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Editorial.

Soil Conservation. Soil conservation was one of the subjects discussed by the Board of Agriculture at its meeting held at Delhi in March last year. The Board, while approving of the progress made in the provinces since their consideration of this topic in 1916, recommended that greater attention should be paid to the practical application of the knowledge already gained and that works similar to those tried in Bombay should be commenced in other provinces. We find in the note sent by the Deputy Director, Southern division, Bombay, to the Board on the experiences gained there that the Agricultural department appointed at first a graduate assistant and later on two bunding officers to design embankments and waste weirs, to advise the cultivators with regard to their location and construction and also to help them in the securing of the *takavi* loans from the District collectors. We are sorry to notice however that the beneficial effects which these officers brought about came to a stand-still when their posts were retrenched on grounds of financial stringency and when the interest on the loans was also increased to 8·3%. While even such small lines of work are being stopped as a result of retrenchment in India, we find other coutries like the United States of America, Japan, Italy, Java and even the much war-disturbed China,

recognise the importance of soil erosion and the associated problems to the nation and are taking concentrated action on a wide front. An action like the one on the part of the Bombay Government would make one believe that there is perhaps not much need or scope for the adoption of preventive measures in this country. That this is not so is apparent from a few instances given below.

The silting of tanks classified in the Government accounts as first class sources of irrigation and yet unable to supply water for the prescribed period, the choking up of important and costly dams, the general rise in the beds of rivers with the loss of many of their valuable spring channels, and the conversion of fertile lands into mere sandy flats are some of the results of soil erosion. We may also add that the frequent cry now raised by the cultivator that their crop-yields have declined considerably is to a certain extent a consequence of the perpetual drain on their most valuable capital—soil—which cannot be replaced by any system of cultivation or manuring. We, therefore, consider that the recommendations of the Board of Agriculture have come none too early in the day.

In Madras, the problem of soil erosion and conservation has, until very recently, received little consideration. The more destructive and insidious sheet erosion is allowed to work havoc especially in the vast black soil regions. Owing to the general depression and the consequent increase in the debts, many of the land-owning cultivators have perforce been changed into tenants with the result that their interest in the land has abated considerably. The new land-lords, being mostly absentee owners, not only do not recognise the fact that their newly acquired assets are being undermined but also go on changing the tenants every year without paying any attention to the maintenance of soil fertility. We are afraid that unless early steps are taken to control this evil, many a field which is now cropped may have to go out of cultivation. We are inclined to believe that some of the items of improvements recommended by the agricultural department particularly the advocacy of summer ploughing of the lands stand the risk of losing their value without the concomittant problem of soil erosion being tackled simultaneously.

To us it appears, therefore, essential that no time should be lost to warn the cultivator of this silent enemy and to help him in all ways to fight it by the timely adoption of suitable preventive methods. If necessary the agricultural department may be armed in view of the importance of the problem in a number of tracts with adequate legislative measures to bring recalcitrant ryots into line with others. Even in a democratic country like the United States of America a soil conservation service was brought into existence in 1933 as a temporary measure which was made permanent by an act in 1935. This body has been empowered to conduct surveys and researches, to carry out

preventive measures, to co-operate or enter ito agreements with, or to furnish financial aid to, any agency, government or otherwise, and to purchase rights or lands if necessary for the proper functioning of the act. It is reported that as a result of establishment of this agency many thousands of acres of abandoned or about to be abandoned lands have been brought back to cultivation.

We would suggest that the subject of soil conservation may be placed in the fore-front in the agenda of work of the newly constituted district economic councils, and district agricultural associations in tracts where the problem is acute. Ways and means can be sought gradually to bring into action the results of experiences gained in other provinces as well as those obtained from the experiments that have been going on at the dry farming station, Hagari. We venture to suggest that the subject of soil conservation will be a suitable one to receive a moiety of the fifteen lacs of rupees now allotted to this province for the rural development by the Government of India. We also feel that the present moment when plenty of money is lying idle in the banks and when huge Government loans are over-subscribed in a few minutes, can be taken advantage of to float a loan at a low rate of interest to re-inforce the slender resources of the back-bone of the nation -the ryots—for purposes which are certain to return decent profits in the long run both to the creditor and the borrower. Incidentally any special works undertaken in this connection might not only go to relieve unemployment to a certain extent but also facilitate monetary expansion. Concurrently the existing rules of the land improvement act may be examined whether they can be modified to suit the measures undertaken towards soil conservation. The villagers will have to be first educated by means of posters and leaflets and convinced of the necessity of their co-operation and earnest joint action in the matter.

This problem of soil conservation will also be a fit subject for the joint action of the Engineering and Agricultural departments to start experiments for the determination of cheap and efficient methods of control suited to the various tracts. We are glad to note in this connection that some action along these lines has already been taken by the agricultural department in the Bellary district (vide an article in last November issue of our journal). We confidently hope that similar steps will be taken in other districts like North Arcot, South Arcot, Salem, Tinnevelly, Guntur, Kurnool, and Nilgiris, where the problem is equally serious.

AGRICULTURAL PROPAGANDA.

BY

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Introduction. Of all the provinces in India, Madras is mainly agricultural. The total population of the Madras Presidency is estimated at 48·64 millions in 1935 of which 71 % live by agriculture. An analysis of the population living by agriculture reveals that 43 % form agricultural labourers, 39 % cultivating owners, 12 % cultivating tenants, 3½ % non-cultivating owners and 1½ % non-cultivating tenants.

The total area under cultivation is about 34 million acres which works out to less than 0·75 of an acre per head of population. Thus the pressure of population on the soil is very great. It has increased since 1914—15 when it was estimated to be just under 1 acre per head.

This large population depending on agriculture is scattered over innumerable villages, the majority of which are accessible only to slow moving country carts even in the best of weather conditions. When rains set in, a still greater number become inaccessible to all except pedestrians.

The villagers themselves are poor, uneducated, ignorant, superstitious, heavily indebted and with a low standard of life. The enervating climate, the treacherous seasons, the social and religious customs, the scattered, sub-divided and uneconomic holdings, lack of capital and the poor cattle, all tend to retard the development of agriculture in the country and make it a losing business concern.

Of late the ryot is awakening to a sense of his position. This is the silver lining to the clouded sky ; for, this will lead to his redemption in a measurable distance of time.

It is to bring the resources of science to bear upon agricultural problems and spread the knowledge obtained thereby to the ryots and thus better their lot, that agricultural departments were established in India. Prior to 1905 there were no organised attempts at agricultural improvements by Government. Since then they are increasingly recognising their responsibilities in the matter and are taking steps to discharge them.

Greater and greater attention is being paid to agricultural research. Without research, agricultural development will be at a stand-still. When research attains a certain stage, propaganda should be simultaneously carried on to spread that knowledge to the farmers. Propaganda forms therefore a complement to agricultural research; without propaganda, research will be of little use.

In the early days of the department when there were only a few workers and research was just in its infancy, there was not

much scope for propaganda. The work of the department as described by Mr. James Mackenna may be summarised as follows:—

"The Problem which the department sets itself is the improvement of Indian agriculture. The basis of all progress is research. The results of research are then tested on a field scale. When the experiment is proved, the stage of demonstration is reached. All the experimental work must be done by the Department and its results offered for application in a cheap and simple way.

It is obvious that if results of a practical value are to be obtained the agricultural worker must have a thorough knowledge of Indian Agriculture and sympathetic feeling towards the people. Above all he must *go slow*".

He realised that "to influence to any extent the vast agriculture some arrangement must be devised to deal with large bodies of cultivators as it is an economy of time to deal with a group of people rather than to deal with single individuals". He expected this to be carried out through the simultaneous development of the Co-operative movement.

After the lapse of more than 2 decades most of these expectations remain yet to be realised. After all these years of travail, even the credit movement, which is considered to have succeeded most, has not touched more than 6% of the population.

We have now come to a stage when we have some data which will help the farmer if he is made to understand them and induced to take them up. We have tried our best to make the fullest use of the co-operative movement to do our propaganda work. Standing on this same platform nearly a decade ago, I narrated how my attempts to induce members of co-operative credit societies to adopt improved methods of agriculture failed and how I started special co-operative societies with the object of spreading improved methods of agriculture and explained the progrees then made by them. I then expected them to progress considerably better than they have done so far and hoped to start and run successfully more such societies. The unfavourable season for a number of years, the economic depression and above all want of incentive stood in the way of further development along that line.

To overcome these difficulties I started village, firka, taluk and district agricultural associations. Many of these are now moribund. They do not rest on self-help. Hence they do not function if the demonstrator is unable to look after every detail of their working. The intensive drive of mass propaganda inaugurated by our former director, Mr. S. V. Ramamurthy gives the demonstrators no time now to attend to such details of work. I am yet to hear that any similar movement has succeeded anywhere on a large scale in this Presidency.

Under such circumstances the traditional method of tackling individual ryots by the Department is more the rule than the exception. This is very laborious and still is in the nature of ploughing the sands. As one who has himself been a demonstrator, I know the difficulties experienced in carrying on the work along the present lines. The demonstrator with great difficulty has to pitch upon a few

ryots in a village to try the improvements recommended by the Department. When he visits the village next he hears that one of them has gone to a neighbouring village, the whereabouts of another are not known, a third is busy otherwise and so on and so forth. A few go on eternally discussing the improvements suggested, but never agree to work out even one of them practically for trial. Hours, days and months are thus spent by the demonstrator without any appreciable effect. I often doubt if even centuries of ill directed efforts like these will ever bring about the desired improvements. The concentration method adopted during recent years which has prevented the demonstrator from wandering aimlessly through-out his jurisdiction is just a step further in the right direction; but it will not take us far. Attending 8 to 10 centres involving 40 to 50 villages is a task beyond the capacity of a single demonstrator. In deltaic areas and on the banks of rivers the villages are close together and their total area is small, while in other tracts the villages are far apart and large areas have to be dealt with. This is due to the fact that Government has based the size of villages and taluks on the amount of revenue fetched by them. In such cases it is desirable that, in addition to the demonstrator at the taluk head quarters, every Deputy Tahsildar's division is provided with an additional demonstrator, and each demonstrator is assisted by an adequate staff of maistries. Above all, there should be some organised bodies to help the demonstrator in his propaganda work.

A former Director of Agriculture in France pointed out the difficulty of dealing with individual farmers in the following words:—

"It is impossible for a Government to influence millions of petty peasants; they are individually too isolated, too suspicious, too shy to accept new ideas to undertake experiments in new methods; similarly they are too poor, too powerless to produce the best products to get better of the middlemen, and the best of the markets".

He pointed out that "there must be some organisation which enables Government to act upon a body of men at once and to serve as intermediary between the Government and the individual. An organisation which can be advised, educated, reasoned with, and listened to, and which will discuss together the suggestions of authority and will through its better educated and bolder members—provide intelligence to absorb new ideas, find courage and funds to attempt new methods and combine both for the improvement of products and for the better sale of the same."

Realising as we do the serious drawbacks of dealing with individual ryots it is incumbent upon us to discover fresh avenues which will result in leading us to better success.

A study of the methods successfully adopted by other people placed under similar circumstances may perhaps give us clues for solving our own problems; for human nature is the same all the world over.

The Japanese for example have solved their agricultural problem by imparting education, both general and agricultural, and also by the

establishment of various types of agricultural associations. In his note on agriculture in Japan, Sir F. A. Nicholson observes, that "the development of general education has been at the root of much of the national progress and has affected and will in the near future most powerfully affect the progress both of the technique of agriculture and the agriculturist."

