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Editorial.

Railway freight on dry cows from Madras. In the October issue of this Journal we, while commending the steps taken by the Indian Merchants' Chamber, Bombay for lowering the railway freight on cattle booked to and from Bombay, referred to a similar representation made by the Madras Provincial Marketing Board to the authorities concerned. We are glad to note that their efforts have met with considerable success. It was recently announced that from 1st February 1937, the freight rate per mile would be reduced from four to two annas per four wheeled vehicle carrying dry cows from Madras to all stations between Kavarapettai and Tenali, subject to a minimum charge and to a maximum in the number of animals carried in a wagon. Apart from this concession, the terminal charge of Rs. 4 now collected on each wagon of cattle imported into Madras, was abolished. We hope that these concessions will stimulate a greater movement of cattle from Madras to places where grazing is available in plenty and will eventually save the valuable Nellore breed from the hands of the butcher.

Payment of wages in kind. In an interesting and instructive press note issued recently on the survey of the wheat markets of India, it is stated that the "undoubtedly wasteful system of payments in kind * * * makes it difficult for the growers to benefit from an improvement in the price of wheat and it is suggested that early steps should be taken to abolish it and to substitute a money economy for a natural barter economy in the villages". We find ourselves unable to subscribe to this view. We are fully alive to the possibility that a change to the cash system will result in a greater quantity of agricultural produce now retained by the cultivators being brought into the market, and will make people realise quickly the position of the agricultural wages compared to that in other industries. It will also free the agricultural worker from the risks to which a farmer is exposed, improve his bargaining power, and enable him to spend his earnings on the purchase of articles of his own choice.

We should not at the same time lose sight of the conditions prevailing, and the forces operating, in the agricultural economy of this country. The survey of wheat marketing has brought to light more prominently than anything else, that the marketing conditions are always to the disadvantage of the grower, that "the number of people who consider themselves as entitled to take share of the cultivators' wheat was found to be astonishing" and that "the cultivator gets only about threefifth of the consumers' rupee". The additional obligation to pay his labour in cash would only tend in our opinion, to aggravate his difficulties. Under the present system of payments, there is available for the guidance of the grower, a sure and fixed scheme of expenditure which leaves him free to deal with the complexities of the market as best he can. This advantage would be lost to him if the system of cash payment is adopted. The Indian farmer is an utter stranger to the price-fixing factors that operate on distant markets and producer-countries, and to the caprices of the exchange. It is also an acknowledged fact that he is seldom able to command adequate and ready cash therewith to pay the labour engaged by him day to day. The result of the innovation under such circumstances is not difficult to foresee. A new class of moneyed exploiters will arise and the grower will not get even the threefifths of the rupee he now gets.

Nor is it a fact that the agricultural labourer in India is really in a position to take advantage of the proposed order of things. He is proverbially poor and has just the money or earnings to provide himself with bare food and clothing and has little left to trouble himself about the choice of his purchases. Situated as he is, the suggested change would only deprive him of the advantages, if any, of having with certainty all the grain he needs and place him at the mercy of an open market. Added to this there is sure to follow the loss of that psychological factor which contributes at present in no small measure to the harmony existing between the two classes. It cannot be gainsaid that this mutual relationship is more intimate and harmonious as a result of this system of paying wages in kind. The labourer feels that he is almost a member of the farmer's household when he partakes of the same produce that his master reaps. The loss of these features from the economic life of the village is certain to give rise to dissatisfaction and will result eventually in disputes and strikes which cultivators in general abhor.

We invite the attention of our readers to the *Press communique* published in this issue on the census of educated unemployed.

Tall Short

Plants of the Italian millet.

INHERITANCE OF HEIGHT OF PLANTS IN THE ITALIAN MILLET—*SETARIA ITALICA* (BEAUV.)

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Varieties of Italian millet vary very much in their height. An experience in the inheritance of plant height in this millet is recorded here. In 1933 a cross was made between two pure lines, S. I. 1646 and S. I. 2485 (vide illustration.) Both of these had a duration of 85 to 90 days. A first generation of 15 plants was raised. These were widely spaced with a view to selfing. Their average height was 119 cm. Contemporary to the F_1 the two parents were also raised. The average height of 200 plants of the tall parent was 111 cm. and of the short parent 75 cm. One of these fifteen F_1 plants, i. e., No. S. I. 2676 gave in the second generation 219 tall plants with an average height of 104 cm. (85 - 125 cm) and 67 short plants with an average height of 66 cm. (45—80 cm.) The segregation was sharp, there being no doubtful cases during the classification.

From this F_2, a third generation was raised. Of the six short plants that were taken all bred true to shortness. Their heights ranged from 45 to 71 cm. with an average of 63 cm. Of the twelve tall selections, 6 bred true to tallness, the height ranging from 99 to 114 cm. with an average of 106 cm. Six selections segregated again sharply and gave a total of 858 talls and 320 shorts ($x^2 = 2{\cdot}82$, $P > {\cdot}05$)

Along with the F_3, the parents were also raised. The tall parent had an average height of 110 cm. and the short parent 65 cm. It will be noticed that the parental and the F_3 homozygous height indices closely approximate. In the tall group, none approached the shorts.

It was thus clear that a single gene was at play in this segregation. The groups, tall and short, were analysed into their components. The number of internodes was counted in the main stalk in 275 plants in each group and was found to be an average of 11·49 in the talls and 10·10 in the shorts. The range in internodal number in both the groups was from 8 to 14. The slightly lesser number in the average of the short group is attributable to the compressed corm-like zone at the very base of the stalk. The cause for the differences in height was therefore not in the total number of the internodes.

The length of each of the internodes below the peduncle was recorded in 60 plants in each group and their averages are given in the following table (Table I).

Table I.

Average length of the internode on the main stalk of parents.
(Average of 60).

Number of the internode below the peduncle.	Length in cm. of the internode S. I. 1646 Tall.	S. I. 2485 Short.
Earhead	15·81±1·35	9·65±1·07
Peduncle	23·00±2·81	15·50±2·61
1st	7·45±0·93	6·60±1·58
2nd	8·10±1·29	7·27±1·82
3rd	7·70±1·31	7·35±1·75
4th	7·30±1·43	7·05±1·90
5th	7·20±0·95	5·65±1·31
6th	7·30±1·05	4·88±0·96
7th	7·19±1·09	4·45±0·83
8th	7·15±0·95	3·75±0·81
9th	6·13±0·83	2·40±0·65
10th	4·25±0·96	1·38±0·18
11th	2·37±0·71	
Total height	110·95	75·93

Table No. 1 shows that the tall group has internodes longer than the short group, proving that the gene at work is the one responsible for increase in internodal length[1].

A study of this table shows that there is a slight reduction in the length of the internode just below the peduncle, an experience recorded in some other cereals also[2]. A third point of interest is the fact that the total length of the peduncle and the earhead makes up a third of the total height of the plant. There is indicated a high relationship between plant height and head length. The average measurements for plant height and head length in the parents and in the homozygous F_3 are given in the following table. The relation of head length to plant height is obvious.

Table II.

Generation.	Population.	Mean height of plants. cm.	Mean length of earhead. cm.
Tall parent	200	110·94±·088	14·40±·085
F_3—Tall pure	750	106·46±·060	13·62±·090
Short parent	200	74·59±·082	8·51±·056
F_3—Short pure	819	62·87±·050	9·01±·030

The earheads in both the groups, tall and short, were analysed and the results are presented in table III.

Table III.

Earhead Analyses of Parents.

	Average length of earhead.	Average thickness of earhead.	Average weight of earhead.	Average No. of Grains.	Average weight of Grains.
	cm.	mm.	gm.		gm.
S. I. 1646—Tall	18·8	16·2	7·6	2104	6·71
„ 2485—Short	10·1	12·8	3·5	1212	3·02
Difference between the averages of the parents.	8·7	3·4	4·1	892	3·69
't' value*	12·49	3·16	15·94	2·88	4·62

* 't' value for P = ·05 and n = 8 as per Fisher's table = 2·306

It will be noted that the earheads of the tall plants are longer, thicker, denser with a larger number of grains and with a heavier seed weight when compared with those of the short parent. The differences are statistically significant as measured by the 't' test.

Summary. In *Setaria italica*, tall plants with an average height of about 111 cm. proved a simple dominant to short plants with an average height of 75 cm. The segregation was monofactorial.

Both the parents had about the same number of internodes but differed in the lengths of the internodes. This internodal length which affected total plant height had its effect on the length, thickness and weight of the main earhead with corresponding increase in grain number and weight.

Literature cited.

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CULTIVATION OF CORIANDER (*Coriandrum sativum*) IN TINNEVELLY DISTRICT

Introduction. Coriander is one of the commonest condiments found in every Indian household as it is largely used for culinery purposes. It is also used in preparing confectionery. As it possesses medicinal properties, coriander decoction is the cheapest and the most commonly prescribed specific in every household for biliousness. Coriander is valued for the oil contained in the seeds.

Tinnevelly is one of the principal districts where coriander is largely grown. It occupies an important place in the system of cultivation in the black soil tracts of this district, and practically stands next to cotton as a money-crop. The income though small, proves handy to the ryot at a particular period of the year when no other money-crop is available to enable him to meet his sundry expenses

and to pay off the assessment on his land. Thus it plays a prominent role in the economic position of the black soil ryot and therefore, an attempt is made in this short note to describe the method of its cultivation as practised in this district.

Soil and rotation. Heavy black soils which generally crack deep in hot weather, are found to be well suited for growing coriander. In such soils, there is a regular practice of cultivating this crop in rotation with a crop of cumbu (*Pennisetum typhoides*) while in some places, it is also rotated with a crop of cotton (mixture of *Gossypium indicum* and *G. herbaceum*). But in light black soils, coriander is mostly grown as a subsidiary crop along with a main crop of cotton. In recent years, ryots in certain villages have also taken to a new method of mixed cropping of coriander and black gram (*Phaseolus mungo-L.*) in the same field.

Preliminary cultivation. The land intended for growing coriander, is ploughed with a country plough twice or thrice between April and August. The first ploughing is as a rule commenced in the month of Chittirai (April—May) as there is a popular belief built up by tradition and experience that a preliminary ploughing given to the land during this month, tends to give a high out-turn. Then in the month of Avani (August—September) an additional ploughing is done to a very shallow depth with the main object of catching early rains.

Manuring. Generally, no manure is applied to the coriander crop. The dryland ryot with a limited quantity of cattle manure at his disposal, manures his food-crop of cumbu in preference to any other crop. However, once in four or five years, some well-to-do ryots do manure coriander.

