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Editorial.

Agricultural Improvement and Madras Provincial Economic Council. We publish elsewhere in this issue of the journal, the recommendations made by the sub-committee appointed by the Madras Provincial Economic Council to examine the question of rural welfare and improvement of agriculture of this Presidency. We are gratified to note that they cover a very wide field and commendably aim at the introduction of efficiency in the existing channels of amelioration of the peasants. We feel sure that they would receive general approval of the discerning public. We appreciate their suggestions with regard to the training of rural guides, opening of a fruit section in all Agricultural Stations, employment of agricultural graduates in every High School, the granting of *takkavi* loans by the Deputy Directors of Agriculture, castration of scrub bulls, utilisation of the underground water resources, training men in fruit preservation, and the introduction of the system of controlled credit in the village co-operative credit societies.

The recommendation of the sub-committee on the growing of crops on the cultivable waste lands of each district does not however commend itself to us. In most of the cases these lands are left in that condition by the villagers on account of their being situated in an

unhealthy locality, or of their unsuitability for cultivation being either too shallow or alkaline to grow crops. It has to be remembered that it is not sound economics, particularly so in days of low prices, to carry out farming on lands which generally allow of a little or no profit to the grower. The fact that the neighbouring farmers are loath to till them is a definite index of their falling under any of the above categories.

It is not known how the subject of training of agricultural graduates in rural economics could have evoked difference of opinion amongst the members of the sub-committee in view of the generally accepted fact that out of all the ancillary sciences essential for success in farming, book-keeping holds a very important place and that a knowledge of economics will be valuable in framing an efficient cropping of a farm.

We feel that sufficient stress has not been laid on the measures leading to the prevention of avoidable waste and maintenance of soil fertility.

The portions dealing with the education of the farmers might with advantage have been more specific and thorough. There is a growing tendency in the villagers to love ease to the detriment of agricultural production, to migrate to the town on the score of lack of certain amenities, and to waste time and wealth not only on unproductive but also on destructive pursuits. It is incumbent on the part of all workers in the field of rural improvement to direct their attention to changing this mentality and widening the outlook of the present and prospective farmers. We would rather lay greater emphasis on the latter class of the village population. We are glad to read in this connection a recent press communique issued by the Government on the reorganisation of elementary education in this Presidency, and that a committee has been appointed to go into this important problem and suggest measures. Any recommendation on these points, had it been made by an influential and authoritative body like the sub-committee of the Provincial Economic Council, would have been most opportune, as that might enable the Government to arrive at correct and speedy decisions. We would recommend, while on this aspect, the adoption of the method said to be pursued with success in Canada and U. S. A. and also in the peasant University of Zagreb in Jugoslavia, with necessary modifications suited to our Presidency. In those countries small plots of ground are allotted to boys in each village school and crops are raised according to the latest methods under the supervision of the expert teachers. Special scientific staff are appointed to give them instruction on agriculture, horticulture, rural economics, public health and personal hygiene. Weekly lectures are given on ethics, poetry, psychology, fine arts with the object of making them appreciate the dignity of labour, value of

truth, ability to look ahead, and efficacy of united action for common good and happiness. We would like to add to the above list that arrangements should be made to instil selfconfidence in their minds by taking them periodically to places of agricultural interest and explaining to them how the various situations are being faced by the cultivators.

The sub-committee of the Provincial Economic Council have felt that their recommendations will not be given effect to on account of financial exigencies. We may suggest in this connection that the Government may be persuaded to introduce measures for diverting a portion of the funds at the disposal of the temple committees, charitable institutions, and insurance companies with a stake in the country, for the noble purpose of ameliorating the condition of the villager whose forbears and relatives have mainly contributed for the establishment of these concerns. We would also urge that the promoters of 'Pinjrapoles' and 'Goshalas' should be encouraged to take up the work of maintaining stud bulls and the rearing of calves of typical breeds of cattle for the benefit of the poor agriculturist—the ultimate carrier of all burdens in the land.

NOTICE

All unemployed old students of the Agricultural College, Coimbatore, can continue to be members of the M. A. S. U. at the concession rate of Rupees Two only, by an application to the Manager, M. A. S. U.

KOLE CULTIVATION OF RICE IN THE MALABAR COAST, WITH SPECIAL REFERENCE TO INSECT PESTS *

BY T. V. RAMAKRISHNA AYYAR, B.A., Ph. D.,
AND

K. P. ANANTHANARAYANAN, B.A. (Hons.)

Introduction. The peculiar method of raising a crop of rice known locally as *Kole cultivation* appears to be a practice existing only along the Malabar coast, especially in the Southern parts of the British District of Malabar and the native state of Cochin; and as far as the writers are aware the practice has been in vogue in these tracts for several decades in the past. The choice of the land selected for this purpose and the special methods employed in that connection reveal a considerable amount of ingenuity and skill on the part of the inhabitants of these localities even in those early years to utilize all available possibilities to add to their income from mother earth.

II The Physical Features and Topography of the Kole Land. The lands utilized for the Kole crop are beds of two or three fresh-water lakes which ordinarily contain water to a depth of three to six feet for over five months in the year from June onwards. It is reported by some of the old residents of the areas that these lake beds were primaeval forests which gradually became lakes, and that large logs of very old and partly burnt wood discovered now and then while digging testify to this. These lakes are bounded on the east by the submontane areas of picturesque fields and gardens extending to the foot of hills of the forest-clad Western Ghats, and on the west by the narrow belt of backwaters lying in close proximity and parallel to the Arabian sea coast with which these are also connected in one or two places. For more than half the year, viz from the time the southwest monsoon sets in with its heavy and continuous downpour of rain, these areas are full and appear as expansive sheets of water and quite deserted, and no stranger to the locality will be convinced if he is told that these tracts are cultivable areas. With the approach of early summer in January the whole area becomes gradually metamorphosed. Streams of labourers, fleets of boats and pumping machinery of various kinds appear on the scene, and the whole area throbs with human activity; and by April or May the quite water covered lake of the previous autumn is completely changed and presents a most beautiful amphitheatre of green smiling paddy fields enclosing a remarkable net work of large and small irrigation canals. The whole landscape at this time of the year presents a most interesting and charming scenery

* Paper read at the Indian Science Congress 1936.

rarely met with elsewhere. One such Kole area is the Enamakal lake situated at the extreme south of the Malabar District with a part of it lying within the limits of the Cochin State. This lake covers an area of about 25 sq. miles and is the best and typical example of one of the Kole areas known. The whole area brought under Kole cultivation along the West coast every year roughly comes to not less than 7,000 acres.

III System of Tenure and Preliminary Preparations. These extensive Kole areas generally belong to a few wealthy landlords called *Jemis* who lease out these areas to different lessees who may in their turn sublease their portion into smaller holdings so that one big area like Enamakal tract will generally be the property of about half a dozen wealthy landlords and actually cultivated by several tenants and subtenants. Each kole area is generally divided into what are known as '*Padivus*' and this partition into smaller pieces is facilitated by the net-work of main and minor irrigation channels which also act as boundaries. By about the beginning of December when the water level, in the lake subsides, the remnants of the boundaries of the canals become visible and the work of repairing and strengthening their bunds is started in earnest all over the tract. At the same time the one or two openings (through the permanent embankments maintained by the state) by means of which these lakes open into the backwaters towards the west are closed in order to prevent the flow of salt water from the backwater into the Kole areas. The work of repairing, raising and strengthening the embankments and bunds of the various channels in the area forms one of the most important items of work, and obviously in most of these preliminary operations, a good deal of co-operation is and has to be displayed by the cultivators. Boat loads of gravel, bamboo skates, matting and straw are brought from the mainland for these purposes and the bunds are gradually raised to a height of 4 to 5 ft. and strengthened. As this work proceeds the water level in the cultivable area gently goes down and pumps of different kinds are employed to pump up the remaining water into the adjacent canals. In the old days wooden Persian wheels and other manual devices were employed to bail off the water from the low-level areas into the adjacent high level channels, but now-a-days with the advent of high power steam and motor engines, this work of pumping up the water is very much facilitated and done expeditiously. During the early summer months, numerous such pumps are installed at the main bunds and will be found at work, and for some days the murmur of these pumps and the noise of the pumped water can be heard continuously night and day. This work of pumping out water from these areas is often undertaken by contractors who own pumps and who get a good remuneration from the cultivators and now-a-days, of the two parties, the cultivator and the water-pumping contractor, while the former has to brave risks of

different kinds, the latter is sure of his income and has absolutely no risk to run since he is assured of his charges for pumping the water whatever happens to the crop. Incidentally we may add that in this way the Kole cultivation has substantially helped engineers and contractors to make large profits compared with those of the actual cultivator.

Next in importance to the pumping up of the water and exposing the lake bed is the problem of clearing the rank growth of weeds. This is a fairly tedious operation and numerous coolies are employed in their removal and collecting them into heaps. One can get an idea of the magnitude of this weeding operation if one is told that there are generally from 8-10 such heaps of weed, to each acre, each of these from 6-7 feet in height and about 6 feet across the heap! It is almost an impossible task to completely clear the weeds. These heaps when dry are burnt and turned to ashes to be used as manure later on. There is hardly any ploughing done, the only cultural operation being the drawing of a wooden harrow-like implement (a horizontal stout piece with numerous short spikes) over the surface of the smooth miry surface and then levelling the same with a long flat piece. Excepting the high channel bunds and the important embankments which still retain their framework, all the small narrow field bunds are almost completely erased by the floods of the previous year and have to be remade; this is usually done by erecting a line of weeds covering them with wet soil and fixing strong bamboo skates along the canal banks. These bunds being new appear clean and absolutely without any growing weeds to start with. In each *Padavu* or block all the preliminary operations occupy a fortnight's time and it is during this period hundreds of coolies from far off villages find occupation in the area.

IV Sowing Seeds and Irrigation. Soon after the land is prepared as before and the necessary arrangements made to get rid of the extra water and preserve the water necessary for future irrigation the seed is sown broadcast in the puddled lake-bed. It is needless to add that the area thus utilized is extraordinarily fertile; the soil is a sort of blackish soft mire mostly composed of large quantity of silt and organic debris deposited by the huge mass of water. The variety of seed used for the major portion of the area is a short-duration variety known locally as '*Cheera*', though occasionally other varieties like '*Ponnaryan*' and '*Champa*' are also used. The seeds are soaked in water in bags or baskets for 12 hours and kept wet for about 30-40 hours and the half sprouted paddy is sown on the 3rd day. The seeds remain exposed on the soil surface or a little below. In 3 to 4 days they give rise to white sprouts and green leaves open out. The sown plots are allowed to dry and crack for about 10-20 days before water is again

let in from the high level channels. In some portions where swampy conditions always prevail transplanting is done, and, for this nurseries are raised in high level areas at the outskirts of the lake. The major portion of the sowing is completed in the course of about 15—20 days. The baled off water which is held in the canals at a much higher level, as stated before, serves as a reservoir for supply whenever needed. The whole area in about 10 days after sowing presents a picturesque show with a vast area of green verdure enclosing and surrounded by numerous channels of different sizes full of water, much above the level of the crop in the fields. A close watch is made day and night by respective lessees to prevent any leak in the bunds; for, a breach at this stage will undo the whole work over large areas. In borders and outskirts away from channels, if the plots dry up too soon, before the seeds are fully germinated irrigation by splashing or by means of Persian wheel is given. By the time the plants are 6 inches high, the plots are fairly dry and water is let into the fields from the main and sub-channels. Sometimes necessity to refill the feeder channels by pumping back water from the main channels also arises for fields sown in somewhat higher levels. In later stages when the channel water supply is exhausted, the crop has to stand the chance of a rain or two. Occasionally a 'Padavu' or two lying uncultivated in swampy situations in the middle, may also serve to supply water as necessity arises. Thus the crop grows and comes to harvest by the end of April or early in May without much by way of further operations on the part of the cultivator.

