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CONTENTS

Editorial.

Food Survey.

It is now recognised that a great percentage of the population in India suffers from different degrees of malnutrition. The diets of the poor people are so defective and deficient in several necessary ingredients that the occurrence of several deficiency diseases is widespread. We are all familiar with the work of the Nutrition Institute at Coonoor financed by the Indian Research Fund Association, and the wide interest created by the popular book 'Food' written by General McCarrison, until recently the Director of the Institute. Even as early as 1932 General McCarrison pointed out that a survey of the food resources of the country and the classification of its natural products into categories of nutritive value should form the first step towards the solution of the problem of nutrition in India. The survey was to consist of the chemical analyses of hundreds of food materials and their biological assay from the point of view of both vitamins and other food essentials. He also advocated the establishment of Nutrition Institutes, at least one for each province, because, the problem of nutrition, the food materials available and the agricultural problems varied from province to province.

The question of undertaking such a survey was, we understand, discussed at the meeting of the Advisory Board of the Imperial Council of Agricultural Research in last March. The reason for this subject

coming up before the Imperial Council of Agricultural Research, was to get the cooperation of the several Provincial Agricultural Departments, where the Chemists had already accumulated some data on the chemical analyses of several food materials relating to their provinces. Besides making such data available for the survey the Agricultural Departments should also be able to help in the survey by drawing up a list of materials that go into the dietary of the people.

Though a comprehensive survey of the food materials would take several years to complete, we are glad to note that a beginning has been made with the appointment of two assistants at the Coonoor Institute who will first take up the investigations of food values of diets actually in use in the Madras Presidency. Dr. Ackryod, the present Director of the Coonoor Institute, who will be in charge of this survey, has already got in touch with our Chemist at Coimbatore with regard to collection of samples, and the work is expected to begin very soon.

With regard to the samples to be analysed, the number must necessarily be large and there are also certain other considerations that have to be borne in mind. The nutritive values of the samples of the same food stuff collected from different parts of the province might vary according to the conditions and soils in which they are grown. General Mc Carrison's work at Coonoor and the work of Rao Bahadur Viswanath at Coimbatore have proved this beyond doubt. Then again the nutritive value of a food stuff may vary according to the form in which it is actually consumed by the people. Taking for example the chief article of diet in Madras, namely, rice, there are ever so many varieties varying, in size—fine and coarse, in colour—red and white, in texture—hard and soft, in duration of the crop—early and late, etc. Whether these differences have any relationship to the nutritive values is not known, though popular opinion does exist that red rices and long-duration rices are generally more nutritious. Preliminary chemical analyses of certain rices done by the Government Agricultural Chemist did show some variations in the proteins, fats, minerals etc., but these were rices that were obtained by simple shelling without the removal of the bran layer, which is usually partly or completely lost according to the degree of polish the rice is subject to. Since rice is usually polished before it is consumed, the degree of polish should therefore determine the nutritive value of the rice. Then again rice is consumed either raw or par-boiled rice and the latter is considered more nutritious. There is also the question of fresh rice and old rice. Every one is familiar with the fact that freshly harvested rice if consumed produces digestive troubles, while converting the fresh rice into par-boiled rice obviates the difficulty. Very little is yet known of the changes happening in the grain during storing and par-boiling and the investigations

on quality in rice, financed by the Imperial Council of Agricultural Research and in progress at Bangalore, will, we hope, throw some light on these matters.

There is also another point that has to be remembered in the collection of samples. While the samples may be straightaway obtained from the markets they are likely to change from time to time. Moreover new strains evolved by the crop specialists are spreading rapidly in the districts and in the case of rice, the work has so far advanced in Madras that even improved strains are grown on a large commercial scale and are brought to the markets as such. This is a line in which the Crop Specialists would be able to give the necessary help in the survey and we are sure it would be available.

As was stated by General McCarrison the next step after the survey would be "to determine what are the natural products of each province that can best and most cheaply satisfy the food requirements of the people of that Province and to group these products according to their cost."

In this connection certain considerations other than cost or nutrition value do influence or bring about a change in the usual dietary of the people. Though it is known that hand-pounded rice is more nutritious than mill polished rice, it is hard to get the necessary labour except in the interior rural parts for hand-pounding the grain. Even the labour classes take their grain to the nearest rice mill to get it husked and the installations of small mills which are increasing even in the rural areas are responsible for this. The development of industries also brings in changes in the dietary. Grains like cholam, ragi, etc , have first to be pounded or ground into a flour before they can be cooked and the people who used to do this before, do not now have the time and they prefer to go in for rice which they can get from the shops and cook immediately. This change-over from cholam and ragi to rice has been very apparent in Coimbatore, recently, with the springing up of a large number of cotton mills which recruit labour from all the surrounding villages. Even if cholam or ragi is considered more nutritious than rice, this change-over cannot be stopped.

Lastly, a collection of the statistics of the physical condition and health of the people in different parts of the province where there are definite variations in the diet should facilitate further progress in nutrition research.

JUICINESS AND SWEETNESS IN SORGHUM STALKS.*

By G. N. RANGASWAMI AYYANGAR, B. A., I. A. S.,

Millets Specialist.

Sorghum is a valuable grain crop. It is pre-eminently a food crop of the poor cultivators, and the dominant cereal of regions of low rainfall. The average yield of grain is about 700 pounds to the acre. The chief point in which sorghum scores over other cereals, is in its heavy yield of fodder. This fodder is on an average about four times the yield of grain. It is moreover considered to be the best straw among cereals. There is a distinct preference for this straw as a feed for milch cattle. In areas of favourable water supply, sorghum makes an excellent fodder crop, giving cuts of over 30,000 pounds per acre. The bulk of the fodder is so very nicely protected within the hard rind, that the keeping qualities of this fodder are much in its favour. For these reasons any improvement in the quality of this fodder is of great agronomic value.

The general economic condition of the bulk of the cultivators of sorghums in dry tracts, will not admit of crops grown purely for fodder purposes. Fodder can only be a by-product of grain. There are varieties and tracts, of minor importance, in which the purely fodder value of sorghum exists. But over an overwhelming area, sorghum is grown for grain and fodder, for man and beast respectively. Any improvement in the quality of this fodder is therefore very desirable. This paper confines itself to the stalks of the grain sorghums.

In the Ceded Districts of the Madras Presidency, the sorghum grower is familiar with the dull-midribbed, juicy and sweet-stalked (*Cheruku*) varieties, and the white-midribbed, non-juicy, insipid (*Bendu*) varieties. In other parts of the Presidency the sorghum varieties are mostly pithy-stalked, with leaves having a white midrib. Typical of this kind is the *Peria Manjal Cholam* of Coimbatore, reputed for its fodder value, in addition to being a producer of grain. The absence of juiciness has not therefore meant any very great depreciation of the value of this variety for its fodder. Feeding tests on work animals at the Millets Breeding Station showed that they consumed 50 per cent. more of the juicy-stalked fodder than the pithy-stalked one.

Attempts to grow many juicy-stalked (dull-mid-ribbed) varieties at Coimbatore have in most cases proved detrimental to grain production. Trials to grow the juicy-stalked *Tella Jonna* of Bellary in the adjacent Nandyal valley did not meet with success. A general review of the areas rich in juicy-stalked varieties shows, that this juicy stalk requires for its flourishing, a highly moisture-retentive soil, a certain

* A paper presented on 2nd August 1935 at the 24th Agricultural College Day and Conference, Coimbatore.

elevation and freedom from rain in the stages of the emergence of the head and the setting of the grain. Most of the juicy-stalked varieties are heavy headed, and fall in the group of *Sorghum cernuum*. A fine modulation of soil and climatic factors of a particular type, seems a necessity for the thriving of these *cernuums* as dual grain and fodder varieties. This limitation has therefore acted as a drag to the desirability of combining juiciness in other local economic varieties.

In 1906, Benson and Subba Rao record the fact, well known to cultivators, associating a dull midrib with juiciness and sweetness, and a white midrib with pithiness and insipidity. In 1914, Annet was the first to find that the colour of the midrib made no difference to the sugar content. In 1916, Hilson corroborated the observations of Benson and Subba Rao and found the white-ribbed character with its pithiness, dominant to the dull midrib with its juiciness and sweetness. In 1931, Swanson and Parker, working on American sorghums, made for the first time a clear distinction between juiciness and sweetness. They found that it was sweetness more than juiciness that determined the susceptibility of a variety to covered kernel smut. They did not work out the mode of inheritance of this character for sweetness.

In the Annual Report of the Nandyal Agricultural Research Station for 1931—32, the rare occurrence of sweet stalks that are not juicy, and of juicy stalks that are not sweet is recorded. These are interpreted as cross-overs, from the popular belief that links sweetness with juiciness.

The study of the relationship between midrib colour and juiciness and other attendant relationships has been in progress at the Millets Breeding Station for a number of years. From the year 1930, a systematic recording of the taste of chewed stalks of varieties has been adopted. It was noted that all juicy varieties were not sweet, and that some of them were insipid. A separation in the pithy group also was attempted and a similar distinction found. All the four possible groups, namely, juicy and sweet, juicy but not sweet, pithy and sweet, and pithy and not sweet, were thus met with. The two latter were very few. The largest number were in the group, pithy and sweet. A few varieties had the ideal juiciness and sweetness. While at this examination it was noted that the juicy stalks were harder to cut than the pithy ones. The colour of the cut ends of stalks gave helpful clues to sweetness. If the central stalks are cut at the milky stage, they will be green in sweet juicy stalks and light yellowish green in juicy stalks that are not sweet. A similar difference in colour exists in pithy stalks also, but confined to the periphery because of the central pith. The sweetness of the stalks is more towards the rind. It would therefore seem clear, that the set of characters, juiciness and pithiness, is independent of the other set of characters, sweetness and insipidity. In the general progress of the evolution and perpetuation of economic

varieties, suited to each tract, the group with pithy stalks and sweetness seems to have had the best survival value. In favoured areas, juiciness and sweetness have gone together. The other two groups lacking sweetness have practically gone to the wall. They might linger in odd unfavourable areas, or as stray plants in a bulk crop.

In the breeding work on this line it has been noted by Hilson, that pithy stalks (white midribs) are a simple dominant to juicy stalks (dull-midribs). Experiences at the Millets Breeding Station are in conformity with this. The extraction of juice was 17 to 20 per cent. in pithy stalks, but 33 to 48 per cent. in juicy ones. In families pure for juiciness, simple monohybrid segregations have been obtained for insipidity and sweetness, the former being dominant. Similarly in pithy varieties simple monohybrid segregations for insipidity and sweetness have been experienced. Analyses, kindly made by the Chemist, showed that the difference in Brix value between sweet and insipid was about 3½ per cent. and the sucrose content kept up a similar difference. The insipid stalks had a greater amount of chlorine in their sap. In one instance, a di-hybrid segregation, proving the independent inheritence of these sets of characters, was also noted. It will thus be seen that there are two separate sets of factors determining juiciness and sweetness and they can be combined independently. Naturally, this genetic possibility of combining desirable characters will be conditioned by soil, climatic, and economic considerations, as grain production is also involved. Endeavours to build up both juiciness and sweetness into varieties that lack these characters, without impairing their grain yield, are in progress at the Millets Breeding Station.

Discussion.

Rao Sahib T. V. Rajagopalachari referring to the author's remark that the pithy sorghum was predominant in dry areas, wanted to know why it was that in the Deccan, which was quite dry the sorghum found was juicy.

Rao Bahadur G. N. Rangaswamy Ayyangar replied that in the Deccan the proper climatic factors prevail for the good growth of *S. cernuum* which gives a good grain along with sweet juicy fodder. All areas can grow pithy stalks, but only select favoured areas can have juicy stalked grain sorghums.

