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CONTENTS

Editorial.

King's Birth Day Honours. We are glad to note that the title of Rao Sahib has been conferred on Mr. C. Narayana Ayyar, Head Quarters Dy. Director of Agriculture. He has been connected with the Madras Department of Agriculture for well over 30 years. His services has been mainly in the districts with the exception of a few years when he was in the Agricultural College, first as an Assistant in Entomology, and later as Lecturer in Agriculture. He is one of the earliest members of the Union and during his stay in Coimbatore has been the Editor of our journal for a period. Among his various activities his pioneering work in connection with rice improvement work in Tanjore District is still remembered in the tract. The recognition of his work has come none too soon as he is due to retire from service next November. On behalf of the Union we offer Mr. Narayana Ayyar our sincere congratulations.

It is with great pleasure we notice that Dr. Shaw, Agricultural Expert to the Imperial Council of Agricultural Research has been awarded the title of C. I. E. His services has mostly been in the Imperial Institute of Agriculture, Pusa, where starting as a Mycologist he was later appointed Imperial Economic Botanist, and finally as the Director of the Institute. His wide experience in Pathological and Breeding problems, had been very fruitful in evolving disease-resistant types of crops amongst which may be mentioned the famous wilt-resistant types of *arhar*.

We are also glad to note that the title of Rao Sahib has been conferred on Messrs. Thadani, Economic Botanist, Sind, and Bal, Agricultural Chemist, Nagpur, two other Agricultural Officers in India. We offer our hearty congratulations to the above three gentlemen.

WEIGHT OF CALVES AND PERIOD OF GESTATION IN SOME INDIAN BREEDS OF CATTLE

BY R. W. LITTLEWOOD, N. D. A.

Weight of calves. In the Live-stock section of the Madras Agricultural Department, the calves borne in the different herds are weighed at birth and the present note is the result of the analysis of the records of the weights of calves at birth for the past 11 years in the herds of (1) Kangayam (2) Sind (3) Ongole.

Sex and weight of calf. In all the above three herds, it is found that the weight of calf is significantly higher for the bull calf than for the heifer calf. Table 1 summarises the results obtained both by the method of comparison of the means for the two sexes with their respective standard errors and also by the method of $2 \times n$ classification (Fisher's).

Table I. *Sex and weight of calf.*

Mean weights of calf.				Alternative method.	
Breed	Bull	Heifer	Deviation S. E. D.	X 2	P = ·05
Kangayam	44·6 ± ·41	41·4 ± 35	5·87	52·5	28·869
Ongole	62·0 ± ·67	57·7 ± 53	5·00	57·9	30·144
Sind	44·9 ± ·47	41·7 ± ·52	4·57	27·1	26·296

The increase in the mean weight of bull calf over the heifer is significant, indicating that sex has an influence.

In addition to the above general indication, it is seen from table I that in the Ongole herd, the average weights of calves in both the sexes are considerably higher than in the other two breeds, Kangayam and Sind.

It is quite probable that it may be the characteristic of the Ongole breed that the calves at birth are well developed, but the figures in Table II showing the weight of calves at birth in the same breed born for the same bulls, but from cows bred in different stations as Chintaladevi and Hosur, show clearly the influence of locality.

Table II.

	Chintaladevi.				Hosur.			
Bull No.	Bull calves No.	Heifer calves No.	Average weight. Bull calf.	Average weight. Heifer calf.	Bull calves No.	Heifer calves No.	Average weight. Bull calf.	Average weight. Heifer calf.
			lb.	lb.			lb.	lb.
6	18	25	69·3	60	12	9	50	46
14	3	1	66·0	62	20	8	62	54
31	3	5	58·3	58	13	16	60	53

As regards the management of the stock in both places, the feeding of the stock was similar for concentrated rations but for forage, the Chintaladevi stock received cholam straw grown on the farm and the Hosur received spear grass hay. The analysis of soils in both the places (Table III a and III b) show that the lime content of Hosur soil is definitely poor when compared with Chintaladevi soil.

