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CONTENTS

THE RELATION OF SIZE & SHAPE OF PLANT TO THE YIELD OF COTTON

By S. N. VENKATRAMAN, B.A., B.Sc. (Ag.) & C. JAGANATHA RAO, B.A.,

Assistants to the Cotton Specialist.

The relation of branching habit to economic characters in Cotton has been the subject of study by many workers. Prominent among characters investigated in this connection are earliness (Leake 1914), shedding (Cook 1911, Harland 1917) and yield per plant (Burt 1919, Cook 1911, Patel 1921 and Kottur 1920). Besides such economic relationships, the genetic behaviour has also been studied. The habit of the plant and the production of basal monopodia have been found more or less, heritable in a number of American and Indian types as the Cawnpores (Leake 1914), Kumptas (Kottur 1920) Gujerats (Patel 1921), Cawnpore-Americans (Burt 1919) and Americans. There is however evidence from other sources to show that considerable environmental modification occurs (Hudson 1920) which can even have large economic significances (Cook 1911). Of particular interest in plant breeding is the evolution of special types associated with good yields. Many workers (Cook, Leake, Kottur loc. cit.) prefer a

purely sympodial habit in the plants as more of these could be grown per acre to give higher yields. It should however be mentioned that part of the above behaviour is dependent on the variety of cotton examined. The results of such a study on a type of *G. indicum*, which, along with a variable mixture of *G. herbaceum*, forms the commercial "Northerns" crop of this Presidency is presented in this paper.

Material and Methods. The plants examined comprised the progeny of forty six single plant cultures grown in the Nandyal Agricultural Research station during the year 1931—32. Altogether 5970 single plants spaced three feet by two feet, were examined. Of these 3,880 plants were attacked by the shoot borer (*Earias sp.*) but these were also included to investigate the part played by this insect in the yield of the plant. To ensure uniformity in all strains, border plants were excluded for a distance of ten feet at the ends. The characters taken up for study were as follows :—

(1) Height of plant.
(2) Number of nodes per plant.
and (3) Number of bearing monopodia per plant.

Very small or poorly developed monopodia were not included in the counts. On the basis of these three characters, which essentially determine the plant configuration for this species of Cotton, the relation of yield (kapas per plant) were investigated. For purposes of comparison, similar data on a species of *G. herbaceum* forming the *Uppam* Cotton of the Presidency and grown in the Coimbatore Cotton Breeding Station during the years 1925—27 are also included in places.

The correlation of yield to other characters. Taking into consideration each of the forty six cultures separately, the coefficient of correlation of yield with height nodes and monopodia were determind. The frequencies of these correlation coefficients are given in Fig. I. for bored and normal plants respectively.

An examination of figure I shows that the correlations are generally higher in the normal plants than in the bored ones. This difference was found significant in all cases. (Student's method. Fisher 1932). The values of these mean correlation coefficients are given in Table I.

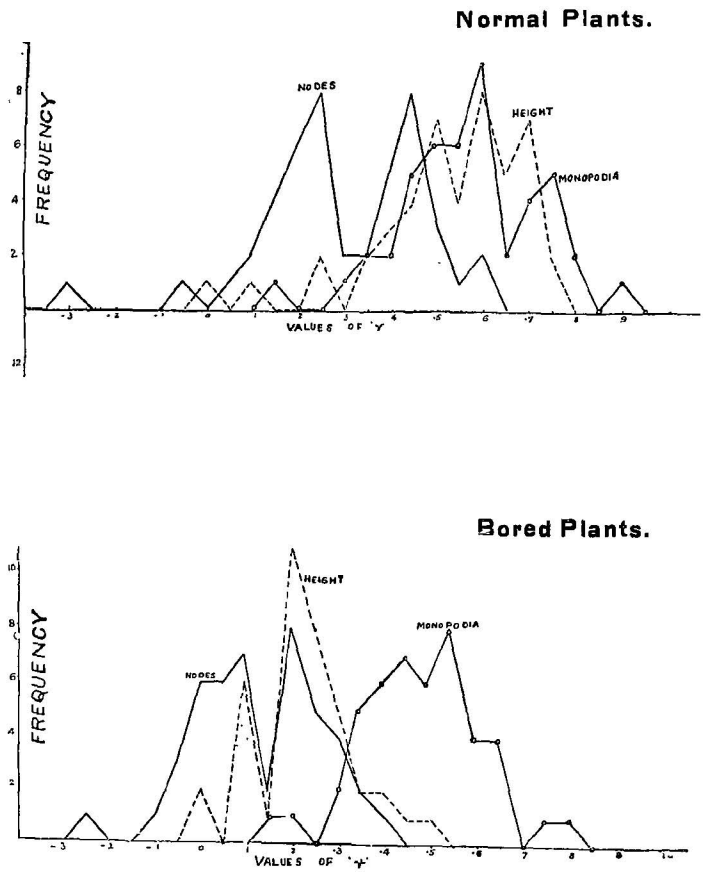
TABLE I. **Correlation of yield of the plant with other characters within the same strain :—**

(Mean value of '*r*' (forty-six strains)

Relative.	Subject, (1) yield of plant (Kapas weight)	
	In bored plants.	In normal plants.
2. Number of monopodia.	0·483 ± 0·013	0·571 ± 0·015
3. Height of plant.	0·251 ± 0·012	0·532 ± 0·016
4. Number of nodes.	0·129 ± 0·014	0·301 ± 0·016

Fig. 1.

FREQUENCIES OF CORRELATIONS OF YIELD WITH OTHER CHARACTERS



It will be seen that the coefficients are all significant. An examination of Figure I shows that in normal plants the monopodia ($r = \cdot571 \pm \cdot015$) and height of plant ($r = 0\cdot532 \pm \cdot016$) are markedly related to the yield, while the relation of number of nodes although significant is variable. In bored plants however, the relation of monopodia ($r = \cdot483 \pm \cdot013$) is much greater than that of height of plant ($r = 0\cdot251 \pm \cdot012$) while the effect of number of nodes is again small. These relations refer to variations from plant to plant within the same strain as determined by environmental influences, but what is of more interest in genetic studies is the behaviour from strain to strain i. e., the part played by the different characters in determining the yield from one selection to another.

Relation of characters from strain to strain. For the above purpose, the mean values of the forty six selections for the different characters were correlated with the corresponding mean yield. The resulting coefficients are given below.

TABLE II. **Correlation coefficients of yield of strain with other characters**

	Subject. Yield of strain (1)		Partial correlation Coefficients.	
	Bored.	Normal.	Bored.	Normal.
2. Number of monopodia.	$0\cdot598 \pm 0\cdot064$	$0\cdot648 \pm 0\cdot058$	$r\ 12\cdot3 = 0\cdot532 \pm \cdot071$	$0\cdot637 \pm .059$.
3. Height of strain.	$0\cdot324 \pm 0\cdot088$	$0\cdot175 \pm 0\cdot096$	$r\ 13\cdot2 = \cdot034 \pm \cdot100$	$0\cdot081 \pm .099$.
4. Number of nodes.	$0\cdot220 \pm 0\cdot095$	$0\cdot075 \pm 0\cdot100$		

It will be seen that the number of monopodia is the only character on which the correlations can be held significant. The partial coefficients indicate that the height of strain is of little genetic importance. It would appear therefore that selection for yield on a height basis will not be lasting in the succeeding generations, but selection of monopodial types will be of more permanent value. To investigate these relationships more fully, it will be necessary to know how changes in yield are associated with changes in the other characters.

Regression on characters of the yield of the plant: In finding this relation of yield to other characters, all the 5970 plants were grouped together into two categories as bored and not bored, and the regressions of yield determined on each character. The curves representing these relationships are given in Figures II, III and IV.

An examination of Figure II will show that in the case of monopodia, the regressions are rectilinear and similar for bored and normal plants. This shows a more or less, proportionate increase in yield with increase of monopodia

Figure II. As regards height, the relation is rectilinear for normal plants and very nearly so for a considerable height in bored ones.

Figure III. In the case of number of nodes the relationship is definitely more complex than in the two other characters, and very dissimilar in bored and normal plants.

Figure IV. Judged by the pronounced curvilinear regression of the character, and taking into account, the small values of its correlation coefficients, the number of nodes does not appear to be a factor on the basis of which selection for yield will be profitable. Greater significance attaches to the relation of height of plant and monopodia, where the relationship is rectilinear. Of these two characters, the influence of height has been shown to be purely environmental. As the effect of monopodia is both environmental as well as genetic, it is obvious that it deserves greater attention in the choice of high yielders.

The effect of the borer *(Earias sp.)* **on the yield of the plant** :— A point of interest in these studies is the part played by the borer in the yield of the plant. The attack of the borer in the present case is so high as 65%. Considering the pronounced modifications it introduces in the plant scaffolding the effect requires fuller study. An examination of the yield of bored and normal plants in the forty-six selections shows that the attacked plants have given a significantly higher yield than the others. Table III (a).

TABLE III (a) **Mean difference between bored and normal plants.**

Variety.	Character.	Difference Bored—Not bored.	S. E. of difference
G. indicum. Northerns.	Yield (ounces per plant.)	0·2204.	·0144 oz.
	Number of monopodia per plant.	0·609.	0·079.
	Rate of increase of yield per monopodium	0 025.	0·008 oz.

An examination of Table III shows that the increased yield is brought about in two ways. Firstly, there is an increased production of monopodia. Secondly, there is an increased productivity per monopodium. (Figure II). The rate at which yield increases with increase of monopodia is greater in the bored plants (Fisher. Page 123).

An examination of the standard errors given in Table III (a) shows that the differences are significant in both of these cases.

It should be mentioned that the increased yield due to borer attack is opposed to the findings from other species of Cotton as *G. hirsutum* (Cambodia—Ramanathan 1931) or *G. herbaceum* (Uppam). Table III (b) below.

Fig. II.

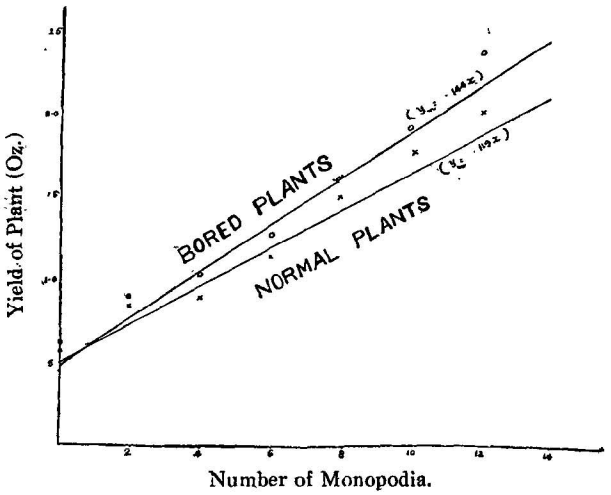


Fig. III.

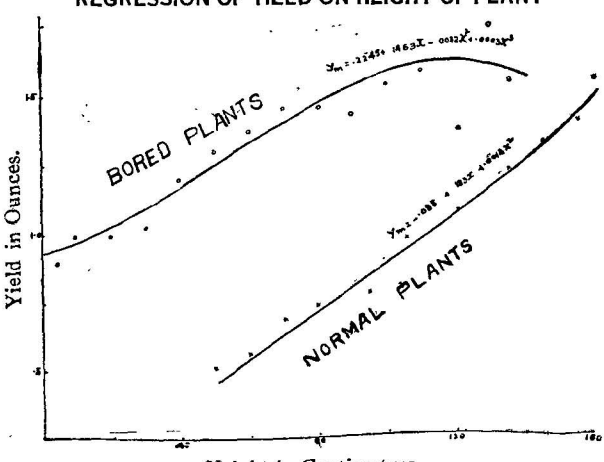


Fig. IV.

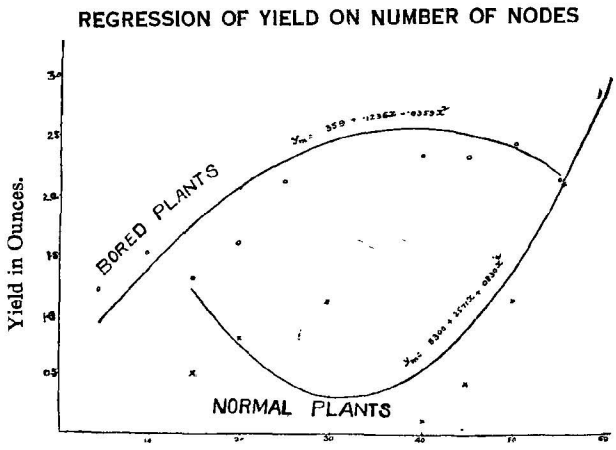

REGRESSION OF YIELD ON NUMBER OF NODES
Yield in Ounces.
BORED PLANTS
NORMAL PLANTS
Number of Nodes.

Fig. V.

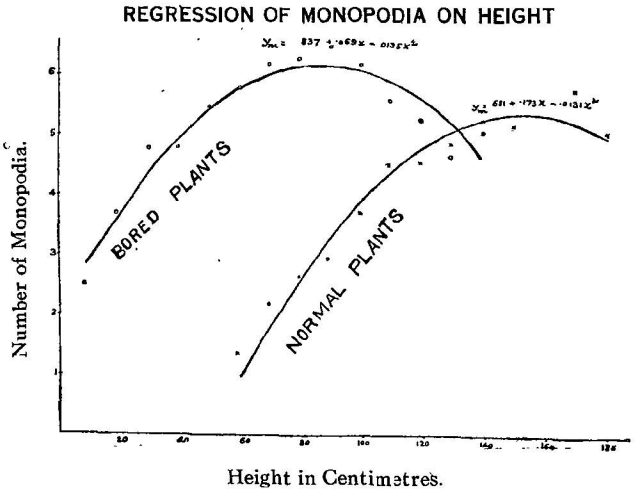

REGRESSION OF MONOPODIA ON HEIGHT
Number of Monopodia.
BORED PLANTS
NORMAL PLANTS
Height in Centimetres.

TABLE III (b). **Mean difference in yield between bored and normal plants in G. herbaceum (Uppam).**

Strain No.	Year.	Number of bolls per plant.		Difference in favour of normal plants.
		Mean of bored plants.	Mean of normal plants.	
54	1924—25	50·76	55·20	4·44
	1925—26	32·22	50·13	17·91
	1926—27	19·42	33·14	13·72
615	1924—25	33·51	37·57	4·06
	1925—26	36·19	48·09	11·90
	1926—27	25·11	27·05	1·94
1885	1924—25	31·75	32·70	0·95
	1925—26	25·76	33·62	7 85
	1926—27	30·25	27·75	2·50
2405	1924—25	30·07	27·12	2·95
	1925—26	42·24	48·76	6·52
	1926—27	28·14	28 47	·33
146	1924—25	29·07	27·62	1·45
	1925—26	33 89	44·38	10·49
	1926—27	25·57	30 42	4·85
480	1924—25	17·38	24·66	7·28
	1925—26	34·04	41·43	7·39

It is probable that the difference in behaviour between the 'Northerns' Cotton and the other two is due to the very high monopodial nature of the former type. Whereas in Cambodia the first sympodial node occurs within a range of five to ten nodes, and in 'Uppam' within seven to twelve, the range in Nandyal Cottons varies so high as thirteen to twenty-two. As such there is a greater chance for more monopodia to develop from the attack.

This effect of the borer appears also to be decided by the time at which the attack occurs. For instance, a well defined relationship is indicated between the growth stage of the plant at boring and the response in yield. An examination of Figure II shows that the higher on the plant the attack the greater is the yield, and to a large extent the production of monopodia (Figure V.)

Figure V. Although the above relationship of height and monopodia persists even from one strain to another, ($r.23 = 0{\cdot}501 \pm 0.074$) it is not the case between height and yield ($r.13 = 0{\cdot}324 \pm {\cdot}038$ $r.13.2 = .034 \pm .100$). The conclusion is probable from this that the quicker growing plants in a strain are likely to benefit more by attack, while this is not necessarily true of more quickly growing strains in a group of selections. In other words, the yield relationship is more or less environmental. A practical application of this will be that forcing the growth, by manuring for instance, and topping the plants will

induce higher yields in this type. Experiments are now being undertaken to test this point.

Discussion. It will be interesting to compare the above results with the findings of other workers. In Goghari Cotton (*G. herbaceum*) Patel (1921, 1924) prefers a tall strain with open habit and large number of vegetative branches, but in another variety of the same species (Kumptas) Kottur finds the reverse to be the case (8). The relation of monopodia to yield is not so pronounced in other species of cotton as for Northerns. In American cottons (U. S. A. Dept. Bull. 169) positive correlations between these characters ranging from 0·029 to 0·435 were got, while it was concluded that the isolation of a strain producing few basal limbs would not influence its productiveness. Burt (1919) prefers a compact type with a limited number of monopodia in Cawnpore-American cottons. In the Uppam cotton plant (*G. herbaceum*) the relation of yield and basal limbs is small ($r = 0.290 \pm .019$) although significant. It should however be recalled that some of these are sympodial types where the change from basal limbs to fruiting branches occurs early and is usually abrupt. In "Northerns" cotton however the production of monopodia is more continuous and the differences in behaviour can be attributed, as before, to this monopodial habit.

