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Editorial

Food Problem at the ECAFE Conference.

Ootacamund was the venue of an international Conference from the 1st to the 12th of June 1948, when the United Nations Economic Commission of Asia and Far East held their third session there. The food problem of the countries in this region was discussed both at the plenary session and in the meetings of the committee set up for the purpose. We understand that a note on the subject of agricultural requisites such as tools, implements, machinery, fertilisers and insecticides, which had been submitted by the Food and Agricultural Organisation, was circulated with the remarks of the Executive Secretary of the *ECAFE*. The need was pointed out for an investigation of the actual requirements of each country in the *ECAFE* region, of the extent to which they can be produced at home or supplied from other countries in the region or imported from outside. It was resolved to appoint a working party of expert investigators in consultation with the F. A. O. and to call for an early report

We are not sure whether tractors and other agricultural machinery, manufactured mostly in the western countries, the United Kingdom and U. S. A. in particular – would be made available to the countries in the East in preference to countries in Europe which are to work under the Marshal plan. When they are made available, they can be of little use on most of our holdings, which are petty and fragmented and full of bunds. They would be of great use, however, in the reclamation of cultivable wastes and deepening of tanks and utilisation of the silt. We have however, little data regarding the extent of cultivable waste in this country, which could be profitably utilised. An enquiry on this would be more pertinent at present Again chemical fertilisers might push up production for a while; but their abuse by peasant population should be guarded against They must be used along with organic manures,

particularly green leaves for paddy fields, which should be encouraged by the Government of each country. In this country there is a appreciation of oil-cakes, whose supply is far short of the demand and therefore all oil seeds should be crushed in the country itself and oil alone permitted to be exported, retaining the cake for use as manure in the country.

An appeal was made by rice-importing countries, principally India, China and Ceylon, to rice-exporting countries like Burma, Siam and Indo-china to lower the prices of rice to reasonable levels in the interest of masses of consumers. The example of the International Wheat Agreement, by which prices of wheat were brought down to 200 per cent of prewar levels, was quoted. The exporting countries contended that prices of rice alone could not be lowered when the prices of agricultural and domestic requisites were soaring higher and that most of the producers were petty holders whose cost of production was high unlike in the case of wheat producers who had large farms. They had no objection to the reduction of prices of rice if other prices were also brought down. This really meant that the problem of inflation should also be tackled. It strikes us that the present food deficit problem and the price problem should be tackled more urgently by each country or by bilateral agreements between countries, leaving to international investigation and action the long range plans to meet the needs of the growing population in future.

A Note on 'Single-vine' Selection in Cucumber.

(*Cucumis sativus*)

By

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On analogy with the large scale improvements that were possible by selection, from natural and hybrid populations in self-fertilised crop plants, it would appear that such a method may also be fruitful in cross-fertilised crops. The results obtained in some of the cross-fertilised crops, like maize and lucerne have showed the value of selection methods in improving them. A standard method for these cross-fertilised crops does not however appear to be feasible as it is found that the effects of continuous self and cross fertilisations are sometimes good and sometimes bad. Hence the methods of improvement in cross-fertilised crops will depend upon the crop in question. On the West Coast gourds are one of the vegetables extensively grown as summer crops and sometimes as monsoon crops. At the Agricultural Research Station, Pattambi, studies are in progress on these vegetables and the present note deals with the studies of 'Vine—to—Vine' selection made on cucumber at the Station.

The cucumber is strictly monoecious and a certain amount of cross fertilisation should therefore be expected. Gabaev (1932) is of the opinion that all the three lines of work, viz., mass selection, single-plant selection and hybridisation could be used for the improvement of this crop. Preliminary observations at Pattambi indicate that there is no loss of vigour by continuous selfing for two generations. While Whitaker and Jagger (1937) concluded that hybrid vigour did not occur in any of the cucurbits, Hutchinson (1938) in cucumber and Curtis (1939) in squash have observed marked hybrid vigour. Studies on heterosis are also being continued at the Agricultural Research Station, Pattambi.

From samples of cucumber seeds collected in the locality 250 pits consisting of about 1000 vines were sown in February 1945 at the Agricultural Research Station, Pattambi. From the shape of fruits it is seen that two distinct types of cucumber are present in this collection. One variety is long and another more or less round giving an appearance of a triangular prism with three edges. The fruits have the following average dimensions.

	Average length.	Average width.	L/B
Long	32·1 ± 0·53 cm.	11·4 ± 0·11 cm.	2·8
Round	17·0 ± 0 51 cm.	16·5 ± 0·67 cm.	1·1

These shapes are found to breed true and the hybrids between them usually have an intermediate shape. A 'vine to vine' study was made for

the total number and weight of fruits per vine. Seed from those vines which gave high weight of fruit per vine and which were pure for the shape of fruit, was gathered and in February, 1946 seed of the individual cultures was sown separately, each culture having about 30 vines. As some natural crossing is inevitable between round and long shapes growing together one or two fruits with hybrid shapes were found occasionally. All the vines in that row which showed variations in fruit shapes were rejected for seed purposes and fruits were selected for seed purposes only from vines in rows which were uniform in fruit shape. A similar study for the total number and weight of fruits of each culture was made that season also and on the basis of these studies 16 cultures were carried forward. In February, 1947 these cultures were repeated thrice with 25 vines for each replication. They were harvested separately and the weights recorded.

The correlation of parent and progeny with regard to total weight of fruit per vine was calculated for the two years and the results are given below :—

Year	No. of pairs	Mean Wt. of progeny Oz	Mean Wt. of progeny Oz	Total correlation 'r' between parent and progeny	Significant 'r' P = 0·05
1946	22	92	161 5	0·77	0·423
1946	16	151·0	259·0	0 53	0·497

It is seen that the correlation in each year is positive and significant. It may therefore be concluded that pure line selection in cucumber is effective in evolving high yielding strains. The results of the yield trials also showed that the selection improves the yield as it was found that six cultures are well above the general mean in yield.

References.

1939. Curtis, L. C. — Quoted by Hayes and Immer 'Methods of plant breeding'. McGraw — Hill Book Co, N. Y.

1932. Gabaev, S. G. — Cucumbers. (In Russian) Imperial Bureau of plant Genetics 635·63. (Translation Summary.)

1938. Hutchinson, A. E
1937. Whitaker and Jagger — Quoted by Hayes and Immer 'Methods of plant breeding'.

Summary.

A vine to vine selection was made in cucumber *(Cucumis sativus)* at the Agricultural Research Station Pattambi and the yield trials with these cultures disclosed the superiority of some of them for yield of fruit.

Early Growth in Rice varieties in relation to their Duration and response to growth-substances

By

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A good deal of attention has been devoted in recent years to the inter-relations that exist in a number of crop plants between differences in the early growth and the subsequent growth behaviour of these plants. (Thimann and Lone, 1938; Sinnott, 1939; Van Overbeek, 1935; Kaiser and Albaum 1938). The last two workers were able to find a close relation in the case of oats, between the early growth and the subsequent flowering behaviour. An early-flowering variety (*Fulghum*) was found to have in the early stages of growth a slower rate of root growth than a late-flowering type *Black Norway*. The two varieties differed also in their response to different concentrations of the growth-promoting substance *B*-indole acetic acid. The late-flowering type *Black Norway* showed a more rapid shoot growth when treated with concentrations of ·002 mg./litre to 2·0 mg./ litre, while the early-flowering type *Fulghum* remained unaffected. A similar relation was observed in two other varieties of oats as well and the authors concluded that if such a relation was found to be general, it could be made to serve as a valuable index of flowering time.

In the course of certain studies on vernalisation that were taken up at Coimbatore on rice the need was felt for a method of predicting the probable duration of pretreated seed as compared to the controls. With this aim, an investigation was started on three rice varieties in each of three duration groups snort, (100 days); medium (150 days) and long duration (200 days and over) to see how far they differed in the growth-rates of root and shoots in the early seedling stages, under the action of different concentrationd of the auxin, B-indole acetic acid.

Material and Methods: The method adopted for carrying out growth measurements on rice seedlings over a period of five or six days was as follows:— About 10 gms. of disinfected seed of nine varieties viz., Adt 3, Co. 21 and PTB 10 in the short duration group, SLO 16, Adt. 10 and GEB 24 in the medium group and AKP 5, SLO 18 and MTU 7 in the long-duration group were taken in petri dishes, soaked in distilled water and germinated for 24 hours in an incubator at 30° C. Fifteen germinated seeds from each variety were then picked and carefully mounted on filter paper sheets using a suitable mixture of melted paraffin wax and vaseline to keep them in place. The paper with the mounted seeds was then rolled and inserted into tall cylindrical jars (500 cc. measuring

cylinders were convenient for this purpose) containing 100 cc. of different concentrations namely, 0, 0·05, 0·5, 5; 10, 20 and 50 parts per million of B-indole acetic acid in distilled water. Care was taken to see that the mounted seeds were all in a line at the same height from the liquid level; and also to see that the seeds were so oriented as to ensure the roots growing vertically downwards and the shoots upwards, so as to avoid errors due to measuring across the curved surface of the cylindrical jars. The jars were then covered to prevent loss by evaporation and kept in a light-proof chamber. Under such conditions the seedlings continued their growth and repeated measurements could be made through the glass without difficulty and without disturbing the seedlings. The length of the longest root was taken as a measure of root growth (*Lane 1936*). Shoot measurements were taken from the point of emergence from the grain to the coleoptile tip. All figures are averages of ten plants. Final measurements on the length of shoot and number of roots were made at the end of seven days after removing the plants from the cylinders.

The stock auxin solution was prepared by dissolving *B*-indole acetic acid in distilled water with slight heating. The concenerations employed ranged from 0·05 p.p.m. upto 50 parts per million and were obtained by diluting the stock solution.

Results: *Root growth*: The normal growth of roots in the three duration groups under the conditions of the experiments is represented in the control column in Table I. It will be observed that short duration types have on the average a more rapid rate of growth than the medium and long-duration types.

The average rate of growth (final length of the longest root divided by the growth period) is 0·677 mm./hr. for the short duration varieties while it is 0·629 mm./hr. and 0 662 mm./hr. in the medium and long duration varieties.

Shoot: The normal growth measurement on the length of young shoot (mesocotyl plus coleoptile) in the three groups is shown in Table II, control column. Here too, the average rate of growth in 120 hours is seen to be higher in short duration varieties (0·388 mm./hr.) than in the medium and long duration groups where it is 0·257 mm./hr. and 0·347 mm./hr. respectively.

Effect of auxin treatment: *Root length*: The data are presented in full in table I and in fig. 1 for typical concentrations of ·05 p.p.m. control, 10 p.p.m. and 50 p.p.m. of auxin, for the sake of clarity. It will be noted that in all the three groups the lower concentrations of auxin especially ·05 and ·5 p.p.m., stimulate root growth while higher concentrations of 10, 20 and 50 parts per million depress growth. This point is brought out more clearly when the values are expressed as percentages of the control against time, as in Table I (a).

Fig.1. Effect of Indole-acetic acid on Root-growth in Rice Varieties

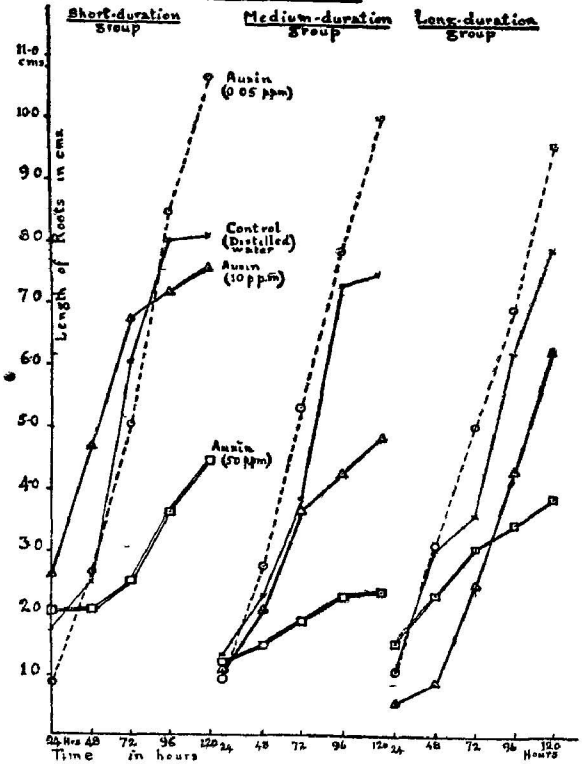
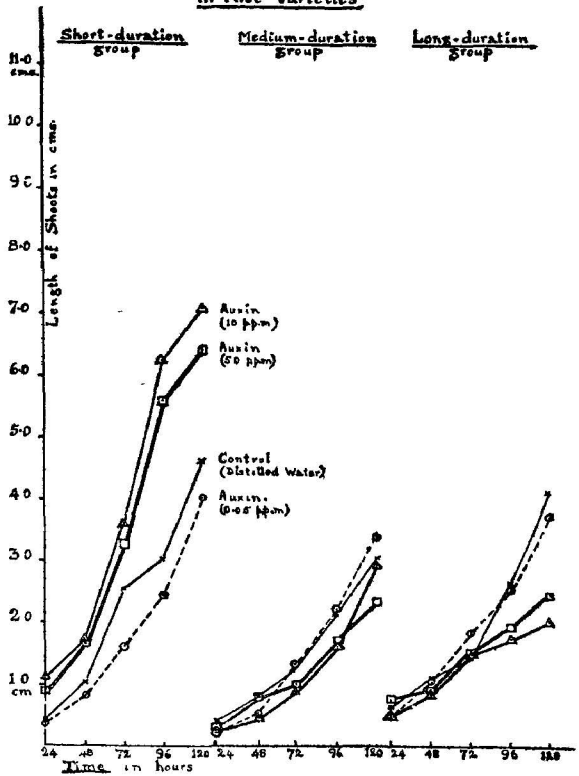


Fig.2. Effect of Indole-acetic acid on Shoot-growth in Rice Varieties



LONDON RECEPTION TO INDIAN SCIENTIST

A largely attended reception was held at India House, London, to meet the Indian Scientist Sir C. V. Raman who is now on a short visit to the United Kingdom. Sir C. V. Raman at India House.

This effect on Rice is in line with that observed in oats (Kaiser and Albaum) that exceedingly low concentrations of auxins were stimulating while higher concentrations inhibited root growth. When expressed as percentages, it would be clear that root growth in the short duration group, is less than in control up to 72 hours, at a concentration of 0·05 p.p.m., of auxin, but later on, i. e. after 96 hours. it exceeds the control by nearly 32% at the end of 120 hours. A similar effect is noticeable with the next higher concentrations also, but the increase over control at the end of 120 hours, is only 26% with 0·5 p.p.m. and 16% with 5 p.p.m. of auxin.

With still higher concentrations of 10, 20 and 50 parts per million the effect in the short duration group is to have an initial stimulation of root growth up to 24 hours, after which it is progressively depressed, the growth at the end of 120 hours relative to the controls, being only 95%, 51% and 55% respectively.

A closely similar trend, is noticeable in the medium and long duration groups also.

(b) *Root Number*: The number of roots possessed by the three groups at the end of 168 hours after germination when growing in distilled water and in different concentrations of indole acetic acid is shown in Table III. It will be noted that under normal conditions, the long duration types put forth a larger number of roots than short and medium types. With added auxins the root number is increased in short duration types, by 10 parts per million of indole acetic acid and reduced by higher concentrations of 20 and 50 p.p.m. In the medium duration group, the number of roots is less than in control, with low concentrations of auxin, viz., 0·05 and 0.5 parts per million and is more or less the same as in control with higher concentrations. In the long duration group, the root number is unaffected by 0·05 p.p.m. but thereafter seems to get depressed by higher concentrations, 10 parts of auxin per million in particular showing the greatest reduction in the average number of roots.