Transplanted crops of Ponnaryan or Champa are also found occasionally in detached areas. Though transplanting gives a comparatively higher yield it is seldom practised due to the additional labour involved, want of suitable plots for raising nursery in the near vicinity, and the inordinate delay necessitated in the actual process of planting such vast areas as compared with broadcasting. In fact transplanting is resorted to only in such plots 'where the soil condition is such that it cannot be brought to a suitable condition to broadcast the seeds, due to the persisting damp conditions or the existence of natural springs.

V Harvest and Yield. Under normal conditions in the locality, a heavy yield of paddy results. On an average, an acre yields 200—250 'parahs' (1 para = about 7 m. m.) of paddy i.e. 20—25 times the seed used. From local inquiries made by the writers the cost of cultivation appears to come to approximately Rs. 30—35 per acre, as follows:—

1. Baling water	Rs. 10—12—0.	2. Trimming bunds	Rs. 10—0—0.
3. Cost of seed	Rs. 5—0—0.	4. Weeding	Rs. 2—8—0.
5. Sundries	Rs. 2—8—0.		

The yield after paying dues in kind for harvesting, threshing etc., comes to Rs. 100—125 (if the price of paddy rises, the income is more). The cost incurred in connection with combating insect pests or in connection with unexpected early floods before harvest is sometimes considerable.

A long duration swampy variety of paddy is also grown in small scale in the flats near the borders of the lakes from March to December. This crop grows and with the rising floods the plants always keep above the level of water; harvesting is mostly done here in boats. Due to increased facilities for draining or irrigating the land by use of pumps, the typical summer crop is raised of late on an extensive scale.

In case the summer rains are late, cattle are allowed to graze in the fields which will be full of green grass after harvest. Ploughing is also done here and there if conditions permit.

VI Insects of the Kole Areas. The Kole cultivator is at once familiar with two important pests viz. the swarming caterpillar of paddy (*Spodoptera mauritia* Boisid) locally known as 'Karakotti' and the ricebug (*Leptocorisa acuta*) known as 'Chayi.' Next in importance are the Rice hispa (*Hispa armigera*), the stem-borer (*Sehobobius incertellus*), the climbing cut worm (*Cirphis albistigma*), the case worm (*Nymphula depunctalis*) and the leaf roller (*Cnaphalocrocis medinalis*). Other insects of minor importance, are the green and white Jassids (*Nephotettix bipunctatus*, and *Tettigoniella spectra*), the rice thrips *Thrips oryzae*, *Leptispa pygmae*, *Dasychira securis*, *Oxya velox*, *Parnara mathias* and *Prodenia sp.*, which appear at several stages of the growth of the crop.

Spodopëtra mauritia, (Boisd) This pest occurs on a large scale and does considerable damage to the crop almost every year. The caterpillars are first noticed by cultivators when they are about two weeks old in crops of 3 to 4 weeks' growth especially when they cut leaves and do appreciable damage to the crop. But the actual infestation starts quite earlier and is little noticed. Usually the ryots' practice of keeping the plots dry for a period of a fortnight and then suddenly flooding the crop, reduces to some extent the severity of attack. More sensible ryots if they happen to see the small caterpillars keep the crop wholly submerged for 2 or 3 days, and then sweep the floating caterpillars with brooms and destroy them. Often a floating raft made of brambles and green twigs is made and dragged over the submerged crop and by this means a large number of the larvae are collected out of the crop, and water let out to the desired level. In the absence of sufficient water supply, the ryot is practically helpless. Fortunately the pest is never found to occur a second time in the same crop. The grown up caterpillars are eagerly singled out and greedily devoured by ducks which are reared in thousands around these localities.

2. The notorious rice bug (*Leptocoris acuta*) is another injurious pest causing very serious damage at the flowering stage of the crop. The bug quickly multiplies in numbers in the numerous grasses and in the swamp paddy at the outskirts of the lake, almost all through the year. In the vast area of paddy the ryots' attempts to capture them are of no avail, and this bug is in some seasons known to cause more damage than any other pest.

3. The rice hispa, the case worm and the leaf-roller appear in stray plots in such large numbers as to disfigure the foliage, and cause a sickly appearance to the early stage of crop which however, recover later on automatically with advance of growth. The egg-masses of the paddy stem borer are found in plenty, as soon as the water is let in, but the later vigorous growth of the crop and with the advance of hot weather, it becomes scarce. Climbing out worms (*cirp his spp.*) appear during certain years and cause some appreciable damage to earheads. Isolated caterpillars of *Prodenia* start along with *Spodoptera*, but they prefer to grow on the weeds in later stages. Thrips *Oryzae*, *Leptispa* and the Jassids are not known to do any serious damage though visible in early stages. *Dasychira*, *Parnara* and *Oxya* are found in small numbers almost to the time for flowering.

It will be seen that almost all important paddy pests are found on Kole paddy, but the more important and serious ones during most years appear to be the swarming caterpillar and the ricebug.

VII Conclusion. It will thus be seen that Kole cultivation presents a unique method of crop growing and offer multifarious opportunities for studies in different directions to all interested in the various aspects of agriculture and allied sciences. To the entomologist it affords exceptional opportunities to study the bionomics of insects under unique conditions. No less important is the field for the zoologist who can get a varied collection not only of fresh water fauna, but also other animal associations such as birds, reptiles etc. The avifauna of this region is extremely remarkable and the ornithologist will find here an ideal spot for game shooting. Of immense value, may be the study of the weeds and vegetation of the locality to the Botanist. The study of the changing conditions of the soil in this area will no doubt interest the chemist and bacteriologist as well. The sudden changes in the atmosphere brought about by the removal of water, drying of the fields, and concomitant rise of crop in a large scale together with the prevailing influence of hot weather also offer exceptional opportunities for the Agricultural meteorologist for the study of the microclimate of crops. The authors have only attempted to give a general out-line of this interesting practice and those who are interested in the details of this subject will find ample scope for further scientific investigations.

THE PROVINCIAL ECONOMIC COUNCIL

• BY RAO SAHIB V. MUTHUSWAMI IYER,

Retired Lecturer in Agriculture, Coimbatore.

The recommendations of the Sub-Committee of this Council have just been published (vide official summary published in the 'Hindu' dated the 17th October 1936).

In these days of universal economic depression and acute unemployment, it is satisfactory to note that the Committee urge "an enquiry into the subject of rural income and standard of living". One would however think that this is too vast a subject for a purely advisory body like the Economic Council effectively to undertake.

That the matter of standardisation of weights and measures should, in the opinion of the Committee, be deferred until after the inauguration of the New Constitution is unfortunate. That the primary producer and the consumer have long suffered and are suffering from the inequities of the existing system is a well known fact. The subject is non-controversial and no one would murmur if the Council had pressed upon the attention of Government the urgency of a measure of reform in this direction which is overdue.

The public would welcome the suggestion of the Committee that Breeding Stations and Sub-stations for paddy may be opened in Vizagapatam, Chigleput, Kistna, Nellore, the Periyar area in Madura, Tinnevely and South Kanara. It is to be noted that this recommendation has reference chiefly to rainfed areas and coastal districts. Tankfed areas in the interior are not negligible and deserve better attention than has been accorded by the Council.

The Committee rightly stress the need for attaching a fruit section to all Agricultural Stations where conditions permit but, it is feared, that they overstep the limit when they suggest that the area of the farms at Samalkota, Aduthurai and Pattukkottai should be increased by 35, 15 and 15 acres respectively.

Consolidation of cultivation on a co-operative basis with a view to forming large scale farms seems to be a pious hope. Wherever conditions permit, ryots do such cultivation and there are limits to co-operative farming as agriculture is still primarily an industry of the individual in India.

'Economics' has for several years formed an important part of the agricultural course at the Agricultural college. A perusal of the College calendars would show that the Committee has been misled in this matter and that their recommendation in this regard is therefore superfluous.

The Committee make a wholesome suggestion that Elementary Teachers should have training in agriculture but their recommendation that facilities should be afforded at Agricultural Stations seems to ignore the fundamental facts that Agricultural farms are opened under rural surroundings where cultivation is possible and training schools are located in urban areas where pupils are available in numbers. Their recommendation should, in order that it may become practicable and useful, aim at a small area being attached to training schools. These schools should be located in or transferred to localities where such facilities can be secured.

Presidents of District Boards who are *ipso facto* members of the District Economic Councils can very well lead the way, as one or two have already done without any objection from Government, in giving effect to the recommendation that an agricultural graduate should be appointed in every high school to give such instruction as will give an agricultural bent to students. Government will most surely and gladly help in this direction. There can be no doubt on this point.

The recommendation that Government should purchase and maintain and encourage co-operative societies and ryots to purchase and maintain bull calves from ryots and sell them when old enough as breeding bulls, will not receive general agreement of the discerning public. The cost and risk involved in rearing bull calves until they grow and are declared fit for service are so great that no co-operative institution or ryot can in the present state of public finance invest on bull calves as such. Much more than in the case of crop seed, it should form one of the functions of the Development Departments of Government to undertake this piece of work. All are aware that cattle improvement is a slow process and that the cattle farms in this Presidency have not distributed even an appreciable number of bulls in proportion to the total cattle population. In this respect sure and steady work is important, if satisfactory results are to be obtained: opening of more cattle farms will be one solution of this vexed problem.

Revival of Tank Restoration Scheme parties is as urgent a matter as investigation of irrigation projects, the area under tank irrigation being very large. The Kudimaramat system seems in the opinion of the Committee to have failed of its purpose and most would favour the execution of repairs by Government owing to existence of factions in villages.

In regard to underground water and its availability for cultivation five recommendations have been made which deserve careful attention on the part of the authorities. It is not known what action was taken on the survey of underground waters made by the Agricultural Engineer over a decade ago.

Touching the recommendation that Government should undertake in suitable areas sinking of irrigation wells and distribution of pumped water, it may be added that in Chittoor, North Arcot, Chingleput, South Arcot and parts of Ramnad and Vizag where the water table is high, such attempts are likely to be more successful and need earlier attention as the extension of electric schemes to those districts would become possible in the near future.

In the matter of crop improvement, the very striking example set by the Bombay magnate Mr. Walchand Hirachand in awarding a prize of Rs. 1000 to the cultivator of sugarcane who produces 100 tons of cane per acre may very well be repeated by the Government and interested parties in Madras.

In this connection mention may be made of the action of the U. S. S. R. in stimulating production of cotton by paying the growers on a graded scale. "Those who raise 2 tons per hectare are paid at 180-200 roubles per 100 kilogram, and for those raising 3 tons the price is from 230-250 roubles per 100 kilogram, though the price for the "American" raw cotton, grown on the irrigated region, is 110 roubles per 100 kilogram. Likewise, in the non-irrigated regions yield of 500 kilograms per hectare is paid at 151 roubles per 100 kilogram; if the harvest is 700 kilograms the rate is 238 roubles and for one metric ton the rate is 307 roubles."