Higher Elementary schools with an agricultural bias, supplementary schools to supplement the work of the elementary schools, regular agricultural schools of lower and higher grades and agricultural Colleges lead the boys from one stage to another according to their capacity, wealth etc. There are thousands of such institutions spread throughout the length and breadth of the country and thousands of pupils are trained in them.

Writing about agricultural associations the same author observed—"these are among the most remarkable evidences and are becoming most powerful instruments of agricultural progress in the country. Practically the whole agricultural population of Japan is united in various forms of associations; probably there is no country in the world, not even Germany, where the associations have taken such hold and are beginning to exert such influence".

All these were prior to 1906. During the succeeding three decades the great strides made by this country in developing its agriculture, have converted it from a food importing country to a food exporting country, in spite of the rapid increase in its population.

The Rural Districts of Denmark as late as 1880—90 had been in a bad way and the people were leaving the country parts for the towns. At the present time all authorities bear witness to the general well-being and contentment of rural Denmark. A three fold development was at the root of the progress—(1) economic reforms, (2) machinery for rural development and (3) technical advance on scientific lines. The economic reforms have been conducive to the formation and maintenance of small farms and state laws have been in the interests of the small farmers who now form their country's pride. The machinery for rural development consists of arrangements for rural and agricultural education and co-operation. Both agricultural schools and co-operative societies were started as private ventures. Scientific dairying has been fully developed on modern lines.

Coming nearer home to the premier state of Mysore it may be noted that it passed a village Panchayat Act during 1926 and gave effect to it in 1927. "The Act recognized the backwardness and the diseased state of social conditions in rural areas and felt that unless some external support and schooling were given, the Village Panchayat may not come to possess local foundations at all". Now the Village Panchayats have some obligatory functions like village communication, sanitation and also certain discretionary duties such as vaccination

economic improvement and delegated duties including the control of the village-forests, tanks, and local religious institutions. The responsibility of supervising the working of the Panchayats is vested in the executive head of the district who is assisted by Inspectors of Panchayats, and the whole system is co-ordinated and controlled by the Registrar of Panchayats.

From a recent notification of the Government of Mysore which appeared in the Hindu of May 12th, it is found that an intensive programme of Rural Re-construction is being taken up through the Village Panchayats. More than 11,000 Village Panchayats have been constituted to administer local affairs in rural areas. The progress achieved during the 9 years the act has worked, is remarkable. More than 30 per cent of the Panchayats are said to function very efficiently.

The Government Order states that "it is felt, however, that the time has arrived to make more intensive efforts in at least some selected villages, of each district so that these villages may eventually serve as examples of good Panchayat administration which less advanced ones may be induced to follow ".

" At the same time it is desirable that the Development Departments concerned with rural welfare should also concentrate on propaganda and administration work in the selected villages so far as they can be done without prejudice to their normal activities. This will not only help the officers of these departments to aim at and achieve speedy and tangible results in definite areas, but will also enlarge the scope of the work of the Panchayats ".

With the above object in view, the Government have issued the following instructions:—

"(1) In each Revenue sub-division about 8 or 10 villages should be selected for special attention by the officers of the Revenue and other Departments namely Education, Health, Agriculture, Industries and Commerce and Co-operation; (2) only those villages need be selected in which Panchayats possess adequate income and are working fairly satisfactorily : (3) the items of work to be adopted should be clear in each case with reference to the needs of the locality, the facilities already existing therein and the funds available for the purpose.

The development of selected villages will be a special responsibility of the head of the district, subject to the instructions of the Revenue Commissioner and the Government and the advice of the Development Departments concerned. In order to assist the Deputy Commissioner in the work, an advisory committee consisting of the Revenue Sub-divisional Officer (as organiser and convenor) and the local officer of the several development departments in the district may be constituted. The members of the Committee will arrange to tour the villages once a quarter and review the progress of work made and settle the lines of future work.

The subjects for special study in the selected villages will be among others (a) raising the standard of Village Panchayats administration (b) propaganda of better farming methods including the supply of good seed (c) rural credit and (d) marketing of commercial crops ".

I have quoted this at some length as I want to suggest the adoption of a similar method, modified if necessary to suit our conditions, to gain our ends.

The object of the Department should be to gradually shift the work of Agricultural Development from the shoulders of Government to those of the people themselves, recognising that it is not that which is done for the people but that which is done by the people that is truly beneficial and that real progress can come only from within; this transference of work is impossible unless there are popular bodies to take up the work.

These popular bodies may be Agricultural Associations as in the case of Japan. Co-operative Societies as in the case of Denmark or Village Panchayats as contemplated in Mysore. As the former two have not succeeded so far in spite of the best attempts of the Department, statutory bodies like the Village Panchayats may be brought into existence in large numbers throughout the length and breadth of the country.

We have our own Village Panchayats in the Madras Presidency but fresh life should be infused into them and they should be established in every village as quickly as possible. Their duties and responsibilities should be widened according to their capacity to bear the burden. At present their duties are confined to improve the Village sanitation, health and education. It would appear that no serious attempt has been made to introduce Agricultural improvements in the functions of the Village Panchayats. Unless the material prosperity of a village is improved, the realisation of other improvements, sanitation, and health is bound to be very slow. The primary source for the material prosperity is increased out-turn from land, and this can be obtained through the adoption of improved methods of agriculture. Therefore the rapid spread of agricultural improvements should be the statutory obligation of Village Panchayats.

The time seems to be propitious. There is a very large mass of educated unemployed who can be pressed into the service of these Panchayats on nominal salaries. Knowing as we do the competition existing among them even for posts of attendars there need not be any apprehension with regard to securing their talents at a price the country can afford to pay at present for the purpose. The cheap and healthy village life and the opportunity of being pioneers in the line will induce them to work whole-heartedly any scheme launched by Government to gain the end in view.

To secure the Co-operation of the villagers themselves in the working of any scheme that may be launched, some element of compulsion may be necessary.

As one Indian Economist observes "a truth of supreme importance which all should bear in mind at the present moment is that no Government in India can give any effective help for the betterment of rural conditions by measures which do not contemplate the co-operation of villagers themselves. Another truth of equal importance is that at present the individualistic spirit which has basked under the British flag for decades together will not permit even the out-of-the-way villager to heartily co-operate with Government agencies in rebuilding rural structures."

An enlightened Government must force at some stage the unwilling patient to swallow the (bitter) pill. In India co-operation by the people in rural economic development must be made compulsory by law.

"In numerous directions we want improvements. Government alone cannot hope to bring them about; people by themselves, have no means, no enlightenment, no eagerness for the common good. To bring about consolidation of farms, redemption of agricultural land from oppressive debt, freedom from unemployment and scarcity of labour and many other economic reforms, the British Indian Legislatures and the authorities in Indian States must have recourse to compulsion as the timely expedient; there is no other method of belling the cat.

We have now a sympathetic agricultural Viceroy who is all for action. The Central Government's rural grants have been increased and we expect it to become a regular feature in years yet to come. The whole of thinking India is interested in rural development. Our educational system and programme are about to be reorganised. It is said that the Central Government is in consultation with the Local Governments about the appointment of an expert committee to go into the whole question of educational reform. It is hoped that realising the position and importance of agriculture to the country, a definite bias will be given to agriculture at every stage in the curriculum; and not be content with having rural education, general and agricultural education, technical.

We are about to enter the stage of Provincial Autonomy with prospects of having Federation at the top of it within a few years. Without the reform of the man at the plough brought about by the initiative and co-operation of Village Panchayats and liberal support of the Government, the new era may yet see us far away from the millenium which it is expected to usher in.

Soils, rainfall, and agricultural practices vary widely from district to district and often between different places in the same district. In

order to increase the opportunities for research, to enable science to solve the peculiar agricultural problems of each district and to act as the local store house of all agricultural development and propaganda, it is essential that there should be one or more of Agricultural Farms in each district. Such farms may be run wherever practicable by the local Village Panchayats, Co-operative Societies or Agricultural Associations.

The possibilities of carrying home the latest developments in agriculture to the minds of young and old through movies and talkies should be explored and utilised.

In carrying on Agricultural propaganda one cannot afford to neglect the new vista of development opened up by broadcasting. Western countries true to their traditions have already made rapid strides in this line. Already some of our sister provinces like the Punjab are leading in this matter. When the Village Panchayats come to function all over the Presidency broadcasting will have to be increasingly resorted to, to educate the ryot.

SORGHUM FOR POPPING.

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Sorghum, *cholam* (Tam) or *jonna* (Tel.), is one of the staple food grains of the poor and backward classes in the presidency. One of the ways in which sorghum grain can be used as a food or delicacy both by the poor and by the rich is by converting it into pops. Pops (or puffed grains) are obtained by subjecting sorghum grains to sudden heat.

Popping is done by putting small quantities of grain on a hot pan kept over a steady fire. For popping large quantities mud pots are generally used, while for small quantities, small iron pans are found to be suitable. To get uniformly good pops the grains should be a layer thick at the bottom of the pan. To ensure the proper heating of all the grains they should be briskly stirred. A small brush made out of the midribs of the coconut leaf serves this purpose well.

As the grain gets heated by contact with the hot pan it swells slightly and a longitudinal crack is developed on the bulging endosperm of the grain. This crack widens, and irregular cracks are formed cross-wise and the white endosperm is thus exposed. The grain expands into a chalky white puff, which is usually hemispherical in shape with bits of the everted seed coat sticking to its bottom. A pop may be likened to a tiny cauliflower in general appearance. When the cracking is not regular, the pops assume various shapes ; some expand

lengthwise, while others expand breadthwise, thus giving rise to long narrow pops. The various stages leading to the ideal pop are presented in Fig. 1. Except the loss of vitality, the tiny embryo remains undisturbed in popping. Beyond being rent up in the process of popping, the seed coat remains structurally not much altered. The colour of the pericarp is also not affected. When coloured grains are popped the colour persists in the bits of adhering seed coat and is set off by the prominent white background on which they appear.

In maize the varieties suitable for popping go under a group called pop corns. In sorghum there is no such group or varietal name indicating suitability for popping as such. Trials were, therefore, made with different varieties and the results are given below. Table I gives the varieties in which good pops were obtained. Table II gives the list of varieties that do not pop and evert. They merely swell and crack.

Table I.

Sorghum Roxburghii var. *hians* Stapf.

