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Editorial.

Rural Development Commissioners. The appointments of Messrs. Brayne and Townsend of the Indian Civil Service as Rural Development Commissioners in the Punjab and Bengal respectively are of considerable significance. They are the logical sequence of that desirable co-ordination in the various endeavours at rural uplift, which need co-relation. The growth in urban populations and the unemployment therein, could find a solution only in a well-concerted plan that will induce people to go back to the land. These villages will have to be made worth living in. We have no doubt that Madras will take early steps to see that a whole time officer is appointed to take care of rural development.

Rural Library Service. It is noteworthy that during this month there were two expositions on this aspect of rural service—both of them in the Y. M. C. A., Madras. One was from Rao Sahib S. V. Kanagasabhai Pillai of Mannargudi fame and the other was by Mrs. Hilda Wood. The need for rural libraries is obvious and the success with which Mr. Pillai is working his rural library at Mannargudi is very striking. These libraries, Mr. Pillai feels, serve the needs of the villager far away from towns, and, the special needs of the villager in immediate proximity to towns, have to be met by a special equipment that will cater to these people absent for most of the time from their homes. Mrs. Hilda Wood's conception goes much farther and looks forward to the enactment of dramas, *kalakshepam* performances,

lectures, songs and music entertainments contributing to the enlargement of rural interests. All this work needs a band of selfless workers wedded to the village. The possibility of retired government servants utilising their leisure to these ends by settling in villages, is also urged in the course of the discussion. It is hoped that as indicated by Kumara Raja Muthia Chettiar, there would soon be introduced a Rural Libraries Bill that would regularise the action to be taken and ensure its continuance on sound lines

Broadcasting in Rural Areas. Col. Hardinge the author of the scheme for Broadcasting in Rural India, which is sponsored by the Indian Village Welfare Association, is of opinion that the supreme need of India for the moment politically, socially and economically was education in the broader sense of the term and this need could only be supplied through broadcasting. He did not favour a few big transmitting stations, but would like small district transmitting stations serving an area of about 2000 square miles. In these stations people could be spoken to in their own dialect. He anticipates installation of foolproof sets capable of being worked by a man of ordinary intelligence. The cost is estimated at £ 25 (about Rs. 335) with Rs. 30 for annual maintenance. This cost would be much less in areas served with electricity. The sets he had in view would be adjusted and tuned by an expert once in three months and could be worked by turning a key just as was done in motor cars. He is starting work in the Punjab and intends taking in Indians for training. He hopes eventually to have factories for manufacturing broadcasting appliances in India itself. This service should employ some men and to a degree relieve unemployment. The greatest benefit from this will be that it will serve as one of the factors contributing to make it worth while to live in villages. We in Madras await rapid developments in this direction and keenly look forward to the coming in of the expert appointed by the Madras Government to advise them on this question. It is gratifying to note that the Government of India intends convening a Conference of representatives from the Provinces to consider the utilisation of wireless in connection with rural uplift programme.

Statistics of Improved Implements. The Merchants' Chamber of the United Provinces, Cawnpore, has written to the Secretary to the Government of India in the Department of Industries and Labour, to the Secretary to the Imperial Council of Agricultural Research and to the Director-General of Commercial Intelligence and Statistics suggesting, that the figures for new and improved agricultural implements, pumps and oil engines in use in the agricultural operations in the country, should be collected for all provinces and made available to the public at the time of the next quinquennial plough and cattle census of India, which is due in 1934—35.

At the time of the last quinquennial census in 1929—30, the figures of new and improved implements and pumps in use in agriculture were

collected in the Bombay Presidency, but not in the other provinces. The inclusion of the suggested statistics and figures of these will be helpful to the Indian manufacturers of these articles, in that they will enable them to gauge the extent of the present as well as the possible future market for these in agriculture—the greatest industry in the country.

We trust that Madras will do likewise and give an impetus to indigenous agricultural engineering in the manufacture of improved implements.

IDENTIFICATION OF SEX IN GANJA (*CANNABIS INDICA* LAMK) BY BOTANICAL CHARACTERS

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This piece of investigation which was undertaken as a subsidiary one during the course of the main investigation on "the causes into the deterioration of Ganja, and the best means of storing it", had given some useful indications which are likely to be of immense practical value in the identification of sex during the earlier stages of growth.

Ganja is essentially a dioecious plant, but it is not uncommon to see monoecious ones also on the field. Any number of variations in the floral parts such as the appearance of stamens in the pistillate flowers, the presence of a few male flowers in the midst of a female spike etc., were observed during the growth of the crop, and all these would have crept in under the continued methods of cultivation and other environmental changes.

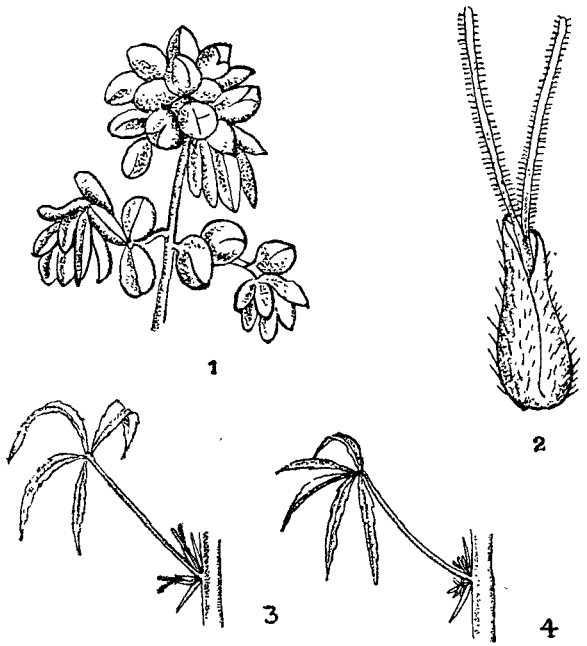
The plants can easily be made out as either males or females when once the flowers open and show themselves out, but the problem was to identify the same during the earlier stages of growth, if possible by some differences in vegetative characters between the two sexes. This was necessitated by the fact that ganja (used as a drug and for smoking purposes) which is the inflorescence of the female plants, owes its intoxicating property to a resin contained in the floral tracts and smaller leaves, and its efficacy is supposed to be lost when once the females get fertilised, as the resin material is transformed into the seed material. This necessity for the identification of sex does not loom large in colder countries where ganja is grown solely for the sake of fibre, and the production of resin either never takes place, or even if formed, is practically nil. Though very many views have been expressed about the effect of fertilization on the resin content of the drug, the last word has not yet been said. Nevertheless, the identification and elimination of males seems imperative owing to the following reasons.

(1) the male plants which do not form spikes like females and produce resin, are useless from the view point of ganja.

(2) by remaining on the field along with the females, (nearly 50% are males) they unnecessarily deplete the soil, and rob the other useful plants of their plant food.

and (3) the plants being absolutely useless, if not detrimental to the other sex, involve the necessity of elimination at the time of harvest which means more labour and waste of time.

Previous workers (Prain. *Report on the cultivation and use of ganja*), stated that the males may show a tendency to have the lower leaves opposite, but such differences were not found to be of much use in the course of identification.



Two things should be borne in mind before the males can be considered harmful and they are, (i) the male flowers should fully mature, and (ii) they must shed their pollen. Even if some differences could be found either in the shape, size, or position of the respective floral parts in the earlier stages, they should be of immense use in the identification of sex. As far as vegetative characters were concerned, it was found to be almost impossible to detect any differences whatsoever between the two sexes. An examination of the floral parts has shown that the flowering generally commences from top. The male flowers are short, round or ovoid in shape, and occur in clusters. (Fig. 1). The female flowers are linear or spear-shaped and also occur

in clusters (spikes) excepting those that are seen in the leaf axils on the main stem. The female flowers even in very young stages sometimes show the presence of the two feathery stigmas (Fig 2). This difference in shape and size is so very characteristic and distinct that it can be made out as early as 30 to 40 days from the date of sowing. But, it is not worth while worrying about the identification at such an early age as that, as at that age the males are very immature and therefore quite harmless. Flowering on a pronounced scale takes place between 50 to 60 days after sowing, and it will be exceedingly easy to identify and eliminate at this age, and possibilities of committing any mistakes are few. A number of plants were examined with the differences noted above as the basis of identification, and a few of the results are seen in table I.

Table I.

Season.	Number of plants kept under experiment, and age.	Number of plants turning out male.	Number of plants turning out female.	Number of plants turning out monoecious	Percentage correct.
1927—28	50 (60 days)	47	2	1	94
1928—29	50 (33 days)	35	13	2	70
	50 (47 days)	46	2	2	92

The method of experimenting was as follows. The plants taken for the experiment were labelled and the probable sexes (in this case attempt was made to eliminate all males) noted. As the plants grew up and revealed their true nature, they were checked against the observations previously made and verified. As the results show, when identification is done at 50 days, 90—95% correct results are obtained. With a little more care and practice it may be easy to obtain 100% correct results.

Again, another interesting difference between the two sexes was noticed, and this was not so much in the floral parts. As was already indicated, the female plants besides the female flowers seen in spikes on the branches, have individual female flowers in the axils of leaves (one on either side of the leaf) on the main stem, and these are quite distinct and large, being linear or spear-shaped as the other females are. (Fig. 3). In many cases these will be the first to form seed. In the case of males, besides the male flowers occuring at the top in clusters, some leaf-like vegetative growths are seen in the axils of leaves (on either side) on the main stem, and the position of these corresponds to the individual female flowers seen in the case of the female plants. (Fig. 4). The place of these vegetative growths might as well be taken up by clusters of male flowers also. These out-growths are quite distinct and cannot be mistaken for the female flowers, as the females are always

single with a single tip (though they sometimes show the two feathery stigmas), whereas these (out-growths) generally have more than two tips.In a few cases, these out-growths appear like small branches also. In many of the plants observed, the appearance of these vegetative buds preceded flowering. For the results noted in table 2, only plants which had these vegetative growths were taken for the experiment and their sexes verified later. No trace of any flower was seen in any of the cases at the time of labelling for the experiment. The results of two seasons' test are seen in table 2.

Table 2.

Identification of males on the basis of leaf buds in the leaf axils on the main stem.

Season.	Total number of plants tested and age.	Number of plants turning out males.	Number of plants turning out females.	Number of plants turning out monoecious.	Missing.	Percentage correct.
1927—28	50 (60 days)	42	6	—	2	84·0
1928—29	50	44	3	1	2	90·0

The results being self explanatory need little comment. This shows that plants which show no trace of any flower on them, but only show such vegetative growths in the leaf axils on the main steam, can in ninety cases out of hundred be definitely put down as males and therefore eliminated. As the above results show, some females also appear to have such out-growths, but their percentage is very low.

Coming then to the practical aspect of the point, it was already pointed out that elimination and identification are easy after 45 to 50 days from the date of sowing. An examination of every plant sown does not appear necessary. The distance generally allowed between two plants in a row is 2½ to 3 feet, and when elimination is done it is easy to pitch upon two positive female plants at that distance and pull out all the intervening plants. This is easier, more time-saving and economical.

Summary.

(1) Male and female flowers can be identified by their shape, size and appearance in very early stages, the males are short, ovoid or round, and appear in clusters; the females are linear or spear-shaped, and occur in spikes, excepting the individual female flowers seen in the axils of leaves on the main stem.

(2) In case where no trace of flower is seen on the plant, the presence of small vegetative buds in the axils of leaves on the main stem is almost a sure indication of its being a male, if not a perfect male it will at least be a monoecious one which is equally bad.