Sowing. When the north east monsoon sets in at about the month of Purattasi (September—October), seeds are sown broadcast and covered with a country plough. Generally coriander and Irungu cholam (*Sorghum dochna*,—Snowden) are the two crops to be sown first at the commencement of the monsoon. If rains are delayed, sowing is pushed through in the dry soil with a hope of getting rains late. But such dry sowings are rare and are not usually adopted. About 3 to 5 M. M. (Madras measure) of seed are sown in an acre while in a mixed cropping with cotton, the seed rate of coriander varies from $\frac{1}{2}$ to 2 M. M. The seeds take 10 to 15 days to germinate depending upon the moisture present in the soil.

After-Cultivation. After sowing, no intercultivation is needed except hand-weeding. This is done once or twice and sometimes thrice if the land has not been given proper preliminary cultivation.

Harvesting and threshing. The crop begins to flower during the month of Karthigai (November—December) and becomes ready for harvest during the month of Thai (January—February). Plants are

pulled out usually in the mornings and taken to the threshing floor either on the same day or the next morning. They are allowed to dry for a day or two and then threshed. But, if the ryot has to attend to other agricultural operations at that time, he stacks the harvested plants in a dry state and threshes them later at his convenience. Threshing is done either by making cattle to tread on the plants or by beating with long sticks. The seeds are then cleaned by winnowing and finally stored after drying. It may be mentioned that cattle-threshing is favoured much as the final produce looks cleaner than that obtained by the other method. In some places ryots prefer to have their crop harvested and threshed on a system of contract in order to avoid personal supervision over labour employed.

Yield. The yield depends upon factors like type of soil, seasonal conditions, previous cropping in the field and incidence of insect pests and diseases. It varies from 2½ to 6 kottahs (240 to 576 M. M.) per acre in fields which had a crop of cumbu in the previous year and from 2 to 3 kottahs (192 to 288 M. M.) on fields where cotton was the preceding crop; in the case of mixed cropping with cotton, the out-turn of coriander is ½ to 1½ kottahs (48 to 144 M. M.) per acre.

Pests and diseases. Coriander is subject to a few diseases which in certain seasons, may assume very serious magnitude, causing great damage or even complete loss of the crop. During the flowering period, if it happens to rain and the mornings are misty, mildew sets in and flowers present a scorched up appearance and are shed. This disease is locally called 'Pumari' or flower-disease. If an ashy appearance is visible on any vegetative part of the plant, it goes by a local name of 'Samble-noi' or ash disease. By an attack of mildew the fruits also get discoloured with the result that the final produce fails to command a proper sale in the market. Further, this crop is susceptible to wilt disease, popularily called *Kanjura-noi* which causes sudden death of the plants. Again at the fruiting stage the fruits are bored by a caterpillar-pest locally known as *Kudavan* which eats away the contents leaving only the outer skin. These are the chief evils that may occasionally upset the fortunes of a coriander-grower before he enjoys the fruits of his labour.

Economics of growing coriander. It is to be particularly noted that ryots do not spend any amount in cash to meet the cultivation charges but pay in kind. However, the approximate cost of labour required per acre has been worked out under each item as shown below. Further, the item of manuring is not included as it is not a regular practice to manure the crop. It may also be noted that the value of the produce fluctuates very widely whereas the cultivation charges practically remain constant and hence the margin of profit is subject to a considerable fluctuation.

I. Cost of Cultivation

Details of operations	Kind of payment made as wages	Calculated Labour required per acre			Calculated cost per acre	Remarks
		Pairs of cattle	Men	Women	Rs. A. P.	
1. *Preliminary Cultivation.* a) Two summer ploughings.	Cumbu grain & food.	4	4	—	4—0—0	A man with a pair of cattle can plough half an acre a day. He is paid 3 M. M. of cumbu grain and one meal a day. A pair is charged at As 12 a day.
b) 3rd ploughing just before the break of the monsoon.	Do.	1	1	—	1—0—0	Very shallow ploughing.
2. *Sowing.* a) Broadcasting & covering with country plough.	Do.	1	1	—	1—4—0	Labour is costly at this time of the year.
b) Cost of 4 M. M. of coriander seeds used.	—	—	—	—	0—4—0	
3. *After cultivation.* Two weedings.	Cumbu grain only.	—	—	8	1—0—0	2 to 6 women per acre. About 1½ M. M. of cumbu grain per cooly per day.
4. *Harvesting.* a) Pulling out plants and carting to the threshing floor.	Do.	½	1	4	1—1—0	About 8 M. M. of cumbu grain for pulling out plants and ½ pair cattle for carting.
b) Threshing.	Do.	1	1½	—	1—1—0	A man is paid 2½ M. M. of cumbu grain per day.
5. Assessment on land.	—	—	—	—	1—8—0	
Total.		7½	8½	12	11—2—0	

II. Out-turn from an acre.

Value of 3 Kottahs of coriander at Rs. 5—12—0 per Kottah of 96 M. M.	Rs.	17—4—0
Less cultivation charges, as calculated above ...	„	11—2—0
Profit per acre ...	Rs.	6—2—0

Trade and market. Indian coriander is exported chiefly to the Straits Settlements and Ceylon. The Tinnevelly coriander is sent via Tuticorin port to Ceylon. At present, coriander is experiencing a great slump in the market due partly to the recent general economic depression all over the world and partly to the keen competition in foreign markets especially in Ceylon with Moroccan and Russian coriander.

THE ADAPTATION OF SHORT CROPPING OF SUGARCANE TO THE LOCAL CONDITIONS IN THE VIZAGAPATAM DIST.

Though attempts were being made during the past 5 years to popularise short cropping among the ryots of the Vizagapatam District, they have not yet adopted the system to any large extent, the area under short cropping even after five years' advocacy having been not more than 167 acres as shown below:—

1931—32	...	...	2 acres.
1932—33	...	...	27 ,,
1933—34	...	...	60 ,,
1934—35	...	...	90 ,,
1935—36	...	...	167 ,,

September-October was originally advocated as the time best suited for planting short crops as they can then follow a 'punasa' (early) crop of gante (*Pennesetum typhodeum*) or gingelly. But this was in practice, often found impossible owing to the lack of timely and favourable conditions for preparing the land and planting the crops in time. They were therefore recommended to be planted in ragi (*Eleusine coracana*) and gante seed beds after the removal of seedlings. In some years even this was found impracticable on account of heavy rains preventing the preparation of the land. Even in years when the land was ready, heavy rains at the time of or subsequent to, planting affected germination of the young crop so much that it had often to be abandoned. Earlier planting, in August, July or even in June was found more successful. In the case of arrowing varieties like Co. 213 planting has however to be deferred at least to the last week of June or early part of July to prevent the crop from arrowing in the usual season (November).

Though early planting was more successful and gave a higher tonnage of seed material it required the allotment of a separate plot for the whole year as in the case of the ordinary crop and this rendered short cropping less popular.

The intensive propaganda work done though not successful in enhancing the area under short crops to any considerable extent, has resulted however in convincing the ryots of the advantages of using tender material for seed. While, with late and nonarrowing varieties like J. 247 which are usually harvested at or shortly before, the time of planting, the use of tops (Vadu davva) or top halves has become popular, the same could not be practised with early and arrowing canes like Co. 213. In such cases, an alternative method was adopted by some ryots of the Bobbili taluk. This consists in leaving

out at the time of harvest in December—January all promising and tender side shoots not fit for milling and giving a ploughing and an irrigation if possible. This not only results in the rapid growth of the shoots thus left, but also stimulates a fresh flush of shoots some of which grow sufficiently well to give 3 or 4 setts by the time of planting (March—May). Even shoots which do not form sufficient nodes for being cut into setts but vigorous enough are found fit enough for planting. Sufficient shoots could thus be obtained for double or treble the area thus treated. Even under adverse conditions sufficient seed material to plant an equal area can easily be got. In areas where Co. 213 is largely grown this method has of late become rapidly popular, obviating the necessity for a separate short crop altogether, and the practice is well worth copying in other districts where similar conditions prevail.

PRACTICAL HINTS ON BEE-KEEPING*

BY M. C. CHERIAN & S. RAMACHANDRAN

I. **Introduction.** In these days of economic depression the income from agriculture is poor and the ryot, therefore, has to look to other sources to enhance his earnings. Taking into consideration the poverty of the average Indian ryot and his consequent inability to invest large sums on new ventures, bee-keeping on improved lines can be safely recommended as a paying cottage industry, as it involves only a small outlay. Moreover there is no dearth of bees or of bee-pasturage crops in this Presidency. Preliminary trials have shown that a colony of bees, under favourable conditions, is capable of yielding a net profit of about Rs. 10 to 15 per annum and as such there are great possibilities for this new industry.

II. **Selection of Bees for rearing.** Enormous profits are derived in the temperate regions by rearing the European bees, but their progress, apart from the prohibitive cost of importing them, has not been very encouraging in this country. Of the indigenous bees, the 'Rock' bee which is the biggest of the Indian honey bees and found mostly on the hilly regions, is unfit for domestication, because of its peculiar comb-building and migratory habits and ferocious temper. The 'Little' bee also has been found unfit for rearing, as it is migratory in habits and a poor honey gatherer. The Dammar bee, the smallest of the indigenous bees, is also not reared because of its poor honey gathering capacity. The only bee that can, with advantage be domesticated is the 'Indian bee'. It is smaller in size than the Rock bee and constructs its combs in parrallel rows inside natural hollows in tree trunks and in the ground, cracks and crevices in buildings, old pots etc. It is a fairly good honey gatherer and is comparatively mild in temper. The present paper therefore deals only with the Indian bee.

* This pamphet has been prepared for the Honey Week.

III. **Food of Bees.** Honey and pollen are the most important bee-foods. Both of these are available from flowers and the plants that provide these bee-foods are spoken of as bee-pasturage crops. The following are the important bee-pasturage crops observed round about Coimbatore :—Pollen yielders :—Maize, cholam, cumbu, castor, sunflower, peltophorum, zinniah, palmyrah, coconut, niger, cucurbitaceous plants. Nectar yielders :—Different varieties of cotton, tamarind, margosa, sunflower, plantains, niger, pungam, raintree, antigonon, white babool, drumstick tree etc.