A problem of very common interest amongst cotton workers is the isolation of branching types adaptable to high acre yields. Although individually less productive, a sympodial type of plant is preferred in many species as the greater number of plants per acre more than make up for this deficiency. (Cook, Leake, Kottur loc cit). This type is early (Cook 1911) and has been found to produce bigger bolls in Kumpta cotton. (Kottur 1920). On the other hand it has been shown that in the species of Northerns cotton investigated, environmental and genetic conditions which favour the production of monopodia are also conducive to good yields. This is also true of Gujarat cotton (Patel 1921, 1924). As however the height of the strain by itself has no particular significance to the yield, it does not seem desirable to bestow too much attention to the selection of taller types. The indications are towards selection of medium sized compact types with moderate production of monopodia, as these will have the advantage of more plants per acre preferred by other workers. Observations have shown that the differential tendency of types to produce monopodia persists also in bulk plants, although it is not so pronounced as in the wider spaced single plants examined for this study. Selection on the basis of monopodia is therefore justifiable in "Northerns" (*G. indicum*) cotton.

Summary. The relation of height, nodes and number of monopodia to the yield of cotton was investigated in 6000 plants, being the

progeny of forty six selections of Northerns cotton. (*G. indiceum*) grown at Nandyal.

It was found that in plants of the same strain, the number of monopodia and height of plant were markedly correlated with yield. The genetic relation from strain to strain was however different. While taller types were not necessarily good yielders, strains with more monopodia were more productive. The number of nodes was not of much significance towards yield either from plant to plant of the same strain or from one strain to another.

The correlation of yield to other characters was significantly more in normal plants than in those attacked by the shoot borer (*Earias sp.*) A study of the regression of the plant yield on these characters showed that the relation of monopodia and to a large extent of height was rectilinear. This shows a proportionate increase of yield with increase in these characters. The regression on nodes was more complex.

From an examination of yield from bored and normal plants in all the strains, it was found that the attacked plants gave a significantly higher yield. This increase of yield was associated with an increase in the number of monopodia per plant, as well as an increased rate of productivity per monopodium. It was also observed that the higher on the main stem the attack, the greater the yield. This was not however the case from one strain to another.

From a comparison of other strains, as Cambodia and particularly Uppam (*G. herbaceum*) where the effect of the borer was just the reverse, it was shown that the difference in behaviour could be attributed to the more monopodial habit of this type.

The relation of yield to monopodia was much higher in this Cotton than in more sympodial types as Americans or Uppams' Selection for high yielders on the basis of monopodia is justifiable in 'Northerns' Cotton.

Acknowledgments. To M.R.Ry. K. Gopalakrishna Raju Garu, Deputy Director of Agriculture, Bellary, we are indebted for facilities. The work on Uppam cotton included was done while the first of the authors was an Assistant in the Madras Herbaceum scheme financed by the Indian Central Cotton Committee.

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A NOTE ON CLOVE CULTIVATION IN SOUTH INDIA

(From The Director of Agriculture, Madras.)

Botanical Origin and Distribution: The clove is known botanically as *Eugenia caryophyllata* and belongs to the family *Myrtaceae* to which the Myrtle, Eucalyptus, Rose apple and other well-known plants also belong. It is a small conical tree 30—40 feet tall and it is a very slow grower. It is said to continue prolific up to 75 years in favourable localities.

The clove is said to be indigenous to five small islands in the Moluccas, but it has spread through the agency of man to many parts of the tropical world and it grows particularly well in the islands of Zanzibar and Pemba which produce the greater part of world's supply. The clove is also grown in the Tinnevelly District and on the southern slopes of the Nilgiris of the Madras Presidency on a small scale, where it thrives up to 2,500′ elevation.

Cultivation: The clove prefers a somewhat sandy soil and a well distributed annual rainfall of not less than 60″. The seeds should be collected for sowing as soon as mature, i.e., when the seed covering becomes soft and purple in colour. They should be sown as soon as collected in nursery beds made up of any good garden soil to which a quantity of sand and leaf mould has been added. Select a site away from the roots of trees and dig the ground to a depth of one foot or more. The width of the beds should not exceed 4 feet, the length being determined by the number of seeds sown. The seed beds should be covered with a pandal to keep off the sun's rays, and the soil kept moist, but not waterlogged. Germination will take place in about six weeks, when more light should be given, otherwise the seedlings will become weak and leggy. The seedlings should be transplanted to planting baskets or established in balls of soil and moss when about 6″ tall and grown on for planting out in their permanent quarters the

following rainy reason. A month or two before the planting season, say in April, pits 3′ square and 3′ deep and 20′ apart should be dug, and if the soil is poor, half filled with the soil removed from the pits and the other half made up with tank silt or any available good garden soil containing plenty of humus all well mixed together. As soon as the South West monsoon begins, the young seedlings should be planted out in the centre of the pits in the baskets or balls of moss without disturbing the roots. On no account should the plants be allowed to become dry until they are about 3 feet tall after which weekly irrigations during the dry season should suffice.

Clove trees may conveniently be grown between fruit trees in already established orchards wherever there is sufficient room, as they do not require much lateral space. For new orchards nutmegs, cloves, mangosteens and loose-jacket oranges would make a good mixture, with papayas and plantains put out between as a catch crop. All these thrive under similar climatic conditions and the water requirements of the different species of trees can be regulated by irrigation. Mixed planting, however, requires a good deal of judgment and forethought and should not be undertaken without expert advice. If cloves are to be grown separately a green manure crop might with advantage be grown between the trees. This could be cut to provide a mulch to the trees during the dry season and would also prevent soil erosion on steep land during heavy rains. I suggest *Tephrosia candida* or one of the Crotalarias as suitable plants for this purpose, or on very steep land *Leucana glauca* would be a useful plant, but the latter requires constant cutting to keep it within bounds.

The clove tree comes to bearing in from 10 to 15 years from planting and attains its full cropping capacity in about 20 years when from 8 to 10 lbs. of dry cloves per tree may be expected. In the Tinnevelly District the yield is estimated to be between 1500 to 2000 lbs. of dry cloves per acre if the trees are planted from 15 to 200 feet apart, giving from 100 to 150 trees per acre ; but this figure is, in my opinion, very much over-estimated as allowance must be made for a large percentage of the trees not producing crops annually. A nearer estimate based on yields obtained in other parts of the world is 800 to 1000 lbs.

The clove of commerce is the unexpanded flower buds and these are gathered from the trees when they are dull blood red in colour. Gathering should be done in fine weather and the cloves spread thinly on mats in the sun to dry, which takes about a week if the weather is dry and longer during dull weather. At nights, or if rain occurs, the cloves should be removed to a light airy shed and spread out thinly until the weather becomes fine again. In some parts of the world cloves are dried over artificial heat and these are said to be a brighter brown and therefore more pleasing to the eye than the sun dried ones. The clove loses from 50 to 60 per cent. of its weight in drying.

The price obtained in South Indian bazaars is roughly Re. 1 per lb. for good quality cloves. The wholesale price in England varies from 8 d. to 1 s. per lb.

Cost of planting and maintenance: The charges for the first ten years are estimated to be Rs. 1,500 per acre, but this must necessarily vary in different districts. Thereafter the probable cost of maintenance such as weeding, forking, mulching, etc., would be about Rs. 100 per annum.

N. B. Clove seeds and plants are available at the Agricultural Department Experiment Fruit Station at Burliar in the Nilgiri District, price of the former being Re. 1 per 100 and the latter annas four per plant or Rs. 15 per 100. Seeds can be supplied in September each year.

* INSECT PESTS OF ORANGES IN THE NORTHERN CIRCARS

By V. MARGABANDHU M.A.,

Assistant to Govt. Entomologist, Coimbatore.

In the N. Circars orange cultivation is carried on, on a fairly extensive scale. The citrus gardens round about Ellore, in and around Palacole and in the vicinity of Rajahmundry in the Godaveri District, and those in the districts of Guntur and Kistna furnish a very imposing sight. The chief varieties grown are the Batavian oranges (*Citrus sinensis*), the Pomelos (*Citrus decumana*), the Sour lime (*Citrus medica* var. *acida*) and the country oranges (*Citrus aurantium*); of these the Batavian forms the most noteworthy. This variety is found to come up well in almost all soils such as sandy or red loams and typical red soils. It requires timely irrigation and the importance is well evidenced by the presence of large wells in these gardens. Good drainage also appears to be essential, since water-logged conditions affect the tap root The trees are planted 20 to 35 ft. apart They begin to bear after seven years and normal bearing begins after ten years. Various manures are applied, such as tank and canal silt and horse and cattle manure. This is done during December, and irrigations are given immediately afterwards, the idea being to induce early flowering which commences during December—January. During the beginning of July, the fruits are ready for basketing which is done to induce good colour and early ripening. A month or a month and a half after basketing, the fruits will be ready for the market. The price of the fruits usually varies between Rs. 30 and Rs. 50 per 1000, each fruit selling for an anna or two. Though a paying crop, there is loss in certain years due to insect attack and as such, the fruit-grower in these parts will do well to get some knowledge of these pests and the possible methods of their control.

* Paper read before the Ind. Sci. Congress, Patna 1933.

The object of this paper is to record some of the observations made regarding citrus pests, during the period of two years 1930—31 and 1931—32, when the writer was stationed at the Agricultural Research Station at Anakapalli, Vizagapatam Dt.

The following are some of the pests noted on citrus.

The Fruit-Sucking Moths, so called on account of their habit of sucking the juices of fruits by means of their sharp sucking tube, are widely distributed. Here is an instance where the adult or the imago is able to cause damage to a crop. The minute punctures caused on the rind develope bacterial activity and the fruit consequently turns yellow and drops down. Fruit-fall is a very common occurence in infested orange gardens. The moths attack pomegranate and mango also. More than one species is concerned in the damage, *Ophideres materna* and *Ophideres fullonica* being the chief. The adults are beautifully coloured and may be mistaken for butterflies. These two important species are distinguished by the differences in the wing coloration.

These moths deposit their eggs usually on *Tinospora cordifolia* (*Tippa Tiga* in Telugu) commonly found among hedges and cactus bushes. The hatched-out larvae feed on the leaves of these creepers and when fully grown are about 7 to 7½ cm. long. They are stout and semilooped, forming a characteristic S-shape when disturbed. The larvae show a great deal of colour variations and they are speckled with orange, blue and yellow spots. The anal segment is characterised by bright yellow patches behind and on the sides. In the case of *O. fullonica* the caterpillars are deep greyish-brown with five pairs of prolegs whereas there are only four pairs in *O. materna*. The larvae before changing into a dark brown pupa spin a tough cocoon among the dried leaves. The pupal period varies between 10 and 16 days.

Control: This is a very important pest in this tract causing appreciable loss and deserves some special notice in the matter of control measures. Removal of larval food plants by the gardeners with concerted action among themselves would mean prevention.

In the Circars there is the practice of covering the fruits with baskets, made of palmyra leaves and costing Rs. 1/4/- to Rs. 2/- per 1000. This is done a month or a month and a half before harvest and is done mainly to induce good colour, and the idea of protecting the fruits by means of these baskets may after all be an afterthought. After basketing is done fruit-fall is considerably reduced. Occasionally fruit-fall is noticed both in the case of basketed and unbasketed fruits. One is inclined to ask how far basketing of fruits is effective in preventing the moth-attack. Not only this. These baskets are made of palmyra leaves and the latter are not intact and the moths could easily pierce the fruits through the crevices. If the basketing should prove effective, the fruits should be basketed earlier than is done at present which may affect the development of the fruit. Round about Ellore the fruits are covered with lotus leaves. These are not

as good as those with palmyra leaves, because the former become dried up soon and tear off easily and the fruits are pecked by birds too. It would be of interest to note that it is reported by gardeners that basketing of fruits with lotus leaves prevent fruit-moths' attack on account of the peculiar odour the leaves possess. This is also a point worth investigating.

Spraying the fruits with Crude oil emulsion and handnetting the moths during nights have been found to produce good results.

The Citrus Butterflies: The caterpillars of these butterflies feed on the foliage and the damage to young plants is more serious than to the trees. There are three species generally concerned in the damage; these are *Papilio demoleus*, Linn., the popular lemon butterfly; *Papilio polytes*, Linn., which is noted for its mimicking female forms; and *Papilio polymnestor*, Cram., a very large butterfly with dark and blue shades and markings. These butterflies are commonly seen flying about in all gardens during day time.

The mother butterfly generally lays the smooth rounded eggs singly on the tender parts of the plant. They are pale yellow in the case of *P. demoleus* and yellow in the case of *P. polytes* and in the case of *P. polymnestor* the eggs are bigger. The egg period in the case of *P. demoleus* is 4 days. The fully fed larva is stout and sluggish with small head, stout thorax and gradually tapering abdomen. The larvae show a good deal of variation in colour and markings in the early stages and resemble dropping of birds. The fully fed caterpillars may be distinguished as follows. In the case of *P. demoleus* the larvae are blue, pale blue, or sometimes pale green with yellow tinge with dark dorsal spots. The forked reddish brown process behind the head (Osmeteria) is very long. The larvae of the other two species are velvety green in colour. In general the larvae of *P. polytes* and *P. polymnestor* resemble very much differing only in size. A fully grown caterpillar of the latter is about 7 to 8 cm. in length. Another noteworthy feature in the larvae is that in the early stages they are pale light green with white dorso-lateral patches on the posterior aspect of the abdomen. Head pale green, thorax stout; when disturbed there is no protrusion of the osmeteria as in *P. demoleus*. The larval period in the case of *P. demoleus* is 13 to 14 days and in *P. polytes* 17 to 21 days. Pupation generally takes place on the stem or the twig; the pupa is attached to the twig by two tough silken strands. The pupal coloration varies a good deal among the three species. The pupal period in the case of *P. demoleus* is 8 to 16 days; of *P. polytes* 12 to 35 days and in *P. polymnestor* 16 to 42 days.

From counts made of eggs and larvae of these insects found on citrus seedlings for a period of nine months, it was seen that the species are found right through the year with the degree of incidence only varying, being very high during the summer months. *P. demoleus* is seen in large numbers during the rainy months between July and November and from then onwards they become very limited in numbers and *P. polytes* and *P. polymnestor* begin to be prominent. From the second fortnight of December *P. demoleus* becomes scarce. The relative proportions of *P. polymnestor*, *P. demoleus* and *P. polytes* are in the ratio of 1:22:17 during the period beginning from the third week of January to the first fortnight of April for nearly four months. The pest is serious only on young seedlings.

Control: In the case of young seedlings, from the time of germination for a year or two they may be examined once in four days only, as the egg period happens to be four days; and the eggs and larvae that may be found on them may easily be hand-picked. This method proved the most efficient; and this was done right through the whole year in the case of the young seedlings. The gardener himself may do this, the time taken to carefully examine 80 rows of seedlings being only about an hour and a half. In addition to this, lead arsenate solution (½ ounce, in one gallon of water, diluted with equal quantity of lime) was sprayed occasionally on the seedlings and the insecticide proved effective to a great extent. The seedlings undergo growth and consequently fresh foliage is put forth and this would mean frequent sprayings. Ordinarily handpicking of eggs and caterpillars is the best, efficient and economical method especially in the case of nurseries, where alone the pest is serious.

Lycaenid Butterfly: (*Chilades laius*, Cram.) The caterpillars of this common coppery blue butterfly eat the tender leaves, and now and then prove serious to young seedlings.

The eggs are very minute, white, corrugated and are flat on both the sides. The single eggs are laid indiscriminately on the terminal foliage, on the leaves, petiole, stalk etc., and sometimes may be found in groups of two, three or even a dozen. The egg period is about three days The larvae on hatching begin to scrape the young leaves and as they grow in size the leaves are eaten away. The mature larva about 10 mm. in length is green, stout, spherical on the dorsal side and flattened below. It is soft and sluggish in habits and remains a larva for about 6 days. The pupa generally found on the leaf is green in the early stages and later on turns dark green. The pupal period occupies 7 to 8 days. The longevity of the adults has been recorded as 3 days when fed with molasses. The pest may be found on the seedlings right through the year abating now and then.

Control: The measures are the same as in the case of Papilios, viz., handpicking of eggs and caterpillars and frequent sprayings with lead arsenate solution of the strength mentioned above.

The Citrus Leaf-roller: (*Tonica zizyphi*, Stn.) The caterpillar of this small moth is also a serious pest of citrus seedling. It attacks the tender sprouting leaves causing them to fold longitudinally and the creature remains inside the fold, scraping the leaves in the early stages and later on eating the leaves from the tip towards the petiole.

The minute eggs are laid on the leaves. The just-hatched larva is pale yellow with black head. When fully fed it turns green and measures about 10 to 12 mm. in length. It is also long and slender with the head black. The body is slightly tapering at both ends. The caterpillar is highly sensitive and when two meet each other they suddenly rush back. The movement is very quick characterised by sudden jerks. Just before pupation it turns pinkish on the dorsal side. Pupation takes place in a silken cocoon inside the leaf-fold. The pupae are green at the outset but later on turn dark brown. The pupal period runs to 6 days. The longevity of the adults when fed with molasses was found to vary from 7 to 20 days.