No.	Varietal Name.	Place.	Grain colour.	Popping Expansion—With evertion.
M. S. 2265	Konda jonna	East Godavary Dt.	Red	X 17
A. S. 667	Muthyala jonnalu	Hindupur	White Pearly.	13
A. S. 1947	Selection from a cross		Brown	13
A. S. 668	Alankara cholam	Palakuppam	White Chalky	12
A. S. 572	Pedda jonna	Rajamundry	,, ,,	11½
A. S. 1899	Selection from a cross		,, Pearly	9½
A. S. 468	Pallaki jola	Kollegal	,, ,,	9
M. S. 1764	Alankara cholam	North Arcot	,, Chalky	9
A. S. 403	Talai virichan cholam	Goundanpalayam (Coimbatore)	,, ,,	9
A. S. 679	Jonna	Parlakimedi	,, Pearly	8½
A. S. 1093	Singara cholam	Nagari (Chittoor)	,, Chalky	8
A. S. 1006	Khed jonna	Nowrangpur (Vizagapatam Agency)	,, ,,	8
A. S. 1055	Talai virichan cholam	Palladam	,, Pearly	8
A. S. 1086	Kaka cholam	Dharmapuri (Salem)	,, Chalky	7½
M. S. 1755	Alankara cholam	Tiruvannamalai	,, ,,	7½
A. S. 566	Pedda jonna	Berhampur	,, ,,	7½
A. S. 1902	Selection from a cross		,, ,,	7
A. S. 678	Jonna	Hiramandalam (Ganjam)	,, Pearly	6½
M. S. 1793	Kaka cholam	Gudiyatam	,, ,,	6
A. S. 1090	Talai virichan cholam	Katpadi	,, Chalky	6
M. S. 1797	Alankara cholam	Vellore	,, ,,	6
A. S. 1008	Khed jonna	Nowrangpur	Brown	6
M. S. 1563/c.	Sitamma jonna	Madanapalle	White Pearly	5½
A. S. 2160	Selction from a cross		,, Chalky	5½
M. S. 1760	Singara cholam	Tiruttani	,, Pearly	5
A. S. 1995	Selection from a cross		Red	5

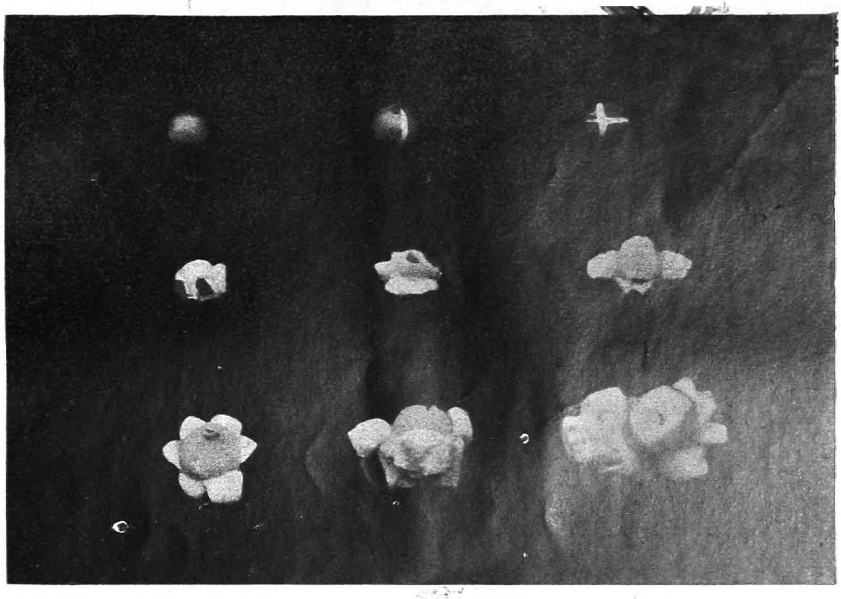

Fig. 1. STAGES IN POPPING

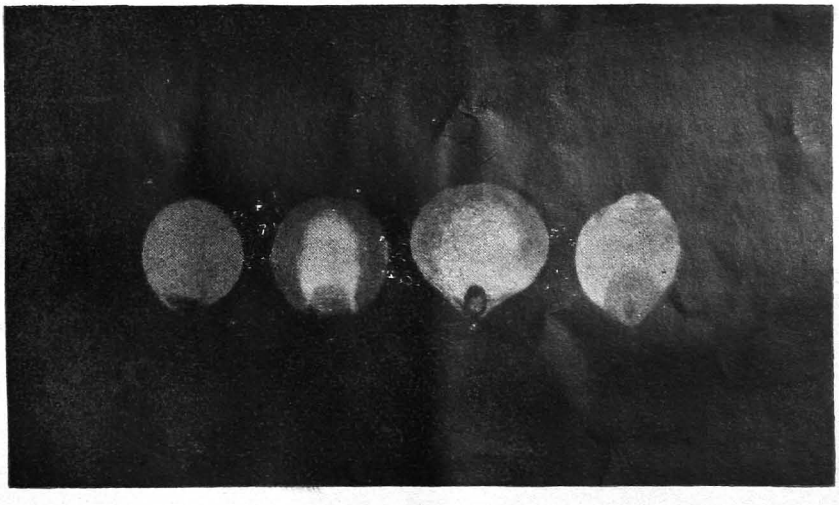

Fig. 2. CORNEOUS TO FLOURY ENDOSPERM

Table II.

Durra group.

No.	Varietal Name.	Place.	Grain colour.	Swelling & cracking—without evertion.
Sorghum Durra Stapf				
T-6	Patcha jonna	Nandyal	Yellow	X 4
A. S. 29	Peria manjal cholam	Coimbatore	,,	3½
A. S. 1098	do.	,,	,,	3
M. S. 1689	Makkattai cholam	Salem	Pink	2½
M. S. 1690	do.	South Arcot	,,	2½
Sorghum subglabrescens Schweinf. et Aschers.				
A. S. 792	Uppam cholam	Coimbatore	White chalky	3½
A. S. 190	Peria vellai cholam	,,	,, ,,	3
A. S. 189	do.	,,	,, ,,	2½
A. S. 127	Sen cholam	,,	Red	2½
A. S. 131	do	,,	,,	2½
A. S. 818	Chinna manjal cholam	,,	Yellow	2½
A. S. 378	Uppu vellai	Jellipatti (Coimbatore)	White chalky	2½
A. S. 389	Sen choalm	Kodaikanal Road	Red	2½
A, S. 841	do	Erode ,,	,,	2½
A. S. 727	Chitrai vellai cholam,	Coimbatore	White chalky	2½
A. S. 723	do	,,	,, ,,	2
A. S. 732	do	,,	,, ,,	2
A. S. 1151	Chinna manjal cholam	,,	Yellow	2
A. S. 367	Vellai cholam	Dindigul	White pearly	2
A. S 809	Chinna manjal cholam	Coimbatore	Yellow	1½
A. S. 1575	Selection from vellai cholam,	Salem	White chlky	1½
A. S. 2095	do	Dindigul	,, Pearly	1½
Sorghum cernuum Host				
T-12	Tella jonna	Bellary	White pearly	3
T-1	do	,,	,, ,,	2½
Sorghum dochna Snowden				
M. S. 2244	Irungu cholam	Kovilpatti	Brown	3

It will be noticed that the first group, namely *S. Roxburghii* var. *hians* (Table I.) is the group which pops best. The group is wide spread and its varieties are cultivated all over the presidency. This group has loose streaming panicles and many of the varietal names are connotative of this. This group will hereafter be referred to as the *Talai virichan* group. It is characterised by small horny grains which do not cook well. These grains are borne in glumes which gape out and leave the grain to develop and mature quite exposed in the late cold weather. The colour of the grain is mostly white. It may be pearly or chalky. Red and brown grains are rare in this group, though they also pop equally well. In Table II it will be noticed that typical grain sorghums like *Peria manjal cholam*, *Tella jonna* and *Pacha jonna* and others belonging to the big Durra group and also the *Irungu cholam* of Tinnevelly do not pop well.

Among foreign varieties tested, a sample of Guinea corn from Jamaica was found to pop very well and equalled the best local variety (*Konda jonna* of the Godavary Agency).

Of others, varieties with dimpled grains do not pop at all. In these the dimple swells and the grains become rounded. The seed coat merely cracks. Grains with waxy endosperm do not pop ; in these the grains crack and burst open but do not evert.

The varieties that pop well being thus determined, the study of popping was examined in greater detail. Grain size was examined. This was done by measuring the grains in a 20 c c. glass cylinder and counting the number in that volume. The number of grains per 20 c. c. in popping varieties is given below in their decending order.

Table III.

Popping Varieties (The *Talai virichan* group).

No.	Varietal name.	Place.	No. of grains in 20 c. c.	Popping Expansion
A. S. 1006	Khed jonna	Nowrangpur	1471	8
M. S. 1764	Alankara cholam	North Arcot	1429	9
M. S. 1755	-do-	Tiruvannamalai	1398	7½
M. S. 1793	Kaka cholam	Gudiyattam	1396	6
M. S. 1563/c	Sitamma jonna	Madanapalle	1377	5½
M. S. 1797	Alankara cholam	Vellore	1361	6
A. S. 1093	Singara cholam	Nagari	1355	8½
A. S. 2160	Selection from cross		1328	5½
A. S. 1090	Talai virichan cholam	Katpadi	1306	6
A. S. 1008	Khed jonna	Nowrangpur	1217	9½
A. S. 468	Pallaki jola	Kollegal	1124	9
A. S. 1055	Talai virichan cholam	Palladam	1087	8
A. S. 679	Jonna	Parlakimedi	1055	8½
A. S. 1086	Kaka cholam	Dharmapuri	957	7½
A. S. 678	Jonna	Ganjam	947	6½
A. S. 668	Alankara cholam	Palakuppam	937	12
A. S. 1902	Selection from a cross		918	7
A. S. 566	Pedda jonna	Berhampur	908	7½
A. S. 572	-do-	Rajahmundry	908	13½
A. S. 667	Muthyala jonnalu	Hindupur	908	13½
M. S. 2257/a	Sitamma jonna	Madanapalle	845	5½
A. S. 1899	Selection from a cross		813	9½
A. S. 403	Talai virichan cholam	Coimbatore	801	9
M. S. 2265	Konda jonna	East Godavary	709	17
M. S. 1760	Singara cholam	Tiruttani	688	5

From the above table it will be noticed that the number of grains in 20 c. c. in this *Talai virichan* group ranges from 700 to 1,400. Similar counts were taken in 30 grain sorghum varieties of the Durra group and they ranged from 400 to 800 only thereby indicating the smallness of the grain as one of the attributes of a popping variety. It may be added that the fluctuation in the grain number of the popping varieties is not keeping parallel to the fluctuation in popping

expansion thus giving a hint about the existence of factors other than mere size, determining popping quality.

The density of the grain was therefore gone into. This was determined as follows. A known weight of grain was taken in each variety. Its volume was determined by the displacement of kerosine oil in a graduated measuring cylinder. The use of the kerosine oil was to avoid the soaking of the grain which will happen if water were used. The results are given in the following Tables, IV and V.

Table IV.

Density of Popping Varieties.

No.	Density gm/cc.	Popping Expansion.
A. S. 468	1·42	X 9
M. S. 2257/a.	1·42	5½
A. S. 667	1·40	13
M. S. 1563/c.	1·40	5½
A. S. 1899	1·38	9½
A. S. 2160	1·38	5½
M. S. 1797	1·38	6
M. S. 1760	1·35	5
A. S. 668	1·33	12
A. S. 572	1·33	11½
A. S. 1090	1·33	6
A. S. 403	1·31	9
Average	1·37	

Table V.

Density of Non-popping Varieties.

No.	Density gm/cc.
A. S. 189	1·31
A. S. 1098	1·31
A. S. 29	1·29
A. S. 1575	1 29
A. S. 389	1·29
T – 1	1·27
A. S. 367	1·27
A. S. 809	1·23
A. S 732	1·20
Average	1·27

It will be seen that the popping varieties have a slightly higher density than non-popping varieties. Relatively to size, the weight of the grain of the popping varieties is greater. In popping varieties, degrees of density do not correspond to popping expansion.

A number of grains were cut open and their examination showed that the endosperm of sorghum grains may be either wholly mealy or often with a mealy centre surrounded by a corneous exterior. The amount of this corneous layer varies between varieties (Fig. 2). In the good popping ones the endosperm is entirely corneous or occasionally with a very little floury endosperm at the core. Non-popping varieties are characterised by a thin horny exterior and plenty of meal inside the grain.