Shoot Length: Table II gives the results of applying B-indole acetic acid in solution through the roots on the shoot length in the three duration groups and the same is shown graphically in figure 2. Under normal conditions the average rate of shoot growth appears to be higher in short duration types than in medium and long duration types. With the addition of indole-acetic acid, the shoot-growth is stimulated, to a very marked extent in the short group by 10, 20 and 50 p.p.m. whereas the same concentrations show no such increase in the case of the other two groups. Lower concentrations of 0·05, 0·5 and 5 p.p.m. appear to have if at all, only a slight depressant effect in the short group and an ill-defined fluctuating effect in the medium and long duration groups.

Discussion: The results obtained with rice are similar in certain respects to those observed in oats by Kaiser and Albaum (1939) and in oats and wheat by Thimann and Lane (1938) but are markedly different in some others. Thus Kaiser and Albaum found that low concentrations of auxin from ·002 mg./litre to 2·0 mg./litre, stimulated root length and higher concentrations inhibited it in the late flowering oat variety *Black Norway*, whereas no such effect was shown in the early variety *Fulghum*. In rice however all the three duration groups early, medium and late showed stimulations of root length by low concentrations of auxin, from ·05 to 5 mg./litre. The relative degree of stimulation also was more or less the same in all the three groups being 31·8% in short. 32·3% in medium and 40·9% in the long-duration group, with a concentration of ·05 mg./litre of indole acetic acid. The response in rice to higher concentrations of 10, 20 and 50 mg./litre was however the same as in oats being progressively inhibited with both time and concentration of auxin.

In respect to Root number, Kaiser and Albaum observed a larger of roots under normal conditions in the early variety Fulghum that in the late variety Black Norway, but in rice it is the late varieties that are found to have a larger number of roots normally than the early and medium varieties. Under the effect of 10 p.p.m. of auxin, the early group in rice produced a larger number of roots than the control, the medium group had the same number both in auxin and in distilled water, while seedlings of the long-duration group had a much smaller number of roots in 10 p.p.m. auxin solution than in distilled water. At higher concentrations of 20 and 50 p.p.m. the average root number was depressed in the short group, remained unchanged in medium and was increased in the long-duration group. A somewhat similar effect has been reported by Thimann and Lane (1938) in oats and wheat, that high concentrations up to 100 mg./litre of auxin, increased the root number but as they studied only a single variety in each crop it is not possible to say whether the response would have been the same with other varieties of different durations. The effect noted on root number in rice would seem to indicate that the longer duration varieties have a lower rate of intrinsic auxin production than short-duration varieties, as in the case of the two oat varieties tested by Kaiser and Albaum, but the effects observed on root length and shoot growth do not bear out such an assumption.

In the case shoot-growth in particular, the effects on rice are the opposite of those reported for oats. In rice the shoot-growth is very markedly stimulated in short-duration varieties by 10 p.p.m. of indole-acetic acid and also by higher concentrations of 20 and 50 p.p.m. In medium and long duration groups, the shoot-growth is depressed by the same concentrations. With oats on the other hand, the late variety showed a more rapid growth when treated with auxin concentrations from 002 to 2·0 mg./litre, while the early variety remained unaffected.

Further study on these as well as other varieties of rice is obviously needed before the differences in response could be explained on a rational basis. For the present it is sufficient to note that the method appears to offer a possible way of judging the duration of a particular variety by testing its response in root and shoot growth to different strengths of growth-promoting chemicals. A more detailed study is being undertaken to verify and collate the observations noted above.

Summary.

A simple method is described for carrying out growth-measurements on rice seedlings over a period of five or six days, based upon a similar study on oats by Kaiser and Albaum (1939). The differences in response of rice varieties of short, medium and long durations, when grown in water and in various concentrations of β-indole acetic acid, are presented and discussed.

Root growth under normal conditions is more rapid in the short duration varieties than in the medium or long duration varieties. With the addition of indole-acetic acid, the root-growth is depressed by low concentrations upto 72 hours and stimulated thereafter. The lowest concentration of auxin, used namely 0·05 mgms./litre showed the highest percentage of increase. Higher concentrations of 10, 25 and 50 mgms./litre stimulate root-growth only upto 24 hours, after that they show a progressive depression with time. This response is common to all the three duration grougs so far tested in paddy.

In *root number* the short and medium duration groups are similar and show a smaller number of roots than long duration varieties. Under the action of indole-acetic acid, the root number is increased in short duration varieties by 10 p.p.m. but depressed by 50 p.p.m. Medium varieties show a decrease in root number by low concentrations of 0·05 and 0·5 p.p m. while in the long duration varieties, the root number is depressed by all concentrations higher than 0 05 ppm. of indole acetic acid.

Shoot growth: Short duration varieties when grown in distilled water have a higher rate of growth than medium and long duration varieties. With indole-acetic acid the short group shows a marked stimulation of growth at 10, 20 and 50 p.p.m. while the response in the other two groups is not very regular or well-defined.

The method would seem to offer a possibility of judging the duration of varieties by testing their early root and shoot growth in different concentrations of growth-promoting substances.

Acknowledgment: The authors are very much indebted to Mr. P. D. Karunakar, M. Sc. (Rutgers), A. R. I. C., Government Agricultural Chemist, for affording all facilities for carrying out this study and for his kind encouragement and helpful suggestions.

TABLE No I.

Effect of Indole-acetic acid on Rice roots

Hours	Adt 3, PTB 10, Co, 21. Short Duration							SLO 16, Adt 10, GEB 24. Medium Duration							AKP 5, SLO 18, MTU 7, Long Duration.						
	D. W. Control.	·05 ppp.	·5 ppm.	5 ppm.	10 ppm.	20 ppm.	50 ppm.	D. W. Control.	·05 ppm.	·5 ppm.	5·0 ppm.	10 ppm.	20 ppm.	50 ppm.	D.W. Control.	·05 ppm.	.5 ppm.	5 ppm.	10 ppm.	20 ppm.	50 ppm.
								(a) Average lengths (cms.) :—													
24	1.77	0·91	0·93	1·09	2·60	0·99	2·01	1·37	0·96	1·05	1·13	1·11	1·17	1·15	1·19	1·11	1.09	0·96	0·57	2·08	1·53
48	2·52	2·64	2·91	2·99	4·69	2·56	2·02	2·31	2·78	2·50	2·98	2·07	1·30	1·50	3·03	3·13	3·09	2·29	0·90	2·85	2·30
72	6·09	5·08	5·50	3·85	6·78	3·03	2·54	3·84	5·35	4·64	3·52	3·68	2·64	1·89	3·62	5·06	4·83	3·85	2·47	3·61	3·08
96	8·03	8·53	8·09	8·22	7·20	3·58	3·65	7·39	7·92	6·79	7·52	4·28	3·39	2·26	6·23	6·98	6·57	5·41	4·38	3·71	3·48
120	8·12	10·70	10·22	9·44	7·60	4·14	4·49	7·55	10·09	8·57	8·49	4·89	3·48	2·37	7·94	9·60	8·89	6·31	6·29	3·81	3·88
								(b) As percentage on control :—													
24	... 51·4	52·5	61·6	146·9	55·9	113·5		...	70·0	76·6	82·5	80·9	85·4	83·9	...	93·3	91·6	80 7	47·9	174·9	128·3
48	... 77·2	82·7	83·4	133·2	72·7	57·4		...	120·3	108·2	129·0	89·6	56·3	64·9	...	103·3	100·9	75·6	29·7	94·0	75·9
72	... 83·4	90·3	63·2	111·3	49·7	46·6		...	139·3	120·8	91·6	95·8	68·7	49·2	...	139·8	133·4	106·3	68·2	99·8	85·1
96	... 106·2	100·7	102·3	87·1	44·5	45·4		...	107·1	91·9	101·7	59·2	45·8	30·6	...	112·0	105·4	86·8	70·2	59·5	55·8
120	... 131·8	125·7	116·2	93·6	50·9	55·3		...	132·3	113·5	112·4	67·2	46·1	31·3	...	140·9	114·9	79·5	79·2	47·9	48·8

TABLE No II.

Effect of Indole-acetic acid on Rice shoots:

Hours	Adt 3, PTB 10, Co, 21. Short Duration							SLO 16, Adt 10, GEB 24 Medium Duration							AKP 5, SLO 18. MTU 7 Long Duration.						
	D W. Control.	05 ppm.	5 0 ppm.	0·5 ppm	10·0 ppm	20·0 ppm.	50 0 ppm,	D. W Control.	·05 ppm.	·5 ppm,	5 0 ppm.	10 ppm	20 ppm	50 ppm.	D W. Control	·05 ppm.	·5 ppm.	5 ppm.	10 ppm.	20 ppm	50 ppm.
								(a) Average lengths (cms.) :—													
24	0·41	0·38	0 18	0·36	1 12	0·32	0·93	0·40	0·20	0·33	0·33	0·23	0·43	0·27	0·62	0·49	0·45	0·55	0·50	0·74	0 76
48	1·08	0 81	0 62	0 81	1·76	1 80	1·69	0 82	0·55	0 56	0 93	0·48	0 86	0·80	1 16	1·12	0·91	1 08	0·84	0 95	0 91
72	2·55	1·62	1·43	1 64	3 61	2·84	3·30	1·28	1·38	1·12	1·44	0·92	1·16	1 01	1·41	1·85	1 57	1·38	1 48	1·54	1·49
96	3·09	2 46	2 25	2 59	6·29	3·85	5·62	2·18	2·21	1 68	1·85	1·62	1·86	1·74	2·65	2·57	2·23	2 09	1 77	2·44	1·97
120	4 65	4 08	3 72	4 13	7·11	5·43	6 42	3 08	3 42	2·56	2 89	2·95	2·69	2·32	4 16	3·74	3·41	3·19	2·02	2.63	2 44
								(b) As percentage on control :—													
24	...	92·6	43·9	87·8	273·1	78·0	226·8	...	50·0	82·5	82·5	57·5	107·5	67·5	...	79·0	72·5	88·7	80·6	119.3	122·6
28	...	75·0	57·4	75·0	162·9	166·7	156·5	...	67·1	68·3	113·4	58·5	104·9	97·5	...	96·6	78·8	93·1	72·2	81·9	78·8
72	...	63·5	56·0	64·3	145·5	111·3	129·4	...	107·8	87·5	112·5	71·9	90·6	78·9	....	131·2	111·3	97·9	104·9	109·2	105·6
96	...	79·6	72·8	83·8	203·5	124 6	181·9	...	101·4	77·1	84·8	74·3	85·3	79·8	...	96·9	84·2	78·8	66.8	92·1	74·3
20	...	87·7	80·0	88·8	152·9	116·9	135·9	...	111·0	83·1	93·8	95·8	87·3	75·3	...	89·9	81·9	76·7	48·5	63·2	38.6

TABLE III.

Effect of Auxin Concentrations on Root-Number in Rice.

(Counted at the end of 168 hours after germination and expressed as mean of 10 plants).

	Short.	Medium.	Long.
Distilled water (Control) ...	44	41	64
Auxin :			
0·05 mgms. per litre ...	39	29	63
0·50 mgms. per litre ...	40	20	49
5·00 mgms. per litre ...	46	38	50
10·00 mgms. per litre ...	62	42	35
20·00 mgms. per litre ...	48	49	38
50·00 mgms. per litre ...	36	41	42

References.

1. Kaiser S. and Albaum H. G. (1939): Early root and shoot growth in two varieties of *Avena sativa* in relation to growth substances. Amer. Jour. of Bot. *26*, 749-754.
2. Lane R. H. (1936): The inhibition of roots by growth hormone. Amer. Jour. of Bot. *23*, 532-5.
3. Marmer D. (1937): Growth of wheat seedlings in solutions containing chemical growth-substances. Amer. Jour. of Bot. *24*. 139-45.
4. Overbeek J. Van. (1935): The growth-hormone and the dwarf type of growth in corn. Proc. National Acad. Sci., *21*, 292-299.
5. Sinnott E. W. (1939): A developmental analysis of the relation between cell size and fruit size in cucurbits. Amer. Jour. of Bot. *26*, 179-189.
6. Thimann K. V. and Lane R. H. (1938): After effects of the treatment of seed with auxin. Amer. Jour. of Bot. *25* 535—543.

Note:— *B* represents Beta.

A Note on the Cattle and Pastures of the Anamalais

By

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Object of the survey: The work was undertaken at the instance of the District Veterinary Officer, Coimbatore with a view to survey the Anamalai hill cattle, the pasture lands and fodder facilities available and to suggest ways and means of further improvement of the cattle. The survey was confined mainly to the estates which are members of the Anamalai Hill Cattle Society.

Geographical Position etc., of the Anamalais: The hills of the Anamalais figure as a great wall to the south of Pollachi with towering peaks ranging from 6,000 to 8,000 feet. The hills are in several ranges but are divided roughly into the upper and lower ranges. The latter consist of undulating country lying at an elevation of 3,000 to 4,500 feet above mean sea level, while the former (the upper ranges) are noted for their scenery and the numerous rugged peaks which rise to a height of about 8,000 feet. The rainfall is rather heavy varying from 100 to 160 inches annually as detailed below —

Annual Average Rainfall in Some of the Estates in Anamalais.

S. No.	Name of Estate.	Rainfall inches.
1.	Monica	118·6
2.	Injiparai	123·4
3.	Nallacathu	123·6
4.	Sirukundra	122·4
5	Mukkothumudi	150·2
6.	Thaymudi	134·0
7	Anaimudi	146 5
8.	Thonimudi	139 6
9.	Gajamudi	141·3
10.	Valparai	128 8
11.	Mudis	140·1
12.	Iyerpadi	121·3
13.	Lower paralai	124 0
14.	Upper paralai	126 6
15.	Water fall	116·4

Soil Condition and Fodder Position: There are about 29 estates comprising The Anamalai Hill Cattle Society with an aggregate of about 3000 head of cattle and about 2500 acres of grazing area. This works out

on an average to 83 cents per head, but actually it is less than half an acre in many of the estates. About 40 Scindhi breeding bulls are stationed on the Anamalais for grading up purposes. The cattles are half-breeds of Scindhi varying from 7/8 to 15/16 pure and are kept for milk purposes only. The general condition of cattle is not satisfactory. The common ailments are due to ticks and worms. The pasture condition is bad as grazing facilities exist only in the ravine swamps infested with numerous leeches. The grasses in these swamps are mostly coarse and are locally known as buffalo grass and bison grass. The soils vary from sandy loam to clayey loam and of all shades from red to black. Since almost all available cultivable area is under tea, coffee and cardamom, only those in deep ravines are left for grazing. Such places are invariably swamps. Cattle entirely depend on the grasses that grow in these swamps. No stall feeding is resorted to, as most of the cattle are owned by coolies who cannot afford it. Concentrates of any form are seldom fed, save in the case of cattle owned by the officers in few places, and even then, not adequately. The cattle on the whole subsist only on the grasses from the swamps and water from the hill streams.

Analysis of Soils: Eighteen samples of soils collected from different localities were analysed and the results are presented in Appendix I. The ph value of the soils ranges from 5·35 to 6·21. The soils are acidic with a fair amount of organic matter. The water soluble salts are low. The soil nitrogen varies from 0·114 to 0·743% and is generally fair in the different samples. Calcium, one of the important minerals, varies from 0·080 to 0·331% and is generally poor in all the samples. The available phosphoric acid varies from 0·0022% to 0·0266% and is generally fair to good.