IV. **The Bee Hive.** The artificial bee-hive is a miniature house designed to accommodate a bee-colony. There are various types of these hives, but in South India the most popular pattern is the Newton Hive. This consists of a brood-chamber and a super, with a floor board below and a top above. The brood chamber consists of a rectangular box open at the top and bottom and provided with a movable floor board below. It contains seven movable frames to support the combs. The super is a separate compartment meant for storing honey only and is kept over the brood-chamber when the latter is full of bees. The top is placed on the brood-chamber or the super as the case may be. Measurements of the various parts are given below :—

Floor-board	14″ by 9½″
Brood-chamber—inner measurements ...	9¾″ × 8¼″ × 6¾″.
Width of groove along the top of the front and rear planks of the brood-chmber to support the frames	¼″
Entrance to be cut along the lower side of the front plank of the brood-chamber ...	3½″ × ⅜″

Measurements of the brood frame:

Breadth of top bar	⅞″
Length of top bar	10″
Thickness of the top bar	⅛″
Inner length of frame	8¼″
Inner height of the frame	5¾″
Total height of frame	6″
Length of side bar	5¾″
Width of side bar at the top	1⅛″
Width of side bar at the bottom	½″

The top bar should be fixed exactly at the centre of the side bar so as to effect a clearance of exactly 1/8″ on either side. The length and breadth of the super are the same as those in the brood-chamber, but the height is only 3⅛″. Measurements of the super frames also are similar to those of the brood frames but the inner height is only 2½″.

The top is made to suit the hive body and a hole is provided in the front and rear planks and a big opening about 3" square in the ceiling plank to provide ventilation. Care should be taken to close all these openings with thin wire gauze.

V. **Hiving wild Colonies and Swarms.** After making a few hives the amateur should think of filling these with bees. This can be achieved either by capturing *wild colonies* or by *hiving swarms.* Wild colonies are generally found in enclosed spaces such as hollows in tree trunks, cracks and crevices in walls, old pots and the best way of locating them is by observing the likely places on bright mornings when numbers of bees will be seen going in and coming out of the burrows. Prior to the actual capture of the bees the entrance should be widened and the combs taken out gently one by one. Good-sized combs having plenty of brood should be selected and fixed to the frames with plantain fibre. The bees can then be induced to come to the hive by capturing the queen in a glass tube and placing it over the frames, after having closed its mouth with a piece of mosquito-net. In the absence of a tube, the queen can be caged in an empty match-box, care being taken to have it partially open. When the majority of the bees have entered the hive the queen can be liberated. In cases where the queen is not captured, clusters of bees that would, by this time, have collected inside the hollow can be scooped and transferred to the hive. The queen will, invariably, be found among these bees. Since the bees are likely to sting when being handled a few occasional whiffs of smoke from burnt rags may be necessary to quieten them.

VI. **Hiving Swarms.** Swarms are small groups of bees each with a queen, which issue from established colonies during the honey flow season and settle in some convenient place for a time in the shape of a bag-like cluster. Later on, these bees move away to some convenient place of abode and start a fresh colony. If one has a few colonies their number can easily be increased by hiving such swarms and keeping them separate. The capture can be effected by getting a new hive with the frames removed and placing in it a good brood-frame taken from one of the settled colonies. If the swarm is from the particular hive, from which the brood-comb has been taken, it can be given with the bees, if not, the bees have to be driven away. In either case, care should be taken to see that there are no queen cells in the comb. The hive should be held in such a way that a major portion of the cluster is inside the box. The bees, being attracted to the brood, quickly transfer themselves to the hive. The remaining frames and the top can now be put on and the hive kept at some distance away from the original colony.

VII. **After-care of Newly Captured Colonies and Swarms.** Wild colonies should, as far as possible, be hived only during the brisk breeding season, since the presence of the brood in the combs induces

the bees to settle in the artificial hive. Fresh captures should not be disturbed frequently, except for an occasional cleaning of the floor-board. Weak colonies should be fed with either dilute honey or thick sugar syrup. The frames should be examined after about a fortnight and the pieces of plantain fibre removed. Combs that have been improperly fixed and those that have dropped down must be refixed. The progress of the colony should be carefully watched and if egg-laying is not satisfactory, a brood-comb from another colony may be given. There is always the risk of the bees deserting the hive until they settle down to their normal routine of brisk pollen, honey collection and brood rearing. Such desertions can be prevented by the use of a queen arrester. This is a simple contrivance consisting of a piece of wood, longer than the entrance of the hive with a shallow cut about ⅛" deep and just as long as the entrance. It is kept close to the entrance with the cut end below. The narrow slit is enough to allow the workers but not the queen and bees do not, as a rule, swarm out without their queen. The same precautions hold good for the newly hived swarms but a few additional old or foundation combs may be given to save the time and energy of the bees.

VIII. **Location of the Apiary.** An Apiary should be started only in a locality where there is plenty of bee-pasturage. Care should be taken to keep the hives absolutely level, in a place which is well protected from the hot sun, heavy rains and high winds.

IX. **Handling Bees.** Bee-hives should be opened and examined only on bright mornings when most of the bees are busy. Quick and nervous movements, incidental crushing of bees should be carefully avoided while handling the frames. The sting is fairly painful but the pain and the attendant swelling can be considerably minimised if the sting, which is left behind, is scraped away immediately. When the bees are in a bad mood they can be quietened by a judicious use of smoke.

X. **Swarming and its control.** Swarming in bees is the natural method of distribution and perpetuation of their kind. This instinct is very strong in bees and steps should be taken to check the impulse, since colonies get considerably weakend by the frequent issue of such swarms. This family separation occurs only during the prosperous season but the actual period may vary according to the locality. Prior to sending out swarms, the colonies multiply rapidly and the initial preparation for swarming is evinced by the excessive rearing of drones. This is followed by the erection of queen-cells along the lower border of the brood-combs and a series of swarms issue after these queen-cells are sealed. The most popular method of preventing the issue of swarms is the periodical cutting of the queen-cells. Another method which shows better promise is the destruction of the reigning queen or her removal with a comb of bees to a separate hive,

after the queen-cells in the original colony are sealed. The colony is kept under careful observation and all the other queen-cells are cut away after the new queen has emerged. The swarming impulse is lessened when the colony remains without a queen for a few days. Neither of the two methods mentioned above can claim to entirely cure the bees of their swarming fever. A third procedure may be adopted provided the conditions are favourable. If the swarming impulse is evinced early in the honey season, the first swarm may be allowed to issue and it may be hived and kept as a separate colony. The rest of the queen-cells should be removed after the emergence of the fresh queen. The owner in this case gets two colonies out of one and both of them may yield honey in the first year itself if pasturage conditions are favourable.

XI. **Care of colonies during the lean season.** Owing to adverse pasturage and weather conditions during certain seasons, the queen reduces her rate of egglaying and the population of the colony dwindles in strength. Under such circumstances, the bees may be fed artificially either with dilute honey or thick sugar syrup, by pouring a small quantity of the fluid over the frames once or twice a week. The feeding may be stopped as soon as a sufficient quantity of honey is found stocked in the combs.

Bee enemies such as the wax-moth, the black ant, the yellow banded wasp, and the death's head moth are very active during the slack season and necessary steps should be taken to check them. Of these the *wax-moth* is the worst enemy of bees. The caterpillars attack the combs and bees in the infested colonies very soon desert the hives. The following hints may be helpful in controlling this pest. All attempts should be made to keep the colony strong as such a condition enables them to withstand the ravages for a longer time. All superfluous combs are to be removed and stocked in an air-tight receptacle. A mud pot with its mouth sealed with cow-dung serves the purpose quite well. The combs should be frequently examined and those showing traces of damage should be promptly destroyed. The floor-board as well as the other parts of the hive should be kept clean. Pieces of discarded combs should not be thrown about carelessly. Necessary precautions should be taken to see that there are no cracks and crevices in the hive body. The interspaces between the brood-chamber, super and top should be examined for the egg-masses and if present should be scraped away. If there is a suspicion that the eggs have been laid in any of the inaccessible crevices, the hive body may be changed frequently. Combs that are stored for the next season's use are also likely to be attacked. The caterpillars infesting these combs can be easily eliminated, by exposing the latter to the morning sun, for about fifteen minutes, taking care to see that the temperature does not exceed 40° centigrade.

Another enemy that has to be guarded against is the *black ant.* These ants are particularly troublesome after the rains; sometimes causing wholesale damage to bee colonies by snatching away numbers of bees, very often grubs and pupae also. The pest can be easily controlled by dropping a few granules of calcium cyanide inside the ant holes. The hives can be kept on stands that have been provided with ant-pans. Occasionally bee colonies are visited by *the yellow banded wasp* and numbers of bees are snatched away. The wasps can be hand-netted and killed. Nests of these wasps can also be searched out and burnt during night time. *Death's head moths* occasionally enter bee-hives and steal away a good quantity of honey. Generally the bees themselves kill these moths after their entrance into the hive, but it is better to destroy them wherever they are found.

XII. **Care of colonies during the breeding season.** Since a strong population is essential for gathering plenty of honey, necessary facilities should be given for the rapid increase of bees during the breeding season. Old combs taken out and stored during the previous season may now be given at the centre and if these are not available, the combs at the sides, which are generally stocked with honey, may be transferred to the centre. This treatment apart from providing the necessary egg-laying space and stimulating the rate of egg-laying by the queen, also saves the time, energy and honey of the bees, which would otherwise be wasted in constructing fresh combs. Since weak colonies do not yield much honey, two or three of them may be united and built up as one strong colony. If this is not desired, the population of a weak and a strong colony can be equalised by inter-changing the position of the two hives on a bright morning when the bees are working briskly. The super may be added when the bee population has become strong enough to cover all the seven combs in the brood-chamber. The provision of spare combs to the super also is necessary so as to encourage the bees to come up and store honey. If spare combs are not available, the two side combs of the brood-chamber may be taken out, cut to the size of the super frames and fixed on to them.

XIII. **Uniting colonies.** This operation consists of uniting two or three colonies into one and it may be done for mixing a queenless colony with another having a queen, uniting two or more weak colonies to make a strong one. There are various methods of uniting but the simplest, which is popularly known as the "newspaper method," is described below:— The colonies that are to be united are brought side by side (as described under shifting bee colonies) and one of them dequeened twentyfour hours prior to the uniting. Late in the evening the colony having the queen is opened and the top of it is covered with a sheet of newspaper. A few small holes are made in this paper. The floor-board of the other colony is now removed and

the hive is kept over the newspaper. All means of escape are now closed with wire-gauze and the two colonies left alone for the night. The imprisoned bees in both the hives, scenting the presence of strangers, begin to investigate by tearing open the holes in the newspaper and by this time the hive-odor gets amalgamated and the union of the two colonies is accomplished. The wire-gauze at the entrance of the lower hive can be removed early next morning. The hives can be opened after the weather gets brighter and the frames of both the colonies can be kept together.