In *Sorghum margaritiferum*, a group of sorghums from Africa with very small lustrous, horny grains, the popping expansion was small (x2½ to 3½). An examination of the grain sections revealed that the seed coat of this variety was thin compared to *Sorghum Roxburgii*. In *Sorghum margaritiferum* it was about 35 μ while in *Sorghum Roxburgii* var. *hians* it ranged from 70 to 125 μ. It will thus be noticed that in

addition to a horny endosperm, a thick pericarp is necessary to produce good pops.

Moisture determinations were made in eight *Talai virichan* varieties and found to be between 10 and 11 per cent. Analyses of grain and pops from a variety of *Talai virichan cholam* were kindly made by the Agricultural Chemist, who remarks, " No difference could be noticed as a result of popping in respect of (1) food values, (2) mineral values and (3) total sugars and starch contents. During popping the starch may undergo certain amount of dextrination which might make it more easily digestible ."

From the above examination it will be seen that popping varieties belong to the *Talai virichan* group of sorghums (*S. Roxburghii* var. *hians*). They are characterised by small grains with a corneous endosperm. Their seed coats are somewhat thick. Discussing the causes of the popping in maize, one of the reasons for popping is set down by Willier and Brunson* to the presence of enough moisture in the grain which when converted by heat into steam results in a violent expansion and the evertion of the endosperm. A similar cause seems to be responsible in sorghum also as the analysis of pops shows no differences other than loss of moisture.

Enquiries through District Officers into the popping of sorghum as a cottage industry show that this industry exists in isolated places, the product being consumed locally as balls mixed with jaggery, especially during fairs and festivals. It is reputed for its fine flavour and good digestive qualities. When the suitable type of grain is not available locally, the grain is imported from the Coimbatore and Cocanada areas of the presidency. There are reports of importations from Burma also. Whether this indicates a more favourable freight position, compared with local movements by rail, is a subject of investigation by the Marketting Officers.

In sorghum pops, the poor and the rich have a cheap and wholesome luxury.

Summary. Popping varieties of sorghum belong to the *Talai virichan* group (*Sorghum Roxburghii* var. *hians*). They are characterised by small grains with a corneous endosperm which is very dense. The seed coats of the grains are comparatively thick. The grains have a moisture content of about 10 per cent. In popping this moisture is converted into steam. This steam seems to find a resistance in its escape from the thick seed coat with the result that there is a sudden bursting and expansion and the packed starch grains expand with a violence, and give pops.

* Factors affecting the popping quality of Pop-corn by T. G. Willier and A. M. Brunson. Journal of Agricultural Research Vol. 35 page 615—627. 1927.

RESEARCH & PROPAGANDA WORK IN BEEKEEPING

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Insects are always regarded as man's enemies, since they devastate his crops, attack store grains, inflict injury on his live stock and above all annoy him personally. Likewise the Entomologist has been looked upon as a destroyer of these insects. But there is another side of the picture. Among insects are some which are man's friends. The predators and parasites which feed on crop pests, the weed killers like the prickly pear Cochineal, and silkworms, lac insects and honey bees from which valuable products are obtained, are all instances in point. Of these insects, the honey bees which form the subject of the present paper, besides giving us honey, also help in pollinating our plants.

In these days of economic depression there are immense possibilities for beekeeping as a side line to farming. The Madras Agricultural Department is trying to popularise beekeeping as a cottage industry. At the Apiary, started at the instance of the Director of Agriculture, research on various aspects of bee-keeping is being carried on. While in the western countries, the European bee—*Apis mellifica*—has been studied in detail, it has to be admitted that the data available on the Indian bee (*Apis indica*)—the only one of the indigenous bees which can be domesticated—is very meagre indeed. Hence the need for detailed studies of our Indian bees.

Items of Research. The main items of research carried on at the Apiary are (1) bee enemies, (2) trials of acclimatising the Hill variety of the Indian bee in the plains, (3) artificial feeding of bees, (4) queen rearing, (5) effects of shifting bee colonies, (6) bee pasturage, (7) range of flight, (8) the decrease and increase in the weight of colonies during different seasons, (9) the life history of the bees and egglaying capacity of the queen, and (10) beekeeping appliances.

1. *Enemies of Honey bees.* There are a number of enemies of the honey bee of which the *wax moth* is the most important. The ravages of this pest to honey combs are well known throughout the world. Its damage is conspicuous in Coimbatore from June to October. A few additional and interesting points in the life history and control of this insect were noted during the course of work here. The female prefers hidden and safe corners, narrow slits in the body of the hive, the cover of crushed cells in the comb etc. to lay eggs. Very often the egg-masses are found in slits which would hardly admit the slender ovipositor of the female moth. The moths need not enter the hives and

lay their eggs on the combs, since the active caterpillars, on hatching, are quite capable of finding their way to the combs. The maximum number of eggs laid by a single female in her life time was 868 and these were laid within the first three days after copulation. The egg period lasts for 8 days, the larval period for about a month and the pupal period for another 8 days.

Feeding habits of the caterpillars—The natural food of the worms appears to be only old combs with plenty of lining with "Propolis" and pollen collected and stored by bees. The caterpillars do not feed on wax, foundation combs or even newly constructed combs.

Longevity of the adults—In captivity, the male moths were found to live from 18 to 27 days with food and the females from 6 to 10 days.

Control measures—Apart from those already advocated such as frequent examination of hives and destruction of caterpillars from infested combs, keeping colonies strong, etc., a few other methods of control of this pest have been under investigation. A simple method to eliminate the worms from stored combs was found quite effective. The infested combs are exposed to the sun for a few minutes taking care to see that the temperature does not exceed 40°C. The worms being unable to bear the heat, wriggle out and collect themselves under the comb from where they could be easily picked and destroyed. The silken webbing woven by the caterpillars can be removed easily with a brush and the small holes in the combs are promptly repaired by the bees when the combs are given back to them. This simple method obviates the necessity for fumigating the infested combs with costly chemicals such as Carbon bisulphide, Sulphur, etc., as it is being done in the western countries.

From a study of the egglaying habits of the moth, a possible line of control is under investigation. It has already been mentioned that the eggmasses are usually laid in cracks and crevices in the hive body. Elimination of such defects by keeping the brood chamber super and roof in their proper positions will minimise the chances of infection. But, in spite of such precautions, eggmasses are often found laid in the narrow space between the brood chamber and the top or super. An Apiarist, having a trained eye, can easily detect the presence of these eggmasses and scrape them off but as the eggs are likely to be laid in the inaccessible and hidden crevices of the hive body the body may be changed as often as possible in cases wherever such infection is suspected.

Another bee enemy which has been studied is the bee hunter wasp (*Palarus orientalis*). This is a small wasp about 1¼ c. m. long, dark in color with transverse yellowish white stripes on the abdomen and thorax. It has recently been noted as a predator on bees at Tiruchengode, Coimbatore and Ponnani and is capable of doing considerable

damage. Since the pest has been noted for the first time in South India, attempts were made to study its life history and habits. The wasp is very active in its habits and makes underground tunnels with separate compartments to stock its prey which serves as food for its young ones. It waits near the entrance of bee colonies and being endowed with powers of quick flight it is able to snatch away bees and stock them in its underground home. Each wasp was found capable of collecting about 20 bees in a day, the time of hunting being limited to bright mornings and afternoons. Eggs are laid by the female wasp between the head and thorax of the prey; one egg being laid for each group of 4 or 5 bees in a compartment. The grub hatches out on the second day and begins to feed on the food provided by its parent. The grub is able to feed on all the bees in about 5 days by which time it attains its full growth. The pupation takes place inside an earthern cocoon made by the grub itself from which the adult emerges. Details regarding the actual pupal period and control measures against the predator are under investigation. The damage caused by these predators is sometimes serious since each wasp is capable of robbing about 20 bees in a day. Apart from the actual loss of the bees the disturbance caused by frequent visits of these robbers upset the routine work of the colony.

2. *Trials with the Hill variety of the Indian bee.* A dark variety of the Indian bee occurs in the Hills. The bees are bigger in size and darker in color than the Plains variety and are better honey gatherers. A colony of these got down from Coonoor was found to thrive well even under adverse conditions on the plains. Preliminary trials indicate that the hill bees are more prolific breeders and better workers. The colony under observation yielded double the quantity of honey obtained from a colony of plain bee kept under similar conditions. There was also an improvement in the temper of the Hill variety after coming over to the plains. A few more colonies have been brought from Coonoor for further trials to find out the possibilities of introducing these on the plains.

3. *Trials on the artificial feeding of honey bees.* Honey and pollen from flowers are the two important natural foods of the honey bee and the grubs. But during periods when flowers are not available, ways and means have to be found to substitute the natural foods by artificial material. Sugar and jaggery syrup, sugar candy and dilute honey are freely given as artificial food. As regards the substitute for pollen, the Italian bee in the western countries is said to utilise various articles such as spores of fungi, particles of saw dust, fine earth from swamps, rye, barley, linseed and pea meals, dry milk, white of eggs.

Based on the above facts, a few trials were made to find out the artificial substitutes of these bee foods for our Indian bee under South Indian conditions. Jaggery solution and sugar syrup were tried

separately and the bees fed on them eagerly and later converted and stored them as honey in their cells. Of the two, sugar syrup was consumed with greater avidity.

To study the qualities of the product from the two samples of food given, two hives were liberally fed with sugar syrup and jaggery solution respectively and honeys extracted separately and analysed. The figures obtained clearly indicate that there is very little difference between the synthetic honey and the natural product in the chemical composition but there is difference in the aroma and taste. The jaggery honey was dark in colour with a strong smell of molasses while the sugar honey was pale yellow in colour and poor in aroma and taste.

Incidentally, the concentrations of the liquids supplied as food and the honeys extracted from these hives were studied. The concentration of the jaggery solution supplied was 37·7% and that of the honey extracted was 71·4%. Similarly the strength of the sugar syrup fed was 53·4% whereas the honey showed a strength of 74·2%. This shows that the bees in the course of their manufacture of honey have eliminated respectively 33·7% and 20·8% of moisture in the jaggery and sugar solutions fed to them.

As for pollen substitutes various material such as Bengal gram flour, linseed and pea meals were tried separately as well as mixed with honey and the feed was given both inside the hive as well as kept outside near the hives. But none of these were favoured by the bees. Before concluding this aspect of research it may be mentioned here that artificial feeding with a honey substitute, whatever its advantages may be, has to be limited to the minimum, since it has its evil effects when taken beyond the limit. In nature, bees are accustomed to take in only minute quantities of nectar at a time and to converting them into honey prior to storing. And whenever any extraneous food such as sugar syrup or honey, is given to them they have a habit of gorging themselves which is as harmful to bees as is to human beings. The effects are much worse in cases where the substitute is sugar solution since the bees have to invert the sucrose contained in the sugar into dextrose and levulose in their stomach thereby causing undue strain on their delicate digestive system. Therefore bees should be fed artificially only when it is absolutely necessary. The food should be given in small quantities and stopped as soon as an adequate supply is found stored in the cells. A better alternative would be to leave a sufficient quantity of the honey stored by the bees in the combs so that they can draw on this reserve food during times of scarcity.

As regards pollen substitutes, since our Indian bees do not show any tendency to accept any artificial material the only alternative is to grow some quick growing pollen yielding crops such as maize, cumbu, niger or sunflower in times of scarcity of pollen.