Analysis of Pasture Herbage: Twenty three samples of pasture grasses collected from different localities were analysed, for their protein and mineral contents and the results are given in Appendix II. The protein content of the herbage ranges from 6·86 to 13·94 per cent and may be considered to be from average to good quality. The lime content varies from 0·283% in Sirukundra estate to 0·661% in lower Paralai. The lime content of the pastures is generally poor with the exception of those at Monica, Gajamudi, Iyerpadi, Thonimudi (F. No. 7) Paralai (Lower). The phosphoric acid content of the herbage varies from 0·217 at Thonimudi to 0·552 at the Waterfalls estate. The phosphoric acid content of the pasture is generally fair except in places like Injiparai, Thonimudi (2nd and 3rd Division) and Nallamudi where it is poor. None of the herbage from these pastures is rich both in lime and phosphoric acid. Both the lime and phosphoric acid content of the pasture are about average only in Monica, Sirukundra (cut grass), Thonimudi, Gajamudi, Iyerpadi, and Paralai (lower).

Suggestions and recommendations: From the figures of analysis of the pasture grasses and the soils of the pasture lands, it is evident that the pasture in many places is deficient in lime or phosphoric acid or both, though the protein content is farily good. The lack of a sufficient supply of mineral matter in the food given to an animal has been found to induce certain abnormalities or diseases in animals. To effect an improvement of the mineral content of the pasture, the pasture lands must be properly attended to, by way of cultivation and manuring. Therefore, the following suggestions if given effect to, may be useful in producing good and rich pasture herbage.

1. *Rotational grazing.*— Overgrazing should be avoidod as it will weaken the best pasture grasses, because there will be no opportunity for the plants to store reserve nutrients in their roots. It is beyond doubt that the natural herbage of grasses, if properly cared for and eaten off the land by cattle provides the ideal roughage. But where the grass-lands are being grazed off, cattle should be left in at the rate of about one head per acre, and a system of rotational grazing should be followed. This will mean that more land must be set apart for grazing.

2. *Weeding out the undesirable cattle*:— The total head of cattle can be reduced by weeding out the undesirable and aged animals. Dry cows may be taken if possible to places at the foot of the hills where fodder may be secured more easily.

3. *Soil improvement:*— Drainage is an important factor; the failure of grasses even under good climatic conditions is due to lack of drainage. It is useless to expect grasses to grow well in cold damp soils. By improving the drainage wherever it is necessary and possible, fine grasses can be grown where sour unpalatable and coarse grasses grew before. Further at least once a year some sort of a cultivation, such as harrowing must be given. In heavily stocked pastures, the droppings should be spread at least once a year, as otherwise, cattle will not graze the rank rings of grass around the piles of droppings, which means considerable wastage of feed. To enrich the mineral content of the pasture herbage, especially of calcium and phosphorus, adequate manuring of the lands with fertilisers rich in the above two elements is necessary. Manuring with (burnt) lime at the rate of 3 cwt. per acre and bone-meal may be tried. Lime besides supplying the deficiency of CaO, rectifies the soil acidity. Cattle manure is very good, but may not be available in the hills. High soluble basic slag upto 10 cwt. per acre with lime, is a very reliable manure to be tried. Any mineral phosphate is good as it acts best on perennial grass in acid soils found in the hills under high rainfall. Alternatively, superphosphate (2 to 3 cwt. per acre) and other phosphatic fertilisers furnish calcium and phosphorus commonly required by the soils under pasture in the hills.

These are best applied in summer or just before the grass has seeded. As the land is sloping in most places it should be protected from excessive erosion by bunding at convenient intervals along the contours. Old clumps of grasses must be removed.

4. *Introduction of new species of grass and legume*:— New species of grass which may thrive well under the swamp condition may be introduced. A species of grass known as buffalo grass *Brachiaria mutica* which comes up well under water-logged condition may be tried. Enriching the herbage by the introduction of leguminous plants is worth while attempting.

5. *Growing fodder crops*:— Wherever posible some kind of fodder may be grown and fed green or converted to hay or silage when available in plenty. Some of the cultivable perennial grasses such as the guniea grass (*Panicum maximum. Jacq.*) and Napier grass (*Pennisetum purpureum Schum*) may be tried. The last mentioned grass has been noticed to come up well at Thonimudi during the survey.

6. *Stall feeding of Cattle*:— The most important function of fodder is to provide a bulk feed to the ration of the animal. A large quantity of fodder is necessary to cattle if they are to be in good health and able to do work or provide a supply of milk. The milking cow, it must be remembered, has not only to provide for maintenance of its own body but also for producing milk as well as feeding the developing foetus. Pasture grasses are generally considered to have high nutritive value. In addition they supply vitamins and minerals in sufficient quantities provided the animals have adequate grazing. The pasture area reserved in the different estates is small compared to the number of cattle grazed on it. Secondly the grass is coarse and wet. Conseqnently the cattle may not graze up to their normal daily requirements. So, to better the condition of cattle, it is imperative to supplement the grazing by stall feeding with straw or hay. These dry fodders may be stocked in each estate for distribution among the labourers for the requirement of their cattle.

Attention must be directed to the feeding of some concentrates. Inspite of the fact that forage is similar in composition and nutritive value to the protein-rich concentrates, even tender forage is somewhat higher in fibre content on dry basis, as compared to concentrates. Therefore, it is correspondingly lower in total digestible nutrients and in net energy than the concentrates. Consequently, although such forage is often good enough it cannot fully replace the use of concentrates. As the Anamalai grasses are generally less rich, the need for concentrates is all the greater. Cows of high productive capacity need some concentrates in addition to even excellent pasture as otherwise their milk production will be reduced.

It is therefore suggested that some stall feeding with concentrates such as oilseed cakes, cotton seed, rice bran, dhall husk etc., may be given from 1 to 3 lbs. according to milk yield. About 2 oz. Mineral supplement (a mixture of powdered shell lime and sterillized bonemeal in equal proportion) with an ounce of salt (common bazaar salt) must be given daily along with the concentrates.

The dry fodder and concentrates with mineral supplement may be made available at cheap rates or free to the labourers, by a subsidized scheme of the Anamalai Hill Cattle Society. If all or at least some of the suggestions are given effect to along with the veterinary attention the animals are receiving, it will be possible to further improve the Anamalai cattle quickly and also maintain such improvements at a high level.

Summary & Conclusion: Eighteen samples of soil and 23 samples of pasture grasses from different localities in the Anamalais were analysed. The soils are generally acidic and deficient in lime. The pastures are generally poor in lime or phosphoric acid or both in several places. Basic slag or bonemeal and lime may be applied to the pasture lands to improve them generally and in lime and phosphoric acid particularly. In addition to manuring of pastures cattle should receive some kind of stall feeding with concentrates and small quantity of mineral supplement. Straw or hay to supplement the grazing is also necessary. As a result of this investigation it is realised that in addition to the attention devoted to the grading of the hill cattle and ridding them of the worms and other diseases peculiar to the Anamalais, attention should also be bestowed on improving the standard of feeding both in quality and quantity.

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References.

1. Nicholson, F. A., Manual of the Coimbatore District (1887).
2. Morrison, F. B., Feeds and Feeding (1936 Edn) Morrison Pub. Co., N. Y.
3. Ramiah, P. V., Some South Indian fodders, Bull. Dept. of Agri. Madras No. 33, 1942.
4. Russell, E. J., Soils and Manures (1945 Edn) Camb. Univ. Press, Cambridge.

APPENDIX I.

Results of Analysis of soil samples (Lab. Nos. 529—546.)

Lab. Nos.	Items of analysis.	Moisture.	Loss ignition	Total water soluble salt.	Nitrogen.	Calcium (CaO)	Available.		pH
							P_2O_5	K_2O	
529	Monica near group office.	7·72	12·56	0·053	0·290	0·080	0·0042	0·0126	6·21
530	Monica swamp.	1·90	1·06	0·086	0·114	0·105	0·0022	0·0066	5·96
531	Monica New field.	3·86	5·59	0·037	0·176	0·089	0·0093	0·0100	5·55
532	Injipparai Swamp.	7·74	9·93	0·079	0·307	0·223	0.0238	0·0245	5·88
533	Nallacathu No. 1 area.	2·32	6·68	0·031	0·187	0·113	0·0147	0 0134	5·95
434	Nallacathu No. 3 area.	7·56	16.93	0·045	0·367	0·189	0·0074	0.0165	5·81
535	Waterfall	3·64	8·42	0·040	0·148	0·106	0·0115	0·0079	5·98
536	Thonimudi F. No. 7.	5·54	15·63	0·083	0·357	0·139	0·0101	0·0074	5·55
537	Thonimudi 2nd division.	3·82	11·09	0·049	0·212	0·114	0·0081	0·0096	5·77
538	Gajamudi Fuel reserve.	5·13	16·56	0·080	0·386	0 331	0·0173	0·0131	5·81
539	Mukkutumudi 1st division.	3·78	12·60	0 058	0·230	0 086	0·0061	0·0124	5·75
540	Anamudi swamp.	7·49	28·28	0·155	0·743	0·203	0·0143	0·0115	5·35
541	Thaimudi 3rd division.	4·96	11·04	0·031	0·204	0·162	0·0186	0·0209	5·75
542	Mudis town swamp,	8·14	17·12	0·075	0·408	0·258	0·0150	0·0373	5·72
543	Thaimudi upper division.	5·37	10·23	0·031	0·102	0·086	0·0055	0·0136	5·65
544	Iyerpadi division No. 2.	2·40	6·10	0·043	0·168	0·087	0·0093	0·0226	5·75
545	Iyerpadi division No. 1.	5·89	5·93	0·032	0·280	0·219	0·0183	0·0219	5·85
546	Paralai Lower division.	5·99	9·01	0·108	0·330	2·297	0·0266	0·0320	5·98

N. B.— All results, except "Total Water soluble salts" have been calculated on moisture-free basis.

APPENDIX II.

Results of analysis of twenty-three samples of grasses collected at Anamalai Hills.

Heads of analysis,	Moisture.	Ash.	Crude proteins.	Crude-fibre	Ether-extractives.	Carbohydrates.	Total.	Insolubles.	Lime (CaO)	Phosphoric acid (P_2O_5)
Lab No. / 46—47.										
506 Grass. Monica near office ...	8·14	10·58	9·54	21·19	2·43	48·12	100·00	4·72	0·628	0·449
507 Grass. Injipparai swamp ...	7·81	14·14	8·18	24·64	1·63	43·60	100·00	7 69	0·327	0 444
508 Grass. Do. Teppakalam Swamp,	7·36	7·86	7·97	28·44	1·64	46·73	100·00	3·09	0·322	0·277
509 Grass. Nallacathu No. 1 area ...	7·57	10·24	9 80	25·23	2·18	44·98	100·00	4·90	0·380	0 438
510 Grass. Do. No. 3 area ...	6·63	10·37	11·98	23·24	2·39	45·39	100 00	5·62	0·367	0·496
511 Grass. Sirukundru cut grass ...	7·61	8·81	8·99	26·11	1·18	47·30	100·00	2·21	0·533	0·368
512 Grass. Do. from field ...	5·08	18·00	10·55	27·24	2·19	36·94	100·00	13·08	0·283	0·379
513 Grass. Waterfalls estate grazing...	7·02	13·68	10·38	23·95	2·72	42·25	100 00	6·61	0·447	0·552
514 Grass. Thonimudi F. No. 7 ...	6 02	8·07	11·81	27·11	2·82	44·17	100 00	2·66	0·530	0·402
515 Grass. Do. Napier grass ...	6·56	8·76	13·03	27·94	2·68	41·03	100·00	2·98	0·551	0·441
516 Grass, Do. 2nd division ...	6 68	8·15	9·13	26·42	2.01	47·61	100·00	2·96	0·356	0·226
517 Grass, Do. 3rd division ...	4·88	7·53	9·15	26·61	2·59	49·24	100·00	2·44	0 314	0·217
518 Grass. Gajamudi—mound ...	8·42	9·01	7·26	29·68	2 46	43·17	100·00	2·07	0·633	0·447
519 Grass. Mukkutumudi 1st division.	4·17	9 27	12·06	23·70	3·10	47·70	100 00	4·30	0·428	0·423
520 Grass. Do. 2nd division.	5·12	7·71	8·20	26·45	2·25	50·27	100·00	2·42	0·316	0·416
521 Grass. Nallamudi Swamp ...	7·59	7 37	10·33	23·57	2·67	48·47	100·00	2·21	0·492	0·287
522 Grass. Anaimalai ...	9·42	8·60	9·85	22·05	3·27	49·80	100·00	2·83	0 440	0·358
523 Grass. Thaimudi 3rd division ...	6·78	10·67	8·39	24 99	2·03	47·14	100·00	4·27	0·330	0 349
524 Grass. Mudis Town area. ...	6·13	20·82	9·09	18·66	1·91	43·39	100·00	11·27	0 446	0·403
525 Grass. Thaimudi Upper division.	4 83	7·83	13·94	21·40	2·97	49·03	100·00	2.38	0·290	0 431
526 Grass. Iyerpadi No. 2nd division	7·19	15·08	7·75	19·85	1·51	48·62	100·00	8·57	0·562	0·319
527 Grass. Do. No. 1st division.	5·55	22·92	8·43	15·70	1·46	45·94	100·00	14·14	0·531	0·414
528 Grass. Paralai—Lower ...	4·66	34·94	7·93	16·29	1·34	34·84	100·00	25·29	0·661	0·454

Some observations relating to natural factors influencing the incidence of insect pests.

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Out of about seven lakhs of species of insects reported to be existing in the world with the identifications so far made only about 10,000 are known to be phytophagous (herbivorous) and of these it is only a small number of about 500 working out to a percentage of 5 that have been put under the category of major pests of some consequence to the agriculturists and horticulturists. From this we can easily infer that but for maintenance of 'balance of life' by the action and reaction of forces in nature many more would have menaced us by becoming pests. The physical and biological factors evidently create a strong environmental resistance round many other insects and do not allow them to become serious pests. The climate and cultural conditions forming the physical factors and food, natural enemies and competition with others forming the biological factors not only prevent many an insect from becoming a pest but even limit its distribution in case any insect is to become a pest with the breach secured in the environmental resistance keeping it at a particular balance in its association with the other animals in the world. Therefore we owe a good deal to the environmental resistance with its physical and biological factors for keeping many insects not only within bounds but also in limiting the zones of occurrences when any of them become pests. South India had recorded about 550 insects as occurring on economic plants and of these it was not even against 100 that artificial methods of control had to be resorted to. Even then it was not everywhere and at all times of the year that the pests proved to be of serious consequence. The occurrences of pests are limited to few areas and during certain seasons. These facts go to show that nature has helped and is helping not only the agriculturists and the horticulturists but also the economic Entomologist whose work would have become quite complex and unmanageable if every phytophagous insect becomes a pest.

The writer in the course of his work has had opportunities to make detailed observations on the incidence of insect pests in regions of widely divergent climatic conditions as for example, the Circars representing the hottest parts of the Madras Province on the one hand and the Nilgris in the south representing the cooler regions. This paper is a record of his observations, and is written with a view to invite attention to an important aspect of the insect control problem, namely, the influence of environmental factors in determining the nature and extent of pest incidence.