Further extension of cultivation of sugarcane whether North of Kuttalam in Tanjore District or elsewhere in the Presidency may wait until after the Tariff Board next examines the question of sugar industry in this country in a year or two, as cheap sugar from Upper India where costs of cultivation are smaller cannot be kept out from Madras even under the conditions of provincial autonomy next year.

Most of the other recommendations of the Committee would meet with general approval as they indicate a distinct step forward in the direction of improvement of the ryot's economic conditions.

Time, labour and funds are prime factors and the extent to which these latter are made available will determine the degree of development reached.

With the experience that will accrue of their working in the interval, the new ministry of 1937 one hopes would be in a position to examine the constitution and functions of District Boards, District Educational Councils and District Economic Councils and their relationship with or dependence upon Government departments and to introduce such measures as will tend to make them live units in the Governmental administration.

RATIONAL FEEDING OF CATTLE

BY T. MURARI, B. Sc., (Oxon), F. L. S., F. R. S. A.,

Deputy Director of Agriculture, Livestock.

Hindus and Buddhists generally venerate animal life and usually show an aversion to hurt dumb animals. In India, especially the cow is a very sacred animal and the veneration in which it is held, evidently had its origin in man's appreciation of its great usefulness, in supplying milk, milk products, and cattle for the farm and the home, not to speak of the dung and urine, which besides serving as manure, figure prominently in the domestic and religious life of the Hindu. It is amazing therefore, to find, when one journeys through the country, emaciated specimens of cows, which are the result of insufficient feed and improper attention, quite out of keeping with sacredness associated with the cow.

This negligent attitude is reflected even in cities like Madras where the professional milkman maintains the cow through her lactation period and later sells her to the butcher. The humane method of killing animals with the special type of gun called the "humane killer" is not practised. It is usual to see miserable-looking calves with the milkman. The calves generally die, due to lack of nutrition and the milkman has the dead animal stuffed with straw and put before the dam so as to induce her to yield milk. That there should be no public opinion to stop this kind of practice in this country is more surprising.

The ryot who mainly depends on cattle for his crop-husbandry does not usually conserve fodder in the same way as the farmer does in the Western Countries. He generally takes particular care of the bullocks but not of the cow. He feeds them when he has plenty and at other times, lets them find their requirements as best as they can by grazing in dried-up fields and roadsides. Nevertheless the ryot expects the cows to work and produce calves.

Again, both in villages and in small towns, people who are not ryots maintain cows to supply home requirements. This practice may be back-yard dairying. The cows in these cases are generally managed by servants who may be ignorant of the best methods of feeding, and very often the animals do not get a balanced ration although they are expected to give large quantities of milk.

All animals need sufficient food for keeping their bodies in working order. The ration which gives sufficient energy for just keeping the animals in good health without further demand for any useful work is known as "the maintenance ration". It is in addition to this,

that food must be given. for producing milk or for turning out work. This portion of the food is known as the "production ration". These terms, maintenance and production are mainly used for purposes of working out rations in a sensible way, but it must be remembered that in the animal stomach no such distinction occurs. Any food that is in excess of the requirements of the body in normal working order, would either be stored as fat or converted into work, or milk. The type of food given will no doubt vary from district to district, but it should fulfill these fundamental requirements.

The ration should contain what are known as proteins or albuminoids. These are of complex chemical composition and contain 16 per cent of nitrogen, a certain amount of sulphur and sometimes phosphorus, in addition to carbon, hydrogen and oxygen. It has been discovered that there are particular types of aminoacids like cystine and tryptophane, required for particular function of the body growth, milk production etc. It is yet too early to state exactly the minimum requirements of the various types of farm stock. The white of an egg and the caseinogen in milk, gluten in wheat are examples of proteins. Cattle foods such as groundnut, coconut, gingelly and other cakes, and tender green grass, rich in proteins, are called concentrates. Proteins are essential for muscle building. When they are not sufficient the young animals cease to grow, while older ones become emaciated and several disorders make themselves apparent. When proteins are given in excess, digestion and kidney functions are disturbed and unpleasant smelling fæces and gases are produced.

Foods should also contain what are known as carbohydrates. These are composed of carbon, hydrogen and oxygen with hydrogen and oxygen in the same ratio as in water. All starches, and sugar, may be classed as carbohydrates. Grass and straws contain large quantities of carbohydrates. Rice, maize, potatoes, sweet-potatoes, tapioca, and yams also contain large percentage of carbohydrates. These are necessary for producing sufficient heat for doing work or putting on fat. Carbohydrates are also required by the ruminants in particular to satisfy their craving for bulk. If the animals feed mainly on bulky fodder like straw, the abdominal muscles get distended and "Pot bellies" become evident. In extreme cases the energy used in mastication is more than the energy in the food; and the result is enfeeblement and death.

Foods also contain fats which are similar to carbohydrates but are poorer in oxygen. They are found in large quantities in foods like groundnut, gingelly, rape and linseed seeds and coconut cakes. The heat producing value of fat is two and a half times that of carbohydrates. The fat is generally used up in work and when in excess will be deposited in the body as depot fat. When stored as fat it is used up

for work in times of stress. At one time it was thought that carbohydrates could replace fats of equal heat value but it is now being recognised that a certain minimum of fat is required for the well-being of the body.

Substances called Vitamins, the chemical composition of most of which is not yet thoroughly understood, are essential for growth, maintenance of good health and for reproduction. These vitamins have been recognised by their specific effect on the body complex and they have been called vitamins A, B, C, D and E. Vitamin A, was first observed to be in loose association with animal fat and to be essential for the growth of the young. This vitamin has been recently isolated and is known to be clearly related to a group of vegetable pigment known as the carotenes. Green vegetables and green herbage grazed by cattle will no doubt supply this vitamin adequately. It is noted that vitamin B is necessary for the proper function of the nervous system. Vitamin B complex is divided into B₁, and B₂. Vitamin C is well known as a preventive of scurvy, a common complaint when fresh foodstuffs are not available for considerably long periods. This vitamin has been chemically separated and it is now called ascorbic acid. Vitamin D is known in connection with rickets. This vitamin is essential for proper assimilation of calcium, and belongs to a class of substance known as sterols. If this is not present in the food of the growing animal, it could be produced by the body itself by irradiation. At Hosur it was found that the pure white ram lambs could not survive more than six months and were not fit for breeding. By the administration of small quantities of cod-liver oil it was possible to make them grow satisfactorily and to use them for breeding. Vitamin E is also known as anti-sterility vitamin. Absence of vitamin E will lead to a failure in reproductive powers. The chemical action of this has not yet been determined. If mixed feeding with sufficient green herbage is possible, there should be no vitamin deficiency in the rations.

In addition to the above, cattle food should contain sufficient minerals such as calcium, phosphorus, sodium chloride, iron, etc. They are absolutely necessary for bone formation in the young, production of milk and for maintenance of proper balance of health. Tuberculosis in the cases of heavy milkers is considered to be directly due to lack of sufficient calcium in the blood. Col. Matson has shown the beneficial effect of potassium iodide in cases of delayed shedding of calf hair. In general practice very often unthrifty animals have improved considerably after the inclusion of minerals in the ration. At Hosur, the Ongole calves weighed on the average 52 lb. while the average weight at Chintaladevi in the Nellore district was 62 lb. but when 2 oz. of equal portions of lime and bone flour were given to pregnant animals for about 2 months prior to parturition, the average weight of calves increased to 61 lb. Of late, deficiency of iodine has

been found to affect growth and produce abnormalities. In order to obviate any mineral deficiencies proprietary articles in the form of mineral bricks are put on the market. Experiments conducted at Hosur show that an ounce of common bazaar salt per animal in addition to 1 to 2 ounces of lime and bone flour in equal quantities and rock salt lick for all stock are very economical from the ryot's point of view. The bazaar salt contains enough iodine to make up for any iodine deficiency in the cattle food.

In addition to minerals, water should be given *adlib* to all animals. As the muscles and blood contain a very high percentage of water it is essential that water should be consumed. It also helps in transporting food materials and washing down of waste products in the body economy.

So far the uses of foods have been described. Now the ryot should know how much food to give an animal. The European standards do not apply to Indian conditions. From Ramiah's nutrition experiments conducted at Coimbatore it is seen that the maintenance ration of adult Indian cattle in the Presidency is extremely low as compared with European. 200 grammes* of groundnut cake and 8 kilograms of paddy straw are sufficient for maintaining an adult bullock in good health. Figures for production are not yet available, but in the absence of such figures, it would be quite safe to give 3 lb. concentrated mixture for every 10 lb. of milk produced by the cow; for work-animals 2 to 4 lb. of concentrated mixture depending on work ought to be sufficient. Hay and water *adlib* should be given in order to satisfy the animal.

The following are some of the useful standards for feeding a bullock of about 1000 lb. liveweight, the production rations being added to the maintenance ration for bullock at work.

<i>Maintenance ration.</i>	<i>Production ration.</i>
1. 14 to 18 lb. hay	2 to 3 lb. groundnut cake.
7 to 10 lb. straw or grazing	1 to 1½ lb. ricebran.
½ lb. concentrate	
2. 25 to 40 lb. silage	1 to 2 lb. wheatbran
10 to 14 lb. hay	1 to 2 lb. horsegram
7 lb. straw	½ to 1 lb. chenna busa.
3. 20 lb. cholam fodder or hay	2 lb. bran (rice or wheat).
½ lb. concentrate	1 to 2 lb. cotton seed (crushed).
	1 lb. soaked horsegram.
4. 10 to 15 lb. green fodder	2 lb. gingelly cake.
such as lucerne, lab-lab	2 lb. gingelly cake.
and 10 to 20 lb. of some	1 lb. ricebran.
grass or straw.	1 lb. bhusa.
	1 lb. wheatbran.

1 oz. bazaar salt, 1 to 2 oz. lime and bonemeal, rock salt lick and water *adlib*.

Palatability of foods and individuality of the animal should not be lost sight of in animal management.

* 1 lb. = 453.593 grammes.

One is likely to ask whether a ryot could afford to give a liberal ration to cattle. If he wishes to get the best out of his animal, it would be far better for him to keep a less number and look after them properly and sell out the surplus than keep an unnecessarily large number of mediocre animals and underfeed them. At present there are far too many useless cattle in the country. It is a greater sin to starve the animals than to kill those that the ryot cannot possibly feed satisfactorily, as he has to conserve fodder for his animals for the dry period when no proper grazing is available.

A PRELIMINARY NOTE ON THE EFFECT OF HAND DIBBLING ON SOME OF THE CHARACTERS IN COTTON

BY C. VIJAYARAGHAVAN, L. Ag.,

Superintendent, Dry Farming Station, Hagari

and

N. KESAVA IYENGAR, M. A.,

Assistant in Cotton, Agricultural Research Station, Hagari.