4. *Queen rearing.* The necessity for spare queens is often felt, especially during the swarming season, when new queens get lost during their nuptial flight. The "Demarree" method of swarm prevention presents a very easy and convenient method of queen rearing. The procedure is briefly as follows:—A colony having a queen with desirable traits and with plenty of brood and eggs is selected. The colony is examined and the brood comb with the queen and bees is taken out and kept in a separate hive. The rest of the frames are given either with foundation or spare combs. A "queen excluder" is placed on the top of this box and over this the old hive with the other brood combs and bees is kept. The entrance of the upper hive is closed and both boxes are tied securely so as to prevent their toppling over. The queen excluder prevents the queen from having any access to the upper chamber as a result of which the workers there begin to rear queens out of the fertilised eggs. After the queen cells are sealed the frames along with the bees and the queen cells are taken out and distributed in a few hives. Thus, about half a dozen nucleus colonies are obtained from a single colony. The success of this method depends upon the prosperity of the season. Healthy queens are reared only during seasons when pasturage is available in plenty. Attempts made to send spare queens by post to different parts of this Presidency have been successful and this method enables us to send spare queens to parties requiring them.

5. *Effects of shifting bee colonies and memory of bees.* While managing an Apiary it may often be found necessary to shift bee hives from place to place for various reasons. Our experience shows that such shiftings should, as far as possible, be avoided since the colonies receive a set back from which they take over three weeks to recover. To study the effects of shifting, five colonies were first weighed and transported from our Apiary to a village about 2 miles off. The colonies were weighed on alternate days in the new locality. In spite of the fact that the latter place afforded much better pasturage facilities there was a steady decline in the weights of all the hives for the first ten days and it took another ten days to attain the original weight. The maximum loss of weight in one case was about 1 lb. 4 ozs. and the minimum was 6¼ ozs. The decrease is partly due to the rapid consumption of the reserve food material and partly due to a good number of the field bees straying away. Egglaying and brood rearing were not materially affected so long as pasturage conditions were satisfactory.

Incidentally, mention may be made of the strong memory of bees as it has to be taken into account while shifting bee colonies. When colonies are shifted from an apiary to a distant place and brought back within three weeks and kept anywhere near the original place, the returning foragers, by virtue of their memory of their old place,

have the habit of going back to that spot instead of returning to their hive. But this difficulty could be avoided if the colony is brought back to the original apiary after about six weeks, i. e., after the generation of the bees accustomed to the old place, have died out.

6. *Bee pasturage.* Before starting an apiary in a locality an accurate knowledge of the honey and pollen yielding flora of that locality is essential. The bee pasturage crops of Coimbatore as well as of the other districts of this Presidency were studied as opportunities occurred and we have now a list of most of the bee pasturage plants along with their months of flowering. The list is, by no means, complete and further work is necessary to make it more comprehensive. Attempts are also being made to introduce bee pasturage plants of economic value from elsewhere.

7. *Range of flight.* A knowledge of the range of flight of the bees is necessary for selecting the site for an apiary in relation to its proximity to the pasturage. The European bee is said to travel up to two miles for forage. But the range of flight of the Indian bee seems to be rather limited since bees from colonies shifted to a distance of about 4 or 5 furlongs from the original place did not come back to the previous place in spite of their pronounced homing instinct. The longest distance that our bees were noted to travel was about 3 furlongs.

8. *The decrease and increase in the weight of colonies during different seasons.* In our Apiary it is found that there is a phenomenal reduction in the strength of the bee colonies from June to October followed by a proportionate increase from November to May. In the absence of a better index of the prosperity or otherwise of a bee colony its condition was judged by its weight. Weights of a selected number of colonies were taken every fortnight for three years during adverse as well as prosperous seasons. The maximum decrease in weight during the lean season was 71% of the original weight, the increase during the subsequent prosperous season being 68%. The main reason for such striking variations is due to the availability or otherwise of bee pasturage. Colonies that have considerably dwindled in strength during the slack season are practically useless during the ensuing honey flow season as they take a pretty long time to rear up sufficient worker force for honey gathering; whereas the colonies that have not been affected by the adverse conditions begin to collect and store honey from the very start of honey season.

The main conclusion that can be drawn from the above investigation is that the secret of success in managing an apiary profitably, lies in the availability of sufficient pasturage throughout the year and the industry will not pay in localities where such conditions do not exist. Granting that the pasturage conditions are favourable the next important aspect of the industry is to build up the strength of the colonies

by certain special methods such as provision of additional breeding facilities, uniting colonies, artificial feeding, etc., just prior to the honey season so as to have the maximum number of workers, to collect and store honey from the very advent of the honey flow season. Incidentally, seasonal conditions also appear to play an important part in the economic aspect of beekeeping. Failure of rains as it has been the experience for the past three years, affects the nectar secretion in flowers and a continued rainy or windy weather prevents the bees from going out and thus curtails their activity.

9. *Life history of the bees and egglaying capacity of the queen.* Along with the above line of investigations, observations were made to find out whether the rapid increase in the population of the hives, during prosperous seasons, is brought about by the shortening of the life cycle or by a more prolific egglaying by the queen or by both. The average period of life cycle was found to be uniform throughout the year irrespective of the external conditions-the egg stage lasting for 3 days, the larval stage for 4 days and the pupal stage for 12 days; the total life cycle not extending over 19 days. On the other hand, the increase in the population is brought about by the higher rate of egglaying, the daily average rate being about 300 eggs (which may even go upto 500 per day) whereas the rate is reduced to about 30 or 40 a day during the slack season.

10. *Beekeeping appliances.* Due attention was paid to this aspect of the work.

Honey extractor—An improved type honey extractor with a brass container and a special ball bearing device was evolved. The machine is priced at Rs. 9 only and there is a considerable demand for it.

Drone trap—Occasionally, the control of the drones becomes a regular problem and a simple drone trap, with the help of which the drones can be isolated and killed, was devised. The trap consists of a piece of wood about 2" wide, the length being adjusted according to the width of the entrance. On the lower side of this block of wood there is a shallow cut of about $\frac{1}{8}$". Drones are generally found in numbers in the supers as well as on the top of the frames. In such cases, the super is removed and the top put on. The super frames are then taken out and the drones picked and crushed. To prevent the drones that might escape from entering the hive the drone trap is kept close to the entrance with the cut end below. The narrow space of $\frac{1}{8}$" is just enough to allow the workers inside and excludes the drones which have a thicker build. The latter can be easily disposed of since they collect themselves in large numbers, at the entrance. In the case of the hives which have no supers, the trap can be successfully used during the evenings when large numbers of the drones come out for their play flight.

Other items of research such as swarm prevention, artificial granulation etc. are in progress; the results of these investigations will be given in a later paper.

Propaganda. The popularity which beekeeping is gaining as a cottage industry is indicated by the steady demand for advice and appliances from all over the Presidency as well as from other provinces of India. Owing to the activities of the department as well as those organisations like the Rural Reconstruction Centre, Ramanathapuram, over 1000 hives distributed among 130 villages are being maintained in this Presidency. The figures given are those obtained last year. The department, in spite of inadequate equipment is doing its best to popularise this industry. A colony of bees along with some of the apicultural appliances has now become a regular feature in almost all the exhibitions and fairs. In addition to this, numerous demonstrations in hiving wild colonies and in the care and management of apiaries have been conducted in various parts of the Presidency. Apicultural requisites such as hives, extractors, smokers, are being made and supplied to the public almost at cost price. In order to popularise this industry further, short courses in beekeeping, for about a month during February are being held for the past two years. More than 50 young men have been trained in the subject and it is hoped that they carry their knowledge of the subject to the very door of the ryot.

A departmenal bulletin—Bulletin No. 37 - Beekeeping in South India—and a pamphlet on the subject were published and the popularity of these publications has been more than what was expected. A leaflet giving practical hints for amateur beekeepers is under preparation.

Before concluding this paper a word may be said about the economics of beekeeping. The appliances needed are not many nor are they costly. A teakwood hive with a colony of bees costs Rs. 5 only. On an average 6—10 lbs. of honey is got in a year from a hive fetching Rs. 7—8—0 to Rs. 12—8—0 at Rs. 1—4—0 per lb. Thus, if a ryot keeps at least 3 or 4 hives he can get about Rs. 30 per year. It will therefore be seen that the possibilities of beekeeping as a cottage industry are great.

Research Notes.

A Note on the interspecific cross in the Cucerbits.

Intergeneric and Interspecific crosses in the family Cucurbitaceae were attempted at the Agricultural Research Station, Pattambi. While the intergeneric crosses were failures some of the interspecific crosses were successful. A brief description of a successful interspecific cross is given below:

One of the two species chosen for the cross, *Luffa acutangula*, is a cultivated variety the fruit of which is commonly used as a vegetable; the other species

Luffa ægyptiaca, is a wild variety and is commonly found growing along hedges, and is fairly drought resistant. The object of this cross was to introduce the hardiness and drought resistant characters of the wild variety into the cultivated one. The main differences between the two species are given below:

	L. acutangula.	*L. ægyptiaca.*
Leaf	Faintly five lobed	Deeply five lobed
Flower	Opens between 5 and 6 P. M.	Opens between 4 and 5 P. M.
Fruit	Oblong clavate with 10 sharp angles	Large, cylindric and smooth
Seed	Not winged, slightly rugose on the sides	Narrowly winged, smooth on sides

Both the reciprocal crosses were successful, and the setting of seeds was fairly large. The F_1 characters were all intermediate especially as regards the more striking of the characters as observed in leaf shape, flower opening (opens between 10 and 11 P. M.), nature of seed coat, and the shape of the fruit. The F_1 plant put on vegetative growth for a period of about one year from sowing; during this period it had one flush of fruiting during the months of February to May, standing the hot weather conditions remarkably well; after the hot weather and with the commencement of the monsoons it again gave a second flush of fruiting.

The germination of F_1 seeds was very poor and therefore a few plants (about ½ dozen) only could be studied. The few plants that were examined were intermediate in all the characters. The production of pistillate flowers was also very few.

An intervarietal cross was attempted between *Luffa acutangula* and *Luffa acutangula*, var., *amara*. The latter is a wild variety while the former is the cultivated one. The wild variety is exactly like the cultivated one, excepting that the fruit is very much smaller (3 inches long and about ½ inch thick), and the leaves, flowers, etc., are comparatively smaller than *L. acutangula*. In this case the cross between *L. acutangula* (female) and *L. acutangula*, var., amara., (male) was successful while the reciprocal did not fertilize.

The fruit of the F_1 was intermediate in shape; and the F_2 seeds did not germinate for further studies.

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Agricultural Jottings

BY THE DEPARTMENT OF AGRICULTURE, MADRAS

I. An Improved Water-Lift for Short Lifts. An improved water-lift of the circular mhote type has been designed by the Agricultural Department and subjected to a long period of trial with very satisfactory results. It is an improvement on the well known circular mhote so extensively employed in the South Arcot district.

The lift employs two cylindrical buckets which rise and fall, the one ascending full of water whilst the empty one descends. A large hinged flap valve in the bottom of each bucket allows the buckets to submerge and fill as they are lowered into the water at the ends of their supporting chains. Each bucket is hung in an inverted 'U' shaped yoke which is hingedly attached to projecting pins on the

sides of the bucket a little above the level of the centre of gravity and which permits the bucket to tip into a horizontal position when it is raised to the point of discharge. A hinged link or ring on the front of the bucket near the top is loosely coupled to a stout iron rod which is hung down the wall of the well from a cross beam at the level of discharge and causes the bucket to tip and discharge when it comes in contact with the bend or stop at the top of the rod.

