Madras Agricultural Journal

(ORGAN OF THE M. A. S. UNION)

Vol. XXIV] OCTOBER 1936 [No. 10.

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Editorial.

Live-stock improvement. Ever since the Viceroy gave an impetus to the improvement of animal husbandry in India by presenting three pedigree bulls for free service in the Delhi District, many local boards and big land owners have come forward with commendable promptitude to maintain breeding bulls in several parts of the country. The Advisory Board of the Imperial Council of Agricultural Research have also arranged to constitute an animal husbandry bureau, to collect information regarding special characteristics of seven best breeds of cattle, and to open and maintain an official herd book for the registration of the performances of the pedigree cows. Besides several press notes by the Director of Public Information, Simla, and addresses by the Live-stock expert attached to the Imperial Council of Agricultural Research are being broadcasted from time to time with a view to educate the public on the importance of the development of live-stock. All these activities have gone a great way in encouraging one important aspect of animal husbandry viz. breeding.

If this impetus is to be kept up and if all the efforts taken so far are to be fruitful, it is extremely essential that arrangements should be made on an adequate scale for the rearing and maintenance of the progenies of pedigree animals. It has to be remembered at the same time that improved live-stock require feeds of higher nutritive ratios

for their maintenance than the low grades, and that a large proportion of the fodders raised under the Indian conditions on soils with low fertility and with no manure has a poorer nutritive value than those grown elsewhere. Naturally the maintenance of improved breeds will involve greater attention on the part of farmers with regard to the provision and choice of forage for them. They will then have to resort to a more extended use of concentrated foods like oilcakes to make up for any deficiency. Not only does this often prove much beyond the means of the average cultivator but even to those who can afford it. The low price which the most carefully tended animals fetch in the fairs and the lack of adequate demand for milk and its products in most of the villages especially those situated away from towns, prove deterrant. The condition of the calves of such a valuable breed as the Ongole that are being paraded daily by the milkmen in towns like Madras. and the practice obtaining in certain districts, of baling out water for irrigation from fairly deep wells by means of piccotahs when bullock power can be employed for the same purpose with greater profit, bear ample testimony if any is needed, to the unremunerative nature of cattle feeding.

Nutrition researches started by the Imperial Council of Agricultural Research and the local Governments have thrown much light on the importance of minerals in feeding, on the causes of malnutrition and on the methods of remedying the defects in cattle. They have not, however, reached a stage to recommend the adoption of a particular feeding standard which will keep them in condition without making any inroad on the slender purse of the farmers.

The Royal Commission on Agriculture recognised the importance and hugeness of this impediment in the progress of animal husbandry in India, and declared in no uncertain terms that 'no substantial improvement in the way of breeding is possible until cattle can be better fed' and that 'in general the rule that increase in production must be preceded by the increase in the food supply holds good'. It is on this fundamental consideration they have made a number of recommendations with regard to the provision and improvement of grazing grounds, the ensiling of crops and grasses, methods of improving coarse fodders, feeding cows during dry period, and the restriction of the number of animals to be kept by the farmers. Much headway has not yet been made in many of these proposals since the publication of the Commission's report. As such we feel that the exhortation made by Col. Olver the other day in his broadcast address that he feels 'that it should be the sacred duty for every good cultivator, of whatever creed, to keep at least one good cow, feed her and her progeny well under the stall fed conditions—which all progressive countries have been forced to adopt—and to mate her with a good bull of her own breed and type' will fall on deaf ears.

In this connection we wish to draw the attention of the readers to the proposals recently made by the Minister of Agriculture and Fisheries, United Kingdom, for safeguarding the beef industry of Great Britain. He indicated that "the Government propose to proceed on the basis of a regulated market with the maximum supplies to the consumer consistent with a reasonable level of remuneration for the producer. The Government have given earnest consideration to the position of the United Kingdom cattle producer under this arrangement and they propose to invite Parliament to make provision for a permanent scheme for the payment from the Exchequer of a subsidy to producers of fat cattle in the United Kingdom which while not stimulating as artificial expansion of the home industry will continue so long as and to the extent, that the situation may require". He has also announced that sums not exceeding £ 5,000,000 per annum would be set apart for the above purpose.

We venture to think that if the public are to respond adequately to the call of the Viceroy, an action on the part of Government somewhat along these lines is urgently called for. We would for instance recommend a considerable reduction in railway freight on bulky as well as concentrated foods, free distribution of grass seeds, encouragement of enclosing pasture lands either by remissions or by granting permission to divert the village panchayat funds, and offering subsidies to persons rearing good cattle and maintaining surplus stock in proper condition. If necessary a small cess may be levied on the import of dairy products and also on the export of edible oil cakes the annual values of which assume an enormous figure of 80 and 182 lacs of rupees respectively. We wish also to mention that the bulk of the consumers of the imported dairy products, coming as they do from richer classes, will least feel the strain of the imposition of the suggested tax.

We have dealt at some length with the collateral aspects of animal breeding in as much as we feel that they are of vital importance to livestock industry. We feel sure that the present Viceroy who was the Chairman of the Royal Commission on Agriculture will not leave any avenue unexplored to cheapen the cost of cattle foods and thereby link up the development of animal breeding with that of fodder supply not only with a view to implement the recommendations of the Commission, but also to see that his first act of love in India is placed in a suitable environment as to develop and unfold all its potentialities to the benefiit of the agriculturist.

STUDIES ON THE EFFECT OF ARROWING IN CANES UNDER COIMBATORE CONDITIONS

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Introduction. In and around Coimbatore sugarcanes begin to arrow in October—November. It is not known why certain varieties arrow, while others do not. There is a certain amount of prejudice in these parts against arrowing. From what follows it will be seen that arrowing is really a disadvantage in many respects in these parts.

The work described herein is part of an investigation published elsewhere jointly with Mr. K. V. Gopala Iyer. Additional corroborative data and some new facts since obtained on the subject are now given.

Material and Methods. Sampling was done on a fairly large scale. For every analysis, eighteen clumps were taken at random from different plots giving from 70 to 100 canes per analysis. A few arrowed canes were selected and labelled in the field, and periodical measurements of the total length of cane from the ground level were recorded to find out the growth, if any, in the arrowed canes. For sectional analysis, the dead leaf portions of the canes were cut into three sections and analysed separately.

Results. *Growth*:—When once a cane arrows there is no fresh nodal formation, but only a slight elongation in the top joints as will be clear from the following table :—

Table I.

Height of the canes from the ground level up to the joint just below the attachment of the sheath of the shot blade.

Co. 290		Co. 223	
30—11—1935	16—12—1935	30—11—1935	16—12—1935
4 ft. 11½ in.	5 ft. 1 in.	5 ft. 8½ in.	5 ft. 10½ in.
4 „ 8½ „	4 „ 10 „	6 „ 9 „	6 „ 9½ „
5 „ 8½ „	5 „ 11½ „	6 „ 0 „	6 „ 1 „
5 „ 7 „	5 „ 8½ „	5 „ 6¾ „	5 „ 8¾ „
5 „ 5 „	5 „ 6½ „	5 „ 7 „	5 „ 8½ „
5 „ 3½ „	5 „ 6½ „	6 „ 11 „	6 „ 11½ „
5 „ 7½ „	5 „ 9½ „	5 „ 0 „	5 „ 2 „
6 „ 3½ „	6 „ 5½ „	5 „ 8¼ „	5 „ 11 „
Average increase about 2 ins.		Average increase about 1½ ins.	

The greater increase in the length and weight of cane after the shot blade stage is only in the millable part of the cane as the joints that were not fit to be milled when the cane was in shot blade become fit to be milled in the course of one or two months.

The non-arrowed canes, on the other hand, grow continuously and weigh at harvest more than 1½ times the maximum weight

attained by the arrowed canes. The sucrose contents also equal and even slightly excel the maximum reached by the arrowed canes.

Table II.

Average maximum weight of millable cane and maximum Sucrose per cent in juice.

	Co. 290		Co. 422	
	Arrowed.	Non-arrowed.	Arrowed.	Non-arrowed.
Maximum weight	1·6 lbs.	2·3 lbs	2 2 lbs.	3 9 lbs.
Maximum sucrose	16·68 %	17·25%	19·16%	19·57%

Yield of sugar :—At the time of arrowing, the yield of sugar from 100 canes is more in the arrowed canes than in the non-arrowed canes. After about 2½ months there is deterioration in the arrowed canes, while the non-arrowed canes continue to improve. Consequently, there is a distinct loss due to arrowing at the usual time of harvest, as is clear from the following graph.

Sectional analysis :—The sectional analysis up to the dead leaf joints of a large number of arrowed and non-arrowed canes are given below :—

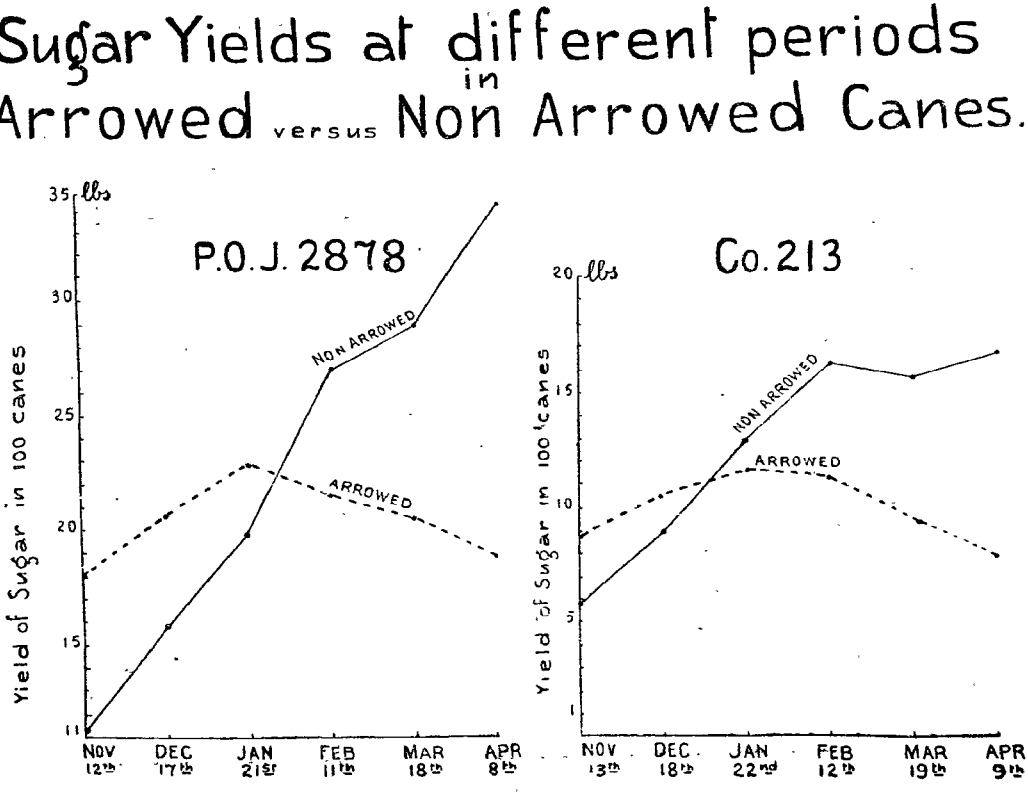

Table III.

Increase of Sucrose Content in the Dead Leaf Portions.

Non-arrowed (Co. 422).

Date of analysis.	Top.	Middle.	Bottom.	Full millable cane.
18—12—1935	14·44%	14·87%	15·66%	12·08%
8—1—1936	14·90%	15·10%	16·53%	13·95%
25—1—1936	16·37%	16·91%	17·05%	15 62%
12—2—1936	18·29%	18·61%	18·62%	17·03%
11—3—1936	19 99%	20·22%	20·43%	19·50%

Arrowed (Co. 290).

Date of analysis.	Top.	Middle.	Bottom.	Full Millable cane.
17—12—1935	14·77%	15·68%	16·53%	15·57%
9—1—1936	16·18%	17·63%	18·16%	16·20%
20—1—1936	15·49%	17·81%	18·60%	16·68%
11—2—1936	14·65%	17·66%	18·48%	16·34%
7—3—1936	14·28%	16·79%	17·96%	15·72%
25—3—1936	14·03%	16·17%	17·49%	15·22%

Although the data in the above table refer to two cane varieties, a similar phenomenon was observed among non-arrowed and arrowed canes in the same variety. It is seen that in the non-arrowed canes there is a considerable increase in sucrose content in all sections of the dead leaf portion from December to March, and that the highest sucrose content continues to be in the bottom section. In the arrowed canes, however, there is increase in the sucrose content till about the middle of January and then deterioration commences. This deterioration appears to be slightly more rapid in the top than in the bottom, thus making it almost impossible for the top sections to ever equalise in their sucrose content the bottom ones.

Green tops :—In the arrowed canes the green tops are not useful for fodder purposes, while in the case of the non-arrowed canes the green tops constitute about 1/6th to 1/8th of the total weight of a cane and are fit for feeding cattle. The actual weight of green tops obtained from different varieties is given below :—

Table IV.

Weight of Green tops obtained from 15 rows.

Variety.	Approximate percentage of arrowing.	Quantity of green tops obtained.
P. O. J. 2878	80%	184 lbs.
Co. 213	60%	270 lbs.
247 B.	20%	624 lbs.
Co. 402	Nil	857 lbs.