The common practice of sowing cotton in breeding plots is to dibble the seeds by hand. This system is preferred to drilling since the quantities of seed material handled are small and the number of units to be sown is very large. In the course of sowing trials conducted on the black soils of the Hagari Agricultural Research Station, differences have been noticed from the very beginning in the mulch of the plots dibbled by the hand and of those sown with a drill. Drill sown plots have an advantage over those sown by dibbling in that the seeds lie uniformly deep in the furrows formed by the drill. The furrows are covered immediately by working a blade harrow and the soil is compacted over the seed leaving a fine mulch on the top. The effect of this harrowing lasts for a long time. In the dibbled plots on the other hand it is not possible to lodge the seed at a uniform depth. Further as no harrow is passed, the top soil gets dry and hard, and starts cracking earlier leading to depletion of soil moisture sooner.

In order to test whether the two methods of sowing affect any of the characters of cotton, observations were made during the season 1934-35 on a pure strain of *herbaceum* (Hagari 1) grown at this station. The two treatments were replicated four times on plots of two cents each.

The characters studied were (1) position of the first fruiting branch, (2) yield of seed cotton per plot, (3) lint weight per seed, (4) weight per seed, (5) ginning percentage and (6) lint length. Samples for the examination of lint and seed weights were collected from 3 locked bolls of weekly pickings and seeds from all the positions of

the lock were taken to form the sample. Only seeds from the third position of the lock were used for the determination of lint length. The results of the studies of the several characters are given in the table.

Table I.

Blocks.	I		II		III		IV		V		VI	
	1st Fruiting Branch		Yield of seed-cotton per plot (lb.)		Lint weight per seed (mgs.)		Weight per seed (mgs.)		Ginning percentage.		Lint length (m. ms.)	
	Hand sown	Drill sown	Hand sown	Drill sown	Hand sown	Drill sown	Hand sown	Drill sown	Hand sown	Drill sown	Hand sown	Drill sown
1. ...	6.9	7.1	1.48	2.22	21.8	23.2	56.2	58.4	27.8	28.4	25.7	26.7
2. ...	7.1	7.5	1.95	2.91	22.0	23.0	55.2	56.4	28.4	29.4	25.2	25.1
3. ...	7.3	7.6	2.39	3.28	21.6	23.8	57.0	58.4	27.6	29.0	25.1	26.4
4. ...	7.2	7.7	2.28	3.75	22.8	24.4	58.6	59.6	28.0	29.4	26.1	26.2
Mean.	7.1	7.5	2.03	3.04	22.1	23.6	56.8	58.2	28.0	29.1	25.5	26.1
t value*	5.0		5.1		5.2		5.0		5.8		2.0	

Yield in pounds of seed cotton per acre = 224 365

Percentage of increase over the hand sown = 33

* t value for P = .05 and n = 3 as per Fisher's table = 3.182.

N. B.—Differences are significant in characters I to V but not significant in lint length (VI).

The following conclusions are evident from the table:—

1. The first fruiting branch arises earlier in the hand sown plots. It indicates that the reproductive phase is initiated earlier, possibly due to lack of moisture in the hand dibbled plots.

2. Hand sowing depresses the yield by 33%.

3. Lint and seed weights are also lowered in the dibbled plots.

4. The ginning percentage is reduced indicating thereby that the rate of fall in lint weight is greater than in the case of seed weight in the hand sown plots.

5. Lint length is not affected.

Further studies are necessary before any explanation can be offered for the above behaviour.

THE FINAL YEAR STUDENTS' TOUR

BY A. V. PITCHUMANI, Class III.

The eagerly expected fortnight's tour of the Final year B. Sc. Agr., students commenced on the 1st of October. We were a jolly batch of twentyfive and we met at Ongole in the early hours of the 1st October. This tour was intended mainly for the study of cattle breeding with special reference to the Ongole and Alambadi tracts. During our two days' stay at Ongole we visited the neighbouring villages of

Karavadi and Tangaturu—two important cattle centres in the Ongole tract. Our stay at Ongole was very happy and useful. While leaving that place we carried with us vivid memories of the excellent cattle reared by almost all classes of ryots, of the majestic Brahmini bulls which are so common in all the Ongole villages, of the well preserved pastures—indeed of all those things which the Ongole ryot so intelligently and carefully does as to maintain a fine breed of cattle. Our class played volley-ball and tennis matches with the Ongole Mission High School and won both of them creditably.

Our next visit was to Narasaraopet which we reached on the 3rd morning. The same evening we visited a neighbouring village where we made enquiries regarding the local agricultural practices of the tract. The next day we paid a visit to Chilakaloorpet—a flourishing village of agricultural importance—where we studied the methods of citrus and guava cultivation. On the 5th we had a very pleasant and instructive trip to the Guttikonda forests, thirtyfive miles from Narasaraopet. There we saw the forest tribe, the Lambadis, whose chief occupation is cattle rearing. Hundreds of cattle, generally of poor type, from the neighbouring taluks are brought to be left here under the charge of the Lambadis in June-July. These cattle are taken back by their owners usually before "Pongal" in January. Before leaving these forest grazing areas or *pentas* as they are called, we were entertained to a nice dance by these Lambadis.

On the 6th we left for Nandyal. The journey especially through the Nellamala forests was exceedingly pleasant and we were enthralled by the sublime scenery which Dame Nature has showered upon those regions. Undulating forests, deep valleys, fearful tunnels and screaming streams, all these captured our imagination. On arrival at Nandyal, we went round the Agricultural Research Station, where we were shown and explained the various experiments and the selection work carried out in the Farm on the dry crops of the Ceded Districts. The next day we visited Panyam, a neighbouring village noted for its fruit cultivation. Here we saw the gardens and nurseries of Messrs R. V. Madhava Rao Bros. and got first-hand information regarding citrus and mango cultivation, budding grafting topworking. Mr. Hanumantha Rao the joint owner of those gardens explained to us the various details very clearly, and also arranged a nice exhibition of the various specimens and varieties of fruits grown by him. After a delightful evening party and group photo arranged by him in his beautiful gardens we returned to Nandyal. We reached Bangalore on the 8th October. Thanks to the untiring efforts of Mr. Vasudeva Rao, veterinary surgeon, Hebbal, who was deputed by the Government of Mysore to look after our comforts, our stay at Bangalore proved most instructive and enjoyable. We visited Hebbal next morning.

Dr. Badami, the Economic Botanist of Mysore and his assistants provided a fund of knowledge to the students. We were impressed with the amount of work turned out here, especially in livestock and plant breeding sections. To Dr. Badami in whom we saw a rare combination of an enthusiastic scientist and a pleasant conversationist, we were sorry to bid goodbye after an entertaining tea. In the evening we visited the Imperial Dairy Institute where the officers and staff were kind enough to take us round and explain the various operations in the Institute. When we were leaving this model dairy our little voices began to question, "When will our India see such dairies on an extensive scale?"—That cleanliness, those students in tiptop clean overhauls looking just like blooming nurses, all left echoing impressions in our mind. Our stay at Bangalore was happy throughout.

Our next place of halt was the Hosur Livestock Research station. While nearing Hosur we could hear the rumblings, "They play cricket and speak English", I mean the farm coolies. Our expectations were materialised the next day when a Bangalore cricket team visited Hosur and Lieut. Murari, the Deputy Director of Livestock turned out with a strong team and routed the visitors. We were none the less responsible for the success (in as much as we lent the services of two of our colleagues.) Hosur is about 3000 ft. above sea-level. With a salubrious climate and rolling pastures, it is an ideal place for a holiday resort for a pick-me-up. At the farm we had a look at the Dairy and the Livestock section and were much impressed especially with "poultry keeping and pig rearing". We also visited the Government Sericultural seed farm run for the benefit of the Kollegal silk industry.

After we left Hosur, our tour during the next few days was so speedy and so full of adventures that we little realised that it was coming to a close until we reached Coimbatore. Karandahalli, Dharmapure, Pennagaram and Kaveri were successively visited and we remember vividly the sturdy herd of Alambadi animals and our dip in the Cauvery falls. It was an exquisite pleasure for all of us to have had a wonderful bath in the sacred waters of the great Cauvery. It was a wonderful sight to see the ever green steep valleys as the buses groaned along the metallised ribbon to the falls. One may be tempted to question what impressions we carry of the tour. It is difficult to give a definite answer. No doubt we can differentiate between an Ongole, an Amrithamahal, a Kangayam and an Alambadi. "Is this all"? one may ask. No. Every thing is there in the subconscious mind, so vivid as to be at the beck and call of our conscious mind. The characteristic agriculture of Nandyal, Ongole, of the Mysore plateau and the hills, their soils, their people and their manners and customs, they jump up vividly and quickly. We went, we saw and we returned more experienced and better informed than before.

We students, scarcely realise the debt of kindness of filial love shown by the various officers and others who were responsible for our well being, which still remains unredeemed when we thank them heartily. Our sincere thanks are especially due to Messrs E. K. Nambiar and P. A. Venkateswara Iyer who were in charge of us throughout the tour and who showed a remarkable degree of patience and forbearance towards us and made this tour of ours a great success. Once again we thank all those officers and others who were of great help to us during the tour and were mainly responsible for the success of this instructive and enjoyable tour.

RETIREMENT.

During the last month, two of the senior members of the Madras Agricultural Students' Union, Rao Bahadur S. Sundararaman and Rao Saheb C. Narayana Iyer retired from Government service.

Rao Bahadur S. Sundararaman was born in the year 1881 in the Tanjore District. His earlier years were spent at Saidapet under the beneficent influence of his father who was then the Vice Principal of the Teachers' College. He graduated from the Presidency College, Madras taking the M. A. degree in Botany with high honours, winning the Pulney Andy medal. In 1905 he entered the Madras Agricultural Department as an assistant under the Economic Botanist. An outbreak of a virulent disease of palmyras and the prevalence of sugarcane redrot in the Godavari and Kistna districts focussed the attention of the Madras Government to the need of Mycological investigations in this province and Dr. Butler, Imperial Mycologist, was requested to undertake the investigation. Mr. Sundararaman who had received his Mycological training under Dr. Butler himself was posted to help him. In this work he acquitted himself creditably and Dr. Butler was greatly impressed with the enthusiasm and earnestness of his young assistant. In his memoir on the palmyra 'Bud-rot' disease, Dr. Butler has recorded his appreciation of Mr. Sundararaman. The training he received from this eminent scientist in the early years of his service was a great asset which stood him in good stead and enabled him in later years to become a successful Mycologist. He was appointed in 1910, chief assistant to Dr. McRae, the first Madras Government Mycologist. In June 1920 he was admitted into the Madras Agricultural Service as Assistant Mycologist, a post which he occupied but for a short time; when Dr. McRae was transferred to Pusa as Imperial Mycologist, Mr. Sundararaman was appointed Government Mycologist in the Indian Agricultural Service.

This was no mean distinction, for it must be remembered that the entry of Indians to the Imperial Service was restricted to a very limited number.

From 1920 till the date of his retirement he continued to be Government Mycologist. For over 2 months he was in addition, in charge of the Principalship of the Agricultural College. In recognition of his service to Government, Mr. Sundararaman was conferred the title of Rao Bahadur in 1936. As a Mycologist, Mr. Sundararaman devoted his attention more towards such of those problems which were likely to be of immediate practical utility and benefit to the ryot than those which were purely of an academic interest. Gifted with great common sense and a shrewd insight into the psychology of the ryot, the methods he advocated were always readily accepted by the cultivator. Of a shy and reserved nature, Mr. Sundararaman shunned the lime light and hated advertising himself, but did not, on that account shirk any honorary duties that were imposed on him. As president of the Officers' Club (1929), Association of Economic Biologists (1934), Research Council (1936) and the Government Servants' Co-operative Society (1936), he rendered great service to these institutions.