A SHORT NOTE ON ONION CULTIVATION IN THE ANAKAPALLE AREA

By A. SURAPPA NAIDU,

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Onion is an important crop on the Anakapalle area, being a short duration money crop either preceding or succeeding paddy in wet lands or grown in rotation with a variety of crops in garden and dry-lands. Beyond the personal labour of the ryot it does not require much cash expenditure in its cultivation, and generally fetches decent returns. There are three seasons for onions: (1) January to March, during which a *Paira* crop is raised from seedlings; (2) May to July, during which a *punasa* crop is raised from bulbs from the *paira* crop; and (3) September to December, during which a rainy weather crop is raised from bulbs of the *Punasa* crop. A brief account of the onion cultivation of the crop in the three seasons is given below.

THE PAIRA SEASON—JANUARY TO MARCH

Nurseries. For this crop seeds are sown towards the end of November in small beds of loamy soil, well prepared after a sufficient quantity of cattle manure is added. One *Kuncham* or 7 lbs. of seed is sown for an acre of transplanted area. The seed-beds are watered thrice, during the first fortnight (once in 5 days) by which time the seeds germinate. Thereafter, the seedlings are watered once in 10 days for about 1½ months by which time they will be ready for transplanting in the fields prepared for the purpose. This crop is raised both in wet and garden lands.

Planting. The planting is done in thoroughly ploughed and well manured fields in the beginning of January. The fields are thoroughly irrigated and seedlings transplanted at a distance of 4 to 6 inches.

Ten days after the planting the crop gets a top dressing of finely powdered cattle manure followed by a hoeing and irrigation. After this, two irrigations are given at an interval of 15 days. Ten days later, the crop gets another irrigation, and with this the bulbs begin to form. Thereafter two or three more irrigations follow once in 8 days by which time the bulbs develop fully. No further irrigations are given, the crop being left to wither for about 20 days and then harvested.

Harvest. After the crop is fully ripe all the bulbs with the leaves are pulled and heaped. The next day the leaves are cut and the bulbs separated. Drying is done in a well ventilated shady place like a *pandal*. For seed purposes medium sized bulbs are selected, the leaves are left intact, tied into bundles, and hung under *pandals*. If in larger quantities seed bulbs are thinly spread in a dry and shady place like a ceiling floor. The yield per acre will generally be about 8,000 to 10,000 lbs.

The bulbs of this crop are small in size, round, heavy and pungent. These are mainly utilised for 'seed' for the *punasa* crop. The leaves and trash cut off are generally spread in the field to act as manure. It is worth noting that seed for next year is never collected from this crop, but only from a special crop raised for the purpose from bulbs. Bulbs from the *punasa* crop are planted in small plots at about the same time as the sowing of nursery for the *paira* crop, and the crop treated in the usual way, but it is allowed to run to flower without any interference, irrigations being cut off after the completion of flowering. By the end of February the flower stalks are harvested with about 4 inches of the stalk, dried in the sun for 4 or 5 days and seeds separated. After further drying for some days the seed is tied up in a piece of cloth, and hung in the kitchen to avert damage by insects and dampness.

THE PUNASA SEASON—MAY TO JULY

Preparation of field and selection of seed:— During this season onions are planted mostly on wetlands. The heavier soils are generally selected for this crop on account of their water-retaining capacity during the months when rains will generally be scanty. The field intended for planting onions is thoroughly ploughed up and a good dose of cattle manure is given. Sometimes sheep are also penned. The selection of seed bulbs for planting in the season holds out a distinct promise, especially in wet land areas, where a certain amount of uniformity is desired to ensure an early harvest, so that planting of paddy can be done at the right time. The seed material generally used for planting contains an equal number of small and medium bulbs. The other cultivation details are the same as for the *paira* crop excepting that the rains help the ryot in reducing the number of irrigations. This crop gives inflorescences, but they are not so important and so they will be removed from time to time so that the food material may be retained for the development of the bulbs. The yield will be about 7,500 lbs. per acre.

THE RAINY SEASON—SEPTEMBER TO NOVEMBER

For this crop onions will have to be planted in garden lands, planting, irrigation and other operations being done as in the case of the *punasa* crop But this crop flowers profusely and the ryots, make some money out of the inflorescences. The crop is harvested in November—December and the average yield will be about 6,000 lbs.

Pests:— The Onion crop often suffers from the depredations of leaf-eating caterpillars and thrips. The leaf-eating caterpillars may attack all the three crops but thrips cause serious harm only to the *Paira* crop. The leaf-eating caterpillars which badly defoliate the crop by getting inside the hollow shoot can be controlled by flooding the field when the caterpillars gnaw the tissue from inside and the shoot lodges to the ground.

Details of cost cultivation on Onion Crop raised from Bulbs.

Items.	Estimated expenditure.	Items that can be considered as positive cash expenditure.
Preparatory cultivation.		
Ploughing 6 times with country plough—9 pairs of cattle at 12 as. and 9 men at 4 annas. ...	9—0—0	
Levelling and forming bunds. 8 men at 4 annas.	2—0—0	
Manure and Manuring.		
Cost of Manure 20 cart loads.	10—0—0	
Carting Manure and spreading. 2 pairs of cattle 2 men and 4 women.	2—8—0	
Sheep penning.	15—0—0	15—0—0
Seed and Sowing.		
Cost of 1,500 lbs. of bulbs.	20—0—0	30—0—0
Planting bulbs 30 women @ 2 annas each. ...	3-12- 0	
After cultivation.		
2 hoeings and weedings, 30 women per acre at 2 annas each.	3-12—0	
Irrigation.		
Irrigations with *Picotah* at 12 men per acre—6 irrigations at 4 as. a head per irrigation. ...	18—0—0	
Harvesting.		
Digging, lifting, carrying and cleaning—10 men and 60 women.	12—0—0	
Miscellaneous expenditure such as drying, storing etc.	4—0—0	
Total Rs. ...	110—0—0	45—0—0

Receipts. By sale of 9,000 lb. of bulbs at 50 lb. per rupee Rs. 180—0—0. Profits realised thereby is Rs. 70 if the labour etc. of the ryot, his family and his cattle are taken into account and Rs. 155 if only cash expenditure is taken into account.

Note. 50 lb. per rupee can be taken as normal one. But at times the price goes down to even 100 lbs. per rupee; when the ryot, can realise a net profit of Rs. 45/- per acre if only cash expenditure is taken into consideration.

Acknowledgments. My thanks are due to Messrs. V. Tirumala Rao, Entomology Assistant and K. Suryanarayana Asst. Agrl. Demonstrator, Anakapalle, for information regarding the cost of cultivation etc.

SOME USEFUL EXPERIENCES REGARDING SUGARCANE CULTIVATION & MANUFACTURE OF WHITE SUGAR AT PALUR AGRICULTURAL RESEARCH STATION

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The only factory manufacturing white crystalline sugar south of Madras is at Nellikuppam owned by the East India Distilleries and Sugar Factories Ltd., which is managed by Messrs. Parry & Co.

Thanks to the interest taken by this firm and their efficient organisation, the cultivation of sugarcanes is extending by leaps and bounds in South Arcot District. The abnormal fall in the prices of all agricultural commodities and the facilities which the factory is affording to the cane-growing ryots round about the factory, by the grant of cash advances for cultivating the sugarcane crop, have contributed in no small measure to the development of the area under this crop. The variety Badila (Fiji B) which was introduced by the Department some years ago has now entirely replaced other local varieties and the factory prefers this to any other variety because of its high sucrose content and purity.

Palur Agricultural Station which is in close proximity to the factory has been devoting its attention to proper methods of cultivation, study of varieties etc., for the last 20 years. The following lessons learnt at the station may be useful to the cane-growers in general.

Rotation. The Nellikuppam factory has taken lease of about 1,000 acres from the ryots and is cultivating canes every year in an area of about 500 acres. In those lands canes are raised once in 2 years. Attracted by the money advances and ready marketing facilities offered to them, very many ryots grow canes every other year on the same land. Sugarcane being a very exhaustive crop, standing in the field for about 12 months, it impoverishes the soil very soon and hence a study of this question was undertaken to find out if the practice of growing cane in alternate years was sound. The experiment started 10 years ago was concluded this year, and the lessons learnt are as follows:—

Rotation.	Average yield of jaggery per acre.	Net profit per acre, per rotation.
Two year.	7,590 lb.	Rs. 103.
Three year.	8,610 ,,	,, 106.
Four year.	9,217 ,,	,, 87.

Note:—The profits include net profits of all crops in the rotation.

The results indicate that the sugarcane does not pay in the long run when raised in the same field in alternate years. The three year rotation is more economical and sugarcane does better. The results indicate further that canes give the best yield when raised once in four years, though a four year rotation is uneconomical.

Preparation of the land. Many ryots have recognised the advantages of planting canes in trenches dug one foot deep and 3 to 4 feet apart. But many are still digging trenches by manual labour. Ransome's Victory plough is being used for trenching at Palur station and 2 acres are easily trenched in a day. A middle breaker or double mould board plough is used for trenching. Nearly three acres are finished in a day which reduces the cost of trenching still further. Trenching by ploughs and setting right the ends cost only Rs. 4 at

the most, while, by manual labour it costs as much as Rs. 9 to Rs. 10 per acre.

Method of seed preparation and planting. In places where canes are to be planted for the first time or any new variety is to be introduced, it is advantageous and economical to adopt the 'short crop' method. A few setts of the new variety are planted in the month of March in trenches 2½ ft. apart, manuring them heavily—applying up to 150 lb. nitrogen per acre in 2 doses. The canes can be cut after about 6 months in August or September, and the whole canes can be cut into setts and replanted in about 5 to 6 times the area. This crop also will receive enough manure to supply 150 lb. nitrogen. By the beginning of March next, the whole crop will give as much as 30 times the original setts got from outside. Besides rapidly multiplying the setts, it is found that the germination capacity of the setts is better, the germination being quicker and more uniform than the ordinary cane tops. This method is also useful in places where the time of planting and harvesting do not synchronise. For example, in some villages round about Nellikuppam, the planting has to be delayed for a long time as the sugar factory regulates the order of cutting to ensure a steady supply of canes to the mills. The 'short crop' or the rapid propagation method obviates the necessity to wait besides getting a good and plentiful seed material.

Treatment of Setts. It pays to select the seed material for planting. Good setts from the clumps showing no signs of 'mosaic' or 'red rot' disease, may be selected and prepared with clean and sharp knives. After some practice the coolies are able to detect the diseased clumps very quickly. As a precaution, the setts may also be dipped in Bordeaux mixture for preventing smut and other diseases. These small precautions reduce the incidence of diseases to a great extent.

Seed rate. It is a false economy to reduce the seed rate in a costly and long duration crop like sugarcane. In places where trouble with white ants is anticipated, it is preferable to plant as much as 12,000 setts per acre, doubling the setts at the ends of trenches. Frequent irrigation till the end of June and application of tar emulsion of 1% strength, keep the white ants in check. It is also advisable to keep a small nursery to fill up blanks during the first two months.

Manuring. From the year 1923, experiments are in progress to study the manurial requirements of canes in regard to the three manurial constituents, nitrogen, phosphoric acid and potash. The set of experiments that was concluded in the year 1923, showed, that there is not much difference between the use of castor cake and groundnut cake; groundnut cake in combination with ammonium sulphate gave the best yield. In order to find out in what proportion the ammonium sulphate should be mixed with groundnut cake, and up to what quantities these manures could be economically given, another set of trials

started in 1928 is being continued. Five year's results are available at present.

