pothi.

Consumption of grain per head of the family—½ Madras—measure on the average, equivalent to 1½ lb.

Social expenses include—presents at marriages and other functions among relatives.

Cost of maintaining cattle worked on the basis of price of cake, etc. prevailing during the time of enquiry.

Supply per pair of animals per week is as follows:—

1 bag bran—8 annas.
1 maund cake—9 annas.
1 maund cotton—seed—9 annas.

(Cost of fodder not included as it is grown).

Chuckler as permanent employee in the garden gets 1/12th share of the produce, and Re. 1 or 1% in the value of cotton, etc., sold.

Other permanent labourers get one bag of grain per month.

Village *mamools* include payment in kind to washerman, carpenter, barber and one or two others, who are each given about 75 lb. grain per annum plus a small quantity during every harvest.

Appendix B

Following are the suggestions of Mr. V. Ramadas Pantulu, President of the Provincial Cooperative Union, for the consideration of the Government in connection with the agrarian situation in our province.

1. A policy of liberal remission of land revenue until prices rise. Mere suspension of a fraction of the revenue collection will not help the situation.

2. Adoption of measures for liberation of some credit to the agriculturists for seasonal operations and payment of kist.

The cooperative credit in the normal way to members of societies has become greatly curtailed and a large number of cultivators are outside its scope, not more

than 3% of them being members of societies. So the cooperative institutions must now be used in this period of economic depression to liberate credit to all eligible rural borrowers on the security of their produce or gold and silver at cheap rates of interest say 7½%.

3. There are large surpluses in the cooperative banks. At least a sum of two crores is now lying idle with no prospect of cooperative investment in the near future. It represents partly the small savings of a large number of people among whom the habit of thrift and banking have been inculcated through the cooperative movement. It would be deplorable to return the money to the investors who are now satisfied with the very low rates of 4 to 5% interest on the average.

The Government may borrow a part of the surplus at 5% and make it available to agriculturists under the Agriculturists Loans Act and the Land Improvement Loans Act

It is estimated that the interest paid by the rural debtors on their debt is at least Rs. 30 crores a year. The total value of the agricultural produce in the province n the pre-depression year was estimated at about Rs. 160 crores. It may now be put at 80 crores.

Appendix C

The Agriculturists Relief Bills of the United Provinces.

The Objects and Reasons of the First Bill are :—

1. To make provision under a legal process under which an agriculturist debtor can apply to a civil court to get his account settled and to fix instalments for the payment of any sums due.
2. To enable a debtor to deposit in court a sum of money in discharge of his debt for payment to the creditor;
3. To limit the sale of agricultural produce in execution of decrees to four years;
4. To limit mortgages to a period not exceeding 20 years;
5. To enable occupancy or exproprietory tenants to mortgage their holdings to cooperative societies with a view to their getting long term credit;
6. To enable an agriculturist mortgagor to redeem his land during the currency of the mortgage on certain conditions;
7. To provide for a summary method of redemption;
8. To enable debtors to receive a statement of accounts from their creditors and to compel the creditors to maintain their accounts in a regular manner;
9. To make it a penal offence for a creditor to enter in his book a sum larger than that actually lent.

The other two Bills are complimentary to the first. One of these protects the landowners and tenants who may pay rent or revenue not exceeding Rs. 5000.

The Second Bill seeks to safeguard their interests by :—

1. Reducing the rate of interest on loans contracted between 1st January 1927 and 1st January 1930 in respect of the period after 31st January 1930.
2. Reducing the rate of interest for loans contracted on or after April 1, 1930 till such date as may be found necessary owing to the present economic depression;
3. Limiting their credit so as to check the tendency to incur improvident loans.

The rate of interest approved is 12% compound interest with yearly rests or 15% simple in the case of secured loans and 18% compound and 24% simple in the case of other loans.

The third Bill is meant to amend the Usurious Loans Act, defining what constitutes an excessive rate of interst, thus fixing a rate of interest to exceed which will be to bring into operation the penal provisions of the Bill.

ABSTRACTS

Notes on the natural colour preservation of Philipine plant materials for museum or exhibition purposes. *(University of the Philipines : Natural and Applied Scienc Bulletin Vol. III, No. 1, July 1933).* F. T. Adriano and Emilia Yonzon recommend the following formulae of preserving fluids for different plant materials :—

1. *Green coloured specimens.* Immerse in $CuSO_4$ solution prepared by dissolving 500 grams of $CuSO_4$ in a litre of water. Over-immersion is indicated by the formation of brownish or burnt-like spots. Wash the materials thoroughly in clean water for several hours until all excess $CuSO_4$ is removed and store the specimens in jars and fill them with storage solution prepared by passing SO_2 in litre of water for about 15 minutes. The jars should be carefully sealed to prevent loss of SO_2. If the storage solution becomes cloudy it must be replaced by a new one.