My thanks are due to Mr. K. V. Gopala Iyer for kind help rendered.

Summary and Conclusion. In an arrowed cane there is only a slight elongation in the top joints.

Arrowed canes deteriorate after about 2½ months from the time of arrowing, while there is continuous growth and steady increase in the sucrose content of the non-arrowed canes; consequently, there is loss due to arrowing.

Though arrowing is a distinct disadvantage in many respects, an arrowing, and quick growing variety will be found useful for early crushing by factories in November, when other varieties are not rich enough in sucrose.

Periodical sectional analysis of canes from top downwards on dead leaf samples has revealed that there is a steady improvement in sucrose content in all sections.

Arrowing involves a loss of green tops suitable for fodder purposes.

SOIL CONDITION AS AFFECTED BY CROPPING IN THE BLACK SOIL AREA OF THE TINNEVELLY DISTRICT

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The ryot of the black soil tract of the Tinnevelly and Ramnad districts adopts usually the following rotation:— Fodder cholam (*Andropogon Sorghum*), Cotton, (*G. indicum gammie*), Cumbu (*Pennisetum typhoideum*), and Cotton; whenever cotton follows cumbu, the yield is normal, but it is depressed when coming after a fodder cholam crop. Actually the figures collected from 1905 onwards show that the yield of cotton after Irungu (the variety of cholam grown) is about 15% less than that after Cumbu. The results of an investigation of this phenomenon, carried out under a scheme financed by the Indian Central Cotton Committee, showed that the growth of fodder cholam tended to alter the physical condition of the soil. After the cholam crop, the soil often turns out in clods under the plough, cracks but little, and has been observed to be considerably less permeable than after cumbu. A search for the more obvious agencies such as depletion of moisture, soil exhaustion etc., having proved futile, it was surmised that the adverse alteration of soil condition induced by cropping was responsible for the poor yield of the subsequent cotton crop.

Change of soil condition, producing profound and striking effects on crop growth, is a phenomenon with which many agriculturists will

be familiar. In fact many of the cultivation practices in vogue in different tracts have been evolved through the ryot's experience of tract, season and water supply, to promote that soil condition which is most favourable for crop growth; and when for some reason or other, an apparently meaningless departure is made from the cultivation practices, it has resulted in poorer crop-return. In the Godavari and Tanjore deltas for example, it is usual after the harvest of paddy, to leave the land fallow during summer without any preliminary cultivation whatsoever, and to take up puddling only after the receipt of rains. In Godavari, attempts on the part of the ryots to raise sugar-cane oftener than once in three years (as is the usual rotation) has entailed the crowbaring or ploughing of the soil after paddy. This has resulted in the soil becoming '*gulla*' or loose and crop growth on this kind of soil has always been poor. Similarly in Tanjore the effect of ploughing the field during summer has been to decrease the yield of paddy that season. A common feature of such phenomenon was an obvious change in soil texture which revealed itself in most cases in reduced rates of percolation or in the refractive behaviour of the soil under the plough and an explanation based on such changes appeared satisfying. The gulla soil, for example, was soft, sponge-like, cracked but little and was tenacious of moisture; so also in Tanjore, summer cultivation of the heavy illdrained soils "causes the cracks in the land to close, which stops all movement of water through the soil when the field is flooded." It should however be admitted that explanations such as these are mere records of observations and cannot be considered satisfactory and much less capable of leading to a control of the phenomena in question.

The only instance known to us for which a scientific explanation has been attempted is the one by Breazeale[1] in connection with the effect of sorghum on the succeeding crop. Breazeale was inclined to attribute the changed condition of the soil to a decrease in available carbondioxide, which again was attributed to reduced bacterial activity. It is not possible to discuss all his arguments here. It may be stated, however, that the theory advanced is not based on direct experimental facts.

In view of these observations, the work reported in this paper, should be of great interest ; for experimental work on the Koilpatti soils has thrown considerable light on the probable causes that are responsible for altering the soil condition and their mode of action.

Experimental results. The experimental investigation was mainly along two avenues, which are detailed below in brief.

(a) *Cationic composition of soils.* Samples of soil were drawn from plots cropped with cholam and cumbu, from successive depth-intervals of 6" during several stages of the growth of the crop and

1. BREAZEALE : Jour. Amer. Soc. Agronomy (1934) 16, pp. 689—700.

were analysed for exchangeable bases. The results are given in brief in table I and are examined statistically in table I-A. It will be seen from the analysis of the data that all the three interactions are definitely significant showing that changes in the exchangeable sodium occur as a result of crop growth and that the extent of such changes is different with the different crops. The soil after Irungu has more exchangeable sodium than the soil after cumbu; further, with crop growth, the exchangeable sodium rises in the soil especially in the top layers of cropped plots; in a *fallow* plot the exchangeable sodium remained more or less constant when examined at various intervals during the season; but in the cumbu and Irungu plots the soda went on increasing from October when the crops were sown to February when the Irungu fodder was cut.

(b) *Variations in the total colloid content of the soils during crop growth.* Samples of soil were also drawn from the several layers at different stages of the crop with a view to find out if there are changes in total clay content. The results are shown in Table II. Here again it will be seen that there is an increase in clay content with the growth of the crop in the top layers of the soil.

Discussion. A good friable texture in a heavy soil depends for example, upon the clay particles being generally flocculated and gathered into little aggregates promoting tilth. Clays which are rich in calcium, are easily flocculated like this, and are least retentive of water; sodium clays on the other hand are more sticky, dry less readily and are more easily dispersed, and this is in fact the type of change observed in the condition of the Koilpatti soil when they are cropped with cholam. The increase in exchangeable soda, noted above i. e. in alkalinity, would, by itself, be sufficient to explain the deteriorated condition of the soil after cropping, as it is only too well known that alkaline soils possess in general a poor texture. Also, it is easy to understand why this increase in alkalinity should follow on cropping with the cereals. The black soil area of the tract contains at a depth of about 3 feet to 4 feet a layer rich in sodium salts and it is probable that when shallow rooted crops are raised, water is lifted from the lower layers as a solution of these salts, which then interact with the calcium soils and leave them more alkaline.

This would, however, mean that cropping in general tends to produce more and more of alkalinity in the surface soils and a logical consequence of such a hypothesis should be that, in general, these black soils should be becoming increasingly alkaline with cultivation, which certainly is not the case. On the other hand even the " cholam effect " is but a temporary phase and does not last for more than one season. The soils get corrected, usually during the period of the succeeding crop; often, a simple fallow, or even a droughty summer

proves sufficient. These observations would appear to indicate the need for formulating an easily reversible mechanism, as the cause of the injurious after-effects of the cropping.

In the gentle flats of the black soil area, the processes of soil formation appear to be much the same as what obtain in other clay flats like those of Sudan and Egypt. A consistent feature of these formations is the absence of any sharp changes in the profiles down to the kunkar layer. Extensive studies of similar profiles in those countries have pointed out that, due to the intermittently moist conditions, their tropical situation, and their heavy nature, a mixing up of the soils of the whole profile is an annual feature and mass transport of soil material (upwards probably in the ascending water columns and downwards through the cracks that these soils develop during summer) should be of common occurrence; this latter is in all probability the agency that corrects the temporary aberrations in soil conditions observed as a result of cropping. The increase in the clay content of the several layers of the soil with the growth of the cholam crop is in all probability due to such movements of colloidal clay *en masse* and sodium clay being the most mobile is likely to be the predominating constituent of such moving masses. This may also be an additional cause for the increased alkalinity induced by cropping.

Again the downward transport of the clay material thus brought up to the surface depends largely on the extent of cracking developed by the soils which in turn depends on the degree of alkalinisation. The cholam crop has been found to leave the soil distinctly more alkaline and therefore less liable to crack; in such a soil, this downward transport of the clay material on which depends its restoration to the original state should suffer considerable retardation and this is exactly what is found. These soils crack poorly and the yields of the succeeding cotton raised on them are reduced by 15 to 20 per cent.

Reference to the table I on the rise of exchangeable soda during crop growth, will show that while both cumbu and Irungu soils definitely show an increase over the fallow soil, the actual difference between cumbu and Irungu is but little, being about 1 to 2 milli-equivalents only, at each stage of examination.

Ratner[2] has shown that quite small changes in exchangeable sodium of heavy soils are sufficient to bring about appreciable changes in the physical behaviour of soils and it is probable that, while with the rise of soda in it also, the " after-cumbu " soil does not show any great changes in physical condition, the slightly greater rise in the " after cholam " soil is responsible for all the faults laid at its door suggesting thereby the existence of an optimum point, which, when exceeded, affects the texture considerably.

2. RATNER E. T. Soil Science (1935). Vol. *40* pp. 462—3.

Table I.

EXCHANGEABLE SODIUM

(in milli equivalents per 100 g. of dry soil)

Time of sampling.	Top 6 inches.			Second 6 inches.			Third 6 inches.			Fourth 6 inches.			Fifth 6 inches.		
	Cumbu	Irungu	Fallow	Cumbu	Irungu	Fallow	Cumbu	Irungu	Fallow	Cumbu	Irungu	Fallow	Cumbu	Irungu	Fallow
Before sowing	3·96	3·94	2 24	3·03	3 13	2·97	3·20	4·48	3·74	14·44	14·94	15·05	14·99	17·19	15·61
Immediately after N. E. rains	6·60	7·30	3·24	8·59	10·35	4·53	9·12	9·82	4·50	10·02	12·99	13·32	15·70	20·09	17·17
At Shot Blade (Irungu)	8·71	10 78	3·89	7 74	9·85	4·70	9·50	10·37	5·12	10·74	13·84	13 67	15·82	19·53	16·89
After Harvest (Irungu)	8·96	11 14	3 96	8·14	11·26	4·91	8·97	11·02	5·64	10·68	13·86	13·94	15·86	19 78	17·21

Table I A.

Statistical Analysis of the Data in Table I.

	Degrees of Freedom.	Mean Variance	Value of Z= Found	Calculated. (P=·01)
Seasons	3	23·97		
Crops	2	51·35		
Layers	4	283·31		
Season X crops	6	3·58	1 043	0·650
Crops X layers	8	7·71	1·415	0·606
Layers X seasons.	12	9·28	1·509	0·554
Residual	24	0·454		

Table II

Clay Percentages at different stages of crop growth After Irungu set seed—soil,

	0 - 6"	6" - 12"	12" - 24"
Before sowing	39·17	40·46	41·55
At shot blade	41·67	41·17	41·98
After Harvest	46·83	45·59	46·54

Note: The figures are the averages of 3 samples for each at each stage.

Summary. Growing of fodder cholam in the black soil tract of the Tinnevelly District has been known to produce certain obvious changes in the physical condition of the soil which is probably the cause of the reduced yield of the cotton crop following cholam.

During the growth of the cereal crops of the tract, a rise in exchangeable soda as well as in clay content of the surface layers has been shown to take place, more in the case of cholam crop than in cumbu.

The probable cause of such rise and their relationship to the changes in the physical condition of the soil are discussed.

Acknowledgement. The investigation was carried out as part of a scheme financed by the Indian Central Cotton Committee, to which body, our thanks are due.

We are greatly indebted to M. R. Ry. V. Ramanatha Ayyar, Cotton Specialist, for his kind criticism and encouragement throughout and to M. R. Ry. R. Chockkalingam Pillai, Superintendent, Agricultural Research Station, Koilpatti, and Mr. S. Sundaram, Assistant, Madras Fodder Cholam Scheme for the drawing of the necessary soil samples at Koilpatti.

FRUIT SUCKING MOTHS ON TOMATOES AND THEIR CONTROL

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and

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Introduction. In July 1935, a crop of tomatoes was raised at the Insectary and it grew well for about 3 months in spite of occasional trouble from certain caterpillars. In October, however, with the advent of the fruits, large numbers of fruit sucking moths appeared and began to pay their attentions to the crop. Hiding by day under bushes and appearing on the scene under cover of darkness these destructive hordes of delicate creatures with pale green forewings and bright yellow hind wings became a menace to tomato culture. They pierced the fruits with their proboscis ; circular patches appeared at the place of feeding and rotting set in with the result that the fruits were utterly useless for human consumption. Taking advantage of the presence of these moths in large numbers detailed observations as to their habits were made and various remedial measures tried.

Life History and Habits of the Insect. Eggs are laid by the female moth on the leaves of a weed known as *Tinospora cordifolia* (சீந்தில் ஓகாடி.) The newly hatched cater-pillars feed on the tender

shoots and leaves of the plant. They grow in size and undergo a series of moults after which they spin together the leaves and line them with a fine texture of silk and then pupate. The life cycle of the moth from egg to adult is about a month, the egg, larval and pupal periods being 3, 18 and 9 days respectively. The caterpillars have an interesting habit of dropping down into the bushes when slightly disturbed which seems to be a method of protecting themselves from their enemies. A moth fed on jaggery water lived for 24 days but 12 days can be taken as an average life of the moth.

Two species of fruit moths (*Ophideres materna* and *O. fullonica*) of which the former predominated were noticed to visit the fruits. From a collection made in the field it was found that about 95% were *O. materna*.