The chains which support the buckets pass over head pulleys which are mounted on a frame directly over the buckets and then diverge horizontally to sheave blocks which are mounted on posts situated diametrically opposite to each other at the edge of the circular bullock track and in a line parallel to the side of the well. After passing through these sheave blocks the chains are brought together to their common terminus on the rotating beam. The sheave blocks are mounted about 7 ft. high on the posts to support the chains with sufficient clearance above the animals' horns.

The rotating beam is self-supported on a central post. The pair of animals are hitched to one end of the beam at about 12 ft. from the centre of rotation and the two chains are connected to a swivelling block which may be attached to the other end of the beam at various distances from the centre of rotation according to the depth of water level in the well or the height through which the water must be lifted. If, for instance, the chains are attached at a distance of 6 ft. from the centre of rotation, the up and down movement of the buckets, produced by the rotation of the beam, will be 12 ft or very nearly so. After the chains are connected to the beam at such a distance from the centre of rotation and the length of the chains is so adjusted where they attach to the beam, that the buckets will be lowered well below the surface of the water and will be raised exactly to the tipping or discharge position, no further adjustment is required unless of course there is any considerable change in the water level due, for instance, to a fall in the water table in the dry season or a rise in a wet one.

Both buckets are raised full of water and discharged during each rotation of the beam. The capacity of the buckets normally employed is 16 gallons so that 32 gallons of water are discharged per rotation of the beam. A pair of average sized cattle will average 2½ circuits of the circular track per minute, so that 4,800 gallons are discharged per hour. This is the normal output of the lift when provided with the usual 16 gallon buckets and lifting from depths up to 10 ft. or so. With better cattle 20 gallon buckets may be fitted to give an output of 6,000 gallons per hour. One of these improved lifts with 16-gallon buckets on the Agricultural Research Station, Palur, near Nellikuppam, raising 4,800 gallons per hour, is worked by a single Ongole bull.

The draught, of course, is not uniform but varies from zero to a maximum of about 145 lbs. and back to zero twice during each rotation of the beam. The weight of the strong 16-gallon bucket with all fittings is 58 lbs.

The lift is designed only for short lifts up to about 12 ft. and is therefore only applicable to those districts where high water tables prevail. It could be adapted for somewhat greater depths but not with the same convenience and advantage. It shares this inherent disadvantage with the original South Arcot design of circular mhote but in comparison with the latter it is very much simpler and neater in design and considerably more efficient giving a 45% greater output with the same capacity buckets and the same sized cattle. The cost is considerably less.

This improved design should make a strong appeal to the ryot and it is hoped that demonstration of the lift will lead him to adopt it in preference to the present crude design which in spite of its low efficiency has attained such a popularity in the South Arcot and neighbouring districts.

II. **Active Carbon and Its use.** The industry of jaggery making, though practised in India from very early times, has till now made little progress as regards its technique. The old primitive method of concentrating the juice in open pans over direct fire is still in vogue and no attempt is made at clarification of the juice except uncontrolled liming. The result has been that the jaggery so produced is dark in colour, unclean and of poor quality and therefore fetches only a low price in the market.

2. Nevertheless, the bulk of the cane grown in India (roughly two thirds of the total output) is converted into this crude form of sugar only, for which there is normally a ready demand in the country itself. In recent years, however, there has been a growing demand for white sugar from the well-to-do and educated middle classes and this increasing demand is being met partly by importation from abroad and partly from the rapidly growing local white sugar industry. Despite this rapid development of the latter, jaggery making will continue to maintain its important place in the economy of the Indian ryot as a cottage industry for several years to come, as a large portion of the cane area is bound to be scattered and out of reach of sugar factories. It became therefore an urgent necessity to devise suitable measures for the rehabilitation of the jaggery industry, one of the obvious means being to improve the quality of the jaggery by cheap methods so that it may sell at a higher rate in the market.

3. It is well known that bone charcoal and more recently active carbons of vegetable origin are in general use in refineries for the production of white sugar. Their prohibitive cost (viz. 8 to 10 as. a lb.), however, militates against their economic use for improving the jaggery making process.

4. Investigations were therefore started in the laboratory of the Government Agricultural Chemist, Coimbatore, in 1932 to prepare active carbons from readily available waste materials like paddy husk, groundnut husk, saw dust etc. These efforts were attended with a great measure of success and large quantities of active carbon were produced from paddy husk at the comparatively low cost of about 2 annas per pound.

5. The method of preparation is simple and merely consists in treating the paddy husk char with caustic alkali and removing the alkali by washing with water.

6. The carbon so prepared becomes light and very porous in structure and by virtue of this fact it is able to remove colouring matter and other organic substances from solutions. Thus on treating sugarcane juice with the active carbon, the juice is not only decolourised completely, but also clarified and sterilised to a certain extent.

7. The new process of jaggery making is extremely simple and does not involve any complicated operations or elaborate machinery. The cane juice is raised to the boiling point and then passed through a bed of activated carbon contained in a conical cylinder with a perforated bottom. The juice comes out through the filter colourless and brilliant and is boiled down to jaggery, whole sugar or rab in the ordinary way. The products thus obtained are strikingly superior in colour and quality to those prepared by the local method and are also extremely clean.

8. For the past three seasons, the Department has been conducting demonstrations of the improved process in almost all the important cane growing districts of the Presidency. Except in a very few places, the products have been so good as to arouse the enthusiasm of the most conservative of the ryot with the result that there arose a very great demand for this carbon from ryots all over the Presidency. As it is impossible to meet this demand for obvious

reasons, it was decided to give practical training in carbon making to a number of departmental demonstrators and to as many private individuals as desired this training. As a result, it has been possible to start carbon making this season, in the Agricultural Research Stations at Anakapalle (Vizagapatam) and Palur (South Arcot). A few enterprising and enthusiastic ryots have taken advantage of this training and have also been preparing carbon for their own use.

9. The cost of producing one pound of active carbon from paddy husk roughly works out to 0—1—9 ps. and it has been found that carbon once used can be reactivated at least twice again by strong heating only. The reactivation thus costs very little and it appears therefore certain that the carbon process will not be economically unsound provided arrangements are made for reactivating the used carbon for further use.

10. Paddy husk carbon can also be profitably used for preparing white sugar under the open pan system of boiling. The quality is much better and the yield of sugar or rab is much more than is obtained without charcoal treatment, and one sugar factory has made enquiries about its use for white sugar making.

11. Palmyrah and coconut palm juices have also been found to respond well to charcoal treatment. There is a striking improvement in the colour and quality of the sugar and jaggery obtained from these juices as a result of carbon treatment. The characteristic palmyrah odour usually present in these products is entirely removed.

12. Yet another use to which paddy husk carbon has been put is for the clarification of oils. Cocoanut oil becomes colourless and brilliant on filtration through this carbon. Castor oil is deprived of almost all of its repulsive odour and Gingelly and Groundnut oils become considerably lighter and purer after carbon treatment.

ABSTRACTS

Resistance of Sorghum to stem borers. It was noticed from field tests that the extent of infestation by stem borers in Sorghum varies with varieties. The results obtained under controlled conditions would appear to show that the host selection of moths is one of the causes of the phenomenon There has been observed a significant association between infestation and height of plants which may be explained by the assumption that tall plants present more space to the borers attacks than the short and dwarf plants. With a large number of grain colours present in sorghums, white grain varieties have shown comparatively less infestation by borers than varieties with other grain colours. Under controlled conditions 'sorgos' as a group were more susceptible to the attack than the nonsaccharine varieties. (*Amer. Sci. Agronom*, Vol. 28, No. 4, pp. 271-278). K. R.

An Electrical Remedy for Tree Borers. The writer recently rigged up a magneto as an amusement device for a pair of growing youngsters, with which they could give mild shocks to themselves and other youngsters of the neighbourhood. Later, having heard of the method of driving earth-worms out of the ground by electric current, the magneto was turned to this use. When a pair of steel rods wired to the magneto were thrust into wet ground about six inches apart and the crank turned, the earth-worms came crawling out. Still later, when the writer was engaged in the laborious task of digging elm-borers out of a tree with a pocket knife, the idea came of turning the magneto to use for this job. When two nails were driven into the bark a few inches apart in the affected area, the nails attached to the magneto and the crank turned, the elm-borers came out in a few seconds. Subsequent digging in the electrically treated bark proved that the borers had vacated 100 per cent.

The system is much less laborious than digging out the borers and far more amusing. A magneto somewhat more powerful than the writer's would no doubt be quite valuable to orchardists and commercial tree surgeons. (*Science, New Series*, Vol. 84, No. 2167). Victor H. Schmidt, Kansas City, Missouri.

Lucerne as a food for human consumption. (*The South African Institute for Medical Research Laboratory Report No. 3.* Johannesburg).

The publication contains a summary of all the available knowledge on the subject. It deals about the history of lucerne cultivation in S. Africa, the chemical composition of the plant at various stages of growth and suggestions for using lucerne as human food. There are two useful appendices to the publication one dealing about the method of cultivation and the other containing suggestions regarding the value and methods of using lucerne as part of the ration for mine labourers.

Lucerne is remarkably rich in the antiscorbutic vitamin C, being about five times as rich as the same weight of orange juice. It contains a considerable amount of mineral matter, calcium and iron, about three times as much calcium as milk and twice as much iron as spinach. Besides vitamin C, it is also rich in vitamins A, D and E. There is also an appreciable quantity of proteins.

It is advisable to use only the leaves and young shoots as the stalks unless very young are apt to be fibrous. When it is chopped, it should be used as soon as possible and its vitamin C value diminishes rapidly when the cells are damaged. The leaves can be incorporated in a salad just like any other green stuff. It can be chopped and put in omelettes or in soups and stews. The leaves can also be cooked as spinach but in so doing the minimum amount of water should be used. It appears tea can also be made with the leaves. Experiments have shown that even a tablespoonful of chopped lucerne per boy is a useful addition to the ration and an ounce a day is regarded as a fully protective ration against scurvy even without the addition of other vegetables.

While it is admitted that, lucerne as usually grown for forage purposes, is apt to be somewhat coarse and lacking in flavour, it is however possible with sufficient attention to cultivation using rich soil and plenty of water to obtain a vigorous and tender growth which would make it more suitable as a vegetable.

K. R.

Correspondence.

To The Editor, Madras Agricultural Journal.

Sir,

I shall be glad if you will kindly inform me whether the injury due to leaves of tamarind trees falling on a paddy field will be confined to that particular field or it is likely to be transmitted to other fields in case water from that particular field flows to the other fields.

PALGHAT,
1—9—36.

Yours truly,
O. M. MENON

Reply.

The presence of tamarind trees in the vicinity of cultivation is generally considered undesirable owing to the acid nature of the leaves. It is well known that grass does not grow well under tamarind trees, since the leaves are supposed to make the soil acid in reaction.

In the case of paddy fields it is likely that the leaves falling on the field may be deleterious, but it is hardly likely that the acidity so formed will affect other fields, by water flowing into them.

The presence of big trees like the tamarind is not desirable in the vicinity of cultivation not only from the point of excessive sbade and effect of acid leaves but also from the point of the roots of such trees exhausting the soil of its manurial ingredients. —Government Agricultural Chemist.

College News & Notes.