The factors that contribute towards natural control of insects are (1) climate (2) topography (3) agricultural practices and (4) natural enemies. Climate and the agricultural practices creating physical limitations for the development of insects constitute the physical factors in the environmental resistance whereas the natural enemies together with the agricultural practices regulating the food supply for pests constitute the 'Biological factors'. We have to consider to what extent these factors by themselves and in combination are influencing the incidence of insect pests.

Phyiscal factors.

Climate:— Climate is the result of combined action of all the physical factors of the environment like temperature, light, humidity, rain and air currents over a long period of time and is relatively stable for the same locality. Weather on the other hand is the result of combined action of all the physical factors of the environment at any time and it varies from hour to hour, day to day and week to week. For purposes of this note we are chiefly concerned with 'climate' as the permanent factor determining once for all whether an insect is to become a pest or not for a particular area. If any insect can become a pest then the 'weather' can determine when and under what weather conditions it can become a pest. It can now be seen that 'climate' determines the type of insects that are to exist in any given locality and when it varies between any two places the insect fauna also differs. This can be evident if we examine the insect fauna at different elevations in the hill regions of South India. In the Nilgiris along the Mettupalayam side the moist tropical region extends up to an elevation of 2,500 feet. It is marked by a limited season of moist weather with dry weather intervening. The Sub-tropical zone starting at the head of the tropical region extends up to an elevation of 6,000 feet. These elevations should not however be taken as defining the limits of the zones accurately. The Sub-tropical region is said to commence in the Himalayas at an elevation of 500 feet and for Nilgiris at 1,000 feet towards the Western Ghats side. We need not discuss about the tropical fauna in Entomology as it is too familiar with us. The Sub-tropical fauna is far more varied than the tropical. The number of species that can find food and can support existence in the extremely varied vegetation and moist equable climate of the former is far greater than those that have to face dry heat and limited vegetation of the latter. We find variety and number in Nymphalids/, and Papilionid butterflies, Longhorned grasshoppers, Stick insects, Cicadas and wood boring *Coleoptera*. Grasshoppers and aquatic and scavenging beetles are however more abundant in plains than in the sub-tropical region. *Attacus atlas*, the atlas moth which is the largest amongst the Indian moths is found in hilly forests mainly in the Sub-tropical zone. The temperate zone presents a region of intense colds

and also frosts and it has a limited natural flora. Consequently the insect fauna of this region is not so rich and varied as that of the Sub-tropical regions.

If we take up the scrutiny of specific economic forms as occurring in definite zones we find that the following insect pests occur in all the three zones with the least consideration for the elevations in the Nilgiris and the differences they create in the climatic conditions. The wingless grasshopper (*Orthacris simulans*); the plant bug (*Bagrada picta*); the plant lice on rose (*Macrosiphum rosaeformis*); the cabbage aphis (*Myzus persicae*); the Red scale on rose (*Aspidiotus aurantii*); the Diamond back moth (*Plutella maculipennis*); the green scale of Coffee (*Lecanium viride*); the potato tuber moth (*Pthorimoea operculella*) amongst crop pests;

Sitophilus oryzae amongst granary pests, cockroaches, crickets, silver fish, book lice, house flies and fleas amongst household pests; hover fly (*Syrphus* sp), the giant water bug (*Belostoma indica*) the ground beetle *Anthia sexguttata*), lady bird beetles (*Rodolia roseipennis* and *Coccinella septempunctata*) amongst predators; *Apis dorsata, Apis indica* and *Apis florea* amongst productive insects also occur at all elevations.

The cutworms (*Euxoa segetum, Agrotis nigrum*) are not found in plains but are confined to Hills. The Cucurbit beetles (*Aulocophora spp*), the tobacco caterpillar (*Prodenia litura*), the red tree ant (*Oecophylla smaragdina*) amongst insect pests, ants, termites, bedbugs and mosquitoes amongst household pests the flour beetles, and moths amongst the stored products pests which are all serious in plains of South India are not at all felt in the temperate zones of the hills. It can now be seen what a wide range of pests we can have if the climatic conditions of different zones have not restricted the spread of different pests. Some are already bad enough with their adaptability to occur in any zone and if the others also are not bound by the climatic factors we would be having a long list of pests occurring at all the elevations and in all climates.

It is sufficiently known that insects do not flourish in places with diurnal variations but thrive best with a steady temperature. Coastal areas record narrow variations between the maximum and the minimum temperatures and high humidities and will consequently be helpful for insect development. Inland places with wider variations and low humidities necessarily discourage insect life that thrives best with a coastal climate. This aspect of insect problem was brought to light by the Department of Food of Government of India when they found that the central stocks of cereals in storage were preserved best when kept in interior places like Lahore. The Rice weevil, *Sitophilus oryzæ* is active only when the grain absorbs moisture from the humid atmosphere and increases the moisture content of the grain and this can happen in coastal areas and not in the interior dry tracts -

Topography :— Next in importance to climate is the general topography of the tract acting as a physical factor and influencing the incidence of insect pests. The topography influences the climate of the place also but not to make any difference as far as our problem is concerned with the immediate neighbouring tracts. The soils however differ even between two adjacent areas and we have to see if they have anything to do with the occurrence of certain pests. It is well known that the Red Hairy Caterpillar (*Amsacta albistriga*) is a pest of groundnut and other crops confining itself to the light soil areas and not occurring in heavy soils. This is due to the fact that the insect which goes into the soil to a depth of 4 to 5" and even 9" at times as early as August or September has to remain in the soil as pupa till the break of next S. W. Monsoon i. e., for a total period of about ten months. The tunnel through which the caterpillar had entered the soil gets disturbed in the long interval that follows before it is able to emerge out as a moth. The spurs specially provided for the tibia help the moth in making out a tunnel for its escape and this can be done only in light soils but not in heavy soils where the clogging nature of the soils interferes with the tunnelling that has to be made for the escape of the moth. The Rice grasshopper (*Hieroglyphus banian*) is a serious pest of paddy in heavy soil areas in tracts that depend upon the break of S. W. Monsoon in June for growing of paddy. The pest tides over the off-season for paddy in its egg stage laid in bunds as early as the month of November but hatching out only in the next June with the break of S.W. Monsoon. The resting period for the eggs is however finished with the end of March and they can develop and hatch out subsequently if the required moisture is made available. In the case of light soils any rains occurring during the months of April and May can be readily absorbed to start the commencement of development of grass hopper eggs in the soil but unless there is the continuity of rains to complete the development of eggs they get desiccated while half way in development and are consequently disabled from hatching. Hence the summer rains occurring during the months of April and May act as a natural check for the grasshopper pest in light soil areas whereas with heavy soils a similar check is not available on account of the slow absorption of moisture by such soils during passing showers. The chilly root grub *Anomala* sp., is a definite pest in heavy soil areas and it may also be added that the rootgall eel worm though not an insect affects plants in light soil areas.

Agricultural Practices.

The agricultural practices influence the incidence of several pests to a considerable extent. Taking up the Paddy crop we find that the Paddy Grasshopper *Hieroglyphus banian* exists in a serious form in tracts where paddy is sown broadcast in heavy soils and where the nature of the cultivation is such that the field bunds are the least disturbed. The egg

masses kept in safe deposit by the pest in the field bunds for passing over the long off-season from the month of November to the next June, for a total period of nearly six months, can remain safe under such conditions whereas in places where paddy is transplanted the bunds are periodically trimmed and also remade now and then. These create a certain amount of natural check for the pest with the result that we do not find it as a serious pest in areas where the preparatory cultivation including the trimming of bunds for paddy is done early enough in the season.

In the delta areas where we have the practice of sowing the *saruva* (first crop paddy) nurseries even before the *dalwa* (second crop paddy) is harvested the paddy stem borer (*Schoenobius incertelus*) gets opportunities with the overlapping of crops to maintain itself to infest the next coming first crop of paddy with the protection the pest gets in the nurseries during the summer. In places abounding with wild paddies the pest gets similar opportunities and we find higher incidence of the pest in such tracts than elsewhere.

Paddy case worm (*Nymphula depunctalis*) is felt to be a regular serious pest in the upland areas of East Godavari District and in Vizagapatam District where the irrigation supplies are not of assured nature and the ryots have to sometimes allow water to stagnate in the paddy plots with the fear that any draining done to the plots may not secure fresh irrigation supplies. In the delta areas with copious supplies of irrigation water the ryot knows the benefits of frequent changes and it is very rarely we encounter the paddy case worm as a pest. In some of the delta tracts where the soils are rich and attain a rank growth with the possible early plantings the occurrence of Rice Hispa (*Hispa armigera*) is not considered by the ryots as harmful and some of them even take it as a blessing in disguise helping to minimise the topping, the crop is to get on account of rank growth in such soils. In other places varying with different degrees from these conditions there may be some loss differing with varying soil fertilities. In the Ramachandrapur area of East Godavari District where pillipesara *Phaseolus trilobus* is grown in small plots in paddy fields, rats have become a serious pest with the "Food Factor" helping them to breed throughout the year.

In parts of Vizagapatam District where sugarcane is planted towards the end of April so as to have the formation of main shoots after the break of South west monsoon the damage by the cane borer (*Argyria sticticraspis*) to young shoots is not felt. If however the crop is planted earlier and the main shoots come up during the dry summer months the sugarcane borer lays heavy toll and may even influence the final yields of the crop so affected. The cane fly (*Pyrilla perpusilla*) and the cane Aleurodids (*Aleurolobus barodensis*) are not felt as pests where the

sugarcane cultivation is so adjusted as to secure some off season between the planting of the new crop and the harvesting of the old crop and where rationing is not practised. It is also known to the cultivators that a cane crop grown near trees harbouring squirrels will attract their attention and sustain damage especially during the active breeding season of the rodent and to the possible extent such situations are avoided for cane growing. The stem borer beetle of plantain (*Cosmopolites sordidus*) is a serious pest under the old system of having perennial crops of plantain in the same land for several years. This pest has however receded to insignificance with the introduction of annual system of plantain cultivation where the crop is changed from place to place with each year and the suckers planted in the new field get sufficient root pruning before planting to dislodge any of the borers if they are found with the suckers. In the Vizagapatam District where chilly is cultivated as a garden crop from the month of October onwards after the root grubs (*Melolonthid*-beetle) get into a resting stage there is no trouble from the pest with the cultivation so nicely adjusting itself to come off after the pest disappears. It was also noted that the Red Hairy Caterpillar (*Amsacta albistriga*) established itself as a sort of indigenous pest on some of the mountain sides with *Canthium passiflorum* shrub (Tel: *Balusu*) as a host, but its presence is not felt by cultivators in the areas as they grow only ragi there and the crop is planted in August—September after the Red Hairy Caterpillars get into the soil for pupation to emerge as moths with the break of next S. W. Monsoon. It appears as though the cultivators have come to an understanding with the pest to allow it to have its way with the wild plants during the early part of the season in the year and have their crops in the later part when they get "all clear signal" with the pupation of the Amsacta caterpillars. In some places the annoyance of the Red tree ant (*Oecophylla smaragdina*) to gardening is sufficiently understood and it is not allowed to establish in the gardens by the burning down of their nests whenever they are found. In other areas where this precaution is not taken our visits to gardens are not at all pleasant and leave some unpleasant memories behind. Amongst the Agricultural practices the selection of resistant types like G. E. B. 24 against the paddy stem borer for Kollair tract in Kistna District and some canes against shoot borers in cane should be mentioned.

Natural enemies.

Not only do the climate, topography and the agricultural practices control the variety, size and distribution of insect population but the natural enemies of insects also especially their own tribe as predators and parasites influence the relative abundance of different insects at different times. An experienced Entomologist when called upon to deal with any pest would not be satisfied in examining the pest and its damage but would go a step further and examine it in relation to its biological

equilibirium and its different associates. If there is promise of early check by any of the biological agents he would necessarily defer the incurring of expenditure in taking up some chemical or other direct control and wait for the natural forces to help him. This aspect of pest control is applicable to the Paddy Leaf roller (*Cnaphalocrocis medinalis*) and the Paddy Gall Fly *Pachydiplosis oryzae*. In The Madras Agricultural Journal for December 1929 under the title 'Insect pests and their natural enemies in the Circars the author stated that, in the case of certain caterpillars found on paddy, such as *Psalis* and *Paranara* the parasites are so constantly found that it is generally difficult to rear the caterpillars of these two insects into adults and that is why they are never noted in a pest condition. To this day the statemet continues to hold good.

Summary and Conclusion.

The study of climatic factors influencing the occurrence of pests helps us a good deal in knowing the zonal distributions and spotting out such phytophagous insects as are likely to continue as pests. The topography can help us to know what kinds of pests can be encountered especially with the newly introduced crops. The agricultural practices give us a clue as to how we can possibly secure permanent relief from insect enemies wherever the local conditions permit. Amongst the different methods we have for control of pests Viz.. Agricultural, Mechanical, Insecticidal and Biological it is the agricultural methods that can fit in well with an Indian cultivator and secure for him a permanent relief from any pests. Methods requiring special sustained effect like chemical treatments require no ordinary struggle to become popular with an Indian agriculturist in spite of all their intrinsic worth. With a detailed knowledge of the local conditions and the pests that occur it would even be possible for us to chalk out the agricultural policy of a tract and put it on a firm ground so that it may not encounter any serious pests that can occur in the tract. As an instance I may add that when a construction of a reservoir for Sabari, one of the tributaries of the Godavari, was under consideration and when it was being designed to grow a short duration crop of paddy in the first season the Agricultural Department could point out that there would be considerable risk in proposing a short crop of paddy for the tract with frequent sporadic outbreaks of the climbing cut worm of paddy. *Cirphis albistigma* and the safest plan would be to have a long duration crop for such areas as it can be harvested during periods when the pest does not occur and evade it. In putting up the above notes to the readers it is my intention to show that the problem of control of pests has various aspects to be worked and to get at the fundamentals to base our recommendations on solid foundations that would stand the test of time.

GLEANINGS

War on Livestock Diseases.

At Glenfield, 25 miles south of Sydney, the New South Wales Department of Agriculture has established a veterinary research station which ranks with the best in the Empire, and compares favourably with any in the world. Here Australian scientists diagnose all types of livestock diseases, carry out fundamental research work on various aspects of animal pathology and nutrition, and operate a dairy cattle artificial insemination ring for neighbouring farmers. Established in 1923, the Glenfield Veterinary Research Station now has an area of 600 acres. About 100 acres are cultivated to produce fodder for experimental animals. The main crops are wheat for hay, and maize for both grain and silage with about 10 acres of lucerne, and a small irrigated area used for millet and other fodder for the many guinea pigs maintained for experimental work.

Livestock on the property include 120 sheep, 90 cattle, 11 horses, pigs, poultry, goats and a large number of guinea pigs and white mice, the latter used for medical tests on humans. The station controlled by Mr. Graham Edgar, B. V. Sc., has a professional staff of 11 veterinary research officers and 8 technicians. With clerical officers, farm workers and livestock attendants, the total staff numbers 39. Since existing laboratory facilities have become inadequate, a £ 30,000 building programme has been begun This will provide three new chemical and nutritional laboratories, and additional staff rooms and offices.

Important work now in progress at Glenfield includes:—

Research in contagious abortion and mastitis in dairy cows
Development of a vaccine to control infection carried by fowl tick
Nutritional studies on dairy cattle, poultry and sheep.
Control of worms in pigs.
Artificial insemination of dairy cows.

Officers of the station are also co-operating with research scientists in other places on sheep nutritional studies, poultry nutritional work, study of growth of fat lambs, and work on toxaemic jaundice of sheep

Clover Infertility in Sheep.