Optimum dose of Nitrogen. Increased yields were obtained when the quantity of nitrogen applied was increased up to 400 lb. The increased yields obtained in the case of 300 lb. and 400 lb. nitrogen were not in proportion to the cost of manures applied and hence found to be uneconomical. The average yields up to 200 lb. nitrogen are as follows:—

Manure.		*Yield of cane per acre in tons.*
50 lb. Nitrogen as cake.		16·6 tons.
do.	Plus Ammonium sulphate.	18·3 ,,
100 do.		22·0 ,,
do.	do.	23·1 ,,
150 do.		27·3 ,,
do.	do.	25·4 ,,
200 do.		30·5 ,,
do.	do.	31·7 ,,

The results show that sugarcane (especially Fiji B in South Arcot) responds to heavy manuring up to 200 lb. Nitrogen; further, that a mixture of cake plus ammonium sulphate mixed in the ratio of 3 : 1 in nitrogen contents, is better than cake manure alone.

Combination of cake and ammonium sulphate. Regarding the combination of cake and ammonium sulphate, the results are not steady but so far as they indicate mixing in the ratio of 3 : 2 seems to be best.

Application of manures. Increased yields are obtained by the application of nitrogenous manures in 3 doses in the proportion of 30 : 40 : 30. The first dose is to be applied before planting, the second in the third month and the third in the fifth month.

Effect of phosphates, potash and Chilean nitrate. In order to study the effect of Chilean nitrate, potash and phosphates on the yield and quality of canes, a new manurial experiment was started a year ago. The available results are as follows:—

200 lb. nitrogen as Nitrate	...	...	35 tons.
200 lb. do.	+ Potash	...	34·4 tons.
do.	+ Phosphate	...	35.8 ,,
do.	+ Potash + Phosphate		39 ,,
do. as cake 120	+ Nitrate 80.		36·7 ,,
do.	+ Ammonium Sulphate 80.		37 ,,
do.	+ Am. Sul. + Potash + Phosphate		43 ,,
do. as cake	+ Potash + Phosphate		42·1 ,,

From the above it may be seen that nitrate either alone or in combination with cake is inferior to ammonium sulphate. Potash by itself has no influence on the yield, while the addition of phosphates increases the yield. The best yield is obtained when potash and phosphoric acid are added to 200 lb. nitrogen in the shape of cake and ammonium sulphate.

Effect of ammonium sulphate on the keeping qualities of jaggery. To test the popular opinion that ammonium sulphate tends to produce soft jaggery, jaggery obtained from plots manured with varying quantities of ammonium sulphate were preserved. Three years' observations go to show that the stickiness and the softness increase as the proportion of ammonium sulphate increases in the manure mixture of cake and ammonium sulphate. The sample from the pure ammonium sulphate plot was the worst while that from the pure cake plot was the best.

Interculture. Sugarcane is ordinarily weeded 4 or 5 times in the early stages. Junior hoe and H. M. Guntaka No. 2 are being used in this station to hoe the ridges in between the rows of canes. H. M. Guntaka No. 2 cultivates nearly 3½ acres in a day and thus a lot of manual labour can be saved. This implement can also be used as an ordinary guntaka in fallow fields.

Banking. In earthing up the canes partially after the second manuring, 8 men are required if done solely by manual labour. It can be done very effectively by a Hindoostan plough. The shape of the mould board is eminently suited to throw the soil loose after complete inversion without clogging, and completely covering the manure. There was a saving of Rs. 2—5—0 per acre by using this plough for partial earthing up.

Propping. The new pitting crowbar designed by the Research Engineer is decidedly a better tool than the ordinary crowbar for making pits to fix posts in the cane fields. When the soil is sufficiently moist and is in a soft condition, the new tool does nearly 2½ times the work of the ordinary crow bar. This small device can be adopted by all ryots to save labour. Propping the canes with galvanized iron wires has become the routine at Palur. Some of the surrounding ryots and the Superintendent of the Factory Cane-farms are also adopting this method with advantage. Some of the P. O. J. varieties require to be propped with double wires.

Trashing. It is believed by some that stripping leaves is a waste of labour. In places which are subjected to cyclonic weather it prevents lodging to some extent. During the cyclone in November 1930 it was observed that the tall grown canes in this station did not lodge so badly as the surrounding untrashed canes, as the fierce wind simply passed through the canes in the former case and caused less damage.

Disposal of trash and stubbles It is a common sight in S. Arcot to see the cane trash in fields being set fire to, after the canes are harvested. Burning these waste products is considered to be an economy as it saves the labour of removing the trash and stubbles outside the field. This seems to be a wrong notion. Attempts were

made to convert the cane trash into compost. It was found possible to do so, by the addition of 50 lb. bone meal and 200 lb. of cow dung as starters, to a ton of trash. The organisms convert this waste product into compost in 3 to 4 months. The following are the manurial contents of the trash compost so prepared, and of the loose box manure prepared at this station.

	Nitrogen, (N)	Phosphoric acid. (P_2O_5)	Potash. (K_2O)
Loose box manure.	0.55	0.29	1.01
Trash compost.	0.36	0.45	0.76

This compost contains a little more than half the quantity of nitrogen contained by farm yard manure and compares very favourably with the cattle manure available in the villages. As some bulky manure is necessary to maintain the physical condition of the soil, and as the available farm yard manure is not sufficient to manure all the fields, trash compost can be used in the place of cattle manure. The cane cultivators who do not require trash for any other purpose may convert it into compost and use it in their fields to supplement the other manures and thus reap good crops at a small cost.

Jaggery-making. Ryots round about Nellikuppam do not mill their canes themselves but sell them to the factory. The produce from about 4,000 acres is being crushed at the factory. But since there are about 10,000 acres in South Arcot, the canes from the rest of the area are being used in the manufacture of jaggery. Sindhewahe furnace has practically replaced the local furnace. During the last four years the double Sindhewahe furnace described in Vol. XIX of the *Madras Agricultural Journal* is in extensive use. By utilising the hot air in the flue, to heat the juice in the top pan, we are able to reduce the time taken for boiling by 15 to 20 minutes for each pan. This furnace can be adopted by all to save time, fuel and labour. This furnace works satisfactorily even for the preparation of 'rab' in white sugar manufacture.

Manufacture of white sugar. In the case of ryots in the immediate vicinity of a big factory as at Nellikuppam, it may be more advantageous for them to sell their canes direct to the factory as by doing so they realise the best price. Taking current prices for jaggery, the manufacture of sugar instead of jaggery appears to be a more paying proposition, and, the information given below might be of some use to those interested in the manufacture of white sugar with the centrifugal. In order to introduce the indegenous method of white sugar manufacture as a cottage industry, the "Belprocess" or the open pan system was, at the instance of the Director of Agriculture, tried for the first time at Palur Agricultural Research Station during the last season.

Though there are about 114,000 acres under canes in this Presidency, due to the lack of communication and to scattered cultivation,

it may not be possible for many years to come to establish factories and bring the whole area under factories. In spite of the low recovery of sugar in the 'open pan system' or the 'Bel process' it has many advantages. The capital required is very small, the technical knowledge required is not very high, the whole plant can be moved from place to place if necessary and the net return per acre is more than that from the manufacture of jaggery.

Capital. The capital required for erecting a small plant to prepare white sugar by the open pan system, is only Rs. 3,000, which is within the reach of any well-to-do ryot, or a co-operative society in a village where sugarcane is cultivated. In districts like South Arcot, where a number of oil engines are used for irrigation purposes, the additional capital required for a power crusher, centrifugal machine, pans, etc., is only Rs. 1,500 at the most. As mentioned already, the double Sindhewahi furnace works very satisfactorily. The multiple Rohilkhand or Bhopal Bel with costly and thick pans seem to be unnecessary.

The process of manufacture. The process consists in crushing the freshly cut canes with power mills and boiling the juice to the consistency of a thick syrup called rab. The mucilaginous liquid got by pounding *Bhendai* (*Hibiscus esculentus*) plants in water, and a solution of bicarbonate of soda are added as clarifying agents after removing the first scum. After a series of trials, 15 lb. of clear saturated lime water were found necessary to clarify every 400 lb. of juice. The addition of lime water helps in better recovery of sugar and in the proper selling of molasses when made into jaggery. The final striking temperature is a very important factor in the manufacture of sugar. The concentrated syrup is struck at 114°C. for thick canes like Fiji B, 247 B. etc. and at 111°C. for thin canes like Co 213. The resultant syrup is poured into earthern-ware tubs and vigorously aerated till the temperature goes down to 65°C. The proper cooling also contributes to the better recovery of sugar. The rab is allowed to crystallize for a week in kerosine tins after which it is pugged with iron chisels. One or two table spoonfuls of sodium hyposulphite are added to dark coloured rab to improve the colour. 60 to 70 lb. of the above pugged rab or 'magma' which is semisolid in condition, are poured into the basket of the centrifugal machine which has perforated walls. The cage is rotated at 2,200 revolutions per minute. By centrifugal action the molasses get separated and get collected at the bottom. The white sugar which appears on the walls of the cage is washed with a syringeful of water once or twice, to completely remove the molasses. After the molasses are completely drained, the sugar is scraped out and dried in the sun which serves to bleach it still further. The molasses, if boiled immediately after liming, sufficiently set well and form a second grade jaggery which fetches half the price of

the good jaggery. If on any account the normal recovery was not got from the first rab, it was found possible to get the balance as second sugar, when the first molasses is boiled and made into second rab.

Cost of production. The cost of preparing white sugar and molass jaggery from a 30 ton crop works out to Rs. 75. During the last season Fiji B cane yielded at the rate of 41 maunds of white sugar and 53 maunds of molass jaggery per acre. Valuing a maund of sugar at Rs. 10 and a maund of molass jaggery at Rs. 1—8—0 the receipts per acre less cost of making sugar is Rs. 415 while the receipts per acre when jaggery is made amounts to Rs. 240. There is thus a clear margin of Rs. 175 in favour of sugar making. Already two ryots have started this industry in North Arcot and Chingleput Districts and it is pleasing to hear that they got an extra profit of Rs. 200 per acre by making sugar instead of jaggery.

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RECENT WORK ON THE GENETICS OF MILLETS IN INDIA.*

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Millets are the food crops of the poor and till recently received very little attention. Much of the work recorded herein has been done at the Millets Breeding Station, Coimbatore in collaboration with the band of young workers devoting themselves to these crops. Work reported by other workers is also summarised with suitable references.

Sorghum—The Great Millet.

Seedlings. In certain cases seedlings give an indication of pigmentation in the adult plant. The coleoptile with or without the root may be coloured. There are seedlings with no purple colour. These distinctions could be utilized to observe segregation in the seedling stage. This practice is very old and has been utilized at Coimbatore for a number of years (Rangaswami Ayyangar, 1930).

Sap Colour. There is a sap colour character, characterised by redness in the leaves, grain, dry stigma and anther. The presence of this group has proved dominant to its absence (Graham, 1916). Ramanathan (1924) records the dominance of red pedicelled spikelets to their non-pigmented condition. This latter is what is observed in

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segregates at grain stripping time, Graham's being a field observation. Both of these are aspects of the same character which colours all these parts. Segregations of this comprehensive group have been met with at Hagari.

Colour of leaf sheath and glume. The colour of the leaf sheath and the colour of the glume go together. The association has been so constant that it is not possible to say whether it is a case of linkage or the expression of the same factor in different places. A factor P separates the purple pigmented from the brown sheathed varieties, the former being dominant. In the purple group a factor Q helps to separate the purple into reddish purple and blackish purple, the latter being recessive (Rangaswami Ayyangar et. al., 1933 a).

Midrib of leaf and Juiciness of Stalk. Hilson (1916) records the dominance of white midrib with pithy stalk to dull midrib with sweet stalk. Swanson and Parker (1931) find distinct genetic factors responsible for juiciness and sweetness, but have not pursued the inheritance of the latter.

Pubescence. Ramanathan (1924) records that felty hairiness on the outermost glume, the rachis and the band above the node go together and are dominant to the sparsely to practically no hairy condition in those places. He is not sure if they are mono-factorial or bi-factorial in composition.