2. *Yellow coloured specimens.* No preliminary fixing with $CuSO_4$ solution is necessary. The well sorted specimens are packed in jars and completely immersed in sulphurous acid solution. Cruess has recommended a preserving liquid which is adopted for some of this class of specimens to be prepared as follows :— 1. Distilled water ... 2,785 c. c. 2. Formalin ... 3 5 gms. 3. Sulphurous acid–6% ... 15 c. c. 4. Boric acid ... 288 gms. 5. $CuSO_4$ to give a faint green colour.

3. *White coloured specimens.* The same formula can be used as for the yellow coloured specimens.

4. *Red or multi-coloured specimens.* (Red tomato etc.) The specimens are placed in jars and then completely immersed in the preserving solution prepared as follows :— 1. Sulphurous acid solution ... 1 litre. 2. Boric acid ... 2-4 gms. 3. Formalin ... 5-20 c c. For more delicate fruits about 2 grms. of boric acid and about 5-10 c. c. of formalin are required. Cruess' preserving formula which is also adopted for this class of specimens is prepared as follows :— 1. Distilled water ... 3,785 c. c. 2. Refined salt ... 56 gms. 3. Formalin ... 7·5 c c. 4. Sulphurous acid–6% ... 4 c. c. 5. Potassium nitrate ... 7 gms. 6. Glycerine ... 270 c. c. For fruits, glycerine may be replaced by cane sugar syrup of about 15% concentration.

P. S. S.

Antipathy between leguminous plants and the organism of malarial fever. Dr. Theo Krysto, M. D. in his article, " Can the world banish malaria ? " (Sci. Am. Vol. 142, April 1930, pp. 270—272) states that when *Anophales,* the malarial fever mosquito feeds on leguminous plants the disease organisms in them get neutralized. They can no longer spread malaria. It is well known, he says, that mosquitoes feed on the juice of plants, the males exclusively, while the females feed partly on this and partly on the blood of animals and man.

The substance common to the leguminous plants capable of neutralizing the malarial organism is the glucoside " coumarine " which in the mosquito probably plays a role parallel to that played by quinine in man. Dr. Krysto believes that malaria can be controlled by growing leguminous plants around houses and relates many observations he has made in Europe, Asia and America in support of this theory. He also quotes instances similar to his own given by d'Herelle (a Yale scientist) and Sir William Willcocks (engineer at Cairo).

K. K. N.

Preparation and Marketing of Papain—*(Bulletin of the Imp. Inst.* Vol. xxxi, No. 4, 1933.) Papain is prepared from the latex of the fruit of the papaw tree (*Carica papaya*) and is used in medicine and in various digestive preparations. Tapping is done in the early morning by making longitudinal incisions ⅛" deep and 1—2" apart in the rinds of the fully grown, but still green, fruits by means of a knife of bone, glass or sharp-edged bamboo. Steel disclours the latex. Tapping is done every 4 –5 days until no more juice is yielded, the subsequent incisions

being made between the previous ones. The exuding latex is collected in glass, porcelain or enamel vessels and dried at a temperature not exceeding 100°F. Addition of a trace of formalin delays putrefaction. Sun-drying yields a dark-coloured product and if adopted the material should not be allowed to get baked and the enzyme properties destroyed. Drying may be speeded up by first squeezing the coagulated latex in a cloth or by pressing it through a colander or perforated plate. The product is best spread on coarse linen stretched on frames and moved from time to time to make drying even. On large estates a hot-air chamber is employed and for a small producer some form of drying stove is more suitable. The dry papain is roughly ground and packed in air-tight tins.

The yield of Papain is very variable and in Ceylon, the only country producing it on a commercial scale, 175 lbs. of the dried stuff per acre a year is a good yield, the average being 100 lbs. on flat lands and 80 lbs. on hilly or rocky lands. About 4½ lbs. of the fresh latex are required to yield one lb. of dry Papain.

Oven-dried Papain is of a better colour than the sun-dried and commands a premium of 3 d.—6 d. per lb. over the latter, the principal factor determining the value of the product being, however, the degree of the enzyme (digestive) activity. The average pre-war price of Ceylon papain of good digestive power was 8 s. per lb. and ranged between 3 s. 9 d. and 7 s. during 1930—1932, the current price being 6 s. 9 d. The following were the total exports from Ceylon in recent years:—

1928	1929	1930	1931	1932
lbs.	lbs.	lbs.	lbs.	lbs.
125,684	128,463	79,338	76,947	64,356

The principal importing countries are United States, United Kingdom and France in the order of volume of imports.

A bibliography is appended to the article. P. S. S.