With the Madras Agricultural Students' Union Mr. Sundararaman has been associated ever since its inception and had the unique distinction of being elected as its Vice President in the Jubilee year. He took a keen interest in Agricultural education and was also closely associated with the Madras University. He was for some time an examiner for the Honours degree examination and the B. Sc. Ag. degree. He was member of the Board of Studies in Agriculture and continues to be a member of the Board of Studies in Botany.

Unostentatious, simple and unaffected in manners, courteous to all and kind-hearted to a fault, Mr. Sundararaman endeared himself to all those who came in contact with him and was one of the most popular officers of the Department. His high integrity, thorough grasp of the principles of plant pathology and an innate capacity for administration made him a successful officer under Government.

Mr. Sundararaman retires after 31 years of useful service and we wish him on behalf of the readers of the *Madras Agricultural Journal*, long life, health and prosperity.

Rao Saheb C. Narayana Iyer comes of a respectable family in Madura District. He took his Diploma in Agriculture from the Madras College of Agriculture, Saidapet in 1902 and entered the department in 1903. After a few years' deputation to the government farms in Bombay Presidency, he returned to Madras and was employed in either starting new farms or running the already started stations in Bellary, Tinnevely, Chingleput and Tanjore. In 1906 he was associated with Mr. Benson, the then Deputy Director of Agriculture, in the selection of the present site for the Agricultural College and farm at Coimbatore. For about 4 years he worked in Tanjore in popularising the

economic transplanting of paddy and green manures and his work bore such remarkable results that he was known in the district as the "single seedling Iyer". He is still remembered in the District for the good work done by him then. He worked for 4 years at the Agricultural College as an assistant to the Entomologist. Later on, he was appointed chief teaching assistant at the Agricultural College and was promoted to the gazetted rank in 1918. He was for a number of years in charge of the Cambodia Cotton Improvement work in Coimbatore, which developed rapidly under his careful supervision. As Deputy Director of Agriculture, Coimbatore, he was responsible for developing and shaping the potato agricultural station, Nanjanad. He took enormous pains to introduce cattle power and labour saving implements in the cultivation of potatoes on the Nilgiris. His services were placed for some time at the disposal of the Co-operative Department for the development of the Co-operative Loan and Sales Societies in the Presidency.

During the last 18 months of his service he was at Madras as the Headquarters Deputy Director of Agriculture assisting the Director of Agriculture. Wherever he worked he earned a good name for his enthusiasm and earnestness in his activities.

As a mark of appreciation of the good work done for the Agricultural Department he was awarded by the Government the title of Rao Sahib in January this year. He retired from service on 17th November after 33 years of active and loyal service. We wish him long life and well earned rest.

SCHEME FOR ECONOMIC DEVELOPMENT OF MADRAS PRESIDENCY*

Recommendations of the Agricultural Development Committee of the Provincial Economic Council.

The Provincial Economic Council Sub-Committee which considered problems relating to the improvement of Agriculture and the economic development of the Presidency has submitted its report.

The Sub-Committee consisted of the Hon. Mr. P. T. Rajan, Minister for Development, (Chairman), Rao Bahadur D. Ananda Rao, Director of Agriculture, Mr. T. Austin, Mr. T. A. Whitehead, Mr. F. M. Dowley, Mr. P. T. Saunders, Dr. P. J. Thomas, Dr. B. V. Narayanaswami Naidu, Mr. T. A. Ramalingam Chettiar, Mr. C. V. S. Narasimharazu, Mr. A. Ranganatha Mudaliar, Mr. A. B. Shetty, Mr. V. Subbiah Mudaliar, Mr. Hunterboyd, the Rev. Father Basenach, Mr. R. M. Palat, and Rao Bahadur C. J. Paul (Secretary).

Mr. T. A. Ramalingam Chettiar has submitted a short minute of dissent.

The Committee which was appointed in November 1936 considered the following subjects.

(1) The preparation of a ten year plan for development of agriculture in order to make the Province self-supporting in the matter of agricultural production.

* Reproduced from the Madras Mail, dated 17th November 1936.

(2) Ways and means to co-ordinate the work of the various agencies for agricultural credit and the steps to be taken to give effect to the recommendations contained in Mr. M. Sathianathan's report on agricultural indebtedness,

(3) The standardisation of ways and measures, and

(4) Proposals for a consolidation of agricultural holdings and the prevention of fragmentation.

Four Sub-Committees were appointed to consider these different problems. Sub-Committee I, which had the Director of Agriculture as its convenor, was to deal with (1) the expansion of agriculture; (2) the improvement of cattle; (3) regeneration of fodder grasses; reduction of grazing fees and production of leaf manures; and (4) consolidation of agricultural holdings and prevention of fragmentation.

Sub-Committee II which had the chief Engineer for Irrigation as the convenor, was to report on: (1) extension of irrigation facilities for the development of agriculture; (2) irrigation wells (3) sinking of irrigation wells in river beds and (4) comparative sinking of irrigation wells.

The Director of Industries was the convenor of Sub-Committee III which was to consider (1) extension of the cultivation of sugarcane in the Tanjore district; (2) fruit preservation and canning; (3) the dairy industry in India, milk, powder and like products, and (4) the open pan system of sugar manufacture.

Sub-Committee IV with the Registrar of Co-operative societies for its convenor was to examine (1) the facilities offered by co-operative credit societies, co-operative loan and sale societies and land mortgage banks to the ryots for agricultural and other purposes; (2) how the agencies for agricultural credit are now correlated and how they can be further co-ordinated; (3) Mr. Satyanathan's report on agricultural indebtedness; and (4) the recommendations of the Madras Provincial Banking Enquiry Committee.

The main Committee reserved for consideration by themselves the question of "Weights and Measures".

The several Sub-Committees concluded their labours by the end of April and submitted their reports. The main Sub-Committee considered these reports and reached the following conclusions.

Agricultural Produce. "Many of us do not consider it feasible to make the province self supporting in the matter of agricultural produce", say the Committee. "But we all agree that in view of the growing population of the province there is need for a larger internal supply of rice and other food-stuffs and that it must be the aim of Government to increase the production from the land now cultivated and to bring new land under cultivation.

A five-year plan was drawn up by Sub-Committee II, with this object in view. We are aware that plans and programmes framed years in advance will have to be modified to suit changing conditions and circumstances but this should not deter Government from framing any at all.

Improved seed. We consider that the Agricultural Department should grow in Government farms pure and improved strains of seed stock and sell them to the cultivators. We are convinced that the seed produced at these farms will not be adequate to meet even a small fraction of the requirements of the ryots. The additional seed material required should be secured by the department entering into agreement with the grower, the terms of the agreement being:—

(i) that he will grow, harvest and stock the contracted quantity of seed under departmental control and direction and sell the same as seed material, and

(ii) that he shall be paid a definite rate of fair compensation for such portion of his seed material as remains unsold.

When the supply by this method is also likely to prove insufficient, the department should buy, stock and sell the balance of the required quantity. The Deputy Directors of Agriculture should be authorised to fix the premium rates as may be fixed by the Director from time to time.

Paddy Breeding Stations. "In our view two more Paddy Breeding Stations should be opened, one in the Vizagapatam District and the other in the Chingleput District for evolving semi-dry, dry, and drought resistant varieties of paddy and varieties suitable for cultivation in the months of September and October in the South-West monsoon. We also consider that small sub-stations for paddy should be opened in the Kistna delta, Nellore, Periyar tract of Madura, Tinnevely and South Kanara. The Godavary Agency offers room for great development and a farm may be started in that area for work on wheat, fruit and other crops suitable to the locality.

The departmental work so far as coconut is concerned, is now practically confined to the West Coast and in view of the large extent of the area under coconut in the Circars, the Committee consider that the Director of Agriculture should be instructed to pay immediate attention to the question of opening a coconut station in Godavari. In this connection we examined the position of the coconut industry in South India and being convinced that the dumping of coconuts from abroad has had very prejudicial effect on the local industry, recommend that an increased import duty be imposed on copra, coconut and coconut oil.

Tobacco Farm. "In our view there is urgent need for introduction of improved varieties of tobacco required for cigars. The Circars afford ample scope for experiments in this direction.

"We recommend that a Cigar Tobacco Farm be opened in a suitable place in the Presidency".

It has been represented to us that the agricultural stations at Samalkota, Aduthurai and Pattukottai are hardly large enough for the work to be done at these places. We accordingly recommend that the area in these farms be increased by 35.15 and 15 acres respectively.

We are glad to note the work being done for encouraging fruit cultivation. We consider, however, that to each agricultural station where climatic and soil conditions permit a fruit section should be attached by extending the station, if necessary.

Propaganda Measures. We are convinced that propaganda and publicity require greater attention and closer coordination.

"We therefore recommend strongly the appointment of a Deputy Director to be in charge of publicity. To aid in the dissemination of new ideas and practices, associations of agriculturists and others interested in the development and improvement of agriculture should be formed in every important village and for every firka, with a central association to coordinate and guide the work of the various local associations.

The assistance of Revenue and Agricultural Officers should be made freely available in the working of these associations. These associations may work under the auspices of the District Economic Councils. The membership of the associations should be limited to actual cultivators, owners of land who cultivate it by hired labour and those who contribute to the funds of the association.

Another effective means of propaganda is the visual representation of the improvements through exhibition vans and films. We understand that the Agricultural Department has already been doing some work in this direction. We recommend that a suitable cinephotographic and projection equipment be purchased and arrangements made for the production of suitable films for propaganda purposes.

"Each assistant director of agriculture should have a motor cinema van. Each agricultural demonstrator should have a well equipped depot from which he should be in a position to supply ryots with improved seeds and agricultural implements such as ploughs, cultivators, chaff-cutters, bund farmers, hand-hoes, dusting appliances, sprayers etc.

Rural Uplift. "To improve the condition of the rural masses should be the predominant aim of the Agricultural Department. We recommend that trained rural guides be appointed, one for each group of villages to work under the guidance of the District Economic Council. It will be the duty of these rural guides to spread improved strains of seeds and better methods of cultivation, to demonstrate suitable subsidiary industries in the villages, to improve the health and sanitation of the village, to effect reform of diet, to organize farmers' clubs and rural amusements, to improve the artistic side of village life, to improve the livestock in villages and to interest the villagers in the work of rural uplift by all kinds of propaganda. The local officers of all the development departments—Agriculture, Veterinary, Industries, Education and Public Health should render them all the help they can.

"A start has already been made in the Vizagapatam District where concentrated work is being done by demonstration maistries in 9 taluks. The existence of the Agricultural department is being felt by the ryots who have begun to appreciate the work of this department and to take advantage of the presence of the maistries amongst them. It may not be possible to introduce these guides in all parts of the presidency at once. One or two taluks may be selected in each district for the present and the scheme may, if successful, be gradually extended to the entire Presidency in the course of about 10 years.

"The training of rural guides should be the concern of the Provincial Government and we recommend that immediate steps be taken for their training in suitable centres, preferably in agricultural farms and schools, the district staff of the various development departments being used for giving the training.