INCREASING THE YIELDS OF GROUNDNUTS.*

By J. S. PATEL, M. Sc. (Cornell)., Ph. D. (Edin).,

Oil Seeds Specialist, Madras Department of Agriculture.

Introduction.—The groundnut crop in Madras occupied, in 1932-33, about 9 per cent. of the total cultivated area. Madras has the distinction of being the biggest producer of groundnuts not only in India,

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but also in the world. The average area under the groundnut in Madras is 33 *lakhs* of acres for the period 1928-29 to 1932-33.

During the same period, the exports of groundnuts from Madras Ports averaged to 4·96 *lakhs* of tons valued at 9·55 crores of rupees. Through the exports of groundnuts, the people in Madras obtained, on an average, Rs. 2 per head of population. Taking the average yield per acre as 7 cwt. of kernels and assuming that the market value is 25 per cent. less than the export price, the average production in Madras is worth about 16 crores of rupees, or equivalent to the budget amount for the Madras Government for a year.

The groundnut crop is one of the important money crops, and it provides cash to the producers in areas where other money crops cannot be grown easily. The capital required for the cultivation is small and, therefore, the crop is cultivated by the poor and the rich alike. In some areas, as in Kurnool, the groundnut is an alternative money crop with cotton. When the prices of cotton are low, the farmers grow more of groundnut.

Varieties.—The area under the groundnut in Madras expanded steadily between 1850 and 1890. By about 1898 the "indigenous" variety was said to have deteriorated, and a variety called *Mauritius* was introduced from Mozambique. This variety is even now largely cultivated. This *Mauritius* variety has a spreading habit and requires about 125 days to ripen from the time of sowing. The bunch variety which is commonly cultivated is about 30 days earlier in duration and can also be harvested more easily but it yields comparatively less. From 1899, the Department has been importing foreign varieties for trial but none of the imported varieties proved superior to those already cultivated in India. In the consignment of varieties obtained in 1930, a variety known as *Saloum* was obtained from West Africa. It has been, in subsequent years, carefully compared in yields with the *local Mauritius*. This *Saloum* (A. H. 25) variety yields on an average 25 per cent. more than the *local Mauritius*.

Table I

Yields of Saloum.

(Agricultural Research Station, Palakuppam)

Years	*Acre yields of pods*		Percentage increase over local *Mauritius*
	local *Mauritius*	*Saloum*	
	lb.	lb.	
1931—32	1,151	1,752	52·3
1932—33	1,410	1,784	26·4
1933—34	1,187	1,495	26 0
1934—35	1,650	2,000	21·0

In 1933—34 & 1934—35 seasons district trials were carried out with the *Saloum* variety at 33 centres. The results of these trials show that it has yielded much more than the *local Mauritius* in 22 centres. The increase in yield in the majority of centres has been over 20 per cent

(Table II). Moreover, it was reported to be drought-resistant. The kernels of the *Saloum* variety are plump and "bold" and generally better in appearance than the kernels of the local *Mauritius*. On the basis of these trials, the *Saloum* variety may be said to suit the conditions in the districts of South and North Arcot, Salem, Chittoor, Trichinopoly and Guntur. So far, in the districts of Bellary, Kurnool and Anantapur, it has not given any definite increase over the local *Mauritius*.

Table II

Results of district trials with Saloum.

District.	Percentage yield increase over local *Mauritius*	
	1933—34	1934—35
	From To	From To
Salem	31—40	12—66
Chittoor	147	...
North Arcot	28—50	...
South Arcot	16—26	29—61
Guntur	20	23
Trichinopoly	24	...

So far no other bunch variety or any selected pure line has proved superior to the local bunch variety. The available variation in the bunch varieties appears to be less, and therefore a programme of hybridization has been taken up with this.

Seed rate. The quantity of seed required to sow an acre, varies with the nature of the soil, the season and the variety. Generally the rainfed crop requires more seed than the irrigated crop. The sowings on red soils require more seed than on black cotton soils. Late sowings require more seed than the early sowings. More seed is required for the bunch variety than for the spreading variety. The results of the experiments carried out during five years at the Agricultural Research Station, Palakuppam, show that where the crop is sown in July—August, the proper seed rate for the spreading variety would appear to be about 60 lb. of kernels per acre and for the bunch variety 100 lb. of kernels per acre. The results are tabulated below :—

Table III.

Yield in pods per acre for various spacings (in lb.)

Years.	Spreading variety–Madagascar variety.					Bunch variety.			
	12″ × 12″	12″ × 9″	9″ × 9″	9″ × 6″	6″ × 6″	9″ × 9″	9″ × 6″	6″ × 6″	6″ × 4″
1928-29	1278	1361	1375	1361	1358	1436	1517	1594	—
1929-30	837	963	1025	1137	1108	443	567	717	777
1930-31	679	750	867	1021	1133	790	1023	1197	1300
1931-32	1241	1374	1419	1436	1593	368	348	325	357
1932-33	1309	1467	1545	1521	1585	901	1108	1289	1375
Average	1069	1183	1246	1295	1355	768	913	1024	952
Difference from control	-226	-112	-49	Control	60	-256	-111	Control	-72
Seed rate—kernels per acre—lb.	28	37	50	74	112	46	69	103	155

In an experiment conducted on the black cotton soil at Guntur it was found that 40 lb. per acre was the correct seed rate for the spreading variety.

Manuring. Groundnuts are cultivated as a rule without the application of much manure. On the roots of the groundnut, as in other leguminous plants, nitrogen-fixing bacteria lead a symbiotic life. The bacteria fix the nitrogen from the air and make it available to the plant. Thus the chief fertilizer requirements of the crop are only phosphate and potash. The manurial experiments carried out at Palur failed to show any beneficial effect either on the rainfed or irrigated crop. Similar experiments in the United States of America and Rhodesia have shown that unless the soil is very poor, the groundnut crop does not respond to manuring. It is a common practice in foreign countries to apply the manure to the previous crop and to allow the groundnut crop to utilize the residue of the manure.

Rotation. The rotation experiments at Palur show that where cereals and groundnuts are grown as pure crops in alternate years, *tenai* (*Setaria italica*) and *ragi* (*Eleusine coracana*) are found better than *cumbu* (*Pennisetum typhoideum*), for the returns from *cumbu*-groundnut rotation are less. There was no difference between *tenai*-groundnut and *ragi*-groundnut rotations. It has been found in Mysore State that a groundnut-*ragi* rotation is superior to groundnut-*avarai* (*Dolichos lablab*) rotation. *Ragi* when rotated with groundnut yields much more than either *ragi* after *ragi* or *ragi* after *avarai*. The Cotton Specialist has tried a number of crops in rotation with irrigated cotton and found that the yield of cotton is the highest when it is sown on the land which had groundnut in the previous season.

Mixed cropping in dry lands is a common and well-established feature of Indian agriculture. It replaces considerably the system of annual rotation which is widely practised in the West. To examine the efficacy of different types of mixtures and also to see whether the rotations of mixed crops were better than the continuous growing of a particular mixture year after year, the following seven experiments were laid down :—

1. Groundnut + *cumbu* every year.
2. Groundnut + *tenai* every year.
3. The rotation of item (1) with item (2).
4. The rotation of item (1) with *ragi* + groundnut.
5. The rotation of item (2) with *ragi* + groundnut.
6. A mixture of groundnut + *tenai* + *cumbu*.
7. A mixture of groundnut + *tenai* + *ragi*.

The mixture (1) (groundnut-*cumbu*) is more economical than the mixture (2) (Groundnut + *tenai*), on account of the higher yields of groundnut. The annual returns from the mixture of groundnut + *cumbu* are equal to the annual returns from rotation under item (3). The

income for the rotation under item (3) is, however, more than the income from the mixture (2) (Groundnut + *tenai*). When *ragi* + groundnut is rotated with groundnut + *cumbu* (item 4) the yield is better than when *ragi* + groundnut is rotated with groundnut + *tenai*. When more than one cereal is grown with the groundnut, a mixture of *tenai* and *cumbu* appears superior to the *tenai* and *ragi* mixture.

These results indicate that for the groundnut, *cumbu* is the ideal partner from among the various cereals which are widely grown, but why this is so is not apparent.

Summary.—The superior performance of the *Saloum* variety is shown. The correct spacing for the spreading variety is 9″ × 9″ and that for the bunch 6″ × 6″. The optimum seed rate for the spreading variety is about 60 lb. of kernels per acre and for the bunch 100 lb. per acre in red soils.

It is suggested that the crop previous to the groundnut should be manured instead of manuring the groundnut directly.

Tenai-groundnut, *ragi*-groundnut and groundnut-cotton are beneficial rotations. Mixed cultivation of groundnut and cereals is more economical than to rotate a cereal with the groundnut. *Cumbu*-groundnut is a better mixture than *tenai*-groundnut.

PRODUCTION AND MARKETING OF GROUNDNUT IN THE MADRAS PRESIDENCY.*

By K. RAGHAVACHARI, L. Ag,

Lecturer in Agriculture, Agricultural College.

Of the several crops introduced at various times into India, the groundnut must be said to have been of the greatest benefit to the South Indian farmers. All the world over, the United States of America not excepted, it is found, that the groundnut cultivation is only in the hands of the small farmer. The main commercial product, namely the oil, removes no plant food, and, being a legume, the crop has been found to get all its nitrogen, about 90 lb. on the average per acre, entirely from the air. Recent research (unpublished) of Mr. T. Rajagopala Iyangar, M. Sc., has proved beyond doubt that by inoculation with a special organism it is not only possible to increase the nitrogen fixation but also to definitely increase the yield of the crop and improve the quality. This discovery opens up a vast field for increasing the acre-yield of the crop which in Madras, is much above the world average. Madras produces over 1,000 lb. of pods per acre, while the world average is only 700 lb. To get the benefit of the increased production, we should, in addition to widening our market,

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see that the produce is put to an increased variety of uses in our own country.

Of all the groundnut growing countries, Madras may be said to have been a pioneer in developing its cultivation and trade. When in about 1890, there was a sudden fall in acreage due to the deterioration of the old country seed, we were almost the first to start an experimental station at Palur (South Arcot district) in 1905 and study this crop in detail. At that time it was the orthodox opinion, that only light soils were most suited to groundnut cultivation and that there was no possibility of growing a satisfactory crop of it, in the black soils. Our studies on groundnut for 30 years in light soils at Palur, Neduveerapet and Palakuppam have yielded valuable results which may be summarised as follows:—

1. When an enquiry into the deterioration and introduction of a new variety was made by Dr. Barber in 1899, he reported "two or three years ago, some thing like a revolution has occurred in the introduction of a new variety of groundnut. After careful enquiries extending over many thousand acres I was only able to succeed in finding four small patches of the original country seed, together equalling about one acre. The suddenness and the completeness of the change is worth considering." This is what a real improved seed should be able to achieve.

2. With adequate manuring and continuous cropping, the yield of groundnut was not seriously reduced.

3. It was more economical to raise a mixed crop of a cereal and groundnut, instead of rotating the two pure crops in two years.

4. In a fairly fertile gardenland, additions of lime or phosphatic manures had little effect and that even the return to the soil, of all the produce except the oil, did not increase the yield of crop over the no manure plot consistently for several years.