Hosur Livestock Research Station.

Composition of soils of paddocks from which samples were drawn.

Table III. a.

	Paddock No.			
	3	35	32	38
Lime as Cao	0·14	0·28	0·28	0·11
Total Potash	0·23	0·45	0·31	0·15
Available Potash	0·024	0·010	0·020	0·013
Total Phosphoric acid	0·05	0·05	0·04	0·04
Available Phosphoric acid	0·0016	0·0019	0·0045	0·0086
Nitrogen	0·042	0·072	0·074	0·057

Generally the four paddocks were poor in lime and phosphate; Nos. 3 and 38 in nitrogen in addition.

Table III. b.

Chintaladevi Livestock Research Station The following are the results of analyses of four soil samples from the Livestock Research Station, Chintaladevi—1924.

	Black soil.		Red soil.	
Loss on ignition	4·45	6·42	6·40	3·97
Insoluble mineral matter	81·60	75·26	67·79	81·47
Iron Oxide (FeO_3)	3·81	4·57	5·87	4·74
Alumina (Al_2O_3)	4·02	8·41	11·45	7·80
Lime (CaO)	3·29	2·50	4·18	0·44
Magnesia (MgO)	0·53	0·41	0·21	0·43
Phosphoric acid (P_2O_5)	0·029	0·025	0·025	0·019
Potash (K_2O)	0·22	0·29	0·73	0·49
Soda (Na_2O)	0·51	0·38	0·37	0·46
Sulphuric acid (SO_3)	0·12	0·067	0·076	0·074
Carbonic acid (CO_2)	2·38	2·26	3·00	Trace
Nitrogen (N)	0·023	0·027	0·033	0·038
Available phosphoric acid (P_2O_5)	0·0054	0·0066	0·0005	0·0014
Available potash (K_2O)	0·0059	0·0069	0·0029	0·009

The following are the details regarding the sex and weight of calf in the different herds.

Kangayam Herd. 531 calves have been born to 16 different bulls, of which 274 were heifers and 257 bull calves. The average weight of these calves works out to 45·2 lb. for a bull and 41·7 lb. for a heifer, the highest weight being 62 lb. both for a bull and heifer calf and the lowest weight 25 lb. for a bull and 21 lb. for a heifer calf.

One bull produced 47 calves, the average weight of the calves being bulls 49·6 lb. and heifers 45·5 lb. Some bulls produced more heifer calves than bull calves and vice versa; bull No. 35 has 43 bulls and 73 heifer calves to his credit whereas No. 132 has 25 bulls and 11 heifers.

Sind Herd. 15 different bulls have produced 277 calves of which 140 are heifers and 137 bull calves. The average weights of these are bulls 45 lb. heifers 41·5 lb. The highest weight for a bull calf is 66 lb. and for a heifer 56 lb. the lowest weights being bull 26 lb. and heifers 27 lb.

The Bull No. 118 produced 24 calves, the average weights being bulls 51 lb. and heifers 43 lb.

Bull No. 8 has produced 18 heifer calves and 6 bull calves and No 38 has 11 heifers and 4 bull calves to his credit whereas Bull No. 115 has produced 15 bull and 7 heifer calves.

Ongole Herd. Chintaladevi Farm :— 248 calves were born to 9 bulls of which 120 were bull and 128 heifer calves. The average weight works out to 65 lb. for bull calves and 59·5 lb. for heifer calves. The highest weight for a bull calf is 83 lb. and for a heifer 84 lb. the lowest being, bull calf 34 lb. and heifer calf 38 lb.

Bull No. 8 has produced 72 calves, 40 of which are heifers and bull No. 125 produced 37 calves, 21 of which are bulls and 16 heifers.

43 calves were born to Bull No. 6 18 bull calves averaged 69·3 lb. each and 25 heifer calves 60 lb. each.

Hosur Farm. 10 Ongole bulls produced 199 calves of which 109 were bulls and 90 heifer calves. The average weight works out to bulls 60·3 lb. and heifers 54 lb. the highest weights recorded being bull calf 80 lb. heifer calf 84 lb.