As stated before, the moths hide during the day among the bushes and are active only after night fall. From 7 or 8 P. M. they commence their destructive activities and continue feeding till very late at night. A few of the moths have been noted to feed upto 4 A. M. Almost similar was the feeding habit of moths kept under captivity in the Insectary.

The moths show preference to ripe fruits but in their absence or when these become scarce they take to green or raw fruits also. The fruits on the top of the trellis are attacked first while the lower ones are taken up later. The fruits plucked and kept on the ground did not attract the moths at all.

A few observations were made on the power of flight of these moths. When the bushes adjoining the tomato plot were disturbed during day time a few moths were seen to rise in the air to about 200 feet and fly away in the direction of the wind and were lost sight of. When disturbed during night time also their quick flight was observed to some distance when they disappeared from view.

Fruits Affected by the Moth. The moths are known to feed in fairly large numbers on the fruits noted below:—

Names of fruits.	Places where the pest has been noted.
1. Batavian Oranges.	Samalkot, Pithapur (Godavary Dt.) Palacole, Nidadavole, Madumadinagudam (Krishna Dt.) Rajampet, (Cuddapah District) Panyam (Kurnool District)
2. Kamala Oranges.	Palacole, Nidadavole, Madumadinagudem.
3. Oranges.	Kallar, Sethumadai, Semmedu, Agricultural College Estate.
4. Guavas.	Agricultural College Estate.
5. Grapes.	" "
6. Tomatoes.	Agricultural College and Tudiyalur.
7. Bilimbi.	Kallar.
8. Cashew.	Kallar.
9 Mango.	Palacole, Nidadavole, Madumadinagudem.
10. Pomegranate.	" " "
11. Cactus.	Agricultural College Estate.

Nature and Extent of Damage to Tomatoes by the Moth. The moths by means of their proboscis. puncture the fruits and feed on the sap. After feeding, the juice oozes out and the very next day after infestation the characteristic 'hollow' is seen and rotting sets in which extends during the next two or three days. The fruits become baggy and get shrivelled up. Unlike oranges the tomato fruit does not drop down to the ground as a result of the attack of the moth. If the moths attack the green fruits close to their stalk then some of them may drop. In nature, the same fruit may be punctured by more than one moth during different nights but one puncture is enough to spoil the fruit. Sometimes as many as five moths have been noticed feeding on a single fruit. On a modest estimate, at least 50% of the fruits were damaged during the season.

Trials of Remedial Measures. Several control experiments were conducted during the last season and a good deal of valuable information added.

Light traps: Bright mantle lights put up in the field to see whether moths had any attraction to lights gave negative results. Coloured lights such as blue, green, yellow and red had also no attraction for the moths.

Small traps: Ripe tomatoes cut open and smeared with molasses mixed with arsenate solution and Amyl acetate also did not attract the moths.

Poison baits: Plantains impregnated with a sugar solution of Sodium arsenate were hung by means of strings along with ripe tomato fruits. The baits were put out in the evening and removed in the morning. A few moths were noticed to feed on the bananas but no special preference to these fruits was noticed.

Experiments in the Laboratory showed that moths fed on poisoned bananas died within 12 to 36 hours after feeding. Other less costly fruits and those that can be got practically free will be tried during the next season.

Spraying of deterrents: Of all the deterrents tried, Crude oil emulsion was the best but even here the repellent action lasted only for three days and from the fourth day onwards the moths came in numbers to feed on the fruits. Spraying deterrents once in four days is not an economic proposition, especially in the case of tomatoes.

Destruction of adult moths: In the course of the experiments it was found that a bright light brought near the moths suddenly while feeding, stupefied them and made them unable to fly. This was taken advantage of and in this way hundreds of moths were captured and destroyed. As the crop does not grow high this method was very easy to practise. This, together with the eradication of the larval food plants *Tinospora* alone can be recommended against these fruit pests.

One other observation made during last year deserves mention in this connection. In the Central Farm Orchard where Batavian oranges and tomatoes were grown side by side, the moths showed distinct preference to tomatoes as against oranges. There was practically no attack on organges as long as the tomato crop was in the field but when this was pulled out in October the moths began to pay their attention to oranges. If these observations are confirmed by this year's studies we will have a cheap and effective remedy against this very serious pest of oranges in almost all fruit growing areas in this Presidency, i. e., growing tomato as a trap crop in such a way that the fruiting season may coincide with that of citrus so that the moths which are attracted to them may be captured and destroyed. We would request the district staff to give this a trial and let us know the results.

AN AFRICAN *RAGI*, ELEUSINE CORACANA GAERTN.—THE FINGER MILLET—WITH A VIOLET PURPLE COLOUR

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In a previous article (Rangaswami Ayyangar and Krishna Rao, 1931) three major types of purple pigmented plants have been described and their inheritance worked out. They are Purple, Dilute Purple and Localised Purple. In a subsequent article (Rangaswami Ayyangar, et al., 1933) a fourth type, Medium Purple was described. The mode of inheritance of all these types of Purple has been given. Factors P, I_1, I_2, H_1 and H_2 are involved in the above. The commonest type of Purple Pigmented Ragi is of the genetic constitution $P = I_1\ I_2\ H_1\ H_2$.

This article describes a fifth type of purple, viz., Violet Purple, and the mode of its inheritance. This Violet Purple was first met with in an African variety from Nyassaland. It was noticed that the plants had a tint of violet and were coloured deeper than the usual purple plants. Not being very vigorous, this purple was suspected to be a type of distress purple that would disappear with acclimatisation. Type plants were carried forward and it was noticed that even the next year the same tint of violet with the same un-economic growth existed. It was found that this type of purple manifested itself in all the places at which the normal purple manifests, with this difference that in the glumes the violet tinge added to the prominence of the purple. In the amount of purple this new type and the ordinary Indian type are about equal, only they differ in the quality of the same, which in the African type takes on a violet tinge so that the new type can fittingly be designated Violet Purple. The absence of this type of

Purple in the wide ragi-growing areas of this presidency coupled with the comparatively un-economic nature of this Violet Purple variety makes it probable that the dropping out of the dominant gene responsible for its presence, marks one of the stages in the evolution of the more recent and economic cultivated varieties. The lingering of this type in a part of Africa is therefore interesting in throwing light on the origin and affinities of the finger millet.

The relationship of this type of purple to the others :

(A) Purple,
(B) Medium Purple,
(C) Dilute Purple,
(D) Localised Purple,

and (E) Green (non-purple pigmented)—allelomorphic to P—was pursued and suitable crosses made. In every case the F_1 was a Violet Purple. The following segregations occurred in the F_2 generation.

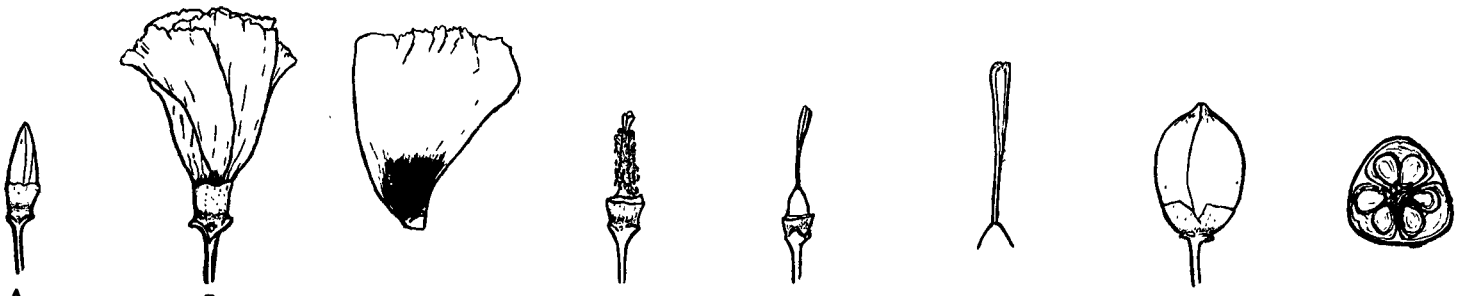
Nature of the crosses.	Generation.	No of families studied.	No of plants obtained in								Nearest theoretical ratio.	Value of P.
			Purple		Medium Purple		Dilute Purple		Localised Purple	Green		
			With Violet	Without Violet.	With Violet	Without Violet	With Violet	Without Violet				
A. Violet Purple × Purple	F1		*									
	F2	2	77	26							3 : 1	1
B. Violet Purple × Medium Purple	F1		*									
	F2	1	12	27	7	4					45:15:3:1	>·1
C. Violet Purple × Dilute Purple	F1		*									
	F2	2	158	70			65	20			9 : 3 : 3 : 1	>·2
D. Violet Purple × Localised Purple	F1		*									
	F2	2	188	53					78		9 : 3 : 4	>·5
E. Violet Purple × Green	F1		*									
	F2	2	142	44						71	9 : 3 : 4	>·3

The 9 : 3 : 4 ratio in (D) above has to be explained. This 9 : 3 : 4 is only like the others a 9 : 3 : 3 : 1 in which the end two groups are not easily separable owing to the poor manifestation of pigmentation, so that whether a Localised Purple has Violet or not is difficult to tell ; so localised and light is this purple.

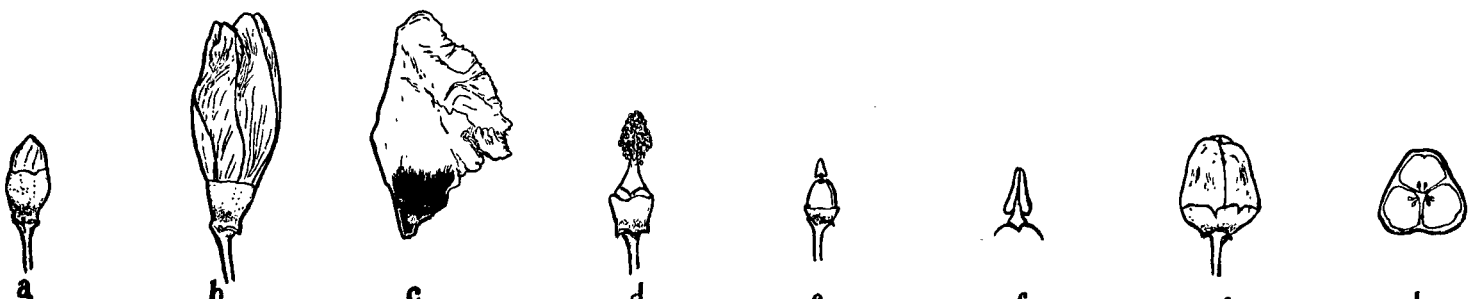
The existence of this Violet factor independently of the presence of the P factor has been demonstrated by designing crosses in which a number of non-pigmented plants picked out from (E) above were mated to a Localised Purple. As expected some of the crosses gave F_1 plants, Violet Purple. The least dose of Purple was enough to activate the latent violet in the Green.

It will thus be seen that a dominant gene designated *Vt* imparts a Violet tinge to purple and makes it Violet Purple. In its absence *vt* the plant is of the ordinary purple type. This dominant gene could be

Floral Parts



Normal Flower.



Sterile Flower.

super-imposed on every other manifestation of purple; only in the case of the Localised Purple its effect is feeble.

Summary. A dominant gene *Vt* found in African varieties colours the ordinary purple in the *Ragi* and makes it appear Violet Purple. *Vt* is a simple dominant to *vt* which is present in all local Indian varieties of *Ragi*. *Vt* could be detected in all grades of Purple, excepting Localised Purple on which its effect is feeble. It could be present in a Green (non-purple pigmented), lacking the factor P. The factor *Vt* is not conducive to economic growth under Indian conditions.

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A HERITABLE CASE OF FEMALE STERILITY IN HERBACEUM COTTON

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A type of female sterility was described in 1934 (Kesava Iyengar, 1934), occurring in a pure strain (No. 1281), of *Gossypium herbaceum, L.* grown at the Agricultural Research Station, Hagari. The inheritance of this phenomenon was pursued during 1934, 1935 and 1936. In this paper are presented the morphology and the inheritance of these sterile plants.

The sterile plant. The sterile plants are perfectly healthy throughout their life history. The size, shape and colour of the leaves are all normal. Differences between the normal and sterile plants can be recognised only from the flower-bud stage onwards. The buds of the latter are distinctly swollen at the base and rounded at the tip, while those of the normal flower are more pointed.

The opening of the corolla is noteworthy. In a normal cotton flower the corolla has a contorted æstivation. The flower buds open normally (under the conditions obtaining at Hagari) at 10 a. m. The petals gradually untwist and liberate their upper margins completely. The flower, on complete opening, presents a campanulate form with the staminal column prominently standing out in the centre. The stigmatic head protrudes through this column. The extent of protrusion of the stigma is a varietal characteristic. In the case of the sterile flowers the opening is modified considerably. As a rule,

the flowers do not open fully and liberate the petals freely. An examination of the petals showed that the margins of the adjoining petals get interlocked with the result that the lower part of the petal has a corrugated appearance and causes the base of the flower to swell. The above feature is perceptible even from the bud stage. The flower on opening has a characteristic appearance.

Actual measurements made to determine if the ratio—breadth of the petal/the length of the petal—is identical in the normal and sterile flowers, show that in the case of the normal flowers the ratio was 0·78 while in the case of the sterile flowers it was 0·96. Thus the sterile flowers have relatively broader petals.