A small team of Australian scientists at the University of Western Australia and the Animal Health Laboratory of the Western Australian Department of Agriculture is doing valuable research into the cause and cure of infertility noticed among sheep which feed largely on one strain of subterranean clover. It had been found that, in some areas, sheep feeding mostly on Dwalganup sub clover had a lamb drop much lower than normal, and that immature ewes were producing milk. The trouble was traced to an Oestrogen-like substance found in the clover. After early experiments, scientists came to the conclusion that while dry clover was comparatively safe, green clover was distinctly dangerous sheep feed, as it was likely to produce disturbances in the sex organs of ewes. Fortunately, the men found a quick way of assaying the clover and producing concentrated extracts containing the toxic female sex hormone This has enabled them to inject baby or immature mice to find the effect of varying strengths of the clover-produced oestrogen against the known results of oestrogen itself The overall aim is to find the soil and growth factors which cause clover to be toxic or potent. Several lines of study are being followed. Clovers are taken from a wide range of soil types, and no less than 20 varieties of sub clover are being tested, besides the Dwalganup strain which is already known to be toxic The potency of other plants growing in the infected areas — grasses, capeweed, lucerne and

clovers other than subterranean varieties is being found. The results will establish just which clovers and other plants are likely to be dangerous, whether the danger comes from a genetic quality of the plant itself, or whether it is due to soil and other factors of environment. Tests are also being conducted at the University and the Animal Health Laboratory to estimate the proportion of non-clover species needed to make an area non-toxic to sheep

Australia Tackling New Citrus Disease.

An Indian gradute, Mr. P S Parsai, B Sc, (Agr.) (Nagpur), is helping a research team of three Australian scientists in an investigation of a plant disease known as 'bud-union decline' This virus disease affecting citrus trees occurs principally in sweet oranges and grapefruit on sour-orange stocks. This failure of trees on sour-orange stock is unfortunate as, until 1941, when the disease was discovered, the stock had been in increasing demand by Australian growers because of its resistance to root and collar rot, and the high quality fruit produced by trees on it. The first sign of the disease is a blockage of the conducting tissues of the bark at the bud-union, Thinning of the foliage at the top of affected trees is followed by the leaves becoming dull, and later yellowing. Often a heavy crop is set, but the fruits remain small and colour prematurely. Unhealthy leaves, fall, new growth is weak, and new leaves are few, resulting in sparse foliage and even die-back of the tips of the shoots. Affected trees usually remain for a few years before dying, but some collapse and die even before leaf-fall.

These symptoms are not peculiar to bud-union decline but may be seen on trees suffering from fungal root rot, water-logging of the soil, or insect damage to the roots or trunk Inspection of the roots of declining trees on sour-orange stocks shows a progressive death of the roots from the tips of the small root fibres towards the trunk This rootlet decay actually begins before symptoms are seen in the tops of the trees but, of course, is not usually detected Tests with iodine solution, applied to diseased trees, have shown that, even before the rootlet decay starts, starch contents of the bark and wood disappear from parts of the root-stock. This is not usual with root rot diseases or root nematode attacks. The starch decline progresses along the larger roots until, in extreme cases, there is no starch in the rootstock right up to the bud-union. These starch observations suggest that at or near the bud-union there is a slowing down of food movements from the tops to the roots. A survey of Mildura citrus groves early in 1946 showed that trees attacked ranged from those in the nursery stage to some 40 years of age, and irrespective of the soil types in which they were growing or of cultural practices

Scion-stock combinations definitely susceptible to the disease, or suspect, are ;—

Sweet orange on sour orange, grapefruit, kumquat or lemon;
Grapefruit on sour orange or Eureka lemon;
Mandarin on sour orange.
Combinations which appear to be safe are :—
Sweet orange on citronelle, sweet orange, trifoliata or mandarin;
Grapefruit on citronelle, sweet orange, trifoliata or mandarin,
Lemon on citronelle. sweet orange, sour orange, trifoliata or mandarin (tangerine)

Budding trials to determine whether bud-union decline is transmissible by budding began in the spring of 1946. Even three months after budding there was evidence that decline could be readily reproduced by inserting sweet-orange buds from a diseased sweet-orrange/sour-orange tree into seedling sour-orange rootstocks. Buds from healthy sweet-orange trees on sour-orange stock produced healthy trees when worked on to similar control stocks Buds from decline trees produced vigorous, healthy, symptomless trees when inserted into citronelle stock, But buds from a healthy Washington Navel orange

tree on citronelle produced decline trees when worked on sour-orange rootstock though giving healthy trees in sweet-orange stock. Large-scale budding trials, which include the testing of many scion-stock combinations and their susceptibility to the new disease, are now being carried out The extent to which trees with tolerant stock-scion combinations are carrying bud-union decline in their tissues, without symptoms, is also being investigated. From evidence collected it is believed that a virus is causing the disease This theory is supported by its sudden appearance, distribution, and rapid spread, the negative results of tests for fungal and bacterial diseases and transmission by budding. Experts consider that the decline is closely related to, if not identical with, problems associated with sweet-orange trees on sour-orange root stock now occupying the attention of scientists in the United States of America, India, South Africa, Java, Ceylon, Brazil, Argentine and New Zealand.

Investigation officers say that they cannot yet pin the introduction of the disease to any specific reason but they find it interesting that the only overseas importation of rootstock into Victoria (Australia) was in 1938 and 1939, when some Robertson Navel orange trees on sweet-orange and sour-orange rootstocks and Robertson Navel budwood were imported from California, U. S. A. The disease was first noticed in 1941 Despite the theories advanced by the research team that the disease develops regardless of cultural practices and is caused by a virus, there are some Australian orchardists who say that it is caused by lack of genuine soil fertility. These men believe that the ploughing in of green crops and heavy applications of sulphate do not increase soil fertility and advocate the use of organic manure (vegetable and animal) only. They recommend that no artificial fertilisers be used at all, but that liberal dressings of finished compost, preferably made on the Indore process, which combines mixed vegetable wastes with animal manure, should be forked in over the root areas of citrus trees.

Brown, Clair A. Louisiana State University, Baton Rouge, La The effects of 2, 4-D on cotton: In Louisiana in 1947, the drift from commercial applications of 2, 4-D to control water hyacinth and rice weeds injured a large acreage of cotton. The severity of the injury depended upon the size of the plants, their vigor, and the quantity of 2, 4-D intercepted Sublethal amounts resulted in the development of plants with abnormal leaves, flowers and bolls The leaf symptoms varied from a slight pebbling to severely malformed leaves with parallel veins, extra long apices aed ruffled margins These leaves usually developed from 10 to 15 days after exposure. Frequently stamens and stigmas protruded from the apex of a bud which was soon shed At times the flower bracts were fused, cylindrical in shape and the petals were often dwarfed, partly fused and strap-shaped. The growth of seedlings 4 to 6 inches tall was delayed from 3 to 6 weeks after which the plants recovered and produced normal leaves, flowers and bolls Plants dusted when the flower buds were forming or when the plants were in bloom, shed the buds and flowers. Often the growth of the main axis was stopped Extra branches were often produced from the lower buds and this resulted in unusually bushy plants Seedlings which received trace quantities showed no appreciable reduction in yield whereas applications heavy enough to induce extreme malformations resulted in reductions in yield up to 60 per cent. In general, plants in bud or blossom at the time of dusting have greatest reductions in yield. Dr. N. K

[Am Jour Bot Vol. 34, 1947; p. 598.]

Gray, Reed and James Bonner, California Institute of Technology, Pasadena, Calif. A naturally occurring substance toxic to plant growth isolated from leaves of *Encelia farinosa*. The composite shrub *Encelia farinosa* which occurs on the Colorado desert of the Southwest is known from observation to be inhospitable to the growth of other species Thus annuals which normally occur in abundance in the neighborhood of other

desert shrubs are not found growing in association with *Encelia*. The unfavorable effect of *Encelia* on associated vegetation is not due to inhibitory substances given off by roots but is owing to an inhibitor of plant growth contained in the leaves of the shrub. Thus leaves which have fallen from the plant to the ground were collected, brought to the laboratory, and applied as a mulch to the surface of sand in which tomato plants were grown. These leaves inhibited the growth of or killed the tomato plants depending on the concentrations used. The toxic material has been isolated in pure form and found to be 3—acetyl—6—methoxybenzaldehyde, a compound new to organic chemistry. This compound is toxic to tomato, pepper, and numerous other species of plants when supplied through the roots in nutrient solution. As little as 1 mg. or less of the compound may inhibit growth of a tomato seedling by 50 per cent while absorption of about 2 mg. may cause complete death of the plant. Dr N. K.

[Am. Jour. Bot, Vol. 34, 1947; p. 600]

Crop and Trade Report

Statistics—Cotton—1947—'48—First forecast report.

The average area under cotton in the Madras Province during the five years ending 1944—'45 represents 10·7 per cent of the total area under cotton in India.

2. The area under cotton in the Madras Province up to the 25th July 1947 is estimated at 72,300 acres When compared with the area of 65,500 acres estimated for the corresponding period of last year, it reveals an increase of 10·4 per cent.

3, *Central districts and the South mainly Cambodia.*—The area in the Central districts and the South represents generally the last year's crop left on the ground for second pickings before the plants are removed in September in compliance with the provisions of the Pest Act. The area in these districts is estimated to have fallen from 57,200 acres to 54,700 acres, the fall in acreage being confined to Salem and Coimbatore. The yield is expected to be generally below the normal.

4. *Westerns tract.*—The area under Westerns is estimated to have increased from 2,500 acres to 7,100 acres. The increase in acreage occurs in Kurnool, Bellary and Anantapur

5. *White and Red Notherns tract.*—The area under White and Red Notherns is estimated to have increased from 400 acres to 3,300 acres.

6. *Warangal and Cocanadas tract.*—The area under Warangal and Cocanada is estimated to have increased from 3,400 acres to 4,200 acres. The increase in acreage occurs in Guntur.

7. The average wholesale price of cotton lint per imperial maund of 82-2/7 lb. or 3,200 tolas as reported from important markets on the 2nd August 1947 was Rs. 38—8—0 for Cocanadas, Rs. 38—7—0 for White Northerns, Rs 39—8—0 for Red Northerns, Rs. 31—12—0 for Westerns Mungari, Rs. 31—1—0 for Westerns Hingari, Rs. 57—5—0 for Coimbatore Cambodia, Rs 52—10—0 for Coimbatore Karunganni, Rs. 53 for Virudhunagar (Southern) Cambodia, Rs 47—12—0 for Virudhunagar Karunganni, Rs. 44—10—0 for Tinnevellies and Rs. 36—12—0 for Nadam cotton.

Weather Review—For May 1948.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches	Division	Station	Actual for month in inches	Departure from normal inches	Total since January 1st in inches
Orissa Circars.	Gopalpore	3·40	+1·27	7·70		Coimbatore C B.S.	4·19	+1 81	6·90
	Calingapatam	0 30	—2 26	3·00					
	Vizagapatam	1·70	—0 30	3 30		Coimbatore	3 00	+ 0·53	4 30
	Anakapalli *	1 30	—1·03	2·26		Tiruchirapalli	5·40	...	8·80
	Samalkota *	0 62	—0 77	9 71	South.	Negapatam	1·80	+ 0·23	8·90
	Cocanada *	1·60	+ 0·06	3·10		Adutural *	0 20	—2·46	4·04
	Maruteru *	0·79	—0 50	1 57		Pattukottai *	0 08	—2·11	4·97
	Masulipatam	1·00	—0 32	1·10		Madura	3·50	+ 0·76	6·30
	Guntur *	3·80	+ 2 05	4·80		Pamban	Nil	—0 97	3·90
	(Agricultural College, Bapatla.)	1.37	+ 0 01	4 76		Koilpatti *	2·48	+ 0·38	8 50
						Palamkottah	0·10	—1·53	11·10
Ceded Dists	Kurnool *	0 30	—0 78	1·80	West Coast.	Ambasamudram *	2·69	+ 1·77	10·57
	Nandyal *	0·70	—1 02	1·65		Trivandrum	6·90	—1·88	14·20
	Hagari *	1 91	—0·41	3·19		Cochin	0 80	—10 88	7·70
	Siruguppa *	1·24	+ 0·45**	2·94	—	Calicut	5·70	...	15·20
	Bellary	2·50	+ 0 61	4 60		Pattambi *	5·11	—2·13	9·64
	Rentichintala	1 00	...	4 30		Taliparamba *	3·99	—2·53	8·16
	Cuddapah	1·70	+ 0 19	2·10		Nileshwar *	4·75	3 87	7·39
	Anantharajapet*	0 79	—2·56 @	1 91		Pilicode *	6 55	—1·53 @	9 79
						Mangalore *	2 60	...	6 30
Carnatic.	Nellore	nil.	—1 09	0 20		Kankanady *	3·85	—3 98	7·43
	Buchireddipalam *	0 07	—2·16	3 76	Mysore & Coorg				
	Madras	2·30	—0·73	2 90		Chitaldrug	7·90	+ 4·96	9·10
	Tirurkuppam *	nil.	—2 88@	2·82		Bangalore	6·30	+ 2·14	7·70
	Palur *	1·42	—2·18	6·65		Mysore	8·20	+ 2·61	11·30
	Tindivanam *	0·13	—3 86	2·64	Hills.	Mercara	4·00	—1·21	11·30
	Cuddalore	0·20	—0·80	3 70		Kodaikanal	5 60	—0 77	18·60
Central.	Vellore	2·70	+ 0 41	4 70		Coonoor *	6·84	+ 2·95	18·27
	Gudiyattam *	3 74	—0 21	4 17	-	Ootacamund *	5·15	—1 08	12·40
	Salem	5·70	+ 0·10	7·00		Nanjanad *	6 05	+ 1 22	15·92
	Coimbatore A.C R I. *	4·79	+ 2·54	6 22					

Note:— (1) * Meteorological stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal

(3) @ Average of 5 years in Tirurkuppam, Anantharajupet and six years in Pilicode.

(4) ** Taluk office rainfall being 2·19".

(5) ... Figures not available.

WEATHER REVIEW FOR MAY 1948.

During this month thundershowers were widespread along the west coast, some of the central districts like, Salem and Coimbatore and *Mysore and Coorg area* (except Marcara) Monsoon had been active towards the end of the month along the Malabar Coast where widespread, light to moderate rain had occurred on 29—5—1948 but it soon became weak there and finally the monsoon in the Arabian Sea had retreated into the Maldives region where it also became feeble. But the western dirturbance over the south-east Punjab continued to persist over that area.

A hailstorm occurred at Rentachintala on 25—5—1948.

In places like Nagpur, Hyderabad, Masulipatam, Cocanada, Nellore, Vellore, Cuddalore, Madras, Madura, Nagapatam and Pamban the maximum temperature happened to be 7° to 14°F. above their respective normals. From almost all these places, heat waves were reported during May 1948.

Weather Report for the Metrological Observatories at the Agricultural College and Research Institute and Cotton Breeding Stations at Coimbatore for the Month of May 1948.

		Observatories at A. C. R. I. (0822 hours)	Cotton Breeding Station (0722 hours)
Report No. 2/48			
Absolute Maximum in shade	...	98·8° F	99·8° F
Absolute Minimum	...	68·2° F	68·2° F
Mean Maximum in shade	...	94·75° F	96·0° F
Departure from normal	...	+0·55° F	+1·1° F
Mean Minimum in shade	...	73·9° F	73·6° F
Departure from normal	...	+0·5° F	+0·2° F
Total rainfall for the month	...	4·79"	4·19"
Departure from normal	...	+2·54"	+1·81"
Heaviest fall in 24 hours	...	1·58"	1·88"
Total number of rainy days	...	5	5
Mean daily wind velocity	...	2·32 miles per hour	3·71 miles per hour
Departure from normal	...	+0·32 "	+0·15 "
Mean Humidity at 8 hours	...	74·0 %	80·0 %
Departure from normal	...	+6·5 %	+5·0 %

SUMMARY.

