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EDITORIAL

Employ the Agricultural Graduate. Agriculture as a pursuit for the betterment of human happiness has developed remarkably from the days when primitive man learnt to scatter around his jungle abode the seeds of his favourite food plant and waited for the time when he could gather and store the produce against a rainy day. The history of the development of Agriculture from the primitive methods to the most modern scientific practices is a tale of romance, adventure and research through which man has unravelled several fundamental secrets of nature and gradually harnessed them to his advantage. Today human achievements in the field of scientific agriculture provide the world with food, drink, shelter, clothing, drugs, spices, dyes, narcotics, fertilizers, vitamins and a host of other materials necessary for sustaining life and making that life worth living. Embracing as it does something of every aspect of human knowledge, scientific agriculture is to-day a compendium of specialised knowledge in several sciences which contribute to human welfare. Consequently the importance of agricultural education in countries which are predominantly agricultural can never be over-estimated. Even in countries which are highly industrialised, the importance of agriculture and agricultural industries becomes acutely felt during a period of crisis. The current slogan "ploughing for victory" in countries like Great Britain is an instance in point. It is for this reason that civilized countries all the world over, establish agricultural colleges and impart agricultural education to its young men (and women). The establishment of an agricultural college involves a great outlay in money. Besides the usual buildings, grounds and equipment necessary for ordinary educational institutions, an agricultural college requires the maintenance of an extensive farm representing different types of soils, with its concomitant adjuncts like crop-breeding stations, cattle yards, dairy, veterinary hospital, engineering workshops, meteriological stations, botanical gardens, green houses, insectary, pumping plants, silos and sewage disposal plants, in addition to expensively equipped laboratories for the study of pure sciences. Agricultural education is consequently immensely more expensive than other professional studies and for this reason agricultural colleges in India as elsewhere, are maintained by the state as a national investment which is calculated to repay the outlay several-fold in the shape of national prosperity. Time there

was, when the products of agricultural colleges in India were all absorbed as rapidly as they were produced, for service in the growing agricultural departments. Other departments of Government and the big land-lords were then deprived of their services. Conditions have changed since. The Agricultural graduate with his diversified knowledge of rural conditions and his unique training for catering to the needs of the people, still remains a potential asset to the revenue, Educational and co-operative departments and better fitted for his job than his comrades emerging from other educational institutions. For the simple reason that his services were in greater need in one particular department in the earlier days of agricultural education, the door to other departments is slammed against him. To us it appears to be a travesty of economy that the heavy investment which the state made in producing a national asset to the country is let drift into a national loss. So much for the state. There is another class of employers to whom a unique opportunity offers itself today for the employment of the agricultural graduate. The European planting community in South India which is ever alive to the importance of scientific agriculture, the Zamindars and the big land lords in the country are perhaps unaware of the availability of these fully trained men for employment. The few men who took up service under these agencies have won laurels in their own line. We trust that these employers especially the planting community will avail themselves of the opportunity at a time when their ranks are sadly depleted by the demands of the state for war service.

A Quantitative Method of Determining Pith-Formation in Sugarcane.

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Introduction. All sugarcane growers are aware of the occurrence of pith in some sugarcane varieties. The pith usually commences from the central region of the sugarcane. Histologically, pith-formation proceeds by the loss of cell-sap and drying up of the innermost tissue of the central cylinder, and the magnitude of pith formed varies from a central streak or fistular strand to the entire region becoming dry and corky. The natural causes of pith-formation are believed to be either varietal or due to deterioration-phases commonly attendant on over-maturity. In any case, it is of primary importance to the sugarcane grower to know when pith-formation forms in a particular variety, and how far it develops with time, to enable the choice of the right variety and to fix upon the most beneficial time of harvest. Moreover, pith-formation is an economic loss to the grower, as it saps the juice and reduces cane-weight resulting in the loss of cane tonnage. A study of the commencement and relative progress of pith formation in different varieties of sugarcane is of great value in preventing loss of cane out-turn, a factor of vital interest to the grower. So far the only method of estimating pith-formation consisted in cutting open the cane, and examining the longitudinal and transverse sections for pith formed. Such qualitative observations, although affording a clue, could never be so precise or exact as quantitative determinations. The enunciation of a suitable quantitative technique engaged the serious attention of the senior author of this paper, and the method of density determinations described hereunder, proved to be a reliable means of estimating the relative degrees of pith formation in canes. As a natural consequence of pith formation the cane becomes light, and the volume remaining the same, the density is consequently lowered.

Methods and details of density study in sugarcane. Density was determined by the cutting and removal of a certain fixed internode of a cane, weighing it in a sensitive balance, and finding its volume by displacement in a graduated jar, and arriving at the weight per unit volume. The internodes were always cut at two distinct marks. The leaf insertion region formed one end of the internode, and the growth ring marked the other. The position of the cane at which the internode is cut is a point of importance. Generally pith formation is found to be more at the top half of canes than at the bottom. In the present study, the internodes were cut

at one-fourth the length of the cane from the top, one-fourth the length of the cane from the bottom and the respective densities determined. The actual pith-formation in the internode as observed when cut open was also recorded in all cases in order to see how far the quantitative density-determinations, supported the visual observations.

As generally pith is associated with canes left to stand on the field after maturity, the density studies were confined to the late varieties and the results are embodied in Table I. The recorded observations on each variety on both 'arrowed' and 'unarrowed' canes were made on the same date. The readings given in the table are the average of two canes.

The figures in Table I disclose that the density of the top internode of Co. 349 'arrowed' which was full of pith, was the least. The density was also equally low in tops of Co. 331 and Co. 417 'arrowed' which were fully pithy. The bottom internodes of all varieties except Co. 408, and tops of 'unarrowed' canes, which contained little or no pith, always showed high densities above unity. Co. 408 'unarrowed' bottom which had a low density of 0·886 contained large amount of pith. A positive correlation between the density of a cane and its pith formation appeared therefore to clearly exist. However for further and fuller confirmation of this indication densities of numerous samples in each variety were recorded, and the extent of the deviations from their means, and the significance of the differences between means worked out. The results are embodied in Table II.

Differences between means of columns 2 and 4 (Table II) were not significant, and the pith formation as observed was also very little in both. Differences between means of columns 1 and 3 were highly significant and the pith formation as observed was also much greater in 1 than in 3. Differences between means of columns 3 and 5 were not significant and the pith formation was more or less the same in both. Again the differences between means of columns 5 and 7 were not significant and the pith formation in both was very little.

The standard deviations or the dispersion of the population from the mean, and the coefficient of variations were small showing that the densities at a particular part of the cane are more or less uniform.

It is therefore established that the density determination is a reliable measure of pith-formation in canes, and consequently to compare the relative pith-formation between varieties it would be quite enough to find the densities of internodes at some fixed part of the cane. But the part of the cane selected must be so judiciously chosen as to give a correct index of its pithiness. Table III gives figures of the density of every internode from top to bottom of Co. 331 'arrowed' and 'unarrowed' cane respectively.

A scrutiny of figures in Table III shows that pith-formation is most in top-half of the cane and least at the bottom-half. It will be undoubtedly ideal to find the density of the whole cane in all cases but such a procedure

TABLE I.

Densities and pith formation of some late varieties.

Date of planting 26—2—39. Date of observation 25, 26—4—40

Serial No.	Variety.	Arrowed canes.				Unarrowd canes.			
		Top internode.		Bottom internode.		Top internode.		Bottom internode.	
		Density.	Pith as observed.	Density.	Pith as observed.	Density.	Pith as observed.	Density.	Pith as observed.
1	Co. 419	0·918	⅓ to ½ diameter pithy	1·066	No pith	1·067	Very slight	1·070	No pith
2	Co. 417	0·881	Very much pithy	1·049	Very slight	1·042	Small core forming	1·066	Very slight
3	Co. 416	...	Not arrowed	...	Not arrowed.	1·028	No pith	1·059	No pith
4	Co. 413	0·948	⅓ to ½ diameter pithy	1·057	No pith	1·069	Very little pith	1·072	Do.
5	Co. 411	0·989	½ diameter „	1·081	Little pith	1·071	Slight	1·056	Small central core
6	Co. 408	0·943	More than ½ diameter pithy	1·065	½ diameter pithy	1·063	Small central core	0·886	¼ to ½ diameter pithy
7	Co. 349	0·852	Full of pith	0·939	⅓ „ „	1·072	Small core of pith	1·082	Small core of pith
8	Co. 331	0·858	Very much pithy	1·027	Small core of pith	1·049	Do.	1·050	Do.
9	J. 247	...	Not arrowed.	...	Not arrowed	1·010	Central core of pith	0·977	⅓ diameter pithy

will entail enormous time and labour. Hence some position, say $\frac{1}{4}$th or $\frac{1}{2}$ the length of the cane from the top can be taken for determining density.

Summary and conclusion. (i) Density determination is found to be a reliable measure of pith formation in canes, and the full technique is described in detail with illustrative figures.

(ii) The internode, say at one-fourth or one-half of the length of the cane from the top can be cut, always at some fixed marks, viz. the leaf-insertion region, and the growth ring, and the density determined.

(iii) It is always best to record the pith-formation as actually observed by splitting open the cane against its density. The one gives a visual indication, while the other is an exact measure of pith-formation.

TABLE II

Densities of certain varieties, their means, and standard deviations.

Serial No.	Co 331 arrowed		Co 331 unarrowed		Co 417 unarrowed		Co 419 unarrowed	
	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
	1	2	3	4	5	6	7	8
1	0·902	1·035	0·863	1·021	1·031	1·058	1·055	1·065
2	0·881	1·023	0·884	1·009	1·021	1·030	1·038	1·027
3	0·879	1·017	1·008	0·987	1·035	1·010	1·077	1·068
4	0·876	1·038	0·995	1·050	1·017	1·043	1·055	1 049
5	0·861	1·016	1·044	1·013	1·046	1·043	1·062	1·069
6	0·887	1·014	1·049	1·023	1·036	1·038	1·048	1·051
7	0·880	1·054	1·051	1·038	1·043	1·036	1·071	1·062
8	0·866	1·050	1·052	0·999	1·025	1·061	1·066	1·039
9	0·823	1·028	0·989	1·026	1·002	1·040	1·056	1 037
10	0·889	1·037	0 962	1·062	1·030	1·058	1·075	1·073
11	0·818	1·026	0·888	1·035	1·039	1·045	1 045	1·012
12	0·878	1·052	1·001	0·999	1·027	1·025	1·066	1 058
13	0·842	1·033	1·048	1·052	0·982	1·056	1·075	1 030
14	0·828	1·007	1·016	1·044	1·043	1 042	1·030	1·009
15	—	—	1·023	0·989	1·013	1·044	1·061	1·042
M. N.	0·865	1·031	0 992	1·023	1·026	1·042	1·059	1·046
S. D.	0·0257	0·0142	0·0544	0·0282	0·0166	0·0058	0·0127	0·0229
C. V.	2·971	1·377	5·484	2 757	1·616	0 559	1·199	2·190
Pith formation	two-thirds to whole core thickness.	Very small central core of pith.	Varying from a small central core to $\frac{3}{4}$ diameter	Small central core.	Very small central core to $\frac{1}{4}$th diameter.	Very small central core.	Very small central core.	Very small central core.

TABLE III

Density of every internode of Co. 331 (one entire cane from the top to bottom).

Date of planting 22—2—39 Date of observation 18—5—40

Co. 331 arrowed			Co. 331 unarrowed		
Internode No.	Density	Pith as observed	Internode No.	Density	Pith as observed
1	0·688	Completely pithy	1	0·981	$\frac{1}{8}$ diameter pith
2	0·769	Full of pith	2	0·981	$\frac{2}{8}$ " "
3	0·810	Nearly full of pith	3	0·950	do.
4	0·825	More than $\frac{3}{4}$ diameter pithy	4	0·966	$\frac{5}{4}$ diameter pith
5	0·902	$\frac{2}{3}$ diameter pithy	5	0·940	Nearly $\frac{1}{2}$ diameter pith
6	0·935	$\frac{1}{2}$ " "	6	0·886	$\frac{3}{4}$ diameter pith
7	0·961	do.	7	0·884	do.
8	0·959	do.	8	0·846	Nearly $\frac{3}{4}$ diameter pith
9	1·018	Small central core	9	0·890	Slightly more than $\frac{2}{3}$ diameter
10	1·034	do.	10	0·968	$\frac{2}{3}$ diameter pith
11	1·035	do.	11	0·966	$\frac{1}{3}$ " "
12	1·027	do.	12	0·970	do.
13	1·026	do.	13	1·028	$\frac{1}{6}$ " "
14	1·047	do.	14	1·024	Small central core
15	1·041	do.	15	1·009	$\frac{1}{4}$ diameter pithy
16			16	1·008	Small central core
17			17	1·020	do.
18			18	1·014	do.
19			19	1·026	do.
20			20	1·053	Very small central core

Rotation and Mixed Crops with Sorghum.

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Introduction. Sorghum is the chief cereal crop grown under rain-fed conditions in the Madras Presidency. It is grown on an area of more than $4\frac{1}{2}$ million acres. It is usually grown in rotation with the commercial crops—cotton, groundnut (*Arachis hypogea*, L.), tobacco or chillies (*Capsicum* spp.). A pulse crop like red gram (*Cajanus cajan*, (L) Millsp.) or Bengal gram (*Cicer arietinum*, L.) is grown in rotation with it in some parts of the presidency. These as well as other pulses are often grown mixed with sorghum, thereby saving land, labour and cultivation expenses, and obtaining a variety of produce. The crops grown mixed with sorghum and in rotation with it depend upon the nature of the soil and season, and the local conditions and demand. Irrigated sorghum is usually grown as a pure crop.

Information on rotation and crops mixed with sorghum was obtained from different parts of the presidency, and the data gathered is summarised in this paper. Considering the soil and seasonal conditions and agricultural practices the presidency can be roughly divided into eight regions, the agricultural practices in each of which being more or less similar for the region. In the districts of Chingleput, Tanjore, Malabar, S. Canara and Nilgiris the area of sorghum is negligible, and hence the practices in these districts are not recorded here.