XIV. **Queenless colonies.** It is very common for colonies to lose their queens during the swarming season. This is due to the queens either getting lost or preyed upon by insectivorous birds during their nuptial flight. The absence of the queen is indicated by the slackness of work in the colony. The workers get their abdomen contracted, turn black in color and they can often be seen remaining huddled together at the entrance. The combs do not contain any worker brood but in most cases, numbers of eggs laid by some of the workers, may be found in each cell. Under such circumstances all the superfluous eggs are removed and even transported to other cells made by the bees. Since the workers are not fertile, the grubs that hatch out of their eggs develop only into drones. The combs get twisted in shape on account of the unequal pressure caused by the presence of the larger drone grubs in the smaller worker cells. In neglected cases numbers of adult drones also will be found. To provide a new queen for such a colony, a comb with a sealed queen-cell from another colony may be given, after driving away the bees adhering to it. The bees may sometimes tear away the queen cells and in such cases a new queen may be introduced by the following method. Dip the queen in honey and drop her into the queenless colony, pouring a small quantity of honey along with her. The workers immediately cluster round the queen and begin to lick the honey. The smell of the latter which attracts the bees, probably neutralizes the individual odour of the queen. Therefore by the time she gets rid of her coating of honey she is accepted by the colony. If the above methods are not successful, the colony may be united with another having a queen. Whatever may be the method adopted, necessary steps to requeen such queenless colonies should be taken, immediately after the loss of the queen is noted, since the bees sometimes refuse to accept either a queen-cell or a queen if there is any undue delay.

XV. **Shifting bee colonies.** Bees have a very strong homing instinct. Powers of good perception and a strong memory of the landmarks enable them to fly back to their hives with unerring exactness, from their foraging excursions. When the bees are working briskly, if the hive is moved even by a few inches, it takes a little time

for the returning foragers to find out the entrance. If the hive is moved by four or five feet, the bees returning with pollen and nectar persistently hover about the original place until they drop down and die of exhaustion. Therefore if the hive is to be shifted from one place to another within the apiary itself, the moving should be done after sunset by about two feet per day. If it is necessary to shift the colonies to a distance, the entrance is closed with wiregauze after nightfall and the hive taken to the desired place and the entrance opened. The minimum distance to which the bees can be moved, without any of the workers returning to the original place, is about half a mile. Frequent shifting of bee colonies should be avoided, since, it always entails the loss of a number of bees.

XVI. **Honey and its extraction.** Bees generally collect nectar from flowers, convert it into honey and store it in their cells. After the cells are filled with the requisite quantity of ripe honey, they are sealed with wax. Honey should be extracted only after 75% of the cells are sealed. Prior to the extraction, the bees that are found adhering on the honey combs may be driven away by the following method. The frames are to be taken out and kept in an empty hive without the top and the floor-board. The box is held in such a way that the top of the front side of the box is just touching the end of the floorboard and smoke is applied from below. The bees, being frightened by the smoke will all rush into the hive. After driving away the bees, the sealed combs should be uncapped with a sharp knife and the honey extracted in the honey-extractor. The latter consists of a cylindrical drum and a box to hold the honey combs. The box is fixed to a rotating rod at the centre and the revolution is effected by the action of a set of two gear wheels on the central rod. The frames containing honey are kept in the slot provided in the comb-box and the latter is rotated. After the honey on the outer side of the comb is extracted the frame should be reversed and the honey on the other side taken in a similar way. The box should be rotated gently at the beginning and the speed increased after the weight of the combs is reduced. Heavy combs are likely to break if the rotation is too fast at the beginning itself.

XVII. **Ripening and Storing of Honey.** Ordinarily bees seal the sells with wax as soon as they are filled with "ripe honey", but occasionally they take a long time to close the cells. In such cases, the honey can be extracted before the sealing, but it has to be ripened artificially prior to storing, as described below:—

The honey has to be poured preferably in an enamel or earthen vessel and the latter kept in a water-bath. The water should be heated up to 150°F., and maintained at that temperature for about half an hour. The water should not be allowed to boil nor can honey be heated directly over fire. The ripening can also be done by

exposing the honey in a wide mouthed vessel to the hot sun for about a week. The mouth of the vessel may be covered with a piece of thin cloth to keep off dirt etc. The ripened honey is best stored in glass or enamel or earthen vessels. The receptacles should be closed tightly and kept in a cool and dark cellar.

XVIII. **A few hints for amateur bee-keepers.** The following hints may be useful for beginners in maintaining their apiaries successfully:—

1. Make the bee hives without cracks and crevices so as to prevent the wax-moth from laying eggs in these.

2. See that the measurements of and spacing in the frames are correct. Any error will induce irregular comb construction.

3. Hive wild colonies during the brisk breeding season since colonies caught during the slack season invariably desert.

4. Locate apiaries in places where pasturage conditions are favourable.

5. Keep the hives absolutely level in a place well protected from the midday sun, rain and high winds.

6. Do not disturb newly-hived colonies frequently.

7. If there is not sufficient honey flow, feed new colonies with dilute honey in the absence of which sugar syrup or jaggery solution may be used.

8. Give the food inside the hive. If the food is kept outside the hive, it often leads to fighting and robbing among bees. Do not over-feed the bees.

9. Examine colonies during bright mornings when bees are busy; otherwise they might sting badly. When stung do not pull out the sting but scrape it off immediately. Rub some green leaf over the part stung to cover the smell.

10. Avoid all jerky and nervous movements while handling bees.

11. When bees are in a bad mood a few whiffs of smoke would quieten them.

12. Do not shift colonies from place to place frequently.

13. As the colony increases in strength, provide additional egg-laying space for the queen by giving foundation or old combs.

14. When brood chamber is full, give super with combs.

15. During the heavy breeding season, be on the look out for queen-cells and for the subsequent issue of swarms. Allow the prime swarm, if it issues early in the season, and hive it as a separate colony. Do not allow any "after swarms."

16. Build up the strength of the colonies prior to the honey season by swarm prevention, requeening, uniting weak stocks, and by provision of breeding facilities.

17. Extract honey when 75% of the cells are sealed and ripen the honey artificially. Do not extract the honey from the brood-chamber.

18. Beware of the wax-moth the worst enemy of the honey bee. To control it keep the colonies strong. Remove all superfluous combs and give just enough for the bees. Examine the joints and interspaces of the hive body for eggmasses of the wax-moth. Scrape away the eggmasses and if necessary change the hive-body once in 6 days. Examine the combs and floor-board of the hive for caterpillars. Store the old combs in an air-tight and insect-proof receptacle. Examine them frequently and if infested by the worms dry them in the sun and eliminate the caterpillars.

19. The black ant is another serious enemy; treat the ant holes with calcium cyanide. Provide ant pans or smear the legs with Tanglefoot.

20. The yellow banded wasp is also known to attack bees. Handnet the wasps. If possible destroy their nests.

Detailed information on the subject of bee-keeping is given in Bulletin No. 37 of the Madras Agricultural Department. For further information the Government Entomologist, Lawley Road P. O., Coimbatore. may be written to.

Research Notes.

The Relationship between the Mechanical Tissue Brown Factor and the Factor for Juiciness of Stalk in Sorghum.

In a previous paper[1] the occurrence, as a mutant, of a sorghum plant with brownish purple-lined internode, leaf-sheath, midrib, panicle branch, and glume top has been recorded. The pigment was not anthocyanic. This mutant behaved as a simple recessive to the common more economic green-internoded and white midribbed plant. A factor mt_b gives a mechanical tissue coloured brownish purple. Mt_B gives the ordinary green internode of the common sorghum.

In another paper[2] Mendelian di-hybrid segregations for the character pairs pithy and juicy stalks (D–d), and not sweet and sweet stalks (X–x) proving them independent in inheritance have been reported.

To determine the inter-relationship between the colouring of the mechanical tissue and such an important factor as juiciness in stalk, crosses were made between the following parents.

A. S. 545	*A. S. 3641*
Sweet Stalk (x)	Sweet stalk (x)
Juicy stalk (d)	Pithy stalk (D)
Mechanical tissue colourless (Mt_B)	Mechanical tissue brownish purple (mt_b)

The F_1 (A. S. CCXXII—a) was sweet stalked (xx), pithy stalked (Dd) and its mechanical tissue was colourless ($Mt_B - mt_b$) In the F_2 the following di-hybrid segregations were obtained.

Family No.	Pithy stalked (DD & Dd) (White midrib)		Juicy stalked (dd) (Dull midrib)	
	Mechanical tissue not coloured	Mechanical tissue brownish purple	Mechanical tissue not coloured	Mechanical tissue brownish purple
A. S. 4765	71	24	26	8

It will thus be seen that the pair of factors Mt_B - mt_b determining the colourless-ness or brownish purple of the mechanical tissue are independent of the D-d factors determining pithiness or juiciness of stalks—(white or dull midrib in leaves). Juicy stalks with their mechanical tissue coloured brownish purple have been extracted and fixed as types.

References.

1. Inheritance of Characters in Sorghum—The Great Millet, VIII. A Brownish Purple Mutant. *Ind. J. Agri. Sci.* VI (II), 1936. Pp. 481—483.

2. Mendelian Segregations for Juiciness and Sweetness in Sorghum Stalks. *Madras Agri. J.* XXIV (7), 1936. Pp. 247—248.

Millets Breeding Station,
Coimbatore,
April 7, 1937.

G. N. Rangaswami Ayyangar.
A. Kunhi Koran Nambiar.

Agricultural Jottings.

BY THE DEPARTMENT OF AGRICULTURE

Malting of cholam as a cottage Industry. Investigations of the Government Agricultural Chemist and his collaborators at Coimbatore have shown that it is possible to make excellent malt and malt foods out of cholam.

The Imperial Council of Agricultural Research sanctioned a scheme in 1935 with the triple object of finding more extended use for cholam, which occupies about 5,000,000 acres in our presidency, establishing cholam malting industry both on a small scale and large scale, and eventually to replace partially imported malted foods, on which a large amount of money is being spent.

Laboratory experiments have shown that foods of a great variety and a high solubility can be made out of cholam malt, but in this note the preparation of a simple kind of malt food from cholam is outlined. This can be tried in every home.