Nature, Distribution and Functions of Soil Micro-organisms by Selman A. Waksman. (*The Newer Knowledge of Bacteriology and Immunology* by Jordan and Falk pp. 310—321.—1929). The micro-organic population of the soil consists mainly of (1) the Algae (2) the Fungi excluding the Actinomycas and Yeasts (3) the Bacteria and (4) the Protozoa, (including various amebae flagellates and ciliates). These organisms are found in greatest abundance in the upper layers of soil, the numbers diminishing with the depth of the soil. The nature and distribution of the soil population depend on the condition of the soil, depth of soil, season of year, moisture, the reaction of the soil, the amount of organic matter, soil temperature and a number of other factors. For the study of the soil micro-organisms different methods are available depending on the nature of the organisms. For the determination of bacteria and fungi, direct microscopic and cultural methods are resorted to and for protozoa, algae and specific physiological groups of bacteria the dilution method has to be applied. The plate method has serious disadvantages for determining the total population in soil, depending as it does on the medium adopted for the cultivation of the organisms. In normal soils the soil population, varies from two or three hundred thousand to a hundred million cells per gm. of soil. The actinomyces constitute 10 to 40 %, non-spore forming bacteria (50—80 per cent) and spore formers 3—10 % of the total population. The fungi vary from 10,000 to 1,000,000 per gram of soil and they are found in abundance in acid soils. Yeasts are rarely present in normal soils and they occur in quantity in Vineyards and Orchards. The protozoa come last and their numbers range from a few hundreds to over a million per gram.

The isolation and cultivation of different types of micro-organisms are usually effected in selective media by adopting electric methods. For example, the symbiotic and non-symbiotic nitrogen—fixing bacteria, sulphur bacteria,

methane bacteria to quote only a few, are some of the organisms which are isolated by electric method involving the use of different media.

Based on the nutrition of different organisms; the micro-organic population is divided into two groups (1) The autotropic organisms, or those which obtain their energy from the oxidation of inorganic elements (S. H_2), inorganic compounds (NH_3 NO_2) S_2 O_3 ' H_2 S), simple compound of carbon (CO, CH_4); carbon dioxide of the atmosphere is used as a source of carbon for structual purposes. Under this group comes the nitrifying sulphur, hydrogen, methane and iron bacteria. Algae also which obtain their energy photosynthetically are autrotropic organisms. (2) The heteotropic organisms, or those that obtain both their energy and carbon from complex organic compounds. The organisms of this class vary considerably in morphology and physiology. Fungi, actinomyces and Protozoa belong to this group.

The economic aspect of the micro-organic population in the soil consists (1) in the decomposition of organic matter resulting in the formation of the so-called Hunus with constant P and N contents. (2) Transformation of nitrogen and minerals like Sulphur, Phosphorous, Calcium, Magnesium, Iron, Manganese into soluble plant nutrients.

The micro-organisms thus play a prominent part in maintaining the soil fertility and their primary function consists in the mineralisation of organic matter constantly added to the soil in the form of plant residues.

The limitation of soil fertility is due to the destruction of one group of soil micro-organisms by another e.g. feeding of bacteria by protozoa. Partial sterilisation of soils by treatment with steam or volatile antiseptics increases their fertility considerably. This increase in fertility is attributed to the destruction of protozoa which feed on the bacteria and thus limit their activities. T. R.

Gleanings.

Transport of Citrus bud-wood in Thermos Flasks. At the suggestion of the colonial office, the Director of Agriculture, Nigeria has carried out during last summer an experimental shipment in Thermos flasks of Citrus bud-wood from the Department of Agriculture, Trinidad.

The bud-wood was sealed at both ends with wax and wrapped in grease-proof paper. Five flasks were received and the following results reported:—

Flask No. 1. 100 Marsh Grapefruit buds All the bud-wood had turned brown and soft; no viable buds.

Flask No. 2. 100 Foster Grapefruit buds. All in excellent condition yielding 92 buds.

Flask No. 3. 100 Valencia Orange buds. A few sticks bad become mouldy—quite distinct from the brown rot of the Marsh Grapefruit; 65 buds obtained.

Flask No. 4. 100 Parson Brown Orange buds. In the same condition as the Marsh Grapefruit; no viable buds.

Flask No. 5. 50 Lue Gin Gong Orange buds. In excellent condition yielding 50 buds.