Bull No. 14 produced 28 calves, 20 of which are bull and 8 heifer calves.

20 calves were born to one bull, of which 11 bull calves average 63 lb. and 9 heifers 59·5 lb. each.

Period of gestation in cows. Breeders generally accept the average period of gestation of cows as 285 days; if a cow goes longer than this, their opinion is that the calf will most probably be a bull calf. The writer has gone through his records and worked out the average period of gestation in cows of the Ongole, Kangayam and Sind breeds. The breeder's acceptance of 285 days gestation period holds good for most cows of the Kangayam and Sind breeds, but not for the Ongoles. For some unknown reason the period of gestation for Ongole cows is 3 to 4 days longer on the average than the two former breeds.

There were cases in all the 3 breeds where some cows calved earlier than 277 days and some over the 300 days periods but these have been omitted.

Table IV. *Sex and period of gestation.*

Mean period of gestation.				Alternative method.	
Breed.	Bull.	Heifer.	Deviation S. E. D.	X^2	P = ·05
Kangayam	286·6 ± ·30	284·1 ± ·26	6·65	57·33	35·172
Ongole	289·8 ± ·32	288·5 ± ·30	2·80	33·46	36·415
Sind	286·3 ± ·41	284·5 ± ·38	3·00	36·17	35·172

Table IV shows for the Ongole in the period of gestation for cows (a) a significant increase in both the heifer and bull calves born (b) sex of calf has also a significant relationship with the period of gestation.

I wish to thank Mr. K. Ramiah, Paddy Specialist, for his kind assistance in working out the results statistically.

THE RELATION OF SOME PLANT CHARACTERS TO YIELD IN CUMBU—*PENNISETUM TYPHOIDES* (Burm.) Stapf and Hubbard—THE PEARL MILLET

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The present study deals with the relationships that subsist between grain yield and some other metrical characters of the Pearl Millet (*Cumbu*, Tamil; *Sajja*, Telugu; and *Bajri*, N. India).

The following six rainfed varieties representative of some distinct types in the Pearl Millet were chosen for study in 1932. The measurements were repeated in 1933.

Selection No.	Population	
	1932	1933
P. T. 17—G.	130	130
P. T. 17—P.	120	85
P. T. 72	130	130
P. T. 248	110	130
P. T. 331	130	130
M. S. 1354	110	125

In Table I are presented the correlation co-efficients between (a) the total grain yield of a plant and (1) height of plant, (2) number of nodes on the main axis, and (3) total number of earheads, and (b) the correlations between the total number of earheads and the average yield per earhead. These are given for both the years.

In the second year of this work, the correlations between the main earhead characters were also studied. Table II presents the correlations between (1) the yield of the main earhead and (2) surface area of the earhead, (3) diameter of the peduncle of the main axis, (4) height of the main axis, (5) length of the earhead, (6) diameter of the earhead, (7) length of the peduncle of the main axis, (8) total number of earheads, and (9) average yield per earhead. The suffix of r used in presenting the partial correlations is as numbered in the list enumerated above.

In order that the significance of the r-values may be readily judged, the correlation co-efficients for the ·01 level of significance are entered throughout by finding $\frac{t}{\sqrt{n-2+t^2}}$ where n is the number of *observations* and *t* (Fisher's *t*) corresponding to P='01 is obtained from Table XXXV of G. W. Snedecor's 'Analysis of Variance' (1934).

Tests were made to see whether the same degree of correlation exists between the variates (a) in the same variety between two years, (b) between all the varieties in each year, and (c) between all the varieties in both the years. These tests are presented in Table III. z is the hyperbolically transformed r and $\sigma_{z \sim z'}$ the standard error of $z \sim z'$ (L. H. C. Tippett, 1931, the Methods of Statistics, p. 140). From columns 2 to 7 it is evident that the fluctuations of r between 2 years in the same variety are in most cases within the limits of errors of random sampling. X_1^2 and X_2^2 relate to the fluctuations (Tippett, p. 142) of r between all the varieties in 1932 and 1933 respectively, and X^2 relates to all the varieties in both the years. When P for X^2 is above '05 the corresponding mean value of r is entered by transforming $\bar{z}$ to $\bar{r}$; likewise for X_1^2 and X_2^2.