5. A high seed rate was quite essential for increased yields.

6. The time has come for changing the local Mauritius for a better yielding variety.

During this period, it has been a surprise to find that the black soil ryots of the Ceded districts tried this crop for the first time in about 1900 and within the last 35 years the area in the Deccan tract has far outstripped the area in the Southern Districts; while the Southern districts of Madras have been able to increase the area from 2·11 lakhs of acres in 1900 to 11½ lakhs of acres, the Ceded districts have in the same period, increased the area from almost nothing to 19½ lakhs of acres. The net return to the ryots of the Southern district is not more than 250 lb. of pods per acre while those of the Ceded districts ryots is about 750 lb. The method of cultivation,

cropping and harvesting adopted by the Ceded districts ryot are quite characteristic and in keeping with his traditional methods of cultivation of other crops. He adopts drill sowing, uses a much smaller quantity of seed per acre, inter-cultivates the crop with bullock power, pulls out the mature crop with about 75% of the pods intact by a special adaptation of his *guntaka*, dries and stacks the crop with the pods for about 3 to 4 months until he gets his leisure, and threshes the crop instead of plucking the pods individually, winnows out the haulms and secures nearly 75% of the produce at less than a sixth of the cost of the South Arcot Ryot. This is almost the American system of cultivation except for this one difference, that while the American farmer finds it economical to allow pigs to fatten on the pods left in the field, the Ceded district ryot collects the same by a few cross-cultivations with *guntaka*. It was an interesting sight to see a ryot taking a stone roller and rolling his baked up groundnut field to force it to yield to his *guntaka*. Extensive experimental work is obviously necessary for suggesting improvements over this method of cultivation. But these practices with certain modifications to suit individual tracts can well be demonstrated in other groundnut areas of the Presidency, where more than half the produce some times goes towards harvesting charges. Organised team work is therefore quite necessary to raise food crops at the lowest cost, suited to different tracts wherein the plant breeder, the bacteriologist, and the agronomist will each contribute his share to improve the efficiency of crop production.

The produce being so dry is able to keep well for a long time and so the Ceded district ryot is not in such a hurry to sell his crop. It is this groundnut that is so largely responsible for supplying a steady foreign market and helping the local oil mills and the soap industry.

The southern district ryot is still unwilling to give up moistening and handshelling the produce in preference to machine decorticating, as he still finds from experience that he gets a better value since what he loses by way of unit value, he gains by the additional moisture which he adds for hand shelling. Machine shelling by itself does not improve the quality of the commercial product. During the harvesting seasons, the arrivals are very heavy and the only aim of the owner of the decorticating factory is to get as much business as possible during the short trade season. Very often the brokers themselves are the proprietors of the factories. As the wholesale purchasers are very keen to avoid breakages of kernels, moistening of the pods is invariably done before machine decorticating.

Further, drying of the kernels is rarely done as at this period there is hardly any space in the factory to dry and store the produce. Purchasing semi-dry produce and decorticating the same and mixing it with the hand decorticated moist seed to equalise moisture content is not an uncommon practice.

Groundnut keeps quite well in the shell for a long time, but it quickly deteriorates after shelling. Even for sowing purposes it is therefore the practice to shell pods just prior to sowing. Broken kernels help to increase the rancidity. Even the bruise on the skin of the kernel is sufficient to admit the easy entry of fungus and bacteria. The presence of a large quantity of moisture accelerates decomposition. It is necessary therefore to exercise a sort of official control and guidance over decorticating factories to secure minimum of breakage without any addition of moisture. Such a measure is reported to have secured absolute freedom from breakages, in other countries. Decorticated nuts suffer from fermentation which increases with the presence of broken kernels, as the free fatty acids in the latter increase during storage and transit. While this is the case with a dry produce, the deterioration is very much greater and more rapid in the case of moist samples. A test was conducted by the author on some export samples of groundnut kernels collected from different exporting firms. Twelve samples were collected from 12 different consignments just before these were loaded in trains for shipment. Each sample was immediately divided into two halves and one, the original, was kept in tins while the other half was dried thoroughly in a steam oven. Both were kept for about 6 weeks and two random samples were kindly analysed by the Government Agricultural Chemist. The dried samples were found to be perfectly good while the undried originals had become highly rancid showing from 17·5 to 101 acid value and were subject to fungus and insects attacks. As all other undried original lots were similar the entire lot was not analysed. This deterioration due to rancidity may be taken to mean at a modest estimate, a loss of about 25% of the value of the crop. If this is the sample that is being constantly received by the purchasers in the consuming centre they will naturally make full allowances for the losses, freights and refining charges, in ordering purchases. Madras Presidency is exporting about Rupees six crores worth of groundnut produce a year and a 25% loss on one item of deterioration during storage in transit would alone account for a loss of 1½ crores of rupees a year. It is however, necessary to analyse a larger number of known samples both at the time of shipment and immediately on arrival at destination to enable us to get a correct estimate of losses on this account.

Export of groundnut in shell avoids moistening and the breakages of kernels and the consequential loss due to deterioration. The main objection is the extra space needed. But the French African possessions send a large quantity of their produce only in shells and China sends a part of her produce in shells to a distant country like America. There is no difficulty of space felt in sending the more bulky copra and cotton. When we remember that we contribute to a third of the world's export of groundnut products, we have a claim for asking for greater consideration at the hands of the shipping firms in the

transport of our produce to avoid loss in storage during transit. Extraction of oil with the shell is said to give a better quality of oil, with better keeping quality.

The high protein content of the oil cake, the absence of an impetus on the part of the Indian cow keeper to improve the milk yield of his cow and his partiality for gingelly and coconut cakes have been responsible for not feeding milch cows with groundnut cakes. The country cows particularly do not appear to respond very well to feeding with cakes. But the reduction of the protein content in the groundnut cake by the milling of the nut with the shell is likely to make the cake cheaper and it has been found that the presence of the shell has no injurious effect on the animals. It is just possible that it may even add to the digestive value. Feeding trials of cakes made this way to local cows and bullocks is likely to lead to useful results.

The feeding of cattle with cakes and recovering a good portion of the manurial ingredients in the dung and thus indirectly manuring the soil with cakes must be tested in our experimental stations, and the same made a special item of propaganda, before contemplating any action to stop the export of cakes which is often a subject of agitation.

The keeping quality of oil is largely dependent on the seed. If the seed is rancid the oil also becomes rancid, the rancidity increasing during storage. Latest scientific methods of refining, deodorizing, and hydrogenation have brought about profound changes in the oil industry and the groudnut oil has been pre-eminently useful in forming either a substitute for or adulterant with all other oils and fats. By the process of hydrogenation it has been found possible to harden this oil and this fat is least liable to rancidity. It is therefore essential that we take up the oil production ourselves adopting the latest improvements and export the solid fat to consuming centres and thus save the enormous losses that we incur every year. Research on an extensive scale is indicated in carrying out this programme and the volume of trade and the extent of national loss that we incur every year are the justifications for the proposal.

The world's production of groundnut is about 5 million tons a year of which India's share is $3\frac{1}{2}$ million tons. Allowing for the estimated quantity of about half the produce being consumed in the country she is still able to contribute about 40% to the world's trade in groundnut and about 18% to the world's trade in total oil products. Though, with this exceptional advantage, India has still been hesitating to place a duty upon the export of cakes, America has barred the import of outside groundnuts by a heavy import duty while France has given a special protection to her African possessions with the result that our trade with France has dwindled from 80% in the quinquennium before the war to about 30% since 1926. The United Kingdom has never been using very much groundnut, except some cake but she has

recently increased her purchase of groundnut and has developed the margarine production considerably. We are thus seriously losing our trade, due to faulty methods of production and trade with the result that the consuming countries of Europe are trying to meet their requirements from their own possessions and colonies where they are making special attempts to increase production. This falling of exports is likely to seriously affect our trade and consequently reduce our prices still further. But it should be an opportunity to utilise the period of low prices to develop the industrial side in our own country and produce soaps, butter and ghee substitutes, both for export to other centres and for increasing the local consumption. It is not possible to punish adulteration of butter and ghee, when the demand for these is much greater than the supply without finding a way to meet the increased demands. Research work to make butter, ghee and other oil substitutes appears to be the most urgent need.

Recently an American Scientist got up about 105 preparations out of groundnut and selected 14 recipes out of them and got up a five course luncheon, which were served to 10 food specialists. It is reported that each one without exception was enthusiastic over the menu and said it was the most satisfying luncheon, she or he had ever eaten. He goes on to observe " that by reason of its superior food value, the peanut product has become almost a universal diet of man and I think I am perfectly safe in the assertion that it will not only be a prime essential in every balanced dietary but a real necessity. Indeed I do not know of any one vegetable that has such a range of food utilities." It is good for our economists to consider if such a valuable food of man, beast and soil should be so lightly disposed of in our country.

Mr. T. Adinarayana Chettiar, Bar-at-law, in his recent book on Co-operative Marketing of Agricultural Produce in South India, depicts vividly the plight of the poor agriculturist in the hands of the wily middleman. The institution of warehouses under the joint auspices of the Agricultural and Co-operative Departments has given some relief, but the tendency to copy the rules and methods of the *Taragu Mandi* should be consistently checked by the warehouse officer, who should help the ryots to avoid storage losses. Though an agricultural officer may not have such a keen knowledge of markets, which is only necessary for speculative purposes, his claims for the management of the warehouses rest upon an intensive desire to help the ryots, coupled with a knowledge of handling produce satisfactorily and avoiding storage losses. But nothing spectacular is possible until a warehouse is able to arrange for a full consignment of direct shipping to the consuming centre which alone will assure substantially better prices. Enforcing the Commercial Markets Act in all the groundnut market centres will rectify a large number of evils connected with weights, samples, allowances and a host of other defects in the trade,

and a system of public auctioning will induce the ryots to improve his produce. We have recently been able to do similar work at Rasipuram with success where the local system of cotton picking was very defective. Intensive propaganda combined with personal advice was done by the distribution of leaflets, specially prepared on the subject and the *kappas* gathered by the improved method was collected by the co-óperative society was put in public auction and secured better prices than the local market rates.

Work on all these lines will be largely helped and hastened by legislation especially when a trained set of demonstrators go about the country and explain the serious losses that the ryots incur every year due to inefficient methods of cultivation and wasteful methods of marketing. This step will be particularly helpful if followed by a system of state aid of some sort, and when once real progress has been achieved, the groundnut cultivator will not grudge a small cess to further develop the industry.

Market standards for each tract should be established and radio service to quote daily prices arranged so that, with a knowledge of freights, there will be a fair competition among the purchasers, while the producer will not also accuse the trader of exploitation as he himself would be conversant with the current market and freight rates.

Discussion.

Mr. G. Jogi Raju remarked that in Vizagapatam, as a result of vigorous propaganda, advocating sowing of groundnut in every furrow instead of in every alternate furrow, the seed rate had been increased by about 50 %, with a resulting increase in yield of about 19%. He further added that the crop which was of recent introduction in that tract was becoming greatly susceptible to insect attacks, and said it might be necessary to extend the operations of the Pest Act to that district also to keep the pests in check.

Rao Sahib T. V. Rajagopala Achariar opposed the opinion of Mr. Jogi Raju, about the necessity for increasing the seed rate to get a good yield, and instanced the Ceded Districts where with a low seed rate of only 15 or 20 lb per acre, good yields were obtained. He also wished to know from Dr. Patel, with regard to his opinion that groundnut is not responsive to manures, whether it was a fact with *lime* also, as there was a belief that groundnut is a *limefeeder*. Referring to Mr. Raghavachariar's paper, he wished to know why moistening the nuts was done by the ryots. before shelling them by the hand-shelling method. He was also of opinion that machine shelling would throw many labourers out of employment.

Mr. G. Jogi Raju remarked that, he could understand how low seed rate, with less plants per acre will give good yield, provided sufficient time is given for normal and full development of pods. Such a condition was not possible in Vizag, where harvest should be finished soon, to get the land ready for the next crop; in such localities a higher seedrate will give a larger number of plants and even after rejecting the immature pods, from each plant it will be possible to get a good yield of well developed pods.