The two flasks which were completely bad appeared to have become so through bacterial infection, judging by the smell. The success, however of the other three flasks point to the feasibility of this method and its low cost is, of

course a great asset. *It is possible that if the bud-wood were properly disinfected* prior to being placed in the Thermos flasks, the results might have been even more satisfactory than those now reported". (*Bulletin of Miscellaneous Information* No. 1 (1934) pp. 41 and 42)

Studies on the Coconut Palm. A desirable mother tree could be described as having the following points:

1. A short straight trunk of even girth
2. Short fronds, well oriented on the crown.
3. Short bunch stalks.
4. A fair number of female flowers on the inflorescences.
5. A large number of inflorescences, carried evenly round the crown.
6. A large number of nuts, the size of nut being of no importance as long as the number is large. The selection of varieties bearing very small nuts in large numbers cannot be recommended without further investigation.
7. High weight of husked nuts. (*The Tropical Agriculturist*, LXXXII, 94.—1934).

Hydrogen Ion Concentration and its Practical Application. The continuous control of pH is an important item of many factory operations, such as, for example, in the washing and processing of textiles, in brewing and the growing of yeast for bread-making, in the manufacture of sugar from the cane, in which there are no less than five different stages in all of which pH measurements can be successfully applied, there being a different optimum for each stage. The same considerations apply to the processing of gelatine and glue, adhesive gelatine being prepared at one pH, ice-cream gelatine at another, and photographic gelatine at a third. Leather and paper present similar problems, and, as might be expected, the food industry would be chaotic without a knowledge of pH. The colour of bread becomes whiter as the pH is lowered (more acid). The dough for making cracker biscuits should be more alkaline. Even the oyster, when of questionable quality, can be detected by its pH value. The change of pH 6.1 to 5.6 is equivalent to the passage from good to stale bivalves, whilst oysters below 5.0 pH are undoubtedly putrid. The pH detector works ahead of the nose and the taste in such matters, and we may anticipate demanding and receiving a certificate of satisfactory pH with our oysters in some future Utopia.—(*The Journal of the Royal Society of Arts*, Vol. LXXXII. p. 199–200.)

The Soluble Proteins of Milk. (L. A. Rogers, Bureau of *Dairy Industry*.) When the fat, casein, and lactose are removed from milk there still remain the soluble proteins consisting very largely of albumin. The albumin of milk resembles somewhat the albumin of egg and has a high nutritive value. All of the amino acids making up its complex molecule are assimilated by the digestive system so that it is what is known as a perfect protein. Of perhaps even greater importance is the physical effect it has when the casein of milk is precipitated in the stomach. Human milk, which contains more than twice as much albumin as cow's milk, is coagulated in fine flocks and is easily digested. Cow's milk, on the other hand, has a tendency to coagulate in large masses which digest slowly. This difficulty could be overcome if the albumin now discarded in whey could be separated in its natural state and added to cow's milk for infant feeding.

In making commercial milk sugar from whey the albumin is precipitated in such a way that its solubility is destroyed and it has little value. But the bureau laboratories have developed a method by which the sugar is crystallized from the concentrated whey, leaving a mother liquor containing some of the sugar, most of the minerals, and all of the soluble proteins. With proper precautions this solution may be dried without affecting the solubility of the albumin. The lactose contained in this powder is not objectionable, but the salt

content is so high that the powder is not suitable for modifying milk. It has been found that the greater part of these salts can be removed without affecting the other constituents by subjecting the concentrated whey to electric dialysis before drying it, and an apparatus in which this can be done on a factory scale has been devised. After dialysis and desiccation a powder completely soluble in water is obtained. When added to cow's milk in the proper proportion it changes the physical properties of the cow's milk so that when it is acted on by the acids of the stomach it is coagulated in the finely divided flocks characteristic of human milk. (*U. S. A. Year Book of Agriculture, 1933.*)

Research Items.

The occurrence of a type of female sterility in cotton.

Introduction. Several types of sterility were described by several workers. (Kottur 1921; Kottur and Patel 1920; Leake and Ram-Prasad 1912). The case reported here has not been described.

Material. During the season 1932—33, at the Agricultural Research Station, Hagari, in the Herbaceum strain No. 1281, a few sterile plants without bolls were observed. Nearly a fifth of the population was made up of such plants.

Observations. The plants were perfectly healthy and vigorous. No malformations were noted any-where on the vegetative parts. The plants produced a large number of flowers but none of them developed bolls. The flowers as a rule never opened. On examining the essential organs, it was found that the stamens were normal, but the staminal column was stunted bearing a large number of free filaments. The pollen was normal and there was no sterility of anthers. The characteristic club shaped stigma emerging out prominently from the staminal column in a normal flower, was found to be absent in this case. On cutting open the staminal column it was found that the ovary was present but the style was very much abbreviated (Plate I) with a thin flattened stigma at the top. The ovary was globose and had developed ovules.