We are glad to learn that Messrs. N. Parthasarathy and N. Krishnaswami from the Research Institute, Coimbatore and Messrs. N. Kesava Iyengar and V. Panduranga Rao from the Agricultural Research Station, Hagari, have gone abroad for higher studies. We wish them *bon voyage* and success in their studies.

Students' corner. Hockey:— In view of our College Team touring Ceylon during the Michaelmas holidays our team played a series of matches with the local Colleges and Clubs. In the first match against the Forest College our College won by a margin of 2 goals in 10. The second match was played against the Stanes European High School whom we managed to beat. Perfect understanding was exhibited by our forwards while the defence kept a complete check over the opposing forwards and stopped many moves which would have resulted in certain goals. The Stanes boys played tenaciously throughout the game and when the score was 4—2, the final whistle blew. The third match was played against a combined XI which ended in a win for the College by 2—1. Our College team is a hard working eleven which will take a lot of beating and it is therefore expected that it will give a good account of itself in Ceylon.

Cricket. The cricket season opened with a match against the Government College which ended in a draw. The Government College ran up a huge score of 172 to which Narasimham and Padhan contributed 46 and 28 respectively. The College replied with 100 runs for the loss of 5 wickets when the stumps were drawn for the day. K. Dinker Rao played a stolid innings and remained unbeaten with 60 runs.

Rhondy Shield Tourney. The first match of this tournament was played against the Stanes European High School and the College registered an easy victory. Entering first, the Collegians ran up a total of 168, Narasinga Rao scoring a vigorous 33 while K. K. R. Menon came next with patient and unbeaten 28. The Stanes were dismissed for 121 runs. Mukundan and D. V. Rajagopal captured 4 wickets each at a cost of 16 and 30 runs respectively. The Stanes team exhibited a high standard of fielding, but for which we would have passed the 200 mark easily. In the second match the College suffered a crushing defeat at the hands of the Coimbatore Cricket Club. The College batted first and were skittled out for a paltry 26, Venku and Potts being responsible for the collapse. Venturing out in turn, the Coimbatore cricket club passed our total for the loss of 2 wickets and carried on till the score was 218 for 4. Briggs played well for a patient 59 while Murray and Venku remained with 50 and 40 respectively. D. V. Rajagopal bowled steadily for the College and took 2 wickets (for 39) out of the 4 wickets that fell for the day. In the third match Government College was beaten by 6 wickets by our team. The visitors who batted first were disposed of for 62 runs, S. Varadarajan was unplayable and bagged 6 wickets conceding only 12 runs. Our College had little difficulty in passing the visitors' total and cried halt when the score was 130 for 4. H. Shiva Rao played a polished innings before he retired with 41 runs to his credit. K. K. R. Menon and Narasinga Rao came up next with 29 and 21 runs respectively.

Tennis. This game as usual, is attracting a large number daily. Our College represented by Messrs. Sayed and Herbert beat the recruits school by 6—3 and

6—2. In the match with the Y. M. C. A., Sayed and Lakshminarayana won by 6—4 and 7—5. The Madras Engineering College which sojourned here on their way to Pykara played us in doubles. Three strings represented each College and our College won five out of 6 sets.

Manager's Note.

ERRATA

Vol. XXIV, No. 8, (August 1936)
Page 281, 9th line from the bottom.
For "T. V. Ramakrishna Iyer" Read "T. V. Rajagopalachari" and after "Jogiraju" add "G. Mahadevan."

Weather Review (AUGUST 1936).

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	8·5	+0·7	58 6	South	Negapatam	2·7	−0·9	16·3
	Berhampore *	8·2	+0·3	44·8		Aduthurai *	2 6	−0·2	14·8
	Calingapatam	7·7	−0·2	33·1		Madura	0·7	−3·6	13·7
	Vizagapatam	5·3	−0·1	20·9		Pamban	0·3	−0·4	5·8
	Anakapalli *	4·5	−0·9	27·0		Koilpatti *	0·4	−1·4	9·3
	Samalkota*	7·1	+2 5	37·4		Palamkottah	0·0	−0·6	12·2
	Maruteru*	9·0	+2·7	34·0					
	Cocanada	7·6	+2·1	32·6					
	Masulipatam	6·1	−0·8	31·5	West Coast	Trivandrum	3·1	−1·0	44·4
	Guntur*	4·0	−1·0	28·8		Cochin	11·7	−1·2	85·0
Ceded Dists.	Kurnool	1·9	−3·1	12·3		Calicut	18·2	+2·6	111·9
	Nandyal *	3·3	−1·9	17·2		Pattambi *	13·7	−2·0	84 6
	Hagari *	1·0	−1·3	7·6		Taliparamba *	22·4	−5·9	108·3
	Bellary	4·2	+1·9	7·4		Kasargode *	23·2	−1·4	135·2
	Anantapur	0·8	−1·4	6·4		Nileshwar*	23·9	−2·3	122·6
	Rentachintala	3·7	—	15·1		Mangalore	23·9	+1·4	129·7
	Cuddapah	1·2	−4·6	9·4					
	Anantharaju-pet *	1·0	—	—	Mysore and Coorg	Chitaldrug	1·2	−1·8	7·5
Carnatic	Nellore	1·2	−2·1	8·8		Bangalore	2·4	−3·1	18·2
	Madras	6·0	+1·4	17·7		Mysore	3·0	−0·4	22·3
	Palur *	4·4	−0·9	17·2		Mercara	28·1	+2·6	131·5
	Tindivanam *	4·3	−0·7	14·7					
	Cuddalore	2·7	−2·3	11·9	Hills.	Kodaikanal	4·4	−2·6	29·2
Central	Vellore	1·8	−4·5	10·1		Coonoor*	2·6	—	37·7
	Salem	5·7	−1·1	26·3		Ootacamund *	4·1	−2·7	34·9
	Coimbatore	1·7	+0·6	11·4		Nanjanad *	4 8	−2·0	36·4
	Coimbatore Res. Inst. *	1·9	+0·9	11·2					
	Trichinopoly	0·0	−3·8	12·1					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 (published in Fort St. George Gazette).

Both the Arabian sea and Bay of Bengal branches of the monsoon remained active during the first week of the month causing wide spread rain in the United Provinces, Central India, Central Provinces and Malabar. After this period the Arabian branch of the monsoon weakened and continued to remain so till about

the 17th when, a depression formed in the Bay of Bengal off the Orissa coast. This depression temporarily strengthened the monsoon in the Peninsula till about 20th after which period it became again weakened and remained so during the rest of the month. Three depressions caused the Bay of Bengal branch of the monsoon to remain fairly active and vigorous. A depression off the Orissa coast on the 28th caused a strong monsoon in the North Madras coast but this was not able to influence weather conditions in the rest of the Peninsula.

Rainfall was normal or in moderate excess in Circars and was generally in defect in West Coast, Ceded districts, South Madras and Mysore.

Weather Report for the Research Institute Observatory.

Report No. 8/36.

Absolute maximum in shade	...	...	90·0 F.
Absolute minimum in shade	...	...	66·5 F.
Mean maximum in shade	...	...	85·8 F.
Departure from normal	...	...	−2·1 F.
Mean minimum in shade	...	...	71·2 F.
Departure from normal	...	...	−0·5 F.
Total rainfall for the month	...	...	1·93″
Departure from normal	...	...	+0·94″
Heaviest fall in 24 hours (Recorded on 6—8—36)		...	1·25″
Total number of rainy days	...	...	4 days.
Mean daily wind velocity	...	...	5·3 M. P. H.
Mean humidity at 8 hours	...	...	73·9%
Departure from normal	...	...	+0·6%

Summary. The maximum and minimum temperatures were below normal. Rainfall was in excess by 0·94″. The skies were moderately to heavily clouded. Humidity was slightly above normal. Dry weather conditions prevailed in the last week of the month. P. V. R. & D. V. K.

ADDITIONS TO THE LIBRARY

JULY 1936

A. Books.

1. Soya bean. *Kale, F. S.* (1936). 2. The World Sugar Problem, 1926–1936. *Gutierrez, V,* (1935). 3. Garden Science. *Grainger, J.* (1935). 4. Your Flower Garden. *Day, H. A.* (1936). 5. Gardening in Towns. *Thomas, H. H.* (1936). 6. Modern Fruit Growing. *Seabrook, W. P.* (1933). 7. Back to the Land. *Orwin, C. S. & Darke, W. F.* (1935). 8. A Course of Study in Managing a Farm. *Lowark, A. T.* (1931). 9. Agrarianism: A Program for Farmers. *Cauley, T. J.* (1935). 10. Modern Production among Backward Peoples. *Greaves, I. G.* (1935). 11. Labour in Agriculture. *Howard, L. E.* (1935). 12. Co-operation and the New Agricultural Policy. *Horace Plunkett Foundation Pub.* (1935). 13. Agricultural Education in Europe. *Int. Inst. Pub.* (1935). 14. Transactions of the Third International Congress of Soil Science, Vol. 3. (1936). 15. Humus. *Waksman, S. A.* (1936). 16. Milk Production and Control. *Harvey, W, C. & Hill, H.* (1936). 17. The World's Hand Book of Dairying. *Murray, A. H.* (1936). 18. Dairy Cow Testing Throughout the World. *Int. Inst. Pub.* (1935). 19. The Poultry Keepers' Text Book. *Brown, E. T.* (1934). 20. Elementary Veterinary Science for Agricultural Students. *Thompson, H. & Duncan, A. C.* (1935). 21. The Beginnings of Plant Hybridization *Zirkle, C.* (1935). 22. The Cultivated Races of Sorghum. *Snowden, J. D.* (1936). 23. Die Fusarien. *Wollenweber, H. W. & Reinking, O. A.* (1935). 24. Plant Viruses. *Smith, K. M.* (1935). 25. Essentials of Physiological Chemistry. *Anderson, A. K.* (1935). 26. Bee Keeping (I. C. A. R. Misc. Bull. 6). *C. C. Ghosh.* (1936). 27. Embryology and Genetics. *Morgan, T. H.* (1934). 28. Practical Zoology. *Hewer. H. R.* (1935). 29. Flour Milling Processes. *Scott, J. H.* (1936).

B. Annual Publications and Reports.

1. Symposia on Quantitative Biology, Vol. 3. (1935). 2. Annual Review of Biochemistry, Vol. 5. (1936). 3. Scientific Reports of the Imperial Institute of Agricultural Research, Pusa for 1933–34. 4. Report of the Agricultural Department, Bihar and Orissa for the Period from the 1st April 1934 to the 31st March 1935. 5. Annual Administration Report of the Department of Agriculture H. E. H. the Nizam's Government for the Year 1342 Fasli (6th June 1932 to 5th June 1933). 6. Report of the Fifth Horticultural and Poultry Show, 1935. 7. Report on the Administration of the Department of Agriculture and Fisheries, Travancore for the Year 1110 M. E. (1934–1935 A. D.). 8. British South Africa Mazoe Citrus Experimental Station Annual Report for 1934. 9. Kenya Colony and Protectorate Department of Agriculture Annual Report, 1934, Vol. I. 10. Kenya Colony and Protectorate Department of Agriculture Annual Report, 1934, Vol. II. 11. British Cotton Growing Association 31st Annual Report for 1935. 12. Transactions of the Highland and Agricultural Society of Scotland Fifth Series, Vol. 48. 13. Massachusetts Agri. Experiment Station Annual Report for the Year ending November 30, 1935. 14. Annual Report of Director of New Hampshire Agricultural Experiment Station for the Year 1935. 15. Annual Report of the Director of Extension Service for 1935. New Hampshire. 16. United States Agri. Dept. Bureau of Plant Industry Annual Report 1935. 17. United States Agri. Dept. Soil Conservation Service Annual Report, 1935. 18. United States Agri. Dept. Bur. of Agri. Economic Annual Report, 1935, 19. United States Agri. Dept. Bur. of Agri. Engineering Annual Report, 1935. 20. United States Agri. Dept. Bur. of Animal Industry Annual Report, 1935.