Agricultural practices. In the three northern districts of Vizagapatam and East and West Godavari sorghum is a minor crop, except on the uplands bordering the Eastern ghats. The total area of sorghum in the three districts is about 240,000 acres. There are two seasons in which sorghum is grown: *punasa* (June to September) and *pyru* (September to January). In the *punasa* season, *Konda Jonna* or *Tella Jonna* (*Talaivirichan cholam* type) and in the *pyru* season *Patcha Jonna* (yellow grain) is grown. The *Patcha Jonna* is also grown in the high level lands bordering the Godavari river and its deltaic branches, subject to flooding during the South West Monsoon. These lands are known as *lankas* and are very fertile. In these the chief crop is tobacco, sorghum being grown only occasionally. In parts of the Vizagapatam district sorghum seedlings are transplanted in rain-fed lands. The seedlings are dropped in plough furrows, the succeeding furrow covering up the previous one and thus planting up the seedlings dropped.

No regular rotation is practised near the hills. Sorghum and other millets mixed with pulses, oil seeds and sometimes rice also, are grown according to the time and nature of rains. Lands under cultivation for two or three years are often left fallow for five or six years before they are cultivated again. This is common in the Agency tracts. In places where cultivation is more advanced, short duration millets like *tenai* (*Setaria italica*, Beauv.), *samai* (*Panicum miliare*, Lamk) or *cumbu* (*Pennisetum typhoides*, Stapf and Hubbard) mixed with gingelly (*Sesamum orientale*, L) and pulses or groundnut are grown in the *punasa* season and *Patcha Jonna* in the *pyru* season.

In the areas lower down, especially in the *lankas* of the East Godavari district, tobacco and chillies are grown in rotation with sorghum. In some places cotton or *ragi* (*Eleusine coracana*, Gaertn.) is rotated with sorghum in black soil areas. In this area sorghum is usually grown as a mixed crop. The crops usually mixed with it are pulses—red gram, lablab, (*Dolichos lablab*, L), cowpea (*Vigna unguiculata*, (L.) Walp), green gram (*Phaseolus aureus*, Roxb.), black gram (*Phaseolus mungo*, L), horsegram (*Dolichos biflorus*, L), and *tegapesara* (*Phaseolus* Sp.), oil seeds—gingelly, and fibres—sunnhemp (*Crotalaria juncea*, L) and *gogu* (*Hibiscus cannabinus*, L.); shorter duration cereals—rice, *tenai*, *samai* and *varagu* (*Paspalum scrobiculatum*, L) are also mixed with *Konda jonna*. Sorghum is grown as a pure crop also, but in very limited areas.

In the Kistna and Guntur districts the area of sorghum is about 635,000 acres. In this region it is grown mostly for fodder in the *punasa* season and for grain in the *pyru* season. The common variety is *Patcha jonna* (yellow grain), of different types of varying duration. *Konda jonna* (*Talaivirichan cholam* type) is rare. Sorghum figures in the same land only once in 3 or 4 years. The other crops grown in rotation with it are tobacco, chillies, cotton, groundnut and *cumbu*. Two crops are usually grown in the same year, both being short in duration. Sorghum or *cumbu* mixed with pulses and oilseeds are the chief crops in the *punasa* season and tobacco, chillies, variga (*Panicum miliaceum*, L.), *pyru jonna* (sorghum), coriander (*Coriandrum sativum*, L.) and horse gram in the *pyru* season. Cotton and red gram are sown in the *punasa* season mixed with short duration cereals (*cumbu* or *tenai*) which are harvested in about three months leaving the cotton or red gram in the field for the *pyru* season crop. Various crops are grown mixed with sorghum. Some of them are *pillipesara* (*Phaseolus trilobus*, Ait.), *tegapesara* and *kollanganjeru* (*Ipomea hispida*, R. & S.) to improve fodder, red gram, green gram, cowpea, sunhemp, gogu, gingelly, and also a variety of cucumber—*Nakadosakaya* (*Cucumis Melo* L. var. *utilissima*). Only some of these and they too only in small quantities (about $\frac{1}{8}$ or $\frac{1}{16}$) of each are mixed with sorghum, which doubtless occupies more than three fourths of the land. Sorghum is sometimes grown as a mixture with *tenai* or *cumbu* in the *punasa* season and with *variga* in the *pyru* season in parts of the Guntur district. In these mixtures sorghum occupies a fourth or less of the area. Sorghum is sometimes grown in field borders for fodder purposes. In some black soil areas in the Guntur district sorghum is often grown as a pure crop.

In the four districts of Kurnool, Cuddapah, Bellary and Anantapur (the ceded districts, as they are commonly called), about 1,779,000 acres of sorghum are grown annually. In this region sorghum is the crop of major importance. It is the chief food and fodder crop of the area. It is usually grown in rotation with cotton—pure or mixed with *tenai*, or groundnut, the choice of the rotation crop depending upon rainfall and market conditions. Thus sorghum is grown in the same land in alternate years in most of the area, and in some places once in three years. In parts of the Bellary district where *Mungari jonna* (early season sorghum) is grown, no regular rotation is practised.

In the Kurnool and Cuddapah districts the common variety is *Patcha jonna* (yellow grain) and in the Bellary and Anantapur districts, it is *Tella jonna* (white grain). In portions of the Kurnool district sorghum is grown as a pure crop, while in the rest of the district and in the other districts sorghum is grown mixed with various pulses such as red gram, cowpea, green gram, lablab and Bengal gram, oilseeds such as gingelly, safflower (*Carthamus tinctorius*, L.) and castor (*Ricinus communis*, L.), and also sometimes with *tenai*, *cumbu*, indigo and sunnhemp. In all cases sorghum is usually the major crop. Sorghum is occasionally found as a

mixture in *tenai* or *cumbu* in the *punasa* season, or *variga* in the *pyru* season, in parts of the Kurnool district. In these mixtures sorghum forms a very small portion and is used either as fodder or for inducing the production of big earheads for good seed. Sorghum is sometimes grown mixed with cotton also, either of them dominating in area.

In the Nellore district (sorghum, about 428,000 acres) the practices differ from the neighbouring districts. No regular rotation is adopted in the major portion of the district. Groundnut, horsegram or *pillipesara* are sometimes grown in rotation with sorghum. Most of the pulses—green gram, black gram, red gram, *pillipesara* and horse gram are grown mixed with sorghum. In the *pyru* season sorghum and *variga* are grown mixed, wherein the latter is the main crop and sorghum is a minor mixture, about one-eighth.

In the three central districts of Chittoor, North Arcot and South Arcot, the area under sorghum is only about 190,000 acres. Most of the sorghum grown is for fodder only, expecially in South Arcot and in portions of Chittoor and North Arcot. There is no regular rotation. The area of sorghum depends upon the rainfall and the demand for fodder. It is rarely grown mixed. When mixed, the other crop groundnut, red gram, *cumbu* or *ragi* is the major one, sorghum being a minor mixture in it.

In the Salem and Trichinopoly districts, area about 470,000 acres, sorghum is a minor crop, occupying less than one-sixth of the net area cropped annually. No regular rotation is followed. The major crop of the area is either *cumbu* or *ragi*. Often sorghum is a mixture in these crops, occupying only a minor place. The other important crops grown in rotation with these cereals in some parts of these districts are groundnut and cotton. When sorghum is grown as a major crop, pulses such as lablab, cowpea, red gram, green gram and dew gram (*Phaseolus aconitifolius*, Jacq.) and castor or gingelly are grown mixed with it. *Irungu cholam* is grown for fodder and *Sen cholam* (red grain) or *Vellai cholam* (white grain) for grain.

In the Coimbatore district sorghum is the major cereal crop in rainfed lands. It is grown in area of about 467,000 acres. In parts of the district where only one crop could be grown annually, cotton and sorghum usually alternate. In the South-eastern parts of the district, where sometimes favourable rains are received in the summer season, a short duration sorghum is followed by a short duration pulse, such as Bengal gram or horse gram, in the same year. In these parts groundnut is an important crop in dry lands in the early season (April to August); and this is followed by sorghum mostly for fodder, in the second season (September to January). Thus sorghum is grown in two seasons in this area. The crops grown mixed with it are one or more of the pulses—red gram, green gram, cowpea, lablab and dew gram, and in parts of the district castor and gingelly also. These mixtures occupy only a minor area. The long duration crops

in the mixture—red gram, lablab and castor continue in the field after the harvest of the rest. When lablab is one of the mixtures, odd stalks of sorghum with lablab twining on them are left when sorghum is cut, as lablab matures later. What is thus lost in straw is more than gained by the produce of the pulse twining on it.

In the Madura, Ramnad and Tinnevelly districts, sorghum is grown mainly for fodder purposes, the area under the crop being about 402,000 acres. The variety grown for fodder under rain-fed conditions is *Irungu cholam*. In this variety the grains are small and almost completely enclosed within the glumes. It is grown in rotation with cotton and *cumbu*, and in some places with groundnut or *varagu*. Some of the following pulses—red gram, green gram, lablab, cowpea and dew gram, and groundnut, castor or gingelly are grown as mixtures with sorghum.

From the above it will be seen that sorghum is not often grown as a pure crop; it is usually mixed with a wide variety of crops. Most of the pulses and sometimes oil seeds and fibre crops are grown mixed with it. It is sometimes grown mixed with other cereals and rarely with indigo.

Objects and advantages of mixtures. Many are the objects and advantages reported for mixing the various crops with sorghum. These are summarised below. The average holding of a ryot is small. He is not in a position to grow different crops separately. To overcome this difficulty he resorts to mixed cropping. By growing a mixed crop of cereals, pulses and oil seeds, the most common mixture, he is able to obtain most of his food products from the limited land he owns. There is a saving not only in land but in labour also, as in most cases the seeds of different crops are mixed together and sown. By this, sowing and cultivation expenses are minimised. In some places a long and a short duration crop are mixed, such as sorghum and *tenai*, or red gram and sorghum, to get the maximum outturn from the land The short duration crop is harvested first, and the other continues in the field and yields almost as much as a normal pure crop in favourable seasons. When the season is unfavourable, the short duration crop at least yields some produce, thus preventing total loss of outturn from the land due to vicissitudes of weather. Also when crops of different durations are mixed the limited labour of the poor cultivator is utilised to the best advantage as different crops come to harvest at different times.

Pulses of three kinds are usually mixed with sorghum. Pulses such as Bengal gram and red gram are mixed for grain. Those, such as cowpea and lablab are mixed with the object of obtaining grain as well as improving the quality of fodder, while others like dew gram, *pillipesara* and *tegapesara* are mixed mainly for improving the quality of fodder. A mixed crop of pulses and cereals is believed to be a good combination to maintain soil fertility, especially when the same crops have to be grown year after year without any proper rotation for want of sufficient land. By this system it is considered possible to maintain the supply of combined Nitrogen in a

way that would not be possible on small holdings if crops are not mixed. It has been reported that cereals grown in association with pulses get enriched in protein content. This is a fruitful line of investigation, especially under Indian conditions, where the toning up of quality of food crops has to be achieved without much extra labour or cost. It is also reported that the mixtures of pulses which are generally small in proportion do not normally reduce the yield of sorghum. Usually about as much yield as from a pure crop of sorghum is obtained from a mixed crop also in favourable years, the produce from the pulse crop thus forming an extra income. It is not economic to grow some of the crops like green gram and cucumber as pure crops; they are therefore always grown as mixtures. Damages due to insects are reported to be minimised by mixed cropping. Sunnhemp when grown mixed with sorghum is reported to be less damaged by insects than when grown as a pure crop.

In some places sorghum is a minor mixture in other cereals such as *tenai, cumbu* or *variga*. It is reported that stray plants of sorghum in the field act as a check on cattle being allowed to trespass and graze on the young crop, as sorghum plants in the young stage are poisonous to cattle. Such plants are usually cut for fodder before they mature. Small mixtures of sorghum in long duration crops such as *varagu* or cotton are utilised to obtain good seed, as plants in such crops will be vigorous and produce big, well-filled earheads with bold grains.

Results of experiments. By mixing two crops which feed at different depths in the soil both can thrive well without interfering with each other. Root studies at the Dry Farming Research Station, Bellary, have shown 'Setaria-groundnut' and 'Setaria-horsegram' mixtures are ecologically sound combinations. Spreading pulses such as *pillepesara, tegapesara*, dew gram and groundnut reduce soil erosion. Experiments on soil erosion studies at the Dry Farming Station, Bellary have shown that *pillipesara*, groundnut (spreading type), horsegram and mixture of groundnut and horsegram with *tenai* are comparatively more efficient in preventing soil erosion.

In the trials of 'sorghum-pulse' mixtures conducted at the Cotton Breeding Station, Coimbatore, the following conclusions have been recorded:—"On all the three soils (irrigated red, rain-fed red and rain-fed black) the mixing of pulse both with irrigated and rain-fed types of *cholam* does not benefit either the *cholam* or the succeeding cotton. Such a step is found on the other hand to lower the straw weights. It is interesting to note, however, that the after effects of growing leguminous crops on cotton are not alike. Cluster beans have been found most beneficial in the case of irrigated *cholam*, while lablab and cowpea seem to do good to rain-fed *cholam*. Soy beans, green gram and cowpea do more harm than good when they precede cambodia cotton in summer. *Pillipesara* likewise depresses the yield of *Karunganni* cotton that follows it. The above observations bring into doubt the present practice of mixing cowpea with irrigated fodder *cholam* raised in summer. Cluster beans would appear to have

more points in its favour than cowpea. The most suitable proportion for mixing a pulse with *cholam*, when one is needed, is three of *cholam* and one of pulse in the case of irrigated red soils, and one of *cholam* to three of pulse or both in equal proportions in the case of rain-fed soils." The above results are with regard to Coimbatore soils.

Rotation experiments at the Agricultural Research Station, Nandyal (Kurnool Dt.), have shown that a three year rotation: Sorghum—cotton—pulse (groundnut or Bengal gram). is more profitable than a two year rotation of sorghum—cotton (without a pulse) both with regard to yield of sorghum as well as nett produce for three years. Similar experiments at a few other stations have not led to any conclusive results.

Conclusion. It is obvious that more work is to be done in different parts of the presidency to decide the suitable mixtures and rotations for different soils and different seasons. This important question of mixtures and rotation requires a thorough *agro-economic* examination. The question of cereal—pulse mixture in dry lands thus presents a comprehensive set of problems in farming practices, economics, soil physics and nutrition, and demands more systematic attention than it has commanded so far. It is hoped that before long this subject will receive the attention it deserves.

Stone Dragging Competition for Cattle in Kurnool District.