The staminal column in the sterile flower is slightly shorter than that in the normal one, but the number of filaments is greater in the former. The normal flower on an average bears 54 staminal filaments while the sterile flower has 64 filaments. The pollen grains of the sterile flower are viable and readily put forth tubes when dusted on to normal stigmatic faces. The resulting bolls are to all appearances normal and contain viable seeds. Pistils of the sterile plants are remarkable in that they present several abnormalities. In the normal cotton flower all the three regions of the pistil are well developed. But in the sterile plant, the ovary alone is well developed and bears ovules. It is globular in shape. The carpels do not however extend to form a well developed style as in a normal flower. The style is about a tenth of a centimetre while the length of the normal one is 6/10 centimetre. The stigmatic head in the sterile flower is again not well developed with no hairs and secretions. It has three triangular faces and appears to perch almost directly on the ovary, lying completely hidden inside the androecial column. The result is that no pollen reach it even by chance.

Fresh and viable pollen were dusted on to the stigma of the sterile plant with a view to test its receptivity. The placenta was examined for the pollen tubes by staining with cotton blue in lactic-phenol. No tubes were observed. None of the artificial pollinations made between the normal pollen and the sterile stigma developed any bolls with seeds.

Parthenocarpy: In the sterile plants, some-times well developed bolls were formed. These were whitish in colour instead of being green and flat on the sides. The examination of the boll showed that it was only an enlarged ovary with shrivelled ovules in the locules. These bolls were found to shed after a fortnight.

Inheritance. Natural crosses were spotted in 1933 which were used for the study of inheritance of this character in the seasons 1934—1936. In 1934, 20 plants were selected from a segregating lot and the produce of these plants was sown in 1935. In the segregating families monogenic inheritance was noticed, normal behaving as

dominant. This behaviour was confirmed also by a further study of natural and artificial crosses during the season 1935 and 1936.

Table I

Nature of the cross.	Generation.	No. of families studied.	No. of plants in		Nearest theoretical ratio.	Value of P.
			Normal.	Sterile		
Natural cross.	Probably 2nd	10	1416	435	3:1	> ·1
	,,	10	Pure			
	Third.	10	338	101	3:1	> ·3
	,,	7	Pure			

Table II

Nature of the cross.	Generation.	No. of families studied.	No. of plants in		Nearest theoretical ratio.	Value of P.
			Normal.	Sterile.		
1281	Parent			*		
H. 1	do.		*			
$H_1 \times 1281$	F_1		6	—		
,,	F_2	18	947	309	3:1	> ·3
1281 X ($H_1 \times 1281$)	Back cross	5	125	123	1:1	> ·5
1281	Parent			*		
1200 A	Do.		*			
1200 A × 1281	F_1		3			
,,	F_2	8	459	173	3:1	> ·1
1281 × (1200 A × 1281)	Back cross	3	116	127	1:1	> ·3

Artificial crosses. Crosses were made by utilising the pollen of the sterile plants and dusting them on to the emasculated flowers of two pure strains (strains Nos. H. 1 and 1200 A) belonging to the *herbaceum* group, grown on the station during the season 1934. The F_1 plants were all normal in both the sets of crosses and exhibited none of the peculiarities characteristic of the sterile flowers. In 1936, some of the F_1 plants were sown. In all the selections, the segregation was monogenic in both the sets of crosses. (Table No. II).

Back-crosses were made between the F_1 plants and the sterile parent in both sets of crosses, during the season 1935 and the behaviour of their progenies was pursued in 1936. The expected 1:1 ratio was obtained. (Table No. II).

Discussion. The behaviour of the segregations in the natural crosses, observed during the two seasons shows, that only one factor is involved in the inheritance of the phenomenon in question. In the artificial crosses, the behaviour of F_1 shows that the normal type is completely dominant to the sterile. The behaviour of the F_2 progenies, and of the back crosses clearly denotes that only one factor

is at play and that the several attendant abnormalities described in the case of the sterile plants are the result of the absence of a single gene. A factor 'Stg' governs the manifestation of the normality of the ovary and its absence (stg) brings about a condition which leads to the sterility of the plant.

Summary.

1. The occurrence of a sterile plant is described.

2. Female sterility is found to be caused by the abnormal development of the style and stigma.

3. Parthenocarpic bolls develop sometimes on the sterile plants.

4. This type of sterility behaves as a simple Mendelian recessive to the normal condition of the flower which is completely dominant.

5. The pair of factors responsible for the above phenomenon are represented by Stg—stg.

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THE PRESENT POSITION OF STRAIN NANDYAL 14 IN THE 'NORTHERNS' AREA.

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The cotton grower is worried. His crop has again fallen below expectation. He got his seed from the best shop in the bazaar. Yet, they say in the market that his stuff is as poor in quality as ever. The buyer does not prize it to his satisfaction. It is annoying in the extreme. He suspects that insects and diseases are partly responsible for his woes. Yet he instinctively feels that in spite of them his crop could do better, but he does not know. Something is wrong somewhere. He goes seeking for advice and happily meets the plant breeder. The breeder understands him and tells him that one reason as he could see from an examination of his crop is that his seed is impure, that is, it is a mixture of several races of cotton. He infuses hope into the dejected grower by saying that the difficulty can be overcome, and that ere long he will be having a crop which will not only be uniform with a fairly steady yield, but will also be valued highly in the market. The breeder sets to work accordingly. He labours for a time and succeeds in discovering what he calls a promising strain—from the local stock. The eager cultivator welcomes it, and is amazed to find it scoring high directly on being put on the market. Buyers rush up to him prefering his produce to others. All goes well with him, and he is carried on the crest of fortune, but only for a while. Soon a tide turns to his vexation. The demand goes down suddenly in the market, and the strain no longer fetches him more money than the original

bulk. The grower gets disheartened. The puzzled breeder who has been watching the whole show quickly adjusts his machinery of improvement to meet current urgent demands.

The above is in brief outline the story of the rise and decline of Nandyal 14 an improved strain evolved from a bulk cotton known to commerce as 'Northerns'. The term refers to the cotton grown annually in the Madras Presidency in the taluqs of Dhone, Kurnool, Nandikotkur, Nandyal, Allagadda and Koilkuntla in the Kurnool district, the native state of Banganapalle in the same District, Jammalamadugu and Proddatur taluqs in the District of Cuddapah, and Tadpatri taluq in Anantapur District. It covers a little over 3 lakhs of acres in extent, and enjoys a reputation for strength and texture, forming one of the chief commercial types of Indian cottons. Though it is recognized as class I according to the Liverpool definition, the crop is a heterogeneous population of several good and bad varieties. The produce as a consequence is a mixture tending to vary widely from year to year in lint qualities. A standard type which is botanically pure, uniform and highly valued in the market would be a great improvement over the local stock. With this object in view the Madras Agricultural Department took up work at the Agricultural Research Station, Nandyal more than 25 years ago. Special attention was bestowed on quality and after years of experimenting, the Department succeeded in isolating a type in the year 1918—now well known as Nandyal 14 (N. 14). With an average yield of 200 lbs. of seed cotton per acre, and capable of spinning to 40's, this strain is one of the few finest cottons at present available in India.

Efforts were then directed towards popularising the same. A number of seed farms was systematically organised. It was planned to get a supply of seeds in the course of a few years sufficient to cover the entire Northerns tract so that thereafter the same stock would be propagated year after year.

More than 15 years have gone by, which is a fairly long period for an improved variety to spread and assert itself, as has been the case of Co. 2 in the 'Cambodia' tract and H. 1 in the 'Westerns'. But N. 14 has failed to expand. At no time in the past has it spread to more than 8 to 10 per cent of the entire area. On the other hand there has been a distinct decline in its acreage. From nearly 30,000 acres in 1930—31 it has dwindled to 2,300 in 1935—36.

In looking out for factors contributing to this state of affairs, the first thing that strikes one is the possibility of a deterioration. But an examination of figures available at the Nandyal Farm shows that apart from fluctuation due to season there is no serious fall perceptible either in yield or lint length. Causes are to be sought for elsewhere.

The opinion of the grower is the best testimony to the capacities of a strain. The Nandyal ryot is not pleased with N. 14 for several

reasons. In the first place it has a low lint out-turn having a ginning percentage of 23, whereas the 'Northerns' bulk has a ginning value ranging between 25 and 28. The slight increase in seed cotton claimed for N. 14 on the basis of trials conducted on the farm is not borne out in the trials carried outside the farm. Again N. 14 lacks drought-resistant qualities, its performance coming up to expectation only in seasons of good rainfall. The ryots' bulk is hardier and more capable of standing seasonal vicissitudes. The red-leaf disease recently observed in the Nandyal cottons with its attendant sterility tending to detract from yield, is also present to a greater degree in N. 14 than in the bulk. Apart from these the high premia which this strain was realising—in some years it was paid Rs. 70 over the market rate—are not obtainable now and naturally N. 14 lost its glamour. Further it is found to thrive only in red and mixed soils.

All kinds of seed are being imported from outside every year. Bulk of these comes from Gadag, Dharwar and Bijapur in the Bombay Presidency and belongs to the commercial type known as 'Kumptas', (locally called as 'Gadag'). This importation of Gadag seed has been going on for several years in the past. Besides, Cambodia seeds from Tiruppur area, and H. 1 from the Westerns tract are also finding their way into this region. The component of the original Northerns possessing longer lint is being slowly swamped out. The crop now raised by the ryot is a mixture of all manner of varieties and is perhaps even more heterogeneous than the original Northerns. In quality, it is definitely inferior to N. 14 and is very varying from season to season depending upon its botanical composition. But this is not viewed with any great concern by the grower, as the extra yield is considered ample to compensate for any depreciation in the market value on this score.

To replace this mixture, a strain similar to N. 14 in quality but with a better yield and higher ginning percentage and more suited to a wider range of soil and rainfall conditions is what is needed. Recently attempts have been intensified in this direction at the Nandyal farm. But nature has, as it were, split up the two desired characters, namely yield and quality, such that when one is supreme the other is generally found to be low. The search for ideal type through the ordinary selection method thus becomes elaborate and is bound to be time consuming. During the last 10 years about 3000 plants from various centres of the tract were examined in detail, and yet a type better than N. 14 in all respects has not been found. This number however is a drop in the ocean of cotton material in the tract, and the isolation of a superior type is largely a matter of chance. It is something like casting nets in a big lake to catch the biggest fish available there. The desired catch may be quick or slow to achieve, and luck plays a great part. With patience and perserverance it is bound to come within the reach of even the unluckiest fisherman.

Recent attempts at the Agricultural Research Station, Nandyal, have succeeded in the establishment of three heavy yielding strains. Under the instructions of the Deputy Director of Agriculture, III Circle, Bellary, these are being tried for testing yield with N. 14. and ryots bulk in addition, in various centres of the tract with the co-operation of the Assistant Director of Agriculture, Kurnool. The trials are planned on up-to-date lines to allow of refined statistical interpretation of results and will be conducted for at least three consecutive seasons. The results of these trials are expected to give information also on whether Northerns tract is divisible into difinite zones with a particular strain suited to each zone. In such a contingency the produce that comes to the market will again be a mixture. But that need not cause alarm as such a mixture will be composed of types with similar spinning values and will go a great way in raising the name and standard of Northerns.

My thanks are due to the Deputy Director of Agriculture III Circle, Bellary for his kindness in offering me facilities in writing up this paper.

Selected Article.

Soil Crumb.* The most striking physical attribute of many fertile soils is their natural tendency to the formation of a crumb structure. This tendency is utilised by the farmer or planter in the production of a good tilth in his cultivations. Soil-tilth greatly contributes to the development of suitable water and air conditions which are of primary importance in the successful growth of the majority of crop plants.

Soil crumb cannot develop in soils entirely devoid of colloidal matter. Pure sand never forms crumb; its particles remain separated when the sand is dried, and settle into a closely-packed mass when it is wetted. At the other extreme, highly colloidal clays may only form crumb when certain conditions are realised. In the absence of these necessary conditions, clay soils merely crack into large lumps when dried, or " run together " into an impervious mass when wetted. The most suitable kind of soil for crumb formation is probably one containing a fair amount of colloidal matter in a suitable condition, together with a dilutant consisting of an assortment of grains of silt and sand of various sizes. The colloidal matter may be either inorganic (clay substance) or organic (humus). It possesses the ability of binding together the individual soil particles into aggregates and the aggregates into crumbs. In this way the soil assumes a characteristic and well-known structure, usually associated with high fertility.

It is imperative that the crumb structure developed in a soil by natural processes or by suitable cultivation should be stable. If the crumb be unstable, the soil tends readily to break down into its component particles, which then may be easily washed away by running water or blown about by wind. Such unstable soils suffer severe erosion, and their drifting frequently becomes a serious menace.

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* **Acknowledgments** :— The subject matter of this article has been taken mainly from the recent writings of Dr. E. W. Russell of the Rothamsted Experimental Station, particularly " A Physical Description of Soil Tilth ", Sands, Clays and Minerals, April 1936, Vol. II, No. 4, pp. 57—63.