Mr. T. Paramanandam said that ever since its introduction into Guntur, groundnut has almost proved a pest; it has ousted out the two important crops

of the district, tobacco and chillies, and there was a belief that groundnut has been responsible for the attack of 'thrips' on chillies, which crop has consequently suffered. Ryots also believed that groundnut spoiled the texture of the soil.

Dr. Patel replying said that he agreed with Mr. Jogi Raju that higher seedrate gave a higher yield and quoted the experience of America and Mysore on the point. He then observed that lime was not necessary in normal average soils. Answering Mr. Paramanadam he said this was the first time he heard of groundnut spoiling the texture of the soil.

Mr. K. Raghavachari observed that seed rate depended upon a number of factors. In the Ceded Districts, the ryot sows his crop with a drill and then intercultivates it, so that he has to use a low seedrate, bacause a high seedrate will leave very little space for intercultivation; another point was that the greater the rainfall, the greater was the seedrate. In Kollegal and Palur, where rainfall is heavy even a seedrate of 100 lb is used. Answering Mr. Rajagopalachari, he said, that ryots moisten the seed, so that the kernels do not split. This practice introduces moisture which is favourable for fungus and mould attacking the kernels.

SOME RECENT MANURIAL EXPERIMENTS IN RICE*

BY K. RAMIAH, L. Ag., M. Sc., Dip. Agri., (Cantab).

Paddy Specialist.

Introduction. The principle of manurial trial or in fact the principle underlying any form of agronomic experiment is to get a bigger yield per unit area. We only measure the end result of the treatment and we had no clear idea until recently as to how this increased yield is brought about. Developmental studies on the rice plant undertaken in Coimbatore have shown that the two important attributes to yield are (1) the number of tillers or ears per plant and (2) the number of grains per ear. A proper understanding of the influence of environment which includes the different forms of manurial trials, on these two developmental phases of the plant is extremely important. A number of experiments have been conducted recently in the rice stations and while the fuller details of these experiments are published in the station reports an outline of the salient features are given in this note.

Spacing and Manuring. Several experiments have been conducted in the research stations in the past with different spacings and with different manures. The two treatments were, however, not combined, to find out their interaction. This has now been done for three seasons in Coimbatore, Pattambi, Maruteru and Berhampore representing four different types of soils and cultivation practices. The seedlings were planted with different spacings with and without manurial application to the transplant field. I shall state here only the final conclusions reached. The optimum spacing varies with the different tracts. While it is about 4½ to 6 inches in Berhampore and

* Paper presented at the 24th Agricultural College Day and Conference, August 1935.

Pattambi, it is about 6 inches, in Coimbatore and is definitely more, towards 8 to 9 inches at Maruteru. While the above are for long duration varieties, 5 months and more, the optimum spacing for short duration varieties is never more than 4 inches. Spacing has a greater influence on tillering or the number of ears per plant, than manuring. But the increased number of ears per plant brought about by wider spacing compensates for the reduction in the number of plants only up to a limit. The action of manure appears to be chiefly confined to its influence on the second yield attribute, namely, the size of the ear. While spacing has its principal effect on the vegetative phase, manuring has its effect chiefly on the reproductive phase. Even for increasing the number of tillers per plant there must be a certain limit of optimum fertility. It follows therefore that manuring is necessary more when the ears are forming. To get the maximum benefit the manuring must come in two stages, firstly to improve initial fertility where it is known to be low and secondly to influence the size of the ear at a later stage. Too much of initial fertility, either natural or added, hastens vegetative development unduly and there is not a proportionate increase in the second yield attribute, namely, number of grains in the ear. This takes us to the next consideration of when the manure is to be applied to have its full effect on ear-formation.

Time of Application of Manure. Naturally the manure has to be a quick acting one, a chemical fertiliser, and so far as the available results go, ammonium sulphate appears to be the only manure that can be used profitably. When this has to be applied varies with the different tracts and the varieties grown. In short duration varieties it has to be applied soon after planting as there is not sufficient interval between the two phases of development. For longer duration varieties, five months and above, the optimum time is found to be a month after planting at Maruteru, six weeks at Coimbatore and 2 months at Pattambi and Aduturai.

Applying Manure to the Seedbeds *vs.* Transplant Fields. Another question concerned with the manuring, is where the manure should be applied, whether in the seed-beds, or in transplant fields or in both. Experiments have been conducted at Coimbatore, Maruteru, Aduturai and Berhampore with regard to raising seedlings under three different conditions namely, unmanured, normally manured and intensively manured, and the three types of seedlings were planted in manured and unmanured fields. In Coimbatore the experiment was conducted with three varieties of different durations, 4, 5, and 6 months. The fairly uniform results obtained over two seasons at all the stations under different conditions add particular significance to their importance. In all the stations it was noticed that though the intensively manured seedlings were very much in advance of the rest at the time of planting, the differences levelled out gradually and the manuring

or non-manuring of the transplant field was the chief condition that influenced the final yield. Irrespective of whether the seed-bed is manured or not unless the transplant field is manured no beneficial results are obtained.

Manuring of the transplant field increased both the yield attributes in the early varieties, but only the ear size in the late varieties.

In addition to manuring, the rate of sowing in the seed-bed was also tried in Coimbatore and Maruteru and the results point out that thinner sowing has a greater influence on the plants' subsequent development than manuring.

It has been ascertained by actual experiments in Coimbatore that the roots, and probably the leaves also do not function for some time after planting, i. e., until new roots are formed. Moreover, the rapidity of establishment of the seedlings after planting is an important consideration. The quicker establishment and quicker starting of the vegetative development which certainly affect final yield are more influenced by the fertility of the transplant field.

This does not mean, however, that seed-beds need not be manured at all. Unless the seed-bed area is too poor, which is usually not the case, all the available manure may be profitably applied to the transplant field. Intensive manuring of seed-beds has some significance only when we want to force the growth of seedlings to get them ready for planting early, especially when the season is late.

General Principles of Manuring. With regard to general principles of manuring rice, several experiments have been going on for a number of years in the different agricultural stations. S. N. Venkataraman* (1932) has summarised all the results obtained up to 1931 and comes to the following conclusions in his report. "Green manuring is found to be beneficial to the rice crop universally throughout the Province. Nitrogenous fertilisers like ammonium sulphate either by themselves or in conjunction with leaves have a limited application except in soils specially deficient in nitrogen as in Manganallur and to a less extent in Coimbatore also. Phosphates, bonemeal and super (preferably the latter), generally have some effect in soils deficient in phosphoric acid. They have always to be applied in conjunction with leaves, they having no value by themselves except in one case, viz., Manganallur. On Anakapalle and Palur soils the phosphates are of no use".

The evidence from the report was also fairly definite that except green manuring the use of fertilisers in any form was not economical. It has also been stated in the report that in fertile soils capable of yielding about 3,000 lb. of grain per acre, the effect of any manurial treatment was negligible.

* Officer appointed on special duty to collate the results of manurial experiments in all the Agricultural Research Stations, Madras—Unpublished data.

It may be worth while to consider the several manurial experiments that have been carried out in Coimbatore, Maruteru, Aduturai, Pattambi and Berhampore since the compilation of the above report.

(a) *Maruteru.* Maruteru represents one of the most fertile tracts under rice in this Province. There are two crops of rice grown but so far as the first one is concerned the yields are mainly dependent upon the season, particularly the absence of rains in summer. Rainless summer and early planting give high outturns and any attempt at manuring does more harm than good, causing premature lodging of the crop. The beneficial effect of green manuring is to be found only in a bad season when it counteracts the bad effects. In any case the increase of crop obtained by green manuring or by any artificials has never been more than about 10 per cent. But the effect of green manuring was particularly noticeable with the second crop where increase of even 20 to 30 per cent. in grain yield has been recorded.

(b) *Berhampore.* The soils represented by Berhampore in Ganjam are very much poorer in fertility compared to Maruteru. Experiments have been conducted with different quantities of green leaves from 2,000 to 6,000 lb. per acre. There was a progressive increase in yield, a 15% increase with 2,000 lb. going up to about 30% with 6,000 lb. A small dose of ammophos in conjunction with green leaves gave a definite increase in yield but the increase was not found sufficient to cover the extra cost of the fertiliser.

The conditions at Pattambi are very similar to those of Berhampore and the results obtained are also similar.

(c) *Coimbatore.* In Coimbatore where the standard of rice cultivation is probably higher, a dose of 4,000 lb. leaf gives about a 15% increase in yield. In one of the experiments in the Central Farm, green leaf has been tried from 2,000 up to 12,000 lb. per acre. There is found some increase, not regular though, up to 8,000 lb. and the increase is not apparent with still increasing doses.

(d) *Adutural.* In Aduturai also the beneficial effect of green leaf is apparent and everyone is familiar with the difficulty of growing a green manure crop in Tanjore. The only possibility of growing a green manure crop lies in sowing it in the standing rice crop just before its harvest and this can be done only with either indigo or wild indigo. If there are any rains in summer they bush out properly and give enough leaf, but if the summer should prove dry, not much of leaf is obtained. The attempts made at this station to grow some green manure crop as soon as water is received in the channels for the single crop lands and ploughing it in before planting, are promising. There is enough scope to do this provided water is received in the channels early enough.

If the land could be ploughed in summer and a green manure crop raised as is done in Coimbatore, the cost of raising a green manure

crop goes high but the produce from one acre may be sufficient to apply to three to four acres.

Though it is true that green manuring is more effective in poor lands, the ultimate quantity of increase is not great as the initial yield is itself low in these lands. A 20% increase in Berhampore will be the same as a 12% increase in Maruteru. Probably there is not a big difference in the value of the increased produce obtained due to manuring. At the present price of rice, the value of the increased produce obtained in the different stations varies from Rs. 6 to Rs. 10 per acre though the figures are higher for Coimbatore. If manuring is to prove an economical proposition, the cost of the manure applied would have to be very much less than Rs. 10 per acre and under these conditions, green manuring is probably the only treatment that might be considered except in very special cases where fertilisers in addition to green manuring might be thought of.

There is one interesting observation recorded in the results of these experiments, namely, that the improved strains always give a better response to manuring and better cultivation than the unselected bulks. The mere value of the strain consists in its ability to make better use of the natural fertility and if this could be improved, the response is also greater. It is possible that the ryots are not realising the full benefits of the improved strains because their fields are not in the optimum condition of fertility.

Need for more work in special Tracts. Just as in breeding even with regard to manuring the conditions vary from place to place and the results of one place are not easily applicable to another. This obviously necessitates intensive experiments in as many centres as possible before any recommendations could be made. It is sometimes stated that all the problems of rice growing have been solved and that the lines of work in rice are very simple. As one who has worked intensively with the crop for nearly 20 years, I feel that the more you intensify your work, the more you find certain definite gaps in our knowledge about this crop plant. It is sometimes mentioned that because of the fall in price of the produce, there is no necessity to carry on much intensive work with this crop, but I feel that the low price and consequently the low return realised by the rice grower must be a reason for more intensive studies from all aspects.

Discussion.

Rao Bahadur K. S. Venkatarama Ayyar, observed that ryots knew about the value of green manure for paddy, but he did not see how it was possible to apply the green manure, after the paddy crop had grown up, as was suggested by the author, to give good results.

Mr. K. Ramiah said that it was not green manure that he meant should be applied after the paddy crop was on, but fertilisers like Ammonium Sulphate, which were best applied at different stages of the crop.

Rao Bahadur K. S. Venkatarama Ayyar, humbly remarked that cattle tresspass was a serious problem in his district, and the man who foresightedly raised a crop of green manure during the summer for his paddy lands, very often found to his cost that he provided good pasturage for the village animals. Even crops like daincha and indigo which were known to be non-edible to cattle were now being eaten up by them in Tanjore. He appreciated some of the new points contained in Mr. K. Ramiah's paper, particularly the one about the manuring of rice seed-beds, and he hoped to benefit by it. There was also another difficulty with regard to applying fertilisers to rice fields in that there was the risk of the manure being washed out of the fields as the irrigation water could not be controlled properly as is usual in Tanjore.