Though the maximum temperature was only slightly in excess over the normal, the weather was sultry practically throughout the month. Though the rainfall was in excess over the normal the weather on the whole was not pleasant. M. B. V. N. and C. B. M

UNIVERSITY OF MADRAS

B. Sc. (Agriculture) Degree Examination, April 1948

FIRST EXAMINATION

AGRICULTURE

Time: Three Hours Max: 60 marks

Answer Six questions only

Questions 3 and 8 are compulsory

1. Explain the methods of observation and recording any four of the various Metereological elements you have studied. State the purpose served by each of them to the ryots of this Presidency. 9 marks

2. What is meant by 'Soil' and 'Sub soil' of a field? How far does each remain independent of the other? Explain the situations that necessitate a ryot to deal with the 'sub soil' of his field for his advantage. 9 marks

3. Give the areas covered by the following implements in a day of eight hours under the given conditions and state reasons for your answer.—

(a) Country ploughs Puddling in wet lands (stiff clay loams with good summer rains).

(b) Country plough—covering groundnut seeds dibbled behind a country plough.

(c) Cooper plough No 11—covering farm yard manure spread uniformally over a well ploughed field (light clay loams).

(d) H. M. Guntaka No 2 Weeding in a ploughed fallow, a week after a good rain (black soil).

(e) Ridge plough—Forming furrows and ridges for sowing cambodia cotton seeds (well ploughed clay loam).

(f) RE Guntaka—To break clods in a field left deep ploughed after a good soaking rain (light clay loams) 12 marks

4. What is meant by 'Tillage'? Explain with reasons the difference in the preparation of necessary tilth for the ragi crop, (a) for sowing in seed bed and (b) for planting seedlings 9 marks

5. Compare and contrast the uses of the following implements:—

(a) Cooper plough No 25 and the Country plough.
(b) H. M. Guntaka No. 0 and Dantulu.
(c) Junior Hoe and the Iron toothed harrow.
(d) The wet land puddler and the Trampler, 9 marks

6. Describe in detail the method of sowing of a mixed crop of Korra (*Setariaitalica*) and Red Gram (*Cajanus Indicus*) in lines economically in a day in a six acre field. Show the turning of the lines at the headlands by means of arrows in a sketch of the field. 9 marks

7. (a) Define 'duty of water'.

(b) Calculate the duty of water for a crop, of six months duration receiving 4'7" of water every 10 days. 9 marks

8. For what depths of wells will the following water lifts be economically useful.—

(a) (i) Picotah (ii) Bullock mhote (iii) Oil-engine with 3" delivery pipe?

(b) Calculate the volume of water lifted in a day of eight hours and the area that can be commanded by each lift. 12 marks

BOTANY

Time: Three hours Maximum: 60 marks

Answer Six questions only

Questions 4 and 7 are compulsory

1. Describle the protective outer layer or layers of three of the typical seeds studied by you, and give details with diagrams of the essential stages in the germination of one of them. 9 marks

2. Give a few instances in which (a) leaves (b) and stems serve as means of vegetative reproduction. Describe the details of one in each. 9 marks

3. What is apical meristem? With the help of diagrams show how the differentiation of the tissues takes place. 9 marks

4. Explain in detail how green plants make such complex organic compounds as carbohydrates and proteins. 12 marks

5. Why is the flower regarded as a highly specialised leafy shoot adapted to perform the reproductive function? What are the functions of the calyx and corolla? 9 marks

6. Describe with diagrams (a) the formation of embryo-sac and (b) the process of fertilization in flowering plants. 9 marks

7. Give the distinguishing characters of *Solanaceae* and mention the economic plants belonging to this family. 12 marks

8. Write short notes on :—

(a) Anaerobic respiration.
(b) Schizocarpic fruits.
(c) Phyllode.
(d) Sieve tubes 9 marks

ZOOLOGY

Time: Three Hours Maximum 60 marks

Answer six questions only

Questions 2 and 6 are compulsory

Sketches and examples should be given wherever necessary

1. Describe the external features of a fish and a caterpillar and show how they are adapted to the mode of life in each case. 9 marks

2. Compare the organisation and stucture of the annelids with those of the coelenterates to show how the former are more advanced than the latter. 12 marks

3. What is meant by *Metamorphosis*? Describe the process in the case of the frog, the beetle, and the grasshopper. 9 marks

4. Give an account of the respiration in amæba, scorpion and cockroach. 9 marks

5 Distinguish between:—

Oviparous and Viviparous,
Mitosis and Binary fission
Parasite and Predator
Secretion and Excretion. 9 marks

6. Give the characters of the phylum *Mollusca* and discuss its economic importance. 12 marks

7. Write short notes on Ecdysis — Halteres — Nematocysts — Nictitating membrane — Typhlosole — Portal system. 9 marks

8. Write a short essay on the *Alternation of Generations* in the animal kingdom 9 marks

CHEMISTRY

Time. Three hours Maximum: 60 marks

Answer six questions only

Questions 3 and 4 are compulsory

1. The following data represent the result of the analysis of an Organic compound.—

0 2993 g gave 0 5412 of carbon dioxide and 0 2583 g. of water. Also in Nitrogen estimation by Will and Varentrop's method it was found that when 0 5112 g. of the substance was taken 7 c.c. of normal Hydrochloric acid were required for absorption. Find the empirical formula of the substance 9 marks

2. Write short notes on the following:—

(a) Homologous series.
(b) Friedal and Crofts reaction.
(c) Space isomerism.
(d) Sandmeyers' reaction 9 marks

3. Compare the action of Nitrous and Nitric acids on the aliphatic and aromatic hydrocarbons and their mono-hydroxy derivatives. Indicate the importance of these characteristics from the Biological standpoint. 12 marks

4 Starting from Acetic acid, how would you obtain the following substances:—

(a) Acetylchloride
(b) Chloro acetic acid
(c) Cyan acetic acid.
(d) Amino acetic acid.

State the distinctive changes in properties following the above transformations 12 marks

5. Organic compounds are made up as often of Carbon as of Hydrogen or Oxygen but are classified as compounds of carbon and not of the other two elements. What are the general features of their preparation and properties that justify the above classification?

6. Describe the commercial preparation of urea.
Mention the more important reactions bearing on its structure 9 marks

7. How are organic substances possessing the general formula $c_nH_{(2n+1)CHD}$ prepared? Describe with equations their more important reactions. 9 marks

8. Describe as many simple experiments as possible for distinguishing —

(a) Maltose and Lactose.
(b) Glucose and Fructose
(c) Tartaric and Citric acids.
(d) Arsenates and Phosphates 9 marks

SECOND EXAMINATION

AGRICULTURE I—PLANT HUSBANDRY

Time: Three hours Maximum: 100 marks

Answer six questions only

Questions 6 and 7 are compulsory

1. Name the different implements used in the various stages of farming the 'Low rainfall tracts' of the Madras Presidency. Explain how each of these implements contribute to the conservation of 'Soil Moisture' in the fields for the upkeep of the crops raised on them. 16 marks

2. State what is meant by the term 'Fertility status' of soils. Name the important methods of maintaining it and clearly explain the principle involved in each of them. 16 marks

3. From what block in the wet lands of your College Farm did you get the 'maximum' yield of paddy, for the last harvest? Is this maximum yield due to the 'Variety' of the paddy planted or the fertility of the block? If the former why could not that particular variety alone be planted in all the other blocks also? If the latter why could not the other blocks also be brought to the same level of fertility? 16 marks

4. Write the cultivation sheet of any fine variety of paddy grown in any of the blocks of the Central Farm wet land and give the cost of production of one bag (164 lbs.) of paddy. 16 marks

5. Write short notes on any four of the following:—

(a) Cultivation sheets. (b) Pasture grasses. (c) Patti mannu.
(d) Dry Farming. (e) Glyricidia. 16 marks

6. Work out the cost per acre of the given operations in the cultivation of the following crops:—

(a) Preparing the land, and forming furrows and ridges for sowing cambodia cotton seeds.

(b) Pulling paddy seedlings from a wet nursery and bundling them and carting.

(c) Digging pits and planting plantain suckers.

(d) Manuring sugarcane with groundnut cake and ammonium sulphate (Include cost of manure)

(e) Harvesting groundnut and preparing pods for the market.

(f) Giving one irrigation to the Ragi crop in summer with a mhote. 18 marks

What are the principles observed in manuring the different crops raised in the 'Dry', 'Garden' and Wet lands of the Central Farm? Explain with examples. 18 marks

8. Give the object, scope, layout and conduct of any one of the simple experiments you propose to find out the effect of four types of manures on the paddy crop. 16 marks

AGRICULTURE II—PLANT HUSBANDRY AND HORTICULTURE

Time. Three hours Maximum: 100 marks

Parts A and B to be answered in separate books

Part A

PLANT HUSBANDRY

Maximum: 60 marks

Answer three questions only

Question 1 is compulsory

1. Describe the methods of cultivation of Sunn Hemp for fibre and extraction of fibre prevalent in South India. Suggest improvements in the cultivation and extraction practices. 24 marks

2. A block of 100 acres of alkaline land is to be brought under cultivation in the Kistna irrigation system. Suggest a suitable method of reclamation and work out the cost of bringing the area under normal cultivation for the paddy crop. 18 marks

3. What are the salient features that are brought out from a review of the manurial experiments conducted during the past years in the several Agricultural Research Stations? 18 marks

4. Write short notes on (a) Unit value of manure (b) Short crop sugarcane (c) Nadam cotton (d) Double transplanatation. 18 marks

Part B

HORTICULTURE

Maximum: 40 marks

Answer three questions only

Question 2 is compulsory

1. What are the factors that govern fruit setting in orchards? How far can they be modified in practice in commercial orchards? 12 marks

2. Describe the methods of raising Grape vine in South India. Where are these largely grown? What are the disabilities of the Viticulturists and how can they be overcome? 16 marks

3. Prepare a suitable cropping scheme for supplying daily 50 lbs. of fresh Indian vegetables to the College hostel. Indicate the acreage, varieties and yields, in the different seasons. 12 marks

4. Write short notes on (a) Budding (b) Basin irrigation (c) Sword sucker (d) Goottee 12 marks

AGRICULTURAL ZOOLOGY

Time: Three hours Maximum: 60 marks

Answer six questions only

Questions 1 and 3 are compulsory

1 Give an account of the lac cultivation in India Mention the chief uses of shellac. 12 marks

2. Discuss the role of insects in the spread of disease. 9 marks

3, Mention the pests of the coconut palm under the following heads.— (a) Name of the pest (b) family (c) Nature and extent of damage and (d) Control measures, 12 marks

4. State the characters and economic importance of the following families:— (a) Syrphidae (b) Tenthredinidae (c) Arctidae and (c) Fulgaridae. 9 marks

5. Explain what is meant by balance of life in nature with reference to insects What are the factors which upset this balance? 9 marks

6 Write a short account of the important introduced pests found in this Presidency. How can such introductions be prevented? 9 marks

7 Explain the term tropism State the possibilities of making use of this in pest control 9 marks

8 Write short notes on:— (a) Cammexane (b) Combined spray (c) Pebrine and (d) Blastophaga. 9 marks

ANIMAL HYGIENE

Time: Three hours Maximum 60 marks

Answer Six questions only

Questions 2 and 8 are compulsory

1. Describe the liver of the Ox. 9 marks

2. Give a brief account of digestion, absorption and assimilation of food in ruminants.

3. Make a sketch of a double rowed byre, giving dimensions of its various parts What is the kind of floor you would lay and why? 9 marks

4. What are the symptoms and treatment of chocking in cattle? 9 marks

5. How would you recognise Anthrax in cattle and what measures would you take to dispose of a cow dead of the disease? 9 marks

6. Write a short essay on Coccidiosis in fowls. 9 marks

7. What are the causes and treatment of diarrhoea in calves? 9 marks

8. Write explanatory notes on any *four* of the following:—

(a) Febrifuges (d) Ferri sulphas

(b) Chiretta (e) Tobacco

(c) Gum accacia (f) Ammonium chloride 12 marks

AGRICULTURAL ENGINEERING

Time: Three hours Maximum 60 marks

Answer only six questions

Questions 1 and 4 are compulsory

1. A Sub artesian masonry weel of six feet diameter has standing water level to a depth of seven feet above its rocky bottom which is 18 feet below ground level. An oil engine driven pump installed at the weel empties the well in three hours, and it takes two hours for the well to recoup fully, Suggest different possible methods of getting out more water from the well for irrigation. 12 marks

2. (a) State the prismoidal formula for detemining volume.

(b) An earthern tank bund 800 feet long has the cross sectional areas 30, 175, 250, 275, 300, 225, 240, 125, and 12 sq. feet the cross sections having been taken 110 feet apart Estimate the cost of removal of the bund. if the rate for earth work is Rs. 35/-per 1000 C ft. 9 marks

3. A page of a level field book is indicated below Reduce the levels, apply arithmetical check, and complete the field book.

Back	Inter	Fore	R, level	
2·75				
1 82		7·31		
2 97		3 52		
	9·26			
6·30		4·75		
3·68		12 13		
	3·82			
		4·23	273 89	9 marks

4. Give a design with neat sketches for a cattle shed for a place in the hills to house 12 pairs of animals and mention the materials to be used for the construction. 12 marks

5. Write short notes on any four of the following:—
   (a) Butter churns.
   (b) Archimedian screw.
   (c) Prismatic compass.
   (d) Thermal efficiency.
   (e) Gins.
   (f) Confined ground water.
   (g) Line of collimation. 9 marks

6. Describe briefly the different classes of water lifting machines in ordinary use

Compare the merits and defects of reciprocating and centrifugal pumps for well irrigation. What kind of pump will you recommend for a well 4 feet diameter with water level 45 feet below ground level? Indicate its lay out by means of a sketch. 9 marks

7. Draw a dimensioned sketch and describe in detail the parts and working of a sprayer suitable for spraying an Orchard with *DDT*. 9 marks

8. (a) Three units of concrete broken stone in cement mortar in the proportion of 1 3·6 are to be laid for the three feet deep foundations of a stationary engine. Work out the quantities of the several materials required. Indicate and sketch the type of foundation bolts you would use for erecting the engine.