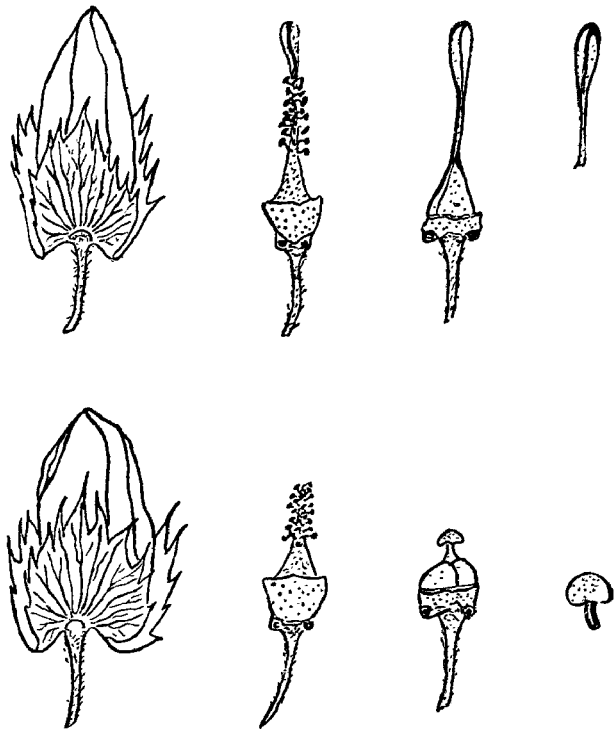
With a view to find out if the pollen was viable and if the bolls develop on supplying the stigma with pollen, flowers on the normal plants were emasculated and pollinated by the pollen of the sterile plants. The pollen was found to bo viable. On the other hand attempts to secure bolls by dusting its own pollen as well as the poll n from the normal plant on the flattened stigma of the sterile plants, were not successful.

It is interesting to note that this type of sterility was not seen in the other strains which were near this strain. In the bulk plots of the same strain also this type of sterility was not seen. The whole thing was found to be occurring only in the particular plot which happened to be the produce of a single plant. In the same strain the normal type of sterility described by the other authors was also seen both in the bulk plots and in the plot under consideration.

References.

1. Kottur K. L. and Patel, (1920). *Agr. Jour. India*, XV.
2. Kottur K. L. (1921). *Agr. Jour. India*, XVI. 1.
3. Leake H. M. and Ramprasad, (1912). *Mem. Dept. Agr. India Bot. Series* V. No. 3.

Agricultural Research Station, Hagari. N. Kesava Iyengar, M. A.



Explanation of Plate.

Explanatory Note.

A. Normal flower. 1. Flower bud. 2. The staminal column. 3. The pistil. 4. The stigma and long style.

B. Abnormal flower. 1. Flower bud. 2. The staminal column. 3. Globose ovary, short style and the flattened stigma. 4. Stigma and the abbreviated style.

Review.

Rice in British Guiana (1927–32). *British Guiana Dept. of Agri.* Rice Bulletin No. 1. The Bulletin contains the important results of the various investigations which have been carried on in the colony during the last 5 years. It is divided into four sections dealing respectively with varietal and cultural investigations; manurial investigations; insect pests of the plant and the grain; and diseases.

Section I. Here is given the development of the industry, the early attempts made to evolve pure lines of the local varieties, the results of the various cultural experiments and the preliminary work on hybridisation. There is also a reference to the introduction of a number of varieties from outside which includes *Krishnakattukkullu* and *Garikasannavari* of Godavari. Though these were found to do well, their grain are considered too small for local requirements. They have however been used as parents in artificial crosses.

Comparison has been made of the analysis of raw and parboiled rice, parboiling the grain before milling being the universal practice throughout the colony.

Though the occurrence of the antineuritic vitamin B is proportional to the amount of the phosphate present, the process of parboiling causes the vitamin (and a certain amount of the phosphate) to percolate into the grain and it is not removed by milling; so that not only does parboiled rice contain more phosphate than raw rice, but the vitamin content of parboiled rice is even higher than would be expected from the phosphate content.

There is also a reference to a small experiment conducted to determine the difference if any in the productive power of the different grades of grain separated from a sample according to their thickness which proved that there was no difference between the different grades. Viability tests conducted with stored grain has shown that seeds should not be sown sooner than six weeks after harvesting nor should it be stored for longer than eight months. While it is true that short duration varieties do not require any resting period as compared to the long duration ones, our experience in Madras is that the viability of the seed is more dependent on the atmospheric conditions prevailing during the storing period and on the nature of the receptacle in which the grain is stored. With perfectly dry samples stored in metallic bins the viability has remained unimpaired even after 12 months after harvest.