"The value of cottage industries to improve the economic condition of the ryot has often been emphasized. Effective steps should be taken early to develop these industries. Special officers and committees have examined the question of subsidiary industries in the past. *We feel that there can be no justification for delay in drawing up a plan or programme of work.*

"The evils of fragmented holdings have been long recognised and suggestions have been repeatedly made for the consolidation of holdings. The problem however, is not so acute in the Madras Presidency as in some other parts of India. So far as this Presidency is concerned, we agree with the opinion expressed by the Revenue Commissioner that the experiment should proceed on the line of consolidation of cultivation rather than of consolidation of holdings and, accordingly, recommend that consolidation of cultivation on a large scale on a co-operative basis be encouraged with a view to forming large-scale farms.

"In view of the prevailing unemployment and the likelihood of its assuming greater proportions in the future, we consider that steps should be taken to divert the attention of the educated youth to agricultural pursuits and that facilities should be made available to them.

Land Colonization Scheme. "Land Colonization Schemes for Harijans and unemployed boys, especially those who have passed out of the Agricultural Schools and College should be formulated.

"The Agricultural Department should investigate the question of growing suitable and remunerative crops on the cultivable waste lands available in each

district. A survey of waste lands should be made; the possibility of cultivation by tractors should also be examined.

"Our attention was also drawn to the damage caused to crops by wild animals. We consider that some assistance should be afforded to owners of land in such areas to fence their lands; if the owners refuse to take concerted action, powers should be given to village panchayats to carry out the work provided the owners of not less than two-thirds of the area demand it, the charges being divided amongst them in proportion to the extent of the land owned by each.

"A suggestion was made to the effect that agricultural graduates should be trained in Economics as the business aspect of agriculture is of great importance. We were divided on this question. We agreed, however, to request the Director of Agriculture to examine the system carefully and to take necessary action.

Training in Agriculture. "In order to give an agricultural bias to education, we consider that wherever elementary training schools are located near an agricultural farm, facilities should be provided in that farm for the training of the pupil teachers in agriculture and that in other cases, arrangements should be made at the agricultural stations for the training of teachers' deputed by local bodies.

"We also regard it as essential that an agricultural graduate should be appointed in every High School to supervise and conduct gardening classes to teach nature study and generally to give an agricultural bent of mind to the students.

"We consider that with a view to expeditious disposal of applications for *takkavi* loans, Deputy Directors of Agriculture should be empowered to grant loans up to Rs. 250 to purchase seed and agricultural implements.

"Finally we agree with the other recommendations contained in the five year programme of expansion and suggest that Government should take up the various recommendations we have made in regard to the expansion of the activities of the Agricultural Department and others included in that programme for very early consideration.

"When our recommendations are given effect to, the work of the Department will have expanded considerably. To cope with that increase and achieve full and effective results the staff of the Department should be augmented in the following directions :—

"(1) There should be at least one Assistant Director of Agriculture in each district so that more effective control over the work of agricultural demonstrators can be secured. The question of the need for having eight circles should be examined with a view to reducing their number.

"(2) We understand that Government have recently sanctioned an addition to the strength of demonstrators and that it will now be possible to station one demonstrator in each taluk. We desire that in view of the importance of fruit culture, the expansion of which we have recommended elsewhere, an extra demonstrator should be employed in such of the agricultural stations where experiments on fruit culture have been or would be undertaken.

"(3) We also consider that there should be an assistant to be in sole charge of seed selection work and cultivation of improved strains in millets particularly in the I Circle.

"(4) The posting of a demonstrator for each taluk will not by itself bring about the much needed link between the department and the ryot and in the very nature of things it is impossible for the demonstrator to make prolonged halts and to pay frequent visits to the villages to the extent necessary to establish

and maintain close contact with, and sustain the interest of, the ryot in the improvements advocated. The system of employing maistries on a wide scale in the Vizagapatam district has had a salutary effect and real progress has been achieved in that district. We consider that at least one demonstration maistry should be attached to each firka or unit of 25 villages whichever is less. We trust that Government will find it possible to provide this additional staff of maistries.

Live-stock Improvement. "Closely connected with the improvement of crops is the question of the improvement of cattle. Its importance can be easily gauged by a remark of His Excellency the Viceroy when he presented two pedigree bulls at New Delhi. 'The cow and the working bullock' he said, 'have on their patient backs the whole structure of Indian agriculture.' The breeding of cattle has been undertaken by Government and the main efforts of the department are now concentrated in Hosur though some work is carried on in Guntur. Dairy herds are maintained at Hosur and Coimbatore. It is unfortunate that the axe of retrenchment should have fallen so heavily on the livestock section. The fine herds of Ongole, bred at considerable expense at Chintaladevi had to be dispersed on the abolition of that farm. We feel that the supply of bulls by the Agricultural Department has in the past been so small that it is imperative to increase rapidly the number of cattle breeding stations in the breeding areas of the Presidency.

"We recommend that a farm be opened in Guntur, in addition to the buffalo-farm which, we learn, is contemplated at Prattur. Another farm may be opened at Vizagapatam for the improvement of the Ongoles. The Kangayams may receive attention at Madura. After the question of improvement of pasture has received the attention of the authorities, the question of starting a breeding station in the West Coast may be considered. Sheep and goats should be added in future wherever suitable.

"Beyond providing the nucleus of pure bred bulls and heifers, no substantial advance can be made through these farms towards the general improvement of the livestock in the Presidency. To effect systematic improvement of livestock other measures have to be taken. Disease control, castration and propaganda have all their share.

Provision of Breeding Bulls. "The main question, however, is the provision of sufficient breeding bulls of the right type. The Government should in our view, select suitable bull calves, purchase them from the ryots, maintain them at their agricultural farms and sell them, when old enough, as breeding bulls. The Government should also encourage the formation of co-operative societies for purchasing suitable calves, and for rearing and selling them as breeding bulls.

"Ryots may also be encouraged to do this with the hope of ultimate purchase by the Government.

"The future work should be mainly concerned with the improvement of stock in the villages. With this end in view, breeding bulls should be distributed to important institutions and individuals who are prepared to undertake their maintenance for the benefit of the public.

"Liberal grants-in-aid should be given to District Boards, Panchayats, Co-operative Societies and private citizens for the purchase and maintenance of breeding bulls. We should aim at supplying at least one bull for each unit of a cow population of 150.

"We attach great importance to cattle shows as a means of improving the breed of cattle. Cattle shows should be organized at least once in every year in

each district under the auspices of the District Economic Council. Intensive propaganda should be carried on through agricultural associations towards the same.

"No permanent improvement can be effected in the breed of our cattle unless energetic action is taken by the authorities to put the scrub bull out of action when necessary. We are of the opinion that Government should take powers to introduce compulsory castration of scrub bulls when in any particular locality there is a sufficiency of breeding bulls.

Livestock Section. "The Committee also examined the question of the future control of the livestock section. The question was whether the livestock section should remain under the Agricultural Department, whether it should be transferred to the Veterinary Department, or whether it should be made an independent section. The subject was considered in all its aspects. The problem really is a matter of administrative convenience. It should be remembered that neither department is complete, but each is complementary to the other under the control of the Minister.

"What is required to-day is an Expert Animal Husbandry Organization, able to carry on scientific breeding control in the villages, combined with systematic castration and disease-control and to ensure that adequate encouragement is given to the conservation and development of natural grazing areas.

"We leave it to the Government to decide the agency to carry out the aim we have in view. Our policy should be to breed cattle for speed and working capacity in the natural grazing areas and, concurrently, along with the systematic development of a dairy industry, to breed cattle in suitable areas strictly for the highest possible milk yields.

Veterinary Work. "We considered the question of expansion of the Veterinary Department, with a view to making its usefulness increasingly felt in the matter of control of contagious and other diseases. Contagious diseases have no doubt been on the decline in the last few years. We are of the opinion that there should be at least one officer in charge of veterinary matters in each district.

"Our attention has been drawn to the desirability of extending veterinary relief more in the direction of providing touring assistants than by increasing the number of veterinary hospitals or dispensaries, as the touring assistant brings relief to the very doors of the ryots. We feel that the Government should endeavour to provide one veterinary dispensary and a touring assistant for each taluk.

"We however, agree that the extension of veterinary dispensaries should be on a contributory basis. Preference should, therefore, be given to localities where the local body or the local landholder is prepared to contribute at least 30 per cent of the capital and maintenance charges.

"With this increase of staff we feel that it may not be possible for the Director of Veterinary Services to control the department effectively. We accordingly recommend that he should be given two Deputy Directors, one for the Northern Division and the other for the Southern Division.

"We also consider that in view of the importance of the work that is being done by the Veterinary Investigation Officer, the Government should consider the question of addressing the Imperial Council of Agricultural Research for the retention of that post for another five years.

"We are convinced that the work of castration, inoculation and treatment of minor ailments can be entrusted to a much cheaper agency than Veterinary Assistant Surgeons. We are also of opinion that the maistries employed by the

Agricultural Department should be utilized for this purpose. We accordingly recommend that short courses of training lasting from three to six months be introduced in select veterinary institutions where the agricultural maistry as well as sons of agriculturists and landlords may be trained.

Grazing and Fodder. "A general improvement in the condition of cattle involves the consideration of the improvement of grass and fodder supply. Similarly, the question of improvement of crops involves a consideration of the supply of green manure. We are aware that the question of grazing fees and supply of green manure from forests has often been debated. It has been held by a few that the rates charged by the department at present should be reduced and brought to a uniform level. On the other hand, it has been contended with equal force that the reduction of rates will, instead, prove detrimental to the interests of the cultivator and cattle breeders. The departmental forests now serve mostly our sylvicultural needs, the panchayat forests being specially and mainly intended to serve for grazing. The departmental forests have not however, been altogether closed to grazing. A large number of animals are allowed to graze on permits from the department. We have no recommendations to make on the subject of grazing fees.

"As for the supply of green manure, we are of opinion that in the case of fuel forests where cutting is done by coupes, the coupes should be sold three months in advance of the year of cutting, the contractor being permitted during these three months to remove and sell green leaf for manure.

The forest panchayaths should be induced by reduction or remission of rent in deserving cases to grow green manure crops like wild indigo and other trees for green leaf manure.

"We understand that manure leaf plantations have already been started by the Forest Department. If the experiment turns out a success the question of starting similar plantations in Panchayat forests should be examined.

Irrigation Facilities. "No schemes for the improvement of Agriculture can be carried through without proper attention being paid to the questions of irrigation and the extension of irrigation facilities now available to the ryots. We agree with Sub-Committee II that a systematic and continuous effort should be made to carry out further drainage improvements where necessary, that drainage schemes should be considered as part and parcel of the concerned irrigation systems and that they should be sanctioned without reference to the question of direct and immediate return to Government in the shape of savings in remissions, and that no demands for contribution should be made from the interested parties.

"We also agree with the Sub-Committee that water rates under an irrigation system should be levied on a uniform basis and that extensions of irrigation should, for the purpose of working out the financial return from the scheme be considered as forming part of the original scheme. The Tank Restoration Scheme parties should be revived and the investigation and execution of the works required to improve the numerous tanks yet to be investigated should be pushed through as expeditiously as possible. We endorse the recommendations of the Sub-Committee in regard to minor irrigation works, Kudimaramat, reduction of the minimum return prescribed for productive and unproductive irrigation works, the financing of productive works from 'Loan Funds' and further investigation of the abandoned schemes of irrigation, especially the four schemes referred to by the Sub-Committee.