The pest is noted on the seedlings almost throughout the year. During the rainy months (August—January) the degree of incidence is very high. Subsequently they are found only in limited numbers Beginning with August the incidence is very high till the first fortnight of January. The degree of attack to seedlings was so high that the plants showed only stalks, all the tender leaves being damaged. During February they were almost absent and in March stray cases were found. The pest is always present whenever there is a good flush, as it always prefers tender foliage.

Control. The measures are the same as in the two previous cases viz., handpicking of caterpillars and spraying with lead arsenate solution.

The Citrus Leaf-miner : (*Phyllocnistis citrella* Stn.) The injury to citrus plants results by the miners traversing beneath the epidermal layer of the leaves—both tender and old. The miner always has a partiality for tender leaves which are damaged badly. As the miner feeds in a zig-zag fashion curls are formed resulting in the stunted growth of the seedlings. Gradually the places traversed by the miner undergo browning and put on a scorched appearance; and as the leaves begin to grow at this stage they become torn in these places. The pest is serious in the case of very young seedlings where growth is retarded a great deal. In the case of trees, this does not appear to matter much.

The tiny little moths could easily be recognised by the presence of a black spot at the tip of each wing of the forewings. They lay smooth, transparent, spherical eggs on the tender newly sprouting leaves alongside midribs on both sides, and sometimes on the tender stalks The newly emerged miner begins to mine or tunnel beneath the epidermal layer which can be seen as a thin brown, membranous film and feeds from within. The fully fed miner is about 3 mm. in length and pale brown in colour and when taken out of the tunnel curves itself and wriggles and falls down and the motion is by rolling. In the case of the larva the head region is stouter. The miner is legless characterized by a tapering head. It pupates near the margin of the leaf always inside a curl beneath a tough web of silk. The pupa is light brown in colour. In the case of the pupa each of the abdominal segments bears a pair of hair-like bristles laterally, arising from warts which are hyaline; at the posterior end carries a pair of short stout triangular processes. On the ventral side each of the abdominal segments bears a number of short spines which become more and more distinct posteriorly; those on the last seven segments are distinct and the spines are brown and slightly recurved. At the anterior end there is a dark process appearing as though the head portion ends in a pointed process. The region of the eyes is dark brown. The adult emerges by making an opening at one end of the web. The miners are noticed in the leaves of *Murraya koenegii*, *Pongamia glabra*, *Jasminum*, *Aegle marmelos* etc.

Control: Owing to the miners remaining beneath the epidermal layer of the leaves, it has been found difficult to control these insects. Four methods were tried viz, insecticidal, cultural, biological and mechanical. Crude oil emulsion was found ineffective as the same

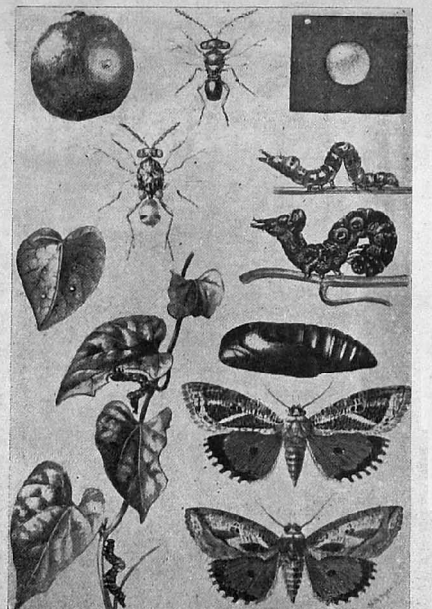

FIG 1. The Fruit-moth ; its stages and parasites.

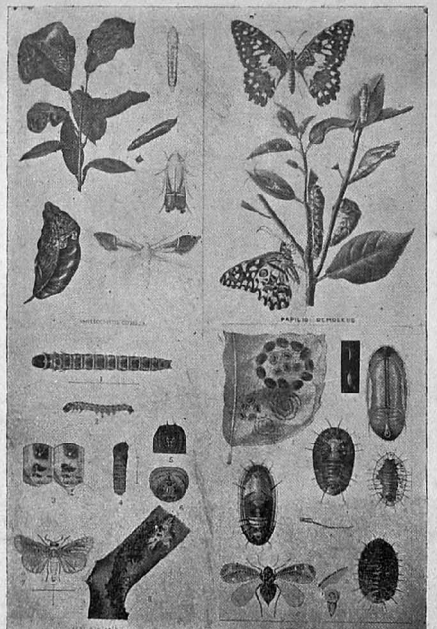

FIG 2. 1. The Citrus Leaf-miner; 2. The Lemon Butterfly ; 3. The Citrus Bark-Borer ; 4. The Citrus Mealy-wings.

does not appear to soak through the thin epidermal layer; but in the case of tobacco decoction stray miners were found dead in the treated leaves. The eggs and pupae do not appear to be affected. Even in the case of tobacco decoction, it is not a preventive and sprayings have to be repeated frequently at least once in ten days, as fresh leaves are put forth resulting in fresh attacks. Bordeaux Mixture was tried as a deterrant with no effect. Therefore in the case of insecticidal trials the sprayings have to be repeated and if the pest persists right through the sprayings may have to be given frequently. Moreover the spray fluid may not reach the underside of the leaves. Thus the scope is very limited. As regards *cultural methods*, observations made during two seasons go to show that soon after good showers, the seedlings recover beautifully well. Even otherwise copious irrigations coupled with treatments with tobacco decoction at a strength of one pound in 5 to 6 gallons of water were found to give results during periods of heavy miner infestations as the plants begin to put forth more vegetative growth which minimise the infestation a great deal. This extra output of foliage leads to a less concentration of the pest. If the plants are weaker and stunted in growth there will be greater concentration of the pest. Tobacco decoction on the seedlings was found to act as a good stimulant. Coming to the *biological method*, though chalcid parasites are noticed on the miners during certain months, scope for this method is limited. With reference to *mechanical means* whenever there are very bad infestations handpicking of the mined leaves will reduce the infestation.

The Citrus Shoot and Bark Borer: This caterpillar is noted to damage citrus by boring through the shoots in the gardens round about Palacole and Rajahmundry. Injection of chloroform and creosote mixture was found effective. Further studies have to be made on this insect.

The Citrus Mealy Wings: (*Aleurocanthus spiniferus* Qt.) These minute creatures are fairly common on citrus from July onwards till next March. Observations go to show that between each brood a month may elapse each lasting about a fortnight.

The minute white eggs are laid arranged in concentric circles on the underside of the leaves in the nature of a spiral; they gradually turn dark brown. The just hatched nymphs distribute themselves on to the whole leaf surface so much so the leaf turns black. These feed by sucking the sap from the tender foliage. Owing to the feeding of the nymphs in large numbers and due to the secretion of the honey dew, sooty mould is formed on the leaves

Control: The trials to kill the nymphs with tobacco decoction, crude oil emulsion, potash fish oil soap and Bordeaux mixture did not prove effective. The best time to spray is when the adults begin to emerge. But if the broods happen to be irregular then very frequent sprayings may have to be given which may not prove

economical, when we take into consideration the extent of damage caused by the pest.

A Coreid Bug: (*Dasynus antennatus*) is noticed in some of the gardens round about Rajahmundry in small numbers. Numerous adult bugs and nymphs are often found on a single fruit; but the damage does not appear to be serious and no punctures or rotting of any kind is seen on the surface. The only injury seems to be to make the fruits turn yellow and ripen earlier. These can be controlled by hand-netting.

The Jasmine Bug: (*Antestia cruciata*, Fb.) which generally attacks jasmine in certain parts of the province is often reported from Rajahmundry on citrus. These are found in numbers on branches and leaves, more particularly on "Kuranji" variety. The bug sucks the juice causing white patches on the leaves and flowers which fade and drop during the flowering season. Handnetting the bugs will be found effective.

The Red Tree Ant: (*Oecophylla smaragdina*, Fb.) This notorious insect is common in almost every batavian garden round about Rajahmundry and other places. It is also found on mango and other fruit trees. The nests are found made among the leaves by means of webbing sometimes enclosing the fruits also. The insect has powerful stings and is a nuisance to gardeners. The nests may be destroyed with poles.

Minor pests: The *Cockchafer* beetles (*Aserica* sp.) are found to eat leaves during night time. Spraying with Bordeaux mixture may be tried as a deterrant. Weevils of different species, chiefly *Myllocerus* are noted to eat the leaves and dusting the leaves with calcium arsenate diluted with lime may be done with good result. The scale insects *Aspidiotus aurantii*, Mask. and *Psudococcus corymbatus*, G. are occasionally noted on the shoots and leaves. Species of *Aphids* called the "Citrus Aphid" are common on young shoots causing leafcurls in young plants and these can successfully be tackled by a spraying with tobacco decoction. There are also *mites* on the leaves and fruits which produce small white dots. Occasionally *Psychid* caterpillars may be found eating the leaves and these may be checked by a spraying with lead arsenate solution at the usual strength.

General Remarks: Of the above pests, fruit-moths may be considered as the major pest of citrus. So far as the seedlings in the nurseries are concerned, the leaf-miners and the leaf-eating caterpillars such as the Papilios, the citrus leafroller and the Lycaenid may prove serious. On the Agricultural Station at Anakapalli, all these four pests were found simultaneously on the seedlings throughout the year with varying degrees of incidence. And recourse was taken to frequent sprayings with lead arsenate solution; and hand-picking was resorted to systematically thus keeping the seedlings in good condition.

In the case of young seedlings, at certain stages, they look very much stunted in growth and any incidence of insect attack is greatly augmented by certain other causes. For instance, when the seedlings are kept in cut pots and then placed above ground, one finds stunted growth and the insect attack is accelerated. But when the pots are buried flush with the ground level and then watered, one finds the same seedlings coming up very well as could be seen by the amount of foliage put forth. Thereby the insect attack is greatly mitigated. Same is the case when the seedlings are given a drenching with tobacco decoction at a strength of one pound in 5 to 6 gallons of water at an interval of a week. One finds a good flush. It has been the experience of the writer that the seedlings put on good flush on receipt of a shower, thereby showing that a certain amount of frequency of irrigations is necessary in the absence of showers. The broad principle underlying this study is that under particular conditions the degree of incidence in the case of any pest will range about a point. Under this degree of insect attack, the plants fare badly with a certain output of foliage. If by cultural means, one is able to improve the condition of the plants, thereby inducing them to put forth good foliage, the degree of incidence being the same, with the increase of leaf surface the insect attack is greatly mitigated. This is the observation which the writer was able to make while studying these pests. Under normal conditions, seedlings may require a particular degree of watering, manuring, etc., when there is no pest. But during periods of infestation, the plants suffer; normal conditions are upset and consequently one may have to change the treatments given under normal conditions so as to suit the changed conditions. This would mean an extra irrigation or an extra dose of manuring or something in the nature of a stimulant like tobacco decoction. Cultural methods of this kind would go a long way, if need be, supplemented by mechanical methods, in mitigating severe infestations.

In order to make the paper very brief details pertaining to descriptions, insect habits and the degree of incidence in each case have not been given in full. The thanks of the writer are due to Dr. T V. Ramakrishna Ayyar, Government Entomologist, Coimbatore for advice and suggestions and for identifying the species; and to the then Deputy Director of Agriculture, I Circle, Mr. A. C. Edmonds under whom the writer worked during the period for affording opportunities to study these insects.

List of Pests of Citrus arranged according to the Different Insect orders.

ORDER: LEPIDOPTERA

Family *Noctuidae*:

Ophideres fullonica, Linn.

Ophideres materna, Linn.

Family *Papilionidae:*
Papilio demoleus, Linn.
Papilio polytes, Linn.
Papilio polymnestor, Cram.
Family *Lycaenidae:*
Chilades lajus, Cram.
Family *Oecophoridae:*
Tonica zizyphi, St.
Family *Phyllocnistidae:*
Phyllocnistis citrella, Stn.
Family *Psychidae.*
Family *Arbelidae.*

ORDER COLEOPTERA

Family *Melolonthidae:*
Aserica nilgirensis, Shp.
Family *Curculionidae.*
Myllocerus evasus, Mshl.
Myllocerus dentifer, F.
Amblyrrhinus poricollis, Boh.

ORDER HYMENOPTERA

Family *Formicidae:*
Oecophylla smaragdina, Fb.

ORDER RHYNCHOTA

Family *Coreidae:*
Dasynus antennatus,
Family *Pentatomidae:*
Antestia cruciata, Fb.
Family *Coccidae:*
Aspidiotus aurantii, G.
Pseudococcus corymbatus, Mask.
Family *Aphidae:*
Family *Aleurodidae:*
Aleurocanthus spiniferus, Quaint.

ORDER ACARINA

Species of mites.

AGRICULTURE IN RUSSIA

BY A. MUIR, B. Sc.

Russia is a country of almost immeasurable agricultural possibilities. Its enormous area covers one-sixth of the earth's surface, and its climate ranges from Arctic Siberia in the North to the almost tropical Caucusus in the South. Between these extremes lie the vast forest regions and the great steppe zone, with its large expanse of fertile black soils, ideally suited for crop production. A further variety of climate and soils is found in the mountainous southern regions—the Crimea, the Caucusus and Turkestan.

The revolution in Russia in 1917 brought about an abrupt transition in practically every phase of national activity; in agriculture the complete change over from little more than primitive systems to large scale productions by modern methods presented problems of special difficulty. In order to appreciate the magnitude and the complexity of this task, it is necessary to review very briefly the conditions of work and life on the land prior to the date of the revolution.

Under the primitive conditions obtaining almost up to the time of the revolution, the two main classes in agriculture were the land-owning class and the peasant. Until 1861, the lot of the peasant in Russia was exactly comparable with that of the bondman under the feudal system in Britain. In that year the peasants gained a certain amount of freedom, but the conditions of life and work changed but slightly. Only to a very small extent was the peasant master of his own destiny. The land-owners in some cases were genuinely interested in the welfare of their small tenants and peasants, but the large majority was interested only in the revenue which could be obtained from the land. The peasant had to do a certain amount of work for his master, and he generally managed to farm a small patch which would keep him and his family during the year. In some places, the village owned or rented a large area, which was divided up among the villagers and run on the three or five-field system. Here, the villagers had to pay the rent for the land either in money or in kind, the landlord taking no interest in agriculture.

Until towards the end of last century the landowners as a whole were content to produce only enough to satisfy the internal requirements of the country, and large-scale farming was of very small importance. About that time, however, it began to be realised that the vast tracts of black-earth soils were an enormous asset, since they could be worked for long periods under one crop without showing any signs of falling off in crop yields. Scientific men, notably one Dokuchaiev, turned their attention to the study of this soil and founded what is now known as Soil Science. It was still some time, however, before agriculturists began to make serious use of the results of scientific research, and in the end it fell to a land-owner in the South to form the first experimental farm. This he did on the lines of the Rothamsted Station, as it was begun by Lawes. Others followed this lead, and at the beginning of the present century, we find farming on a larger scale than had formerly been possible.

The improvement in methods of cultivation did not, however, do much to bring about the desired increase in yield owing to the extensive of farming which still prevailed. The average yield per acre in Russia for the period 1901 to 1919 was 1—3/4 qrs. wheat, 2 qrs. barley and 3 tons potatoes. During these ten years there was a slight decrease in that of barley, but on the whole these changes had little effect on the total output. The fluctuations in yield over a period are remarkable. Thus taking the lowest for spring wheat over the period 1883 to 1898 as 100, we find that the highest is 336. Live-stock showed a large decrease during 1900 to 1912, reaching in the case of sheep and goats 27%. Only in the case of horses was there an increase (5·7%).

An explanation of these decreases is found in the amount of land per head of population. The agricultural population increased from about 50 millions in 1860 to 86 millions in 1900, resulting in a corresponding decrease in the amount of land per head of population. This decrease in some cases amounted to about 50%, i. e. from 12 acres per capita to 7 acres. This "land hunger" caused great hardship among the peasants, lowering the amount of stock the small farms were able to carry, and in general lowering the standard of living of the peasants. To alleviate this suffering, the Asiatic Colonisation Bureau was formed. This Bureau sent out expeditions, which made detailed surveys of various districts and contributed greatly to the knowledge of the country. On the basis of this work peasants were transferred to Asiatic Russia and found there a rich and fertile country.

The first revolution of 1905 had brought very few changes in its wake, and the peasants were very ready to follow the lead of the town workers when the great revolution of 1917 took place. Having thrown off his yoke of servility, the peasant simply carried on his farming in the old way. None of them was rich

enough to purchase the new machinery, and that which belonged to the rich land-owners was often destroyed, and in any case there was not enough to go round. The problem which confronted the new government was how to apply the Marxian theory of economics to such a great problem Lenin summed up the position in the following words: "To live the old way, to live as people lived before the revolution is impossible, and such an expenditure of human strength and means as is connected with peasant farming can no longer continue. The productivity of human labour would be doubled and trebled if the transition from these scattered farms of small size to socialised farming could be made."