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Introduction. The Ceded District ryot is noted for his skill in the use of his cattle for a variety of agricultural operations. The soils of the tract are generally poor, the rainfall low and ill-distributed and the holdings extensive. The climate is also adverse and the ryot is naturally averse to much of human labour. While ploughing, carting, and mhoting where there are deep wells, are all the operations that cattle are set to do in other districts, the work cattle of the Ceded Districts are put to a much wider use. The work cattle draw heavy ploughs in teams of four to six pairs, while the ryots of the Tamil or Circars country think that such work can only be done by elephants. In this tract crushing big clods raised by the use of these ploughs is done by cattle power while in other districts to break much smaller clods raised by the wooden ploughs, manual labour is engaged. Where the stubbles of cotton and sorghum are dug out by manual labour elsewhere, the Ceded District ryot removes them over wide areas by a pleasure drive standing over a blade harrow worked by his cattle.

He drill-sows his seeds economically using lower seed rates and obtains a meticulous uniformity in stand and an admirable straightness of rows which are sometimes several furlongs long. This is achieved with the

aid of his cattle. He weeds his fields and cultivates the soil between rows of crops with the help of cattle. It is an interesting sight to see crops like chillies and tobacco being carefully intercultivated by cattle power, without even a leaf being broken by the careless trampling of the cattle. Though groundnut is a crop of recent introduction in the Ceded Districts the ryot has learnt to harvest the entire crop by the use of his work cattle at less than a fourth of the labour cost expended by the ryots of the Central Districts who still find some excuse or other for the lifting of their groundnuts by human labour. Threshing of produce like Italian millet and sorghum is all done by rollers drawn by cattle. Even in the matter of carting it is a sight to see clumsy looking carts loaded several feet wide and high with miniature hay stacks, causing no little inconvenience to motorists, as these straw laiden carts practically occupy the full breadth of the road. His cattle thus do almost all agricultural operations and it is possible to manage 20 to 50 acres of land with a pair of cattle while the ryots of other districts cannot manage more than six acres with a pair.

Ongole breed of work cattle. The work cattle used in the Ceded Districts are mostly of the Ongole type. These are huge animals generally bred in the Ongole tract, but reared from a young age in the Ceded Districts. Soon after weaning, young male stock are brought by dealers in hundreds to the Ceded Districts and sold to ryots on the instalment payment system. They are carefully reared in their new homes, where they are given names to which they respond on calling, and become so tame that they do not generally require nose ropes. The Ceded District ryot takes a great pride in the proper maintenance of his work cattle and even the most aristocratic of the cultivators tether their cattle at nights in a shed which is usually the enclosed front portion of their residences.

Stone dragging competition. Some of the best Ongole cattle which are noted for their size, steadiness and docility are found in the black cotton soil tracts of Kurnool District. In this area there exists an ancient pastime at which the strength of the work cattle is tested by means of a stone dragging competition. The competing pairs have to drag a huge stone over a firm earthen road. The pair that comes out best has a reputation for strength and is known as the *Rallu gunju eddulu* (the pair that pulled the stone). Such competitions are generally held in many villages during the local temple festivals which attract crowds Ryots usually spend several months in training animals for these competitions. Such training of young animals is comparable to breaking the animals to the yoke. The biggest stone is kept at the Mahanandi temple where vast crowds are attracted for the Sivarathri festival. The temple trustee gives annually a gold sovereign as a prize for the bulls that come first in the competition. There is a similar competition at Ahobilam where the stone is less than 2/3 of the size of the Mahanandi stone. The stone at Mahanandi is $11'-3''$ long $2'-3'' \times 1'-10''$ in section and is calculated to weigh about $4\frac{1}{4}$ tons There is usually a hole provided on the top at one end for attaching a

chain and it is to be drawn over a firm earthern road for a period of 30 minutes. The pair that pulls the longest distance is declared winner. No regular records have been maintained, but it is reported that a distance of 90 feet is the record within recent memory. Animals for competition come from far and wide after getting selected at local preliminary heats. Ryots used to get some very magnificent animals for the competition. Though the honour of winning at these competitions is its own reward, animals that won at the competitions are reported to have been sold for Rs. 1500 to Rs. 1600 a pair—a premium of about Rs. 300 to 400. The Ceded Districts have no good roads to boast of except the trunk and District Board roads and one accustomed to travel into the interior during the rainy season can easily imagine why the ryots have been so particular to test the dragging power of their cattle. It is only these cattle that can take the villager or a stray visitor out of the village to the nearest metalled road after a rain. Two such District competitions in addition to the usual cattle shows were held, one at Mahanandi and the other at Ahobilam in March 1940. The Agricultural and Veterinary Officers and some ryots acted as judges. Cruelty of any sort like beating, goading etc. was prevented. The Sub-Collector of Nandyal presided over both the functions and medals were awarded to the winners. The entries for the cattle show and the stone dragging competitions are declining. It is a great pity that a useful function like this should show signs of decline. It is necessary to investigate the cause and organise the competitions in such a manner as to attract enough entries.

Causes for decline of cattle. One reason for the decline in the competitions is that the splitting of holdings which is silently going on has reduced the demands on big animals with the result that smaller sized cattle are getting to be more in demand.

Conclusion. It would be interesting and useful if such competitions are organised in important cattle fair centres. It may be mentioned that a pair that can drag a $4\frac{1}{4}$ ton stone on a bare ground, can easily drag a stone road roller. When 4 to 6 such pairs are not uncommon sights in team ploughing in the black cotton soil tracts, road rolling of even the heaviest type is an affair with these cattle and the competitions such as these can be turned to more practical advantage.

Further Studies on *Calocoris angustatus* Leth

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Introduction. The cholam earhead bug, as the *capsid* bug is appropriately termed, has been known as a pest of *Sorghum vulgare* for well over 25 years; it infests the earheads, damages the setting grains and thereby causes loss in yield of the grain. In the Madras Presidency, it is seen in pest form, as a rule, in tracts like, Bellary, Cuddapah, Anantapur, Kurnool, Guntur and Coimbatore. It is known to occur in other provinces as well. Nowhere has it ever been recorded as a serious pest except in Mysore where it was reported to have appeared for the first time as a pest in some 'jowar' growing villages in 1936. Punjab, Burmah, Central Provinces, United Provinces, Hyderabad, etc., do grow sorghum on an extensive scale but this insect has not been recorded as a pest so far.

Due to the periodic appearance of the pest and extensive damage caused to the irrigated sorghums raised in March-April, investigation was first started in 1914. Ballard (1916) published the results of preliminary investigations in the form of a bulletin. Subsequently, more detailed investigations were carried out from 1934 – 37 at Guntur and Coimbatore, the results of which are embodied in this paper.

Incidence of the pest in general. As previously stated, the insect appears in a pest form on sorghum earheads. At Coimbatore, there are two seasons in which the sorghum crops are raised – the irrigated *chitrai cholam* (April to June) and the rainfed *Periamanjal cholam* (August to January). It is established by counts that the severity of infestation is marked in the *chitrai cholam* and considerably less so in the rainfed *Periamanjal*.

The bugs first appear as soon as the earheads emerge out from the leaf sheath; there afterwards, within a short space of time, i. e., a week or a fortnight, the nymphal population mounts up considerably. In the worst years as in 1926 an earhead is likely to carry as many as 350 nymphs. After the grains are well set the population drops considerably. It is interesting to record that prior to the appearance of earheads, adult bugs are known to live inside the spindles of the rainfed sorghums from September but they are not known to breed till and after the earheads appear, i e, in the middle of October.

Similarly, at Guntur, there are two seasons, the '*Punasa*' the early (June to September) and the '*Pyru*' the late (October-February); white (*Tella*) and red (*Yerra jonna*) are raised in the *Punasa* and the yellow (*Paccha*) in the '*Pyru*'. An intermediate crop of *Pedda jonna* is sometimes

taken from between August and November for fodder. Thus, with the exception of a few months, there is sorghum grown all through the year which makes it possible for the pest to thrive through and to assume pest proportions in a varying degree, year after year. The incidence of the pest follows much the same lines indicated under the Coimbatore conditions. There is an accelerated breeding resulting in a very high population of nymphs about the second week after the emergence of earheads and then a big drop a week after. In the case of *Punasa* sorghums, it has been observed that the middle of September or thereabouts is the period of maximum incidence and heaviest infestation. In Coimbatore, the proportion of adults to nymphs ranges somewhere between 1 : 10 at the time of peak infestation.

Incidence in relation to the shape of earheads and the type of seed. In Coimbatore, as well as Guntur, the close or compact type of earheads representing the *chitrai* and *Telia* and *Yerra* sorghums respectively show a higher infestation than the loose or less compact types. This must be due to the habits of the pest feeding on the swelling grains and developing in concealed situations which the compact types offer in a pre-eminent degree. At Coimbatore, certain types, *chitrai* sorghum (compact-A. S. 1095) and *chinnamanjal* (less compact) sown about the same period (May 1936) showed striking differences in the incidence of the bug. Whereas A. S. 1095 gave 128 adults and 872 nymphs, *chinnamanjal* gave 168 adults and 152 nymphs for 200 plants.

General incidence of the pest in Coimbatore from May 1936 to May 1937. The incidence of the pest for the three seasons is given for Coimbatore. Population counts taken once a week from 100 plants selected at random were as follows :—

1936 May (A. S. 1095)—92 adults and 950 nymphs.
1936 November-December (Periamanjal)—24 adults and 172 nymphs.
1937 May (A. S. 1095)—136 adults and 408 nymphs.

In all these three seasons the yield was average and hence the incidence must be held to be mild and light.

Nature and extent of damage. Both the adults and nymphs are sap-feeders. The severity of attack varies with the stage of growth of the earhead at which it is attacked. If the earhead is attacked just before it emerges from the sheath by a large number of nymphs there will be no grain formation. The whole head then takes a red and unhealthy appearance and is swathed in a gummy or resinous exudation. If the infestation starts after the head emerges out, damage is somewhat less severe. There is not much of damage if the pest attacks after the flowers are well set and the grains have begun to harden. A few laboratory trials with potted plants indicated likewise.

Alternate host plants. Fletcher (1917) has recorded *Calocoris* as a pest of *cumbu* (*Pennisetm typhoideum*) but not mentioned the locality. The

authors have not found it as a pest on *cumbu* at a time when there was sorghum in the field. It was stated to breed on the male inflorescence of maize but the fact has yet to be confirmed. Apparently, the adult bug keeps on feeding on the green grasses and starts breeding in sorgum earheads alone.

General life history studies. Ballard's studies (1916) have shown that the bug takes 15—17 days to complete its life cycle. Mr. Krishnamurti's studies at Guntur (1935) show that the life cycle is shorter by 2 to 3 days. Attempts by the second author to follow up the life history at Coimbatore have met with little success so far. Though identical conditions were given, the bugs refused to breed and lay eggs even though each female had 12 to 16 eggs inside its abdomen. It would appear that the weather had got something to do in inhibiting or accelerating the tendency for egglaying. The pest ordinarily gets through only one generation on the earhead; by the time a second generation is reached the grains become well matured and stony hard so that they are unfit for them to feed on; in such cases, the nymphs appear to be content to feed on the main stalk.

Control Experiments. The treatments consisted in the use of 'Cooper's special spreading sulphur' as a dust. The first part of the experiment was to ascertain if one dusting alone is sufficient or two dustings were essential; the second part of the experiment was to find out at what stage of the growth of the earhead dusting should be given to secure good results. Dusting was done in the morning with a bellows hand duster; the earheads and the flag leaf got a good coverage of the dust. In no case was there any interference with the setting and formation of grains as a result of the above dusting.

In 1936 population counts were taken once a week for four weeks both from the control and treated plots from 200 plants selected at random; the first count was taken just a week after the earheads had emerged out. Table I gives the population counts.

TABLE I. Population counts of *Calocoris angustatus*.

Date of emergence of earhead—3-5-1936.
No. of plants under observation—200.

Treatments.	Dates on which counts were taken.	No. of insects counted.		Remarks.
		Adults.	Nymphs.	
1. Bulk (before treatment)	11—5—36	14	137	The fourth count was not taken into consideration owing to interference by Ragmus (capsid bug).
2. Sulphur dusting	15—5—36	116	730	
	25—5—36	154	706	
3. Control	15—5—36	168	1512	
	25—5—36	114	1900	

It will be seen from the table that the infestation has reached the peak in about a fortnight to three weeks after the emergence of the earheads and

that the treated plots have given considerably lower populations of nymphs as against the controls.

Another series of experiments was conducted in 1937. There were 7 treatments replicated 4 times in plots of one cent each. The population counts of the bugs were taken at random from 100 plants from each plot. The yields were also taken to note if there was an enhanced yield in the treated plots on account of the reduction of the pest due to treatment. Table II gives the averages of population of the four replicated plots under each treatment.

TABLE II. Averages of population counts of *Calocoris angustatus*.

Counts	A	B	C	D	E	F	G	Date
1	10—72	13—73	12—93	10—63	18—86	9—74	10—83	1-6-37
2	19-135	32-119	25—97	40-169	39-157	18—97	34-102	11-6-37
Total	29-207	45-192	37-190	50-232	57-243	27-171	44-185	

TABLE III. Plot yield of grains in pounds.

Replication.	A	B	C	D	E	F	G
1	32·5	45·5	43·0	31·5	33 0	44·0	35·0
2	40·5	40·5	40 0	31·0	46·5	39 5	45·0
3	39·0	44·5	54·0	43·5	50·5	47·5	29 0
4	36 5	48·0	43·5	40·5	36·5	46·5	38·5
Total	148·5	178·5	180 5	146·5	166·5	177·5	147·5

A. Dusting immediately after emergence of earheads.
B. do. on the 4th day do. do.
C. do. on the 8th day do. do.
D. Same as A with second dusting at 6 days interval.
E. do. B do. do.
F. do. C do. do.
G. Control.

From the statistical analysis of the data given above it is found that the differences in population and yield due to the treatments are not significant. However, the observations made in the course of the experiments indicate the trend of numerically lower populations and higher yields in the treatments C. and F. It was found that one good dusting is quite sufficient and that the dusting given on the 8th day after emergence of earheads is about the best. About 35 lb. of sulphur were found necessary for dusting an acre; inclusive of labour charges the cost of dusting comes to about Rs. 5.

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SELECTED ARTICLE

Indian Indigenous Milk Products.