Panicle. Karper (1929) working at the Texas Agricultural Experiment Station on head characters in kafir, records that the classification of the F_3 generation data on the basis of the means and standard deviations of the characters, shows that length of rachis, number of nodes to head, and number of seed branches are inherited in a simple Mendelian fashion, the data grouping themselves into a 1 : 2 : 1 ratio.

The shape of the panicle and its inheritance is very complex especially when characters have to be read through the various manifestations of different varieties. The simple dominance of the loose panicle over the compact has been recorded by Ramanathan (1924) and also reported from Kansas. These panicle characters are under study at Coimbatore. In *S. nervosum* a segregation of loose-conical to compact-spindle has been met with, the former being a simple dominant. In *S. Roxburghii* characterised by its very loose streaming branches this recessive compactness has also been met with, in the shortening of these branches and clustered disposition of the spikelets.

Glumes. Grain sorghums have to develop a plump grain in their glumes. In the *S. Durra* and *S. cernuum* groups which embrace many of the grain sorghums, glumes in the mature earhead develop a transverse wrinkling which accommodates the growing grain and helps to keep it clipped up. This wrinkling does not occur in some other grain sorghums. Ramanathan (1924) records a simple mono-hybrid ratio

between wrinkled and non-wrinkled glumes. His figure suggests a segregation between *S. cernuum*, a grain sorghum, and *S. nervosum*, a fodder sorghum, with poor grain development. This wrinkling seems to be an independent factor operating in the grain sorghums themselves and at Coimbatore experiences in segregates in the grain sorghums (*S. Durra*) have been met with.

In the *S. Roxburghii* and *S. margaretiferum* groups, which are also grain sorghums, the freedom of the small grain from the glume is achieved by an in-curving of the edges of the glume giving the spikelet a winged appearance, the small grain sticking out of the gaping glumes. This gaping condition of the *S. Roxburghii* group has proved a simple recessive to the normal glumes. Graham (1916) records that short glumes are dominant to long glumes. Vinall and Cron (1921) find that broad truncate glumes are dominant to narrow ovate glumes.

Sorghum Durra × S. papyrascens. *S. papyrascens* is characterised by long and narrow glumes, poor setting, irregular flowering and poor extrusion of anthers. This character group of *S. papyrascens* has proved a simple recessive to the short and wide glumes, good setting, regular flowering, and good protrusion of anthers of *S. Durra*.

Awns. Long awns are a simple recessive to 'Nil' awns. In some races a 1 : 2 : 1 ratio has been obtained of long : short : nil, the shorts proving heterozygous.

Glume Tip Colour. Ramanathan (1924) finds that the glumes with red tips are dominant to those without the red tips. While expecting a relationship between this red tip and red in the pedicelled spikelets, his separate numbers for these two experiences have not been interrelated; the families in these are not the same. The red tip to the glume has no constant relationship to the redness in the pedicelled spikelets.

Grain Colours. Red, Yellow and White Grains. The relationship between Red, Yellow and White grain colours have been worked out by Graham (1916), Vinall and Cron (1921), Conner and Karper (1923), and Sieglinger (1924). Rangaswami Ayyangar and his co-workers (1933) determined Yellow (factor Y) as the basic factor in the colour scheme. With R, red grains are produced. A factor W determines the manifestation of colour in wholeness. Without W, R gives a white grain with a red base. Similarly Y gives a white grain with a yellow base. Dry anther colours run parallel to grain colours and help in the separation of the white grains into their respective allelomorphs to coloured grains. A factor I determines the intensity of colour manifestation and is unmistakably noticeable in the red group. Red without the I factor gives a pink grain. Monogenic and digenic interactions of these factors have been met with.

Brown Grains. Vinall and Cron (1921) found a bi-factorial expression of Brown. They refer to an under-coat of brown in some

white grains. Their 15 : 1 ratio of coloured to white grains is obviously an interplay of one B factor and W, though no such explanation is given. Sieglinger (1924) explains his brown grains experiences in terms of the existence of a brown nucellar layer above the aleurone layer, possibly similar to the brown under-coat of Vinall and Cron. This basic presence is made manifest into pericarp brown and further ramifications with other colours is thus made possible. Swanson (1928) after microscopic examination elaborated Sieglinger's experience by letting in (1) the presence or absence of the nucellar layer and its brown; (2) a thick or thin mesocarp masking the expression of above colour, and (3) a factor determining epidermal and hypodermal pigmentation. In our experiences the nucellar brown has not been met with. Two factors B_1 and B_2 are responsible for the production of a full brown colour on the grain, produced by their concurrent presence. Each of the B factors is capable of giving a light brown wash to the grain provided the W factor determining the expression of pericarp colour is also present. In white grained varieties the B factors can be detected only through the colour of the dry anther, so much so that chance matings bring about brown grains in crosses between some white grain varieties. This possibly explains the spontaneous occurrence of browns gradually vitiating a pure white grained crop. The interplay of the B factors which are not anthocyanic, over and above the anthocyanic red and yellow and their colourless allelomorphs, leads to the wealth of blended colours met with in sorghum.

Linkage between Sheath—Glume and Dry Anther—Grain Colours. There is a linkage probably complete, between Qq (factors for leaf sheath and glume colour) and Bb (factors for brown colour in dry anther and grain).

Pearly and Chalky Grains. Sorghum grains fall into the two broad groups Pearly and Chalky. The former is translucent and the latter opaque. Chalky grains are characterised by a large deposit of starch in their thick mesocarp. The deposit being uneven, gives the grain a banded appearance. The opaque grains seem, by virtue of their quicker absorption of water, to be specially suited for sowing in light loams. Pearly (factor Z) is a simple dominant to the Chalky character. Coloured grains also manifest this banded appearance when chalky. A separation can be attempted in lighter colours, but with the depth in colouring the colourless allelomorphs have to be depended upon for this classification of coloured grains into pearly and chalky.

Panicle Shape—An instance of Linkage with grain consistency. *S. nervosum* is characterised by pearly grains, that keep enclosed in the prominent glumes. An instance has been met with of a linkage between the characters pearly (Z) and chalky (z) and between loose-conical and compact-spindle earheads. Whereas the loose earheads

gave both pearly and chalky grains the compact ones were all pearly, the ratio of pearly to chalky as well as loose to compact was 3 : 1.

Endosperm Characters. Karper (1933) has recorded the dominance of the starchy endosperm to the waxy one. There was pollen dimorphism indicative of this ; as also xenia. At Coimbatore races of sugary grains with dimpled appearance have been met with. This sugary dimpled character has proved a simple recessive to the starchy non-dimpled character. Xenia was experienced in this character also.

Anther Tip. The anthers are commonly not coloured purple. A rare form with coloured anthers was met with. In cultivated forms rare instances of purple colour at the tip of the anther and occasionally at its base have occurred. The association of this character with other plant characters is under investigation ; but it is worth recording one experience in which anthers with purple colour at their bases were closely linked to brown grains which segregated as dominants to white grains having no purple in the anthers.

Nodal Band. There is a band of soft tissue above the nodes which in some varieties is coloured purple. The purple is of two kinds, one of these is associated with factors for brown grains and in segregates is dominant to a green band. There is a rare kind of band colour a bit checkered in appearance which is associated with a good sienna anther and its linkage with that anther is so strong that this coloured band is automatically a dominant or recessive according to the segregate in which this sienna anther finds itself.

Height of Plant. Sieglinger (1932) records a segregation of a bifactorial type giving Talls, Dwarfs and Extra-Dwarfs. Two dwarfs gave the tall. Karper (1932) records a dominant tall mutation arising and proving dominant to the standard shorter variety of kafir (*Sorghum caffrorum*). Sieglinger (1933) records through mutation the occurrence of an extra-dwarf recessive to the standard dwarf. There seem to be mutative tendencies productive of differential heights in sorghum, sometimes towards tallness, a reversion to parental form. and more often towards dwarfness and the consequent perpetuation of dwarf varieties of commercial value. This latter has been much in evidence consequent on the new introductions into America. At Coimbatore, there has been recently an experience in S. Durra of " Short early " plants proving a sharp dominant to " Tall late " plants. Another experience has been met with in *S. Roxburghii var. Hians* in which a tall plant of the same duration appeared as a mutant among dwarfs and proved heterozygous for height, tall being dominant.

Albinism. Five types of chlorophyll deficiencies have been noted : (1) Lethal white, (2) Lethal virescent white, (3) Lethal pale, (4) Lingering lethal pale, (5) Surviving pale. Each of these is a recessive to the normal healthy green. The first four types proved lethal of varying degrees. In one type of deficiency distorted 3 : 1 ratios have been

set to the presence of a zygotic lethal factor (Rangaswami Ayyangar and Sankara Ayyar, 1932). Karper and Conner (1931) record that the factor R for red stem and W for albino were found to be linked with a cross over percentage of 41·34. This linkage between anthocyanic and chlorophyll factors should if pursued prove of great interest (Rangaswami Ayyangar, 1932.)

Disease Resistance. Whereas much work has progressed in determining varietal resistance to the various diseases to which sorghum is subject, very little has been done on the inheritance of such resistance. Swanson and Parker (1931) find that susceptibility to smut (*Sphacelotheca sorghi*) is dominant to its resistance. They find a tendency in the juicy stalked sorghums to greater susceptibility, but do not mention any definite linkage between the two. They think it probable that this susceptibility might go with sweetness rather than juiciness. Reed's (1930) experiences point to both the dominant and recessive condition of susceptibility.

Tenuous Plants. Sieglinger (1929) working in kafir records a segregation between normal kafir plant and grass-like ones, characterised by an absence of coronal roots and the thickening of stems and leaves, the latter being recessive.

Pennisetum typhoideum (The Pearl Millet).

This millet is protogynous and its genetics present very great practical difficulties. Protogyny results in cross pollination, so much so that it can be said that most varieties of this millet are characterised by a fair uniformity in duration, the type of the earhead, and crop height. This uniformity in essentials being secured, the rest of the non-essential characters tend to be kept up in a perennial heterozygous condition. *P. Leone* was a new form from Africa and has a big long cylindrical truncate head, glumes purple and felty, grains pearly white with a pointed apex, and with anthers emerging while the stigma is fresh. This was crossed with the Coimbatore variety with a tapering head, not so compact, glumes green and glabrous, dark leaden coloured grains with round apex and with anthers emerging when the stigmas shrivel up. The Leone characters have proved dominant in the F_1 plants now on the Millets Breeding Station at Coimbatore.

Chlorophyll Deficiencies. Albinism was met with in this millet. All albinos proved lethal. The albinos range themselves into pure whites, whites with the leaf tip greenish, and those with cream coloured leaves. These may occur singly or in combinations. The commonest occurrence is of pure whites, the next common is in combination with green tips. Of the earheads taken, about a tenth came pure green. The segregations varied within wide limits from 1·5 : 1 to 20 : 1, indicative of the existence of a number of factors for chlorophyll, so difficult of pursuit in this protogynous crop. A type of

chlorophyll deficiency, non-lethal, producing pale green foliage has been met with. Plants with these attributes are economically weak. They have proved recessive to normal green and dominant to the lethal albino.

Apart from the basic attributes of similarity in duration, height and ear-head characters, the other distinguishing features are pigmentation on the plant, hairiness on the leaf, and bristles on the earhead. In each of these characters, the stronger manifestation appears to be dominant to the weaker aspect of it. A number of generations have been studied by Godbole, (1927), Patvardhan (1927), and at Coimbatore, and the pursuit of the inheritance of these characters is beset with practical difficulties. They are valuable in keeping up heterozygosity in non-essentials to the benefit of the crop community. The only method of determining initial dominance is to try crosses with fresh importations (as was done with *P. Leone*) and in the light of the F_1 behaviour, make back crosses and suitably modulate future mass selection work to fix a variety fairly pure in essentials.