The socialization of agriculture has proceeded along two lines—the formation of state farms (*sovhozes*), and of collective farms (*kolhozes*). Farms of both types were formed immediately after the revolution, but these did not become factors of any importance until recently. From 1921—27 there was a large decrease in the number of the most highly collectivised farms due simply to over-eagerness on the part of those sent out to organise them. Those chosen were no doubt good communists but bad psychologists, as was shown by their failure to find the proper approach to the humble but suspicious peasant. Many of the brigadiers, as they were called, had absolutely no knowledge of practical farming.

The "*sovhoz*" is run by some trust which is directly responsible to the Central Government. Each farm has a manager, mechanics, labourers, etc., who are simply paid servants of the State, and are in no way affected by the success or failure of the crops. These farms, which in some cases have reached a colossal size, e.g., the Giant in the North Caucusus, which has an area of 450,000 acres, are the basis of present day agriculture in Russia and towards this form all others tend. In the collectivised sector there exists three types of farms. The first and most primitive is simply an association for the joint tillage of the soil The products of the land are divided up at the end of the year according to the amount of land owned by each family. This is only the first step towards further collectivisation, of which the "*artel*" represents the second. Here we have almost complete collectivisation, each family being left only one cow and their hens for personal use. In the final stage of collectivisation—the commune—everything is collectivised, except, of course, personal belongings. This state of affairs is found but rarely, the peasants being encouraged to increase the productivity of the land rather than bother about communal houses. The collective farms are run by a committee elected by the villagers, and sometimes, if the village is small, all the villagers may take parts in the work. A president and secretary are chosen by the committee, and they together act as the executive body. An agronomist is generally to be found in each village, but if the district is sparsely populated, one agronomist has to suffice for the whole district. Attached to many of the farms are tractor stations, which are assuming greater importance as the production of tractors increases. The Stalingrad factory was recently producing about 110 tractors per day and the Leningrad factory about 90. The chief difficulty found in the use of tractors is the lack of spare parts, and it is not uncommon to find most of the tractors in one station laid up owing to some minor trouble. The peasants have on the whole taken fairly well to the mechanisation of agriculture, and are ready and willing to learn the handling of the various modern machines which are now at their disposal. The working day is generally one of ten hours, but weather conditions and other factors outside the peasants' control may necessitate much longer hours sometimes. Lateness in the delivery of seed, an increase in the sowing area and mechanical break-downs in machinery are common causes of delay, giving rise to the necessity for extra work. During the sowing and harvesting season it is not uncommon to find a night-shift being worked with the aid of head-lights. The area sowed must be increased every year, and every district is required to furnish a detailed programme for each

financial year. When the total production falls short of the requirements of the plan, the area is increased very often without any regard to the capabilities of the peasants and the conditions under which they work. This is generally responsible for many of the poor crops very often produced by the collective farms. When the harvest is brought in, the government takes a pre-arranged portion at a fixed price. The remainder is divided among the members of the farm. In some cases, the whole of the produce is sold and the money received divided up according to the amount of work done. A strict record of the work performed by each member of the farm is kept, and it is according to this record that the final division is made. Quality counts just as much as quantity. The contract system has been applied in certain cases in order to ensure that there would be sufficient supplies available to the government for State marketing This system also ensures the peasant a higher standard of living than he would otherwise obtain. More up-to-date machinery and implements are granted to those farms contracting, and the transition to collective farming is thus rendered easier. Some idea of the proportion of crops contracted for, in relation to total area sown, is given in the following table :—

Crops.	1928	1929	1930
	per cent.	per cent	per cent.
Summer corn ...	4 3	25·0	30·0
Winter corn ...	14·7	32·7	...
Cotton ...	100 0	100·0	100·0
Flax Fibre ...	20·5	36·8	37·9
Sugar beet ...	100·0	100·0	100·0
Tobacco ...	66·3	74·9	100·0

This system is being applied more generally each year, and production by this method will ev.ntually reach 100 per cent. for every crop. Recently new regulations have been introduced to allow the peasants to retain a larger proportion of this products than formerly, but these will not affect the contracting system.

The status of women on these farms is the same as that of the men. They enjoy as much freedom and their work counts equally. In most villages, creches have been established where the children are well looked after by a trained teacher or nurse, while their mothers are at work in the fields. When the children reach the age of seven, they must attend school. At that age, most of them have learned to read, write and count, and they continue at school until they are fifteen. Under the old system it was very difficult for a peasant to proceed to the University, but that is now changed, and while the student is attending classes, he receives a grant which enables him to live without depending on his parents for everything

In most farms, as in factories the peasents form themselves into "*Shock brigades*", and these vie with one another in producing the best results from their labours. These "*Shock brigades*" generally set themselves a definite piece of work and then strive to get it done as quickly and efficiently as possible. Their rewards are more spiritual than material. If a brigade is highly successful in its work, it may gain a Red Banner, which is a much coveted award. Individual members may be awarded the Order of Lenin, but this is given only after long service with the party. Sometimes members of the "Shock Brigades" receive gifts in kind, and the writer was present at a distribution of such awards when t ese included an overcoat a pair of boots a primus stove, a samovar and so on.

An interesting series of figures was given by Jakovlev in 1931 for the distribution of collective farms in relation to three of the main regions of the country.

Percentage of collectivised farmers to Total Number of peasents.

Region.	1928 per cent.	1929 per cent.	1930 per cent.
North Caucusus, Lower and Middle Volga and the Ukrainean Steppes.	3·5	7·4	48·8
The rest of grain producing areas.	1·6	4·0	25·5
The consuming regions	0·5	1·5	8·5

The figures for 1931 show still further increases. The explanation of the large difference is easy to find. The peasants in the vicinity of large towns find it more profitable to remain outside the collective sector and to sell their produce in the open markets in these towns. In the other regions they have not the same facilities, and therefore it is much easier to get them to collectivise. Of course, the first and second regions being the chief grain regions, the government paid special attention to the collectivisation of these districts. There is difficulty in forming large farms in the north owing to the occurrance of great tracts of forest and peat bogs. Very little attempt is made to cultivate the peat, but it is largely used as fuel, since in the north, especially in the Leningrad region, there are no coal deposits of any importance. To compensate for the lack of coal, however, the north has very extensive mineral phosphate deposits, which are used to supply the large phosphate deficiency found in all the northern soils. The main crops in the north are flax, oats and rye. Attempts are now being made to concentrate around the large towns market gardens, which up to the present have been scattered over a fairly large area.

The transition to modern farming methods has thus been going on with varying degrees of success since 1917. During the period of civil war the area under crop decreased by about 20 per cent and did not reach the pre-war level again until 1925. During the last few years, however, the grain output of the country has increased enormously, as can be seen from the following figures. Two sets are given, one for the collective farms and one for State farms.

Year	State Farms.	Collective Farms.
1927 ...	...	2·0 mill. cwt.
1928	6·4 mill. cwt.	3·6 ,,
1929	7·9 ,,	12·7 ,,
1930	18·0 ,,	82·0 ,,

Figures for 1931 are not available, but the increase in production certainly would be continued, as a much larger area was under crop. The expected yield would not, however, be obtained owing to the fact that weather conditions were most unfavourable to cereals during the whole growing season.

To conclude this brief account of agricultural conditions in Russia, a few notes on agricultural science may be added. Agricultural science in Russia may be said to date from the 18th century, but in most branches the contributions of Russian scientists were very meagre until the 19th century. During that century the possibilities of expansion in the agricultural markets gave science the necessary impetus, and towards the end of the century we find the Russian scientific men coming into their own. The study of the soil as a natural body was the chief contribution from Russia. In 1883 Dokuchaiev issued his monumental work on the Russian Black Earth, and the principles which he laid down in that work have become the foundation stones of the modern study of the soil. The practical aspects of the problem were not ignored, but the Russians felt that a thorough study of the actual processes of soil formation would give in the end a more complete picture of the conditions obtaining in the soil and hence a surer basis for rearing the structure of applied soil science or agronomy, as it is now known.

Dokuchaiev had many illustrious pupils, and these in turn carried on the task of making a complete study of the soils of their vast country. Small-scale maps of both the European and Asiatic parts of Russia have been issued, and an attempt is now being made to cover every important part of the country on the scale of 1 inch to the mile. These soil surveys are made the basis of any agricultural expansion and for the introduction of new crops. In other branches of agricultural science, the achievements of the Russian scientists have not been so marked. Since the revolution, the net-work of agricultural experiment stations has been brought into better co-ordination, and all problems are investigated on a co-operative basis. Thus, instead of each station working away independently on its own region, the problems cropping up in that region are attacked by a number of institutes, and thus the final results are far more valuable than if each had pursued a line of work regardless of others. This co-operation is seen in the so-called "complex" expeditions which are sent out by the Academy of Sciences. We may take as an example the expedition sent out to investigate the Salt Lakes of Siberia. It was well-known that the salt content of the lakes was high and that it would prove profitable to work them. However a difficulty at once arose from the fact that in the neighbourhood the soils were so impregnated with salt that cultivation was impossible. Thus to investigate the region properly, there were needed: geologists to study the salt deposits and other rocks in the vicinity; botanists to study the present flora: soil scientists to study the soil and advise on the proper methods for bringing it into a state fit for cultivation; lastly, chemists, to study the methods for extracting the salt. The expedition will return again this year for more detailed study of the region.

Time alone will show how this great experiment is going to work out. Many of the difficulties often appear insuperable, but by whole-hearted co-operation they may be overcome. The general backwardness of the agricultural population has been one of the controlling factors, but by raising the cultural level of the people a higher efficiency should be attained. The people on the whole are in sympathy with the new system, and that means a great deal. A rigorous application of Marxian principles to agriculture has proved impossible, but suitable modifications would appear to have been of great value in ordering the life and work of that vast country:— *Scottish Journal of Agriculture, October, 1932.*

Notes and Comments

(1) **The Mannargudi Agricultural Colony.** We cannot sufficiently congratulate the movers of this laudable scheme of establishing an Agricultural colony for the uplift of the rural population—especially at a time when the agriculturist is in need of some real stimulus in this direction. The scheme appears to be to open an Agricultural colony and to impart practical instructions in the different aspects of agriculture to the population and in this way to educate the agriculturists especially of the surrounding area and carry on rural reconstruction work. The Government also have shown their appreciation of this idea by granting a site of about 200 acres of land near Vadavun about nine miles from Mannargudi, Tanjore District. The prime mover of the whole movement is Rao Saheb S. V. Kanakasabhai Pillai, retired P. W. D. Assistant Engineer. Even while in service Mr. Pillai was carrying on silent and unostentatious work in this direction. He

has as his co-worker and secretary Mr. Ramalingam Pillai who received his training in rural reconstruction work at Marthandam. We had an opportunity of getting some insight into Mr. K. Pillai's enthusiasm and earnestness for this work when he had gone over to Coimbatore in connection with a recent Agricultural conference which was held at Mannargudi at his instance. We also understand that Mr. Pillai is arranging to get the services and co-operation of some retired agricultural officers in this work; we need hardly add that it is the duty of all interested in agriculture to help this scheme in all possible ways; especially is it the duty of all agricultural officers and the Department of Agriculture. We offer our sincere good wishes to Mr. Pillai and hope that his well conceived scheme will be attended with success and benefit the country in various ways.

2. **Protection for Indian Silk Industry.** We invite the attention of our readers to a few extracts we reproduce elsewhere in this issue from a memorandum submitted by the Mysore chamber of commerce to the Indian Tariff Board in connection with the present critical position of the Silk Industry in that state, its national importance, and the consequent need for protection. The chamber has pointed out that owing to the dumping of cheap foreign silk goods especially from Japan and China, the local industry is not likely to develop at all. This foreign competition has seriously affected the silk industry not only of Mysore but of the other parts of India as well. The imports of foreign stuff during the past six years appear to have increased more than 50 per cent. in volume. And to add to this volume the phenomenal decline in the prices of imported silk hits the local manufacturers very seriously. This free dumping of foreign silk will also affect many a poor farmer who is now attempting to earn something extra by having sericulture as a cottage industry. The chamber has made out a very good case for the Indian silk industry and we hope the Tariff Board and the Government may be inclined to view the position favourably and save this ancient industry in India.

3. **Economic Enquiry Scheme.** Our readers will be glad to note that at a meeting of the joint committee of the Indian Central Cotton Committee and the Imperial Council of Agricultural Research held on the 27th January at Karachi, a scheme was agreed to for an economic enquiry into the cost of production of crops in the principal sugarcane and cotton tracts of India at a cost of five lakhs. This is considered the first enquiry of its kind in India for the development of the sugarcane industry, which recently was afforded substantial protection by the Assembly. This enquiry is also expected to show where exactly it is remunerative to extend the area under sugarcane. The Government of India is giving substantial encouragement to the Imperial Council of Agricultural Research by means of a grant which the Council will utilise for this enquiry. The entire cost

of the enquiry is to be borne by the Indian Central Cotton Committee and the Imperial Council of Agricultural Research on a fifty per cent basis. The enquiry is to continue for a period of four years, and embrace seven British Indian Provinces. The enquiry in Madras is to be conducted in six selected villages in each of the districts of Vizagapatam, Bellary and Coimbatore, each village being assigned an investigator and each district a supervisor. The approximate cost, so far as this presidency is concerned is expected to be Rs. 48,000 of which three quarters will be met by the Imperial Council and the remainder by the local Government. Further details are expected to be worked out very soon and the work started with the new official year. Such enquiries regarding the important crops grown in the country and the needs of such crops and of those who cultivate them and the future possibilities are practically overdue and the decision of the joint committee is a welcome decision to all those who have the economic welfare and agricultural prosperity of the country. This is a beginning with the two very important crops Sugar-cane and Cotton and we believe such enquiries may be extended to other crops as well in course of time.

4. **Young men to the Land.** A very interesting communique has been issued by the Government of the United Provinces in connection with the appointment of a committee to investigate the feasibility of employing educated young men on lands. The commuique has raised a series of important points, practically as a sort of questionnaire, which demand elucidation from persons interested in the subjects. The more important items relate to the size and extent of land and the number of men to be employed in such cases, the minimum area that may be alloted to each settler, the actual functions of these men, the nature of the crops to be grown, what cottage industries may be added, the nature of the preliminary training they should have if any, the nature of the supervising agency, the funds for the scheme and the preliminary capital each is expected to equip himself with. Those interested in this problem might send their views on these matters to the United Provinces Government to enable them to come to some definite conclusions. We would draw the attention of our agricultural Graduates and such young men who are anxious to work on the land to this communique. We could wish that such schemes are elaborated by every province and avenues opened up not only for the spread of scientific agriculture but also to relieve the present distress of non-employment among the youth of the country.

5. **Fruit culture in South India.** We have to admit that the aspect of agriculture related to pomology and horticulture has not received as much attention from scientific workers or the Government as the subjects deserve. Excepting some attention paid to the trials in growing some temperate fruits on the hills, practically very little has

been done by the agricultural department till now in the way of carrying on researches with local indigenous fruits like Oranges, Bananas, Grapes, Mangoes, etc. for which nowadays there is a great demand. The public have also begun to realise the value of fruit food and many of our educated men are anxious to get reliable information in these subjects. It is therefore good news to hear that the Government are contemplating to open a fruit Farm for trials of the different local fruits with an idea of improving the local varieties and supplying information and suggestions to fruit growers all over the province. In our opinion an ideal tract for such an experimental station appears to be Rajampet taluk in the Cuddapah District. The soil and other conditions for fruit growing appear to be quite satisfactory and there exist numerous Orange and fruit gardens all over this area. If the Government have not already come to any definite conclusion we would wish that our suggestion may receive due consideration.

6. **The M. Sc. Degree for Graduates in Agriculture.** The Academic Council at its meeting held on the 30th. January has agreed to recommend to the Senate the amendment of the statutes so as to permit B. Sc. Ag's. to proceed for the M. Sc. Degree by Research and also to recognise the research work already being carried on by such candidates, as being of an " approved " nature for purposes of the above Degree. The matter may probably come before the Senate at its next meeting in March and it is hoped that they will accord timely sanction to the recommendation of the Academic Council and thus afford relief to the long delayed claims of the B. Sc. (Ag.) students, several of whom have already begun their work in this direction in anticipation of the Senate's approval.

Gleanings.

Plant Immunity. A very interesting point of view has stimulated the investigations of Dr. A. C. Leeman into plant immunity. It is recognised that antibody production and related phenomena, as they are associated with the animal body, play no direct part in the immunity of the plant. But it is shown that certain extracts and organic substances play a considerable part in stimulating the resistance of plant to attack by a fungus disease. The substances when added to the soil are harmless to the parasite, but become detrimental when taken into a plant and incorporated with its protoplasm. Secretions and extracts of micro-organisms, and various enzymes, have been found to reduce the damage caused by the parasitic fungus *Helminthosporium sativum*. The interaction of micro-organisms has also been studied as a means of disease control.

(*Nature*, No. 3268. Vol. 129.)