Soils possessing no crumb structure at all exhibit a continuous pore-space distribution, which permits either air or water to move more or less freely through them, though air and water cannot each move freely if both occur together. When a stable crumb structure is developed, however, pore-space distribution becomes discontinuous. Although the pore-spaces within the individual crumbs may be continuous, cracks and spaces occur between the crumbs, so that there is sufficient room for the free circulation of both air and water around the crumbs. The finer pores within the crumbs may hold an appreciable amount of water which is available to plants even under fairly dry conditions. The larger cracks and spaces allow surplus water rapidly to drain away, and at the same time, they allow air and carbon dioxide to circulate freely, maintaining a high degree of aeration within the soil. The colloidal matter which binds the soil particles into crumbs also possesses the property of absorbing air as it dries. This air is liberated again when the colloidal matter is wetted but it becomes entrapped in the form of minute bubbles. Hence during temporary water logging, the colloidal matter provides a source of oxygen for plant roots, thus preventing asphyxiation.

The mechanism of crumb formation, and the precise factors which confer stability on the crumb are not yet completely understood, although they are being actively investigated in certain research institutes, notably the Rothamsted Experimental Station in England. It is known that the primary requisite for crumb formation is that the soil should first be wet, and that the water in it should then be removed at a certain rate. Water removal may be effected either by direct drying or by freezing. Frost is perhaps the most effective natural known agent for producing crumb structure and a good soil-tilth. In northern countries, clay lands are roughly ploughed in the late autumn, so that as large a surface as possible is exposed to the action of frost when winter comes. In countries where no winter is experienced, the alternative process of direct drying is utilised for producing a tilth. The land is ploughed into large clods during the early part of the dry season, and these are allowed to dry out during the following months. When the first rains come, the land is cultivated, and the shattered lumps then break down into crumbs The mechanism of this action is probably attributable to the liberation of entrapped air during the wetting process. The air forms holes and channels within the clods, which consequently become mechanically weaker and shatter readily under the action of the plough and the harrow.

A third method is often practised in countries where frost is unknown, and particularly if the soil lacks organic matter. It consists in the growing of heavy grass crops or vigorous leguminous plants, whose rootlets hold the soil particles together, and thus impart a crumb structure to the soil. The incorporation of bulky organic matter into the soil furnishes a supply of colloidal matter, which will confer a crumb-forming ability when the soil lacks colloidal clay.

The particular size of crumb most suited to the crop depends partly on climatic conditions. In humid climates, the chief need is an adequate air supply to the roots, so that an open structure is best, and the crumbs should therefore be of relatively large size. In arid regions, on the other hand, water is usually the limiting factor, so that a close compact structure is best, and the soil should have a fine crumb structure conducive to water conservation. For the best results, the size of the soil crumbs should range from about 0·5 to 3·0 millimetre, depending on the air and moisture-requirements. Smaller crumbs block the air channels without increasing the water-retaining capacity, whilst larger crumbs enhance the rate of evaporation of water, causing plants to die from dessication.

Factors affecting Crumb Formation and Crumb Stability. The proportionate amount of colloidal matter in the soil requisite for the suitable development of a

crumb structure is not known with certainty, although the effects of either too little or too much colloidal matter are well understood. The smaller the colloidal content the larger the pore spaces and the weaker the crumbs. The crumbs dry out more readily, but they yield only small amounts of air when re-wetted. Hence plants are liable to suffer both from water-logging and from drought. The greater the colloid content, the more difficult it is to obtain a good structure. The pores within the crumbs may be too minute to enable plant roots to remove water from them, in spite of the fact that the clay component of the crumbs contains large amounts of water which is tightly held. Hence plants are liable to suffer from lack of water when the clay content is high, even though the total amount of water present in the soil is relatively great.

The effect of organic colloidal matter (humus) so far as is known, is similar in most respects to that of colloidal clay. Its main difference probably lies in its effect on crumb size, although the magnitude of this effect has not yet been ascertained. Another important property which organic colloidal matter confers on soil in greater degree than inorganic colloidal clay is to increase the pore space within the crumbs, and thus to improve materially their water-retaining capacity and their ability to supply water at a rapid rate to growing plants. Organic colloid also in some way reduces stickiness and improves a soil's workability, but little is known about the mechanism of these effects. Soils rich in organic matter are never so sticky and are very much more spongy and springy, than soils containing corresponding amounts of colloidal clay. Their humus component probably absorbs more air, and it certainly does not give it up again with the same facility as clay colloid. Highly organic soils are therefore more difficult to wet than heavy clay soils.

The stability of soil crumb is of two sorts, namely mechanical stability and water stability. The former enables the crumb to withstand the action of beating rain or gusty wind; the latter enables it to maintain its structure when thoroughly wetted. Both types of stability appear to depend on the nature, composition and chemical attributes of the colloidal matter that holds the soil particles together. Recent research has established the fact that the seat of the important binding forces is the surface of the colloidal matter. Such surfaces are chemically very active; they are capable of combining with or "absorbing" entities such as water molecules and ions of various sorts, particularly basic ions, for example, calcium, magnesium, potassium, sodium and hydrogen ions. The ability of colloidal material to combine with ions and to exchange them for other ions confers upon it what is known as "base exchange capacity". In order for soil crumbs to be formed, the base exchange capacity of the soil should exceed 20 units (milligram equivalents per 100 grams of soil). The measurement of base exchange capacity is now a routine procedure in soils laboratories so that the soil chemist can readily determine whether or no any given soil is likely to form crumbs easily, merely by determining its total exchangeable base content.

It is quite likely that basic ions bind colloidal surfaces together through bridges of water molecules. The positively-charged (hydrogen) end of the water molecule (H. OH) is attracted to the negatively-charged colloidal surface, and the negatively-charged (OH) end is attracted to the positively-charged basic ion.

The conditions that decide the size of soil crumbs are not yet known, but evidently one factor is the rate of drying. The faster water is removed, the smaller the crumb. Another factor appears to be salt content. Soils having large contents of salts (such as sodium chloride) develop only small crumbs. Such conditions may characteristically occur in nature; for example, arid-land soils are generally subject to rapid drying, and common salt is a usual component in them, so that the natural soil structure in this case is one distinguished by small

crumbs. In soil survey studies observations of the natural size and shape of the crumbs is frequently employed as evidence of the conditions under which soils have been formed.

The proportionate amount of the different exchangeable ions associated with the colloidal matter in a soil seems mainly to decide the water stability of the crumbs. If more than 20 to 30 per cent. of the exchangeable ions of a soil are sodium ions, the soil will usually form crumbs that are markedly unstable when wetted. Such "sodium-clay" soils may produce a good tilth when properly cultivated in favourable weather, but the whole structure rapidly and completely disappears when the first soaking rains arrive. The surface may subsequently solidify into a hard cake after drying conditions have again set in, and plant roots may be injured so that the crop is irreparably damaged. Nevertheless, soils rich in exchangeable sodium-ion, but containing at the same time abundant free sodium salts may appear to possess a stable crumb structure, but this is lost when the excess of salts is washed out or leached away by irrigation with pure water.

On the other hand, soils containing a large proportion of exchangeable calcium-ions usually produce crumbs that are very stable in the presence of water. This fact may partly explain the beneficial effect of thorough liming on the physical properties of acidic clay soils. Much fuller information is needed concerning the water and ionic conditions prevailing in the neighbourhood of colloidal surfaces before the causes of water stability of soil crumb can be fully understood. The different ions operate to different extents, but sometimes in opposite directions. Thus sodium-ion and calcium-ion appear to be antagonistic in their effects on crumb stability, whilst magnesium-ion seems to resemble sodium-ion rather than calcium-ion in their ability to confer a fair degree of crumb stability on a soil containing a sufficient amount of colloidal matter.

In farming practice, mechanical cultivation operates in two chief ways. If the soil possesses a good crumb structure, cultivation improves it by developing tilth which directly benefits the crop by improving the moisture and air conditions. If the soil possesses no crumb structure, and has bad tilth, cultivation puts it into the best condition for weathering agents to act on it. Cultivation implements should be used in such a way that a stable tilth is produced in a previously structureless soil, or an already existing tilth is not destroyed, and at such a time that the greatest benefit to the soil's structure is realised. Successful tillage thus demands knowledge and experience on the part of the cultivator, both with regard to the correct kind of implement to use, and the right time to use it. Thus, a good stable tilth in a heavy clay soil may be completely spoiled by ploughing with a steel mould-board plough when the soil is too wet. Such a soil should either be allowed to dry before ploughing, or a wooden mould-board plough should be employed. Liming has been proved at Rothamsted to reduce the force needed to draw implements through the soil. This effect may be explained by the more stable crumb structure which the lime confers on the soil. Heavy dressings of organic manure produce similar results, whilst cropping with green manures probably aids crumb formation through the binding effects of tiny rootlets.

The formation of a satisfactory explanation of the various stages in crumb production and the elaboration of means of measuring the various factors involved seem now to be within reach. Before long it should be possible to design field experiments to test the main conclusions, and thus further to develop the practice of field husbandry on precise scientific lines.

From *Tropical Agriculture*, Vol. XIII, No. 6, pp. 143 to 145.

Press Service.

Nutrition and Agriculture. Further discussions on the subject of improved nutrition standards, which promised to be highly interesting and important, will take place in October next on the occasion of the XIIIth General Assembly of the International Institute of Agriculture of Rome. Certain special studies of this question have been made recently by the League of Nations and by the International Labour Office, in collaboration with the Institute, which has provided both institutions with an ample statistical documentation. A highly informative report has also been prepared for the Assembly by Mr. McDougall, Delegate of Australia on the Permanent Committee of the Institute. A brief summary of this Report is given in the following paragraphs.

The writer shows in the first place that a satisfactory human dietary must be based on an adequate consumption of the "protective" foods which include milk, cheese, butter and other dairy products, fresh fruit and vegetables, eggs, fish and meat. Unfortunately the special studies and statistics which deal with the subject show that the great masses of the population throughout the world do not consume these particular foods in sufficient quantities. The result is frequently the appearance of "deficiency diseases" such as pellagra and beriberi, and also, especially in the child population, dental troubles, bone malformation, rickets and a general sub-normal physique.

After having demonstrated the benefits that would accrue to human welfare through the raising of nutrition standards and directing attention to the growing tendency of public opinion to make the State responsible for the supervision of national nutrition, Mr. McDougall considers the effects of such improved standards on agriculture. Consumption of the "protective" foods might go far to cause a revival in the trade in food products If practical steps were taken to bring about a rise in consumption, particularly as regards these particular foods, it would be possible for the industrial countries to concentrate their attention on producing larger quantities of the more perishable foods, and the production of the chief world agricultural staples, such as wheat and sugar, might be left to a greater extent to the great low-cost exporting countries.

Thus the way would be opened for a general recovery in world trade with beneficial effects, not only upon the economic situation, but also on political relations in all countries.

The writer then considers the different methods of improving nutrition, after stating that malnutrition is due in the first place to poverty and in the second to ignorance.

In reference to the first of these factors, he instances certain of the more important suggestions that have been offered. These include the distribution of milk and other food, either free or below cost, to pregnant and nursing mothers, to children below school age and to children at school; the lowering of the margin between wholesale and retail prices where unduly high; differential prices for certain social groups. Further more subsidies, now granted to producers, might in certain cases be utilised as subsidies to consumption.

In regard to the matter of ignorance, the writer considers that the newer methods of popular education, such as broadcasting, the talking film, etc. might be adopted with advantage.

Mr. McDougall lays stress on the value of adequate credit provision, if agriculture is to be called upon to readjust and intensify production. He considers that the idea of an International Agricultural Mortgage Bank, capable of assisting the Governments to turn over to the production of the most economic and

health promoting foods, might now be revived with better hope of success. The great creditor nations would be the more willing to give their support, since they would see that their own economic interests would stand to gain by the operation of the proposed Bank.

Herein, in the view of Mr. McDougall, there may be found a solution of the hotly debated problem of agricultural protectionism. There can be no doubt that the solution of the questions discussed by the writer of this report might contribute in no small degree to a revival in world prosperity.

[*International Institute of Agriculture, Press Service.*]

ABSTRACT

Tobacco in South India. By W. R. C. Paul, M.A , M.Sc., D.I.S., F.L.S. (*Trop. Agri.* LXXXVII p. 3). This crop was first introduced by the Portuguese in the 16th century. Its cultivation was restricted to dark, and strong flavoured types and as such there was no or very little export in the early period. In order to meet the demand of the mild flavoured light tobacco in the United kingdom, efforts were made in the direction of introduction of new types, methods of growing and curing. Madras Presidency occupies second largest position in India with an area of 292,000 acres and outturn of 286,000,000 lb. of cured leaf out of the total area of 1,350,000 acres and production of 1,000 000,000 lb. leaf respectively. The different kinds of tobacco grown may be grouped under (a) smoking (b) chewing (c) snuff. Dark tobaccos are strong flavoured and are used in the manufacture of cigars, cheroots, chewing and snuffing. Light tobaccos are generally associated with mild flavour and comprise cigarettes, pipe mixtures and beedies. The light tobacco industry has developed during recent years due largely to the efforts of the Indian Leaf Tobacco company, and Guntur District forms the chief centre of its cultivation with about 40,000 acres under the virginian variety Harrison's special. The flue-cured Virginia is used for manufacturing standard brand cigarette while the sun-cured stuff and the finer country types are mostly used in blending the innumerable other cheaper brands and pipe tobaccos, and are exported to United Kingdom and Japan.