Cholam is soaked for a day in pure drinking water which has to be changed at least four times to allow proper aeration of the seed. The grain is allowed to sprout in a cool place in a room for three to four days until the rootlets are about ¾" long. After drying in the sun, the husk and sprouts are carefully removed by pounding in a wooden mortar. The husked, unbroken grain is gently roasted in a roaster or frying pan till a characteristic aroma is given out. This treated grain is called malt which can be crushed and sieved to get fine flour. The coarse fraction can be crushed once again to get second grade malt flour.

Conjee prepared out of the cholam malt flour with milk and sugar added to taste, would make a beverage which has practically all the beneficial effects of any other malt. During the sprouting of cholam active substances like diastase are developed, which digest starch into malt-sugar and break down partly the

protein and fat. The net result is the formation of easily digestible material useful for infants and invalids whose digestive powers are weak.

Agricultural Exhibitions. The extent to which actual cultivators take part in exhibitions organised by the Agricultural Department may be said to be an indication of the increasing touch of the departmental staff with the ryots of the district. At the sixth Vizagapatam District Agricultural Exhibition held at Etikoppaka in January last, a very large number of ryots from all over the district including the taluks added from Ganjam District sent in their exhibits and competed for certificates and medals. The character of the exhibition has during the past six years changed considerably from a more or less departmental show to one in which ryots who follow departmental advice show their best produce for the benefit and emulation of other ryots.

Another feature of this exhibition was that it was held under completely rural conditions in the farm of Rao Bahadur C. V. S. Narasimharaju Garu, where sugarcane (10 varieties), plantain (30 varieties), green manure and other crops were grown on improved lines for the occasion, besides demonstrations in the methods of conservation of manure, different improved implements, pumping machinery, cream jaggery manufacture. The visitors were predominently agricultural and took keen interest in the show and demonstrations, a number of lantern lectures and a radio entertainment having been also arranged for their education and amusement.

Some improvements in paddy cultivation. At Palur Agricultural Research Station in the South Arcot District, experiments were conducted on paddy in regard to methods of sowing and planting, varieties and manures.

Whether the crop is broadcasted or transplanted, a very large quantity of seed is used. Experiments were therefore devised to find out the number of seedlings to be planted in each hole and the maximum distance between any two to obtain the best results. These experiments were tried for five years and it was found that better results could be obtained by planting one or two seedlings than the usual method of planting in bunches. It was also found that samba seedlings 30, 40 or 50 days old and planted 6 inches apart yielded practically the same. With regard to seed rate in the nursery 2½ lbs. in one cent gave the best result.

Manurial experiments were carried out for fourteen years to test the different green manures and bulky organic manures in comparison with oil cakes. The experience gained during this long period went to show that the physical condition of the soil was greatly improved by the incorporation of bulky organic manures and thereby increased the yield. The advantage of the application of cattle manure to wet lands was practically inappreciable. Further the plots manured with *erukkam* and other tree leaves gave 200 lbs. more yield per acre than those manured with oil cakes. Hence ryots who own dry as well as wet lands will do well to apply cattle manure to dry lands and raise green manure crops in the wet lands for manuring paddy.

With regard to the several green manures, there was not much difference among them although Daincha produced the highest yield.

Daincha was grown in a field continuously for 15 years. By this method the mechanical texture of the soil was greatly improved and the alkalinity removed. This was evident by the increased yield obtained gradually year after year from 2,282 lbs. to over 3,900 lbs. per acre.

To find out whether green manures are to be supplemented with phosphatic and potassic manures, trials were conducted for about eight years in both single and double crop wet lands. The results showed that in order to obtain a fair yield, the application of green manure alone would generally solve the

problem. But there is certainly an advantage in the application of bonemeal although the effect is not very perceptible. It was found that in the case of single crop lands the increase in yield by the addition of bonemeal and potash was only slight but in double crop lands the addition of bonemeal at 1 cwt. per acre gave a slightly better yield than green manure alone. But the residual effect of phosphatic manures was always evident in the succeeding crop.

Bone guano and Kossier phosphate were compared with bonemeal to supply the phosphates to paddy and bonemeal was found to be superior to the other two by about 4%.

In order to see if better varieties could be substituted for the local varieties, several experiments were carefully conducted in different seasons. At present Aduthurai No. 12 for the first crop season, G. E. B. 24, Local garudan samba No. 43 and Aduthurai Nos. 1 and 2 for the samba season and Coimbatore No. 2 for the second crop season are being introduced and are finding much favour with ryots.

The Deputy Director of Live-stock informs us that the cow No. 95 H. bred by the Agricultural Department died at the Guntur Veterinary Hospital on the 2nd April 1937. She was reported to be the best milker among the Ongole cows milk yields of which have been recorded so far.

Her history is given below

Born	...	...	18—10—1925.
Sire	...	...	No. 20.
Dam	...	...	No. 32.

Yields :—

Lactation.	No. of days in milk.	Milk Yield lb.	Daily average lb.	No. of days dry.
1st.	342	4260·4	12·5	189
2nd.	213	5510·5	17·6	90
3rd.	334	7190·5	21·5	60
4th.	348	5765·6	16·6	220
5th.	219	4075·8	18·6	139
6th.	266	4841·7	18 2	160
7th.	157	2843·3	18·1	...

EXTRACT

Science and Practice of Agriculture in India. (Extract of the Presidential address given at the Agricultural Section of the Indian Science Congress 1937). By Rao Bahadur B. Visva Nath, F. I. C., F. N. I.

Soils. The work on soils has for its ultimate object the maintenance of the high productive capacity of soils which are rich, the restoration to normal those whose capacity has been reduced and to effect an appreciable increase in the yield of soils which are naturally poor. * * * * *

The important and common characteristics of the majority of the soils are that they are old, have reached a stage of minimum cropping capacity, are subject to intense sunlight and extremes of temperatures and are alkaline in reaction. Soil work in the beginning was, as would be expected, confined to problems of soil fertility. In recent years, the scientific study of the soil has received considerable attention. The work and experience of over a quarter of a century have brought into prominence certain factors which are of special interest.

In the majority of cases, the characteristics and reactions of soils are determined more by climatic factors than by geological origin. For example, the

so-called black cotton soils, though of different geological origin, have several important soil characteristics in common. The soil profile does not appear to have the significance that it has elsewhere, probably due to age and to the fact that the majority are transported soils. In several cases, the surface horizons are missing, due probably to erosion through centuries. The profile study is, however, of considerable importance in the field study of the soil as a whole. Such a study has been able to solve the puzzle in regard to the downward movement of water in stiff black cotton soils. It has been ascertained that minute cracks are responsible for the downward and lateral movements of water.

* * * * *

Soil-Cultivation. We were taught in the olden days that surface cultivation helps to decrease evaporation and on this basis the better growth of crop in cultivated fields was explained. Recent research has shown that surface cultivation does not help to conserve moisture, but does not explain its effect on crop growth. Likewise, the object of deeper cultivation was stated to be better aeration of soils. Leather's work shows that gaseous exchange occurs in soils normally to a depth of one foot. * * * There is evidence that frequent and deep cultivation is harmful to the soil and to the crop. This is in opposition to what we have been taught but is in agreement with the practice of the cultivator who, except at great intervals of time, does not ordinarily cultivate his soils deeply, nor is he willing to carry out too frequent cultivations of the surface soil. * * * * Recent experience in England also has raised doubts whether deep cultivation or intensive cultivation is really and always good. In an experiment in 1932 in England, neither potato nor sugar beet responded to more intensive cultivation than was necessary to keep down weeds. Indeed, further cultivation beyond this minimum amount did more harm than good. * * * * The effects of cultivation must, therefore be looked for elsewhere. One accepted advantage of cultivation is that it contributes to tilth and crumb structure in soils. The satisfactory formation of soil crumbs due to the aggregation of smaller particles by cultivation depends on the stability of these aggregates towards water. The more stable they are the better they will be from the point of view of crumb formation. In the light of modern work on soil clay, crumb formation and its stability depend on the cationic composition of the clay. It is greater and better for calcium clay than for other clays. The water relationships that exist between clay and water and the salt content of the soil and clay, exercise a direct or indirect influence according to conditions. The intermediate stages between complete calcium clay and sodium clay may have varying degrees of moisture requirements for the use of the plough. The more we understand these factors under different conditions of climate and cropping, the better we shall be in a position to deal with problems of soil cultivation.

Soil-Base Exchange and Related Phenomena. Soil workers are familiar with base-exchange phenomena in soils. This is the greatest achievement of modern soil research which has brought about a revolution not only in the study of the soil, but also in the practical aspects of soil management and amelioration. The conception of the reactive soil particle and of its exchange processes as ionic interactions has given us valuable information in the study of our soils and in understanding their behaviour, particularly in regard to irrigation and the formation and amelioration of alkaline soils. We now know how irrigation water and fertilizer salts can influence the composition and the properties of clay and the soil. We also know that in soils with adequate reserves of calcium, the intensive use of ammonium sulphate does not induce soil acidity. It is on the relative proportions of exchangeable calcium and hydrogen and not on their absolute quantities that the properties of a soil depend and by measuring the degree of saturation, it is possible to assess the field behaviour of a soil under

irrigation or during the rainy season. Attempts to correlate base exchange capacity with crop performance are not yet successful.

* * * *

The composition of the clay complex with respect to cations is of primary importance in determining the soil's ability to absorb water. When saturated with different bases, the moisture holding capacity varies with the base in the descending order, Na., Ca., Mg., and K. The ability to part with water will be in the reverse direction.

The implications of these observations in experiments dealing with water requirements of crops or in the amelioration of alkaline and saline soils is obvious. In the case of the former, the critical and total water requirements of crops will vary even if every other variant except the soil is kept constant. Depending on the nature and quantities of the salts present the amount of water that will be available to the plant will vary. In a salty soil, maize and jowar wilted at over 12 per cent. moisture content in the soil, while in a salt free soil the wilting point under identical conditions was at 7·6 per cent. moisture. In the presence of about 2 per cent. organic matter on the weight of the soil, the position was considerably altered. The difference in moisture content at the wilting point in the two soils was narrowed down to below 1·5 per cent.

The swing of the soil's reaction depends on the degree of moisture in the soil. With soils above pH 7 alkalinity will be in evidence under wet conditions while under dry conditions the same soil will show diminished alkalinity and increaed salinity. From theoretical considerations any calcium salt would be able to effect the necessary exchange reaction but in practice cost decides what should be used. In any case, the presence of organic matter is necessary. From these considerations molasses mixed with any available calcium compound is capable of bringing about the necessary reactions.