Sclerotial Rice Diseases. Investigations by Messrs. Malcolm Park and L. S. Bertus at the Royal Botanical Gardens, Peradeneya, Ceylon, reveal that *Rhizoctonia* (*corticum*) *Solani* not only gives trouble in the potato fields of England, but also causes a disease of rice in Ceylon. It has been found that the ordinary methods of crop rotation are inadequate owing to the longevity of sclerotia in

soil. Experiments are, however, being directed towards finding a specific soil treatment. The other disease investigated is caused by *Sclerotium oryzae*. This occurs in patches in the rice growing areas. Methods of control consist in the burning of the diseased patches at harvest time and in preventing irrigation water from running through a diseased field since it might carry infection. It has also been found possible to grow varieties of rice which are resistant.

(*Trop. Agri.* Vol. IX. No. 12. P. 380.)

A Curious Plantain Tree. A plantain tree, of about 14 inches in height, and about 2 inches in diameter, with a fairly large rhizome has put forth an inflorescence. It is about 4 inches long and about 2 inches broad. All the flowers, however, have all their floral parts just like mature flowers. The tree was found in the flower garden of Mr. Kanakasabai Nattar, Perfumery Merchant, Chidambaram. It is preserved in the Museum of the Botanic Laboratory of the Annamalai University. (*Hindu*, 27—1—'33.)

Soap and Oil Industries in South India. South India enjoys an abundant supply of materials for making soap. The utility of some of these was not generally understood before the Government Soap Institute at Calicut showed how various vegetable oils could be profitably employed. The Institute was started at Tanur 17 years ago by Sir Frederick Nicholson, as a branch of the Fisheries Station. Mr. A. K. Menon, Soap and Oil Expert of the Government, made a fish oil soap as an insecticide which by its quality and cheapness soon attained wide popularity. This soap is now used by agriculturists and planters throughout India to destroy insect pests. The Institute gradually extended its field of research and developed new activities, and is at present marketing various kinds of toilet and industrial soaps. Experts and high officials who have visited the institute, have spoken highly of its pioneer work. The Institute has also carried out experiments in the manufacture of lubricating oils and paints, and is also engaged in work on the deodorisation and hydrogenation of oils. India exports oil seeds amounting to over a million tons annually, and a large portion of the oil extracted returns to India, in the form of fats or refined oils. The Institute at Calicut is devising methods which may be employed by peasants and industrialists for the extraction and utilization of these oils.

(*Chemistry and Industry*, December, 16th, 1932.)

Artificial Production of Rain. The American scientists, Professors Warren and Bancroft, have successfully produced rain in a series of experiments based on the natural process which takes place in the upper atmosphere. Moisture is always present in the upper atmosphere in the form of minute drops so light that they remain in suspension. When particles of dust come in contact with the drops of moisture they are absorbed, thus increasing the weight of drops. As a result of their electric charge (positive or negative) the particles tend to become aggregated into masses too heavy to remain in suspension and then fall as rain. Thus, clouds formed of vapour too light to fall as rain may be artificially weighted by electrically charged dust and immediate rain produced.

Acting on this theory a load of electrically charged sand was dropped from captive balloons on to clouds. Rain fell immediately. Prof. Bancroft calculates that 40 lb. of electrified sand would be sufficient to dissolve into rain 1 square mile of clouds.

In subsequent experiments an aeroplane was used carrying sand with a charge, partly positive and partly negative, of 12,000 volts. The machine rose and disappeared among the clouds while spectators below awaited the miracle, which proved even more dramatic than before. The clouds burst in a violent shower of rain, while at the same time the sky cleared and the sun shone again.

In the Netherlands Prof. Veraat has succeeded in producing rain over an area of about 8 square kilometres by throwing finely divided "dry ice", i. e., solid carbon dioxide, from an aeroplane on the clouds. Similar experiments had been tried previously by various scientists using powedered kaolin, but had not given satisfactory results. Prof. Veraat rose to a height of 2, 500 metres in an aeroplane carrying 1½ tons of "dry ice" and fitted with a special spreading apparatus; he then let the powder fall on the clouds 200 metres below. Abundant rain immediately fell. The experiment was officially controlled by observers in four military aeroplanes.

Prof. Veraat explains the formation of rain by supposing that during the fall from the aeroplane to the clouds the particles of solid carbon dioxide become electrically charged and transformed into microscopic drops of liquid carbon dioxide, which caused condensation in the clouds and consequently a fall of rain. According to Prof. Veraat this method will also make it possible to ensure fine weather when desired. By converting the clouds into rain early in the day he holds that a clear sky may be assured in a given locality for the rest of the day.

(*The Agricultural Gazette* of New South Wales. Vol. xliii. Part ii, November 1, 1932).

New Road Material. A new road paint called "Pintar," a composition evolved from the *chir* tree (*Pinus longifolia*), has been invented at the Forest Research Institute at Dehra Dun, in India. It was subjected to a practical test over a stretch of road, and after 6 months' wear and tear it was found that some portions had stood up very well, whilst others had not given such satisfactory service As the result of further laboratory experiments, an improved composition has been evolved, and the cost of manufacture has been reduced without in any way impairing its properties. This improved "Pintar" is being tested. If it proves to be successful and capable of production at the cost which will allow of its competition with proprietary preparations imported for road painting, not only will a market be made available for all the *chir* tar that can be produced, but employment will also be provided for the inhabitants of Kumaun (in Northern India), where the making of *chir* tar is an important local industry.

(*Bulletin of the Imperial Institute*).

Rice in Austria. Experiments in rice-growing have met with success in Central Europe. Good rice in satisfactory quantities is reported to have been yielded by marshy land in Hungary, and it is now intended to open an experimental area for rice cultivation in a nearby district of Austria. During the coming spring rice is to be grown on the borders of the Neusiedlersee Lak, according to an announcement by the Agricultural Chamber of the Burgenland, a district on the border of Austria and Hungary. The slime in this area contains salt, and is therefore expected to prove suitable for the growing of rice.

("*Statesman*" January 20th, 1933).

ABSTRACTS.

Cost of Milk Production at Lyallpur, Punjab. D. P. Johnston and S. Kartar Singh (*Rural section Publication No. 25 of the Board of Economic Enquiry, Punjab, 1932*). With a view to improve the present unsatisfactory state of the milk supply in certain Punjab towns, where the supply was generally unequal to the demand, highly insanitary conditions prevailed, the marketing left much to be desired, and reliable statistics were absent, the authors have conducted an enquiry into the cost of production of milk under Punjab conditions. To ensure reliability of data, the enquiry was conducted at the Agricultural College Dairy Farm at

Lyallpur with a herd of 50 cattle (21 mature cows, one bull and 28 young stock) all of Montgomery breed, completely stall-fed, the cows yielding on the average about 4000 lbs. milk per year. The enquiry extended over a year from 1st April 1930 to 31st March 1931 and the costs of production were analysed under (a) feed, (b) man labour (c) bullock labour (d) buildings (e) equipment, (f) cow cost, (g) bull cost and (h) miscellaneous. The figures showed that :— (1) on the average, the following quantities of food stuffs were required to produce 100 lbs. of milk,— concentrates 60·54 lbs.; green fodder 413·58 lbs.; *bhusa* 31·56 lbs.; salt 1·48 lbs. (2) The total cost per cow including items (a) to (h) above mentioned, amounted to Rs. 272 out of which feed alone represented about 50 per cent, labour came next with 20 per cent and interest and depreciation on cattle came to about 12 per cent. Deducting the value of the calves and manure, the net cost per cow was Rs. 257. (3) The cost of production per 100 lbs. of milk came to about 98·67 annas; or 0·986 annas per lb. for the whole year; but the monthly costs varied considerably from 82·68 annas in February to 148·85 annas in October. This was chiefly due to variations in total production of milk, which ranged from 4,576 lbs. in October to 9,938 lbs. in March; the cost of production of milk varied inversely as the yield per cow. In the Punjab, under natural conditions, cows generally calve between February and May and hence the supply of milk is greater in summer than in winter. The unit proportions of the different items which go to make up the cost of production per 100 lbs. of milk were :— concentrates 60·54 lbs.; green fodder 413·58 lbs.; *bhusa* 31·56 lbs.; salt 1·48 lbs man labour 2·40 days; and bullock labour 0·30 hours. These proportions, being more or less constant irrespective of market fluctuations of prices and rates paid, it is possible to work out the approximate cost of producing milk at any given time by taking current prices, provided of course that the average production of the herd in question is about 4000 lbs. per cow per annum. (C. N.)

Carbon Dioxide Assimilation of the Leaves of the Rice Plant, (Oryza sativa, L)- Dastur, R. H. and Chinoy, J. J. *(Indian Jour. Agri. Sci. 1932, Vol II Part V, pp. 431–454).* The paper presents results of measurement of the photo-synthetic activity of the leaves of the rice plant, at different stages of growth of the plant, the activity being measured in two ways viz. (1) by determining the carbohydrate contents of the leaves in the mornings and evenings and by difference, estimating the probable amount of carbohydrates photo-synthesised during the day: and (2) by measuring the rate of absorption of carbon dioxide by the leaves from the air under controlled and uniform conditions of experiment. Both methods gave similar results which indicated that there is at first a sudden rise in photosynthetic activity immediately after transplantation (July 22nd to August 1), after which there is a steady level maintained for about a month. In September there is a temporary depression of activity, followed by a steep rise in October, corresponding to the period of flowering. The maximum is reached in 80—90 days after transplanting, after which there is a continuous fall corresponding to the period of senescence. There are thus two periods of maximum photo-synthetic activity, viz., the post-transplantation stage and the stage of flowering. The second maximum is higher than the first; thus at the post-transplantation stage the total carbohydrates, expressed as hexoses, formed 10·75% on the dry weight of leaves, and the amount of carbon-dioxide absorbed per 100 sq. c. m. of leaf area was 0·017 gm., while at the stage of flowering, the total carbohydrates formed 15·2% on the dry matter and carbon-dioxide assimilation per 100 sq. c. m. leaf area was 0·031 gm. Almost all the carbohydrate present in the leaves was in the form of cane sugar, and from observations on the amounts present at different hours of day and night the authors infer that the carbohydrates are translocated from the leaves to the storage tissues in the form of cane sugar. (C. N.)

Nitrogen Recuperation in the Soils of the Bombay Presidency Part II D. L. Sahasrabuddhe and N. V. Kanitar (*Indian Jour. Agri. Sci. 1932, part V, pp. 455—483*). The authors believe that natural nitrogen recuperation (fixation of atmospheric nitrogen by unmanured as well as manured soils) plays an important role in the nitrogen economy of the arid and semi-arid tracts of the Bombay Deccan. In the previous investigations of this series (1925: Mem. Dept. Agri. India, chem. ser. Vol 8. No. 5; and 1931 Indian Jour. Agri. Sci, Vol. 1, p. 631). laboratory pot experiments with different typical soils of the Bombay Presidency, showed definite fixation of nitrogen under favourable conditions of moisture and temperature, and the fixation was increased by additions of lime, phosphatic substances and organic matter. The present experiments report the replication of these experiments on the field scale at the Dry Farm Experiment Station at Manjri near Poona, on clay loam soil of known previous history. Determinations of total nitrogen on composite samples were made once every month from July 1930 till June 1931, (1) in a rectangular unmanured block measuring 3/10 of an acre divided into 12 small bunded areas to prevent run-off of water and kept under careful cultural treatment including frequent harrowing and removal of weeds; one crop of Jowar was grown every year; (2) under the ordinary cultivator's conditions, on 1/10 of an acre divided into four equal plots; the soil was harrowed and stirred a less number of times than in (1) and had a higher density of plant population and also had some weeds; (3) on plots treated as in 1, with this difference that one series of plots in triplicate were kept fallow the previous year, i. e., in 1929, to test the effect of previous fallow on nitrogen recuperation. The rainfall on the area under experiment was mostly precipitated between September and November (13 inches in these 3 months out of a total annual rainfall of about 21 inches); and the maximum air temperature varied from about 26 to 36°C. The effect of manuring on nitrogen recuperation was also studied. The following are among the conclusions arrived at:— (1) The nitrogen content of the soil is not a constant quantity; it fluctuates from month to month, the variations amounting to about 60 to 70 per cent. of the original nitrogen, (2) There is a definite recuperation of nitrogen by the soil both under unmanured and manured conditions, and the recuperation is far more pronounced and continues for a much longer time under field conditions than under laboratory conditions (3) Wetting of the soil by the monsoon rains and the subsequent partial drying and heating during the dry spells of the monsoon seems to be favourable for starting the recuperation process. Moisture, soil temperature and soil aeration, due to the stirring of the soil by harrowing or interculturing, have great influence in changing the nitrogen content of the soil. Addition of organic matter increases also the recuperative power and maintains the nitrogen content at a fairly high level. (4) The maximum peak of nitrogen accumulation is reached in December in unmanured soils and somewhat earlier in manured soils. The maximum is attained at a time when soil moisture is about 20 per cent. and the soil temperature is nearly 30° C. (C. N.)

All India Life Tables. H. P. Choudhuri (*Indian Journal of Med. Research. 1932, vol. 20, pp. 585-598*). The author has compiled and presented in the present paper two sets of Life-tables—one for the Hindu and the other for the Mohomedan male population—with a view to study the mortality rates of these communities in a scientific manner by comparison amongst themselves and with the English people. Previous workers like Baines, Hardy, Auckland, Meikle and others started with the decennial census figures as the basis for their mathematical graduations and actuarial analysis. But the present author considers that the census records are defective and far from satisfactory for mathematical treatment; and has preferred to draw his material from the lives registered with the

Life Insurance Companies, which have been under regular observation and offer satisfactory and accurate material for the construction of a standard Life Table. One draw-back of such a table, however, is that the data are limited only to the well-to-do and literate section of the population, the poor illiterate mass being, as a rule, unable to take advantage of life insurance. As only about 10% of the population of India is literate, the tables presented are not National Life Tables, but Life Tables of a 'Select Class'. From an actuarial analysis of the figures, which are presented in the form of comparative Tables, the author arrives at the following deductions:— (1) The Hindu mortality has decreased in the course of the last 20 years. (2) The Mahomadan mortality is lighter than the Hindus, taking the average for all India. It is heavier up to age 15, in the Punjab and Madras, and up to age 30 in Bengal; it is lighter at all ages in Bombay and United Provinces, from 30 years upwards in Bengal and from 15 years upwards in the Punjab and Madras. The difference however, is only of small magnitude eg. the graduated All-India ratio of probability of living of Mahomedans with that of Hindus, is at age 10, 0·9964; at age 20, 0·9990; at age 30, 1·0005; at age 40, 1·0018; at age 50, 1·0037; at age 60, 1·0060; at age 70, 1·0087; at age 80, 1·0118 etc. (3) The All India Hindu mortality at any age corresponds to the English mortality at an age nine years in excess. (4) In expectation of life, an Indian life is 7 years shorter than that of an Englishman (between ages 20 and 95). (5) One-fourth of the children die before the age of 1 year, and half the population die within the age of 25 years. (6) Average expectation of life at birth is about 30 years. (C. N.)

Drought resistance in relation to the physiology of the Rice plant. J. Onodera (*Proc. Crop Sci. Soc. Japan, 1931: vol. 3 pp. 91—116*). The author has studied the factors underlying drought resistance from the standpoint of rice cultivation and breeding, with special reference to the differences between low-land rice and upland rice varieties. He considers that in the rice plant, the influence of drought is most marked on yields and heights of culm, and hence ratios of yields and heights of culms are good indications of drought resistance. More than one hundred varieties of rice were compared in low-land and upland conditions for 4 years since 1923; characters investigated were, the height of culm, mean weight of panicles, the development of stereome or mechanical tissue in leaves, the osmotic pressure of the cell sap and the transpiration coefficient or water requirement. The data showed:— (1) The up-land rice was not so much influenced by scanty water supply as low-land rice. The ratios of height of culm were longer in upland rice than in low-land rice. (2) The mean weight of panicles of the plants grown with soil moistures of 5, 10, 15 and 20 per cent., showed a distinct difference between up-land and low-land varieties. The decrease of mean weight of panicles owing to the droughty conditions was not so much in up-land rice as in low-land rice. (3) The difference of development of the stereomes in leaf-blades was distinctive of the degree of soil moisture; the less the soil-moisture content, the more the stereomes developed (4) Changes in osmotic pressure of cell sap and of pressed plant juice seemed to be characterised differently in up-land and low-land varieties. Upland rice was not so sensible to a slight decrease of soil moisture in the moistened state, but in the limiting dryness showed remarkable elevation. Low-land rice however, was more sensible to slight decreases of soil-moisture in the moistened state, but at the stage of limiting dryness did not show any remarkable elevation. (5) Cryoscopic determinations of the osmotic pressure of the cell-sap, showed no relation between osmotic pressure and drought resistance. (6) The difference in transpiration coefficients or water requirements between upland and low land varieties, was not statistically significant; the water requirement of upland rice, however, tended to be somewhat lower than that of lowland rice. In both cases, the water requirement was increased by decrease of soil moisture. (7) In regard to yields

per plant in upland and lowland conditions the yields of upland rice were not so much influenced by soil moisture as those of lowland rice, just as in the height of culms. The ratios of yields of upland varieties were larger than those of lowland varieties. (8) The correlation between ratios of yields in the two different conditions and ratios of height of culm in the two different conditions was very distinctive. Correlation coefficient r was $+0{\cdot}7313 \pm 0{\cdot}03576$, and this value indicates that there is close correlation. The author therefore infers that ratios of yields and heights of culms are good indications of drought resistance. (C. N.)