Relation between the Total Grain Yield of a Plant and Some Other Characters. *Total grain yield and height.* The height of a plant is taken as the height of the main axis measured from the soil level to the tip of the earhead. The variations of r between the varieties in each year are beyond the limits of errors of random sampling. (Table III). In no case is the r value high, though significant. The mere height of a plant gives little indication of its capacity to yield well.

Total grain yield and the number of nodes. The number of nodes (and these mean leaves) is reckoned on the main axis. The fluctuations of r are not significant (Table III). z='20 is significant, the standard error being '03. However, this value is too low to consider the number of nodes as of importance in estimating the total grain yield.

Total grain yield and the total number of earheads. In 1932 the r-values fluctuate widely but not in 1933 (Table III). The correlation coefficients are fairly high throughout. A plant with a large number of earheads is to be preferred though the total number of earheads is negatively correlated with the average yield per earhead (Table I).

An estimate of the total grain yield can be made when in addition to the total number of earheads being known an estimate of the average yield per earhead is possible. It was therefore thought fit to explore the possibility of any single earhead giving an indication of the average yield per earhead, and the main earhead which is a convenient fixture was chosen for this study. It was found that the yield of this main earhead is correlated with the average yield per earhead (Table II). For this reason attention was directed to investigate the factors that contributed to the yield of the main earhead.

Relation between the yield of the main earhead and some other characters. *Main earhead yield and the total number of earheads.* The main earhead yield is independent of the total number of earheads produced on a plant. The corresponding correlations are (except in one case) below the level of significance (Table II).

Main earhead yield and its surface area. The inflorescence of this millet is a terminal compound spike. The grains are borne on rachillae disposed round an unbranched rachis in a seriate arrangement. A ripe earhead presents the appearance of grains packed on a surface almost cylindrical about the rachis. The surface area of the earhead can be taken approximately as being proportional to *dl*, *d* being the diameter and *l* the length of the earhead. It is seen from Table III that all the correlation coefficients can be combined and the improved estimate of *r* is ·67. The partial correlations obtained by eliminating the effect of the thickness of the peduncle and the height of the main axis, the two factors which bear some relation to yield, are considerable (Table IV).

Main earhead yield and the length and the diameter of the earhead. The yield is correlated with the length and the diameter of the earhead, these being the dimensions determining the surface area. It is found from Table III that in both cases the several values of *r* can be combined, $\bar{r}_{15} = \cdot53$ and $\bar{r}_{16} = \cdot52$. These two factors supply more information when combined to derive the surface area, than singly.

Main earhead yield and the length and the diameter of the peduncle. The length of the peduncle of the main axis is the distance between the topmost node and the base of the earhead. The diameter of the peduncle was measured with Vernier callipers at a standard distance of 5 cm. below the base of the spike. Table III shows that in both cases the *r*'s can be combined. $\bar{r}_{17} = \cdot20$ is just above the level of significance but not high enough to consider the length of the peduncle as an index to yield. $\bar{r}_{13} = \cdot64$ showing that a thick peduncle is a mark of high yield. The partial correlations obtained by eliminating the effect of the surface area are smaller than those obtained by eliminating the effect of height (Table IV). The high correlation between the peduncle thickness and yield is due to the close relationship subsisting between the peduncle thickness and the surface area which has a direct relation with yield.

Main earhead yield and the height of the main axis. The correlations between the main earhead yield and the height of the shoot bearing this earhead fluctuate from variety to variety (Table III). The correlations are significant but generally not high enough to rely on this factor by itself as a guide to yield.