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The total annual value of the milk and milk products produced in India has been estimated as Rs. 300 crores, of which liquid milk accounts for 107, ghee 100, *khoa* 40, *dahi* 20 and other products about 33 crores of rupees. The total annual production of milk in India is about 700 million maunds. Ghee accounts for 53, Khoa 7·6, dahi 3·8 and other products 5 per cent as milk equivalent of this production. The amount of milk product manufacture is enormous, especially ghee. The energy value of this milk is sufficient for 30 million adults for one year (10 per cent of the population) without taking into account the special value of milk as a protective food due to its fat, protein, ash and vitamins. The energy value of the milk produced in England is sufficient for 7 million adults (15 per cent of the population) for one year. There is thus considerable scope for greater milk production in India so as to raise the percentage of milk and its products used in the diet of the people from 10 per cent nearer to the 15 per cent level found in western countries.

Indian Milk Products. The main reason for the manufacture of milk products is to concentrate and preserve all or some of the nutritive value of milk in time of plenty for use in a future time of scarcity. Ghee is an outstanding example. Another reason is to prepare solid products which can form the basis of food confections and so add variety to the diet, e. g. *Khoa* and *channa*. In the case of fermented milk products such as *dahi* and *lassi* we have products of uniform quality prepared by a natural lactic acid fermentation of milk. In the case of these two products, the property of milk to become sour is made use of for the production of wholesome milk drinks.

Other milk products result from the effect of heat on milk either by the separation of clotted cream (*malai and sar*) or as concentrated milk, sweetened or unsweetened, e. g. *rabbri* and *khoa*. These are looked upon as delectable confections and require considerable skill to manufacture.

Indian milk products have their counterparts in western dairy products. Ghee is similar to butter oil and butter, desi butter to butter, *channa* to cheese, *rabbri* and khoa to condensed milks and *dahi* and *lassi* to buttermilk and other fermented milks The main difference is that except in the case of ghee, all Indian products have a low keeping quality, due mostly to recontamination of the product with micro-organisms from the air and packing material after manufacture. All by-products are also made from small batches of milk. It is in the westernizing of methods e. g in the manufacture of butter from cream, that milk is bulked in any quantity.

Liquid Milk. The production of most of Indian milk is fragmentary ; that is, the units of production are only a few seers. The collection of these small quantities adds greatly to the cost of obtaining milk in bulk for retail as such or for manufacture. The hygienic quality of all milk is low owing to ignorance of the producers of even the rudiments of hygiene. Then there is the possibility of after-contamination of milk all along the line of handling. All milk must therefore be taken as of the same poor hygienic quality and will have to be boiled as soon as received in the home in order to preserve its keeping quality. No milk must be taken as of better quality on the word of the retailer. No

objection should be taken to the commendable practice of boiling as this ensures a safe milk which will keep without seriously impairing its nutritive value.

The *skin* which forms on the surface of milk which has been boiled is a small amount of coagulated cream and consists of fat, casein and some ash; it is highly nutritious. The texture of this skin can be varied at will in the heating process, as is exemplified in the preparation of *malai* or *sar* (clotted cream) or in the preparation of *rabbri*.

Loose milk is sold at so many seers to the rupee and there does not appear to be any sale on a compositional quality basis i e. on fat content. Three classes of milk are recognized for the setting of presumptive standards: buffalo, cow and mixed milk. A considerable amount of adulteration of milk either by abstracting fat or adding water is to be expected in loose milk sold haphazardly. A realization of the value of the freezing point test for detecting the latter would tend to lessen the practice. Other practices such as the addition of sugar, *gur*, rice, water, etc. should also be detected and dealt with through the usual procedures.

Whole milk products These consist of highly condensed milks such as *kheer* which is milk condensed to a quarter of its volume, and *khoa*, which is the solid product obtained by condensing milk to 6½ times its total solid content. Both products may contain cane sugar, and *rabbri* always contains it. *Kheer* may be considered as the most delectable of all Indian sweets: *Khoa* is used for food either as such or as the base for the preparation of many types of sweets.

Both are made by direct evaporation of milk in shallow iron pans over open fires. For *khoa*-making not more than two seers of milk are taken in the pan; this is boiled vigorously while stirring with an iron ladle to prevent burning of the milk. After concentration to about a quarter of the volume the milk takes on the consistency of honey and later, as more water is driven off, attains a doughy consistency. The material is thoroughly stirred at the end of the evaporation process and the viscous product is collected as a circular pat. The product must be white or creamy and should show no brown colour due to burning. The flavour must be clean and not show evidence of excessive heat treatment. The texture should be dry and caseous and should not show sweating drops of water or films of free fat. *Khoa* contains about 30 per cent moisture.

Kheer is made in the same way except that condensing is stopped at the honey consistency, at which sugar to the extent of a quarter of the weight of the product is added.

Rabbri is made by evaporating milk slowly over a small fire. After the initial frothing the milk is boiled without stirring, the skin which forms being skimmed off with wooden splints and laid on the cool pan surfaces above. The is done until the liquid is condensed to one-eighth its volume. Sugar may then be added and the skins well beaten into the condensed milk. The product contains about 30 per cent moisture. These products contain all the total solids of milk and have lost little, if any, of their nutritive value in their preparation.

Fermented milk products. These are fermented whole milk, *dahi*, and fermented skim milk, *lassi* (or more commonly, buttermilk from buttermaking from *dahi*); the difference in these two products lies mainly in their fat contents

Dahi is cooled boiled milk in which lactic acidity to a titratable value of 0·7 to 1·1 per cent has been developed either by natural souring or by the agency of an artificial lactic acid bacterial culture (a starter). The ensuing liquid is used either as a beverage as such or churned into *desi* butter, the butter milk being drunk as lassi and the butter collected and used for ghee-making.

Dahi is prepared by taking fresh milk, bringing to the boil and cooling to blood heat, and then keeping the milk at that temperature until it sours naturally or sours after the addition of a starter. The use of a special starter is rare; a small quantity of the previous day's dahi may be stirred into the cooled milk. There is usually enough lactic acid bacteria in the pores of the earthenware pots to carry on the fermentation. The milk sets to a soft curd when the *dahi* is ripe; this coincides with an acidity of 0·9 to 1·1 per cent lactic acid. The curd can be beaten up to a good-bodied liquid drink of appetizing acid flavour.

The step of ripening the milk is almost universally used in the making of *desi* butter from milk. The fermented milk is churned in the usual *desi* churn until the fat separates out either as a liquid layer (hot weather) or a lump of solid butter (cold weather). The crude butter is carefully separated by hand. The liquid is *lassi*, and contains some unchurned butter-fat and the casein of milk in a fine state of division. The liquid has a full bodied, acid flavour with the aroma of butter-milk and serves as an appetizing and valuable drink to the cultivator's family. A similar drink made by the fermentation of skim milk is not so uniform in texture as butter-milk *lassi*. Such a liquid should be churned for five minutes to simulate buttermilk in aroma and flavour.

Acid-and heat-precipitated curd. A mixture of butter fat and milk protein is prepared from boiling milk by the addition of lime juice, lactic acid or lactic acid liquor (ripened whey). The protein of milk is precipitated as a stringy curd under these conditions, and is separated as a solid, *channa*, by filtering in a cloth and pressing. It does not require much acidity to precipitate curd from boiling milk (it occurs at pH 6·0—6·2). Most of the skill enters into the completeness of precipitation and preparing a product of as low a moisture content as possible. Too little acid for coagulation gives a curd which holds on to its water too much and requires pressing before a satisfactory product is given; too much acid gives a sour product. *Channa* is used mostly as a base in sweet making. It is usually frothed up by beating before use. *Channa* can be made either in small batches, or in large batches commercially by the same principles of acid coagulation.

Fat-rich products consists of creams, *desi* butter and ghee.

Reference has already been made to *malai* and *sar*. The word *malai* may be used for a variety of products from the thin skin of milk used for the table to the thick clotted cream made by special methods. The yield of skin on boiled milk can be varied at will by concentrating the milk and or by allowing to occur slowly in milk heated over a slow fire. The latter process is similar to that used in the manufacture of western clotted creams. The high fat and solids contents of Indian cow's and buffalo's milk cause good yields of clotted cream to be given.

The process of manufacture of *malai* and *sar* is fairly simple. A volume of milk is slowly brought to the boil with slow stirring to prevent burning. The heated milk may then either be taken off the fire and allowed to cool of its own accord or kept overnight over a dying fire. The cream together with heat coagulated protein rises as a soft layer to the surface. This layer may be of considerable thickness and is ladled off and eaten with cereals or as part of confectionery. If the milk is allowed to remain overnight over a dying fire, a more solid layer is given. *Rabbri* is a form of clotted cream whisked or soaked in sweetened condensed skim milk. *Malai* may contain 25 to 35 per cent of fat and 100 lb. of milk yields about 20—25 lb. of the product.

Desi butter. This is the term used for the fat-rich fraction churned out from *dahi*, or in some cases, ripened cream, by the method using the indigenous churn. The method used for making *dahi* has been described in the first part of this article. The *dahi* is made in a wide-mouthed jar (*ghara*) and when ready,

churned with a wooden paddle inserted in the liquid the paddle being turned by a cord twisted around a spindle, which is a prolongation of the paddle above the vessel, the cord being pulled with a reciprocating motion. When churned, the butter layer or granules are carefully collected and drained free from *lassi*. Sufficient of this *desi* butter is collected from daily churnings to merit a *boiling* of ghee.

Manufacture of katcha ghee. The butter now collected in batches in a wide-mouthed copper vessel is melted and slowly brought to the boil; the moisture in the curd layer below the fat boils away slowly and completely. A slight scum forms on the surface of the fat. This is carefully skimmed. The curd particles also begin to brown and to circulate in the convection currents in the fat. The fat is now allowed to cool as the boiling process necessary for making *katcha* ghee is complete. The pure fat is decanted as carefully as possible from the solid curd and the last runnings of fat may be filtered through muslin. This is the crude ghee of commerce; the fragmentary production of the product made in this way by cultivators goes towards accounting for a large part of the enormous amount of ghee produced in India.

The crude ghee is collected either in large brass vessels holding 20 to 40 lb. or in tins of the kerosene oil 4 gallon variety which hold about 36 lb. of ghee. The ghee is marketed in such containers.

The next step is the refining of such ghee. Other steps are embraced in the process namely the blending of ghee and its storage in clean containers so as to ensure a reasonable keeping quality. The ghee is now subjected to a *heating* process so as to rid the *katcha* ghee of some residual curd particles and water droplets. The ghee in the tins is melted and poured and according to the required blend into large boilers in which the ghee is heated to 75—85°C. After thorough stirring the clear ghee is poured off through taps (set at different levels in the boiler) and immediately run into tin containers (36 lb. size) using muslin for straining. The contents of the tins are allowed to cool when the ghee crystallizes into a white solid mass.

Large scale boiling. In the boiling of ghee in larger batches special ghee boilers of which there are many types, are used. The *boiling* process, it must be understood, is totally different from the *heating* process The boiling process is always done at temperatures above 100°C., in order to boil away the water of the serum of the butter. With large boilers the maximum temperature rarely exceeds 116°C. With smaller boilers and good quality *desi* butter the temperature can be raised to 120°C., but not exceeding 123°C. Too high a temperature must be avoided so as not to give the ghee a browned colour or a slightly burnt taste. The ghee boilers can also be used as ghee heaters for blending and purifying crude ghee. Ghee made by the large-scale process may require blending but not purifying.

Making ghee direct form cream. Attempts have been made to cut out the churning process in the manufacture of ghee. One of the main points in ghee manufacture is to get as high a yield as possible. The process of churning milk is one in which the fat is concentrated in the resulting butter, which may contain from 50 to 90 per cent butter fat. It is feared that there is an appreciable loss of fat in the *lassi* in the *desi* method of churning. By the use of a cream separator the fat can be concentrated in cream (40—70 per cent fat content). Then this cream can be boiled like butter for the separation of ghee. Experiments have shown that this is possible but only with an 80—90 per cent yield of fat, a yield which can be improved on considerably. The reason is that the cream does not give all its fat up into the free form in the heating process and there is some loss of fat by absorption in the excessive amount of dry curd.

With acid cream the curd tends to precipitate as a large lump in the liquid below the fat, causing difficulties in manufacture and a further loss of fat. Further investigation is necessary to make this method of making ghee satisfactory

Quality in ghee. Ghee is the pure butterfat of milk prepared by methods which give the highest yields and a product of desirable odour, flavour and crystalline texture when solidified. Buffalo ghee is white, cow ghee from slightly to deep yellow and sometimes light brown, and mixed ghee white to different gradations of yellow according to the amount of cows ghee and the season of the year. The texture should be a fine easy, working crystalline mass (cold weather) or fine crystals in liquid ghee (hot weather). Of great importance is the aroma and flavour which must be acid and full and not bland and tasteless as in freshly-rendered non-acid butterfat. This form of flavour is developed by making ghee from butter churned from ripened cream. Ghee from sweet butter is tasteless and of inferior quality. There are however, a variety of tastes locally for ghee. In commerce these tastes are ensured by the proper blending of small consignments of ghee. As in butter, the acidity of the fat at the time of manufacture is linked up with the keeping qualities of ghee; the more acid the ghee at the fresh stage the shorter the keeping quality, ghee of low acidity which thereby suffers in flavour keeps longer. There should be compromise between initial acidity and length of time of storage. Ghee should be consumed within seven to nine months of manufacture.

It is well known that ghee lends itself to adulteration with cheaper animal and vegetable fats. There is considerable activity among public analysts and workers in research institutes and university laboratories connected with methods of analysis of ghee so as to detect all forms of adulteration. There is no quick, simple, reliable test possible for the detection of adulteration of ghee and one has to be satisfied with the evidence of the usual standard methods of fat analysis. After all the amount of adulteration of ghee is very small considering the enormous amount of ghee manufactured and traded in annually.

Other dairy products. A small quantity of hard, smoked and cream cheeses are made in some parts of India. Surti cheese is a soft cheese of low keeping quality (14 days) Dacca cheese is a small medium pressed cheese which is smoked for preservation. Bandal cheese is a form of cream cheese very much like Surti cheese. Some lactic casein is prepared from skim milk by the natural sour process. The quality is usually low owing to high fat content and a brownish colour. (*Indian Farming* 1 : (1940) 534—36 and 583—85).

ABSTRACTS

Report on the marketing of eggs in India issued by the Agricultural Marketing Adviser to the Government of India. I. C. A. R. New Delhi, Price Re. 1—4.

The domesticated fowls of the present day world are descendants of (*Gallus bankiva* (red jungle fowl), (b) *Gallus sonnerati* (grey jungle fowl), (c) *Gallus lafayetti* (the Ceylon jungle fowl) and (d) *Gallus varius* (the Javan jungle fowl).

World's production of hen eggs.