Fertilisers and Manures. * * * * The Imperial Council of Agricultural Research has recently collected and collated all the available data on fertilizer and manurial experiments carried out in India in the past. The study of the data on experiments which are sufficiently comprehensive and long enough to justify the view that the results are truly representative, warrants certain broad conclusions. The evidence establishes the suitability and, therefore, the importance to the great majority of Indian soils of indigenous organic manures like cattle manures, green manures, bone manure and fish manure and oil cakes; artificial fertilizers are of importance, but only of secondary importance by themselves, and they show themselves at their best in conjunction with organic manures or when the soil is normally rich in organic matter. In areas of precarious rainfall or inadequate irrigation facilities, artificial fertilizers almost invariably failed to be useful while the effect of organic manures was erratic. With assured moisture supply in the soil, the performance of artificial fertilizers was distinctly better and, in many instances, as good as and sometimes even better than organic manures, according to the nature of the crop.

Among the fertilizers the returns were greatest generally with nitrogenous fertilizers in almost all parts of India. The action of phosphates was evident generally but it was considerable in the crystalline tracts of peninsular India. The response to potassic fertilizers was not appreciable. Of the nitrogenous fertilizers, ammonium sulphate was the most satisfactory but not to such an extent as to rule out concentrated organic manures like oil-cakes, fish manures and hoof-meal. Superphosphates and ammonium phosphates showed themselves to be useful phosphatic fertilizers in combination with organic or inorganic nitrogenous fertilizers. Superphosphate was generally as efficacious or was even superior in some instances to bone meal, but when used alone the action of superphosphate was erratic. Potassic fertilizers were not used to the same

extent as nitrogenous and phosphatic fertilizers. On the few occasions on which they were used, the response was either feeble or none at all, and this experience was perhaps a sufficient deterrant.

In several cases, the continued use of artificial fertilizers only led to bad residual effects on the soil. When used in combination with organic manures, however, the effect of artificial fertilizers was almost the reverse of that when used alone. Higher dosages did result in higher yields, but these were not commensurate with the expense incurred. The evidence in regard to the time of application of fertilizers is neither extensive nor conclusive. What little there is, indicates that the fertilizers are best applied generally in one application at the time of planting for crops other than sugarcane, which prefers applications in two instalments. The next line of investigation should be an experiment and research on the internal and external effects of time of application to the crop. We have as yet not enough data on the proportionalities of N, P, and K, suited to different soils and crops and of the proportions in which organic and inorganic manures should be used.

The average nitrogen content of Indian soils is 0·05 per cent. and of organic carbon content is 0·6 per cent. Similar figures for European soils are 0·15 per cent. nitrogen and 3 per cent. organic carbon. European soils are five times as rich in humus contents and still the demand there is for organic matter. * * The needs of Indian soils are evident and the data from manurial experiments portray the requirements correctly. Cattle manure, green manures and other organic manures are valuable to soils because they supply what is popularly known as humus which is so essential to maintain soil fertility. The cry for organic manures for Indian soils is even stronger and more imperative because the disruption of organic matter is faster at the high temperatures obtaining in India. The rate of destruction can be imagined when it is stated that a soil receiving cattle manure at 10 tons per annum in two instalments continuously for over 20 years, contains only 0·74 per cent. or organic carbon as against 0·59 per cent of organic carbon in a soil that received no organic manure at all.

The theoretical possibilities of artificial fertilizers are almost limitless, but their achievement on the majority of Indian soils is limited by climatic factors and economic considerations. In India the major part of its agriculture depends on the monsoon, and therefore the supply of moisture in the soil is the foremost limiting factor in production. The control of monsoon is beyond our power, but surely we can better conserve and regulate moisture in soils by husbanding the existing resources of indigenous organic manures and using them properly.

* * * *

Soil organic matter is the life of the soil. It improves the physical condition of the soil; it provides organic colloidal material which plays a very important part in absorption and exchange, possessing four to five times the exchange capacity of inorganic colloids in the soil. * * * * Time was when it was supposed that artificial fertilizers had substituted and would continue to substitute natural organic manures, especially farmyard manure, with equal and even greater efficiency. It is now universally recognized that organic manures, exemplified by cattle manure, are necessary for maintaining soil fertility and that no combination of artificial fertilizers can exercise the steadying effect on crop yields from year to year. * * * *

The effect of farmyard manure is seen not only in the total crop yield but also in the higher ratio of grain to straw compared to artificials. In regard to the composition of the crop, there is no significant variation in nitrogen and potash but striking difference is noticed in the phosphate content of the crop from mineral and organic manured plots.

The most striking difference is in the quality of grain as *seed* and food. Ten years ago attention was called by Viswa Nath and Suryanarayana, and McCarrison and Viswa Nath to this important and till then unsuspected aspect of manuring crops. It will be instructive and useful to examine the evidence that has accumulated in this regard since then and to define the position as it now stands. With your indulgence I propose to discuss the work in a little more detail than it has been possible to discuss other lines of activity.

It is interesting to note that although the mechanism of action and the agents responsible for it are under debate, the evidence in the main lends support to the earlier observations on the effect of manurial and fertilizer treatment given to the crop. Repeated experiments by Viswa Nath, subsequent to the first publication, confirm the previous findings in showing that the crop producing quality of the *seed* is influenced by manurial treatment. When seeds from differently manured plots are sown in a soil of moderate fertility the resulting crops are different. The seed from a plot continuously manured with cattle manure gives a better crop than that manured continuously with artificials or not manured at all. Kottmeier (Kuhn, Archiv., 1927) carried out trials to determine the effect of different fertilizers on the *seed* value of potatoes and found that the worst quality *seed* was obtained with physiologically alkaline fertilizers like calcium cyanamide and sodium and potassic manures, while the best all round effects were obtained with farmyard manure or physiologically acid fertilizers like ammonium sulphate. Tallarico (Mem. R. Accad. Ital., 1931) has found that seeds from plants that are overnourished have less vitality than seeds from poor soils.

* * * * * *

Animal nutrition experiments by McCarrison with the identical grains (millet and wheat) as were used by Viswa Nath and Suryanarayana for vegetation tests, showed that grains grown with cattle manure possessed better nutritive value than crops grown with chemical manure or with no manure and that the crop grown with chemical fertilizers was superior to that from an unmanured soil. Subsequent experiments also pointed to the same result. * * * *

The probable causes for the superior effect of organic manures may well be either in the relatively high vitamin contents of the produce, or in the better metabolism in the crop under better moisture conditions due to manure. In some experiments with herbage, Viswa Nath (Annual Report, 1930–31) found that the digestive co-efficients varied with the nature of manuring; herbage raised with cattle manure had a protein digestion co-efficient of 74 per cent., while the figures for the crops raised with mineral manure and no manure were 70 per cent. and 62 per cent. respectively. The animals were fed on equivalent protein basis. Cattle manured herbage had the lowest total nitrogen and soluble ash content. The quantitative effects of nitrogen and mineral contents of the feeds having thus been ruled out, the high protein digestibility of cattle manured herbage points to better availability of proteins and other constituents. In certain preliminary experiments, grain from the unmanured plot yielded the largest quantity of prolamin and that from cattle manured plot yielded the least. The values for the grain in the mineral manured plot have been intermediate. Similar proportionalities have been observed by Bishop whose findings are that low nitrogen content of grain is associated with low prolamin and high salt soluble protein content. It would appear possible that protein metabolism in the plant varied with manurial treatment. * * * *

It would thus appear that if we neglect organic manures and fail to build up the humus content of the soils we shall be doing four things.

Firstly, we shall not be able to maintain the fertility of the soil.

Secondly, we shall not be using artificial fertilizers to the best advantage.

Thirdly, we shall be failing to keep up the inherent cropping power of our improved seed and run counter to the good work of the plant breeder.

Fourthly, we shall be producing food deficient in nutritive value.

* * * * It is therefore justifiable to expect a unanimous acceptance of the proposition that at the back of all improvement lies that of the soil whose organic matter content should be built up by all means in our power.

The Nitrogen Cycle. Soil nitrogen in its several phases has been receiving attention in many laboratories. The results of recent work bring into review the whole of the nitrogen cycle both from the scientific and practical points of view. Dhar and his collaborators have made the important observation and brought forward evidence to show that photonitrification occurs in soils. * * *

An important point on which there is however unanimity of opinion is in regard to photo-denitrification. * * * *

There is besides a considerable volume of evidence in India and elsewhere that loss of nitrogen occurs from the soil in ways other than through drainage and the consensus of opinion is that the loss occurs in the form of elemental nitrogen under dry and swampy conditions. * * In comparative experiments in the field the loss was the greatest with ammonium sulphate, least with cattle manure and intermediate with green manure. The loss was, however, not a continuous process. It was a series of periodical gains and losses of varying degrees of intensity, depending on the nature of the material. The position in the end was that a net loss in total nitrogen was registered with ammonium sulphate, and a net gain with cattle and green manure, the gain being greater with the former. The presence or absence of crop did not make any difference in the nature of the reaction although there was difference in the magnitude of the fluctuation.

Nitrogen fluctuations in the soil are usually explained in terms of the effect of carbon-nitrogen ratios on the biological processes which begin to operate immediately the requisite nitrogen is either put in the soil or is obtained from the atmosphere and any defect in nitrate nitrogen is placed to the credit of the concerned micro-organisms. On this basis it is difficult to explain the loss of total nitrogen. * * * *

Some recent laboratory investigations with soil cultures using sugar only in one set and nitrate only in another and a third in which sugar and nitrate are used together, show that regardless of the initial C : N ratio, the loss of carbon is fairly constant amounting to about 70 to 80 per cent. of added carbon, the ratio ultimately assuming a value round about 10. With sugar alone, loss of carbon was associated with gain in nitrogen, the latter obviously being obtained by fixation from the atmosphere till the ratio reached 10. With only nitrate the changes in the carbon and nitrogen were too small to be significant. When, however, sodium nitrate was substituted by ammonium sulphate, it was converted into nitrate with a loss of ten per cent on the total nitrogen. * * * *

What is the meaning of all these changes? What is the significance of nitrification? If crops feed in the form of nitrates, why should there be loss of nitrate and nitrogen? Is it possible that the capacity for nitrification is simply an index of the soil's respiration efficiency? What is the relationship between nitrification and nitrogen fixation? Can it be that nitrogen fixation is more intimately connected with the direct feeding of crop and nitrification is a means of rendering oxygen available, and what part does sunlight play in this? Do the results of recent experiments by Subrahmanyan on the action of inorganic oxidizing materials give any clue? These are all intensely interesting questions that arise from a critical study of the recent results and require an answer.