Rao Sahib T. V. Rajagopalachari pointed out that in some parts of Madras people preferred carting leaves to rice fields from outside even at enormous costs to growing a green manure crop in the land itself. He also pointed out that there was an impression often expressed that the produce obtained from a green manured field was insipid in taste when compared to the produce grown without any manure.

Mr. K. Ramiah replied that in several experiments, there has not been any perceptible difference between green leaf manuring and green manuring. As regards the quality of the produce he thought that the cooking qualities were probably more dependent on the harvest and threshing practices rather than on manuring and he mentioned the case of Tanjore produce of a particular variety (Nellore Samba) fetching less price than the same from elsewhere. He also pointed out that the difficulties of cattle tresspass with regard to growing a green manure crop were remediable and he pointed out that under very similar conditions in the Godavari delta, the practice of growing sunhemp as a green manure crop was extensively in vogue and that Godavari ryots were able to maintain better type of cattle than in Tanjore.

THE PROBLEM OF MILK SUPPLY TO CITIES

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

Intensive urbanisation of a population always creates certain problems which need solution. Housing, lighting, transport, roads and medical aid and food supply are the more important problems of the urban population. As it is not within the scope of this article to study all the problems, only one aspect of food supply will be considered. Milk supply to an urban population has become increasingly important of late, as people find it difficult to maintain a cow to supply home requirements. In cities like Madras where the milk supply is dependent on professional milkmen the problem is acute. Depending on their prosperity these milkmen keep a limited number of cows and try to meet the demand as best they can, with the result that the housing of cows and sanitation in general do not come up to a high standard.

In the absence of a sufficiently strong public opinion these drawbacks have not been rectified. Moreover, the house-wife is not prepared to pay a higher price for a better quality of milk, and the milk man in his turn wants to make profits. These are limited as the cows do not give sufficiently high yields so as to show profits. The result

is that the calves are starved and when dead they are stuffed with straw and placed before the cow so as to induce milk flow. The milk is then adulterated so as to make the industry pay. In addition to this the milkman cannot afford to keep the cow when dry. She is therefore either sold or exchanged for a cow about to calve or in milk. Very often the dry cows are purchased by the butchers who slaughter them for the beef-market. By this method the country is becoming deplete of very good milch-stock.

From time to time capitalists have started dairies to meet the demand of urban population but they have often failed owing to lack of proper supervision, adequate capital and suitable animals. * The author has already shown how the costings for milk production work out. As matters stand in this country it has not yet become possible to supply a large number of milch cows which will yield sufficiently large quantities of milk to make the industry pay. But when the cost of milk production is low and if there are adequate transport facilities dairy farming under expert supervision should pay.

Under prevailing conditions, however, there seems to be only one quick method of solving the problem without upsetting the economics of the population of villages surrounding large cities. This is by collecting the milk produced in the surrounding villages and suitably treating it at a convenient centre and supplying it to the customers. When there is initiative among villagers, a co-operative creamery can be easily organised. If this is not possible a well qualified individual with sufficient capital should be able to collect the milk on a contract basis and transport it to cities. Some of the trained-men from the Imperial Institute of Animal Husbandry and Dairying and the Agricultural College at Coimbatore could easily tackle this problem quite successfully instead of being on the unemployed list.

In this connection it is not out of place to mention how the milk supply of Mysore and Bangalore is being tackled by Mr. M. Krishnaswami who was trained at the Imperial Institute of Animal Husbandry and Dairying. Mr. Krishnaswami had the foresight to see the growing demand for a proper organisation for supplying milk to the City of Mysore. He has organised the concern known as the City Milk Supply, Mysore, and as it is now working at a profit it would be of interest to know how it is worked. This type is usually called a creamery in the west. Like most big concerns the beginning has been a modest one. The factory is housed in a hired building with its own limitations for a proper dairy at the Old Post Office Road, Mysore. The proprietor is well aware that the locality and the building are not ideal but he feels it will not be possible to build one in a suitable locality until the business warrants a building of its own.

The initial capital outlay was Rs. 16000 and later Rs. 6000 from earnings were utilised for improvements.

The plant consists of the following:—

1. "Pioneer" Pastuerising outfit-comprising of a small steam generator working at 51 lb. pressure, a bulk pasteuriser with hand agitator, hot and cold water tank with a steam turbine for washing bottles and a sterilising chest.

2. The "Servel" refrigerating equipment and Frigidaire worked with submerged cooler, sufficient to cool the store between 1000 lb. to 1500 lb. of milk per day.

3. Separator, butter making apparatus, bottling machine and testers, milk cans, miik bottles, weighing machine and office equipment.

4. A lorry used for carrying sterilised milk cans to and from milking centres and tri-cycles with arrangements for holding cans. (A recording clerk is employed at each centre.)

There are six milking centres situated on the Yelwal road, the last village being nine miles from Mysore. The cows for milking are brought to the centres between 6 A. M. and 8 A. M. and again between 4 P. M. and 6 P. M. each day and milking is done at all the places at the same time. The milk is filtered through cotton filter and weighed, put into sterilised cans and taken to the factory for pasteurising within half an hour of milking. Samples are taken for milk from various centres for testing and the milk is pasteurised. Samples are also sent once a week to the Food Analyst. The method of pasteurising is to keep the milk under pressure say about 200 lb. for about half an hour at 145°F. and to rapidly cool it down to 40°F or thereabouts.

The cows' milk is purchased at 16 lb. to a rupee and sold at 8 lb. to a rupee for casual and extra orders and at 10 lb. to a rupee on coupons and for approved credit customers. There is a loss of about 3 per cent of milk in handling. The cost of pasteurising works to 2 pies and cost of delivery charges to about 1·05 pies per lb. In addition there is the cost of breakage of bottles, cost of bottling, office staff, messengers, lighting, telephone in addition to other expenses to be taken into account. Good prices are likely to be realised during seasons, festivals, holiday making etc. 50 per cent. of the milk handled is supplied to Government hospitals, Government and public institutions. A certain amount of buffaloes' milk is handled for the use of coffee clubs as well.

It is interesting to note that the concern was worked at a heavy loss for about two years, but that it works at a profit now, because of expert supervision. Mr. M. Krishnaswami not only deserves to be congratulated on his effort at Mysore but needs more encouragement in his present endeavour to organise the milk supply of Bangalore.

By this system it is seen that the existing milk-men are not adversely affected and a large amount of capital is not tied up and there is no necessity for the concern to take the risk etc., of managing cows. The milk-men are sure of selling their milk to the factory and in time the two industries become inter-dependant. The type of cows that supplies Mysore are *Hallikars* and cross-breeds. The former is said to

yield only 6 lb. per day on the average. In spite of this, the ryots are increasing their milch-cows to supply the factory which acts as an incentive for high milk production.

There is no doubt that the problem of milk supply of other cities can be solved on the lines suggested above, provided trained young men have the initiative to organise industries or co-operative societies; or capitalists could employ these men for running the factory efficiently. In the latter case unless managers of factories are paid satisfactorily it will be difficult to expect a high standard of work.

My thanks are due to Mr. M. Krishnaswami for permitting me to go through his factory and furnishing me all details without hesitation.

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CULTIVATION OF KORAI (*CYPERUS TEGETUM*) OR MAT GRASS IN NORTH ARCOT DISTRICT

BY N. KRISHNA PILLAI, L.Ag.,
Agricultural Demonstrator, Cheyyar.

Introduction. *Korai* is one of the few crops that can profitably be grown on heavy clay soils, deficient in drainage and consequently regarded as unfit for cultivation. Low-lying lands below tanks and also swampy and saline lands could successfully be planted with this crop. The culms of this grass, supply raw material for the manufacture of mats, so commonly in use in almost every Indian household. The cultivation of this crop in India is however limited to a few places in the Bengal and Madras Presidencies. In the District of North Arcot, there is a fairly large area under this crop in Cheyyar and Wandiwash Taluks, the villages of Vadanangur in Cheyyar Taluk and Tennangur in Wandiwash Taluk contributing the largest portion. In recent years the area has considerably decreased due to scarcity of water. Though the industry has to some extent suffered in common with others in the general trade depression, it has however not been so much affected since it is not influenced by the fluctuations of foreign markets.

Details of cultivation. *Soil*—The cultivated species of *Korai* comes up well in a heavy clay soil with abundant and perennial water supply. It thrives in sandy soils also, but the land is liable to be infested with weeds which gradually suppress the growth of *Korai*, thus necessitating the renewal of the crop by fresh plantation at shorter intervals. In heavy clay soils, kept free from weeds, the crop yields for about ten to fifteen years when once planted. Though the grass is not affected by water-logging it is believed that stagnant water affects the

colour of *Korai*, the bottom portions of culms turning black and the rest failing to get the desirable golden or white colour.

Preparatory Cultivation:— The soil is first dug with *mammatty* or sometimes with crowbar to a depth of 7 to 8 inches. It is then ploughed four or five times, puddled and then levelled with the levelling plank before planting.

Manuring:— In addition to about 100 headloads of green manure or green leaf, about 40 cartloads of ash are usually applied per acre. Cattle manure is never applied as it is believed that such application results in the formation of holes in the culms of *korai*. In some cases, instead of ash, castor cake at one cwt. per acre is being used quite successfully especially for subsequent manurings which are given after each cutting.

Seeds and sowing:— About 16,000 bundles of *korai* (each containing 10 to 15 slips are required to plant an acre. Slips with bulbs (nuts) having about 9 inches of shoot are selected and planted 4 to 5 inches apart.

After cultivation:— Two to three weedings are given during the first year and in subsequent years one weeding after each cutting. Manure is applied after each cutting.

Harvesting:— The first cutting is done about ten months from the time of planting. The produce of the first cutting is of inferior quality, being thick and coarse and is also poor in quantity. Thin and superior *korai* is obtained only from later cuttings. Two cuttings per year on the average are taken in subsequent years, depending on the growth. *Korai* is cut before the flower heads dry up.

After harvesting, the produce is first removed to the drying floor, the damaged and waste culms are rejected, flower heads cut off and the culms are sorted into 8 different lengths. They are then dried for two or three hours and then split into two by a special knife called '*korali*'; it is possible to split twenty pieces of grass at one time, by the use of this knife. After a further drying for a day or two the grass is finally stacked.

When required for sale, the stacks are opened and bundles of uniform size are made, five such bundles making a head load and twenty such headloads filling a cart. The whole labour involved in the operation from harvesting to the preparation of such headloads is done on contract at twelve annas to Rs. 1—4 - 0 per headload.

Marketing. *Korai* is marketed either as raw material in units of headload or as finished product, mats. Muhammadans engaged in manufacturing mats, purchase *korai* culms and weave them into mats. A number of Muhammadan families engaged in this craft are living in and around Vadanangur and Tennangur villages. Tinnevelly is an important market for *korai* culms produced in these places. The chief

market for mats manufactured in North Arcot district is Madras, though places like Vellore and Tiruvannamalai have also minor markets.

The price realised for *korai* depends on the quality and length of the culms. The produce from the first harvest being coarse always fetches less price. As already mentioned, *korai* culms are sorted into eight different lengths before they are sold. The first sort will be 4¼ feet long, the second 1½ inches less than the first, the third 1½ inches less than the second and so on. The third sort (4 feet long) is the standard on which prices are based, the sorts above and below fetching proportionately higher or lower price. The variation between each sort may be about Rs. 10 per cartload. The present price of standard quality of *korai* culms (4 feet long) is Rs. 90 per cart of 20 headloads.