Countries.	Percentage to the world's production.	Average number of eggs produced per hen per annum.
(a) *Europe.*		
Netherlands	3·8	125
England and Wales	5·7	120
Belgium	3·1	116
Austria	1·4	82

(b) *Africa.*		
French Morocco	1·9	60
(c) *Canada.*	5·2	109
(d) U. S. A.	58·6	82
(e) *Asia.*		
Japan	7·0	130
India	5·3	53 (*desi*)
		103 (improved)

India produces every year about 33,648 lakhs of eggs. Put end to end, they would stretch about four times round the world. The total value of the eggs sold in a year amounts to 5¼ crores of rupees. The value of the birds themselves equals about 7½ crores. By shear neglect about 14 lakhs rupees worth of eggs are simply not collected in the course of a year. This is apart from depredations of kites, crows, jackals and other vermins to poultry itself. Much, if not most, of this waste is preventable by the provision of small but sanitary mud poultry houses and the use of a little wire netting. This provides scope for those interested in village reconstruction.

In the course of marketing the loss due to stale eggs, breakages, etc., is enormous and at some periods of the year amounts to as much as 25 per cent. The value of the total loss to the industry due to various causes is estimated to be over 57 lakhs rupees annual. The report shows how this waste may be eliminated and indicate how the business could be expanded and made more profitable to producers.

The *desi* fowls found in India are known as Tennis, Chittagong, Asiles, (fighters), Chagas (breed with feathers on their shanks), Lolab and Karakanath (black skin). The number of cross bred fowls is rather few and the progeny in one or two generations invariably reverts to the *desi* type. The conditions under which they are kept in the village actually help to hasten the process of reversion.

India contains 10·5% of world's fowl population.

Production of eggs.

	(a) *Desi* hens estimated No. of total birds. (lakhs)	No. of eggs laid annually per bird.	Proportion of total production per cent.
All India	1711·3	53	100
Madras Presidency	316·3	51	12·3*

* U. P. holds first rank with 13·8 per cent.

(b) **Improved hens.**

	(Thousands)		
All India	2139·6	103	100
Madras Presidency	68·0	102	1·9**

** U. P. holds first rank with 66·4 per cent.
Travancore State holds the third rank with 9 per cent, while Cochin has 1·3 per cent.

Production of duck eggs.

	Estimated No. of total birds (lakhs)	No. of eggs laid annually per bird.	Proportion of total production per cent.
All India	166·3	90	100
Madras Presidency	51·4	126	40·9

* Madras Presidency holds the first rank in India, while Bengal comes second with 34·4 per cent.

Production of goose eggs.

	Number of eggs laid annually per bird.	Proportion of total production per cent.
All India	19	100
South India (Mysore, Coorg, Cochin and Travancore)	22	0 9*

* Bengal has 65·9 while Behar comes second with 19 per cent. Production in Madras presidency is negligible.

Production of Turkey eggs.

	Number of eggs laid annually per bird.	Proportion of total production per cent.
All India	38	100
South India (Mysore, Cochin and Travancore)	41	49 4*

* U. P. stands first with 32·4. Mysore comes second with 24 8 and Travancore comes third with 21·7 per cent. Production in Madras presidency is negligible.

Production of Guinea fowls eggs.

	Number of eggs laid per bird per year.	Proportion of total production per cent.
All India	60	100
South India (Mysore, Cochin and Travancore.)	53	0·3*

* U. P. stands first with 85·3, while Punjab comes second with 7·2 per cent Madras presidency negligible.

World's duck population.

Countries.	Ducks (lakhs).	Percentage to world's total.
China	567	62·1
India	166	18·2
Europe	122	13·4

In South India the main areas of higher concentrated production of hen's eggs are the deltaic regions of the Godavary, Cochin and Travancore.

India.

	Desi fowls.	Improved fowls.	Duck.	Goose.	Turkey.	Guinea fowl.	Total.
Laying birds (lakhs)	514 7	7·3	54 8	1·6	0 1	4·2	582·7
Eggs laid per bird.	53	103	90	19	38	60	
Percentage of total production.	81·3	2 4	15 4	0·1	0 01	0 8	100

Per capita consumption of eggs.

Ireland	283	*India	7 8
U. Kingdom	158	*Travancore	21·6
Germany	114	Baluchistan	19 7
Denmark	100	Cochin	10·5
		Madras	10·7

Imports. There is practically no import of eggs in shell by sea from abroad. A trial consignment of only about 1400 eggs was imported in 1935 by a firm at Bombay from Durban (South Africa). But the export was given up due to high cost. Foreign made egg products like dried eggs, and albumen are imported in small quantities for industrial or food purposes.

Exports.

		To Burma. Eggs. (lakhs)	Value (lakhs of rupees)		*To Ceylon.* Eggs (lakhs)	Value (lakhs of rupees)	
1930—31.	All India	374	8·9		115	3·5	
1936—37.	All India	236	3·7		2·2	0·04	
				Price per 1000 eggs.			Price per 1000 eggs.
1930—31.	Madras	91	2·4	26 3	115	3·5	30.4
1936—37.	Presidency.	5	0·1	20·0	2·2	0·04	20·6

The entire trade to Burma is of preserved eggs. Of the total exports from India, the share of Bengal is over 80 per cent. The export to Ceylon is entirely from Madras. If the present rate of decline continues Madras might stand to lose the entire trade with Burma. The reason appears to be that Madras exports mostly hen eggs which are expensive compared with the duck eggs supplied from Bengal

In the case of Ceylon the decline is due to the fact that from 28th July 1934, the import duty of 12½% on the tariff value was raised to a prohibitive duty of Rs 3/- per 100 eggs i. e., equal to the value of eggs.

In 1930, one Bombay merchant at the instance of the United Poultry Association, Lucknow, sent a consignment to London. The details are :—

Expenditure.	Rs.	a.	p.
14,400 hen eggs at Rs 3—10—0 per 100. ...	522	0	0
Packing (10 cases)	40	4	0
Transport etc.	16	15	0
Freight.	103	10	0
	682	13	0

Receipts.				
14,400 eggs at 5sh. 3 d, per 120 eggs. ...	£	31	10	0
Less commission (5%)	,,	1	11	6
		29	18	6 or Rs. 403
Loss Rs.		279	13	0

On an average the producers in India, get Re. 0—2—11 per dozen of mixed hen eggs or in other words the producers get about 58·7 per cent of the price paid by the consumers, In the case of duck eggs the producer gets about two-thirds of the retail price.

Grading. The Agmark classification is as shown below :—

Special	1⅞ oz and over.
"A"	1¾ oz. to 1⅞ oz.
"B"	1½ oz to 1¾ oz.
"C"	1¼ oz. to 1½ oz.

Grading Experiment. It was observed that if the eggs were sold ungraded they fetched a flat price of Rs. 2—0—1 per hundred, upon grading them and selling them on quality basis the realisations have been as shown under : —

		No. of eggs obtained of different grades from hundred ungraded eggs.	Rate of sale per hundred. Rs.	A.	P.	Amount realised. Rs.	A.	P.
Marked								
Agmark	A.	25·6	2	9	0	0	10	6
"	B.	49 5	2	7	8	1	3	8
"	C.	21·5	2	4	11	0	7	11
Unmarked.								
Small		1·1	1	11	10	0	0	4
Cracked etc.		0 6						
Stale		1·7	1	0	0	0	0	4
		100·0				2	6	9

It may therefore be seen that the aggregate return from the sale of hundred eggs after grading them is Rs. 2—6—9 against Rs. 2—0—1 only from the sale of ungraded eggs. This amounts to a gross increase of about 20 percent over the price of ungraded village eggs and indicates the prospects that lie in grading. Because of their uniformity, pleasant appearance and freshness it pays to grade eggs, but the difference in size does not attract a commensurately higher price. This gives rise to the important issue of introducing a method of selling the eggs on the basis of weight, provided the interior quality is reliable. In the absence of a weight basis it is difficult to see how buyers are made to appreciate the fact that it is actually cheaper to buy the larger eggs.

		Minimum calculated weight per 100 eggs.	Calculated price per lb. of eggs.
			Rs. A. Ps.
Agmark	A.	10 lb. 15 oz.	0—3—9
,,	B.	9 ,, 6 ,,	0—4—3
,,	C.	7 ,, 13 ,,	0—4—9
Small.		6 ,, 4 ,,	0—4—5½

Transport. For packing and transport of eggs sent in lime pickle to Burma from Bengal and Madras large heavy earthen jars are used. A jar generally contains about 3500 hen eggs or 2500 duck eggs.

It is observed that the urban demand is high during the cool, dry months and at its highest in November—December. Production is at its peak in March—April

Industrial uses. For industrial and other purpose e. g. glazing, book binding, preparation of medicines and tanning, a very small number of eggs is used. So far, however, in India none have been used for the preparation of industrial egg products such as frozen, liquid or dried yolks or whites (albumen). China at present is the source of about 95 percent of the total world exports of egg products, but enquiries indicate that this would be a fruitful line of action for local enterprise in India, particularly in Bengal and in the Cochin and Travancore areas. There appears to be a market for sale of hard boiled eggs on the railway platforms, etc. This is being done in some parts of N. India.

General method of grading. There are four stages viz., (a) sorting of cracked eggs and cleaning of other eggs, (b) candling, (c) grading, (d) marking or stamping the graded eggs.

Hatching. An ingenious method of artificial hatching in warm rice husk practised by the Chinese in Burma, as described, is well worth reading.—M. K. R.

Rice Breeding in Burma J. W. Grant, *Indian Farming* (1940) 606—608.

Rice is by far the most important crop in Burma and covers an area of about 12¾ million acres. It is grown year after year in these lands with no rotation what-so-ever. The annual exportable surplus of rice (not in husk) from Burma is over 3 million tons. On account of the large number of markets for Burma rice, many different qualities of grain are in demand. Shortly after the first great war, Burma began to lose some of her Western markets on account of the competition there from high-grade rices produced in America, Spain and Italy, and in 1931 a grant was made by the Imperial Council of Agricultural Research for Rice Research in Burma, half of the funds being provided by the Empire Marketing Board. A short account of the breeding work carried out during the period of the grant i. e., 1931—1937, is presented in this article. Since pure line selection is carried out on all Agricultural Stations, intensive work on hybridisation was taken up under the Rice Research scheme with the special purpose of synthesising high yielding strains with good quality grain so as to suit the

demand in the different markets. Sixty-six exotic varieties obtained from sub-tropical regions were submitted to yield tests, but all of them matured too early and proved to be very poor yielders. None of the imported tropical varieties could also out-yield the local strains. During the period of the grant a large number of crosses were made and studied with definite objects in view besides taking over 201 hybrid cultures in various generations from Hmwabi Agricultural Station. At the end of the period of the grant, two hybrid strains of a local Ngasein cross, which had come out successful in yield tests were under cultivation in about 10,000 acres in Lower Burma in 1938. The grain in both cases approach American Blue Rose variety in size and quality. The occurrence of sterility and partial sterility in crosses between local and exotic varieties proved to be a serious handicap but these were eliminated in 7 or 8 generations by rigorous selection of fertile plants. At the end of the period of the grant there were 450 hybrid cultures in various generations under study and 55 cultures were under yield test on the Rice Research Station and at various centres in the districts. Many of the hybrid cultures with good quality grain were also promising as regards yield. The quality of rice as demanded by the different markets was always kept in view in the course of the breeding scheme. Hard translucent rice is exclusively in demand in high-grade markets of Europe whereas high out-turns of whole rice in milling are desirable for all markets. The promising strains were submitted to milling tests both inside the laboratory and in a small commercial rice mill before being distributed to the cultivators. The advice of the various Chambers of Commerce in Rangoon was also regularly sought regarding the qualities of rice. The work carried out during the period of the grant from the Imperial Council of Agricultural Research indicated that considerable improvement can be effected in the Burma rice crop by breeding and selection, particularly as regards commercial quality. Most of the cultures under study at the end of the period of the grant were of much better quality than those obtained by pure line selection within local varieties, and from yield tests that were in progress at that time there was every indication that quality could be combined with satisfactory yielding capacity. —K. R.

The effect of differential irrigation and spacing on the field behaviour and quality of Cambodia CO_2 cotton, Ramanatha Ayyar, V. Nazir Ahmad and N. C. Tirumalachari, *Ind. Jour. Agri. Sci.* 10 (1940) : 493.

Nearly 60 per cent of the area under Cambodia cotton in Madras Province is being irrigated from water lifted from wells and irrigation forms an expensive item in the cost of production It was therefore thought desirable to find out if the present practice of cotton growers to irrigate their crop very frequently was not wasteful. With this purpose, experiments were conducted during 1932—1935 on the Cotton Breeding Station in Coimbatore, to determine the optimum frequency of irrigation for a crop of Cambodia cotton and to study whether such frequencies would affect the qualities of fibres. In the trials conducted during the first two years, the soils were reddish loam and the soil used in the third year was distinctly alkaline and heavy, with defective drainage. The irrigational treatments were confined to the non-rainy period from the middle of December to the middle of April during which the crop suffers from insufficiency of soil moisture. Twelve treatments in all were introduced, combining four variations in irrigation, viz., (1) No irrigation, (2) irrigation once a week, (3) irrigation once in two weeks, (4) irrigation once in three weeks and three variations in spacing viz., 4" and 9" between plants in ridges, and broadcast in beds. The treatments were laid out in randomised blocks replicated four times during the first two years and three times in the third year. The quantities of water consumed in each irrigation in all the treatments were measured with the help of Kents Lea recorder. Fibre tests included the determination

of the mean fibre length, mean fibre weight per inch and percentages of mature, half mature, and immature hairs. The spinning performance and yarn neppiness were also found out. The conclusions are summarised thus :— (1) Irrigating Cambodia after December improved the yield definitely, (2) Irrigating once a week tended to give the highest yields but not remunerative returns, (3) Irrigating once in three weeks was most profitable, (4) The quantity of water consumed at each irrigation by 'one week' plots was distinctly less than in plots irrigated once in three weeks, (5) There was little difference in the consumption of water between ridge and bed system of irrigation, (6) variations in the density of plant population had no effect on water consumption, (7) The frequency of irrigation and the different modes of sowing had no appreciable effect on the mean fibre length of this cotton, in the experiments of the first two years. In 1934—35, season, however, the 4 in. spacing gave, on the whole, somewhat higher mean length than 9 in. spacing, which, in its turn, gave slightly better results than broadcast sowing. (8) Hair weight per inch of cotton showed a tendency to increase with the amount of irrigation given to the crop. Mode of sowing had no effect on hair weight in the first two seasons, but in 1934—1935, samples from '4 in.' plots proved finer than from '9 in.' plots and 'broadcast' plots. (9) Irrigated samples contained a higher percentage of mature fibres than the unirrigated samples. The mode of sowing did not affect the maturity count in 1932—33 and 1933—34 seasons, but in 1934—1935, samples grown with 4 in. spacing contained a lower percentage of mature hairs. (10) The total loss sustained by this cotton in the blow room and the card room was independent of the mode of sowing, but, it was somewhat less when the cotton was grown under irrigation. (11) While the yarn neppiness of this cotton is independent of the mode of sowing adopted in this experiment, it is appreciably reduced by growing it under irrigation. (12) The mode of sowing did not affect the spinning performance. The yarns spun from irrigated samples gave lower strength as compared with those spun from the unirrigated samples. S. K.