"We draw attention, in particular to the need for examining the question of the improvement of tanks in Malabar and South Kanara. In regard to the possibilities of extending irrigation facilities by sinking wells in river beds

we agree with the Sub-Committee that where the interests of existing irrigation are not affected, irrigation from such wells should be encouraged by Government who should charge only a nominal water rate in order to maintain their rights over the water. Further, the same procedure should be adopted when water is taken from a spring channel.

Underground Water Resources. "The question of the survey of the underground water resources was considered. The work that has so far been done is negligible. It is essential to make a thorough survey of the underground water resources of the Presidency with the aid of a geologist to be deputed by the Government of India. The services of water diviners should be requisitioned only in respect of the areas selected by the geologist. Work should be taken up in a limited area—say two or three districts, one dry and one Coast district—in the first instance and extended to the whole Presidency gradually. We also agree that further experiments should be made in the red soil areas of the Ceded Districts, these experiments being extended to other districts only if the results prove favourable.

"We agree with the view of the Sub-Committee in regard to the remission of charges incurred in sinking wells and putting down bore holes in unsuccessful cases. We approve of the recommendations of the Sub-Committee that Government should themselves sink wells and distribute water for irrigation, charging a suitable water-rate for the service rendered.

"In the interest of sugarcane cultivation in the areas covered by the Cauvery-Metur Project, we recommend that a survey be made of the underground water resources by putting down bore holes at select centres free of charge. If the results are satisfactory, *takkavi* loans should be granted to ryots for the sinking and construction of large wells. We also desire that the possibility of developing cultivation of the sugarcane crop in the area north of Kuttalam in the old Delta in Tanjore should be examined by the Agricultural Department as expeditiously as possible.

Fruit Preservation. "One of the Sub-Committees has, as already stated, considered the question relating to fruit preservation and canning, the possibility of adopting the open-pan system of sugar manufacture and the dairy industry as objects that could well be included in the scheme of agricultural development in the Presidency. We have already drawn attention to the imperative necessity for extending fruit culture in various parts of the Presidency and we have made recommendations for the employment of special staff to attend to these experiments. Fruit cultivation on any extensive scale is, however, impracticable unless a fruit preservation and canning industry is developed contemporaneously.

"We therefore, agree with the recommendations of the Sub-Committee that the Department of Agriculture should undertake research on fruit preservation on the lines recommended by it and that the Fruit Specialist should be asked to undertake research on two or three important kinds of fruit with a view to standardizing the manufacture of fruit juices and fruit syrups, bearing in mind the need for turning this industry into a cottage industry. A station for experiments on fruit preservation and canning should be attached to the research station recently opened by the Government in the Cuddapah district.

"We understand that the Government have received a report on the question of continuing the work initiated by the late Sir. F. A. Nicholson. We consider that Nicholson's work should be continued as part of the experimental work on fruits we have now recommended.

"We are of the opinion that short courses of training in fruit preservation and the preparation of juice, etc., should be provided in the Fruit Research Stations at Cuddapah and Coonoor.

Sugar Manufacture. "We agree that the open-pan method of sugar manufacture is uneconomic. As regards palmyra sugar, the proposal which, we understand, the Director of Industries has submitted for the demonstration of white sugar and improved jaggery from palmyra juice in the West Godavari District, should be favourably considered and that if the demonstration is successful, cooperative societies of tappers should be organized for this purpose, not only in West Godavari but also in Tinnevely District.

"We agree with the conclusions of the Sub-Committee that there is no need to initiate any experiments in regard to the manufacture of sugar from the juice of coconut palm.

"As regards manufacture of activated charcoal used in decolourisation processes, we understand, that both the Departments of Agriculture and Industries have been carrying on experiments with a view to placing in the hands of the ryot an efficient and simple method of cleaning jaggery and rab by methods which will be within his means.

"The activated carbon process for preparing sugarcane products clarifies and decolorises sugarcane juice to an extent which was not possible before and enables a better quality jaggery to be prepared.

"The Department of Agriculture has successfully demonstrated the manufacture of activated charcoal from paddy husk and is at present engaged in manufacturing it from groundnut husk. The Department of Industries has, on the other hand, concentrated its attention on the manufacture of vegetable activated charcoal by processing spent tanning materials. We recommend that small-scale manufacture of activated charcoal from paddy husk, groundnut husk and spent tanning materials should be undertaken with a view to ascertaining definitely the economics of the processes employed.

Molasses. "We examined the several methods, in which molasses may be disposed of. Molasses is now being exported in tankers to Europe where it is used not only for the production of industrial alcohol and by yeast makers but also as an ingredient for cattle foods. In Mysore experiments are in progress in regard to the use of molasses as a road surfacing material. They can also be used in the boiler furnaces of sugar mills, but satisfactory furnaces which will overcome the clinking difficulty have yet to be evolved. In India we should introduce legislation making it compulsory to mix a certain proportion of industrial alcohol with petrol but this proposal, we understand, has been turned down by the Government of India.

"Another possible way of utilising molasses produced by sugar factories situated not far from ports would be to manufacture butyl alcohol by the direct fermentation process. Butyl alcohol is becoming of increasing importance as it is widely used in the varnish and lacquer industries. By the same process acetone and ethyl alcohol are also produced whilst hydrogen and CO_2 are obtained as by-products. The possibility of attaching a factory for manufacture of these chemicals to a sugar mill located within easy distance of a port seems to be worthy of detailed examination.

"Molasses could also be usefully added to the diet of cattle. We feel that experiments should be carried on in this direction and we recommend the offer of Messrs. Parry & Co., to supply up to five tons of molasses free from their Samalkota factory for experimental purposes be accepted with thanks. Molasses is also useful as manure. Experiments carried on at Allahabad seem to indicate that molasses is a useful fertilizer and reclaiming agent for alkaline soils. We recommend that the Agricultural Department initiate experiment without delay to find out the possibilities of molasses as a fertilizer.

Sugar Prices. "We view with grave anxiety the fact of Holland having gone off the gold Standard and devalued the guilder. This news has caused considerable disquiet among people interested in sugarcane growing and in sugar manufacture. Already the prices of sugar have been steadily falling for some months past, and if the fall continues, there is little doubt that the prices paid to the cultivator for cane will be seriously reduced. At this juncture particularly, a depreciated currency will increase the competitive power of Java very considerably.

"And we are of opinion that measures should be taken in time to meet the contingency of Java sugar being imported to India at cheap prices to the possible ruin of the few sugar factories that have just been started under cover of the protection afforded to the industry and incidentally of the sugarcane grower.

We accordingly by a majority passed the following resolution:—

"This Sub-Committee recommend that the Government of India be addressed to take necessary steps to counteract the effects on sugar prices of devaluation of guilder."

Agencies for Agricultural Credit. "The subject of Agricultural Credit also received our close attention. We agree that the Government agency for lending money is cheaper and speedier than any other agency, cooperative or otherwise, and approve the following Suggestions to make the cooperative agency quicker,

(a) Introduction of the system of forecast loans. Sufficiently in advance of the cultivation season each society should prepare as carefully as possible an accurate forecast of the requirements of its members for cultivation, purchase of seed, manure, payment of kist, etc., for the whole year. The normal requirements of the society for the whole year should be arrived at and a loan application for the amount so arrived at should be sent to the Central Bank in instalment after executing the necessary bond, and make it available to members as and when there is actual need. Interest will be charged by the Central Bank on the amount drawn from time to time only. The Central Bank should remit the money to the society promptly without requiring any fresh formalities.

(b) "Supply of Agricultural implements, etc.—Where facilities exist agricultural implements, etc., may be supplied to the ryot by debiting to the member's account through Co-operative Inspector or Agricultural demonstrator. Loans for purchase of implements, etc., need not be disbursed in cash to members. The Agricultural department ordinarily runs a depot at each taluk headquarters or at other central places. The demonstrator in charge of each depot may obtain, with the help of the supervisor of the local co-operative supervising union, an indent of the requirements of members of societies in the area and may supply the articles direct. The cost of the articles so supplied may be adjusted out of the loan sanctioned by the Central Bank to the societies. On the advice of slips issued by the demonstrator, the societies may debit the accounts of members with the cost of articles supplied to each.

(c) Joint indent system.—Similarly other requirements of members may be obtained on a joint indent system with advantage.

(d) The payment of kist loans by Central Banks into the treasury.—Loans for payment of kist need not be paid in cash. As and when instalments of kist fall due, the Central Bank on receipt of a list of kist dues of members of a society may pay the amount directly into the treasury and advise the Tahsildar and the society to make necessary entries in their respective accounts.

Crop Loans. "On the question of granting crop loans to agriculturists, we recommend that the Departments of Agriculture and Cooperation should encourage the formation of marketing warehouses in rural areas for agricultural product and make arrangements to give crop loans to the members that

undertake to bring their crop to the said warehouses for sale by or through warehouse officers.'

In particular, we consider it necessary to adopt a system of controlled credit as a means of avoiding overdues in cooperative societies. By controlled credit we mean that the loans must be granted in instalments during the different stages of cultivation on the basis of a forecast prepared in advance, that such loans must be made on the security of crops, and that the crops so secured must be marketed by a Loan and Sale society to which the cooperative primary society must be linked. In this manner, an incentive to better cultivation can be created, the ryots can be prevented from diverting loans for other purposes, an orderly marketing of produce can be carried out to the advantage of all parties and the repayment of cooperative loans will be assured. Such experiments have been tried in Cuddalore and in Salem and have succeeded to some extent,

"The need for a Central Committee consisting of the heads of the Revenue, Cooperative, Agricultural and Industries departments, with non-officials representing Cooperation, Banking, Agricultural Interests, and Economists to plan credit work in the Agricultural Cooperative and Industries department was also examined. We are of the opinion that such Central Committee should be established. We feel, however, that the Provincial Economic Council, if enlarged by the inclusion of non officials, may serve the purpose we have in view.

"To carry out the plans formulated by the Central Committee there should be a District Committee in each district. Such a committee should consist of the local officials concerned, the President of the Cooperative Central Bank and 2 or 3 nominated non-officials. We have no objection to the District Economic Councils being utilised for this purpose.

Board of Economic Inquiry. "We also considered the need for constituting a Board of Economic Inquiry. There can be no doubt as to the need for reliable and accurate information on agriculture and economic conditions in rural areas. The present arrangement of deputing an officer of the Government to undertake any economic inquiry that is considered necessary cannot be said to work very satisfactorily. In several of the Indian Provinces, there are standing Boards of Economic Inquiry. We fully realise that already there are too many Standing Committees. The Provincial Economic Council or a Committee thereof might function as a Board of Economic Inquiry and future enquiries should be conducted under its auspices.

"To measure the effect which any plan of development has on the economic condition of the people, it is essential that we know their present income and their standard of living. We suggest:—

"That an inquiry on the subject of rural income and standard of living, should be made by the Provincial Economic Council at an early date."

Weights and Measures. "We had the benefit of a note on the subject relating to the standardization of weights and measures prepared by the Development Secretariat. In the course of the discussions it was pointed out to us that under the reformed Constitution legislation regarding standardization of weights would be a matter for the Federal Legislature. After considering the necessity for legislation, at the present juncture, in regard to weights and measures, we have come to the conclusion that the matter might well be deferred until after the inauguration of the new constitution.