Eleusine coracana (The Finger Millet).

Purple Pigmentation. As in the case of other cereals, purple pigmented plants are dominant to green-throughouts in Ragi. Four distinct types of pigmentation, localised purple, dilute purple, medium purple and purple, varying in intensity are met with, each showing a single factor difference of advance over the next lower group. Localised purple is the basic purple and arises by the presence of factor P. This P with I_1 becomes dilute purple. I_2, the second intensifying factor acts only in the presence of I_1, and with dilute purple becomes medium purple. Two factors, H_1 and H_2 either alone or together determine the depth of manifestation of purple pigmentation in the glumes. These act only in the presence of all the three factors, P, I_1 and I_2 making the medium purple into purple. Green-throughouts, that altogether lack purple pigmentation, are capable of being classified into various types of purple pigment producing potentials.

Grain Colours. The characteristic brown colour of the Ragi grain has been designated Ragi Brown. Two factors B_1 and B_2 either alone or together are capable of producing this brown. A third factor S in association with either or both of the B factors, results in plant purple pigmentation. This fact accounts for the absence of white grained ragi in purple pigmented plants. The S factor is carried by some races of white grains. A factor D that deepens the effect of brown factors behaves as a simple dominant. This is independent of the factors concerned in the plant purple pigmentation and is not in selective association with either of the B factors.

Depth of green in the Pericarp. The pericarp of the developing grain of ragi is usually green. Minor races with a light green pericarp are met with. A factor Cx is responsible for the green of the pericarp.

In its absence, the pericarp is light green. This is independent of P, I and B factors. The tint of dry anthers shows a differentiation in depth corresponding to the depth of the green pericarp, and is associated with it.

Sterility. Chronic sterility, short of complete sterility is occasionally met with in Ragi. The cause of this sterility is two-fold. It may be due to the non-dehiscence of anthers or to the agglutination and consequent absence of free pollen. Normal dehiscence occurs with the presence of the X factor. Free pollen is produced by the Y factor. Both the factors X and Y behave as simple dominants to their absence resulting in sterility.

Albinism. Two factors C_1 and C_2 either alone or together are responsible for the production of chlorophyll in the plant. In the absence of both, the resulting seedling turns white and dies. Plants with C_1 and C_2 have been isolated and crossed with the result that in the F_2 they segregated and threw albinos one in sixteen. The factor Cx inducing a differential depth in the pericarp has no influence whatever on C_1 or C_2. (Rangaswami Ayyangar, et al. 1931).

Earhead Shapes. The earheads in ragi vary in their length. Two factors E_1 and E_2 determine this elongation. Either of them gives a short length, both give a long length. When neither is present a very short length is obtained. A factor Q, determining the density of disposition of spikelets per centimetre length results in a crowding and consequent curving of the earheads leading to the three types of curveds viz., Top-curved, In-curved and Fist-like. The number of spikelets in the earheads of ragi being about equal, such crowding naturally reacts on length. In the absence of Q, the corresponding opens are Long Open, Short Open and Very Short Open. Factors Q, E_1 and E_2 are independent of P, I_1 and I_2 and H_1 and H_2 (Plant Purple Pigmentation), B_1, B_2 and S (Grain Colour) and C_x (Unripe pericarp colour) factors. (Rangaswami Ayyangar et al. 1932).

Setaria italica (The Italian Millet).

Rangaswami Ayyangar and his co-workers at the Millets Breeding Station, Coimbatore, have begun a genetic analysis of this millet and their work is summarised below:—

Plant Purple Pigmentation. Plants are pigmented (anthocyanic) and without purple pigment (green throughouts.) The former condition is dominant and arises by the basic presence of a factor P. There are various manifestations and intensities in this pigmentation. A factor I determines a manifestation in intensity and is dominant to a weaker depth. The degree to which P is operative, in addition to being dependent on the presence of I, is conditioned by two other factors V and H, which determine the alacrity with which P manifests in the vegetative or earhead parts. An interaction of P, I, V and H

factors produce the diversity of forms characterising varieties of this millet.

Grain Colours. Six grain colours have been noted in Setaria italica. These fall into two groups (a) Black, Tawny Buff and Korra Buff, and (b) Sepia, Red and Tawny Red. A factor K (after Korra, the Telugu name for this millet) is present in group (a) and absent in group (b). In each of these groups the basic colours Tawny Red and Korra Buff, with the addition of a factor I, turn into Red and Tawny Buff. This Red and Tawny Buff with the addition of another factor B turn into Sepia and Black respectively. Factor B has an individuality, but its presence is not visible except in association with I. (Rangaswami Ayyangar and Narayanan, 1931).

Anther Colours. Two fresh anther colours are met with, viz., brownish-orange and white. These, when dry and seen *en masse* appear brownish-black and buff-yellow respectively. These colours form a simple Mendelian pair, with orange dominant. (Rangaswami Ayyangar and Narayanan, 1932).

Bristles. The bristles fall into four groups 'long', 'medium', 'short', and 'dwarf'. The 'dwarf' bristle represents the basic bristle condition in all setarias. This is due to a factor X. Three other factors E, L_1 and L_2 acting on X are responsible for the four differential lengths. E determines the expression of the various bristle types, and depends for its manifestation on the factor L_2. X with or without E remains a 'dwarf'. L_1 and L_2 contribute to the lengthening of the bristle. L_1 and L_2 acting individually on the dwarf (Xe) produce a short bristle; together they produce a 'medium'. L_1 with XE gives a 'short'; L_2 with XE gives a 'medium'. L_1 and L_2 together with XE produce a 'long'. The factors governing bristles and their expression are independent of those for grain (K, B and I) and anther colours.

Spikelet Tipped Bristles. The bristles in Setaria occasionally bear an extra spikelet at their tips in some races. This is more common in the cultivated *Setaria italica* than in the wild *S. glauca* or *S. verticillata*, and behaves as a definite heritable character. The condition where most of the bristles are tipped with a spikelet is designated 'full' and it is allelomorphic to the 'nil' spikeletted bristle condition. The 'full' in some families has been found to be a simple mono-hybrid recessive to 'nil'. In other families dominance is incomplete and an intermediate heterozygous class 'stray', where only a few bristles are spikeletted, is present, the three classes occurring in a 1 : 2 : 1 ratio. The full spikeletted condition has been found to be incompatible with a long bristle.

A Type of Lax Earhead. A primitive type of 'lax' earhead characterised by fewer spikes, fewer spikelets, and chronic sterility,

has suddenly occurred and behaved as a simple recessive to the normal economic 'dense' earhead. A factor A is set down to be responsible for this difference.

Albinism. A simple segregation of mono-factorial type for green and albino seedlings has been met with in Setaria italica. Factor C_1 is responsible for green seedlings, its absence resulting in albinos which do not live. (Rangaswami Ayyangar et. al. 1933 b.).

Paspalum scrobiculatum (The Kodo Millet).

Albinism. In *Paspalum scrobiculatum* a case of variegation occurred. Its progeny gave green seedlings and albinos in the proportion of about 8 : 1. In the succeeding generations, with populations varying from 500 to 2000 a series of ratios from 2.3 : 1 up to 469 : 1 was experienced. The tenable explanations for this behaviour are numerous. But the second observed fact, that the proportion of segregating to pure families is about equal, suggests as most probable an explanation based on complementary factors lying on two or at most three different chromosome pairs and functioning in the capacity of chemical determiners for the production of chlorophyll.

Panicum miliaceum (The Proso or Common Millet).

Hairiness. In this millet grown as a catch crop in the cold weather many of the cultivated forms are chararcterised by hairiness of degrees. The commonest is a medium hairy type. This type of hairiness has behaved as a dominant to the recessive glabrous forms. Both 3 : 1 and 15 : 1 ratio have been met with indicative of the bi-factorial composition of hairiness.

Purple Pigment. Plants with anthocyanin pigment in parts have given 3 : 1 ratios to green-throughouts.

Grain Colour. The commonest shades of grain colour in Madras varieties are dark olive grey and buff yellow. In crosses between these two the former colour proved a simple dominant.

Panicum crusgalli var. *frumentaceum* (The Barn-Yard Millet).

Plant Purple Pigmentation. In this millet there are plants with and without anthocyanic pigment. The pigmented plants vary in depth of manifestation. The whole manifestation is so light that it is a question of degrees in this limited manifestation. The touchiest parts for this difference are the stigmas and anthers. A good purple is brought about by two supplementary factors each one of them of different dilutions so much so that 3 : 1 and 15 : 1 ratios are obtained for purple and green. One grade of dilution is fairly separable resulting in a 12 : 3 : 1 ratio of good purple, dilute purple and green.

Panicle Shapes. The panicle shapes fall into two broad groups, open and closed, which on crossing give an intermediate. The segregates fall into a rough 1 : 2 : 1 grouping.

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ABSTRACTS

The Vitamin B_1 and B_2 contents of cotton seed products. By M. L. Whitsilt (*Jour. Ind. & Eng. Chem. Vol. 25, No. 10, P. 119*). By methods of rat growth, cotton seed meal was found by the author, to be a rich source of vitamin B_1, and a fairly good source of vitamin B_2. On the other hand the cotton seed oil was found to contain no vitamin at all; the cotton seed hulls were found to be as rich as the meal in vitamin B_2, though of vitamin B_1 not much was found in the hulls. The results tend to indicate, in confirmation with general belief, that the seed coats are richer in vitamin contents, than the seeds themselves. (M. R. B.)

Potato starch. By T. C. Taylor and T. J. Schoch (*Jour. Amer. Chem. Soc. Vol. 55, No. 10, October 1933, P. 4248*) Potato like many cereals is rich in starch, but α amylose or amylopectin, which is present in cereal starches is found to be absent in potato starch. Experiments of the author show that a former impression that potato starch was similar to cereal starches, is due to the fact that the associated material in the potato starch granule, gets disorganised and thus gives rise to an insoluble material, which is difficult of dispersion and which is similar to the α-amylose of the cereal starches. Light has also been thrown in this paper, on the fact, that organic phosphorus, the distribution of which was not clear before, is found to be randomly distributed throughout the starch and not attached to any amylose fraction. (M. R. B.)

Amount of residual arsenic on leafy vegetables sprayed with arsenical insecticides. By Juan N. Samson (*The Phil. Agriculturist Vol. XXII—No. 5, P. 356–372*). The experiments which were done on the following crops :- Cabbage, Lettuce, Celery, Pechay and Mustard, showed that while the amount of residual arsenic depended on the frequency of application and on the interval between the last application and the time of harvest, no amount of residual arsenic was found to exceed the lowest fatal dose for human beings. Incidentally, the author concludes from his several trials that *dusting is more costly than spraying* and that in the case of vegetables like cabbage and mustard more susceptible to insect attack, the yield is also affected by the insecticide. (M. R. B.)

Does the Moon affect our Crops. (R. R. Bellamy. *The Jour Jamaica. Agric. Soc. Vol. 37, No. 6, pp. 291–2. June 1933*). The experiences of the author in the South Seas published in *The Field, The Country Newspaper* is extracted in this Journal. The influence of the moon upon terrestrial conditions is still a matter of dispute in England while in the Islands this question has long since been settled by irreputable experience which the author verified at first hand. The islanders declare that the plant sap flows upwards with the waxing moon and downward when it is on the wane ; consequently timber felled during the last quarter of the moon being full of juice will attract borers and will be damaged by them soon. The author had a chance of having this belief verified in a hut constructed for his own use.

" Crops planted during first quarter of the moon put their greatest strength into stem, leaf and fruit while those planted with the declining moon thrive more vigorously below ground. Maize, sugarcane and bananas are planted during the new moon, while yams, sweet potatoes, manioc, etc., are planted in the old. Many crops that the author planted himself behaved according to the above belief.