(b) Explain the following statements of an importing firm:— 'The T. D. 6 type Crawler tractor develops a draw bar H. P. of 28 and a maximum belt H. P. of 35. The maximum draw bar pull is 7160 lbs.. 9 marks

FINAL EXAMINATION

AGRICULTURE I—ECONOMICS

Time: Three hours Maximum: 100 marks

Answer six questions only

Questions 5 and 8 are compulsory

1. Define the meaning of four of the following:—
   (a) Wealth (b) Capital (c) Consumption goods (d) Wants (e) Monopolies. 16 marks

2. What are the fundamental differences between Indian and British Agricultural Industry? Are the differences governed by economics of production. 16 marks

3. Justify the statement that the law of diminishing return operates much too sooner in agriculture than in industry. 16 marks

4. What are the distinctive features of diversified and specialised farming? Give the advantages of each system Which of the two systems is more prevalent in this country? 16 marks

5 Give a short description of a weekly shandy you know of. What is your reaction to the proposal that these shandies should be adopted for the marketing of agricultura commodities on modern lines? 18 marks

6. Does the law of demand and supply operate immediately today? If not what are the factors operating against its unrestricted play? 16 marks

7. What is meant by the term 'Controlled Credit'? How has it influenced agricultural production and the economic status of the grower? 16 marks

8. Work out the economic production of rice and cambodia cotton crops under well irrigation in the Coimbatore district. 18 marks

AGRICULTURE II—FARM MANAGEMENT AND ANIMAL HUSBANDRY

Time: Three hours Maximum: 100 marks

Answer six questions only
Questions 1 and 5 are compulsory

1. Describe the methods adopted for breeding, feeding and rearing of cattle in the Kangayam tract. 18 marks

2. Fifty pounds of milk are left over as surplus in a dairy. Discuss the economics of their disposal as butter, ghee and Khova, adopting the current market rates for the product concerned 16 marks

3. What is the difference between the following sets of terms used in animal husbandry:—

(a) Rotational and deferred grazing.
(b) Pasteurisation and homogenisation.
(c) Performance and Pedigree records.
(d) Line and close breeding? 16 marks

4. With the farm produce available on the Central Farm frame suitable rations for the following classes of stock:—

(a) Breeding Bull (for one in number).
(b) She-buffalo in milk (10 lbs. per day).
(c) Pregnant goat (for one in number).
(d) A laying hen (for one bird).

How can the rations be improved if you are permitted to purchase feed in addition? 16 marks

5. What is mixed farming? What are its merits and demerits? How many cattle, in addition to those required for work, can be maintained on a wet land farm of 25 acres? 18 marks

6. What are the common measures adopted for judging profits from farming? Work out the farm business income for a farm cultivating 10 acres of paddy and 2 acres of sugarcane. 16 marks

7. Labour in India is said to be inefficient and cheap Why? How can the efficiency be increased with special reference to agriculture? 16 marks

8. Write short notes on:—

(a) Depreciation. (c) Crop insurance,
(b) Collectivisation. (d) Commercial crops. 16 marks

AGRICULTURAL BOTTAN I

Time: Three hours Maximum: 100 marks

Answer six questions only
Questions 5 and 7 are compulsory

1. Describe the anatomy of the stem and leaf of a typical variety grown in Coimbatore district of either (a) Sugarcane or (b) Cotton 16 marks

2 How would you test the germination of the seeds of a commercial crop? What are tha conditions affecting the vitality of seeds? 16 marks

3. Taking any crop plant the root system of which you have studied describe how the root system variety according to (a) the particular species or varies and (b) soil type. What is the effect of water logging on root development? 16 marks

4. Describe the structural features and roll of air spaces in aquatic plants. 16 marks

5. Describe by diagrams the floral adapations in plants to secure cross pollination. 18 marks

6. What part is played by plant introductions in the improvement of agriculture? Discuss this with reference to (a) sugarcane and (b) fodder plants introduced into India from foreign countries. 16 marks

7. Explain why weeds are such successful plants Mention some of the introduced weeds and describe the morphological features of *Acanthospermum hispidum* together with the means of controlling its spread. 18 marks

8. Write short notes on any *four* of the following:—

(a) Parasitic seed plants,
(b) Epiphytes,
(c) Anthocyanins,
(d) Mangroves,
(e) Photoperidism,
(f) Cleistogamy, 16 marks

AGRICULTURAL BOTANY II

Time: Three hours Maximum. 100 marks

Answer six questions ouly
Questions 5 and 8 are compulsory

1. What evolutionary stages could be traced from a study of the structure and reproduction observed in (a) *Chlamydomonas* (b) *Spirogyra* and (c) *Oedogonium*? 16 marks

2. Discuss the position Selaginella occupies among the pteridophytes. Give an account of the development of the micro and the megaspores of Selaginella. How does the prothallus of Selaginella differ from that of ferns? 16 marks

3. Describe the development of the sporophyte in *Polytrichum* 16 marks

4. In what way can the inheritance of quantitative characters be explained by Mendielian explanation of inheritance? 16 marks

5. Give a genetic explanation of the phenomenon of heterosis. Discuss the economic importance of heterosis and state to what extent it can be applied in agricultura practice of this country. 18 marks

6. What important differences characterise mitotic and metoic divisions? Of what genetic significance are these differences? 16 marks

7. Enumerate the imporant diseases which affect the yield of sorghum. Describe in detail one of the most serious of these and suggest methods of control. 16 marks

8. What control measures are to be adopted in the case of the following diseases:—

(a) Koleroga of arecanut.
(b) Damping of tobacco seedlings.
(c) Wilt in cotton.
(d) Ring disease of potato. 18 marks

AGRICULTURAL CHEMISTRY I

Time Three hours. Maximum: 100 marks

Answer six questions only

Questions 4 and 6 are compulsory

1. 'Green manuring is necessary for the maintenance of fertility of Paddy soils as well as for the economic manuring paddy crop'. Explain. 16 marks

2. Compare laterite soils of Nellore and Malabar with the red earths of the other parts of the Madras Presidency and discuss their mode of formation and fertility status. 16 marks

3. What is meant by total and available plant food of a soil? Describe how the latter is determined in a soil containing soluble Calcium 16 marks

4. The following analytical report is presented to you:—

Result of analysis of a soil sample for water solubles

Soil type —Sandy loam —Brownish red

Soil reaction pH 8 8

	parts per 100,000		parts per 100,000
Co 3	2 3	Cl	8 2
H Co 3	28 8	Ca	4·4
So 4	Traces	Mg	3 6
		Na	22 5

From the above report, what do you make out as to the condition of the soils for crop production? What would you suggest or recommend for the improvement of such soils in the matter of manuring and cropping under irrigation? 18 marks

5. Write short notes on any *four* of the following:—
   (a) Base exchange
   (b) Ammonification
   (c) Soil structure.
   (d) Mechanical analysis of soils.
   (e) Composting. 16 marks

6 State the more important portions that Nitrogen plays in plants and describe in detail the commercial method of obtaining Ammonium sulphate. 18 marks

7. An irrigation project is proposed to be constructed in your district and you are asked to investigate and to report on the possibilities of developing irrigation cultivation,

Briefly state the procedure you would adopt for such an investigation. 16 marks

8 Write what you know about the role and the quantities required to be present in soils of any two of the minor elements of plant nutrition. Briefly outline one of the more recent advance in analytical methods by which their deficiency may be diagnosed 16 marks

AGRICULTURAL CHEMISTRY II

Time. Three hours Maximum: 100 marks

Answer six questions only

Questions 3 and 4 are compulsory

1. Describe in detail the factors that govern the metabolism of minerals in cattle Which of the minerals are the most important, and what are the effects of their deficiency?

State how you would proceed to experimentally determine the requirement of milch cows for one mineral 18 marks

2. What is meant by a sliding scale of rations for cattle? On what principles are sliding scales based? Illustrate your answer with examples of rations for milch cattle. 16 marks

3. State in brief how you would proceed to analyse a sample of Oil cakes to evaluate its value as cattle food. 16 marks

4. Give a brief account of the chemical changes that are undergone during germination by seeds of (a) Legumes and (b) Cereals. How are the changes utilised in cereals in the manufacture of foods? 18 marks

5. What processes of Plant metabolism are responsible for the formation and storage of the vegetable oils used as human food? Describe some of their important chemical characteristics. 16 marks

6. What is the average composition of the Milk of (a) Cows and (b) Buffaloes? How would you proceed to determine whether a given sample of milk has been adulterated. 16 marks

7. What are the factors that are involved in the spoilage of milk? What are the effects and how would you prevent them? 16 marks

8. Write short notes on any *four* of the following:—
   (a) Endogenous metabolism.
   (b) Starch equivalent.
   (c) Nitrogen fixation.
   (d) Plant Harmones
   (e) Rennet.
   (f) Lucerne. 16 marks

OBITUARY.

We regret to report the sudden death of Sri. K. Jagannatha Rao, L. Ag., Deputy Director of Agriculture, Vizagapatam, of heart failure at Araku on 24—6—1948. Sri. K. Jagannatha Rao comes from a well known family of Cuddapah District and has served in the Department for over 25 years in various capacities. A very hard working and enthusiastic officer, he has left a mark in whatever capacity he has served and endeared himself to one and all in the Department. His death deprives the department of one of the most experienced and able officers at a time when it could ill afford to lose. He leaves behind his wife and children and brothers besides a host of friends and relations to bemoan his loss.

Agricultural College, Bapatala Students' Corner:— Due to summer vacation there is no student activity. The following are the results of the B. Sc. (Ag), Degree Examination held in March — April 1948.

First Examination. Complete passes — Abdul Aziz, Abdul Rahiman Baig. Asirvadam, M. K. S. Balagurunadan, S. Balakrishnamurty, S. Bhanumurty, M. Bhaskara Rao, Y. Chandra Rao, P. V. George, J. F. Jaganadha Rao, G. Krishnamurty, K Krishnamurty, P Krishnamurti, S Krishnan, S. Kumaraswamy, P Lakshmaiah, V Loganadhan, M. S. Kondiah, M. M Mahaboob Ali, Syed Meeniah, V Mohmed Basha Naganna N. Ch, Nagabhushanam, K Nagireddi, K. Narayanappa, G. Narsingh, M Payanaraju, R. V. S. S. Palamandi, V. S. Panakala Rao, M. V. Papi Reddi, V Prahalada Rao, C. Radhakrishnamurty, D. Ramachandra Rao, A. V. Ramachandra Reddi, T. K. Ramana Reddi, M. V. Ramalinga Chetty, P. Ramamohana Sastry, V. Ramanujam, C. Rama Rao, K. Satyanarayana, A. Satyanarayana Murty, M. Sitaramayya, K. Sitarama Sastri, S. V. Siva Rao, K., Siva Rao, Y. Sree Ramamurty, G. Sree Ramachandramurty, N. Subba Rao, A. Suryanarayana, H. Thanikachelam, T. K. Thejomurty, P. S. Umadarapatro, Y Vamsavardhanam, B. B. Venkataramana Reddi, A. Venkateswara Rao, A. Venkataramaiah Ch., Venkataranga Reddi, P Veeraraghavan, V. Venugopalaswamy, S.

The following candidates have references in the subjects noted:—

Agriculture:— Balaramdas, M. Miss Navaneetham, K.

Agricultural Botany — Nagarajan, C. Miss Navaneetham, K. Rajeswara Rao, K. Padmanabhan, S Srinivasa Rao, K. Subba Reddi, K C. Venkatapathi Raju, S. P.

Agricultural Zoology.— Majajuddin, Md. Nagarajan, G. Miss Navaneetham, K. Parthasarathy, S. A. Srinivasa Rao, K. Subba Reddi, K. C. Venkatapathi Raju, S. P.

Civil Engineering.— Narayana, El Majajuddin, Md. Nagarajan, C. Parthasarathy Reddi, V. Augustin, K P R. Rajeswara Rao, R. Raju, M. D. A. Satyanarayana Raju, G. Srinivasa Rao, K. Subba Reddi, K G.

Results of the following candidates were with-held —

Anirudha Misra, Bhaskaram, A. R. Bhaskara Rao, Ch. Buchivenkatapathi Raju, S. Samantarai Chintamani, Sathpathy, J. M. Rath, K. C. Muthukrishna, K. S. Narayana Chetty, V. Padmanabhan, P. Radhakrishnan, K. S. Ramachendra Reddi, G. L Manamurty, M. V. Ramanadhan, N. Rangaswamy, P. Sheik Abdul Khader. Sriramakrishna, K Tiruvenkatachari Yuvaraj, N.

Second Examination. Complete passes— Appava Naidu. Azmatulla Khan, Balagopal, K. Bhanji Rao, B Bhaskara Rao, K. Bhimasatri, A. Gangaprasad, N. George Vasanta Rao, M. Gopalakrishniah, Gopalaratnam, G. Gopinath, M. Harishchandramurty, L. Imam Sheik, Jagannadham, A. Patnaik, V. J Kamoji, B. Jayaram, A. Karunakara Rao, A. Koteswara Rao, K. Krishnamurty, M, Krishnamurty, P. Krishnamurty, P. P. V. Krishnamurti Rao, B Ch. Lakshmiah, C. Lakshminarayana, K. Mallikarjuna Rao, Y. Mohamed Hameed, Waizullah, Md. Narasimha Rao, P. Narayanan, S. Raffuddin Alishkhani, Neelakantiah, O. Prabhakara Rao, C. Rajaratnam, J. Ramachendran, L. Ranga Reddi, B. Rama Rao, Koka. Rama Rao, D. V, Ratnakara Rao, T. V. L. Raveendra Rao, G Mahanti, P. C. Satyanarayanamurty, K. Satyanarayanamurty, Karlapalem. Pomode Kishore Patnaik. Parama Hamsa, B. R. Seshachela Sarma, C. Sitapati Rao, S. Sivaramakrishnayya, M. Siva Reddi S. Sadasiva Reddi, G. Srinadhan, A. Srirama Rao, T. Srirama Sarma, K. Srimulu, C.

Subbiah, J. Sudhakara Rao, K. Sundara Rao, P. Sundara Singh, M. Suryanarayana, P. Suryaprakasa Rao. P. Valasi Naidu, K. Varada Reddi, C. Varaprasada Rao, T. Gopala Rao, B. V. Veeraraghava Rao, K. Venkatapathi Chetty, T. Venkat Rao, G Venkatachari, B Surya Rao, M. V Reddiah, G V. Venkoba Rao, K. Virabhadra Rao, N. Brahmmanna, N. Hanumanth Rao, M. Raghava Rao, N.

The following candidates have references in the subjects noted under.—

Agriculture;— Appala Narasayya, P. Jaganmohan Rao Patnaik, Krishnamurty Pisapati. Prasada Rao, K. Ramachendra Rao, K. Sanyasi Rao, C. Seshatalapasayi, P. Venkataswamy, K

Agricultural Botany:— Suryanarayana N. Seshatalapasayi, P. Rama Rao, C. V. Prasada Rao, K. Krishna Sarma, I Krishnamurthi Pisapati. Venkataswamy K.

Agricultuaal Chemistry.— Dharma Rao. B. Krishnamurty Pisapati. Krishna Rao, M. Krishnasarma, I. Lakshminarayana M. Prasada Rao, K Raghavulu G R, V. Vedantam, C. Veera Reddi, D. Rama Rao, C V. Venkataswamy, K Viswanadiah, K. Seshatalapasayi, P.

Agricultural Engineering:— Kameswara Sarma, V. Krishnamurti Pisapati.

Agricultural Entomology — Rama Rao, C. V. Viswanadiah, K. Jaganmohan Rao Patnaik. Venkataswamy, K Krishnamurthi Pisapathi.