Section II Manurial Experiments. Single applications of super at 240 lbs. per acre and rice straw at one ton per acre are found to give significant increses in yield as compared to controls. Dressings of limestones are found to depress the yield of straw. The results of the experiments have also been made use of to determine their effect on the incidence of the desease "Man Rice" and it would appear that application of limestone increased the incidence of the disease. It has been shown that there is a definite correlation between the yield from the unmanured plot and the yield obtained on manuring, and it would seem possible to predict the increase due to manuring by examining the yield of the control plot. The general trend of the experiments was to the effect that it was not profitable to undertake manuring any area which already gives an average yield of 2,800 lbs. per acre.

Section III. Insects Pests on Paddy. Two insects have been intensively studied, the rice weevil (*calandra*) and the white stem borer (*Scirpophaga albinella*). Investigations on the former had shown previously that relative humidities below 80% for 90 hours tend to kill the adult weevils. Incidentally it has been found necessary to measure the hardness of rice by a specially designed machine and this hardness was found correlated with relative humidity. Among the several insecticides tried against this insect only one, sodium flour silicate even in such small doses as ¼ lb. per bag of rice was found effective in keeping down the infestation. The white stem borer is considered of very minor importance as the eggs are parasitised by a minute hymenopterous insect.

Section IV. The last in the bulletin deals with the disease "Man Rice" of minor importance. This disease is stated to be closely related to, if not identical with, the more serious "foot rot" disease of Madras.

The bulletin is a useful publication and should be of interest to all those engaged in rice research.

K. R.

Correspondence.

Honey from Diseased Sorghum Plants.

Mr. K. V. Joseph writes from Tiruvalla: I happened to read an article in the September issue of the Madras Agricultural Journal about a "Sugary exudation from Sorghum". I am carrying on experiments with the rearing of honey bees. On reading Dr. Seshadri's article it occured to me whether it would not be better

to get honey bees to collect the exudation from the plants. What do you think about it? Will the plant Tella Jonna (T1) grow well in our parts here? What is the cultivation? I should like to try and see whether the idea is practicable. I should be very much obliged if you can send me some seeds of the plant and details about its cultivation; or please put me in touch with somebody who will supply me with these.

2. I have had a few years experience in the rearing of Indian bees and now I should like to rear the Italian variety. I understand that at Coimbatore you have Italian bees. Is there any way in which I could obtain a colony?

Dr. T. V. Ramakrishna Ayyar, Government Entomologist answers the above queries as follows:— Bees occasionally do collect exudation from plants and even the sugary secretions from other insects but the honey so collected is not found to be of good quality and compares unfavourably with that collected from fresh honey yielding flowers. The sugary exudation of cholam is a sort of malady not generally found in healthy plants. I would certainly not advise him to carry on Bee-keeping with such abnormal and diseased secretions, as bee pasturage. He might as well feed them on jaggery water or syrup and try to get good honey.

2. We will not advise him to get the Italian bee since that bee is susceptible to some bad diseases. For further particulars regarding Bee-keeping he can apply to us.

Crop and Trade Reports.

Government Crop—Madras—1934—First Report. The area sown with the summer or irrigated crop of groundnut during the three months of January to March 1934 is estimated at 41,800 acres as against 49,200 acres for the corresponding period of last year, a decrease of 15 per cent. The reduction in area is due to the fall in the price of groundnut.

2. The figures by districts are given below:—

District.	Estimate of area sown with irrigated groundnut from January to March.		Increase (plus) or decrease(−)(1) of the area in column (2) as compared with the area in column (3).
	1934	1933	
1	2	3	4
	Acres.	Acres.	Acres.
Anantapur	200	200	Nil
Cuddapah	4,000	4,000	Nil
Nellore	200	100	+ 100
Chingleput	3,500	3,000	+ 500
South Arcot	20,000	25,000	— 5,000
Chittoor	5,000	6,500	— 1,500
North Arcot	1,000	2,000	— 1,000
Trichinopoly	800	1,000	— 200
Tanjore	4,800	4,800	Nil
Madura	2,000	2,000	Nil
Ramnad	300	600	— 300
Total.	41,800	49,200	— 7,400

3. The wholesale price of groundnut per imperial maund of 82-2/7 lb. as reported from important market centres towards the close of March was Rs. 2—14—0 in Vizagapatam, Rs. 2—10—0 in Vizianagaram, Rs. 2-8—0 in Guntur and ranged from Rs. 2 to Rs. 2—6—0 in the other centres.

Gingelly Crop—Madras—1933-34. Fourth or final report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1931—32 represents 12·3 per cent of the total area under gingelly in India.

2. The area sown with gingelly up to the 25th March 1934 is estimated at 848,500 acres. When compared with the area of 806,400 acres estimated for the corresponding period of last year, it reveals an increase of 5·2 per cent. This year's estimate also reveals an increase of 1·5 per cent over the finally recorded area of 835,819 acres last year. Last year's estimate fell short of the actual area by 3·5 per cent.