Cost of cultivation :

	Per acre Rs. A. P.
1st year	
Digging—100 men at 4as. each.	25—0—0
Ploughing and puddling—32 pairs at 5as. each.	10—0—0
Green manure—100 headloads at 2 as. each.	12—8—0
Ash manure—40 cartloads at 1—8—0 per cartload and spreading at 4 as. per cartload.	70—0—0
Seeds—16,000 bundles of slips at 200 per Re.	80—0—0
Planting—40 women at 2 as each.	5—0—0
2 weedings—120 women at 2 as. each.	15—0—0
Harvesting, sorting, drying, splitting, bundling, etc.—Labour on contract at Re. 1 per headload—100 headloads.	100—0—0
Total expenses for the first year. ...	317—8—0
2nd year. (same in subsequent years also)	
2 manurings—60 cartloads of ash at 1—8—0 each and spreading at 4 as. per cartload.	105—0—0
2 weedings—160 women at 2 as. each.	20—0—0
Harvesting and other operations of getting the *korai* ready for the market—2 cuttings—contract labour—200 headloads at Re. 1 each.	200—0—0
Total expenses for the 2nd year. ...	325—0—0

Taking the average life of the crop to be 10 years and the total number of cuttings to be 20 at 2 per year on the average, the cost of cultivation per year will be Rs. 325 *plus* 1/10 of 1st year's expenses (Rs. 31—12—0) *plus* annual lease at Re. 1 per cent of land (Rs. 100).

	456—12—0
Produce per year—2 cuttings—10 cartloads—value at Rs. 75 per cartload.	750—0—0
Net profit per acre per year.	Rs. 293—4—0

Rotations followed : — When a *korai* plantation becomes too weedy or shows heavy reduction in yield, a fresh plantation is opened. Two or three crops of paddy are raised between two successive crops of *korai*. The paddy crop that follows a crop of *korai* yields well due

to the residual effects of the heavy dose of manure applied to *korai* crop every year and also to the decomposed *korai* bulbs left in the fields.

Uses. The main use to which *korai* is put is the manufacture of mats. Waste *korai* unfit for making mats is used for thatching purposes and also as fuel.

Reasons for localisation of korai crop. The most important factor for the limitation of the cultivation of *korai* to certain special localities appears to be the distribution of that section of Muhammadan population engaged in the manufacture of mats. From time immemorial people of other castes have looked upon manufacture of mats as an exclusive profession. Other factors for the localisation of *korai* crop are the availability of suitable clayey soils, assured water supply, knowledge and practice of the cultivation of crop and the preparation of raw material.

Suggestions for improvement. The following steps may be taken to improve the crop:—

(a) Finer and heavier yielding species of *Cyperus* from other parts of the world may be introduced.

(b) Artificial manures may be tried to find out whether the quantity of the produce is increased and the quality improved.

(c) Fresh plantations at shorter intervals may be raised to test the effect on the quality and quantity of raw material.

(d) Where facilities exist, the cultivation of *korai* may be encouraged.

(e) Co-operative societies may be organised to help and finance people engaged in the cultivation of *korai* and manufacture of mats to purchase manure, meet cultivation expenses and market the produce.

Acknowledgments. The writer acknowledges with thanks the encouragement and suggestions given by Mr. M. Kanti Raj, Assistant Director of Agriculture, Vellore, in preparing this note.

Research Notes.

The nutritive value of Teosinte flour.

Teosinte, (*Rena luxuriana*) a profusely tillering fodder plant has proved to be extremely suitable for making silage Apart from its value as a green fodder, no trials have so far been made by including the Teosinte grain in a ration for cattle, probably because it is found to be very hard. Below are given figures relating to trials made with Teosinte flour, used as a ration for cattle, in place of *Ragi* flour.

Two *Sind* bulls and two *Kangayams* were selected as experimentals and a similar number to serve as controls; while the controls got 1 lb. of *Ragi* flour, the experimentals got 1 lb. of Teosinte flour Weights of the animals were taken at periodical intervals—once in ten days—throughout the period of the experiment—7—2—1934 to 21—8—34. The results, tabulated below indicate that Teosinte flour can be utilised in the ration to a limited extent.

Feeding Experiment: Teosinte vs. Ragi: Started on 20—2—1934
Closed on 21—8—1934.

Month.	Fed on Teosinte: Average weight during the month of.				Fed on Ragi: Average weight during the month of.			
	Sind Bull.		Kangayam Bull.		Sind Bull.		Kangayam Bull.	
	No. 72 born 15th July 1932	No. 77 born 27th. Novr. 1932	No. 161 born 15th. Novr. 1932	No. 163 born 10th. Decr. 1932	No. 75 born 13th. Novr. 1932	No. 78 born 15th. Decr. 1932	No. 151 born 29th. July 1932	No. 152 born 5th. August 1932.
	lb.	lb.	lb.	lb.	lb.	lb.	lb	lb.
On 7-2-1934.	385	399	392	427	350	406	392	448
March	418	433	422	446	388	448	441	489
April	427	472	447	486	427	472	481	452
May	427	479	466	497	435	477	494	479
June	438	528	505	518	478	522	541	533
July	467	571	567	570	530	579	583	597
August	482	592	588	606	580	612	611	631

Live Stock Research Station, Hosur Cattle Farm. } T. Murari, B. Sc. (Oxon) F. L. S.
M. P. Kunhi Kutty, L. Ag.

ABSTRACTS.

A Biochemical study of the starches from old and new grain of different varieties of Rice. by D. L. Sahasrabuddhe and M. M. Kibe. *(Ind. J. Agri. Sci. 1935, 5,12.)* The article reports the results of experiments designed to elucidate the causes of the better suitability of certain varieties of rice for cooking and others for bread making. and to explain the common belief that old (stored) rice is more easily digested than new (freshly harvested) rice. Pure starches prepared by treating different varieties with weak alkali to remove proteinaceous matter were studied under the following heads: (1) size of starch grain, (2) action of boiling water and alkali (3) digestibility as gauged by the degree of hydrolysis with hydrochloric acid, diastase and pancreatin, (4) liquefaction and (5) amount of amylo-hydrolitic enzyme in stored and germinating rice. Starch grains from different rices differed in size and the depth of colouration when stained with iodins. Starches from old and new grains of the same variety did not differ from each other in either of these respects. Effect of boiling with water or weak sodium carbonate studied qualitatively under the heads swelling, softening, breaking of grain coat, and attack on internal contents showed that the varieties used for cooking and the older rices of the same varieties are less resistant to attack. Treatment with sodium hydroxide of different strengths (2—5%) for varying periods of time (1—24 hours) brought out in a more marked manner the differences mentioned above regarding cooking and bread making rices and the age of the rice. Hydrolysis with 50% HCl showed that although hydrolysis proceeded to varying degrees with different rices the cooking varieties and the older rices of the same variety hydrolysed most. Enzyme hydrolysis yielded similar results. Liquefaction studies brought out a significant difference in the percentage liquefaction of the various starches, the older rices liquefying more readily than the fresh ones. Positive results were obtained, when, the presence of an amylo-hydrolytic enzyme capable of acting on both gelatine and starch, was tested for in resting seeds. The last two observations easily explain

why stored rice is more easily digested—the enzyme is active during the period of storage and at least partly liquefies the starch. Y. V. N.

Activated sludge as a Bio Zeolite. By E. M. Theriault. (*Ind. and Eng. Chem*, 1935, *27*. 5683). Chemical evidence is presented in support of the author's postulate that the absorbent principle in activated sludge is in effect, a base-exchanging material akin to the zeolites that function in water purification. The high silica content of normal sludge, taken in conjunction with the marked absorbent properties of silica gels would tend to point to the gels as being the seat of activity. As it is definite, however, that silica gels as such, are absent in the sludge, the possible existence of complex ferro or alumino silicates or zeolites is indicated. Careful analysis of purified sludge samples, after correction for bacterial ash, give figures for the mineral constituents of the gelatinous matrix corresponding to an empirical formula which bears a close relationship to the constitution of zeolites in general, and this coupled with striking resemblances in their physical properties, indicates the essential similarity of the two. T. V. N.

June drop of citrus. By B. J. Weston (*Cyprus Agri. Jour. Vol. 30. p. 43*). The shedding of immature citrus fruits from the trees during summer is mainly due to hot dry winds which reduce the humidity in the atmosphere, and intensify the deficiency of soil moisture. Besides, the lack of available nitrogenous plant food in the soil also aggravates the abnormal shedding of fruits. Planting wind-breaks will mitigate the injurious effect of hot dry winds. The trees must also be liberally manured with organic manures just in advance of the blossoming period to keep them in a vigorous and actively-growing condition. A fertiliser mixture may advantageously be applied in two doses before and after flowering. The amount of manure to be applied will depend on the condition of the crop and on the fertility of the soil. It is important that plants should be irrigated during summer to minimise the extremes of the atmospheric temperature and defective humidity; and also to render the plant food in the soil readily available for vigorous crop growth. The lower shaded branches in the trees which often do not bear fruits may be pruned to reduce transpiration. S. R. S.

A soil moisture meter By W. S. Rogers—*(J. A. S. XXV—Part 3 July 1935 pp. 326—344.)* Based on the knowledge that the soil exerts a certain "capillary pull" caused by the surface energy of the film of water surrounding its particles, and that this pull varies with the moisture content of the soil, devices have been used by some workers, for auto-irrigation of plants under experiment, and by others for recording moisture content of soil. In the present paper is given a description of apparatus and the successful working of a soil-moisture meter, based on the above principle and with refinements carried out. The apparatus consists of a "porous pot filled with water, connected by a tube to a mercury manometer. The pot is buried in the soil, whose capillary pull causes the mercury to rise—the height to which the mercury rises depends on the amount of moisture in the soil and also on the size of soil particles and the degree of compactness of the soil."

The instrument has to be calibrated for the soil in which it is installed—and since it enables one afterwards, to read off the actual percentages on the meter, all sampling and weighing is eliminated and great rapidity of work is ensured. Figures obtained with the instrument in the laboratory and on the field, have shown the contrast between loss of water by evaporation and loss by root absorption and in irrigated orchards it has been possible to study the penetration of irrigation water and the drying out of the soil at various depths. M. R. B.

Studies on firmness and keeping quality of certain fruits :— i. Effects of Nitrogen Fertilisation by E. S. Degman and ii. Effects of Potash Fertilisation by J. H. Weinberger *(Bulletin No. 366, July 1934, Maryland Agri. Expt. Station.)* The

bulletin is an attempt to collect data on two popular beliefs (1) that nitrogen fertilisers are detrimental to, and (2) that potash fertilisers promote the keeping quality of fruits. After a review of previous literature, which was not of a systematic nature, the authors have given a detailed account of their experimental procedure and conclusions. The methods of attack included (1) sampling of fruits for analysis, keeping in view, the uniformity of size, colour, maturity etc. at *time* of picking (2) cold storage of samples, (3) pressure tests for firmness. (4) sampling of the thin slices of fruits, for chemical analysis, like estimation of carbo hyhrates, pentosans, etc. and (5) the maintenance of a record of observations on weather conditions during the period of analysis. The fruits examined were, apples, peaches and strawberries and the results showed that nitrogenous fertilisers, although they affect the chemical composition, by a greater percentage of nitrogen and carbo hydrates, this change of chemical composition, does not materially affect the keeping quality of the fruit. There is therefore no warrant for the belief that nitrogenous fertilisers spoil the fruits. On the other-hand, there is a greater harm done, by the misuse of the fertiliser. than because of the nitrogen in it, the keeping quality of fruits being very much dependant on the practices of the grower, like excessive pruning or excess application of nitrogen and so on.

As regards potash. it was again found that potash fertilisers, do not confer any *consistent* effects in improving keeping quality. But sulphate of potash, alone showed a definite improvement in improving the firmness and keeping quality of apples.