Fishing is also based on Moon's phases, in that it affects the movement of fish. Marine crustacea change their shells once in 28 days—a lunar month. The author's wife while staying in Egypt had a chance of experiencing the effect of the moon on lunatics. It may be that the influence of the moon is more pronounced in the torrid zones than in the northern latitudes. But it would certainly be interesting and may lead to important results if the influence of the moon on agriculture is investigated on scientific lines. (M. A. S.)

Research with a Hen. Lecture by Hutt, F. B. *Science No.* 2029 (Presidential address at the 25th annual meeting of the Poultry Science Association, Michigan.) Our whole knowledge of early embryology of vertebrates, rests largely upon the great body of facts which has been accumulated about the development of the chick. Harvey who demonstrated the circulation of blood was a keen student of the embryology of the chick. In subsequent years the chick was established as *par excellence* the animal, for both microscopical and macroscopical studies in embryology. If the chick has been of service in revealing the processes of normal development, it has figured conspicuously in the study of teratology or abnormal development. The chick embryo could be separated from the maternal organism and be submitted to all the influences capable of modifying development and has proved ideal for the purpose. Man's knowledge of the physiology of reproduction was greatly clarified by the discovery of mammalian ova and of spermatazoa. The latter were for the first time discovered in the male fowl in 1667. Pasteur's researches in the field of bacteriology were first made with fowl cholera, in which he discovered that aged cultures produce only mild and temporary symptoms and led him to the successful use of attennuated organisms as a means of building up resistance to anthrax and other diseases. The fowl is the favourite object of research in endocrinology and the existence of the endocrene secretion was first demonstrated on it. The ease with which it could be subjected

to the influence of hormones of the male and female gonads and the use of the feather follicle as an indictor of thyroxine, mark this out as a favourite object in these experiments. The modern era in the field of nutrition was initiated with Beriberi and it was a fowl again that figured in these early experiments. In genetics it was the domestic fowl that first bore witness to the applicability of Mendel's laws to the animal kingdom. It has proved valuable material to the geneticist in sex linkage, disease resistance, crossing over, and the varietys of morphological characters which have to be utilized to find out how a gene give rise to the character. The hen has thus acquired a right to stalk with pride through biological laboratories having proved a lass of many parts. As poultry, men, we respect the hen as being of all domestic animals the most efficient converter of raw materials into edible food stuffs. In a farm it is a valuable source of revenue and the mainstay in crop failure. As biologists, we respect her for the valuable material she has proved in her constitution to knowledge. (G. N. R.)

Gleanings.

Farmers' Empire Tours. The 10th tour of Empire Farmers, organized by the British National Union, has been arranged to take place in the Union of South Africa and Southern Rhodesia during the early months of next year.

Rancidity in Foods. The annual value of foods which are subject to spoilage by rancidity is more than $ 1,000,000,000; feeds and industrial products likewise subject to rancidity amount to several hundred millions more. Light plays an important role in the development of rancidity. This was recently demonstrated by the department in experiments that led to the granting of a public-service patent to make the discovery available to the American public. The experiments showed that the portion of the spectrum lying between 4,900 and 5,600 Angstrom units, which imparts the color approximating chlorophyll green, prevents or delays rancidity. On the other hand, the parts of the spectrum lying on either side of this portion stimulate and hasten rancidity. This photo-chemical discovery has numerous immediate practical applications. Wrapping oil-bearing foods in materials of the proper shade of green will keep them longer. Black wrappers will do the same thing because black absorbs all wave lengths of light. The discovery applies to butter, lard, nuts, potato chips, mayonnaise, cookies, crackers, whole-wheat flour, corn meal and other products. In the common wrapper all the commodities specified become rancid in a relatively short time. This discovery should save millions of dollars to manufacturers and consumers.—*U. S. A., Year Book of Agriculture, 1933.*

Insurance of Cattle and other Livestock by Goods Train. The following notice was issued by the Railway Companies' Association on October 10:—

Arrangements have been made by the railway companies of Great Britain to introduce on November 1 next, a scheme of insurance on most favourable terms by which senders of livestock may be protected against risks incidental to the transit of animals by goods train. The animals which may be insured, the premiums and the insurable maximum values covered are:—

Animals.	Premiums.	Insurable maximum value.
Cattles	4 d. per head.	£ 25 per head.
Calves	¼ d. „	£ 2 „
Sheep and Lambs ...	¼ d. „	£ 3 „
Pigs (Bacon)	½ d. „	£ 6 „
„ (Porkers) ...	½ d. „	£ 3 „

Minimum premium 2 d. per consignment.

The insurance covers risk of death or injury (except for disease or destruction due to foot-and-mouth disease, or under any Contagious Diseases Act, or death or injury caused by persons participating in any railway strike) whilst the insured animals are in transit and during loading and unloading. Complaints must be made in writing within 3 days of delivery and claims within 10 days. The scheme does not apply to imported livestock sent by rail from British ports. The scheme is experimental for 12 months and its continuance will depend upon the support that it obtains from farmers, livestock dealers, butchers and others interested in the transit of livestock.—*Journ Min. Agricul. XL, No. 8.*

Heat Excluding Roofs. In a paper on "Radiant Heat" read before the Institution of Heating and Ventilating Engineers on November 2, Mr. A. F. Dufton summarised the results which have been obtained at the Building Research Station on the relative merits of various forms of thin roofs as excluders of heat due to sunshine from the buildings they cover. Most roofing materials absorb about three-fourths of the sun-light that falls on them; for example, red tiles 67 per cent., blue slates 85 per cent., red asbestos tiles 74 per cent., old roofing lead 77 per cent., bituminised felt 89 per cent., galvanised iron when new 65 per cent., and when old and dirty 91 per cent. Whitewashing the upper surface of any one of these reduces the absorption considerably, for example, that of the dirty iron to 26 per cent. A glass roof under which the temperature was 188°F. when the temperature outside was 70°F. in the shade, when given two coats of whitewash on its top surface showed a temperature underneath of only 103°F. Mr. Dufton has not been able to detect that the rays from an incandescent electric light relieve the congestion of the nose produced by the radiation from an electric fire, although Sir Leonard Hill stated some time ago (*Times*, August 13) that they have this property.—*Nature No. 3291, p. 816.*

Alligator Breeding. The first alligator breeding farm in Germany is at Icking on the Isar (Upper Bavaria). By crossing different kinds (the process being kept a secret) hybrids have been successfully obtained which are resistant to every kind of climate. The object is to produce a crocodile skin which is durable, and unexceptionable in respect of colour, thickness, markings, etc.—*International Review of Agriculture, XX, No. 5, (May 1929).*

Crop and Trade Reports.

Castor crop—Madras—1933—First or Final Report. The average of the arrears under castor in the Madras Presidency during the five years ending 1931-32 has represented 22 per cent of the total area under castor in India.

2. The area under castor in the Madras Presidency up to the 25th November 1933 is estimated at 319 400 acres. When compared with the area of 333.600 acres estimated for the corresponding period of last year, it reveals a decrease of 4.3 per cent. The estimate for last year fell short of the actual area of 355,373 acres by 6.1 per cent.

3. The decrease is general outside Ganjam, Vizagapatam, Tanjore and Malabar

4. The yield is expected to be 98 per cent of the normal as against 102 per cent in the previous year according to the season and crop report. On this basis, the yield is estimated at 32,700 tons as against 34,700 tons estimated for the corresponding period of last year and 37,510 tons estimated in the season and crop report of last year.

5. The wholesale price of castor seed per Imperial maund of 82—2/7 lb. as reported from important markets towards the close of November 1933 was Rs. 3—14—0 in Vizagapatam, Rs. 3—13—0 in Vizianagaram and Rs. 3—11—0 in Trichinopoly. It ranged from Rs. 3—3—0 to Rs. 3—10—0 in other markets.

Groundnut Crop—Madras—1933—*Fourth or Final* Report. The average of the areas under groundnut in the Madras Presidency during the five years ending 1931—'32 represents 51.5 per cent of the total area under groundnut in India.

2. The area sown with groundnut in the Presidency in 1933 is estimated at 3,830,400 acres. When compared with the corresponding estimate of 3,494,100 acres for the previous year and the area of 3,516,679 acres as per season and crop report of fasli 1342, this reveals an increase of 7.6 and 8.9 per cent respectively. The estimated area for this year is in excess of the normal area of 3,068,100 acres by nearly 25 per cent. The increase was general outside Ganjam, East Godavari, Kurnool, and Cuddapah.

3. The harvesting of summer and early crop of groundnut was finished by October. The harvesting of the winter or main crop is proceeding. The crop was normal or above normal in the Circars (Guntur excepted), Nellore, Coimbatore and the South (Tanjore excepted) and below normal in the other districts. In South Arcot, *the yield is expected to be only* 55 per cent of the normal due mainly to insect attack and insufficient and unfavourable rainfall. The seasonal factor for the Presidency works out to 89 per cent of the average as against 98 per cent in the previous year. On this basis, the yield is expected to be 1,710,900 tons of unshelled nuts as against 1,728,910 tons in the previous year, a decrease of one per cent. *The yield in an average year is estimated at 1,534,050 tons.*

4. The wholesale price of groundnut shelled per Imperial maund of 82—2/7 lb. as reported from important markets towards the close of December 1933, was Rs. 3—10—0 in Cuddalore, Rs. 3—6—0 in Vizagapatam and Nandyal and Rs. 2—10—0 to Rs. 3—5—0 in the other districts. When compared with the prices of October 1933, these prices reveal a rise of 17 per cent in Nandyal, and a fall of 12 to 15 per cent. in Vellore and Salem, 2 per cent in Adoni and 8 to 9 per cent in the other stations.

Cotton Crop—Madras, 1933—34—Intermediate report. The condition of the standing crop is satisfactory except in Tinnevelly where the late sown crop is reported to have suffered from the heavy rains soon after sowing and the continued drought in December.

2. Pickings of the early sown cotton in the Deccan are almost complete and the yield is reported to be below normal.

3. The wholesale price of cotton lint per imperial maund of 82—2/7 lb. as reported from important markets towards the close of December 1933 was about Rs. 15—5—0 for Cocanadas, Rs. 15—10—0 for Red Northerns, Rs. 16—8—0 for White Northerns, Rs. 13-13-0 for Westerns Rs. 21—8—0 for Cambodia, Rs. 20-7-0 for Coimbatore Karunganni, Rs. 20—11—0 for Tinnevelli Karunganni Rs. 17—0—0 for Nadam, and Rs. 19—13—0 for Tinnevelly cotton. When compared with the prices in the previous month, the prices of Northerns and Nadam are stationary. They are higher by about one per cent for Cocanadas, 8 per cent for Tinnevelly Karunganni and 11 per cent for Tinnevellies. The prices of other varieties viz. Westerns, Cambodia and Coimbatore Karunganni, reveal a fall of about 1 to 3 per cent.

Paddy Crop—Madras—1933-34—Intermediate Report. The main crop of paddy has been harvested in parts of the Circars, Deccan and the West Coast. The yield is reported to be generally *normal outside East Godavari*, West Godavari, Guntur and Kurnool where it is reported to be slightly below normal.