"We would, in conclusion, emphasise that the recommendations and suggestions we have made in the foregoing paragraphs will involve an appreciable expenditure of money. We are convinced that if any effective and lasting progress is to be made and the lot of the agriculturists improved and their economic condition bettered, this expenditure is inevitable.

" We know that all the schemes and proposals cannot be immediately adopted and given effect to; but the Government may, after a consideration of our suggestions, work out a programme of expansion for a period of five or ten years. It is a matter entirely for them to set forth in a systematic form their plan of expansion subject, as it will no doubt be, to financial exigencies. We regard it as important that some plan or programme should be adopted and when once adopted, that plan should as far as circumstances permit, be adhered to and carried out."

ABSTRACTS

Growing plants without Soil. Thanks to Dr. W. F. Gericke, the pioneer in plant nutrition of the University of California, growers in Los Angeles and California are successfully growing vegetables and berries in nutrient solutions, heated by electricity.

Electric heating cables run under the bottom of vats. A mesh wire layer covers the top on which litter is spread to serve as seed-bed and insulation against heat-loss. The plants or seeds are placed on the bedding, and kept moist by the water in the vats. As a result of growth, the roots descend into the water when the necessary chemicals are added to the water in the right proportions. The electric cable keeps the solutions at the required temperature.

Success has been reported in the case of tomatoes, sweet-peas and strawberries. The tomatoes come to harvest earlier than 'soil grown' ones, the yield large, the quality better and hence the premium on the market price higher.

Dr. Gericke is expanding the use of this technique to the growing of tobacco, cucumbers, papaya, and other floral crops. (*Scientific American*, October 1936).

K. S. R.

The Stock Improvement Scheme in S. Rhodesia. A stock improvement scheme has recently been launched by the Government to assist stock owners to import or to improve their herds or flocks. The scheme is to be operative for the official year 1936-37 and to be limited to £ 3000 provided.

Applicants for the Government subsidies should satisfy the following conditions:

Sufficient supplementary feed must be available for the cattle and the sheep during dry weather and arrangements made to prevent heifers from breeding till the proper age is reached. The flock must be dosed regularly for internal parasites and in the case of sheep, mating to be allowed only during the breeding season. The farrowing pens for the pigs are to be provided with concrete floors.

The bull, ram, or boar selected should be approved by an officer of the department.

In the case of animals imported from the United Kingdom, the Government will contribute a sum not exceeding half the certified landed cost of the bull, limited to the maximum of £ 75, and in the case of pedigree rams or boars, limited to £ 20 per animal. The export from the United Kingdom in these cases is to be arranged through the High Commissioner for S. Rhodesia. The importer should specify that the animal is certified to be good value for the money.

In the case of animals purchased in the colony of S. Rhodesia and imported from any territory in S. Africa the Government will contribute a sum not exceeding half the certified cost of the bull or ram and boars, subject to the limit of £ 15 and £ 4 respectively. But at the discretion of the Minister of Agriculture and Lands, the contribution may be increased to £ 25 for stud bulls got in established pedigree herds. The assistance to any one breeder will be limited to 2 bulls, 2 rams or one boar during the year.

Under special circumstances, approved breeders may purchase pure bred female stock; in such cases the Government contribution will not exceed half the amount granted for the respective lines.

No animal will be eligible for more than one grant during its lifetime

Breeders with animals that are likely to be useful in this scheme are required to invite the Department to inspect the same for disposal to future applicants.

No grants are paid on bulls of over eight years of age.

No animal under grants may be sold off within 12 months from the time of the grant.

The animals must be of the right age and healthy.

The home bred bulls, and rams, should be differentiated by brandings and ear-tags and the purchase is to be made as far as possible within the colony, unless suitable animals at a reasonable price are not available locally. (*The Rhodesia Agricultural Journal*, August 1936).

K. S. R.

College News & Notes.

Sir John Russel, Dr. N. C. Wright, and members of the Animal Husbandry wing of the Imperial Agricultural Research Council New Delhi, visited the Agricultural College and Research Institute between the 18th and 21st instant.

Under the auspices of the Economic Biologists' Association Sir John Russel delivered an instructive lecture on the development of Scientific agriculture.

Students' Corner. The inter collegiate hockey finals was played against the Stanes High School which ended in a defeat to the college by 3 goals to nil.

The second year students retain the victory cup by defeating the first year students in both cricket and hockey in the finals.

Weather Review (NOVEMBER 1936.)

Summary of general weather conditions. A low pressure wave passed over South Peninsula causing heavy rains along its course and passed into Arabian Sea on the 3rd; it persisted in South East Arabian Sea concentrated into a depression by the 7th and then into a cyclonic storm moving west ward and finally became unimportant off the Kathewar Coast on the 15th.

This depression caused heavy rains in the South Peninsula and later on in the western half of the Peninsula. A depression formed in the Bay on the 15th, but disappeared by the 8th after causing locally very heavy rainfall on Coramandal Coast.

The rainfall was in large excess generally in the Peninsula except in Circars. Day temperature was normal through out.

The chief falls of rain recorded were:—

Cuddalore	...	...	9.2	2nd
Panrutti	...	...	8.6	"
Virdhachalam	...	...	5.4	"
Negapatam	...	...	4.6	"
Trichinopoly	...	...	6.2	3rd
Nellore	...	...	5.0	6th
Nellore	...	...	14.1	7th

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	0.2	-3.8	80.3	South	Negapatam	12.9	-4.8	32.9
	Berhampore *	1.2	-4.4	58.3		Aduthurai *	12.8	+3.0	33.1
	Calingapatam	1.9	-2.0	45.2		Madura	7.6	+2.6	28.5
	Vizagapatam	1.1	-2.7	36.9		Pamban	14.3	+2.3	28.4
	Anakapalli *	2.2	-0.7	38.9		Koilpatti *	7.6	+0.7	22.5
	Samalkota *	1.7	-1.6	56.3		Palamkottah	8.6	+1.2	26.9
	Maruteru *	6.4	+2.6	55.4					
	Cocanada	5.5	+0.1	68.0					
	Masulipatam	4.6	-1.1	47.4		West Coast	Trivandrum	11.6	+5.0	70.3
Guntur *	4.4	+0.9	46.8	Cochin	8.6		+2.1	115.1	
Ceded Dists.	Kurnool	0.9	-0.2	16.9	Calicut		7.8	+2.4	134.9
	Nandyal	3.0	+1.7	23.3	Pattambi *		7.2	+3.6	118.0
	Hagari *	6.2	+5.2	24.6	Taliparamba *		8.1	+3.6	130.7
	Bellary	4.3	+2.1	17.7	Kasargode *		5.3	-0.8	155.0
	Anantapur	3.3	+0.5	17.4	Nileshwar *		4.3	+1.0	138.3
	Rentachintala	4.1	...	22.5	Mangalore		2.7	-0.4	161.9
	Cuddapah	6.5	+2.92	21.1					
	Anantharajupet *	13.2	Mysore and Coorg		Chitaldrug	4.7	+2.4	20.1
Carnatic	Nellore	30.1	+18.9	49.4		Bangalore	2.0	-0.9	30.3
	Madras	14.5	+0.2	42.3		Mysore	2.3	-0.2	36.7
	Palur *	19.6	+9.2	43.7		Mercara	1.7	-1.5	151.5
	Tindivanam *	12.3	+2.5	29.6					
	Cuddalore	21.7	+6.6	42.5	Hills.	Kodaikanal	22.8	+14.6	70.3
Central	Vellore	12.7	+5.8	31.9		Coonoor *	13.0	...	69.3
	Salem	3.1	-0.6	31.6		Ootacamund *	6.3	+1.7	54.6
	Coimbatore	3.9	+0.1	21.3		Nanjanad *	2.8	-1.0	52.2
	Coimbatore Res. Inst. *	4.4	-0.1	20.0					
	Trichinopoly	13.7	+8.1	30.1					

* Meteorological Stations of the Madras Agricultural Department.

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

Weather Report for the Research Institute Observatory :-

Report No. 11/36.

Absolute Maximum in shade	...	...	87.0°F.
Absolute Minimum in shade	...	...	60.0°F.
Mean Maximum in shade	...	...	83.9°F.
Departure from normal	...	...	-0.8.
Mean Minimum in shade	...	...	69.0°F.
Departure from normal	...	...	+0.3.
Total rainfall	...	...	4.43"
Departure from normal	...	...	-0.10"
Heaviest fall in 24 hours	...	...	1.33"
Total number of rainy days	...	...	8 days.
Mean daily wind velocity	...	...	1.2 M. P. H.
Mean Humidity at 8 hours	...	...	84.0%
Departure from normal	...	...	+2.7%

Summary. The monsoon was fairly active during the month giving normal rainfall. Day temperature and humidity remained normal.

Departmental Notifications.

Transfers and Postings. Mr. C. S. Rajaratnam Mudaliar, A. A. D., Mycology, Koilpatty, to be A. D., Mycology, Coimbatore; Mr. C. Rangaswamy Ayyangar, A. D., Mycology, Coimbatore, to be A. D., Mycology, Koilpatty; Mr. M. K. Swaminatha Iyer, A. D., Arkonam, to be F. M., Central Farm; Mr. V. Achyutaramiah, D. A. S., Anakapalle, to be A. D., II Circle; Mr. V. N. Subbana Acharya, D. A. S., Bellary, to be A. D., Guntakal; Mr. P. Nagadhara Naidu, A. A. D., Guntakal, to be A. A. D., Adoni; Mr. S. Varadharajulu Naidu, A. D., Adoni, to be A. D., Allagadda; Mr. A. Anantapadmanabha Pillai, A. D., Allagadda, to be A. D., Nandyal; Mr. M. Chinnaswamy Naidu, A. D., Special Duty, to be A. D., Udamalpet; Mr. A. K. R. Iyer, A. D., Udamalpet, to be A. D., Gobi; Mr. K. C. Thomas, A. D., Gobi, to be A. D., Tirupur; Mr. N. Srinivasa Rao, A. D., Tirupur, to be A. D., Pollachi; Mr. B. G. N. Menon, A. D., Pollachi to work under A. D., Coimbatore; Mr. C. Vadamalai, Assistant in the Cotton Section to be F. M., Hagari; Mr. K. Tejappa Shetty, F. M., Hagari to report himself to D. D. A., VII Circle; Mr. B. Dasappa Malli, A. D., Coonoor to be A. D., Puthur; Mr. S. Madhava Rao, F. M., Anantharajapet to be F. M., Botanical Gardens, Coimbatore; Mr. R. Sankara Iyer is permitted to return to duty cancelling the unexpired portion of the leave. Mr. K. Ramanuja Acharya, Special Duty under the Live Stock Officer to report himself to D. D. A., II Circle.

Leave. Mr. A. P. Balakrishnan Nair, F. M., Kasargod, 1. a. p. for one month and one day from 22—11—'36 with permission to suffix the Xmas and New Year holidays; Mr. T. Gopalan Nair, F. M., Nileshwar II, 1. a. p. for two months from 4—1—'37 with permission to prefix the Xmas and New Year holidays.

Concession for old unemployed students of the Agricultural College, Coimbatore.

Old boys (unemployed only) of the Agricultural College, Coimbatore may apply to the undersigned for a concession in subscription from 1937. They will be charged Rs. 2/- only per annum, provided a certificate to the effect that they are without job is attached to the concession application. This rate will hold good till they continue to be unemployed.

Manager.