Incidentally it was found that seasonal factors at the time of picking and packing had more to do with the keeping quality. than the effects of fertilisers used.

M. R. B.

Choline—A new vitamin. (*Science Suppt. June 21, 1935, page 5.*) A new vitamin, which is essential for liver function and which may play an important role in controlling diabetes, has been discovered by Dr. C. H. Best of Toronto, a codiscoverer of Insulin. Having a real name, choline, instead of being designated by a mere letter like other members of the vitamin family, it is found in many foods, but the best sources are egg yolk and yeast.

Lack of this vitamin which was discovered in the course of Insulin investigations, causes the serious condition of fatty liver. The choline discovery has thrown new light on the diabetes problem, which is now considered to be a liver disorder rather than a disorder of the Insulin producing pancreas. Diabetes may be caused in three different ways, (1) the liver as the result of injury or disease may become too active and make too much dextrose sugar from the starches, sweets and proteins taken, (2) the liver may become overactive, due to lack of insulin, (3) the pituitary, thyroid and adrenal glands either alone or in combination may become overactive and affect the liver through their relation with the insulin-producing part of the pancreas.

As, according to Dr. Best "the pancreas is not always to blame in cases of diabetes", the discovery of choline as an essential vitamin for preserving the condition of the liver, is of far-reaching importance.

Gleanings.

Viruses and Heterogenesis. The definition and nature of life have been favourite subjects for ancient and modern discussion. Sir Henry Dale, armed with many recent exact data referred in the Huxley Memorial lecture on "Viruses and Heterogenesis", delivered at the Imperial College of Science on May 2, to the dilemma which confronts those who attempt to decide whether all the viruses

which cause disease are self-propagating micro-organisms or whether some of them do not originate from the tissues of the host. Admitting their minute size as perhaps the most important obstacle to accepting the smallest viruses as frankly living, he pointed out that there is an unbroken series from a virus of about the same size as the smallest bacteria with a diameter of 750 micron to the virus of poliomyelitis, which approaches the size of a protein molecule., (the diameter of a molecule of egg albumin has been calculated as 4 33 micron (1 micron one millionth of a millimetre). The long category of viruses has several characters in common, making it very difficult to draw an arbitrary line at a certain size as criterion for separating two classes of entirely different natures.

Sir Henry referred to Huxley's discussion of biogenesis and abiogenesis, and to the recurring claim for the origin of life from dead matter, including the 'spontaneous generation' of worms, maggots and bacteria, and the repeated victories of the advocates of biogenesis. He stated his personal opinion that the similar claim that viruses have their origin by heterogenesis in the tissues of the host would in the future be disproved, and that the doctrine that like breeds like would triumph in this field also. Sir Henry emphasised the fact that viruses are obligatory parasites and suggested that the minute filterable particles are only a stage in the life of the infective agent, which might be able to reconstitute larger and more complete forms inhabiting the cells of the host where they cannot now be recognised or their size determined. He propounded the view that our theoretical problem is not to determine the lowest limit of size compatible with the minimum required for a living reproductive cellular unit, but to determine what is the minimal protein of such a unit which might be adequate for its reconstruction under favourable conditions. (*Nature*, 1935, Vol. 135, 783).

Effects of drought on yield of coconuts. In the Tropical Agriculturist Vol. LXXXIII, pp 141—50, M. Park from the examination of yield records from a group of coconut estates in the Puttalam district, Ceylon, shows that a *severe drought* in 1931, affected the yield of nuts for a period of two years with a maximum effect about 13 months after the conclusion of the drought, at which time the yield had sunk to about 30% of the average for seven years. A sharp rise in yield during the drought is thought to be partly due to the physiological shedding of nuts approaching maturity. The size of the nut as indicated by the amount of copra per nut was decreased for one year only with a maximum effect about six months after the end of the drought. (*Tropical Agriculture* 1935 Vol. XII. p. 138.)

Photographing Heart beats. A method of photographing heart sounds with an apparatus, called the electro stethograph, has been devised by three Iowa scientists. A viewing screen is used on which the vibrations from the heart can be seen, at the same time the physician is listening to and photographing the heart sounds. The photograph provides a permanent record of heart action. (*Science supplement* June 21, 1935 page 6)

For Bee Stings. After scraping off stinger, smear spot with liquid honey; nothing can beat it to relieve pain and stop swelling. (Miles E. Miller, in *American Bee Journal*, July 1935 page 344).

Correspondence.

Vindictiveness in Bees.

Mr. A. Muhamad Ali, Farm Manager, Palur, writes: A few days ago while examining a bee-hive the roof of the hive was placed over one of the poultry cages nearby. A broody country hen that was inside, made a feast of a few honey bees that happened to drop into the cage. To prevent further loss of bees, the roof was removed instantaneously. Strangely enough, it was observed that a

few minutes later, the country hen was surrounded by a swarm of honey bees and stung very vehemently. As the bird was in the cage it became the victim of many stings. Nearly a dozen chicks that were with the hen were also stung badly. No sooner was this observed than the cage was opened and the birds allowed to escape. The severity of the stings was such that the whole face and the eyelids of the hen got swollen, while six chicks succumbed to the poisonous effects of the stings, a few hours later. The next day it was found that the remaining birds, though placed nearly 30 yards away from the hive, were chased by a swarm of bees and stung, while other birds were not touched. It was with great difficulty that the bees were turned away from their victim.

In this connection it may also be mentioned that these birds had been kept caged for over a fortnight very close to the same hive and no bee was found to get into the cage and sting the birds. It was only after the above mentioned incident happened that the bees began to chase and wreak their vengence both on the country hen and her brood.

As honey bees seem to be very vindictive by nature, the experience gained at the Palur Agricultural Research Station, may be borne in mind by all poultry farmers who adopt bee-keeping in addition, in the interest of both their bees and poultry stock.

Crop & Trade Reports.

Madras-Gingelly crop—1935-36 First Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1933-34 has represented 12 per cent of the total area under gingelly of India. The area under gingelly up to the 25th July 1935 is estimated at 307,900 acres. When compared with the area of 310,600 acres estimated for the corresponding period of last year, it reveals a decrease of 2,700 acres. i. e., about 0 9 per cent. The decrease in area occurs in East Godavari, South Arcot, North Arcot, Salem, Tanjore and Madura and is due to want of timely sowing rains. The yield is expected to be generally below normal except in the Circars (Ganjam and Vizagapatam excepted), the Deccan and Coimbatore owing to the insufficiency of summer showers. In parts of the Circars and in the Deccan the crop is still very young and its condition is satisfactory.

Madras—Sugarcane crop—1935-36—First Report. The average of the areas under sugarcane in the Madras Presidency during the five years ending 1933-34 has represented 3·7 per cent of the total area under sugarcane in India. The area under sugarcane up to the 25th July 1935, is estimated at 108,650 acres. When compared with the area of 104,080 acres estimated for the corresponding period of last year, it reveals an increase of 4·4 per cent. There has been an increase in area in the Circars (Guntur excepted), Cuddapah, Chingleput, South Arcot, Chittoor, North Arcot and the West Coast which has been partly counter-balanced by a decrease in area in Guntur, the Deccan (Cuddapah excepted), Salem, Trichinopoly, Madura and Ramnad. The increase in area in Kistna is attributed to the opening of a sugar factory at Vuyyur. The condition of the crop is generally satisfactory. The wholesale price of jaggery per imperial maund of 82-2/7 lb. as reported from important markets towards the close of July 1935 was Rs. 8—1—0 in Nandyal, Rs 6—9—0 in Bellary, Rs. 6—4—0 in Bezwada, Rs. 6 in Ellore, Rs. 5—15—0 in Guntur, Rs. 5—12—0 in Cuddapah, Rs. 5—10—0 in Cocanada, Rs. 5—9—0 in Rajahmundry, Rs. 5—4—0 in Vellore, Rs. 5—2—0 in Erode, Rs. 4—9—0 in Vizagapatam and Rs. 4—7—0 in Trichinopoly. When compared with the prices in the corresponding period of last year, these prices reveal a rise of 38 per cent in Bellary,

30 per cent in Ellore, 28 per cent in Nandyal, 23 per cent in Guntur, 16 per cent in Cuddapah and 6 per cent in Vellore and a fall of 15 per cent in Erode and 5 per cent in Trichinopoly.

Madras—Cotton crop—1935-36—First report. The average of the areas under cotton in the Madras Presidency during the five years ending 1933-34 has represented 9 per cent of the total area under cotton in India. The area under cotton up to the 25th July 1935 is estimated at 303,600 acres. When compared with the area of 198,400 acres estimated for the corresponding period of last year, it reveals an increase of 53 per cent. The area in the Central districts and the South represents generally the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts rose from 142,200 acres to 186,000 acres, i.e, by about 30·8 per cent. The increase is marked in Salem, Coimbatore and Madura. The yield is expected to be generally below normal. In Kurnool and Bellary, where the early crop is sown in June, the area rose from 31,000 acres to 85,800 acres owing to the favourable season. The area sown was the same as in the previous year. The slight fall in area in the districts of Kistna and Guntur is due to the monsoon being late. The wholesale price of cotton lint per imperial maund of 82-2/7 lb. as reported from important markets towards the close of July 1935 was about Rs. 19—10—0 for Cocanadas, Rs. 22—10—0 for red Northerns, Rs. 24—11—0 for white northerns, Rs. 20—6—0 for (early crop). Westerns, Rs. 29—15—0 for Cambodia, Rs. 28—12—0 for Coimbatore Karunganni, Rs. 28—6—0 for Tinnevelly Karunganni, Rs. 26—12—0 for Tinnevellies and Rs. 26—2—0 for Nadam.

Madras—Groundnut crop—1935—Second report. The area under the summer or irrigated crop of groundnut in parts of the Madras Presidency during the five months of January to May 1935 is estimated at 67,000 acres. When compared with the area of 77,400 acres estimated for the corresponding period of last year it reveals a decrease of 13·4 per cent. The crop has been harvested in most places. The yield is reported to be below normal in all the districts except Nellore, Trichinopoly and Madura where it is reported to be normal. The total yield is estimated at 57,000 tons of unshelled nuts as against 66,700 tons during the corresponding period of last year.

The area under the early crop of groundnut (mostly unirrigated) up to the 25th July 1935 in the districts of Salem and Coimbatore is estimated at 96,000 acres. When compared with the area of 127,000 acres estimated for the corresponding period of last year, it reveals a decrease of 24 per cent. The decrease is due to late and insufficient rains. The condition of the crop is generally satisfactory. The total yield is estimated at 44,100 tons of unshelled nuts as against 61,100 tons estimated for the corresponding period of last year. The wholesale price of groundnut (shelled) per imperial maund of 82-2/7 lb. as reported from important markets towards the close of July 1935 was Rs. 6—4—0 in Cuddalore. Rs. 5—10—0 in Vizagapatam, Rs. 5—8—0 in Vizianagram, Rs. 5—4—0 in Vellore, Rs. 5—2—0 in Guntur and Cuddapah, Rs. 5—1—0 in Salem, Rs 4-15-0 in Nandyal and Rs. 4—10—0 in Adoni. When compared with the prices of June 1935, these prices reveal a fall of 12 per cent in Vizagapatam, 11 per cent in Salem, 10 per cent in Vizianagram, 7 per cent in Vellore, and 1 per cent in Nandyal. The prices remained stationary in the other centres.

Madras—Ginger crop—1935—First report. The area under ginger up to the 25th August 1935 in Malabar is estimated at 10,600 acres as against 11,000 acres for the corresponding period of the previous year. The condition of the crop is fair. The wholesale price of dry ginger at Calicut rose from Rs. 17—10—0 per imperial maund of 82-2/7 lb. towards the close of December 1934 to Rs. 26—7—0 towards the close of August 1935.