Cigar filler tobacco is mostly drawn from certain areas in Dindigul and Trichinopoly while cheroot tobacco is extensively cultivated in the Districts of Madura Coimbatore, Trichy, Salem, Kistna, Godavari and Vizagapatam to the extent of 105,000 acres. Soil and weather conditions determine the quality of the tobacco. Light soils are suited for mild bright tobaccos, and heavy soils for coarse dark types. Application of cattle manure produces excess of chlorides in the leaf and the burning quality is poor On the other hand application of organic manures leads to a high nicotine content. Irrigation is found better for chewing and cheroot types, and brackish water produces a greater potash content.

Tobacco curing may be either by flue, sun or air Most of the light virginians are flue-cured and usually contain about 13% moisture at the time of export.

There are about 30,000 barns in the Guntur area. R. B.

Gleanings.

Vitamins and Plants. In general, vitamins are products of the vegetable kingdom. Their possible role in plants, however, has been almost totally unknown until quite recently.

Some years ago we followed the synthesis of carotene (the precursor of vitamin A) and vitamin C (ascorbic acid) in plants, and observed that the percentage content of these compounds in the plant is generally the higher the better

the plant grows. Their concentration thus reaches a maximum at an early stage of growth, either before or at the beginning of flowering. Similarly we found that an adequate fertilisation increases the percentage content of vitamin C and carotene. The view that artificial fertilisers would seriously affect the composition of plants is thus not tenable, at least where vitamins are concerned. This fact was clearly demonstrated by Scheunert's prolonged work on rats.

On the other hand, we found that all factors which have an unfavourable influence on the growth of plants, such as soil acidity, excessive concentrations of phosphate, potassium, sodium chloride, etc., lower the content of carotene and vitamin C in plants. In my opinion, these facts showed, although indirectly, that carotene and vitamin C are important growth factors of plants.

In the case of vitamin C, this assumption has now been conclusively proved by further work in this laboratory (S. V. Hausen.) Addition of crystalline vitamin C to the medium in sterile pea cultures led to an increase of 40—100 percent in the dry weight of the treated plants. (At the same time it was noted that the roots of the plant protect vitamin C very effectively against autoxidation). The effect of vitamin C on growth is a specific one, since, for example, glucose has no such effect. It was also shown that the peas actually took up with their roots vitamin C from the medium. Shortly after, L Havas at Rothamsted made similar observations.

These results showed that an addition of vitamin C to the medium promotes markedly the growth of the plant, but they did not conclusively prove that vitamin C is essential for plants. Definite proof for the latter fact has, however, now been obtained through Miss. V. Hausen's work on pea seedlings which were deprived of their cotyledons at a suitable stage, when they contained about ninety per cent of the total vitamin C present in the seedling. Such seedlings generally die or remain completely dwarfed, whereas they will develop distinctly better, and even produce normal blossoms, when small amounts of pure ascorbic acid are added to the medium. Even the treated plants naturally suffer from the removal of cotyledons, which evidently contain also other necessary compounds besides vitamin C. The accompanying table will illustrate the effect of ascorbic acid on the development of cotyledon-less seedlings.

'Torstal' peas (cotyledons removed) in sterile Hiltner's solution with $(Ca(NO_3)_2$; *initial pH 5·5 Time of growth 29 days.*

	Average length of two plants in cms.		Dry weight of two plants, in grams.		Vitamin C in two plants, total (ml. of ind. solution).	
	Treated.	Controls.	Treated.	Controls.	Treated.	Controls.
	83	35	0·431	0·070	22·8	2·7
	66	30	0·305	0·063	12·5	2·0
	75	30	0·461	0 075	22·5	2·8
	82	22	0·405	0·044	17·5	1·5
Normal plants (cotyledons not removed; ascorbic acid not added)	—	85	—	1·850	—	4·80
	—	92	—	1·706	—	44·0

It is therefore reasonable to regard vitamin C as a phytohormone, which is indispensable to plants. The formation of vitamin C during germination is necessary for the early development of the plant. During later stages of growth, large quantities of vitamin C are produced in connexion with photosynthesis,

So far, vitamin C is the only vitamin the indispensability of which to higher plants has been proved through *direct* experiments. Corresponding work on vitamin B_2 (lactoflavine) is at present in progress in this laboratory.

W. H. Schopfer has recently shown that vitamin B_1 promotes greatly the growth of lower fungi (Phycomyces, etc.). According to his results, the effect is very delicate and specific, so that it can be used for the quantitative determination of B_1.

The fact that certain compounds, which act as vitamins in the animal organism, have important functions in plants, is additional evidence of the similarity of the metabolism of plant and animal cells.

—*Artturi I. Virtanen.*

Review.

Hoard's Dairyman. This Journal contains a lot of useful information for persons connected with dairying and the care of animals. Some of the articles published by successful dairymen and business people are exceptionally good and are good examples to follow. Lists of important bulletins are also published. Pages are also allocated for articles on Poultry breeding and Veterinary matters which contain a lot of useful tips. Even the farmer's wife is not forgotten; recipes and notes on the home are also included. The cost of the Journal is small due to the large number of subscribers.

R. W. L.

Agricultural Fottings.

Campaign against Chillies Thrips. Chillies occupy an area of about 43,000 acres in the sixth circle comprised of Madura, Ramnad and Tinnevelly districts. Till very recently this crop gave satisfactory returns, yielding about 6 pothies of 250 lbs. each of dry chillies per acre. Of late the yield has been reduced considerably due to some cause or other. One of the causes, if not the chief cause, of this reduction in yield is the severe infestation of 'thrips'. Thrips are small straw coloured active insects which attack the plant in all stages of its growth. They suck up the 'sap' from the tender growing portions of the plant which make the leaves to shrivel up irregularly, causing leaf curl disease. The plants get stunted bear only a few flowers and of these only a small number grow up to the fruiting stage. In worst cases the plants dry up completely and do not flower at all and the farmer is forced either to give up the infested crop or to recultivate it, if the season is favourable, with fresh healthy seedlings.

It has been observed that during normal seasons the plant may be kept free from leaf curl disease by giving better preparatory cultivation, heavy manuring, frequent irrigation and above all by getting healthy and vigorous seedlings for planting. As the normal favourable season cannot be expected always, the cultivators are advised to take some precautionary measures to protect their crop by adopting suitable prophylactic measures against the attack of thrips. Remedies to mitigate the disease or to prevent it entirely are very simple and effective. Healthy seedlings may be obtained by treating the seedlings in the nursery with tobacco dust once a week or so from about 10 days after germination and rinsing them in tobacco decoction before planting.

During adverse season, in spite of the above precautions thrips get the upper hand even though healthy seedlings are planted. In such circumstances the

plants may be protected from the infestation of thrips by timely sprayings with tobacco decoction.

An acre of treated crop gave an increased yield of 22·65% over the untreated plot under similar conditions. The best of our demonstration plot at Uthamapalayam gave an acre yield of 10 pothies per acre, while the maximum yield of untreated fields was only 6 pothies. It costs only Rs. 10 per acre to treat the seedlings and to spray the crop thrice against thrips infestation which is about one-tenth of the cost of cultivation.

As chillies are being cultivated widely and in almost all seasons, the leaf curl disease can be controlled only with the active co-operation of the ryots of the area. Indifference on the part of a few will spoil the neighbours' crop as well to some extent, in spite of the precautions taken by the latter to protect their crops. If only the ryots take to better manuring, cultivate properly and spray in time according to season, a better harvest may be ensured.

The Cambodia Cotton Seed Multiplication and Distribution Scheme. Cambodia cotton (Gossypium hirsutum), a type of American cotton was introduced into South India in 1905 from the province of Cambodia in Indo-China. The yield and quality of the cotton soon attracted attention and the acreage both irrigated and unirrigated increased rapidly mainly in Madura and Coimbatore districts. Owing to the fact that other cottons were being grown side by side e. g., Karunganni, Uppam and Nadam, mixing of kappas before ginning was rife and soon mixed seed was being sown by the ryots to the detriment of quality and outturn.

In order to cope with this problem, the Department of Agriculture started selection work in Cambodia and strain No. 15 was released in 1921—22. In 1924—25, this was replaced by Co. 1 and in 1928—29 by Co. 2. The seed released by the Cotton Specialist, was taken over by the district staff and grown pure by ryots on seed farms under the supervision of the Agricultural Department. The kappas so produced was collected and ginned and the seed thus obtained was carefully stored for distribution during the next sowing season.

When Cambodia seed farms were first started, the Department issued free seed, rogued the crops, advanced cultivation expenses to Rs. 30 per acre and then purchased the kappas from the ryots. With the development of Co-operative societies, advances to ryots were given by the Co-operative societies and purchase of kappas was stopped. Instead there was introduced the system of co-operative ginning, departmental officers acting as advisers in regard to ginning and sale of lint. All good seed was purchased by the department after ginning at a premium of about Rs. 6 to Rs. 8 per 1000 lbs. About 1000 acres of seed farms were thus being handled by the Deputy Director of Agriculture, VIII Circle, Coimbatore with 12 limited liability Co-operative societies formed for the purpose in Avanashi and Tirupur areas.

The amount of seed produced on 1000 acres of seed farms was at most only sufficient to sow about 8000—10,000 acres of Cambodia out of a total acreage of over 1 lakh acres of Cambodia cotton. Full advantage could not be taken of this specially produced seed as mixing of the kappas with poorer types of Cambodia and other varieties of cotton led to mixed seed in the following year and the purity of the good seed was not maintained.

It therefore became necessary to produce good Cambodia seed on such a scale that almost the total acreage under this variety could be sown with pedigree seed. Such a scheme was drawn up in 1931 to be run by the Tirupur Co-operative Trading Society, Tirupur under advice from the Agricultural Department and financed by the Indian Central Cotton Committee. The scheme was put into operation in 1932 and the staff, acreage and seed production estimated as follows:

Year.	*Agricultural staff paid from Indian Central Cotton Committee funds.*	*Actual seed farm acreage* (Acres).	*Production of seed in maunds.*	*Sufficient to sow.** Acres * (approximate).
1932—33.	Business Manager and 2 Agricultural Demonstrators.	1739	19,944	20,000
1933—34.	—do.—and 4 —do —	4122	29,596	30,000
1934—35	—do.—and 6 —do.—	5152½	53,545	54.000
1935—36.	—do.—and 6 —do.—	5320	45,995	46,000

The Business Manager and his staff are responsible for arranging the seed farms with the ryots, who should belong to a co-operative society, so that they may be financed if necessary through them. Advice is given during the cultivation period and kappas are collected in a central ginning factory usually in Tirupur for ginning. Ginning is carried out under the supervision of the Business Manager and the Agricultural Demonstrators and help is given to the ryots in the disposal of lint.

After ginning, all seeds of good germination capacity are purchased outright from the ryots by the Tirupur Co-operative Trading Society at a premium. The seed is carefully stored and during the next sowing season is issued for sale by the Tirupur Co-operative Trading Society, any profit on the transaction going to the society. In order to prevent any serious financial loss to the Tirupur Co-operative Trading Society, the Indian Central Cotton Committee has guaranteed interest on the money spent on the purchase of seed during the period between the purchase and sale of the seed, and also any loss incurred up to 10% of the total value of seed purchased.

Seed from the Cotton Breeding Station and Central Farm is handed over to the Deputy Director of Agriculture, Coimbatore, who grows it on the Departmental seed farms (inner area). Seed from this inner area is given to the Seed Multiplication Scheme for their 6000 acres seed farms (outer area) and from this area the pedigree seed is sold direct by the Tirupur Co-operative Trading Society to the ryots growing the commercial crop on up to 100,000 acres. The scheme is therefore a direct link in the chain from the Cotton Specialist to the ryot growing the commercial crop and pure seed is produced on such a large scale that few ryots who want good seed need go without it.

Correspondence.

I

To The Editor, Madras Agricultural Journal.

Sir,

Please publish the following in your valuable journal.

In an Industrial taluk like Coimbatore cereals are being sold at the same price as those prevailing in places with no iudustries and no scarcity of labour. But the agricultural wages are higher than elsewhere. Such a condition hits the landed interest rather hardly.

There is a competition between the mills and the ryots with regard to finding out the required labour with the result that the labour charges increase often, the increase in some months being double or treble of what is going on in non-industrial places. The little margin of profit is thus deprived of and the cultivator suffers much from being in the proximity of the mills and other industrial concerns.

Further the ryot's cotton-lint is knocked off at 5 annas a pound and resold to him as cloth at 32 annas a pound. The higher wages paid in the mills are made good by the differences between the low price paid for lint and high cost of the cloth sold to the ryot himself. Thus the Coimbatore ryot loses both ways.

Avarampalayam.
10—9—1936.