Reviews.

The Open Pan System of White Sugar Manufacture. By R. C. Srivastava (Government of India Central Publication Branch, Calcutta, 1932, Price Rs. 3-2-0 or 5 sh. 6 d.) This timely publication from the pen of R. C. Srivastava, Sugar Technologist to the Imperial Council of Agricultural Research, India, reports a comparative study of two of the popular indigenous (Khandsari) systems of white sugar manufacture in India, viz., the Rohilkhand and the Bhopal Bel systems. The sugar industry in India has, of late, been much in the fore-ground of public attention, and, acting on the recommendations of the Indian Tariff Board, the Government of India have adopted a strong protective tariff policy, in regard to sugar imports, with a view to develop and encourage local manufacture. Though India grows nearly 35·2 million tons of cane, most of it (25·5 million tons) is used in the manufacture of *Gur*, and only a small proportion (about 4·5 million tons) is utilised in the manufacture of white sugar by *Khandsaris* and factories combined. The amount of white sugar produced locally is about 320,000 tons, while the imports amount to over a million tons per year, mostly from Java. Of the 4·5 million tons of cane utilised for white-sugar manufacture, about 3·8 million tons are dealt with by *Khandsaris* (*bel* processes), and only about 0·75 million tons in sugar factories. The efficiency of the factories is undoubtedly high, as shown by the fact that for the small amount of cane handled by them, they have shown a production of 120,000 tons of white sugar, while the *Khandsaris* (bel processes) with their much larger utilization of cane, have produced only about 200,000 tons of white sugar. But for several reasons, including the lack of organised capital, the scattered nature of the sugar cane areas, the inevitable delay in setting up large-scale machinery etc., the number of factories manufacturing white sugar in India, has not shown, in spite of the impetus given by protective tariff, the desired increase during the last few years. It is true that the number has risen from 18 in 1919 to about 30 in 1930 and as many as 20 new factories are in course of construction; but even allowing for a more rapid increase in the number of factories in the next decade, the total capacity of the factories for white sugar production may hardly aggregate to more than about 300,000 tons per year as against the imports of a million tons which may show an increase hereafter, with increasing sugar consumption in the country. As such, the Imperial Council of Agricultural Research have rightly felt that attention could profitably be devoted also to the encouragement and improvement of the local Khandsari (bel) system, which produces even today more white sugar than all the factories put together, and where, on account of the lower capital involved and the small scale of enterprise, a much more rapid increase of production can be expected and practical improvement obtained early enough to render India self-contained in the matter of sugar, within the fifteen year limit proposed by the Imperial Council.

Mr. Srivastava's study of the indigenous *bel* systems, reported in the present publication, though of a preliminary character and extending over a few

months only, has served to show the imperfect nature of even the best of the local systems, like the Rohilkhand and the Bhopal methods, and the great scope for improvement that exists in both these methods. It is of course, not possible within a few months' trial, to suggest workable improvements or radical modifications the incorporation of which may be necessary before the efficiency of the indigenous system can be raised to enable it to compete with factory production. The author has rightly pointed out the necessity for opening a Central *Bel* Research Station in the cane-belt area of Northern India for carrying on a sustained study of the local systems and for obtaining the technical data necessary for improving the plant and process on scientific lines.

As conditions prevail at present, the *b l* system of white sugar manufacture is sorely lacking in efficiency in all its aspects—in the percentage extraction of juice which amounts to only about 60% as compared with 85 to 90% in factories and also in the recovery of the sucrose present in the expressed juice, which amounts to about 50 to 60% as against the 90% obtained in factories. The net result is that only about 6 to 6·5% of the sucrose, present in the cane, is finally recoverd as white sugar even in the best of the *bel* processes, while the average recovery in factories is about 10%. A serious draw-back of the *bel* system which may require early attention, is that during evaporation and concentration the purity of the juice falls from 86% to about 80%, indicating considerable inversion which adversely affects recovery and quality in later stages, while in factories there is always a rise of purity from juice to syrup and massecuite.

The author has, as the result of his comparative studies, given drawings of an improved type of *bel*, which combines several advantages of the present methods, with additional improvements like increased fuel efficiency secured by the provision of a fire-grate, decrease in the number of boiling pans etc, but his suggestions still remain to be tested under actual working conditions. It should be possible, with the help of technical investigations concentrated at a Central Research Station, as suggested by the author, soon to evolve a simple type of plant, combining the open pan and vacuum processes and employing liming and sulphitation, which could be run on a small capital and at the same time be able to produce at competitive prices sugar of better quality than the present average *Khandsari* sugar. C. N.

Bibliography of Tropical Agriculture (International Institute of Agriculture, Rome, price 10 Liras). The International Institute of Agriculture, Rome, has added one more to its list of publications by starting this Bibliography. Until 1930 this bibliography used to appear in the monthly Bulletin of Technical Information of the International Review of Agriculture under the head "documentation". It has been possible to undertake this publication by a donation from the President of the Institute; but its continuance will depend upon its sale sufficient to cover the cost.

The Bibliography deals with all technical publications on crops grown in the tropics. The crops are first classified as Starch and Sugar plants which include all cereals; Oil yielding plants; Beverage plants including coffee, tea, cocoa etc.; Industrial crops; Vegetables; Fruits; Forage crops; Spices; Medicinal plants etc. Under each of the crops dealt with the subjects are classified according to the alphabetical order of the authors, giving in the form of a short abstract the salient feature of each of the publications. The book will form a highly useful reference to all those interested or engaged in Tropical Agriculture and should find a place in all the Agricultural Institutions of the Tropics. K. R.

Crop and Trade Reports.

Sugarcne Crop Report, Madras, 1932, Third or Final Report. On an average of the five years ending 1930–31, the area under sugarcane in the Madras Presidency has represented 3·6 per cent of the total area under sugarcane in India. The figures in this report relate to the sugarcane crop sown in 1932. (Estimates up to the 25th December 1932.) (1) The area planted with sugarcane is estimated at 125,220 acres as against 116,530 acres, the estimate for the previous year. This represents an increase of about 7·5 per cent. The estimate for the previous year was in excess of the final area of 116,105 acres by about 0·4 per cent. (2) The present estimate of area exceeds the second forecast by 8,120 acres. The excess occurs mainly in Vizagapatam, Chittoor, Salem and Coimbatore. (3) The increase in area over the final forecast of 1931 occurs in all districts outside East Godavari, the Deccan, Madura and Ramnad. (4) The harvest has just commenced. Normal yields are expected in all districts outside Kurnool, Chingleput, South Arcot, Trichinopoly, and the South (Tinnevelly excepted), where the yield is expected to be below normal. The crop was affected by heavy rains in Chingleput, South Arcot and Madura. The seasonal factor is calculated at 98 per cent of the average as against 97 per cent in the previous year. On this basis, the yield is estimated at 345,930 tons of jaggery as against 319,430 tons estimated in January 1931. The final estimate for 1931–32 was 323,630 tons. (5) The wholesale price of jaggery per candy of 500 lb. is reported to vary from Rs. 24 to 33. *(From the Board of Revenue, Madras).*

Pepper Crop Final Report, Madras, 1932. (1) The area under pepper in 1932 is estimated at 80,000 acres in Malabar and 7,700 acres in South Kanara against 83,409 acres in Malabar and 7,534 acres in South Kanara in the previous year. (2) The crop in Malabar was affected to some extent by the "Pollu" disease owing to excessive rains in October and November 1932. (3) The seasonal factor is estimated to be 95 per cent in Malabar and normal in South Kanara. On this basis, the yield is expected to be 11,400 tons for Malabar and 1,200 tons for South Kanara or 12,600 tons for the West Coast. This is the same as in the previous year. (4) The present price of pepper varies from Rs. 117 to 125 per candy of 500 lb. against Rs. 160 reported in August 1932. *(From the Board of Revenue, Madras)*

Ginger Crop Final Report Madras 1932. (1) The area under ginger in 1932 is estimated at 10,300 acres in Malabar against 10,635 acres in the previous year. (2) The seasonal factor is estimated to be normal and the crop is expected to yield 3,700 tons of dry ginger against 3,900 tons in the previous year. (3) The price of dry ginger varies from Rs. 34 to 38 per candy of 500 lbs. *(From the Board of Revenue, Madras).*

Ground-nut Crop Report, Madras, 1932, Fourth or Final Report. On an average of the five years ending 1930—31 the area under ground-nut in the Madras Presidency has represented 53·7 per cent of the total area under ground-nut in India. The figures in this report relate to the ground-nut crop sown between January and December 1932. (Estimates up to the 25th December 1932). (1) The area under ground-nut in the Madras Presidency in 1932 is estimated at 3,494,100 acres as against the estimate of 2,707,500 for the previous year. This was in excess of the finally recorded area of 2,635,427 acres by 2·7 per cent. The average area is 3,068,100 acres. (2) The area in 1932 was greater than that in 1931 by 32·6 per cent. The increase was general outside East Godavari, South Arcot, and Malabar and it was due to the rise in price at sowing time. The increase was marked in the Deccan, where the area rose from 1,064,800 acres to 1,559,000 acres. (3) The harvesting of the summer and early crop of ground-nut was finished by October. The harvesting of the winter or main crop is proceeding. (4) The crop

was normal only in the Circars, Coimbatore, the South (Tanjore excepted), and Malabar. The crop was affected by caterpillars in parts of Salem. In the other districts, the crop was to some extent affected by drought during the growing period. In South Arcot, the yield is expected to be specially low, about 75 per cent. of the average. The seasonal factor for the Presidency works out to 93 per cent of the average against 94 per cent. in the previous year. On this basis, the yield is estimated at 1,631,200 tons of unshelled nuts against 1,234,250 tons in the previous year an increase of 32 per cent The yield in an average year is estimated at 1,534,050 tons. (5) The wholesale price of ground-nut, unshelled per candy of 500 lb. is reported to vary from Rs. 20 to 25 in Chittoor and North Arcot and Rs. 15 to 20 in the other districts. As compared with the rates reported in November, the price was stationary in Chingleput, rose in Bellary, Anantapur Chittoor, Salem, Coimbatore and Tinnevelly and fell in the other districts. (*From the Board of Revenue, Madras*).

Gingelly Crop Third Report, Madas, 1932-33. On an average of the five, years ending 1930-31, the area under gingelly in the Madras Presidency has represented 12·5 per cent of the total area under gingelly in India. The figures in this report relate to the gingelly crop sown between April and December 1932. (Estimates up to the 25th December 1932). (1) The area sown with gingelly up to the end of December 1932 is estimated at 634 500 acres as against the estimate of 541,900 acres made for the corresponding period of last year. This shows an increase of about 17 per cent. (2) The increase in area is general in the main tracts in which the crop is grown. It is marked in the Central districts where the area has risen from 153,700 acres to 201,500 acres. (3) The main crop has been harvested except in Trichinopoly and the South. The yield is reported to be normal except in Ganjam, Vizagapatam, South Arcot, Chittoor, North Arcot and Tanjore. (4) The seasonal factor for the Presidency works out to 98 per cent of the average against 97 per cent for the corresponding period of last year. On this basis, the yield is estimated at 83,600 tons as against 70,900 tons for the corresponding period of last year. (5) Gingelly which was selling at 10 to 13 lb. per rupee in November 1932 has slightly fallen in price, the present rates varying from 10 to 15 lb. in most districts. (*From the Board of Revenue, Madras*).

EXTRACTS FROM THE SEASON AND CROP REPORT OF THE MADRAS PRESIDENCY FOR 1931-32 (Fasli 1341).

1. **Classification of area.**—The total area of the Presidency was 91,148,210 acres or 119,330 acres more than in the previous year. This is mainly due to the large difference in Kurnool and to smaller differences in Bellary, Anantapur, Coimbatore, Madura, and Malabar. The matter is under correspondence. Forests constituted 14·6 per cent in the year under review and the area not available for cultivation was 22·5 per cent. The area available for cultivation was 57,299,433 acres of which 19 per cent was fallow, 23 per cent was other cultivable waste, and the rest (58 per cent) was cultivated, viz., 33,495,798 acres. The area cultivated was 36·8 per cent of the total area for the Presidency. The cultivation was the highest in Bellary being 66 per cent and was between 50 and 60 per cent in the districts of West Godavari, Guntur, and Tanjore.

2. **Area irrigated.**—Of the area under cultivation referred to above, 27·5 per cent, viz., 9,204,063 acres was irrigated. This area was 50 per cent and more in the deltas of East Godavari (57), West Godavari (82), Tanjore (73), and in the non-delta, Chingleput (61). Of the total area irrigated, Government canals served 40·5 per cent, private channels 1·6, tanks (Government and private) 37·5, wells 14·6, and other sources as spring channels 5·8 per cent. Besides, wells supplemented other irrigation sources to the extent of 3·6 per cent. Government canals were important in all the deltaic districts, private channels in Ganjam, Vizagapatam,

and East Godavari, tanks in Chingleput (91 per cent). Ramnad (85), North Arcot (70), Chittoor (64), Ganjam (64), Tinnevelly (63), South Arcot (58), and Vizagapatam (55); wells in Coimbatore (79 per cent) and Salem (46), and other sources as spring channels in Ganjam, Vizagapatam, East Godavari, Cuddapah, and Nellore. Canals, tanks, and wells are almost equally important in Madura. Though there are no recognized sources of irrigation on the West Coast, there is some irrigation from *porambake* channels and streams, but figures showing the extent so irrigated are not available.

3. **Crops irrigated.**—The area of crops cultivated was 38,344,577 acres and it exceeded the area of land under cultivation by 4,848,779 acres. The difference is due to the fact that on some lands more than one crop was raised. 29 per cent (viz., 11,184,258 acres) of the area of crops cultivated was irrigated. The percentage of the area of irrigated crops exceeded 50—in Chingleput (68), Tanjore (70), and West Godavari (69). The percentage of irrigated area was the smallest in Salem (17), Guntur (16), Anantapur (10), Kurnool (5), and Bellary (3). Out of the area of crops irrigated, cereals and pulses contributed 90 per cent, oil-seeds (groundnut, gingelly and castor) 2 per cent, and sugarcane 1 per cent. Seventy-two per cent of the extent under paddy was irrigated. The corresponding percentage for other crops irrigated were 43 (ragi), 27 (indigo), 12 (gingelly), 11 (cumbu), 9 (cholam and cotton, mainly Cambodia), and 3 (summer groundnut). The areas under irrigated ragi and indigo were among the lowest reported. Sugarcane was irrigated everywhere except on the West Coast, where it was mainly rain-fed.

4. **Area sown with Crops.**—(38,344,577 acres). Food crops occupied 79 per cent of the total area sown in the Presidency against 78 per cent in the last year and the percentage was the highest reported since 1922-23. Cereals occupied 66 per cent of the total area. The area under non-food crops, mainly groundnut, has been decreasing since 1928-29. Excluding the Nilgiris, the area under food crops was the lowest, ranging from 60 to 70 per cent, in Kurnool, Bellary, and Tinnevelly and the highest, ranging from 83 to 93 per cent, in the Circars (Guntur excepted), Nellore, Chingleput, Chittoor, Salem, Trichinopoly, Tanjore, Madura and South Kanara. Paddy occupied 30 per cent, cholam 13, cumbu 8, groundnut 7, ragi and cotton 6, kora 4, gingelly 2, castor, coconut, and tobacco 1. The area under paddy, blackgram, greengram, condiments and spices, and fruits and vegetables (plantains and mangoes) was the highest or among the highest reported, while the area under cumbu, ragi, samai, and maize, was among the lowest reported. Of the non-food crops, the area under tobacco, tea and fodder crops was the highest or among the highest reported while the area under castor, coconut, and indigo was the lowest or among the lowest reported. The area cultivated with crops was restricted in Ganjam, Anantapur, Cuddapah, South Arcot, the Central districts and the South (Ramnad excepted). The reduction was marked in Coimbatore (-99,656 acres).