2. The condition of the standing main crop is satisfactory except in parts of the Carnatic, Salem and Tanjore where the heavy rains and cyclone of November have slightly damaged the crop. In parts of Cuddapah, Coimbatore and Trichinopoly the crop is reported to have been affected to some extent by insects

3. The wholesale price of paddy per Imperial Maund of 82—2/7 lb. as reported from important markets towards the close of December was Rs. 2—14—0 in Nandyal, Rs. 2—5—0 in Negapatam and Tinnevelly, Rs. 2—3—0 in Cuddapah and Nellore, Rs. 2—2—0 in Cuddalore, Rs. 2—0—0 in Vellore and Salem and ranged from Rs. 1—6—0 to Rs. 1—14—0 in the other markets. When compared with the prices reported for November 1933, these prices are stationary in Vizagapatam, Cocanada, Bezwada, Masulipatam, Nandyal, Vellore, Trichinopoly and Cochin. They are lower by 6—3/4 per cent in Berhampore and Ellore and by 12½ per cent in Guntur. They have risen by 35 per cent in Negapatam, 15 to 16 per cent in Cuddalore and Tinnevelly, 10 to 11 per cent in Cuddapah and Salem and 5 to 6 per cent in Nellore, Kumbakonam and Madura.

Gingelly Crop—Madras—1933-34—Third Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1931—32 represents 12·3 per cent of the total area under gingelly in India.

2. The area sown with gingelly up to the 25th December 1933 is estimated at 608,000 acres. When compared with the area of 634,500 acres estimated for the corresponding period of last year, it reveals a decrease of 4·2 per cent.

3. The decrease is general except in the Circars, Kurnool, Trichinopoly, Ramnad and Tinnevelly. The main crop has been harvested except in the south where the harvest is in progress. The yield is reported to be either normal, or above normal in Ganjam, Vizagapatam, Kurnool, Cuddapah, Coimbatore, Ramnad, Tinnevelly and South Kanara and below normal in the other districts. The seasonal factor for the Presidency works out to 96 per cent of the average as against 98 per cent for the corresponding period of last year. On this basis, the yield is estimated at 79,400 tons as against 83,600 tons for the corresponding period of last year, a decrease of 5 per cent.

Ginger Crop—Madras—1933 Final report. The area under ginger in 1933 is estimated at 10,800 acres in Malabar as against 10,165 acres in the previous year.

2. The seasonal factor is estimated to be normal and the crop is expected to yield 3,860 tons of dry ginger as against 3,700 tons in the previous year.

3. The wholesale price of dry ginger at Calicut towards the close of November 1933 was Rs. 7—10—0 per Imperial Maund.

Pepper Crop—Madras—1933—Final Report. The area under pepper in 1933 in the districts of Malabar and South Kanara is estimated at 89,500 acres in Malabar and 8 100 acres in South Kanara as against 89,485 acres in Malabar 7,583 acres in South Kanara in the previous year.

2. The crop in Malabar was affected by the "Pollu" disease; the flushing was not satisfactory and there was shedding of spikes. The harvest commenced towards the end of December. The seasonal factor is estimated to be 80 per cent in Malabar and 90 per cent in South Kanara. On this basis, the yield is expected to be 10,740 tons for Malabar and 1,090 tons for South Kanara as against 11,400 tons for Malabar and 1,200 tons for South Kanara estimated in the previous year.

3. The wholesale price of pepper per Imperial Maund as reported from important markets towards the close of December 33 was Rs. 17—10—0 in Calicut Rs. 17/- in Tellicherry and Rs. 14—3—0 in Cochin.

Raw Cotton in the Madras Presidency.

Receipt of loose cotton at presses and spinning mills.

From 1—2—33 to 15—12—33 Bales	1—2—33 to 22—12—33 Bales	1—2—33 to 29—12—33 Bales	1—2—33 to 5—1—34 Bales	
456,5 9	459,183	461,387	463,992	as against an estimate of 411,600 bales in case of the total crop of 1932—33.
Receipts in the corresponding periods of the previous year. 415,271	419,199	424,529	425,383	
Pressed cotton received at Spinning mills 278,970	283,852	288,031	292,247	
Exported by sea 150,630	150,915	151,904	153,252	
Imported by sea mainly from Bombay and Karachi 41,813	42,345	42,840	43,030	

Bales = 400 pounds.

Correspondence.

I

Ginger—Is shade essential for cultivation of

Mr. K. Suryanarayanamurthy, Siddantum P. O., West Godavari, writes:-

Ginger is cultivated in portions of Amalapur and Narasapur Taluqs in the Godavari Delta under the shade of cocoanut and citrus topes, for green ginger. There is a great demand in the delta for green ginger which has to be imported at present from Koluvai in Nellore District and other places The prevailing rates are also high and hence, there has been a tendency among the ryots to introduce this crop to other parts of the delta, in suitable soils with drainage and irrigation facilities. But, because it is cultivated in Amalapur and Narasapur only under shade, there is a doubt whether it can be grown in open space, without any sort of shade. I will therefore be thankful if you would kindly let me know

(1) Whether shade, or covering the beds after planting, with green leaf and repeating the operation a number of times, as is done in the west coast, is essential for the successful growth of ginger ?

(2) Is not the yield less when ginger is grown under the shade of some other crop ? If so, what is the principle for growing ginger under shade in parts of Amalapur and Narasapur ? If shade is essential, is it throughout the life of the ginger, or only at certain stages of growth ? What are the suitable annual shade crops when it is not possible to grow ginger under the shade of cocoanut or citrus? If covering the beds with green leaf is necessary, what are the most suitable green leaf crops for the delta, as there are no forests in the tract ?

(3) What are the best climatic conditions for ginger and do the Godavari conditions suit ginger well ?

Mr. K. T. Alwa, Deputy Director of Agriculture, VII Circle, Tellicherry, answers :-

Shade is not absolutely necessary for ginger, perhaps it withstands a certain amount of shade and in the Godavari Delta, it is grown as a catch crop in cocoanut and fruit gardens. In the west coast it is grown in the open on high-lying lands as a rain-fed crop. Leaf-mulching is given in Malabar, because it is available in plenty and is a cheap manure. In South Kanara, successful ginger crops are taken without any leaf mulch at all, although the conditions are similar to Malabar. Cattle manure and ashes are also applied for the crop in the west coast.

The conditions required for ginger cultivation are well-drained soil, humid atmosphere good manuring and moderate irrigation.

Mr. S. Narayaniah, Assistant Lecturer in Agriculture, Agricultural College, also replies the above queries as follows :-

Shade is not absolutely essential for ginger. In hot places however, during the middle of a hot day, covering the crop is essential when the crop is in its early stages. The Tamil saying " இஞ்சிவாட்டம் மஞ்சளிலே " (The probable loss of ginger will be made up in the turmeric) should go to show that the two crops are generally grown together and the quicker-growing turmeric just provides the necessary shade for the ginger during the early stages.

II

An Improved Furnace for Boiling Sugar-cane Juice.

Mr. S. Raghava Ayyangar, Retired District Judge, Srirangam, writes :-

During 1932-1933, we were using 2 sets of Sindewahi furnaces with multiple pans (two) in each for boiling sugarcane juice. They were constructed in accordance with the instructions contained in the leaflet issued by the Agricultural Department. We were not able to boil in the course of twelve hours the juice extracted in about four hours with our small power crusher extracting about 700 lbs. of juice per hour. So we were thinking of reverting to a series of country furnaces. But in October 1933, my friend Mr. S. R. Srinivasa Ayyangar, Librarian, Agricultural College, Coimbatore, suggested a design of a new furnance which would combine the merits of the country furnace. He gave a description of the proposed furnace. We thought that the same may be tried and so we requested him to construct in our village Olaitheverayan Pettai, Tanjore District, a furnace according to the design suggested by him. He was kind enough to do so early in December. We began to use the furnace from about the 12th December 1933 and worked it till 1st January. We found it to be working satisfactorily. The furnace is now used by my tenants.

As I consider that others might try the furnace, with advantage, I have ventured to give a description of the same for publication in your journal. The furnace is rectangular. 4 feet 6 ins. long, 2 feet 3 ins. broad, and 2 feet 6 ins. deep fitted with an iron grating to the full length of the bottom. There is an ash chamber below the grate, which also provides air draught for the furnace. The mouth of the furnace is a small feedhole near the grating located in the front side. The feedhole is provided with an iron shutter, in order to close the hole when it is not used. Over the furnace 2 small rectangular pans are placed. A long flue with a good gradient is built behind the furnace. In this flue two pans are placed one behind the other. There are baffle walls across the flue passage in several plac s to deflect the heat towards the bottom of the large pans. At the farther end of the flue a tall chimney is built for the discharge of the flue gas at a higher level.

The first two pans are rectangular in shape measuring 3 feet by 2 feet by 1 foot. The 2 bigger pans now used are circular with a diameter of about 5½

feet (ordinarily one big pan will do). The first two pans which are directly over the fire, are used for concentration of the juice to jaggery. We boil in each of the 2 small pans 150 lbs. of cold juice. It took generally about 2½ hours for the first charges in the two pans, to concentrate into jaggery. Meanwhile the juice stored in the two big pans gets heated and begins to boil with the hot gas of the flue. The removal of scum is also done as far as possible in those pans. The boiled juice is later on transferred to the smaller pans in small quantities. The second charge in the smaller pans comes down to jaggery consistency in about 1½ to 2 hours. Later on we took only 45 minutes for each charge. With ease we were able to boil down 8 to 10 charges in each of the 2 small pans in 12 hours (9 A. M.—9 P. M.). The quantity of juice boiled was about 2,400 lbs. In summer, I believe we may be able to boil nearly 3,500 lbs. of juice in 12 hours; while in one Sindewahi furnace we could boil about a third of the quantity. Moreover in the Sindewahi furnace the man who feeds the furnace had to be constantly and steadily feeding the furnace. A little slackness led to further delay. Whereas in this furnace the man has ample time to look about, as he is feeding according to the country method with trash and megass. We found that there was a large quantity of megass remaining after the juice is boiled. As the quantity of juice to be handled in each pan is small, the men were able to deal with the jaggery easily. The men had also steady work throughout the day instead of having to work very hard for a little time when the syrup is transferred into the jaggery mould; and then to remain idle for a long time waiting for the next operation of a similar kind.

Ample benefit can be derived from this furnace even if there is no power crusher. By using a storage pan the juice need not remain cool until the smaller pan is ready. The flue heat is not wasted. Consequently the boiling of the juice need not continue for a long time after the bulls have ceased to work.

Instead of the rectangular small pans, circular small pans may be used.

The cost of the furnace without the chimney and pans come to about Rs. 30/- as burnt bricks were used. The inside of the furnace was plastered with a thin coat of cement. It is believed that the cement coating conserves the heat. In fields a smaller furnace may be constructed with unburnt bricks.

Mr. Srinivasa Iyengar, I have no doubt, will furnish the particulars necessary to build a furnace permanent or temporary.

[In publishing the above letter, we note with pleasure that the correspondent has placed his experiences before our readers, and welcome similar notes from others as well, regarding other improvements suggested to them by the Department. For the benefit of our readers, we might inform that the same furnace has been constructed at the Central Farm, Coimbatore during the month and is being tried. *Ed M. A. J.*]

College News & Notes.

Students' Corner. The College reopened after Christmas on the 3rd. January and immediately two classes went out on tour. Class II accompanied by Messrs. S. Narayanayya and P. N. Krishna Iyer visited Anakapalle, Samalkota, Rajahmundri, Bezwada, Guntur, Nandyal and Bangalore. Class III proceeded to the south of the peninsula and after visiting en route, Tinnevelly, Nagerkoil, Trivandrum and Quilon, returned to headquarters via, Aleppey, Ernakulam and Trichur. Messrs. H. Shiva Rao, S. N. Chandrasekhara Iyer and E. K. Nambiar accompanied this class.

As the students returned only on 17th. there was not much of athletic activity in evidence, but at the end of the month, a beginning was made with the inter tutorial hockey and cricket tournaments.

Change in Principalship. On the 16th. Mr. R. C. Broadfoot took charge as Principal from Mr. S. Sundararaman who from October 23rd last, had been holding additional charge of the post.