A. P. Krishnaswamy Naidu,
Landlord.

II

Dear Sir,

I have got about 110 acres of dry land in the villages of Nandyal, Polur, Munagole and Rayamalpur all within a radius of 1½ miles from Nandyal town. I am now getting a rent of Rs. 500 and the lands are estimated to cost Rs 15,000. I have also a house in the village and I can place it at the disposal of the man who takes up cultivation. I am prepared to lease out the lands on the same rent. I can also finance him to the extent of Rs. 1000 towards the purchase of two pairs of bulls and the necessary agricultural implements provided he furnishes necessary security. I shall agree to any conditions that you propose regarding the discharge of the amount mentioned and the further profits that may accrue. I shall be glad if you can secure an agricultural graduate to take up this cultivation. I can lease out the lands to any period extending up to 20 years. I enclose herewith the list of lands showing the Survey Nos. and their extent.

Yours sincerely,
G. Subba Reddy,
Deputy Collector, Cuddapah.

List of lands showing the Survey Nos. and their extent of M. R. Ry. Rao Bahadur C. Subba Reddi Garu, Deputy Collector, "Ramaprasad", Cuddapah. Rayamalpuram: Survey Nos. 111 (7·49); 155/4 (0·08); 29 (0·58); 60 (1·33); 21 (9·74); 23 (6·15); 103 (1·05); 129 (1·03); 73 (12·22); 15 (6·66); 16 (3·55); 17 (3·04); 116 (3·54); 189 (2·11); 178 (7·62); 190 (3·91); 130 (6·82); 102 (1·20); 142/1 (0·09); 146 (0·10); 138 (0·32); 171 (1·00); 183 (0·75); 25 (0·11); 72/1 (11·72); 154 (0·37); 198 (0·84). Nandyal 59 (7·45); 60 (3·00); Polur 196 (7·14); Munagole 56 (2·04).

III

NANDY SAYS

Listen! What Nandy says
The part in Country's wealth he plays
" Why not fence and fodder grow
To feed us man? Tell us so.
No use to graze the barren waste
With numbers large and wakeful taste.
Grounds we lost by slow Darkast
And that now men learn to their cost.
How weak we are with scanty food!
To hope to fill the barn no good.
To plough the field and grow more corn
As farmers' servants are we born
In places all with milk of bold
Our sisters nurse the young and old

Feed us well. Fast no more
A willing hand will give you more.
We and you a happy band
Will soon make this a fertile land."

K. R. SANKAR,
An Old Student of the College.

Crop & Trade Reports.

Receipts of raw cotton at presses and Spinning Mills.

Total cotton pressed and unpressed..

	Bales of 400 lbs. against an estimate of 540.700 bales for 1935–36.	Figures for corresponding period in previous year.
1—2—36 to 21—8—36	481,046	368,051
,, 28—8—36	494,443	376,746
,, 4—9—36	504,034	383,258
,, 11—9—36	511,654	387,447
,, 18—9—36	523,524	395,283
,, 25—9—36	530,582	399,710
,, 2—10—36	541,798	402,802
,, 9—10—36	548,884	406,313

	Cotton bales received at Mills.	Export by Sea.	Import by Sea.
1—2—36 to 21—8—36	288,936	164,063	90,720
,, 28—8—36	295,097	179,490	90,928
,, 4—9—36	300,281	189,062	91,567
,, 11—9—36	305,138	195,959	92,948
,, 18—9—36	310,144	198,603	92,949
,, 25—9—36	317,056	203,776	93,221
,, 2—10—36	324,424	206,314	93,295
,, 9—10—36	328,797	218,521	93,819

Sugarcane—Second report. The average of the areas under sugarcane in the Madras Presidency during the five years ending 1934–35 has represented 3·6 per cent of the total area under sugarcane in India.

2. The area planted with sugarcane up to the 25th September 1936 is estimated at 109,690 acres. When compared with the area of 114,090 acres estimated for the corresponding period of last year, it reveals a decrease of 3·9 per cent.

3. The decrease in area occurs outside East Godavari, West Godavari, Guntur, the Deccan, Nellore, Chingleput, Chittoor, North Arcot, Tanjore and the West Coast.

4. The condition of the crop is generally satisfactory except in Chittoor and North Arcot where the crop has been affected by drought to some extent. If a normal season is experienced during the rest of the growing period, the yield is estimated at 308,820 tons of jaggery as against 328,780 tons for the corresponding period of last year.

5. The wholesale price of jaggery per imperial maund of 82–2/7 lb. towards the close of September 1936 was Rs. 6—1—0 in Adoni, Rs. 6 in Madura, Rs. 5—9—0

in Nandyal, Rs. 4—15—0 in Bezwada Rs. 4—12—0 in Guntur and Tuticorin, Rs. 4—10—0 in Masulipatam and Kumbakonam, Rs. 4—5—0 in Rajahmundry and Ellore, Rs. 4—2—0 in Bellary, Rs. 4—1—0 in Coimbatore, Rs. 3—12—0 in Cocanada, Rs. 3—11—0 in Cuddapah and Salem, Rs. 3—10—0 in Vellore, Rs. 2—14—0 in Vizagapatam, Rs. 2—10—0 in Trichinopoly and Rs. 2—8—0 in Tinnevelly. As compared with the prices of the previous month, the prices reveal a fall of 8 per cent in Adoni, 7 per cent in Tuticorin, 6 per cent in Cuddapah, Salem and Kumbakonam, 5 per cent in Cocanada and Tinnevelly, 4 per cent in Vizagapatam and one per cent in Ellore. The prices remained steady at other centres.

Paddy—First Forecast Report. The average of the areas under paddy in the Madras Presidency during the five years ending 1934-35 has represented 13·4 per cent of the total area under paddy in India.

2. The area sown with paddy up to the 25th September 1936 is estimated at 6,010,000 acres. When compared with the area of 5,827,000 acres estimated for the corresponding period of last year, it reveals an increase of 3·1 per cent.

3. The increase in area occurs in all the districts outside East Godavari, Kistna, Anantapur, Cuddapah, Nellore, South Arcot, Chittoor, North Arcot, Salem, Coimbatore, South Kanara, and the Nilgiris. There is a marked decrease in area in Nellore owing to the unfavourable season.

4. The first crop of paddy is being harvested in parts of Trichinopoly, the South, and on the West Coast. The yield is expected to be about normal. The condition of the standing crop is generally satisfactory except in Nellore.

5. The wholesale price of paddy per imperial maund of 82-2/7 lb. as reported from important markets towards the close of September 1936 was about Rs. 3—0—0 in Cuddapah, Rs. 2—14—0 in Vizianagaram, Rs. 2—11—0 in Nellore and Salem, Rs. 2—8—0 in Erode and Madura, Rs. 2—6—0 in Vellore, Rs. 2—5—0 in Nandyal, Rs 1—14—0 in Nagapatam, Rs. 1—13—0 in Kumbakonam, and ranged from Rs. 2 to Rs 2—4—0 in the other markets. As compared with the prices reported in January 1936, these prices are stationary in Cocanada and Masulipatam, while they reveal a fall of 15 per cent in Tinnevelly, 10 per cent in Nandyal, 9 per cent Erode, and one to four per cent in Rajahmundry, Bezwada, Nellore, and Nagapatam, and a rise of 20 per cent in Salem, 15 per cent in Cuddapah, 10 per cent in Guntur, 9 per cent in Viziangaram, 7 per cent in Madura, and 2 to 5 per cent in the other markets.

Cotton—Second Forecast Report. 1936-37. The average of the areas under cotton in the Madras Presidency during the five years ending 1934-35 has represented 9 per cent of the total area under cotton in India

2. The area under cotton up to the 25th September 1936 is estimated at 756,700 acres. When compared with the area of 1,148,600 acres estimated for the corresponding period of last year, it reveals a decrease of 34 per cent. The decrease in area occurs in almost all the important cotton growing districts and is marked in the Deccan where the area fell from 811,500 acres to 448,500 acres, i. e., by about 45 per cent owing to want of timely and sufficient rains.

3. The area in the South and the Central districts relates partly to the last year's crop and partly to the current year's sowings which have commenced in parts.

4. The condition of the standing crop is satisfactory except in the Deccan where it has been affected by drought to some extent.

5. The wholesale price of cotton lint per imperial maund of 82-2/7 lbs. as reported from important markets towards the close of September 1936 was about Rs. 19—7—0 for Cocanadas. Rs. 23—11—0 for Red Northerns, Rs. 18—11—0 for

Westerns, Rs. 25—4—0 for Cambodia, Rs. 24—5—0 for Coimbatore Karunganni, Rs. 23—2—0 for Tinnevelly Karunganni, Rs. 22—8—0 for Tinnevellies, and Rs. 21—4—0 for Nadam cotton.

As compared with the prices in the previous month, the prices of Cocanadas, Cambodia, Karunganni, Tinnevellies and Nadam cotton have remained stationary while those of Northerns and Westerns cotton show a fall of eight and two per cent respectively.

Gingelly—Second Report. The average of the areas under gingelly in the Madras Presidency during the five years ending 1934-35 has represented 11·6 per cent of the total area under gingelly in India.

2. The area sown with gingelly up to the 25th September 1936 is estimated at 437,200 acres. When compared with the area of 388,300 acres estimated for the corresponding period of last year, it reveals an increase of about 12·6 per cent.

3. The increase in area is general, outside West Godavari, Kistna, Kurnool, Nellore, Salem, Trichinopoly, the South and South Kanara. The increase is marked in Vizagapatam (+30,000 acres) and Chingleput (+12,300 acres).

4. The early crop of gingelly has been harvested in parts. The yield was generally normal. The condition of the standing crop is fairly satisfactory except in parts of Bellary and Anantapur where it has been affected by drought to some extent.

Groundnut—Third Report—1936. The average of the areas under groundnut in the Madras Presidency during the five years ending 1934-35 has represented 45·4 per cent of the total area under groundnut in India.

2. The area sown with groundnut up to the 25th September 1936 is estimated at 2,853,100 acres. When compared with the area of 1,978,000 acres estimated for the corresponding period of the previous year, it reveals an increase of 44·2 per cent.

3. The increase in area is general outside Trichinopoly, Ramnad and Tinnevelly. The increase is marked in Kistna, Guntur, the Deccan, South Arcot, and North Arcot.

4. The summer crop throughout has been harvested. The yields were generally normal. The yield of the early crop in Salem and Coimbatore is reported to be normal.

5. The condition of the main crop is reported to be generally satisfactory outside the Deccan, Nellore and South Arcot where the crop has been affected by drought to some extent. In parts of South Arcot the crop has been attacked by the hairy caterpillar.

6. The wholesale price of groundnut (shelled) per imperial maund of 82-2/7 lbs. as reported from important markets towards the close of September 1936 was Rs. 6—6—0 in Vizianagaram, Rs. 6—3—0 in Guntur, Rs. 6—0—0 in Cocanada and Cuddalore, Rs. 5—14—0 in Vizagapatam, Rs. 5—12—0 in Nandyal, Rs. 5—11—0 in Vellore, Rs. 5—9—0 in Negapatam, Rs. 5—5—0 in Madura, Rs. 5—2—0 in Cuddapah, Rs. 4—15—0 in Adoni, Rs. 4—12—0 in Salem, Rs. 4—7—0 in Ellore and Rs. 4 -3—0 in Tinnevelly. When compared with the prices reported towards the close of July 1936, these prices reveal a rise of 24 per cent. in Tinnevelly, 21 per cent. in Madura, 6 per cent in Ellore and Nandyal, and 5 per cent. in Vizianagaram, Cocanada and Guntur, and a fall of 16 per cent. in Salem, 15 per cent. in Cuddalore, 12 per cent. in Cuddapah, 11 per cent. in Negapatam, 10 per cent. in Adoni, 6 per cent. in Vizagapatam, and 5 per cent. in Vellore.

College News and Notes.

Students' Corner. *Hockey Tour to Ceylon.* Thanks to the untiring efforts of Mr. H. Shiva Rao, the Vice-President of our club, the long contemplated and eagerly longed for tour to Ceylon at last materialised and we left Coimbatore on Friday the 18th September. The team was represented by Messrs. S. V. Joseph Das (Captain) K. K R. Menon, P. M. Somanna, M. Mukundan, V. Brahmanandam, Ayappa, Herbert, T. P. S Nainar, B. K. Mohanrao, D. V. Rajagopal, Kesava Reddi, K. Santhanam and S. Sundararaman. We arrived at the Colombo Fort station on the 20th morning, where the University College authorities mustered strong to accord us a warm and cordial welcome. The tour being only of a week's duration, we had to keep an engagement on the very day of our reaching the destination.

The first match of the tour was played against the Tamil Union Hockey Club. Being tired after the tedious journey and also being quite unaccustomed to play on lawns we could not put forth our best that day. The game was eventless throughout, but towards the end of the second half the Tamil Union forced a corner and converted it into the only goal of the evening.

Not dispirited by the initial reverse we played against the Varsity XI and Varsity past and present combined XI on the 21st and 22nd September, respectively. We were able to give a better account of ourselves on both the occasions by winning these encounters without much effort, the scores being 3 : nil and 5 : 1 respectively.

A visit to Kandy and Perndeniya gardens was included in the tour to provide a short respite and also to combine a little sight seeing and horticultural instruction. The trip undertaken on the 23rd morning was very beneficial from the point of view of horticultural knowledge and the authorities of the world famous gardens spared no pains to take us round and explain the aims and activities in progress. On the evening of our arrival there we had the honour of being the guests of Mr A. Vittal Pai, I.C.S. the agent to the Government of India. We had a sumptuous tea with him and Mrs. Pai, followed later by a very appetising South Indian dinner which we very much enjoyed.