Meanwhile we may examine with reference to practice the problem. Nitrogen is the most expensive of the fertilizer constituents to buy It is surely bad business if it is to be bought and put into the soil only to be entirely or partly lost into the air. Fortunately, however, it is capable of replacement in the soil by natural means. * * * * Comprehensive studies by Rao Bahadur Sahasrabudhe, in the field and in the laboratory, establish that considerable nitrogen fixation occurs sufficient to maintain the fertility of the soils of the arid and semi-arid tracts in the Deccan. * * * Joshi has computed from field experiments at Pusa that under favourable conditions as much as 360 pounds of nitrogen per acre, including that removed in the crops, is gained in the cold and hot seasons.

It is natural to enquire that if such large nitrogen gains are possible, where then is the necessity for adding nitrogenous fertilizers and how additional crop responses are possible on the mere addition of 20 or 30 pounds of artificial nitrogen. If the conditions in the majority of Indian soils are favourable for nitrogen recuperation, the same conditions, namely sunlight and temperature, help to destroy the organic matter of soil which produces a disturbed physical condition in the soil soon to be followed by all other inevitable consequences. Under such circumstances the addition of small amounts of artificial nitrogen probably helps, partly at least, in assisting the recovery of physical and biochemical conditions. The natural process of nitrogen recuperation depends for its success on the sufficient organic matter-supply in the soil.

Recent experience at the Kansas Experiment Station points in the same direction.

The Problem of Organic Matter and Manure Supply. * * * * It is computed that under our conditions about 75 per cent. of the fresh organic matter added to the soil and about thirty per cent. of the stabilized humus are destroyed annually. The position calls for investigations on the means both for conserving organic matter that is already in the soil and for increasing our resources of organic manures.

By carefully storing the dung, urine, litter and other refuse material, it is possible to conserve this source of supply. * * * * However carefully it is preserved and its quality improved, we cannot get enough of it to meet the requirements. Composting all waste vegetation is another means by which the supply of farmyard manure can be supplemented.

The problem of composting has been receiving considerable attention at the hands of agricultural workers in India. These endeavours have always been to develop a technique suitable to Indian conditions. * * * * The changes in the details of the technique during the last few years are indicative that the process of composting is still open to further studies.

It would appear that it is the organic matter of the compost or of the manure that is more important than its nitrogen components, its loss of nitrogen does not seem to be an avoidable factor which depends on the initial richness of the basic material used for the compost. It would also appear from a study of temperatures that the process is both chemical and biochemical consisting of a low temperature period of chemical oxidation and a high temperature period of biochemical oxidation. Both the processes proceed side by side, the one or the other being a predominant feature for the time being. The low temperature fermentation seems to be more in evidence after the high temperature fermentation is over and when the apparent stabilized stage is reached. It is possible that the reinforcing of these composts with nitrogen and phosphate at the end of the fermentation period is likely to render fertilizer usage more valuable than it is now. * * * While many of the methods proposed are workable on plantation basis, their suitability to the peasant cultivator is doubtful. If composting is to form a regular agricultural practice in India, it is necessary that

efforts should be made to make the method simpler and cheaper than what it now is.

* * * * The possibilities of utilizing the vegetation of forest areas for supplying cheap fuel in the shape of charcoal and compressed briquets of composted humus, without affecting the requirements of the forests themselves, is a problem worthy of investigation. Vageler has estimated that the yearly production of fresh organic matter in the primaeval or rain forest at one hundred tons per acre as a cautious estimate. For the monsoon forest the estimate is about 20 tons to the acre. The problem is, how much can be spared for the plains. The problem should be viewed and be considered on the analogy of irrigation by which waters from areas of plenty are carried to areas of scarcity.

* * * * * *

Problems of Food and Nutrition. * * * * *

A W. Flux, in his presidential address to the Royal Statistical Society (June, 1930) on 'Our food supply before and after war', fixed 86·5 grammes of protein per head per day in England. This is equivalent to 14 grammes of nitrogen per head per day. For India, I have assumed that the food requirements are lower and have taken an everage of 75 grammes of protein consumption per head per day. This is equivalent to 12 grammes of nitrogen. On this basis, the annual requirement of nitrogen, necessary for feeding a population of 353 millions, works out to 1,522,312 tons of food nitrogen for the whole population or 9 66 pounds of nitrogen per head per year. From the 247,000,000 acres under cultivation with various food crops, a total of 1071,138 tons of food nitrogen are available. Thus, we are short by roughly 500,000 tons of food nitrogen. In other words, we are at present producing food sufficient for the proper feeding of only two-thirds of the population.

The supply of food has to be increased by increasing the outturn per acre and by bringing more land under cultivation. With high yielding strains of crops and suitable soil management, it should be possible to increase production sufficient to meet the needs. Our botanists can and are producing high yielding strains which, on the average, give 10 to 15 per cent. increase in yield. A quarter of a century of experimental work has demonstrated that by rational soil management and manuring a further increase of 10 to 15 per cent. can be expected. The results of recent sugar-cane growing competition under the auspices of the Maharashtra Chamber of Commerce, Bombay, show that large increases are not impossible. In these competitions, the Kalamb Sugar Factory harvested as much as 104·28 tons of cane to the acre. Several other factories recorded 80 to 100 tons of cane to the acre as against the normal average of about 40 tons to the acre.

Conclusion. In this brief sketch I have endeavoured to draw attention to some of the outstanding problems, the solution of which intimately concerns agricultural practice. * * * * Great as has been our achievements in the past, we have only laid the foundations for the future. The scientific study of the soil will doubtless enable improvements for the future as it has done for the past, but the utilization of this knowledge to the full will be in proportion to our ability to build up the reserves of organic matter in the soil.

Indian agriculture is one of great antiquity and many of the present-day practices are the outcome of experience through at least fifty centuries. * * * The effect of intensive cultivation and the intensive use of fertilizers in India without the necessary accompaniments is obvious.

Research should concern itself more with details of existing practices than with the evolution of wholly new methods and should aim at building up on the existing system a state of agriculture to suit the condition of the soil and the resources of the cultivator.

Reviews.

Booklet on " Beekeeping " in Tamil by S. Gopalakrishnan, Madras.

The booklet is on the whole well written, presenting the salient points of the subject, in a concise form, with a few illustrations. Its get up is quite attractive and the low price (four annas) as compared with the information contained, is bound to make it quite popular.

The subject is dealt with in 11 chapters, commencing with beekeeping– new and old. The subsequent chapters contain information regarding the life history of the honey bee, the different indigenous varieties, hives and appliances, care and management of bees, swarming, enemies, etc. Information on hiving wild colonies and details of the bee hive are given in two appendices.

As the booklet is expected to serve as a useful guide to amateurs, the following few suggestions, to make it more useful to the public, are offered. A few facts on the bee pasturage plants, breeding season, economics, may be given in the booklet. There are certain statements such as the capacity of the queen to lay 3000 eggs per day, of the capacity of the bees to travel up to 2 or 3 miles, the massacre of the drones, which are not quite correct in the case of the Indian bee. The statement that the pollen basket is in the second joint of the hind leg needs correction.

The portion dealing with the care and management of bees must be more comprehensive, giving fuller details of the various operations including uniting bee colonies, introduction of queen in a queenless colony, which are often necessary while managing an apiary. The portion on swarming—the most important aspect—is too meagre. The portion on bee enemies is too short. The wax moth especially deserves a more detailed treatment and the remedy suggested by the author will hardly be of any use to the amateur. The method advocated by the author for hiving swarms and capturing wild colonies do not seem to be quite practicable ; at any rate, there are better methods which can be suggested.

M. C. C.

Rural Reconstruction. N. G. Apte, B. Ag. (Dairy).

The book is a collection of a few notes and articles prepared by the author at different times during 1931—34 as a result of his investigations into the rural life of Maharashtra. Mr. Apte has spared no pains in making the investigation as thorough as circumstances permitted and as far as it goes the book gives a fair idea of the present-day conditions which rural workers are faced with. The only portion however which will interest the general reader is, in our opinion, that which deals with the possibilities of starting "Fruit preserves" industries wherever facilities exist.

As regards the rest we do not certainly see eye to eye with the author especially regarding some of his generalisations about the causes of the present unenviable position of the Indian villager. Nor are the remedies proposed as convincing as the author tries to make out. The chapter on the village water supply is, if at all, of only local interest.

As a faithful record of the investigations carried out by an enthusiast we commend the book to all those interested in the work of rural reconstruction.

The publication is priced Rs. 2—8 and is available with R. K. Rao, Pallipat, Nagari Ry. Stn., Chittoor Dt.

M. U. V.

College News & Notes.

Honey Week. The celebration at the Agricultural college of the 'Honey Week' that had been arranged for the first time to be observed on a Presidency basis came off on the after-noon of the 24th of last month. Before a distinguished gathering, Mr. R. C. Broadfoot, Principal inaugurated the function at the College Apiary.

Mr. M. C. Cherian, the Government Entomologist, in inviting the Principal to preside on the occasion said that the economic possibilities of bee-keeping as a cottage or subsidiary industry are great owing to its low capital cost and the existence of other natural facilities. The cost of a hive and an extractor, which represent all that are required, would come to only Rs. 8, while at a modest estimate, each hive can be expected to yield about 6 to 8 lb. of honey in the year worth about Rs. 10. He then proceeded to narrate what the Entomological section is doing to popularise the industry. Started in 1931, the Apiary at the college has at presnt 40 hives in working condition, and a great deal of information has been collected regarding the bee-pasturage plants, its enemies and their control. In addition, active propaganda is being made by means of printed pamphlets and by demonstration, at most of the exhibitions and fairs.

Specialised instruction is also being imparted to the sons of farmers in the short courses arranged at the college.

Mr. R. C. Broadfoot, in thanking Mr. M. C. Cherian for the invitation expressed the pleasure it gave him in inaugurating the first 'Honey Week' at the college. The object of this week, he said, was to introduce bee-keeping as a subsidiary industry in rural areas. He recalled how one of his friends in England was making quite a decent living out of 20 hives and by supplying bees and bee-keeping appliances to others. His hives averaged over 100 lbs. of honey per annum, which indicates its possibilities in skilled hands. Honey is being sold in England from 9 d. to 1/- per lb. for ordinary grades and from 1/4 to 1/6 for heather-honey. Conditions in India are considerably more favourable for the industry. Bee pasturage can be had all the year round and there would be little need therefore to feed the bees. Further, good honey fetches somewhere about Rs. 1—12—0 a pound at which rate even small yields of 10 to 12 lb. will prove profitable. Mr. Broadfoot then referred to the facilities available at the college for learning this art and that if specialised training or advice is wanted, the Government Entomologist would no doubt make suitable arrangements. With these words, he declared the exhibition open and in recommending it to all present, announced that the exhibition would be on for a week.