C. Special Reports and Publications.

21. Conference on Co-ordination of Agricultural Research in the East African Territories. 1936. 22. Guide Book for the Excursion round Britain of the Third International Congress of Soil Science, 1935. 23. Soil Research in the British Empire published during 1935. Imperial Bur. of Soil Science Pub. 24. Standard Methods of Malt Analysis for Commercial Purposes, 1933. 25. Investigations on the Improvement of Hill Grazings. Welsh Plant Breeding Station Series R. No. 11. 26. The Calculus of Plenty by Josiah Stamp. The Norman Lockyear Lecure, 1935. 27. Financing Agriculture in 1935. (U. S. A. Farm Credit Admin. Pub.).

D. Bulletins, Memoirs, Etc.

28. Hints on the Improvement of Cultivated Crops. *Assam Agri. Dep. Bull. 8.* 29. Quality of Lint in Relation to Ginning Factors. 30. The Effect of Employing Different Roller Settings and Twists on the Spinning Performance of Three Indian Cottons. *I. C. C. C. Tech. Bull. Nos. 31, 32, Ser. A.* 31. The Culture of Fish in Ponds. 32. Rotation of Crops. 33. Chrysanthemums. *Eng. Min of Agri. Bull. Nos. 12, 85, 92.* 34. Studies on the Wastage of Export Grapes. *Union of S. Africa Scie. Bull. 151.* 35. Studies on Contagious Pleuro-Pneaumonia of Cattle. 36. Cercospora Leaf-spot (Erogeye) of Tobacco in Queensland. *Com. Australia C. S. I. R. Bull. 9.* 37. The Common Black Field Cricket a Serious Pest in South Dakota. 38. Vitamin D in Milk. *S. Dakota A. E. S. Bull. 29.* 39. Crop Adjustment Oklahoma's Opportunity for Soil Improvement. *Oklahoma Coop. Ext. Cir. 30.* 40. Soil Erosion Control by Engineering Methods. *Minnesota A. E. D. Spe. Bull. 171.* 41. Hitches for Field Machinery. *S. Dakota A. B. S. Bull. 297.* 42. Poultry Flock Improvement. 43. Heavy Mulching in Bearing Apple Orchards. 44. Winter Pause in Rhode Island Reds. *Massachusetts A. E. S. Bull. Nos. 325, 328, 329.* 45. Growth and Survival of Deciduous Trees in Shelter-belt Experiments at Mandan, N. Dak , 1915–34. 46. The Cooking Quality, Palatability, and Carbohydrate Composition of Potatoes as Influenced by Storage Temperature. *U. S. Agri. Dep. Tech. Bull. Nos. 496, 507.* 47. Bacterial Diseases of Plants Occurring in

Taiwan (Formòsa) VI. 48. Sclerotium Rolfsh Sacc in Perfect State III. Variation in the Cultures Originated from Basidiospores. 49. Immunological Studies of Mosaic Diseases V. Micro-serological Tests as Means of Detecting the Virus in a Small Area of Mosaic Tobacco Plants. *Taihoku Imp. Uni. Cont. Nos. 35, 36, 37.*

E. Circulars, Pamphlets Etc.

50. Peppermint: Its Cultivation and Distillation. *Eng. Min. Agri. Leaf. 98.* 51. The Chemistry of Australian Timbers. 52. Studies of Five Introduced Grasses. *Com. Australia C. S. I. R. Pam. 62, 63.* 53. Some Results of Seed Treatment of Grain Crops. *Alberta A. E. S Leaf. 17.* 54. Propagating Trees and Shrubs from Seed. *Alberta A. E. S. Cir. 21.*

AUGUST 1936.

A. Books.

1. The Application of Electricity to Fruit Farming. *Nehru, S. S.* (1936). 2 Gardening for Egypt and Allied climates. *Stout, M.* (1935). 3. The Agricultural Fair. *Neely, W. C.* (1935). 4. Self-Subsistence for the Unemployed. *Scott, J. W.* (1936). 5. Economics of Farm Organisation and Management. *Holmes, C. L.* (1928). 6. An Economic Survey of Bhadaa (A Village in the Punjab). *Brayne, F. L. & Dyal, S.* (1936). 7. Theoretical Basis of Jarovisation (In Russian). *Lyssenko, T. D.* (1935) 8. The Genus-Diaperthe Nitschke and Its Segregates. *Wehmeyer, L. I.* (1933). 9. Nematoda—I. Ascaroidea and Strongyloider. *Baylis, H. A.* (1936). 10. Procedure in Taxonomy (Zoological). *Schenk, A. T. & McMasters, J. H.* (1936).

B. Annual Reports and Publications.

1. Annual Report of the Agri-Horticultural Society of Madras 1934—35. 2. Annual Report of the Imperial Council of Agricultural Research, India, 1935—36. 3. Triennial Report of the Experiments carried out on the Various Agricultural Stations in the United Provinces during 1932—35. 4. Proceedings of the Indian Central Cotton Committee, 32nd Meeting 1935. 5. Farm Accounts in the Punjab, 1933-34. 6. Annual Report of the East Malling Research Station, Kent, for 1935. 7. Annual Report of the Imperial Bureau of Soil Science, 1935—36. 8. Annual Survey of American Chemistry, Vol. X, 1935. 9. Proceedings of the American Society of Horticultural Science, 1934, Volume, 31. 10. Annual Report of the Kenya Coffee Board for 1935—36. 11. Annual Report of the Antigua Agricultural Department for 1935. 12. Annual Report of the Uganda Agricultural Department for 1935.

C. Special Reports and Publications.

13. & 14. Proceedings of the 6th International Botanical Congress, 1935—in two volumes. 15. Poultry Farming. 16. Beekeeping in Victoria. *Victoria Agri. Dept. Pubn.* 17. A Comparative Study of the Utility of the Milks and Ghees of the Indian Cow and Buffalo, as human food. *Godbole, N. N. & Sadgopal* (1936). 18. Ceylon Coconut Commission Report, 1933. 19. Proceedings of the 1st Meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India, 1935. 20. The Cattle Census Report of the United Provinces of Agra & Oudh, 1933. 21. A Summary of the Results of the Phytalus Investigations, 1933—1936. *Mauritius Imp. Inst Ent Publication.* 22. Course of Study in Making a Living on the Farm. *Mont. Vocation. Edn. Pubn.* 23. Soil Conservation: Its Place in National Agricultural Policy, 1936. *U. S. Agri. Dep. A. A. A. Pubn.* 24. Formaldehyde for Seed and Soil Treatment: A Bibliography, 1936.

D. Bulletins, &c.

25. Improvement of Rice in the Bombay-Karnatik: Part 1. Selections in the Mugad and Antersal Varieties of Paddy. *Bombay Agri. Dept. Bull. No. 178, 1935.* 26. Economics of Lac Industry in the Punjab. *Punj. Bd. Econ. Inq. Pubn. No. 47,*

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E. Circulars, Leaflets &c.

56. Improved Ploughs Designed and Locally constructed to suit the Bengalee Cultivator. *Beng. Agri Dept. Leaf. No. 201936.* 57. Sweet Potato (Ipomoea batatas). *S. S. & F. M. S. Agri. Leaf. 14.* 58. Potato Blight. *Eng. Min. Agri. Adv. Leaf. 271.* 59. Methods for controlling insect Pests in the Home. *Alberta Exten. Leaf. 19.* 60. The Wax Moth and Its Control. 61. Distribution of the Argentine Ant in the United States and Suggestions for its control or Eradication. 62. Variety Tests of Sugarcanes in Louisiana during the Crop Year 1933–34 and Summary of Annual Results 1926—1934. *U. S. Cir. Nos. 386, 387, 395.*

Departmental Notifications.

Appointments. The following appointments are ordered by the Director of Agriculture, Madras. M. R. Ry. K. Minakshisundaram to officiate as Assistant in Cotton Section, vice Mr. N. Kesava Iyangar on leave or until further orders to report himself for duty to the Superintendent, Dry farming station. Hagari. M. R. Ry. K. M. Narayanan to officiate as Farm Manager, A. R. S., Taliparamba till further orders in an existing vacancy to report himself for duty to the F. M., A. R. S. Taliparamba; M. R. Ry. V. V. Rajagopalan to officiate as Assistant in Oil Seeds Section till further orders in one of the temporary posts sanctioned in G. O. No. Mis. 494 development dated the 27th March 1936 to report himself for duty at the A. R. S, Kasargode; M. R. Ry. P. C. Sahadevan to officiate as Assistant in Paddy until further orders vice Mr. N. Parthasarathi granted leave, to report himself for duty to the Superintendent, A. R. S. Pattambi, forthwith.

Transfers. M. R. Ry. M. K. Venkatasubramaniam, Assistant in Paddy, A. R. S. Pattambi is transferred to Coimbatore; M. R. Ry. Tirumala Rao, W., Offg. Assistant in Chemistry, Coimbatore to A. R. S., Anakapalle; M. R. Ry. F. L. Daniel Offg. Assistant in Chemistry, A. R. S, Anakapalle to Coimbatore; Agricultural Demonstrator, Cocanada to be in additional charge of Tuni sub circle; Mr. T. Ramanujulu Naidu, Upper subordinate under training will be under the A. D. Cocanada; Agricultural Demonstrator Bhimavaram will be in additional charge of Narasapur sub circle until further orders; Mr. P. Seetharamia, Upper subordi-, nate under training is transferred to Kovvur to be under A. D., Kovvur; Mr. M. L. Balasundaram, Offg. F. M., A. R. S. Maruteru, is appointed to officiate as Assistant in Paddy at the same Station vice Mr. C. Venkatasaravayya Chetty on deputation under the Imperial Council of Agricultural Research; Mr. V. V. S. Varadarajan, A. D., Bezwada is transferred to the A. R. S., Guntur as Farm Manager in place of Mr. A. K. Annaswami Iyer transferred to Hosur; Mr. M. Vaidyanathan, Assistant in charge of Dry Farming Experiments in Anantapur district is tranferred as A. D., Hindupur; Mr. S. Krishnamurthi Rao, probationary Farm Manager, Dry farming station, Hagari is transferred as Assistant in charge of Dry Farming experiments in Anantapur district vice Mr. M. Vaidyanathan; Mr. A. R. Krishnamurthi Iyer, A. A D. Peravurani to Orthanad; Mr. R. Kolandavelu Nayacker, A. D., Orthanad to Peravurani; Mr. P. K. Natesa Iyer, A. D., Srivilliputhur is transferred to Manamadura on the expiry of his leave. He will take charge of that sub circle from the A. D., Ramnad.

Leave. M. R. Ry. U. Vittal Rao, L. A. P. for 2 months from the date of his reversion to the Madras Agricultural Subordinate service.—M. R. Ry. J. David, A. A. D. (Microtome section) L. A. P. for one month from the 15th September 1936 with permission to avail the holiday on the 15th October 1936. M. R. Ry. C. A. S. Ramalingam Pillai, A. A. D., Manamadura extension of L. A. P. on M. C. for 2 months in continuation of the leave already granted.