3. 240,500 acres have been reported as sown since the previous forecast report was issued in January, as against 171,900 acres during the same period last year. These late sowings were mainly on wet lands in the Circars. South Arcot and the South where gingelly was raised as a second crop after paddy.

4. As compared with the actual area sown last year, there has been a decrease in area except in the Circars, Kurnool, South Arcot, Trichinopoly, Tanjore, Ramnad and Tinnevelly.

5. The yield has been below normal except in Vizagapatam, Kistna, Kurnool, Cuddapah, Ramnad, Tinnevelly and South Kanara where it has been normal or slightly above normal. The condition of the late sown crop is generally fair.

The seasonal factor for the Presidency works out to 92 per cent of the average as against 100 per cent according to the season and crop report of last year. On this basis the yield is estimated at 106, 900 tons as against 112,230 tons in the previous year and an average yield of 107,570 tons.

College News & Notes.

Students' Corner. With the University examination under the Old and the New Regulations in full swing, athletic activities were not in evidence during the month. The first and the second year students finished their examinations on the 10th and 17th respectively, and with their departure for the vacation, life in the hostel has become very much less active. On Friday the 6th of April, a Farewell to the third year students was arranged under the auspices of the Union, when, Rao Bahadur M R. Ramaswami Sivan. Retired Principal, presided. Mr. R. C. Broadfoot, Mr. G. N. Rangaswamy Ayyangar, Dr. T. V. Ramakrishna Iyer, Mr. V. Ramanatha Iyer, Rao Bahadur C. Tadulingam, and Mr. M. R. Balakrishnan, spoke on the occasion wishing the out-going students all success in life, and appealing to them to keep in touch with the Union and with the Journal. Mr. C. Balasubramanian responded suitably, on behalf of the students.

Public Lecture :— Under the auspices of the M. A. S. U., Mr. Ebrahim Madhavi, an Officer of the Department of Agriculture, Persia, gave a very interesting talk on "Certain aspects of Persian Agriculture", Rao Bahadur, B. Viswanath presided on the occasion.

Visitors. As external examiners for the several subjects, the following gentlemen visited the estate during the month :— Rao Bahadur D. L. Sahasrabuddhe (Chemistry), Mr. J. S. Pinto (Engineering), Mr. M. R. V. Panikkar (Veterinary), Rao Bahadur, C. Tadulingam (Botany) and Rao Bahadur M. R. Ramaswami Sivan (Chairman). In addition to the above, the following resident officers were also external examiners :— Messers D. G. Munro and V. Ramanatha Ayyar, (Agriculture), Dr. T V. Ramakrishna Iyer (Zoology) and Rao Bahadur B. Viswanath, (Chemistry). The internal examiners for this year were, Messers V. Muthuswamy Iyer, and S. Narayaniah (Agriculture), Messers P. S. Jeevan Rao, and S. N.

Chandrasekara Iyer (Botany), Messers H. Shiva Rao and M. Rajagopala Iyer (Chemistry), Messers M. C. Cherian and P. N. Krishna Iyer (Zoology), Mr. B. M. Laksmipathy (Engineering) and Mr. G. Krishnaswamy Mudaliar (Veterinary).

Mr. K. Gopalakrishna Raju, Headquarters, Deputy Director of Agriculture, Madras, camped at the estate for a few days in the early part of the month.

Radha Kalyanam. The celebration came off with the usual enthusiasm on Sunday the 25th of March, the Scouts erecting the *Pandal* and rendering service for the function.