Madras—Pepper crop—1935—First report. The area under pepper upto the 25th August 1935, in the districts of Malabar and South Kanara is estimated at 97,500 acres (89,000 acres in Malabar and, 8,500 acres in South Kanara) as against 94.400 acres (86,000 acres in Malabar and 8,400 acres in South Kanara) estimated for the corresponding period of last year. The condition of the crop is fair. The whole sale price of pepper per imperial maund of 82-2/7 lb. as reported from important markets towards the close of August 1935 was Rs. 18—4—0 in Calicut, Rs. 15—15—0 in Cochin and Rs. 14—15—0 in Tellicherry. When compared with the prices in December 1934, these prices have fallen by about 25 per cent in Calicut and Cochin and by 35 per cent in Tellicherry.

College News & Notes.

The Y. M. C. A. Cricket Tournament. The first match of this Tournament which our College played against the Coimbatore Cricket Club, ended, as was reported last month, in a very comfortable win for us, by the huge margin of 118 runs. Much interest was centred in this match, as the two were the strongest teams, and the result practically decided the winner of the Tournament. Our College has a very strong batting side this year right up to ten down and as the Coimbatore Cricket Club had the services of B. S. Krishnamoorthi a very good bowler, a keen encounter was expected. The College batted first and Krishnamoorthi accounted for C. N. Babu our steady opening bat quite early in the College innings, but that was all the Coimbatore Club were able to do materially. Thomas played a stubborn game and with Albuquerque carried the score to the nineties, when the latter left after a well hit 36. With the advent of Ramanatha Rao, our star batsman, matters took a lively turn for he now set about his work in a confident and aggressive style hooking with delightful freedom and runs came on at a very fast rate. He left after making 61 in about half an hour and included in his score were twelve crisp boundaries. Thomas left soon after, for a patient and invaluable 51 but Varadarajan and Rajagopalan, carried on merrily, till with the score at 236 for only 6 wickets we cried halt. Venturing out in turn, the Coimbatore Cricket Club were all out for 118 runs, Rajagopalan and Narasinga Rao doing the most damage.

The second match against the Government College on 24—8—35 ended, as expected, in a win for us, but there was some flutter, as with rain interfering and the Government College boys fighting tenaciously, the issue was in doubt till 10 minutes on time. Our team declared at 195 for 9, (Dinkar Rao 59) while the Government College were all disposed of for 89 runs towards which Venkatachalam contributed a very creditable 59. Rajagopalan for our team bagged 6 wickets for 43.

The third and last match against the Forest College was played on 2—9—35 and once again our team reached the two-century mark, declaring at 239 for 8. Our captain Ramanatha Rao again distinguished himself and played a masterly innings, and was unlucky to miss his century, being out when he had made 96 runs, included in which were 14 four.

Thus for the second year in succession our College has won the Y. M. C. A. Rondy Shield and we congratulate the team and the captain on this unique success. Mr. Ramanatha Rao is in very good form this year and as he is also a very good wicket keeper it is hoped that his claims will be considered and chances given to him for the next Presidency match at Madras.

Hockey. Two matches were played during the month against the Government College; the first ended in a draw of 2 all and the second in a win for us by 4 goals to nil (Ramachandran 2 and Rajagopalan 2).

Terminal Examinations. The examinations at the end of the first term, which were not being held, for the past two years were revived this year, during the second week of September, the College closing for the Michaelmas vacation on 14th September.

Farewells. Mr. K. M. Thomas, B. A., M. Sc., Assistant to the Government Mycologist who has been granted one year's study leave left for Colombo, *en-route* to England on 31st August. He proposes to join the Imperial College of Science, London and acquaint himself with the latest methods in plant pathology. Mr. R. Kochukrishna Pillai, B. A., Assistant to the Government Agricultural Chemist. who has been granted two year's leave left for Bombay on 16th September. He is also proceeding to England where he will stay at the London University. Mr. S. Ramanujam, B. A. (Hons.), Assistant to the Paddy Specialist, also on two year's leave who is proceeding to London to work under Prof. Gates, left on 14th. These officers were the recipients of several 'teas' from friends and well wishers and their respective sections, before their departure.

University Elections. The election to the Acadamic Council from among the staff of the College resulted in a tie between Messrs. H. Shiva Rao and K. Rajagopalachariar each candidate securing 8 votes; and by a toss of the coin, Mr. K. Raghavachariar, has since, been declared elected by the University.

Rao Bahadur M. R. Ramaswami Sivan has been returned to the Senate of the Annamalai University to one of the 12 seats from the Registered Graduates' constituency. We understand he is seeking election to the Syndicate of that University as well.

Visitors. Mr. H. C. Javaryya, Senior Marketing Officer and Mr. Khan, Assistant Marketing Officer, Imperial Council of Agricultural Research visited the estate and stayed at the rest house on 6th and 7th September. Mr. Samuel Bhakhta another Senior Marketing Officer, also visited the estate on 14th.

Weather Review (AUGUST 1935).

The monsoon weakened in the Peninsula in the first week of the month. Conditions in the North west angle of the Bay of Bengal became unsettled on the 4th and a depression formed there and moving inland on the 6th, weakened after causing a strong monsoon in the central parts of the country. After the middle of the month the pressure distribution over the Peninsula became irregular and resembled that of the transition period, and fairly widespread thunderstorm rain occurred in the interior of the Peninsula.

Temperatures remained normal during the first half of the month. Thereafter the maximum was below normal in Madras, Deccan, and normal elsewhere.

Rainfall was in large defect in the West coast and in the Circars while it was above normal in the rest of the Peninsula. Nandyal and Cuddapah recorded 8·6″ and 5·1″ above normal.

Chief falls reported were:

Nandyal ..	...	...	4·1″
Tittagudi (Cuddalore)		...	5·9″ on the 18th.
Kodaikanal	...	...	4·7″ on the 21st.
Trichinopoly	...	...	3·2″ on the 22nd.
Ananthapur	...	...	3·1″ on the 25th.
Bangalore.	...	...	3·1″ on the 31st.

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	3·8	−5·0	26·6	South	Negapatam	2·5	+1·9	17·1
	Berhampore *					Aduthurai *	4·2	+1·5	12 8
	Calingapatam	2·2	−6·7	17·7		Madura	6·3	+2·0	12·7
	Vizagapatam	1·3	−4·1	7·7		Pamban	0·1	−0·7	10·6
	Anakapalli *	5·0	−0·4	11·2		Koilpatti *	1·5	−0·3	6·8
	Samalkota*	5 7	+1·1	17 7		Palamkottah	2·2	+1·5	10·5
	Maruteru *	5·8	−0 4	11 2					
	Cocanada	2·8	−2·8	12·4	West				
	Masulipatam	1·7	−5·3	13·8	Coast	Trivandrum	7·8	+3·7	31·3
	Guntur *	5·1	+0·2	17·8		Cochin	8·8	−4·1	53·1
						Calicut	11·4	−4·2	80·1
Ceded Dists.	Kurnool	3·5	−1·3	16·3		Pattambi *	9·2	−7·4	51·0
	Nandyal *	13 1	+8·6	24·3		Taliparamba *	15·0	−16·2	101·8
	Hagari *	3·6	+1·5	14·6		Kasargode *	17·7	−6·8	117·8
	Bellary	2·6	+0·2	10 1		Nileshwar *	14 3	−12·0	99·3
	Anantapur	0·5	...	16·2		Mangalore	18·7	−3·8	94·1
	Cuddapah	10·8	+5·1	24·7					
					Mysore				
Carnatic	Nellore	3·8	+0·5	11·3	and	Chitaldrug	10·2	+7·2	21·7
	Madras	9 1	+4·4	13·1	Coorg	Bangalore	13·6	+8·1	27·1
	Palur *	9 0	+0·3	13·8		Mysore	5·7	+2·3	21·8
	Palakuppam *	5 6	+0·4	10 2		Mercara	25·1	−0·3	95·8
	Cuddalore	3·8	−1·2	10·5					
					Hills.				
Central	Vellore	12·0	+5·7	18·4		Kodaikanal	12·0	+5·0	38·8
	Hosur cattle farm *					Coonoor	4·9	...	26·3
						Ootacamund *	5·7	−1·5	21·4
	Salem	9·2	+2·3	20·7		Nanjanad *	4·5	−2·5	28·2
	Coimbatore	1·1	0·0	5·5					
	Coimbatore Res. Inst. *	1·4	+0·4	6·5					
	Trichinopoly	9 3	+5·4	21·0					

* Meteorological Stations of the Madras Agricultural Department.

Weather Report for the Research Institute Observatory.

Report No. 8/35.

Absolute Maximum in shade	...	92·2°F.
Absolute Minimum in shade	...	67·5°F.
Mean maximum in shade	...	89·1°F.
Departure from normal	...	+1·2°F.
Mean minimum in shade	...	71·2°F.
Departure from normal	...	−0·5°F.
Total rainfall	...	1·38″
Departure from normal	...	+0·39″
Heaviest fall in 24 hours	...	0·44″
Total number of rainy days	...	4
Mean daily wind velocity	...	4·2 m. p. h.
Mean humidity at 8 hours	...	75·0%
Departure from normal		+1·7%
Total hours of bright sunshine	...	158·3
Mean daily hours of bright sunshine		5·1

General Summary. Rainfall was slightly in excess of normal. Dry weather prevailed up to the middle of the month. Monsoon was active in the latter half.

A. S. R. & A. S.

Departmental Notifications.

Appointments and Reversion. Mr. E. J. Verghese, Offg. Assistant, Chemistry section, to officiate as Assistant Lecturer in Chemistry, Agricultural College, vice Mr. M. Rajagopala Iyer on leave. Mr. Abdul Samad, Temporary Assistant in Soil Physics, Dry Farming Scheme, to Dry Farming Station, Hagari. Mr. U. Vittal Rao, Officiating Assistant Director of Agriculture, Guntur on relief by Mr. A. Gopalakrishnayya Nayudu to revert as Agricultural Demonstrator, ii circle. Mr. A. Ramaswami Iyer, Offg. Assistant Director of Agriculture, Kurnool, on relief by Mr. S. Narayaniah, to revert as Agricultural Demonstrator, iv Circle and is posted as Warehouse Officer for groundnut. Mr. V. Panduranga Rao, Assistant, Millets section, Coimbatore, is appointed as temporary Assistant for Plant Physiology in the Dry Farming Scheme, Hagari, financed by the Imperial Council of Agricultural Research. Mr. R. Subrahmania Iyer, Agricultural Instructor, Borstal School, Palamcottah, is reverted as Lower Subordinate in this department with effect from 20th August 1935. Mr. C. Balasubramania Mudaliar, A. R. S. Koilpatti, to be Assistant in Chemistry, Coimbatore.

Transfers. Mr. K. Bhushanam, Assistant in Chemistry, Samalkotah, is re-transferred to Coimbatore with effect from 1st September 1935.

Leave. Leave out of India on half average pay for 24 months from 1st September 1935, granted to Mr. N. Parthasarathy, Assistant, Paddy Section, Coimbatore, is cancelled. Mr. D. Marudarajan, Assistant in Mycology, extension of l. a. p. for two months from the 2nd September 1935. Mr. G. Sitarama Sastri, A. D. Vinukonda, further extension of leave on half average pay on medical certificate for 2 months and 27 days with effect from 5th July 1935. Mr. M. Eggiaswami Iyer, A. D. on leave from 24th August 1935, extension of leave by four months on Medical Certificate.

ANNOUNCEMENT

The Diamond Jubilee of Agricultural Education in S. India

AND

The Silver Jubilee of the M. A. S. Union

WILL BE CELEBRATED IN JULY 1936

Your co-operation is solicited.