We returned to Colombo on the same night and resumed the rest of our engagements by taking on the Ceylon Hockey Association on the 25th evening. In spite of inclement weather and sodden ground we were able to exhibit a high standard of game and claim a victory over the best combination in Ceylon by 3:1.

The last match was played on the 26th evening against the Colombo Y.M.C.A. Our attack was completely off colour that day so much so, our defence had to do double work of initiating attacks as well as keeping at bay the opposing forwards. Nevertheless we were able to lower the colours of our opponents by claiming a win by 2 goals to nil

After this very enjoyable stay and a sequence of success after the initial defeat, we left Colombo on the 26th evening amid cheers and arrived at Coimbatore on the 28th evening, after a day's halt at Rameswaram.

We the members of the Agricultural College hockey team take this opportunity to express our indebtedness and sincere gratitude to the Principal and Hockey Captain of the University College, Colombo, for having entertained us and made our stay at Colombo enviably enjoyable, also to Mr. and Mrs. A. Vittal Pai for the keen interest they evinced in our tour. Our thanks are also due to Mr. E. J. Verghese, the officer in-charge, for having made the tour a grand success.

S. V. J.

Football. The first match of The Abraham Memorial Foot-ball Tournament which ended in a draw was played against the Sarvajana High School, in the Stadium grounds on Friday the 9th October. The same match replayed on the 12th instant, resulted in a victory for us by one goal to nil. The full backs of the opponents kept an effective check on our forwards. On the whole our players played a good game on both the days and our 'goalie' was responsible for warding off many balls.

The next match of the tournament has to be played against the Municipal High School.

A combined eleven of both the students of the Agricultural College and officers played a match against the Mysore Medical College in our grounds on the 13th inst. The visitors were defeated by three goals to one.

Tennis. Our College represented by Messrs. K. K. R. Menon and Narayana Rao was defeated by the Medical College, Mysore, by 6 : 1.

Volley Ball. A match was played against the Mysore Medical College on the 14th instant. Here again the visitors scored over us. But our full team was not represented owing to the 3rd year students being away on tour. The third year students were on an agricultural tour to Ongole, Hagari, Bangalore, Hebbal Farm and other places. They returned only on the 16th morning.

Visitors. Dr. Ekambaram, Professor of Botany, Presidency College, Madras who accompanied the students of the final year Honours Course on a tour, stayed here on the 29th and 30th visiting the various breeding sections.

Weather Review (SEPTEMBER 1936).

While the monsoon in the Peninsula was generally weak on most of the days the bay monsoon was strong and active during the first two weeks of the month. The monsoon weakened during the third week and withdrew from the country by the 18th.

The activity of the monsoon was associated with the movement of two depressions. The first of these appeared over the Central Provinces on the 31st of August and moving northwards, weakened and filled up two days later. The second depression formed in the North Bay of Bengal on the 6th of September, passed inland across the Orissa coast and by over the East Central Provinces on 7th and 8th. It then moved slightly North west and got merged into the seasonal low over North west India near Neemuch on the 10th. Wide spread and locally heavy rain fell along and near the tracks of these depressions.

During the latter half of the month, associated with thunderstorms there was general rain in the Peninsula and other parts of the country.

Conditions became markedly unsettled from the North Andaman sea to the East Central Bay of Bengal and a deep depression of small extent formed off Irrawaddy on the 29th. This depression filled up on the 30th, but a trough of low pressure continued to extend from the Arakan to the Orissa Ganjam coast and conditions were markedly unsettled in the Central and North Bay of Bengal.

Rainfall was in defect in North Madras coast and Ceded districts, almost normal in South Madras and in excess in parts of West Coast, Mysore, Coorg, and the Hills.

Mean maximum temperatures were generally above normal in the Peninsula during the first three weeks. Nellore recording the highest maximum temperature of 103°F. The skies were moderately to heavily clouded.

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	5·4	−2·1	66·0	South	Negapatam	0·7	−3·1	17·0
	Berhampore *	8·6	+0·1	50·4		Aduthurai *	2·7	−0·1	17·4
	Calingapatam	2·4	−5·0	35·5		Madura	4·5	−0·6	18·3
	Vizagapatam	2·6	−3·9	23·5		Pamban	1·8	+0·6	7·7
	Anakapalli *	1·9	−5·6	28·9		Koilpatti *	2·3	+0·3	11·3
	Samalkota *	0·0	0·0	00·0		Palamkottah	2·7	+1·4	14·9
	Maruteru *	6·5	−0·1	40·4					
	Cocanada	8·3	+2·5	40·9					
	Masulipatam	3·6	−2·6	35·2	West Coast	Trivandrum	9·1	+5·0	53·5
	Guntur *	1·3	−5·4	30·2		Cochin	16·6	+7·6	101·9
Ceded Dists.	Kurnool	2·2	−4·0	14·5		Calicut	11·4	+3·7	123·5
	Nandyal	2·1	−3·9	19·4		Pattambi *	16·2	+7·7	100·9
	Hagari *	7·5	+1·9	15·1		Taliparamba *	8·5	−1·8	116·9
	Bellary	5·0	−0·1	12·4		Kasargode *	5·3	−4·0	140·6
	Anantapur	6·6	−0·7	13·0		Nileshwar *	5·7	−3·8	128·3
	Rentachintala	2·4	—	17·5		Mangalore	17·8	+7·4	149·6
	Cuddapah	3·5	−2·8	12·9					
	Anantharaju-pet *	6·4	—	—	Mysore and Coorg	Chitaldrug	6·1	+1·5	13·6
						Bangalore	7·5	+0·4	25·8
Carnatic	Nellore	3·5	−1·3	12·3		Mysore	9·5	+4·6	32·0
	Madras	1·9	−3·1	19·6		Mercara	12·7	+1·9	145·1
	Palur *	4·4	+1·2	21·6					
	Tindivanam *	2·1	−1·6	16·8					
	Cuddalore	5·7	−0·4	17·7	Hills.	Kodaikanal	13·8	+6·5	43·0
Central	Vellore	7·7	+0·4	18·0		Coonoor *	6·0	—	43·7
	Salem	6·6	0·0	33·0		Ootacamund *	7·5	+3·1	42·4
	Coimbatore	1·9	+0·4	13·3		Nanjanad *	8·5	+3·7	44·9
	Coimbatore Res. Inst. *	0·9	−1·5	12·1					
	Trichinopoly	3·3	−1·5	15·6					

* Meteorological Stations of the Madras Agricultural Department.

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

Weather Report for the Research Institute Observatory.

Report No. 9/36.

Absolute Maximum in shade	...	93·3°F.
Absolute Minimum in shade	...	66·8°F.
Mean Maximum in shade	...	89·9°F.
Departure from normal	...	+0·9°F.
Mean Minimum in shade	...	71·2°F.
Departure from normal	...	+0·6°F.
Total rainfall	...	0·94″
Departure from normal	...	−1·5″
Heaviest fall in 24 hours	...	0·26″
Total number of rainy days	...	3 days.
Mean daily wind velocity	...	2·7 M. P. H.
Mean Humidity at 8 Hours	...	75·5%
Departure from normal	...	+0·5%

Summary. Rainfall was in large defect. Dry weather prevailed during the first two weeks of the month. The maximum and minimum temperatures and the humidity were slightly in excess of the normal.

Departmental Notifications.

Appointments and Promotions. Mr. G. C. Balanna, F. M. under training at A. R. S. Nandyal is appointed to officiate as assistant in Millets vice Mr. N. Krishnaswami on leave The following provisionally substantive promotions of Upper subordinates in the Agricultural section are ordered, from V grade to IV grade. Mr. M. Narayana Iyer, A. D. III circle from 8th August 1935. Mr. T. V. Krishnaswami Rao, A. D. Sompeta from 8th August 1935. Mr. A. Ramalinga Iyer, A. D. Trichendur from 29th October 1935. Mr. K. Ramaswami Iyer, Upper subordinate IV grade (provisionally substantive) to be substantive in IV grade with effect from 8th August 1935. Mr. M. K. Swaminatha Iyer, IV grade (provisionally substantive) to be substantive in IV grade with effect from 8th August 1935. Mr. A. Krishnaswami Iyer, Upper subordinate IV grade (provisionally substantive) to be substantive in IV grade with effect from 29th October 1935. Mr. M. A. Sankara Iyer, Assistant, Millets section is promoted to IV grade with effect from 22nd May 36.

Transfers. Mr. P. Sitharamayya. A. D. under training, Kovvur to A. R. S. Maruteru to officiate as F. M. The transfer of Mr. H. Narihari Rao, Poultry Assistant from Anakapalle to Guntur already ordered will be held in abeyance till further orders. Mr L. Narasimhacharya. F. M., A. R. S. Guntur to IV circle and is posted as A. D Ponneri, Chingleput District. Mr. P. Kannappa Pillai, A. F. M., A. R. S. Koilpatti to VII circle and is posted to A. R. S. Taliparamba. Mr. S. Subbiah Pillai, Assistant in Paddy, A. R. S. Aduturai to Tinnevelly to report himself for duty to A. D. A. Tinnevelly. Mr. V. Srinivasan, F. M. under training, A. R. S , Aduturai to officiate as Assistant in Paddy in the same station. Mr. S. Ramachandra Rao, Assistant in Paddy Section, Coimbatore to Nellore to report himself for duty to the A. D. A. Nellore. Mr. C. Doraiswami, officiating Assistant in Paddy, A. R. S. Maruteru to Coimbatore. Mr. N. H. V. Krishnamurthi, officiating F. M A. R. S. Maruteru to officiate as Assistant in Paddy in the same station Mr. K. Rangaswami Iyangar, Assistant in Botany, A. R. S. Anakapalle to Maruteru to officiate as Farm Manager. Mr. P. Kesavanunni Nambiar, F. M., A. R. S. Pattambi to VIII Circle. Mr. L. Krishna Iyangar, A. D. Co. 2. Scheme to V circle to report himself for duty to the Dy. Director of Agriculture, V Circle, Trichinopoly. Mr. V. K. Kunhunni Nambiar, F. M., A. R. S., Erayenur to A. R. S. Pattambi. Mr. C. S. Sankaranarayana Iyer, F. M., A. R. S., Pattambi to the Potato Research Station, Nanjanad. Mr. K. Govinda Kurup, Probationer under training at the Research Station Nanjanad to A. R. S. Pattambi. Consequent on the transfer of Mr. L. Narasimha Acharya, F. M., A. R. S , Guntur to IV Circle, the following arrangements are ordered. Mr. S. Sithapathi Rao, A. D., Kovvur will be in additional charge of Nellore Sub Circle. Mr. K. V. Gaurangamurthi, A. D., Nellore on relief by Mr. Sithapathi Rao will relieve Mr. A. Venkatarangam, A. D., Atmakur. Mr. A. Venkataran, am on relief by Mr. K. V. Gaurangamurthi will immediately relieve Mr. I. Narasimhachari. Mr. M. Narayana Iyer, A. D , Kurnool Division on the expiry of his leave on 3—10—36 after-noon, is posted to Jammalamadugu for District work in the Cuddappah district to open a new sub-circle. Mr. M. Jivana Rao. A. D., Nandyal to Sirugupa Sub-Circle as A. D. Mr A. Ramaswami Iyer to be A. D., Polur. Mr. T. K. Mukundan from Polur to be A. D., Vellore. Mr. M. K Swaminathan from Vellore to be A. D., Arkonam. Mr. N. V. Kalyanasundaram from Tirukoilur to be A. D. Chengam. Mr. B. G. Narayana Menon, Offg , A. D., Gobichettipalayam to Pollachi, Sub-Circle. Mr. N. Srinivasa Rao, A. D. Pollachi to Tirupur Sub-Circle Mr. T. K. Thangavelu, A. D., Gobi is posted for van duty from 1—10—36. Mr. K. H. Subrahmania Iyer, A. D., Erode to Gobi to relieve Mr. Thangavelu.

Leave. Mr. R. Sankaran, Assistant to Cotton Specialist extension of leave out of India, 22 days half average pay plus 3 months 9 days half average pay "not due" from 30—8—36. Mr. M. Singara Rayan, Artist, l. a. p. for one month from 1—10—36. Mr. C. Raghavendrachar, Assistant, Chemistry Section, l. a. p. without m. c. for one month from 12-10-36. Mr. A. P. Balakrishna Nair, F. M., Kasargode, l. a. p. without m. c. for one month from 22-10-36 with permission to avail 22nd November. Mr. L. Kurma Rao, F. M., Anakapalle, l. a. p. for one month from 21-9-36 with permission to prefix 19th and 20th being public holidays. Mr. P. Gopalaratnam, Assistant, Guntur extension of l. a. p. for one month from 27-9-36. Mr. C. A, S. Ramalingam Pillai, A. A. D. extension of l a. p. on m. c. for one month in continuation of leave already granted. Mr. C. Raman Moosad, A. D., Ponnani l. a. p. for one month and 10 days from 26—8—36. Mr. P. P. Syed Mohamad, A. D., Somanur, l. a. p. for one month from 13—10—36. Mr. K. C. Thomas, A. D., Tiruppur, l. a. p. for 30 days from 25—9—36.