Weather Review (MARCH—1934)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	0·3	−0·2	0·3	South	Negapatam	0·0	−0·4	7·7
	Berhampore *	0·0	−0·5	0·0		Aduthurai *	1·1	−0·2	6·3
	Calingapatam	0·0	−0·4	0·0		Madura	1·1	+0·6	4·3
	Vizagapatam	0·0	−0·3	0·0		Pamban	0·0	−0·5	10·6
	Anakapalli *	0·0	...	0·0		Koilpatti *	2·0	+1·2	7·1
	Samalkota *	0·0	−0·4	0·0		Palamkottah	2·5	+1·6	9·2
	Cocanada	0·0	−0·5	0·0					
	Maruteru *	0·0	...	0·0					
	Masulipatam	0·0	−0·3	0·0	West	Trivandrum	2·5	+0·9	6·9
	Guntur *	0·0	...	0·0	Coast	Cochin	3·5	+1·6	6·2
						Pattambi *	1·3	+0·9	3·5
Ceded Dists.	Kurnool	0·0	−0·2	0·0		Calicut	0·0	−0·4	0·4
	Nandyal *	0·0	...	0·0		Taliparamba *	0·0	...	2·3
	Hagari *	0·0	...	0·0		Kasargode *	1·1	+0·5	2·8
	Bellary	0·0	−0·2	0·0		Nileshwar *	0·0	...	0·0
	Cuddapah	0·0	−0·2	0·0		Mangalore	0·0	−0·1	1·2
	Anantapur	0·0	...	0·0					
Carnatic	Nellore	0·0	−0·2	0·9	Mysore	Chitaldrug	0·0	−0·2	0·1
	Madras	0·0	−0·1	2·1	and	Bangalore	0·3	−0·2	0·6
	Cuddalore	0·0	−0·2	1·8	Coorg	Mysore	0·1	−0·2	1·2
	Palur *	0·0	−0·8	1·9		Mercara	0·1	−0·6	0·3
	Palakuppam *	0·0	−1·8	3·7					
Central	Vellore	0·0	−0·2	2·6	Hills.	Kodaikanal	1·1	−0·9	15·1
	Salem	0·0	−0·5	1·3		Coonoor	0·3	...	12·6
	Coimbatore	0·0	−0·5	1·7		Kallar *	2·8	+0·7	10·3
	Coimbatore Res. Inst. *	0·0	...	1·6		Ootacamund *	0·4	−0·2	6·3
	Trichinopoly	0·0	−0·4	5·2		Nanjanad *	0·5	−0·3	5·1
	Hosur cattle farm *	0·0	...	1.5					

* Meteorological Stations of the Agricultural Department.

Summary of General Weather Conditions. Throughout the Peninsula dry weather prevailed during the month except for a few thundershowers which occurred after the middle of the month in Malabar and South-east Madras. With the cessation of these showers once again the weather became dry.

But the weather conditions in the Frontier, in North India and in parts of Central India were largely influenced by the frequent western disturbances which occurred several times in the month.

The first disturbance caused local rains in Baluchistan, West Central Provinces, South-west Punjab and nearly general thunderstorms and widespread light showers in the plains of North-west India to the United Provinces till the 6th. Later it lay as a low pressure area over South-west Punjab on the 7th and filled up there on the 8th after causing widespread rain and thunderstorms in the plains.

The second disturbance which insurated on the 7th developed into a depression over North Baluchistan on the 8th and passed away eastwards through Kashmir on the 10th after causing nearly general rain or snow in its course. The third western disturbance commenced on the 17th with a rise of temperature along the North-west Frontier and lay as a low pressure area over Baluchistan and Sind on the 18th and filled up on the 19th after a few scattered dust and thunderstorms in that region. Thereafter fairly widespread thundershowers occurred in the N—W Frontier Province on the 19th and 20th and scattered thunderstorms in Lower Sind on the 19th, in Gujerat on the 19th and 20th and the North Punjab, North Baluchistan and West Rajputana on the 21st. The fourth disturbance started on the 24th and passed away eastwards with light showers or snow in the Frontier and Kashmir.

The fifth and the last one for the month caused clouds along the N—W Frontier and Kashmir on the 28th and lay as a depression over Baluchistan on the 29th and filled up on the 30th after a few falls of rain in the region of its activity.

In the Peninsula the humidity continued to be below normal for the major portion of the month being in excess in parts of Malabar and Mysore soon after the receipt of thundershowers. Maximum temperature was normal for the month except for slight fluctuations recorded during the second week. The minimum was below normal in the first week, which returned to normal with the approach of the second week and continued to be so over the rest of the month.

The rainfall was in defect throughout the Presidency except in parts of Malabar and South east Madras where the rainfall has been slightly in excess due to thundershowers which occurred during the month.

Weather Report of the Research Institute Observatory:

Report No. 3/34.

Absolute Maximum in shade	101·5°F.
Absolute Minimum in shade	58°F.
Mean Maximum in shade	95°F.
Mean Minimum in shade	68·6°F.
Total Rainfall	Nil.
Mean daily wind velocity	2·5 M. P. H.
Mean 8 hours wind velocity	2·5 M. P. H.
Mean humidity at 8 hours	71%.
Total hours of bright sunshine	287·3 Hrs.
Mean daily hours of bright sunshine	9·3 Hrs.

Summary of weather conditions. The pressure distribution was normal for the month except for slight departures observed for a day or two during the second week. The maximum temperature gradually rose from 93·5° f. to 101·5° f. during the month and the latter was attained on the 30th; whereas the minimum rose from 58° f. to 78° f. during the second week. The mean humidity was slightly in excess, the mean maximum and minimum being normal for the month. On the days of highest maximum and lowest minimum, the humidity was the lowest viz. 54%. Except for a slight drizzle on the 13th, the weather remained hot and sultry throughout the month.

C. V. R. & T. S. L.