Gleanings.

Economic Survey of Madras Villages. The Economics Department of the University of Madras is to be congratulated in conducting economic resurvey of the villages originally surveyed under the guidance of Dr. Gilbert Slater. The main conclusions which can be drawn from the results presented by Dr. Thomas are :—

(1) the growing rural congestion in certain areas and increasing sub division and fragmentation of holdings (2) the growing number of non-cultivating landholders and the increase of tenancy, (3) the large increase of landless labourers and the decay of customary relations between landowners and labourers, (4) slow progress of agricultural improvements. (5) growth of indebtedness, although the rates of interest had fallen much, (6) the growing disparity in the incidence of Land Revenue between different classes of land, calling for a readjustment of the Land Revenue system, (7) extensive progress in communications and breakdown of village self-sufficiency, (8) changes in diet—from millets to rice, from hand-pounded rice to milled rice—and the growing popularity of coffee and tea. Rural incomes range from Rs. 73 to 40 per head. Food supply seems to have kept pace with the growth of population, but while the quantity of carbo-hydrates available is more than adequate, there is an insufficiency of fats and proteins. During the period under survey, industrial areas have made more rapid progress than agricultural, largely owing to the protective tariff policy followed by Government. While the economic activities of Government in the past have greatly benefited the urban classes, the beneficial effect on the population of rural areas

has not been so appreciable, and everything points to the need for a concentrated effort in rural development.

The picture is by no means encouraging and however much those engaged in rural work including the Govenment may protect, there is no denying the fact of woeful neglect of villages. * * * * * [*Mad. Jour. Co-op.* 32 (1941) 390—391.]

Ripening of the Banana The banana differs from many other fruits in that cut from the tree (after allowing some forty days for early stages of development) it will continue to ripen, none the less the developmental processes at work whilst on the tree probably have a determining influence in respect of the time limits at which fruit may be cut for exportation, considerable practical importance probably is attached, therefore, to such studies as those described by H. R. Barnell of the Low Temp Res. Station, Imperial College of Tropical Agriculture, Trindad (*Ann. Bot.* N. S. 4, 1940). He has followed the changes in dry matters and various types of carbohydrates and acidity in the pulp and skin of the fruit, during development in the plant, from the time the fruits emerged until they rotted. It had been proposed to study the quality of fruit left to ripen on the plant but in these Trindad observations, after the 'hundredth' day, the fruit began to split and then to fall and rot. It would seem that the Gros Michel variety under these conditions is more suited to picking at an incipient ripening stage and export than home consumption as ripe fruit gathered from the plant. The banana is relatively unusual also in the low sugar content in the early stages of development when strach is rapidly accumulating; the splitting later is associated with a rise in water content of the pulp as the sugar content begins to increase. Off the plant, bananas at this period will ripen with sugar formation in the pulp, but there is less danger of splitting as only a relatively small amount of water can migrate into the pulp from the skin. Unlike the apple in its high starch accumulation and low sugar concentration, the banana also differs in that along with starch synthesis there is a continuous fall in the acidity of the pulp—rising acidity values are only met with as starch hydrolysis begins after about the 100th day. [*Nature* 146 (1940) 494.]

Agricultural Jottings.

PREPARATION OF COMPOST BY THE ONGOLE MUNICIPALITY

The actual preparation of municipal rubbish into compost with night-soil was started during August 1939 at the advice of the Agricultural Department by the Municipal Health Officer, Ongole. The following gives the details of work from August 1939 to the middle of 1940.

The composting yard is at first cleared, made even, and divided into 12 suitable plots with intervening pathways. Each one of the above plots represents, the composting product during a month. In a proportion of each of the above plot, a days street refuse and night-soil of the town is applied in the following way:—

The municipal street refuse after it is sorted out of stone and glass pieces etc., which it generally contains is at first spread, as a stack to a height of 1'—6" from the ground This forms the first layer of the heap and upon this night-soil and street refuse in layers of different thickness are again put, so that a complete heap that comprises of one day's street refuse and night-soil of the town, would be four feet six inches in height. A complete heap in this place, consists of the following layers from bottom to the top.

		Ft.	in.
1.	Height or thickness of the 1st layer of street refuse.	1	6
2.	Do night soil	0	9
3.	Do 2nd layer of street refuse ...	0	9
4.	Do night-soil	0	6
5.	Do 3rd or top layer of street refuse	1	0
	Total...	4	6

These heaps are raked up once in 10 days and sprinkled with water for four months after they are started. By this time the whole stuff gets mixed up and forms itself into a most inoffensive poudrette.

The proportion of night-soil added to the refuse during the process is approximately 1: 4.

Prior to the starting of this method the Municipality was simply trenching the night-soil and dumping the street refuse in separate places. Practically the night-soil trenches were never sold and the dumped street refuse when bid for auction used to get only a very insignificant amount. For instance the sale proceeds that the Municipality got for 12 months during 1938—39 was only Rs. 51. But compost product which resulted in hardly eight months from August 1939 to the end of March 1940 had fetched the Municipality an income of Rs 903/-.

Apart from the increased revenue that this method of disposal had fetched to the Municipality, it is attended with several other advantages which are absent in other methods of disposal. If only some regular attention is paid, the composting process can be successfully carried on, without any offensive odours emanating from the heaps. Even fly breeding can be said to be entirely nil.

No special staff has been engaged so far for this work in this Municipality. The work now is being adjusted by the regular scavengers only who are whole-time workers in this Municipality and whose business is also to sweep the streets and latrines in the town. Only for the last four months a skilled scavenger has been appointed exclusively to supervise the stacks and to watch the heaps. His monthly salary is only Rs. 9/-. *(From the Director of Agriculture.)*

COTTON SEED FLOUR

The manufacture of this product is described quite fully in *Food Industries*, July 1935, p. 342. This article referred to so called nutty brown flour made by the Nutty Brown Mills of Houston, Texas. Another flour which is used in this country for food purposes is made by the Traders Oil Mill, Fort Worth, Texas. This product is called 'Pro Flo'. According to the Connecticut (New Haven) Agricultural Experiment Station Bulletin 476, nutty brown flour contains 7·4 per cent moisture; 5·5 per cent ash; 4·0 per cent fibre; 12·7 per cent fat; 49·1 per cent protein and 21·3 per cent nitrogen free extract. The latter includes about 6 per cent of starch.

Texas Agricultural Experiment Station Bulletin 128 relates to cotton seed meal as a human food and gives considerable information along this line.

In the *Jour. Ind Eng. Chem.* Vol. 6, p 338 (1914), C. A. Wells tells of the characteristics of cotton seed flour.

The following U. S. patents should prove of interest: 1,276,447 and 1,142.243.

According to *Food Industries* mentioned above, cotton seed is thoroughly cleaned to remove dirt and then subjected to the linters machine where about 20 pounds of lint are removed per ton of seed. The seed thus partially cleaned is subjected to a second battery of linters where an additional 75 pounds of lint is removed. This cleaned seed is then sent to the hullers, which remove the hulls; the kernels are subsequently purified and the meats are conveyed to pressure rolls where they are converted into flakes about one hundredth of

an inch thick. The rolling operation prepares the meats for cooking and pressing. Cakes are formed under 350 pounds pressure. One ton of cotton seed yields 310 pounds of oil, 506 pounds of hulls, 95 pounds of lint, 8 pounds of miscellaneous or foreign material, 150 pounds of water and 920 pounds of oil cake, from which approximately 600 pounds of flour are obtained.

(*From the Director of Agriculture.*)

SCHOOL CHILDREN FIGHT HAIRY CATERPILLAR PEST

For many years past the Department of Agriculture has been endeavouring to persuade ryots to co-operate in fighting the Hairy Caterpillar Pest and in some districts the Agricultural Pests and Diseases Act has been in force. Both persuasion and compulsion have in most cases not been fully effective.

It was thought that it is not common sense for the children in villages to sit in school when this pest is literally devouring their fathers' crops. With the approval of the Director of Public Instruction, the Presidents of District Boards in areas where the pest was likely to be serious were therefore requested to issue instructions to all elementary schools in the areas affected directing all teachers and children to work as volunteers in the afternoon for a week or two when this pest appears, under the supervision of the local agricultural officers. The work expected of the teachers and children were: (1) persuading ryots to take the necesssary control measures advocated by the department, and (2) picking egg masses on waste lands which no one else is dealing with. The procedure adopted was that the local Assistant Director of Agriculture declared "an agricultural emergency" when the pest threatened to be serious in any area and then applied to the President, District Board, to issue necessary instructions for the purpose referred to above.

Reports received from North Arcot, South Arcot and Tanjore Districts show that the participation by elementary schools in the fight against the pest was both willing and effective. (*From the Director of Agriculture.*)

Moffussil News.

Guntur. An Agricultural Exhibition on a large scale was arranged at the Hindu College, Guntur on the 14th and 15th December last and the credit for its grand success goes to a large extent to Sri. P. Venkateswara Rao. B. Sc. Ag., Lecturer in Agriculture at the college. Sri. R. Swami Rao, Assistant Director, Guntur opened the exhibition which consisted of a model orchard arranged by the late Sri. P. Parthasarathy, B. Sc. Ag., and a large variety and collection of exhibits from the Agricultural Research Station, Guntur.

The monthly social gathering organised last April, at which all the officers, friends and well wishers of the Agricultural and Live-stock Research Stations, Guntur, meet every month at Tea for social contact and exchange of ideas, continues with great enthusiasm and has been responsible for popularising the activities of the station and directing the attention of those interested in the locality. At the gathering held this month on the 6th instant, several gentlemen including Sri. R. Swami Rao, Assistant Director, Guntur, spoke in touching terms referring to the untimely demise of two of the officers of the station, both of whom were connected with the newly started fruit work at the station. The late Sri. K. Rajabapanya and the late Sri. P. Parthasarathy were trained in fruit work, were unostentatious and extremely capable in their work and their premature death is a severe loss to the Department.

Old students and friends of the late Dewan Bahadur K. Rangachariar who was Government Lecturing and Systematic Botanist at Coimbatore will be glad to learn that one of his sons Sri. K. Seshadri, now working at the Agricultural Research Station, Guntur, has been selected by the Civil Aviation Department New Delhi, for training in the Indian Air Force in accordance with the newly started scheme for training of pilots and mechanics for the air force. He has been posted for training at Calcutta.

P. M. Kharegat Esq , I. C. S., C. I. E., Vice Chairman, Imperial Council of Agricultural Research accompanied by Rao Bahadur B. Viswanath, Director of the Imperial Agricultural Research Institute, New Delhi, visited the Station on the 6th February 1941. The distinguished visitors showed keen interest in the work of the station and a small but imposing show was put up showing the achievements of the station in crop improvement work and on the new line of profitable disposal of virginia tobacco seed. The same afternoon, the Vice-chairman opened the first Market yard at Guntur for the Tobacco Market Committee at Guntur. Sanction has been obtained for making a survey in the chilli (*Capsicum*) growing tracts of the presidency with a view to collect resistant types in connection with the improvement work on chillies now in progress at the Agricultural Research Station, Guntur. Sri. M. P. Narasimha Rao, Cotton Assistant has started the survey work this month in the Circars. S. V. D.

Avadayarkoil. An agricultural exhibition on a small scale was conducted at Avadayarkoil (Arantangi taluk) on the 10th and 11th January 1941 during the *Arudradarisanam* festival. Different departmental paddy strains, sugarcane varieties, fodder grasses, varieties of green manure seeds, and crops raised in pots, improved implements and posters on all crops &c., were exhibited at the stall. Nearly 20,000 visitors who were mostly agriculturists visited the stall and evinced keen interest. A large number of querries put by the interested ryots regarding, bee keeping, cultivation of sugarcane, cotton and green manure crops etc., were answered in detail by the Agricultural Demonstrator, Arantangi. Two lectures were delivered on improved methods of agriculture. During the exhibition 1,000 Napier grass slips and 20 lbs of kolinji seeds were sold and the former planted in two places. The Trustee of the Avadayarkoil Devasthanam, Sri Namasivaya Thambiran and the Superintendent took keen interest in the exhibition. The Tanjore District Board with their Rural Reconstruction van and Radio set and the Public Health Department participated in the exhibition and made it a success. A. G. N.

Chidambaram. An agricultural exhibition was held during the local *Arudra Dharsanam* festival at Chidambaram from the 6th to 12th January 1941. It attracted more than 10,000 visitors from the rural areas of the neighbouring taluks. Paddy and rice samples of the important strains of Aduturai, Palur and Coimbatore Agricultural Research Stations, Groundnut, gingelly and castor selections from Tindivanam station, budded citrus and grafted mango plants from Kodur Fruit Research Station, were exhibited. Sugarcane varieties, fodder grasses and plantain varieties from Palur and Aduturai were on view. Improved implements for tillage and interculture, cream jaggery and malt samples appliances and chemicals used in the control of pests and diseases were also among the exhibits. Illustrated posters in the local languages detailing all the improvements advocated by the Department were a feature. Two lantern lectures and several ordinary lectures were delivered to the interested ryots by the local Agricultural Demonstrator and the plant pathological Demonstrator of the division. M. A.

Correspondence.