Science Congress. Messrs. G. N. Rangaswami Iyyangar, K. Ramiah, and Dr. T. V. Ramakrishna Iyer attended the session of the Indian Science Congress held in the first week of January at Bombay.

Cream Jaggery Manufacture—A Demonstration. During the month, a demonstration on the manufacture of cream jaggery using the activated charcoal was given for the benefit of giving training to a number of demonstrators and demonstration maistries who had been deputed from the moffusil for the purpose.

Officers' Club. The annual meeting for the election of office bearers of the club came off on the 20th. when the following were elected. *President* Mr. G. N. Rangaswami Ayyangar, *Vice President* Mr. T. S. Ramasubramanian, *Secretary* S. Ramachandran, *Committee Members* Messrs. V. T. Subbiah Mudaliar, C. S. Krishnaswami and M. K. Krishnaswami.

Association of Economic Biologists. The annual meeting and tea came off on 27th when the retiring president Mr. G. N. Rangaswami Ayyangar delivered a lecture on "The Biological outlook." The following were elected to hold office for the current year: *President* Mr. N. L. Dutt, *Vice President* Rao Bahadur B. Viswa Nath, *Secretary* Mr. K Ramiah, *Committee Members* Messrs. G. N. Rangaswami Ayyangar and K. M. Thomas.

Visitors. Rao Bahadur M R. Ramaswami Sivan, Retired Principal, Mr. K. Raghavachari, Asst. Director of Agriculture, Salem, Mr. S. Rama Rao, Agricultural Demonstrator, Chittoor, Mr. T. N. Balasubramaniam. Agricultural Demonstrator, Lalgudi, and Mr. N.V. Kanittkar, Chief Investigation Officer, Dry Farming Scheme, Sholapur, visited the estate during the month. Mr. M. R Ramaswami Sivan talked under the auspices of the Students' club on the 25th. on the "Scope for the students of agriculture in the life of the country". Mr. Kanitkar spoke under the auspices of the Union, on "Dry Farming" on the 30th.

Arrivals. Friends and well-wishers of Mr. M. Sanyasi Raju will be glad to know that he has returned from America and joined duty on the 27th. Mr. Raju has taken his M. Sc. degree at the University of Wisconsin.

Extension of term. It is understood that Rao Sahib Y. Ramachandra Rao's term of office as Locusts Entomologist and Mr. T. Murari's term as Superintendent, Live-stock station have been extended, each for one year.

Weather Review (DECEMBER—1933)

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	0·0	−1·9	54·7	South	Negapatam	8·3	−7·7	44·3
	Berhampore *	0·0	0·0	59·1		Aduthurai	8·8	−0·4	34·3
	Calingapatam	1·1	−2·7	44·6		Madura	0·4	+0·6	36·1
	Vizagapatam	0·3	−1·8	29·6		Pamban	4·0	−8·6	24·2
	Anakapalli *	0·1	−0·2	46·5		Koilpatti *	0·1	−2·7	27·1
	Samalkota *	2·1	+1·8	34·9		Palamkottah	0·7	+0·5	34·6
	Cocanada	2·7	−2·2	35 2					
	Maruteru *	1·6	+1 4	43·2					
	Masulipatam	1·9	0·0	43·7	West Coast	Trivandrum	0·8	−2·5	119·6
	Guntur *	0·5	+0·4	33 9		Cochin	0·9	−0·7	155·8
						Pattambi *	1·9	+0·5	139·8
Ceded Dists.	Kurnool	1·2	+2·8	28·2		Calicut	0·3	−3·9	167·7
	Nandyal *	0·6	+0·3	32·9		Taliparamba *	1·1	0·0	190·1
	Hagari *	0·8	−1·4	26 3		Kasargode *	8·7	+8·0	168·6
	Bellary	0·9	−0·1	37 4		Nileshwar *	1·9	+0·9	169·2
	Cuddapah	1·5	−0·8	24·1		Mangalore	6·2	+4 6	167·2
	Anantapur	1·6	...	28·6					
Carnatic	Nellore	7·7	+0·6	53·3	Mysore and Coorg	Chitaldrug	5·3	+3 2	41·8
	Madras	15·0	+0·6	39·7		Bangalore	2·2	−1·0	41·3
	Palakuppam *	10·1	+4 9	40 6		Mysore	1·7	−1·2	39·4
	Palur *	11·3	+5·3	47·5		Mercara	1·5	−1·2	161·2
	Cuddalore	6·7	−9·8	38·7					
Central	Vellore	6·6	−1·6	27·3	Hills.	Kodaikanal	3·5	−2 0	73·4
	Salem	4·1	+1·4	49·3		Coonoor *	...		
	Coimbatore	0·5	−2·0	27·0		Kallar *	3 9	−1·2	86·5
	Coimbatore Res. Inst. *	0·4	...	30·0		Ootacamund *	4·3	+0·5	66·0
						Nanjanad	2·0	−0·2	56·8
	Trichinopoly	4·0	−2 0	38·7	Central "	Hosur cattle farm *	3·3	+2 2	30·0

* Meteorological Stations of the Agricultural Department.

Summary of weather conditions: In South-east Madras, a few scattered showers were received during the first week of the month followed by a spell of dry weather till the 11th. Then conditions became unsettled in South-west Bay of Bengal to East Ceylon on 11th and a depression formed there by the 12th evening within one degree of Lat. 9° N, Long. 83° E. The depression intensified into a very severe cyclone by 14th morning and was centred now within one degree of Lat. 10° N and Long. 82½° E. Moving north-westwards the cyclone crossed the Coromandel coast near Cuddalore on the 15th evening and lay as a depression over South-east Madras on the 16th. It there filled up on the next day but induced unsettled conditions in South-east Arabian Sea off Kanara. The unsettled conditions moved northwards on the 18th and were located off Konkan, then becoming unimportant after causing widespread rain in the Northwest Peninsula on the 20th.

This cyclonic disturbance was responsible for widespread rains in South-east Madras and Mysore between 14th and 16th it being particularly heavy in Nellore, Madras, Chingleput and Arcot districts. With the northward movement of unsettled conditions rainfall extended into Kanara, Konkan, Deccan, North Madras Coast, West Central Province, Central India, East Rajputana and Gujerat. The cyclonic effect was of the most devastating character in the region of its

activity, resulting in extensive damage to crops as well as to property. The disappearance of the Cyclone was closely marked by the appearance of dry weather conditions in the Peninsula over the rest of the month.

Western disturbances were of frequent occurrence as in the previous month; but some of them were of sufficient intensity as to cause heavy precipitation of snow or rain in the region of its activity. The first distrubance during the early part of the month caused rain in the North-West Frontier Province and South West Punjab and filled up rapidly over the Punjab on the 4th. The next one which originated on 8th passed Eastwards across Northern India after causing scattered showers in and near the Punjab—Kumaon Hills on the 11th and a few falls in Assam on the 12th. The third of the series passed away eastwards through extreme north on the 15th without giving any precipitation. The fourth one caused scattered light showers in North Baluchistan on 19th and extension of cloud towards Kashmir on 20th and passed away Eastwards without any rain. The fifth distrubance which filled over Sind on the 24th caused scattered light showers near Kashmir. The last western disturbance of the month was of some intensity which led to the formation of a trough of low pressure from Baluchistan, Lower Sind to Punjab on 28th which caused a few falls of rain or snow in Kashmir on the 29th and became unimportant during the next day.

The first fortnight of the month was marked by defective humidity, the maximum and minimum termperatures remaining below normal. With the approach of the middle of the month, consequent upon the widespread rains due to cyclonic weather, the humidity showed a tendency to rise and continued to be in excess till about the end of the month. Whereas the maximum temperatures were below normal, the minimum inclining to be above normal. About the 27th the temperatures returned to normal, the minimum alone tending to be below normal over the rest of the month

The rainfall was below normal throughout the presidency except in those places which were influenced by the cyclone where the rainfall was in excess. Unusually heavy rain has been experienced along the west coast specially in parts of Malabar and Mangalore where marked excesses have been recorded. The heaviest falls recorded during the month were: Madras 6·4″ (16th), Vellore 5·1″ (16th), Nellore 4·9″ (16th), Negapatam 4·7″ (16th), Madras 5·5″ (17th) Pudukottah (Trichinopoly) 8·3″ (17th), Mangalore 6·0″ (18th), Chitaldrug 4·3″ (18th).

Weather Report of the Research Institute observatory: Report No. 12/33.

Absolute maximum in shade	80·0° F.
Absolute minimum in shade	57·5° F.
Mean maximum in shade	84·3° F.
Mean minimum in shade	65·4° F.
Rainfall during the month	0·44″
Heaviest fall in 24 hours	0·38″
Number of rainy days	1
Mean daily wind velocity	2·4 M. P. H.
Mean humidity	79%
Total hours of bright sunshine	247·2 hrs.
Mean daily hours of bright sunshine	8·0 hrs.

General weather conditions. The pressure was steady throughout the month except for two days in the middle of the month when a sudden fall in pressure was recorded as a result of the cyclone in South East Madras. The cyclonic effect was partially experienced here on the 15th and 16th when an overcast sky with strong winds was noticed followed by a rainfall of nearly 38 cents. The humidity was in defect. The temperatures were above normal throughout the month except for a recorded minimum of 57·5° on the 30th which was 5·5° below the one recorded the previous day. Nights were chill towards the end of the month.

C. V. R. & T. S. L.

Departmental Notification.

Postings and transfers. Mr. K. Ramaswami Ayyar on return from leave is posted for Pulichai cotton eradication work with headquarters at Virudunagar. Mr. P. S. Athmarama Ayyar is transferred to Coimbatore to officiate as F. M. Central Farm. Mr. A. Narahari Rao is posted to A. R. S. Anakapalle to do Poultry Breeding work. Mr. K. Varadachari F. M. Palur is transferred as additional A. D. Tiruvellore to do rural reconstruction work.

Leave *I Circle.* Ms. S. Ramaswami, Botony Asst. Anakapalle, extension of L. A. P. on medical certificate for 6 weeks from 12—12—33.

Gazette Notifications. Mr. K. M. Thomas, Upper Subordinate, II grade, Science Section, to officiate as Assistant Mycologist, Coimbatore, from the date of taking charge, vice Mr. S. R. Venkatakrishna Mudaliar, granted leave. Mr. C. Ramaswami Naidu, Assistant Director of Agriculture, Cuddalore leave on average pay without medical certificate for two months from 3rd January 1934 with permission to prefix the Christmas and New Year holidays of 1933—34 subject to the conditions laid down in the subsidiary rules. The High Commissioner for India has granted to Mr. P. Venkataramiah, Assistant Agricultural Chemist, Coimbatore, extension of leave for three months from the 27th ultimo. Mr. R. C. Broadfoot, Headquarters Deputy Director of Agriculture, Madras, to officiate as Principal, Agricultural College, Coimbatore, vice Mr. D. Ananda Rao, on other duty as Director of Agriculture. Mr. K. Gopalakrishna Raju, Deputy Director of Agriculture (provisionally substantive), II Circle, Guntur, to officiate as Headquarters Deputy Director of Agriculture, Madras. Mr. T. Bhudavidya Rao Naidu, Assistant Director of Agriculture, Guntur, to be Assistant Director in charge of II Circle, Guntur. Mr. A. Chinnatambi Pillai, Agricultural Demonstrator, I Grade, to officiate as Assistant Director of Agriculture, Guntur. Mr. P. Subramaniam, Agricultural Demonstrator, I Grade, to officiate as Assistant Director of Agriculture, Cuddalore, vice Mr. C. Ramaswami Naidu, granted leave.

[From this volume onward, leave notifications of officers for periods less than two months will not be published in these columns. Promotions, postings, transfers, confirmations etc., will however continue to be published.—*Ed. M. A. J.*[