5. **Main Crops.**— Marked variations in the area under main crops are noted below:— **Paddy.** (Average 11,169,600 acres; current 11, 537,753 acres).—The increase in area was general outside Ganjam, Vizagapatam, Bellary, Anantapur, Tanjore, Tinnevelly and Malabar. The increase was greatest in Chittoor, North Arcot, and Ramnad. **Cholam.** (Average 4,843,270; current 4,830,678).—There was a large increase in area in Anantapur and Salem and a large reduction in area in Tinnevelly. **Cumbu.** (Average 3.088,100; current 2,877,161).—The area was restricted in all districts outside the Circars, Cuddapah, and Chingleput. The reduction in area was marked in Coimbatore (—89,705 acres). **Ragi.** (Average 2,293,700; current 2,200,674).—There was a reduction in area in all districts outside Vizagapatam, West Godavari, Kistna, Salem, Coimbatore, Trichinopoly, and the West Coast. **Korra.** (Average 1,519,390; current 1,428,839).—This crop occurs mainly in Guntur,

and the Deccan. There was an increase in area in Kurnool and a reduction in other districts. **Varagu.** (Average 1,089,500 ; current 1,118,182).—The area showed an increase in all the districts outside Ganjam, Vizagapatam, Anantapur, Nellore, Chingleput, Coimbatore, and the South. **Samai.** (Average 803,720 ; current 746,833).—There was an increase in area in Vizagapatam, East Godavari, West Godavari, Cuddapah, Salem, Coimbatore, Trichinopoly, and Tinnevelly and a reduction in most of the other districts. **Maize.** (Average 136,470 ; current 110,184).—This crop is important in Guntur, Kistna, and Vizagapatam. There was a reduction in area in the first two districts. **Pulses.** (Average 2,880,330 ; current 3,140,112).—There was an increase in area outside East Godavari, Chingleput, Chittoor, North Arcot, Trichinopoly, and Madura. There was an increase in area under all the pulses except redgram. **Chillies.** (Average 283,750 ; current 330,929).—The increase was almost general. **Sugarcane.** (Average 100,900 ; current 116,105).—The increase occurred in all the districts outside Vizagapatam, Kistna, Trichinopoly, and the West Coast. **Groundnut.** (Average 3,068,100 ; current 2,635,427).—There was an increase in area in Vizagapatam, Kistna, Guntur, Bellary, Anantapur, Ramnad, and Tinnevelly and a reduction in other districts, especially in Chingleput, South Arcot, and the Central districts. **Gingelly.** (Average 799,630 ; current 747,053).—The area was restricted in all the districts outside Vizagapatam, Bellary, Anantapur, Chingleput, Chittoor, Trichinopoly, and Ramnad. **Castor.** (Average 327,140 ; current 330,106). **Cotton.** (Average 2,411,670 ; current 2,204,506).—The reduction in area was general outside Bellary and was due mainly to the fall in price. **Indigo.** (Average 49,720 ; current 37,239). **Tobacco.** (Average 270,550 ; current 268,815).

6. **Trade.** The volume of trade in the year under review was less than that in the previous year. Exports declined from 43·03 crores to 35·5 crores and imports from 44·39 crores to 35·49 crores. The decline was due mainly to world trade depression and fall in prices and partly to the political situation. The general level in the rates of import duty rose from 15 per cent. to 25 per cent. at the end of September 1931.

Foreign Imports. Imports of rice and paddy amounted to 23,935 tons from Indo-China, and 2,292 tons from Siam. Imports of leaf tobacco from the United States of America rose from 11·05 lakhs of lb., to 14·95 lakhs of lb. There was a great fall in imports of cigarettes owing to local manufactures. Imports of sugar declined from 88,296 tons to 79,120 tons; a noteworthy and new source of supply was Southern Russia which supplied 5,113 tons. The imports of rice and flour machinery fell from 2·98 lakhs to 1·86 lakhs and agricultural machinery from 1·09 lakhs to 0·62 lakh while imports of sugar machinery rose from 0·13 lakh to 1·03 lakhs. Two thousand four hundred and twenty-two tons of raw cotton were imported from America. Imports of cotton twist and yarn fell from 7 million lb. to 6·6 millions ; China was the main supplier of grey yarn while United Kingdom held the predominant position in other varieties. Imports of manures fell from Rs. 32·48 lakhs to Rs. 15·93 lakhs chiefly due to the reduced purchasing power of the ryots. Imports of soaps mainly from the United Kingdom fell from Rs. 23·11 lakhs to Rs. 15·52 lakhs ; three-quarters of the quantity imported being "household and laundry" and the rest toilet soap.

Foreign Exports. Shipments of groundnuts increased by 8 per cent in quantity ; nearly half was exported from the Madras Port. Exports of raw cotton fell from 21,167 tons to 12,264 tons due to the increased demand by the Indian mills for Madras cottons. Belgium took the largest quantity (4,541 tons) followed by China (1,934 tons), France (1,424 tons), and Japan (1,382 tons). The exports of pepper and chillies were slightly greater than in the previous year in quantity, but the value was less. Ceylon practically consumed all the chillies. Ceylon imported 2,354 tons of paddy and 56,587 tons of rice as against 4,368 tons of paddy

and 101,659 tons of rice in the previous year. The United Kingdom was the principal consumer of tea to the extent of Rs. 368·02 lakhs. Exports of coffee declined from Rs. 188·35 lakhs to Rs. 92·92 lakhs due to very poor harvest and over-stock in foreign markets as a result of very large shipments in the previous year; France was the best customer closely followed by the United Kingdom. Exports of oil-cakes mainly to Ceylon increased from 21·31 lakhs to 26·82 lakhs; Ceylon was the sole importer of gingelly cakes to the extent of 11,806 tons. There was a decline in the exports of tobacco by 9 per cent in quantity and 12 per cent in value; the United Kingdom was the chief consumer of raw tobacco. Shipments of castor fell from 41,279 tons to 33,407 tons. Exports of rubber declined from Rs. 99 71 lakhs to Rs. 29 91 lakhs due to the abnormal fall in prices; the United Kingdom and Ceylon were the chief buyers of raw rubber.

A SHORT ACCOUNT OF THE TOUR OF CLASS II STUDENTS OF THE AGRICULTURAL COLLEGE, COIMBATORE.

BY C. BALASUBRAMANIAN, *Student, Class II.*

The second year students left on the 4th January on a tour to the Ceded Districts, accompanied by Messrs. H Shiva Rao, B. Sc., E. K. Nambiar, L. Ag., and M. Satyanarayana, B. A., B. Sc. Ag. The route chosen being through Bangalore. advantage was taken of a day's stay there to visit the "Indian Institute of Science" and the "Hebbal School" and the Farm attached to the latter. At the Institute, Dr. Subramaniam, Professor of Bio-Chemistry very kindly explained the methods of disposal of sewage, activiated sludge process and septic tank process, obtaining at the Institute. At the Hebbal Farm, Dr. V. K. Badami, L. Ag, Ph. D. showed us round the newly started Serum Institute, the manurial, cultural, varietal and other experiments on paddy and sugarcane conducted on the farm, and the sheep-run where experiments are in progress to improve the quality and quantity of wool produced.

Three delightful days were spent at the next halt Hagari—where Mr. C. Vijayaraghavan, Farm Manager, led us round the farm and explained the numerous experiments including the newly started experiments on 'Conservation of soil moisture' in a very lucid manner. The museum attached to the Research Station with its interesting collection of Ceded Districts implements, renowned and very efficient, at the same time very simple and indigenous, afforded an instructive study. Yet another interesting day was spent at Hagari in the company of Mr. K. Sanjiva Shetty, Agricultural Demonstrator, in visiting the neighbouring villages, where we learnt the methods of cultivation of paddy in wet lands adopted by the villagers. We elicited from a representative ryot, statistical information about the economics of the Ceded District ryot.

At Hospet Mr. T. Krishna Reddi, the Agricultural Demonstrator, gave us all the particulars about the cultivation of oranges, lime, mango, and grapevine and the work he had done in that direction advocating to local ryots such methods as root-pruning for grape-vine and shoot-pruning for citrus. We were led by Mr. Reddi to certain extremely alkaline patches of land and were given an exhaustive and clear idea of the methods adopted for reclamation of alkali lands. The party then visited the farm house of Mr. A. Ranganatha Mudaliar, (Ex-Development Minister) who has given practical evidence of his keen interest in agricultural and horticultural practices by maintaining a good fruit garden himself.

On 10th Januury the party proceeded to Hampi to see the old irrigation works and also to learn about the method of cultivation of sugarcane adopted by ryots

there, and incidentally availed of the opportunity to visit also the ruins of the old Vijayanagar kingdom.

Leaving Hospet on 11th January and passing through Bangalore on 12th, Hosur was the place of next visit. Here the students saw the different breeds of sheep, cattle and pigs and acquainted themselves with several varieties of useful fodder grasses grown on the pastures.

The party visited the "Imperial Institute of Dairying and Animal Nutrition," Bangalore, the next day, where pasteurisation of milk was demonstrated. The students also acquainted themselves with the breeding experiments in progress wherein wild breeds from Kathiawar are attempted to be domesticated and turned to lucrative purposes.

At the Lal Bagh gardens, Mr. M. K. Sitarama Chetti, the Assistant Superintendent, demonstrated to the party the method of propagation of roses by budding, and of apples by grafting and showed some rare specimens of the gardens such as "Queen-Pine," many scented plants, etc. He also showed an uncommon tree known as '*Ficus kistna*' the leaf of which is cup-shaped and laid stress upon the fact that in the whole of India only two or three such trees are found and that much religious significance is attached to them. He explained very clearly the methods of fruit preservation pointing out that the process is easy and does not involve much capital expenditure and therefore could be tried by several people both as a hobby and also as a commercial enterprise.

The party wound up the stay at Bangalore by playing a hockey match against the Central College. We ungrudgingly acknowledge our defeat by a big margin of 7 goals in nine as they were certainly much superior to us.

In conclusion we offer our heart-felt thanks and gratitude to all those gentlemen, who rendered us great help and enabled us to bring the tour to a successful termination.

College News and Notes.

The Victory Cup. The annual interclass tournament in hockey, football and cricket provided more than passing interest. In hockey, class II were the favourites, but class I by clever team work defeated them and subsequently registered another win over class III to whose credit it may be said that despite the absence of some of their regulars, they put up a strenuous fight. In cricket, class I fielded what was on paper the strongest team but were fully extended by class III for whom Varadarajan played a great game both with bat and ball. Class I were expected to have an easy walk over class II and annex the cup. However, their encounter proved most interesting and at times thrilling in that class II sprang a great surprise on their stronger rivals by dismissing them for 31 runs and in their turn making a paltry lead of 4 runs on the first innings. Class I woke up too late and though their opening batsmen easily registered a century without loss and declared, try as they might they could not run through their opponents' side within time. Ananda was the hero of the day, for besides being deadly with the ball in the first innings, he virtually carried his side on his shoulders was top scorer in both innings. Class II narrowly managed to beat the clock and avenged their defeat in hockey. In football, class III upheld their reputation and won convincingly over the other two classes. Thus for the first time in the history of this tournament the honours were even.

Krishnamurthi Rao Memorial Tournament. The intertutorial hockey tournament run on the league system was keenly contested and was eventually won by Mr P. V. Ramiah's Wards.

Olympics. Our College was represented at the Coimbatore Olympic Sports recently organised by the Coimbatore Athletic Association and which is open to institutions as well as private individuals in the districts of Coimbatore, Salem, Nilgiris, Malabar and S. Kanara. Student Bennet Massilamony of class II won the individual championship medal for the best all round athlete by snatching first places in Pole vault and Javelin throw and the second place in 100 yards dash.

Indian Officers' Association. The Agricultural section of the I. O. A. entertained Rao Bahadur C. Tadulingam at a garden party held in the Botanical Garden in honour of the title recently conferred on him.

Our Flying Director. The Agricultural colony was delighted to hear the news that our popular Director, Mr. S. V. Ramamurti, I. C. S. recently made a *flying visit* to Hosur on an inspection tour and returned to Madras by air, this being the first instance of any officer in the Province and perhaps in the whole of India to travel by air on official tours.

Students' Club. Under the auspices of the Students' Club, Mr. K. S. Vydhyanatha Iyer, Professor of English at the Victoria College, Palghat, delivered an address to the students and staff on " The saving grace of your profession ".

A games tour. Following the lead of the College cricket team, a combined team of hockey, soccer and tennis players went on a weekend tour during February and played a series of matches at Calicut. In hockey, our team drew with the Bharat eleven but lost to St. Joseph's European High School by one goal. In football we met the Malabar Christian College, the strongest combination in Calicut, and lost by one goal, but in tennis, we won both doubles and singles matches against the same institution. The tour was thoroughly enjoyed and it is hoped that the precedent set up this year will be followed in the future.

Research Council. It is understood that at the instance of the Director of Agriculture, a Research Council consisting of the heads of research sections in the Institute was formed recently. At a meeting of the Council Dr. T. V. Ramakrishna Ayyar and K. Ramiah were elected President and Secretary respectively. The function of the Council appears to be to discuss the programme of work of the various sections and to co-ordinate the research done at the Institute.

Poona Agricultural College Commission. On the invitation of the Bombay University Rao Bahadur C. Tadulingam visited the Poona Agricultural College as a member of the University Commission of Inspection.

Visitors. Among distinguished visitors who came to the College recently were the Raja of Kangundi and Mr. Francis, Cane Farm Superintendent of Messrs. Parry & Co., Nellikuppam.

The Association of Economic Biologists, Coimbatore. The annual meeting of the association came off on 17th January afternoon. After the usual tea and group photograph the members adjourned for the business meeting. The annual report presented to the general body showed an all round progress, first in the increased strength of the members and secondly under finance there being a net balance of nearly Rs. 200. The question of the association publishing its proceedings either on its own separately or in the Madras Agricultural Journal was discussed and for want of time it was decided to continue the discussion at a special meeting to be convened later for the purpose. The following members were then elected for the various offices for 1933.

President. Mr. G. N. Rangaswamy Ayyangar. *Vice-President.* Mr N. L. Dutt. *Secretary,* Mr. K. Ramiah. *Committee members.* Rao Bahadur T. S. Venkatraman and Dr. T. V. Ramakrishna Ayyar. Mr. M. A. Sankarier was re-elected the auditor for 1933.

Later in the evening Mr. S. Sundararaman, the retiring president gave his address on " The Progress of Mycological Research in Madras ". In the address

which was illustrated by slides, he gave a brief outline of the several investigations that had been undertaken and solved successfully by the mycological section. He cited as instances the following diseases, Budrot in palmyra, *Koleroga* in arecanut, Red rot in sugarcane, mildew in grape vines, bleeding disease in coconut palm, Smuts on Cholam etc. He also gave details about the investigations that were in progress on *piricularia* in rice, mosaic disease in sugarcane etc. He finally stressed the importance of plant pathology to crop-breeders and the necessity for the evolution of disease resistant forms of crops as the damage caused to crops by some of the diseases was often several times greater than the degree of improvement sought to be obtained by breeders by selection and breeding alone.

With a vote of thanks to Mr. Sundararaman proposed by the President the meeting terminated.

The fieldmen Association of the Madras Agricultural Department. At a General Body Meeting of the above Association—which was founded in the year 1930, for promoting the welfare of the Fieldmen of the Madras Agricultural Department,—the following executive was formed for the current year:—*President*: Dr. J. S. Patel, Oil Seeds Specialist. *Secretary*: S. Srinivasan, Fieldman, Millet Section. *Assistant Secretary & Treasurer*: K. Raghavan, Fieldman, Indian Central Cotton Committee and a Committee of four members.

The Association takes this opportunity to thank Dr. J. S. Patel, for accepting to be its President.

On 8—1—1933, the Association was 'At Home' to M.R.Ry. Rao Bahadur C. Tadulingam Mudaliar, Avl., to express its felicitation on the conferment of the New year honour on him.

. . . The Secretary appeals to all mofussil fieldmen, who have not yet joined the Association, to remember the proverb 'Union is Strength' and to enroll themselves as members as early as possible. He will also be glad to receive any suggestion or proposals regarding the Association.

An Appeal to Sympathisers.

Mr. K. T. Alwa writes: The unexpected and sad news of the death of late Mr. M. K. Nambiar, Asst. Director of Agriculture, Madura, has caused considerable sorrow among his friends and admirers. It is the desire of some of his friends that the memory of such a noble soul should be kept alive and they have written to me that I should appeal to you on their behalf for support. Being in close touch with the late Mr. Nambiar for nearly 25 years as a class-mate, co-worker and a friend, I undertake this as my bounden duty with the full hope that you associate yourself with this humble yet noble cause of showing our appreciation of the good qualities of a man who is no more with us today, but his simplicity, honesty, nobility, sincerity, ability to guide juniors and capacity to follow the superiors are characters which he has left behind. His fragile constitution was no hindrance for hard work stimulated with the burning desire to do his utmost in whatever position he was placed. The greater part of his service was spent at Taliparamba in working up the Agricultural Middle School which unfortunately did not survive the experimental stage, but records and surroundings of the school will reveal his labours. Though of a shy disposition with inherent dislike for lime-light, yet he was a loving friend, kind master and a faithful subordinate on whom one could rely for sound advice, able guidance, and devoted service. He was a man of clear thinking and was clean in his thoughts and deeds. Such a man had a premature and sorrowful death, away from his home without the tender look and nursing of his loving family and friends. He stood for duty and died for it.

Sir, now it is our duty to show our appreciation of his good qualities by contributing our mite to the humble memorial we have in veiw. If you are in sympathy with our humble effort, please send your contribution to Mr. E. K. Govindan Nambiar, Agricultural Demonstrator, Tellicherry, who will thankfully acknowledge the amount.

Weather Review.

Weather Report for the Research Institute Observatory :

January 1933 Report No. 1/33.