To

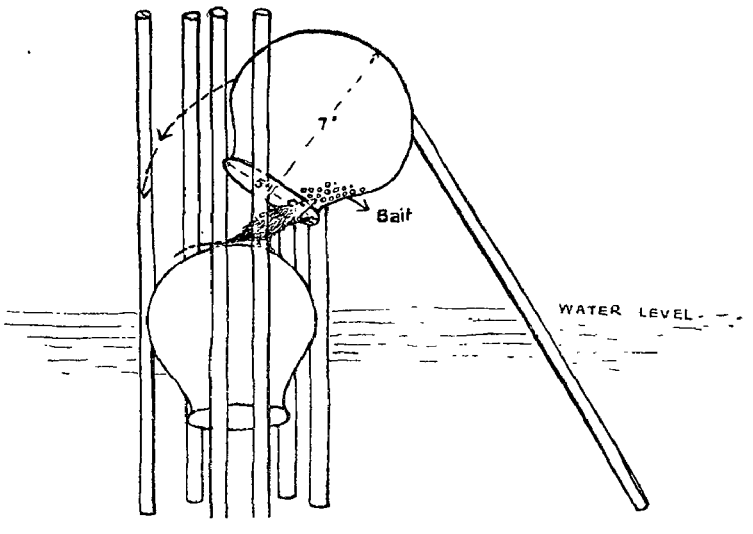
The Editor, Madras Agricultural Journal.

I. A simple rat-trap.

Sir,

Field rats are one of the most common pests of paddy, taking a heavy toll of the crop at times. The rodent damage especially in a rice research station, where valuable comparative yield trials are conducted in strip plots is a great nuisance, vitiating the results of the experiments and so to keep the rat trouble under control, various methods such as, (1) cyanogas fumigation of the rat-holes (2) placing poisonous rat baits like sodium arsenate or barium carbonate mixed with cooked rice, on the field bunds, (3) hand catching by professional rat-catchers, and (4) a local device of trapping rats by two small mud pots, were tried in this station. Among these, the last method has been found to be most efficient and quite successful and it is described below.

This rat-trap is a simple device and consists in setting up two small mud pots (capacity one and a half Madras Measure by volume) by means of seven bamboo stakes ($2' \times \frac{1}{2}'' \times \frac{1}{2}''$), one pot is placed with its mouth downwards in the soil and it is tightly held in position by six bamboo stakes. This inverted pot is pressed into the puddle soil keeping its top surface 2 to 3 inches above the level of water in the field. Just over and above this pot, another pot of the same size is rested on three bamboo stakes 20 inches long in a tilting position as shown in the diagram. Care should be taken to adjust it in such a way that when it is lightly touched it is tilted and slips down on to the resting pot. Fried paddy grains of good aroma and flavour are placed inside the catch pot and some grains are placed on the top of the bottom pot also. When a rat attempts to eat the bait inside, the top pot which is kept in a tilting position falls suddenly on the resting pot trapping the animal.



A cooly goes round the field every morning and kills the trapped rats. The top pot is gently raised about $\frac{1}{2}$ inch when the tail of the rat is protruded. The rat is pulled by its tail and by manipulating the pressure on the body of the rat, he takes hold of the neck in a firm grip. In the case of small and medium sized animals the pressure exerted on its neck by the rim of the top pot is enough to kill them. With full grown animals the catcher grips them firmly by the neck with one hand and by the other hand gives a quick and forcible pull to the tail. This kills the rat instataneously.

This rat trap is quite simple and cheap costing about one anna only. A dozen such traps set up in an acre from the shot-blade period of the crop may be

adequate to trap the rodents visiting the field. It may be recorded that by this method 75 field rats were effectively trapped and destroyed at this station during the year 1939-40.

Being cheap, simple and efficacious this method may commend itself to any ordinary ryot to keep the rodent trouble under control.

Yours etc.,

Rice Research Station.
Ambasamudram, Tinnevelly.

M. Subbiah Pillai.
S. Krishnamoorthi.

To

The Editor, Madras Agricultural Journal.

Sir,

II. Croton Sparsiflorus—manurial value.

Anent the article on "Two exotic weeds—How best to use them" published in October 1940, I may be permitted to draw the attention of the readers of the *Madras Agricultural Journal*, to the fact that 4,000 lb. of green-matter of the weed. *Croton sparsiflorus* was compared against an equal amount of sunnhemp (*Crotolaria juncea*) with a 'no-manure' control for three seasons (1933—35) at the Rice Research Station, Berhampur. The results on the paddy crop showed that the effect of the application of the weed was as good as that of sunnhemp, and gave an average increased yield of 12 per cent of grain over 'no manure'.

Agricultural Research Station,
Maruteru, W. Godavari Dt.

Yours etc.,
M. B. V. Narasinga Rao.

Crop and Trade Reports.

Statistics—Paddy—1940-41—Final forecast report. The average of the areas under paddy in the Madras Province during the five years ending 1938-39 has represented 13·2 per cent. of the total area under paddy in India.

The area sown with paddy in 1940-41 is estimated at 10,467,000 acres as against 9,614,000 acres for the corresponding period of the previous year and the finally recorded area of 9,884,316 acres in 1939-40. The present estimate exceeds the final area of the previous year by 5·9 per cent. and the area of 10,211,440 acres in a normal year by 2·5 per cent.

1,539,000 acres have been reported as sown since the last December forecast was issued. The extent so sown was large in the South (420,000 acres), the Carnatic (405,000 acres), the Central districts (290,000 acres) and the Circars (230,000 acres). The area sown in December and January was greater than that sown in the corresponding period of the previous year by 411,000 acres or by 36·4 per cent.

The area under second crop paddy is expected to be above normal owing to the heavy rains received in November in most districts.

The harvest of the main crop of paddy is in progress.

The crop was affected to some extent by the heavy rains in November 1940 in parts of the districts of South Arcot and Tanjore, by drought in parts of the districts of Vizagapatam, East Godavari and West Godavari, by the attacks of insects in parts of the districts of Chittoor, North Arcot and Coimbatore and by plant diseases in parts of the districts of Guntur, Anantapur Cuddapah and Tanjore. The yield is expected to be above the normal in Salem (110 per cent.), normal in Kurnool, Bellary, Nellore, Madura, Ramnad, Tinnevelly and the Nilgiris and below the normal in the other districts. The seasonal factor for the Province works out to 95 per cent. of the average as against 90 per cent. in the Season and Crop Report of the previous year. On this basis, the yield works out

to 100,540,000 cwt. of cleaned rice. This represents an increase of 11,202,000 cwt. of cleaned rice or 12·5 per cent. when compared with the estimate of 89,338,000 cwt. of cleaned rice in the season and Crop Report of the previous year. The yield in an average year is estimated at 102,450,000 cwt. of cleaned rice.

The wholesale price of paddy, second sort per imperial maund of 82⅔ lb (equivalent to 3,200 tolas) as reported from important markets on 10th February 1941 was Rs. 3—9—0 in Rajahmundry, Rs. 3—7—0 in Masulipatam, Rs. 3—6—0 in Guntur, Rs. 3—5—0 in Ellore, Rs. 3—4—0 in Bezwada, Rs. 3—0—0 in Vizianagaram and Tinnevelly, Rs. 2—14—0 in Chittoor, Rs. 2—13—0 in Cocanada and Virudhunagar, Rs. 2—12—0 in Vellore, Rs 2—11—0 in Hindupur and Mangalore, Rs. 2-9-0 in Trichinopoly, Rs. 2—7—0 in Madura, Rs. 2—5—0 in Negapatam, Rs. 2—4—0 in Cuddalore and Kumbakonam; Rs 2—1—0 in Conjeevaram and Rs. 1—14—0 in Anantapur. When compared with the prices published in the last report, i e., those which prevailed on 6th January 1941, the prices reveal a rise of approximately 14 per cent. in Rajahmundry, 12 per cent. in Masulipatam, 8 per cent. in Guntur, 6 per cent. in Ellore and 4 per cent. in Bezwada and a fall of approximately 32 per cent. in Anantapur, 30 per cent. in Madura, 23 per cent. in Kumbakonam, 18 per cent. in Negapatam, 16 per cent. in Trichinopoly, 10 per cent. in Virudhunagar, 8 per cent. in Cocanada and Cuddalore and 7 per cent. in Hindupur, the prices remaining stationary in Vizianagaram, Conjeevaram, Chittoor, Vellore and Tinnevelly. *(From the Director of Industries and Commerce.)*

Statistics—Crop—Sugarcane—1940—Third or final report. The average of the areas under sugarcane in the Madras Province during the five years ending 1938—39 has represented 2·8 per cent. of the total area under sugarcane in India.

The area planted with sugarcane in 1940 is estimated at 161,850 acres. When compared with the corresponding estimate of 132,010 acres for the previous year and the actual area of 137.633 acres according to the Season and Crop Report, the present estimate reveals an increase of 22·6 per cent and 17·6 per cent respectively. The estimate of the previous year fell short of the actual area by 4·1 per cent.

The present estimate of area exceeds the second forecast by 12·430 acres. The excess occurs mainly in Kistna. South Arcot, and the Central Districts.

The estimated area is the same as that of last year in Tinnevelly. A decrease in area is estimated in Nellore and Coimbatore and an increase in area in the other districts of the Province, especially in South Arcot (plus 8,740 acres), North Arcot (plus 4,200 acres) and Salem (plus 3,760 acres). The area estimated for Vizagpatam, West Godavari, Kistna, Bellary, Anantapur, Cuddapah Chingleput, South Arcot, North Arcot, Salem, Trichinopoly and Tanjore is the highest reported in recent years. The increase in area is due to the favourable price for jaggery which prevailed before the planting season.

The present estimate includes an area of 15.150 acres under ratoon sugarcane in the districts of Vizagapatam (7,000 acres), East Gadavari (2,500 acres), West Godavari (900 acres). Kistna (200 acres), Bellary (1. 400 acres). Chingleput (80 acres), South Arcot (1,200 acres), Chittoor (900 acres), Coimbatore (800 acres), Trichinopoly (100 acres). (Tanjore 50 acres) and Malabar (20 acres).

The crop suffered to some extent from heavy rains in South Arcot, Coimbatore and Trichinopoly. The condition of the crop is generally satisfactory in the other districts.

The harvest has just commenced. Yields above normal are expected in Kurnool, North Arcot and Salem (110 per cent). The yield is expected to be normal in Kistna, Guntur. Anantapur, Nellore, Chingleput, Chittoor, Tanjore, Madura Ramnad and South Kanara and below the normal in the other districts. The seasonal factor for the Province as a whole is estimated at 97 per cent of the

average as against 95 per cent in the previous years according to the Season and Crop Report. On this basis, the yield is estimated at 4,416.610 tons of cane or 481,510 tons of jaggery (gur) as against 3,753,380 tons of cane or 409,260 tons of jaggery (gur) according to the final figures as revised with reference to the revised figures of normal yield per acre of the previous year. The present estimates reveal an increase of 17·7 per cent over those for the previous year.

The wholesale price of jaggery per imperial maund of 82⅔ lb. (equivalent to 3,200 tolas) as reported from important markets on 27th January 1941 was Rs. 4—3—0 in Erode, Rs. 4—2—0 in Adoni, Rs. 4—1—0 in Cuddalore, Rs. 3—15—0 in Salem, Rs. 3—14—0 in Vizianagaram and Mangalore, Rs. 3—7—0 in Chittoor Rs. 3—5—0 in Rajamundry, Rs. 3—2—0 in Vellore, Rs. 2—15—0 in Cocanada Rs. 2—14—0 in Bellary and Trichinopoly, Rs. 2—8—0 in Vizagapatam and Rs. 2—6—0 in Coimbatore. When compared with the prices published in the last report, i. e., those which prevailed on 9th December 1940, these prices reveal a fall of approximately 29 per cent in Cocanada, 22 per cent in Rajamundry, 18 per cent in Erode, 13 per cent in Mangalore and Chittoor, 12 per cent in Trichinopoly, six per cent in Nellore and three per cent in Cuddalore, the prices, remaining stationary in Vizianagaram, Adoni, Bellary, Salem and Coimbatore.

(*From the Director of Industries & Commerce, Madras*).

Statistics—Crop—Gingelly—1940-41—Intermediate condition report.

Sowings of late gingelly are in progress in most districts and the germination is reported to be satisfactory.

The wholesale price of gingelly per imperial maund of 82⅔ lb. (equivalent to 3,200 tolas) as reported from important markets on 10th February 1941 was Rs. 6-12-0 in Tinnevelly, Rs. 6-10-0 in Tuticorin, Rs. 6-8-0 in Cocanada, Rs. 6-7-0 in Cuddalore and Trichinopoly, Rs. 6-1-0 in Salem, Rs. 6-0-0 in Vizianagaram, Rs. 5-13-0 in Rajahmundry, Rs. 5-11-0 in Ellore and Rs. 5-8-0 in Vizagapatam. When compared with the prices published in the last report, i. e., those which prevailed on 6th January 1941, those prices reveal a rise of approximately ten per cent in Ellore, five per cent in Salem and Tuticorin and one per cent in Trichinopoly and a fall of approximately four per cent in Rajahmundry, the prices remaining stationary in Vizagapatam, Vizianagaram, Cocanada, Cuddalore and Tinnevelly. (*From the Director of Industries, Madras*).

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1940 to 31st January 1941 amounted to 541.922 bales of 400 lb. lint as against an estimate of 366,80 bales of the total crop of 1930-40. The receipts in the corresponding period of the previous year were 496,291 bales. 583,487 bales mainly of pressed cotton were received at spinning mills and 136.428 bales were exported by sea while 161,923 bales were imported by sea mainly from Karachi and Bombay.

(*From the Director of Agriculture, Madras*).

The late Sri. M. Sambanda Mudaliar

(Patron of The Madras Agricultural Students' Union).

OBITUARY

We record with regret the demise of one of our esteemed patrons, Mr. M. Sambanda Mudaliar, B. A., B L., Advocate, Coimbatore. Mr. Sambandam was born in the year 1869, at Madras, of respectable parents. His father, Mr. Muthukrishna Mudaliar was Tahsildar for a number of years in Coimbatore district. Mr. Sambandam was one of the leading advocates in Coimbatore and acted twice as Public Procecutor for short periods. He was a Councillor of the Coimbatore Muncipality for nearly 25 years and was elected Chairman for two terms. This good work and experience in municipal affairs won him a certificate of merit and a silver medal in 1911 and he was honoured by an invitation from the Government of India for attending the Delhi Durbar.

Mr. Sambandam was an elected member of the first Madras Legislative Council under the Minto-Morley Reforms and was also a member of the first Indian Legislative Assembly under the Montagu-Chelmsford Reforms. He was appointed Commissioner for Hindu Religious Endowment Board in 1930 and retired as its acting President in 1935.

He was a patron of Tamil learning and music and a deeply religious man and was a stout champion of popular interests and personal and public liberties. His love for the ryot was no less and he became a patron of the Madras Agricultural Students' Union in 1917.