The results of the following candidates were with-held.—

Anjaneyulu, K. Narayana Rao, R

Final Examination. Complete passes:—First Class: Anjaneyulu Naidu. Second Class: Ananthakrishna, V. Anji Reddi. Appala Narasimham, J Achutaramaraju, B. Appa Rao, G. V. Appa Rao, V. Bhaskara Rao, V Brahmanna, N. Chandrayya Naidu, N Chelapathi Rao, S. V Chakrapani, K. Dharmalinga Swami, P. Dharma Rao, M Gopalachari, N. C. Gopalakrishnamurty, A. Hanumantha Rao, A. Hanumantha Rao, Ch. Jaganadha Rao, P. Kanakaprasada Rao, P. Kondiah, B. Koteswara Rao, K. Koteswara Rao, T. Krishnamraju, K. Krishna Murti, B Krishnamurti, G. Madhava Rao, S. Murthusa Sheriff Mohana Rao, N. V. K Nageswara Sarma, D. Nagi Reddi, N. Narasimharaju, K A. Narasimha Rao, G. L. Narasimha Rao, M. Narasimha Rao, R. Narasimha Rao, T. L. Narayanaswami, V. Panduranga Rao, C. Prahalada Rao, G Radhakrishnamurty, K. Radhakrishnamurty, P. Raghvendra Rao, J. Ramachendran, T Ramachendra Reddi, B. Ramalinga Reddi, K Ramalinga Reddi, Kothakota Rama Rao, B. V. Rama Rao, M. Rama Rao, V. Ramasubbiah, K. Satyanarayana, K Satyanarayana, T. Satyanarayanaraju, V. Satyanarayana Rao, K Satyanarayanaswami, G Siddalinga Reddi. Miss Sitalakshmi, V Sitapathi Rao, C. Sivaramakrishnayya, Y. Srinivasa Rao, P Sriramamurthi, S. Sriramulu, K. Subba Rao, P Subba Rao, R Suryanarayana, T. Suryanarayana, Y. Suryanarayanamurty, H Suryanarayanamurty, V. V. Sriyanarayana Sarma, D. Raghavaraju, N. V. Venkat Rao, M Venkiah, P

The following candidates have references in the subjects noted under :—

An-Husbandry and Dairy:— Pushpayeni, G. Surendranath, G. Subharanjan-Amma, G. Madhava Rao, T.

Agricultural Economics and Farm Management:— Raghava Rao, Surendranath G.

Animal Hygiene:— Ahmed Syed. Hanumantha Rao, M. Janardhana Rao, P. Madhava Rao, T. Nageswara Rao. M Pattabhirama Reddi, Ramakoteswara Rao, G. Reddi Babu, I. Sabharanjanamma, G. Surendranath, G. Suryanarayanamurty, T. Venkata Rao, A.

Plant Physiology:— Ahmed Syed. Janardana Rao, P. Krishnanandam A. V. Madhava Rao, T. Nageswara Rao M. Papa Rao, P. Prasada Rao, G P. Pushpavemi, G. Reddi Babu, I, Sabharanjanamma, G. Surendranath, G.

Agricultural Chemistry:— Ahmad Syed. Madhava Rao, T. Nageswara Rao, M. Sabharanjanamma G. Surendranath, G.

Horticulture.— Madhava Rao, T. Sabharanjanamma, G.

DEPARTMENTAL NOTIFICATIONS.

GAZETTED SERVICE—POSTING AND TRANSFERS.

Name of Officers	From	To
Janab A. Mohammad Ali Sahib Bahadur,	Asst. Marketing Officer Madras,	Asst. Marketing Officer Trichinopoly.
Sri M. P. Sankaran Nambiar,	D. A O.,	D. A. O., Calicut
Janab P. P. Syed Mohammad Sahib Bahadur,	D. A. O., Calicut,	D. A. O., Vellore.
Sri K. G. S. Bhandari,	D. A. O., Vellore,	Asst. Marketing Officer Madras (Chemical work)
,, S. Madhava Rao,	(on leave)	Asst. Curator, Ootacamund.
,, T. Gopalan Nair,	Asst. Curator, Ootacamund,	Superintendent F. R, S, Kodur.
,, K. C. Ramakrishnan,	(on leave),	Lecturer in Agricultural Economic Coimbatore.
,, R. Rama Rao,	D A O, (on leave),	D. A. O., Bellary.
Janab Mirza Anser Baig Sahib Bahadur,	D. A. O, (on leave),	D A. O., Cudappah.

LEAVE.

Sri T. G. Anandarama Iyer, Assistant Marketing Officer, Madras, L. A. P. for 2 months from 1—6—1948.

SUBORDINATE SERVICES.

APPOINTMENTS.

The following B Sc. (Ag.) Graduates of 1948 are appointed as Upper Subordinates in the Madras Agricultural Subordinate Service are ordered

Messrs. A. Appa Rao, Cotton Assistant, A, R. S., Nandyal. N. Anjaneyalu, Fruit Asst, Kodur. B. Achutarama Raju, Fruit Asst., Kodur. D. Meenakshisundaram, Asst. in Paddy A. R S., Adutural S Muthuswami, Fruit Asst, Coonoor. M. V. Jayaraman, Metero Asst, Coimbatore. S Kamalanathan, Cotton Asst, A R. S., Palur M Govindan, Cotton Asst., A. R. S., Palur. S. M. Sankara Rao, Asst, in Entomology, Coimbatore, C. Venkateswan, F. M, S. R. S., Anakapalli. M Ramalingeswara Rao, F. M., S R S., Anakapalli. C. Sitapati Rao, F M, A R. S., Hagari. H. Suryanarayanamurthi, A. D, Madakasira. U P Umamaheswara Rao, F. M,, A, R. S, Samalkota G, Satyanarayana, Swami, A. D, Cocanada. Y. Sivaramakrishnayya, A. D., Salur. G Prahalada Rao, A. D

Penkon. M. Dangaiayya, A. D,, Narasaraopet. K. Chakiapani, A. D., Palakonda. A Gopalakrishnamurthi, A. D., Ellore V. Srmivasa Rao, A. D., Cheepurupalli. M. Narasimha Rao, A. D., Kovvur. M. Seshagiri Rao, A. D, Allagadda A. Gopala-Krishna, A D., Puthur. V. Purnachandra Rao, A. D , Anakapalli. G. L. Narasimha Rao, A. D., Tiruttani. V. Suryanarayanamurthi, A. D., Nandyal. K Satyanarayana, A. D., Kandukur. G. Babu Rao, A. D , Coimbatore. T. V. Rádhakrishnan, A. D., Sankar, C. N, Sambandham, A. D , Bhavani. K. Duraiswami, A. D., Kallakurichi K Rajagopalan. A. D., Peravurni. M C Appayyan, A. D , Pattukottai. D. Raghunatha Reddi, A. D., Krishnagiri. M. Sundaraman, F. M., Botanic Garden, Ootacamund. P. Ramani, Marketing Asst , Coimbatore. Arumugavelu, Marketing Asst., Tiruchirapalli. P. Ramachandra Marar, A. D , Kotagiri. K, Radhakrishna Menon, F. M , A. R. S., Pilicode S Kannan, A D., Maduiantakam. R Vaidyanathan, A D , Tenkasi. A R. Viswanathan, A. D., Gobichettipalayam. T. B. Krishnaswami Rao, A. D., Orathanad. R. Pattabiraman, A. D., Tirutturaipundi and V. Gajapati, A. D., Tiruppattur.

POSTING AND TRANSFERS.

Names	From	To
Sri K. S. Krishnamurthi,	A. D., Pattukottai,	P, A., to D. A. O., Pattukottai.
,, C. S, Krishnamurthi,	Asst., in Mycology, Coimbatore,	A. D , (Green Manure), Wynad.
Janab Sheik Hussain Sahib,	A. D., Bellary,	P. A., to D. A O., Nellore.
Sri T. V. Seshadri,	A. D., Venkatagiri,	A. D , Nellore.
,, K Rangaswami Ayyangar,	A. D., Nellore,	A D., Venkatagiri.
,, A. K. Annaswami Iyer,	Dairy Manager (on leave),	Dairy Manager, Coimbatore.
,, N. G. Raja Rao,	Asst. Inspector under Dt. Supply Officer, Vijayavada.	Marketing Asst. Rajahmundry
,, M Suryanarayana Sastri,	,,	Marketing Asst. Cuddapah.
,, L. Krishnan and S. Lakshmanan,	Teaching Assts Agricultural College, Coimbatore.	Instructors in the Agricultural School, Orathanad. (Tanjore Dt)
,, C. V. Anjaneyalu,	Asst in Cotton, Gurzala,	Asst. in Cotton, Narasaraopet.
,, V. Mahimai Doss,	Marketing Asst.	A. D , Madura.
,, M. V. Meenakshisundaram,	F. M., Tindivanam,	Horticultural, Asst. Coimbatore.
,, A. Rama Doss,	P A., to D.A.O., Pattukotai,	A. D., Kumbakonam.
,, E. J. Balaraj,	Asst. A. D., (on leave),	Asst A. D., Paramakudi.
,, K. R. Krishnamurthi Iyer,	Asst. A D., (on leave),	Asst. A. D., Kulitalai.
,, S Lakshminarayana,	Asst. in Dry Farming Scheme, Bellary,	F. M., A. R. S., Nandiyal.
,, S. V Hariharan,	A D,, (on leave),	A. D , Arantangi.
,, N Narayanan,	A. D , (on leave),	A. D., Arupukottai.
Mr Syed Ahamadullah,	Marketing Asst, (on leave),	Marketing Asst., Salem.
Sri. G. Venkata Raman,	F. M , A. R. S., Nandyal,	F. M.. A. R. S , Pattukottai.
,, M. K Swaminatha Iyer,	A. D Krishnagiri (on leave),	Agricultural Instructor Junior Certified School, Tanjore

Names	From	To
„ M. Jeevan Rao,	D. A. O. Bellary,	P. A. to D. A. O., Bellary
„ S. Krishnamurthi Rao,	P. A. to D. A. O., Bellary,	A. D , Bellary.
„ T. Sankaran Unni,	A. D. Bhavani,	Asst. for Conducting Experimental Trails on Exotic Plant, Wynad
„ S. Madhava Rao,	Asst. in Paddy, A. R. S., Maruteru.	Asst. in Paddy, Coimbatore.
„ K. V. L. Krishnamurthi,	Asst. in Paddy, Coimbatore,	Asst in Pady, A. R. S., Maruteru.
„ K. Sambamurthi,		Fruit Asst., Anakapalle.
„ V. N. Madhava Rao,		Horticultural Asst., Coimbatore.
„ P. S. Anantachari,	A. D., Peravurni,	A. D., Sriperumbudur.
„ S. Muthuswami Iyer,	A. D., Pattukottai,	Teaching Asst. in Agriculture, Coimbatore.
„ K. Ramaswamy Iyer,	A. D., Coimbatore,	Do.
„ K. H. Subramania Iyer,	F. M. A. R. R , Pattambi,	Dairy Manager, Coimbatore.
„ I. L. Narashima Rao,	F. M., Araku Vally,	Marketing Asst., Vizianagaram.
„ R. Appalanarasaiah,	F. M., A. R. S., Arakapalle,	F. M., Araku Valley.
„ G. Narasimha Rao,	F. M., A. R. S., Samalkot,	A. D., Gudur.
„ G. Satyanarayana Rao,	A. D., Puttur	A D., City Vegetable Schame, Madras.
„ K. Janardhana Rao,	F. M., Anakapalle,	Marketing Asst., Guntur.
„ C. Vadamalai,	F. M , A. R. S., Hagari,	Panagal Demonstration Farm, Kalahasti.
„ P. Venkateswara Rao,	F. M., A. R S., (on leave)	F. M , Bagavath Farm.
„ K. Radhakrishnan Menon,	F. M., A. R. S., Pilicode,	F. M., A. R. S. Nileshwar.
„ T. V. Ayyaswami Iyer,	Agricultural Instructer Junior Certified School, Tanjore.	A. D., Srivaikundam.

The following of Special Agricultural Demonstrators in the Scheme of Exploratatory Stations for Cigaratte Tobacco for a period of two years, are ordered:—

Names	From	To
Sri. M. Lakshmikantam,	A. D , North Vizagapatam,	A.D., Vizagapatam Station.
„ G. Pralebakara Reddy,	A. D , Peneukonda,	A D. Nandyal Station.
„ R. Ranganathan,	A D., Orthrnad,	A. D., Cuddalore Station.
„ T. S. Shanmugam,	A. D., Tiruturaipundi,	A. D , Elayirampannai.

The following Eight Agricultural Demonstrators are selected for training in Entomology (3 months) and Mycology (9 months) at the Agricultural College and Research Institute, Coimbatore

Training in Entomology:— Sri. P. Ramadoss, A. D , Narasaraopet. Sri. P. Ammi Raju, A. D., Ellore. Sri. V. L. Narasimha Sastri, A. D. Salur. Sri. K. Rama Mohan Rao, A. D., Cheepurupalli.

Training in Mycology.— Sri. B. Venkataswamy, A D, Gobichettipalayam. Sri. Y. B. Morachan, A. D., Kotagiri. Mr S. A. Ibrahim Ali Sahib, A. D., Madurantakam. Sri. K. Sundaram Pillai, Tenkasi.

LEAVE.

Name of Officers.	Period of leave.
Sri. R. Subbiah Pillai, A. D., (on leave)	Extension of unearned leave for 30 days Form 4—6—48.
„ S. Bhima Raju, A. D., Aruppukkottai,	L. a p for 2 months from the date of relief
„ S. Sangameswara Sarma, Teaching Asst in Agricultural College, Bapatla,	Earned leave for 30 days from 1—6—48.
„ V. Ramaswamy Mudaliar Cotton Asst. (on leave)	Extension of leave on loss pay for 90 days from 7—5—48
„ R. Venkata Rama Iyer, Sub Asst in Botany,	L. a p. for 3 months from 6—6—48
„ P. Lakshminarayana, Asst. A D, Cocanada,	L. a. p. on m. c for 4 months from 13—4—48.
„ C K. Subramanian, Asst. in Entomology, Coimbatore,	Extension of l. a. p. for 3 months from 1—5—48.
„ M. Narayana Nambiar, F. M, A. R. S. Pilicode,	Earned leave for 75 days from 5—6—48.
„ B. Ramakrishna Reddy, A D., Nandyal,	Earned leave for 30 days from the date of Relief.
„ K. Sitarama Iyer, A. D., Tirukoilur,	Extension of leave on half average pay for 1 year and 5 months & 5 days from 24—4—48 preparatory to retirement.
Sri M. S. Sethuraman, A. D., Kulitalai,	Earned leave for 30 days from the date of relief.
„ R. Shanmuga Sundaram, A. D, Tiruppattur,	„ „ 60 days „ „
„ P. R. Subramania Iyer, Asst. F. M., A R. S, Pattukottai,	L. a. p. from the date of relief preparatory to retirement.
„ W S. Ramarathnam, A D, Sriperumbudur,	Earned leave for 60 days from the date relief
„ K. Raman Menon, P. A., to D. A. O, Calicut,	L a. p. for 4 months from the date of relief.
„ G. Ramalingam, A. D, Kandukur,	Earned leave for 1 month „
„ M. K, Gopalan, Marketing Asst (on leave),	Extension of l. a. p. for 4 months from 4—6—1948.
„ K. V. S, Suryanarayanamurthy, Marketing Asst. (on leave),	Unearned leave on M O., for 4 months from 23—4—1948.
„ Herbert Adiseshaiah, A D, (on leave),	Earned leave for 90 days from 10—6—1948.
„ M. Dhanavantari Reddy, A. D., Kovur,	„ for 60 days from the date of relief.
„ S. Ponnuswamy Naidu, A. D, Sankarankoil,	L. a. p. for 1 month and 18 days from 16—6—1948

THE ASSOCIATION OF THE UPPER SUBORDINATES OF THE MADRAS AGRICULTURAL DEPARTMENT.

The Annual General Body Meeting of the above association will be held on 1—8—1948 at 4 P. M. in the Freeman Building. The following is the agenda for the meeting.

1. Consideration of Annual Report and Budget.
2. Election of office bearers for 1948—'49.
3. Any other proposals.

All resolutions intended for consideration of the General Body should reach the Secretary before 25—7—1948.

All members are requested to attend.

K. Meenakshisundaram,
Secretary,
Upper Subordinates Association.