Absolute maximum in shade	...	...	89·5
Absolute minimum in shade	...	...	58·5
Mean maximum in shade	...	...	85·6
Departure from normal ...	...	...	– 0·5
Mean minimum in shade	...	...	63·7
Departure from normal ...	...	...	– 0·9
Total rainfall in month ...	...	...	nil.
Departure from normal ...	...	...	– 0·84"
Mean daily wind velocity	...	...	2·00 M. P. H.
Mean 8 hours wind velocity	...	...	3·00 M. P. H.
Mean humidity at 8 hrs. ...	...	...	71·6 %
Total hours of bright sunshine	...	...	254·5
Mean daily hours of bright sunshine		...	8·2

General weather conditions : The weather was generally fine and dry throughout the month. Both day and night temperatures were below normal during the first half of the month when typical winter conditions prevailed. Temperature rose to above normal during the second half during the day but continued low at night.

The weather was dominated by anticyclonic conditions to the north of the area which determined northerly winds.

P. V. R. & T. S. L.

Departmental Notifications.

I Circle. G. Sitharamasastri, A. D. Vijayanagaram, extension of l. a. p. on m. c. for 20 days from 3—2—33. A Rammohan, A. D., Rajahmundry extension of leave on m. c. for 1 month from 21—1—33. **II Circle.** M. V. N. Sastri, A. A. D., l. a. p. for 8 days from 3—1—33. Y. Venkateswara Rao, A. A. D. Bapatla, l. a. p. for 6 weeks from 11—1—33 on m. c. P. Gopalratnam, cotton Assistant, Guntur, extension of l. a. p. from 22—1—33 to 11—2—33. **III Circle.** K. Hanumantha Rao, A .A. D Rajampet, extension of l. a. p. for 2 days on 13th and 14th January 1933. S. Muthuswami Iyer is put in charge of the Exhibition Vans Unit 1, touring in the Bellary District for two months from 28—1—33. K. Balaji Rao, A. A. D, Tadpatri, will be in additional charge of Gooty sub-circle for two months. **IV Circle.** *Transfers.* K.V. Natesa Iyer, A. D. Kallakurichi to Cuddalore sub-circle, and K. B. Vydeeswara Iyer, A. D. Cuddalore to Kallakurichi sub-circle. R. Narasimha Iyer A. A. D. in Mycology, extension of l. a. p. for one month and 9 days from 23—12—32 in continuation of l. a. p. already granted. **V Circle.** S. Mahadeva Iyer, A. D. Ariyalur, l. a. p. for one month from 18—1—33. **VII Circle.** B. Narasimha Pattathan, A. A. D. Coondapore, l. a. p. for 18 days from 14—1—33 to 31—1—33 with permission to prefix 12th and 13th January. **VIII Circle.** M. Subramania Pillai, A. D. Tiruppur,

extension of l. a. p. for 14 days from 3—2—33 to 16—2—33. D. S. Subrahmania Iyer, A. D. in charge of vans, l. a. p. for 15 days from 27—1—33. **G. M's Section.** D. Marudarajan, Assistant, l. a. p. for one month from 20—1—33 **O.S. S's Section.** A. P. Balakrishna Nair, F. M. Pilicode, l. a. p. for 15 days from 25—1—33. T Gopalan Nair, F. M. Nileshwar No. iii, extension of l. a. p. for one month in continuation of leave already granted. **P. S's. Section.** S. Dharmalingam Mudaliar, Assistant l. a. p. for 21 days from 1—2—33. M. K. Padmanaban, Assistant, l. a. p. for 4 days from 3—1—33 to 6—1—33 and l. a. p. on m. c. from 7th to 11th January 33 with permission to prefix Xmas and New year holidays from 28th December 1932 to 2nd January 33 and to suffix Pongal holidays on 12th and 13th January '33. **D. A's Office Orders.** *Promotions:* U. Vittal Rao, F. M., A. R. S. Samalkota, from II to I grade. T. R. Venkaswami Rao, A. D. Tiruvallur from iii to ii Grade. M. Sanyasi Raju, Bacteriology Assistant, Research Institute, Coimbatore, on leave out of India is permitted to return to duty cancelling the unexpired portion of his leave. T. S. Lakshmanan, now offg. as Assistant, Chemistry section Vice Sanyasi Raju on leave, will from the date of the latter's return to duty, officiate as Assistant in the Chemistry section Vice M. Suryanarayana, on other duty displacing K. Veerabhadra Rao. A. Chinnathambi Pillai, Upper subordinate Agricultural section, extension of l. a. p. for one month and 7 days from 23—12—32 to 29—1—33 and leave on half average pay for 2 months and 2 days in continuation thereof. R. Anandapadmanabha Pillai, Upper subordinate, whose officiating appointment will cease on the 2nd February, will continue to officiate till 31st March '33 Vice A. Chinnathambi Pillai. **Gazette Notifications.** Mr. S. R. Venkatakrishna Mudaliar, Asst. Mycologist, Extension of l a. p. for 3 months from 4—2—33. Mr. K. M. Thomas, Upper Subordinate, Mycology section to act as Asst. Mycologist for 3 months from 4—2—33.

ADDITIONS TO THE LIBRARY DURING NOVEMBER 1932.

A. Books.

1.	Economic Ivestigations in the Hyderabad State 1929-30.	*Kesava Ayyangar, S.*	
	— Vol. II—Nanded District	,,	1932
2.	— ,, III—Warangal ,,	,,	,,
3.	— ,, IV—Aurangabad ,,	,,	,,
4.	— ,, V—Raichur ,,	,,	,,
5.	Pyrheliometers and Pyrheliometric Measurements —(U. S. A. Weather Bureau Circular)	*Kimball, H. H.*	,,
6.	Some Aspects of Plant Nutrition (Society of Biological Chemists, India, Publication)	*Viswanath, B.*	,,
7.	Indian Culture through the Ages—Vol. II—Public Life & Political Institutions	*Venkateswara, S.V.*	,,
8	Telugu Equivalents of English Terms in Natural Science	*Madras Govt. Publication.*	,,
9.	Village Officers' and Ryots' Manual	,,	1931.
10.	Madras District Gazetteers—Statistical Appendix for South Arcot District—Vol. II.	,,	1932.
11.	Do. for Salem District Vol. II.	,,	,,

B. Reports.

1. Annual Report of the National Institute for Research in Dairying for 1931.
2. Annual Report of Agri. Dept. Uganda Protectorate for 1931. 3. Do. for St.

Kitts-Nevis for 1931. 4. Do. for Agri. Exp. Stn. Arkansas 1931—32. 5. Do. for Hawaii 1931—32. 6. Do. for Missouri 1929—30. 7. Do. for New York 1930—31. 8. Do. for Wisconsin „

C. Bulletins and other Publications.

Dairy Cattle in India. K. J. V. Naidu. 1927. Fodder Crops in India. Do. 1927. Entomological Investigations on the Spike-Disease of Sandal (Santalum Album Linn.) Part I—An Introductory Survey of the Problem. *Indian Forest Records.* Vol. XVII, Pt. 1. Immature Stages of Indian Coleoptera (11) (Playtypodidae Do. III. The Problem of Pure Teak Plantation *Indian Forest Bulletin* No. 78. Calorific Values of Some Indian Woods. 79. Trials with Pedigree Strains of Herbage Grasses:— (1) Yield & Palatability, (2) Influence of Nitrogen Manures & (3) Variations in the weight of Sheep *Wales Plant Breeding Station Bulletin*—Series H, No. 13. An Economic Survey of Agriculture in the Eastern Counties of England, 1931 *Cambridge Univ. Agri. Dept. Farm Econ. Branch* Report No. 19 Bee-Keeping (Revised Edn. 1932) *Mini. Agri. & Fish Bull.* No. 9. "Potato Sickness" and the Welworm Heterodera Schachti. *Imp. Bur. Agri. Parasitology*—Notes and Memoranda No. 6. The Durability of Paper—Report of the Special Committee (For Library reference) *Library Association Publication.* Soil Physics in Relation to Meteorology. *By Dr. B. A. Keen.* Insect Pests & Fungus Diseases of Cyprus and their Control. *Cyprus Agri. Dept. Bull.* No 3. The Tobacco Growers' Hand Book by T. Selwyn "*Dawn*" *Manufacturing Co., Publication.* The Relation between External Body Characters and Annual Egg Production. *Union of S. Africa Bull.* No. 110. Aspects of Rainfall in the Western Cape Province: A basis of Geographical and Agricultural Study. *Pretoria Univ. Series* 1 No. 22. The Grasslands of South Africa—Problems and Possibilities. Do. 23. Biology and Control of the Corn Leaf Aphid with Special Reference to the South-western States. *U. S. A. Agri. Dept. Tech. Bull.* No 306. Strength of Light I—Beams (A Report) *Illinois Eng. Exp. Stn. Bull.* No. 241. Experiments with Lime, Fertilizers, and Varieties of Field Crops in the Cotton and Peanut Section of Virginia. *Virg. Agri. Exp. Stn. Bull.* No. 284. Membership Relations in Community Organisations A Study of Factors affecting Organisational Attitudes. *Virginia Agri. Exp. Stn. Bull.* 287.

Hawaii Agl Expt Stn. Bulletins: No. 62. Physical Properties of Hawaii Soils with Special reference to the Colloidal Fraction. No. 63. Physicochemical Properties of Edible-Canna and Potato Starches. The Pigeon Pea (Cajanus Indicus) its Improvement, Culture and Utilization in Hawaii. 83. Fifty-year Index to Personnel and Publications of the Ohio Agricultural Experiment Station. *Ohio. Agri. Exp. Stn. Bull.* No. 501.

Iowa Agl. Expt. Station Bulletins: No. 290. The Ages of Breeding Cattle and the Possibilities of Using Proven Sires. No. 292. The Uses of Water Bowls in the Dairy Barn. No. 293. The Peppers. No. 294. An Economic Study of the Hog Enterprise.

New Jersey Agl. Expt. Stn. Bulletin: No. 515. The Milk Supply of the New Jersey Metropolitan Market No. 540. Annual Hay Crops. No. 541. Fertilizer Materials and Mixed Fertilizers. No. 542. Farm Profits and Factors Influencing Farm Profits on 98 Dairy Farms in Sussex County.

Florida Agl. Expt. Stn. Bulletins: No. 243. Type, Variety, Maturity and Physiological Anatomy of Citrus Fruits as Affecting Quality of Prepared Citrus Juices. No. 244. Diseases of Peppers in Florida. No. 245. Farmers' Co-operative Associations in Florida. 1. Status & Legal Phases.

Louisiana Agl. Expt. Stn. Bulletins: No. 204. Report of the North Louisiana Experiment Station for the years 1928–1929. No. 205. Report of the Rice Experiment Station for the years 1928–1929. No. 206. Report of the Fruit and Truck

Experiment Station for the years 1928–1929. No, 207. Cotton Varieties for Louisiana—A Preliminary Report. No. 208. The Agricultural Credit Situation in Louisiana. No. 209. Management of Farm Woodlands in Louisiana. No. 210. Louisiana Corn Varieties. No. 211. Sugarcane Variety Work at the Test Fields. No. 212. Factors Influencing the Severity of the Root Rot Troubles of Sugarcane. No. 213. Blackberry and Muscadine Grape Culture at Hammond, Louisiana. No. 214. Damage by the Rice Water Weevil proved negligible. No. 215. An Economic Study of Factors affecting Farm Organisation and Power Utilization of Sugar Cane Farms, 1929 No. 216. Rice Farm Irrigation Systems in Louisiana, 1929 No. 217. Some Economic Problems in the Rice Farming Area, 1929. No. 218. Tractors and Trucks on Louisiana Rice Farms, 1929 (With Supplementary Data on Labour requirements). No. 219. Financing Production and Marketing of Louisiana Strawberries and suggested Reorganisation. No. 221. Cotton Price-quality Relationships in Local Markets of Louisiana. No. 222. Soil Fertility Investigations Sugarcane Districts of Louisiana. No. 223. Studies on Sugarcane Roots. No. 224. The Organization and Financial Returns of 129 Small Sized Louisiana Cane Farms, 1930. No. 225. Control of Strawberry Leaf Blights in Louisiana. No. 226. Part I—Sugarcane Variety Test Fields, Part II—Sugarcane Variety Report 1930–31.

Cornell University Agl. Expt. Stn. Bulletins: No. 532. Production and Marketing of Field Beans in New York. No. 580. Geneva, A Greenhouse Cucumber that develops Fruit without Pollination. No. 582. The Rosy Aphid in Relation to Spray Practices in 1929. No. 583. Responses to Light of the Bud Moth and Leaf Roller. No. 584. Commercially Prepared Infant Foods. No 585. Straining Milk on the Farm. No. 586. Combating Damping-off of Tomatoes by Seed Treatment. No. 587. The Quality of Packet Vegetable Seed on Sale in New York in 1929 and 1930. No. 588. Filberts No. 589. A New Method for Enzymic Clarification of Unfermented Apple Juice No. 590. Cucumber Disease Investigations on Long Island. No. 591 How the Cream Layer Forms on Milk. No. 592. Spraying and Dusting Experiments with Potatoes on Long Island. No. 593. The Creaming of Raw Milk. No. 594. Composition and Cost of Commercial Fertilizers in the New York from 1913 to 1930. No. 595. Sauerkraut. No. 596. Some effects on Legumes in Relation to Economic Crop Production. No. 597. Vegetable Seed Treatment. No. 598. The Propagation of Multiflora Rootstocks for Roses by Soft Wood Cuttings. No. 599 The Response of Apples, Cherries and Roses to Fertilizer Applications in the Nursery. No 600. Control of Hibernating Caterpillars of the Eye-Spotted Bud Moth in Apple Orchards. No. 601. Virus Disease Control Experiments in Black Raspberry Plantings in 1931. No. 602. Legume Inoculant Test in 1931. No 603 The European Corn Borer in Western New York. No 604. Recent Investigations on the Control of Apple Scab in the Hudson Valley. No. 605. Sampling Milk for Fat Test at Milk Plants. No. 606. Apple Insects in the Hudson Valley and the Lake Champlain Fruit Districts. No. 607. Grafting American Grapes on Vigorous Stocks. No. 608. The Quality of Vegetable Seeds on Sale in New York in 1931. No. 609. Summer Treatments for the Control of the Eye-Spotted Bud-Moth. No. 610. Dust Treatments of Cut Potato Seed. No. 611. Spray and Other Deposits on Fruits. No. 612. Sterilization of Dairy Farm Utensils with Dry Heat.

Cornell University Agl. Expt. Station Memoirs. No. 139. An Analysis of the Characters of the Inflorescence of the Fruiting Habit of Some Varieties of Greenhouse Tomatoes. No. 141. Multiple Correlation Analysis as Applied to Farm-Management Research.

Missouri University Publications: Agl Expt. Stn Research Bulletins: No. 129. The Effect of the Amount and Nature of Exchangeable Cations on the Structure of a Colloidal Clay. No. 131. A Classification of Soy Beans. No. 132. Legume

Bacteria with reference to Light and Longevity. No. 138. Apple Pollination Investigations. No. 140. The Anatomy of the Mammary Gland of Cattle, I, Embryonic Development. No. 141. Growth and Development with Special Reference to Domestic Animals.

Extension Bulletin: No. 214. Why Build a Silo ?—And How.

University Agl. Expt. Station Bulletins: No. 274. Selecting the Dairy Sire. No. 275. Care, Feeding and Management of the Dairy Sire. No. 277. The Co-operative Marketing of Fruits and Vegetables on the St. Louis Market. No. 279. Time of Harvesting Soy Beans in Relation to Soil Improvement and Protein Content of the Hay. No. 281. Feeding Dairy Cattle. No. 282. Legume-Inoculation. No. 283. Fruit Pollination.

D. Leaflets, Circulars, etc.

Madras Agrl. Dept. Leaflets: No. 40. The Swarming Caterpillar of Paddy (Telugu Edn). No. 41. The Rice Bug. No. 45. Early Sowing of Cambodia Cotton (Tamil Edn). No. 47. Note on the Cashew Cultivation.

Ministry of Agriculture and Fisheries Publications: Leaflet 324. Buttermilk Cheese.

Advisory Leaflets: No. 5. Potato Scab. No. 140. Cleanliness in Dairying. No. 141. Caerphilly Cheese. No. 142. Cheshire Cheese. No. 148. Foot and Mouth Disease.

New Jersey Agl. Expt. Stn. Circulars: No. 225. An Agricultural Policy and Program for New Jersey. No. 229. Blueberry Culture. No. 241. Diseases of Roses. No. 249. The Winter-Time Management of the Laying Flock. No. 258. Dahlias in the Garden. Sultana Cultivation in Cyprus. *Cyprus Gazette Agri. Supp. No. 52.*

E. Bibliographies.

Ministry of Agriculture and Fisheries (England) Publications: Agricultural Meteorological Scheme—Bibliography of Literature on Agricultural Meteorology—Section I, Subject Index. Section II, Extracts and Summaries. Sections III & IV, Author's Index and Key to Abbreviations.