Mr. Sambandam was very much loved by the people whom he served loyally in several spheres of life for over 50 years.

He passed away in October 1940 mourned by his devoted children, a large circle of friends and the townsmen of Coimbatore. The *Madras Agricultural Journal* joins them in paying the last tributes to the memory of a noble soul and conveys its sympathies to the members of the bereaved family.

College News and Notes.

Students' Corner. *Club activities.* Under the auspices of the Students' Club Sri N. Lakshmanan, founder-secretary of the Tagore Academy, delivered a lecture on 'The creative joy through dancing' on 31st January 1941 at 6 p. m. in the Freeman Hall. Sri R. Srinivasa Ayyangar, B. A , L. T , Headmaster, Saravajana High School, presided. The lecture was accompanied by a dance recital by the lecturer's pupils. A purse of Rs. 22—8—0 was presented to the Academy in appreciation of its invaluable services rendered to the public.

Essay competition. The annual easay-writing competition was held on 10-2-41 in the Freeman Hall. The subject was "Why India should participate in the present war?" and the length of the essay was limited to five pages. Messers B. Seshavatram, N. Srinivasalu and A. Adivi Reddy were the successful candidates in the descending order of merit.

Elocution contest. Sir M. Visweswara Ayya's saying 'Industrialise or Perish' was the subject for the general annual elocution contest held at 6 p. m. in the Freeman Hall on 10—2—41. Speakers were allowed each five minutes to express their opinion. Sri N. Lakshmanan and Mr. K. A. Joseph, Lecturers, Government College and Sri C. S. Chokalingam Pillai acted as the judges. Messers H. Gurubasappa, B. Seshavataram and G. V. Raghavalu were declared first, second and third, respectively.

Inter-tutorial competitions. In the intertutorial elocution contest held on 17—2—41 at 6 p. m. in the Freeman Hall, Sri B. M. Lashmipathi's wards represented by Messers Seshavataram and S. N. Ramasubramaniam were declared winners.

Cricket. Mr. P. V. Ramiah's wards having defeated Sri C. Narasimha Ayyangar's wards and Sri C. R. Srinivasa Ayyangar's wards, met, on 16—2—41 Mr. K. M. Thomas' wards who had previously defeated Sri B. M. Lakshmipathi's wards. Mr. Thomas' wards won by 8 wickets and 4 runs, having scored 70 runs for two wickets, (Shanker Rao 26, Nageswara Rao 15 not out, Somanna 18 not out), Mr. P. V. Ramiah's wards scored 66 all out.

Foot-ball. Sri. M. Kantiraj's wards won creditably after a very keen fight with Sri. B. M. Lakshmipathi's wards.

Hockey. Mr. K. M. Thomas's wards came out victorious in the finals against Sri. C. R. Srinivasa Ayyangar's wards by scoring a goal in the second half of the extra time.

Inter-class matches. *Victory cup tournament.* The victory cup was annexed by class III by winning hockey and foot-ball events.

Parnel cup. Parnel cup for inter-class hockey, was won by class I after a keen contest with class III.

Award of College colours. The College colours for the year were awarded to the following students for proficiency in various games and sports.

(a) *Athletics.* Messrs. H. Narayana Kamath of class III and Govidaswami of class I.

(b) *Crickets.* Messrs. Monappa Hegde of class III and C. Shankara Rao of class II.

The Maharaja of Travancore Curzon memorial lectures. Under the auspices of the Madras University, Dr. M. Damodaram, Director, Bio-Chemistry Laboratory,

Madras University, delivered a course of three lectures on 3rd, 4th and 5th February 1941. The subject for the lectures, was "The nitrogen metabolism and feeding of plants and animals". The lectures were greatly appreciated and a large number of students and officers attended the meetings.

Visitors. F. Rodrigo Esq., C.C.S., Director of Agriculture, Ceylon, Dr. M. Damodaram, Director, Bio-chemistry laboratory, Madras University, and Dewan Bahadur Sri. T. Ananthachariar, Member, Madras Public Services Commission, visited the Agricultural College and Research Institute during the month.

Personal. Consequent on the leave granted to Rao Bahadur K. T. Alwa, Headquarters Deputy Director of Agriculture, Madras, preparatory to his retirement Mr. T. Budhavedeya Rao Nayudu, Superintendent, Livestock Research Station, Hosur, has been appointed instead. We offer our felicitations to Mr. Nayudu on his well-merited appointment.

OBITUARY

Sri A. Gnanadurai Pandiaraj David. It is with profound regret that we record the untimely death of Sri A. Gnanadurai Pandiaraj David, B. Sc. Ag., Fieldman at the Agricultural Research Station, Pilicode (South Kanara Dt.) of snake bite. Mr. Pandiaraj was as usual returning home after a walk along with his friends when he was bitten by the reptile at about 8 p. m. on the 31st January. In spite of best medical aid and all efforts made by his colleagues to save his life, he succumbed to the effect of the poison on 6th February 1941. Mr. Pandiaraj passed out of the Agricultural College, Coimbatore in May 1939 and was entertained as a fieldman in the Oilseeds Section and posted for work at the Coconut stations. He was a promising young man, intelligent and industrious and was liked by one and all alike. The large number of people who attended his funeral at the Christian Cemetery at Nileshwar bore ample testimony to his popularity. In Mr. Pandiaraja's death the Oilseeds Section has lost an excellent and enthusiastic worker. He leaves behind him his widowed mother and a large number of relations and friends and a band of sorrowing colleagues to bemoan his loss.

Sri Sakkarama Rao. We record with deep regret the death of Sri K. Sakkarama Rao, Head Clerk, Office of the Senior Lecturer and Superintendent, Central Farm, Coimbatore. Born on 22—7—1891, he entered service as a clerk in the Government Mycologist's Office on 1—8—1913. Later on he was transferred to the districts and served as Head Clerk in the Deputy Director's offices in Coimbatore, Trichinopoly, Guntur and Madura. He died of paralysis on 6th February 1941 in spite of best medical aid. He leaves behind his wife, his aged father, a son and a daughter, and many relatives and friends, to whom we offer our sympathy.

Weather Review—JANUARY 1941.

RAINFALL DATA

Division	Station.	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since 1st Janaruy
Circars	Gopalpore	0·0	−0·2	0·0	South	Negapatam	1·7	0 0	1·7
	Calingapatam	0·0	−0·3	0·0		Aduthurai *	1·2	−2·2	1·2
	Vizagapatam	0·0	−0·5	0·0		Madura	1·4	+0·8	1·4
	Anakapalli*	0·0	−0·3	0·0		Pamban	4·9	+2·8	4 9
	Samalkota*					Koilpatti*	1·7	+0·3	1·7
	Maruteru*	0·0	0·0	0·0		Palamkottah	1·4	−0·1	1·4
	Cocanada	0·0	−0·2	0·0					
	Masulipatam	0·0	−0·2	0·0					
	Guntur*	0·1	+0·1	0·1	West	Trivandrum	0·9	0·0	0·9
Ceded	Kurnool	0·1	−0·1	0·1	Coast	Cochin	1·7	+1·0	1·7
Dists.	Nandyal*	0·0	0·0	0·0		Calicut	0·6	+0·2	0·6
	Hagari *	0·0	0·0	0·0		Pattambi *	0·0	−0·2	0·0
	Siruguppa*	0·3	+0·2	0·3		Taliparamba *	0·0	0·0	0·0
	Bellary	0·0	−0·1	0·0		Kasargode *	0·0	−0·2	0·0
	Anantapur	0·0	−0·4	0·0		Nileshwar*	0·2	0·0	0·2
	Rentachintala	0·0		0·0		Mangalore	0·0	−0·1	0 0
	Cuddapah	0·3	−0·1	0·3					
	Anantharaju-pet*	0·1	−0 6	0·1	Mysore and Coorg	Chitaldrug	0·1	−0·2	0·1
Carnatic	Nellore	0·0	−1·7	0·0		Bangalore	0·2	−0·1	0·2
	Madras	0 7	−0·7	0·7		Mysore	0·1	0·0	0·1
	Palur*	2·7	+1·4	2 5		Mercara	0·0	−0·2	0·0
	Tindivanam *	1·0	0·0	1·0					
	Cuddalore	3·3	+1·7	3·3	Hills	Kodaikanal	4·1	+1·2	4·1
Central	Vellore	0·5	−1·0	0·5		Coonoor			
	Gudiyattam*	0·5	−0·5	0·5		Ootacamund *	1·3	0·0	1·3
	Salem	0·1	−0·2	0·1		Nanjanad *	0·9	−0·2	0·9
	Coimbatore	0·8	+0·2	0·8					
	Coimbatore A. C. & R. I.*	1·4	+0 7	1·4					
	Trichinopoly	0·2	−0·5	0·2					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated up to 1937 (published in Fort St. George Gazette).

Weather was generally dry over the whole area except for one spell of widespread rains over the South between the 7th and 9th of the month and for some scattered showers at the beginning of the month and again between the 18th and 25th.

Rainfall was generally below normal, except in parts of the South Coromandel Coast and in parts of the Coimbatore district and hills.

The chief falls of rain were:—

Cuddalore	3·1″	7th.
Pamban	2·5″	8th.
Kodaikanal	2·0″	7th.
Coimbatore A. C. & R. I.	1·1″	8th.

Weather Report for the Agricultural College and Research Institute Observatory.

Report No. 1/41.

Absolute maximum in shade.	...	90°F
Absolute minimum in shade.	...	56·5°F
Mean maximum in shade.	...	85·5°F
Departure from normal.	...	−0·4°F
Mean minimum in shade.	...	66·0°F
Departure from normal.	...	+1·8°F
Total rainfall for the month.	...	1·37 inches.
Departure from normal.	...	+0·67 ,,
Heaviest fall in 24 hours.	...	1·05 ,,
Total number of rainy days.	...	3
Mean daily wind velocity.	...	1·2 m. p. h.
Departure from normal.	...	−1·8 ,,
Mean humidity at 8 hours.	...	79·9 %
Departure from normal.	...	+3·7 %

Summary. Rain to the extent of 1·37 inches, constituting an excess of 0·67 inches over the normal, was received during the month. The temperatures during the day time were nearly normal while during nights were slightly above normal. The skies were heavily to moderately clouded and the relative humidity was above normal. The movement of air was below normal. P. V. R. & R. S.

Departmental Notifications.

Gazette Notification.

Appointments.

The temporary post of Gazetted Assistant to the Principal, Agricultural College, the appointment of Sri P. Krishna Rao as temporary Gazetted Assistant to the Principal, Agricultural College, Coimbatore is extended from 24th December 1940 till 23rd December 1941 or until further orders whichever is earlier.

Sri P. N. Krishna Ayyar on the termination of his temporary appointment as Parasitologist on 29th January 1941 is appointed to officiate as Assistant Entomologist, Coimbatore in Category 7 Class I Madras Agricultural Service.

Sri S. Ramachadra Ayyar, officiating Assistant Entomologist, Coimbatore on relief by Sri. P. N. Krishna Ayyar, will revert to his permanent post as Assistant in the Entomology Section, Coimbatore in the Madras Agricultural Subordinate Service.

Subordinate Services.

Appointment

Sri. P. S. Narayanaswami Ayyar whose present officiating appointment in the Entomology section terminates on 29th January 1941, will continue to officiate as Assistant in the same section from 30th January 1941 to 28th February 1941 vice Sri. M. S. Kylasam granted leave.

Transfers.

Name of officers.	From	To
Sri. C. Raman Moosad,	A. D. Manjeri	F. M., A. R. S., Nanjanad.
„ P. Nagadhara Naidu,	Secretary, Cotton Market Committee, Nandyal	II Circle, Cuddapah.
„ S. V. Ramachandran,	A. D., Tenkasi	A. D., Satur sub-circle.
„ K. Dorai Raj,	A. D., Cuddapah	A. D., Hospet.
„ P. K. Natesa Iyer,	A. D., Omalur	A. D., Rasipuram.
„ N. S. Rajagopala Iyer,	A. D., Rasipuram	A. D., Krishnagiri.
„ P. A. Narayanan Nambiar,	A. D., Krishnagiri	A. D., Omalur.
„ L. Krishnan,	A. D., Tanjore	A. D., Trichinopoly sub-circle.
„ K. S. Krishnamurthi,	A. D., Trichinopoly	A. D., Tanjore.
„ T. V. Srinivasacharlu,	A. D., Tanjore	A. D., Ambasamudram.
„ S. Rajarathnam Chetti,	F. M., A. R. S., Nanjanad	A. D., IV circle.
„ E. K. Govindan Nambiar,	F. M, A. R. S., Taliparamba	C. F., Coimbatore.
„ P. S. Narayanaswami Ayyar,	Asst. in Entomology Section, Coimbatore.	Asst. Chemistry Section, Coimbatore.
„ N. C. Tirumalachari,	F. M., C. B. S., Coimbatore	A. D., Srivilliputhur for special duty.

Leave.

Name of officers.	Period of leave.
Sri C. S. Namasivayam Pillai, Asst. A. D., Nangunery.	Leave on half average pay on m. c. for 4 months from 19-1-41.
„ L. Sankarakumar Pillai, A. D., Rasipuram.	Extension of l. a. p. on m. c. for 1 month from 4-2-41
„ M. Bhavani Shanker Rao, Assistant Groundnut Scheme, A. R. S., Tindivanam.	Extension of earned leave from 5-2-41.
„ S. Viravarada Raju, A. D., Trivellore.	L. a. p. for 3 months from 5-2-41.
„ B. N. Padmanabha Ayyar, A. D., Gingee.	Extension of l. a. p. on m. c. for 2 months from 1-2-41.
„ M. C. Krishnaswami Sarma, Asst., A. D., Sattur.	L. a. p. on m. c. for 4 months from 27-1-41.
„ V. S. Rangacharlu, F. M., F. R. S., Koduru.	Leave on half-average pay on m. c. for 2 months from 25-1-41.
„ V. Achutaramayya, A. D., Jami.	Extension of l. a. p. on m. c. for 4 weeks from 9-2-41.
„ Parameswarajotilaksminatha, Asst., A. D., Bhimilipatam.	Extension of leave on half average pay for 6 months from 1-12-40.
„ N. G. Narayana, Asst., Mungari Scheme.	L. a. p. for 30 days from the date of relief.
„ S. Madhava Rao, F. M., C. F., Coimbatore.	L. a. p. on m. c. for 2 monts from 9-2-41.
Janab A. Azimuddin Sahib, A. D., Nilakottai.	Granted earned leave on m. c. for 59 days from 3-2-41.