The function came to a close with a vote of thanks proposed by Mr. T. V. Subramaniam, Assistant Entomologist.

B. Sc. Ag. Examination. The following gentlemen were at the College in the capacity of examiners in the recent University examination. Mr. B. G. Appadorai Mudaliar B. A., B. Sc. (Tech.), A. M. I. M. E. for Agricultural Engineering. Rao Sahib Mr. M. Ananta Narayana Rao G. M. V. C. for Animal Hygiene and Mr. K. R. Narayana Iyer M. Sc. for Agricultural Chemistry.

Economic Biologists' Association. There was a lecture by Mr. Percy Kent Norris Cotton Commissioner, Section of Plant Industry, Dept. of Agriculture the U. S. A. on the subject of " The working of the Agricultural Adjustment Act in U. S. A. ".

Coronation Honours. We are glad to note that the Government have been pleased to award titles to two of our Departmental Officers in the recent Coronation Honours List, and we congratulate Messrs. Rao Bahadur N. S. Kulandaisami Pillai and Rao Sahib G. Jogi Raju Garu on their well merited distinction.

Weather Review (MARCH 1937).

RAINFALL DATA.

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·3	−0·2	8·1	South	Negapatam	0·2	−0·1	4·6
	Berhampore*	0·7	−0·5	5·1		Aduthurai *	1·1	−0·3	1·5
	Calingapatam	0·3	−0·1	3·5		Madura	0·5	0 0	0·6
	Vizagapatam	0·4	−0·1	3·5		Pamban	2·5	+0·97	6·7
	Anakapalli*	2·7	+2·4	5·6		Koilpatti *	0·7	−0·2	3·8
	Samalkota*	...	−0·2	1 6		Palamkottah	...	...	...
	Maruteru*	...	−0·0	0·9					
	Cocanada	0·1	−0·4	1·1					
	Masulipatam	...	−0·3	2·8	West Coast	Trivandrum	3·9	+2·3	5·3
	Guntur*	...	−0·2	0 5		Cochin	1·1	−0·9	2·4
Ceded Dists.	Kurnool	0·1	−0·2	1·1		Calicut	0·2	−0 3	0·2
	Nandyal*	0·4	+0·2	1·5		Pattambi *	0·5	−0·5	0·6
	Hagari *	0·6	+0·4	1·1		Taliparamba *	0·3	−0·1	0 3
	Bellary	0·6	+0·4	1·8		Kasargode *	0·0	−0 5	0·0
	Anantapur	...	−0·2	0·7		Nileshwar*	0·0	−0·3	0·3
	Rentachintala	0·2	...	1·8		Mangalore	0·0	−0·1	0·0
	Cuddapah	0·6	−0·5	0·9					
	Anantharaju-pet *	...	...	2·1	Mysore and Coorg	Chitaldrug	0·1	−0·2	0·1
Carnatic	Nellore	...	−0·2	0·7		Bangalore	0·8	+0·2	2·7
	Madras	...	−0·2	0·1		Mysore	0·9	+0·5	1·6
	Palur*	2·2	+0·8	3·6		Mercara	3·6	+3·0	4·7
	Tindivanam *	1·8	+0·3	2·2					
	Cuddalore	1·3	+1·1	3·2	Hills.	Kodaikanal	2·5	+0·5	4·7
Central	Vellore	0·4	+0·4	0·7		Coonoor*	6·4	...	13·9
	Salem	...	−0·5	0 0		Ootacamund *	2 1	+1·0	3·4
	Coimbatore	0·7	−0·2	0·8		Nanjanad *	1·7	+0·7	4·3
	Coimbatore A. C. & R. I.*	2·0	+0·2	2·1					
	Trichinopoly	0·4	0·0	0·7					

* Meteorological Stations of the Madras Agricultural Department.

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

A wave of low pressure moving westwards across Ceylon has caused wide spread thunderstorms in South Madras.

During the month rainfall is normal in Mysore, and Coorg and hills, below normal in West coast and elsewhere.

Weather Report for Research Institute Observatory.

Report No. 3/37.

Absolute maximum in shade.	...	96·5°F.
Absolute minimum in shade.	...	64·0″
Mean maximum in shade.	...	94·1″
Departure from normal.	...	0·4″
Mean minimum in shade.	...	70·80″
Departure from normal.	...	plus 1·4″
Total Rainfall.	...	2·0″

Departure from normal.	...	plus 1·2″
Heaviest fall in 24 hours.	...	1·41″ (recorded on 19th)
Total number of rainy days.	...	3
Mean daily wind velocity.	...	1·1 M. P. H.
Mean humidity at 8 hours.	...	70·2%
Departure from normal.	...	plus 0·5%

Summary. The mean minimum temperature was above normal by 1·4°F while the mean maximum was about the normal. A rainfall of 1·41″ were recorded on 19th and rainfall was in excess of the normal by 1·2″. The mean humidity was in excess by 0·5%. Otherwise the general weather conditions continued to be normal. P. V. R. & P. G.

Departmental Notifications.

1. Transfers.

Name of officers.	Transferred	
	From	To
M.R.Ry. T. Paramanandam	Guntur	Nandigama.
,, D. Atchyutarama Raju	Nandigama	Ongole.
,, D. C. Hanumantha Rao	Ongole	Tenali.
,, D. Bapayya	Tenali	Bezwada.
,, M. Ramareddi	Bezwada	Guntur.
,, I. Kurma Rao	Anakapalli	Second Circle.
,, A. B. Adisesha Reddi	Coimbatore	Third Circle.
,, K. Sri Raman	Science Section	Chemistry Section.
,, C. A. S. Ramalingam Pillai	Srivilliputtur	Fifth Circle.
,, P. V. Samu Ayyar	Kulitalai	Srivilliputtur.
,, A. Chidambaram Pillai	—	Dindigul.
,, M. C. Krishnaswami Sarma	Coimbatore	Tirumangalam.
,, A. K. Ganesa Ayyar	Tirumangalam	Ramnad.
,, S. P. Fernando	Dindigul	Eighth Circle.
,, K. C. Thomas	Tiruppur	Central Farm, Coimbatore.
,, T. V. Ayyaswamy Iyer	Tirupattur	Aruppukottai.
,, S. Ponnuswamy Naidu	Sankarankoil	Ambasamudram.
,, S. Bhima Raju	Ambasamudram	Sankarankoil.
,, P. Somayajulu	Maruteru	Buchireddipalayam.

2. Leave.

Name of officers.	Period on leave.
M.R.Ry. T. Paramandam	3 months on m. c. from 20-4—37.
,, K. Suryanarayana	1 month on m. c. from 10—5—37.
,, K. Kuppuswamy	1 month on m. c. from 10—5—37.
,, T. Varahalu	1 month from 1—5—37.
,, V. M. Ramunni Kidavu	3 months on m. c. from 23—4—37.
,, K. Jagannatha Rao	2 months on m. c. from 1—5—37.
,, R. G. Mal	3 months on m. c. from 20—4—37.
,, P. Kannan Nambiar	2 months on m. c. from date of relief.
,, K. S. Krishnamurti Iyer	2 months on m. c. from 10—5—37.
,, T. Rajagopala Iyengar	1 month on m. c. from 3—5—37.

The following officiating appointments in the III Grade have been ordered.

3. Posting.

Name of officers.	Posting.
Mr. Ali Hyder.	Third Circle.
M.R Ry. C. Bhujanga Rao.	,,
Mr. James Colaco.	Chemistry Section.
M.R.Ry. S. D. S. Albuqerque.	Nileshwar.
,, C. T. Ittyachan.	Chemistry Section, Coimbatore.
Mr. Joshua Moses.	Sixth Circle.
M.R.Ry. Rajabapaniah.	First Circle.
,, M. Venkataramhiah.	Second Circle.
,, T. Arunachalam.	Sixth Circle.
,, K. Jaya Raman.	Oil seed Section.
,, M. M. Krishna Marar.	Third Circle.
,, K. S. Kutty Mudali.	Sixth Circle.
,, G. Satyanarayana.	First Circle.
,, M. Kasivisvanathan.	Third Circle.
,, M. Lakshmikantham.	First Circle.
,, C. Krishnamurti.	Third Circle.
,, G. Narasimhamurty.	Third Circle.
,, D. Satyanarayana.	First Circle.
,, G. Satyanarayana Rao.	Third Circle.
,, K. Adinarayana Rao.	Second Circle.
,, G. Vekata Sastry.	First Circle.
,, A. Subba Rao.	Second Circle.
,, K. Sri Raman.	Third Circle.
,, B. Suryanarayana Murthi.	Second Circle.
,, G. Kameswara Rao.	First Circle.
,, Ranganathachari.	Third Circle.
,, V. G. Venkatarama Rao.	Second Circle.
,, V. S. Rangacharlu.	Third Circle.
,, G. V. Vekataramana.	Second Circle.
,, N. Ragava Rao.	Agricultural Research Station, Anakapalli.
,, S. V. Parthasarathi.	Second Circle.
,, P. Ramanatha Rao.	Second Circle.
,, A. Raghavan.	Third Circle.
,, S Sangameswara Sarma.	Anakapalli.

Promotion.

The following promotions of Upper Subordinates in Class I, Madras Agricultural Subordinate Service, in the *Science Section* are ordered:—

(i) M.R.Ry. K. M. Thomas Avl., Assistant in Mycology, II Grade (Rs. 225/-) to I Grade Rs. 250/- without prejudice to his appointment on probation in the Madras Agricultural Service—to take effect from *16th Decemher 1935.*

(ii) M.R.Ry. Samuel Jobitha Raj Avl., Assistant in Paddy, from III Grade (Rs. 200/-) to II Grade Rs. 225/- without prejudice to his officiating appointment in the Madras Agricultural Service—to take effect from *16th December 1935.*

(iii) M.R.Ry. C. V. Sundaram Avl., Assistant in Entomology, from IV Grade (Rs. 120—10—170) to III Grade (Rs. 200/-) to take effect from *26th February 1936.*

(iv) M.R.Ry. S. Ramanujam Avl., Assistant in Paddy (on leave) from V Grade Rs. 85—5—120 to IV Grade Rs. 120—10—170 to take effect from *22nd May 1936.*