Multiple Correlation Coefficients. The multiple correlation coefficients between the yield of the main earhead and the surface area of the earhead, the thickness of peduncle and the height of the main axis (the three factors that were worth pursueing) are given in Table V. The table commences with r_{12} because of the direct relation that surface area has with yield. The R-values for the ·01 level of significance are entered by taking $\sqrt{\dfrac{me^{2z}}{N-m-1+me^{2z}}}$ where m is the number of independent variates, N the size of the sample, and e^{2z} corresponding to $n_1 = m$ and $n_2 = N - m - 1$ is obtained from Table XXXV of Snedecor's 'Analysis of Variance.' Throughout, $R_{1 \cdot 234}$ is significantly above r_{12}. The tests of significance presented in Table VI were carried out by considering P corresponding to

$$z = \frac{1}{2} \log_e \frac{(R^2_{1 \cdot 234} - r^2_{12})(N-4)}{2\,(1 - R^2_{1 \cdot 234})}$$

for degrees of freedom $n_1 = 2$ and $n_2 = N - 4$ (Tippett 1931, p. 208). It is concluded that the additional factors namely the thickness of peduncle and the height of the main axis help to predict the grain yield of the main earhead with a greater precision than is possible with a knowledge of the surface area only.

Summary. The correlations between the total grain yield per plant and the height of the main axis, the number of nodes in it, and the total number of earheads were determined in six rainfed varieties of the Pearl Millet in two years. The number of heads is correlated with yield. The other factors are but slightly correlated. The average yield per head is correlated to the yield of the main earhead. The yield of the main earhead is correlated with the length, the diameter and the surface area of the earhead, the thickness of peduncle, and the height of the main axis, while the length of the peduncle bears no correlation to yield.

Partial and multiple correlations were also calculated. The yield of the main earhead can be predicted with a fair amount of certainty when the surface area of that earhead, the thickness of its peduncle, and the height of its axis, are known.

Table I.

Total correlation coefficients.

Correlates	P. T. 17/G		P. T. 17/P		P. T. 72		P. T. 248		P. T. 331		M. S. 1354	
	1932	1933	1932	1933	1932	1933	1932	1933	1932	1933	1932	1933
Total grain yield and height	·30	·08	·30	·27	·53	·36	·27	·29	·59	·41	·41	·09
„ „ number of nodes	·19	·11	·20	·07	·14	·36	·08	·16	·44	·14	·20	·13
„ „ number of ear-heads	·69	·69	·65	·71	·46	·73	·51	·80	·59	·72	·83	·70
Number of ear-heads and average yield per ear-head	–·60	–·59	–·56	–·62	–·59	–·44	–·63	–·46	–·27	–·37	–·35	–·55
Level of significance (P = ·01)	·23	·23	·23	·28	·23	·23	·25	·23	·23	·23	·25	·23

Table III.

Combination of the correlation co-efficients.

Correlates.	$\frac{z \sim z'}{\sigma_{z \sim z'}}$ z for 1932, z′ for 1933						All the varieties in 1932		All the varieties in 1933		All the varieties in 1932 & 1933	
	P. T. 17-G	P. T. 17-P.	P. T. 72.	P. T. 248.	P. T. 331.	M.S. 1354.	X_1^2	$\bar{r}$	X_2^2	$\bar{r}$	X^2	$\bar{r}$
1	2	3	4	5	6	7	8	9	10	11	12	13
Total grain yield and height	1·75	·21	1·35	·15	1·43	2·42	17·04	...	13·82	...	42·39	...
,, number of nodes	0·64	·90	1·75	·61	2·39	0·53	11·05	·22	7·20	·17	19·14	·20
,, number of earheads	...	·76	2·15	4·12	1·04	0·98	34·51	...	5·10	·73	51·14	...
Number of earheads and average yield per earhead ...	0·08	·69	1·20	1·83	0·80	1·51	21·97	...	9·78	- ·59	31·75	...
Main earhead yield and surface area of earhead ...	...	...	...	...	...	...	...	...	6·24	·67	...	...
,, diameter of peduncle	...	...	...	...	...	...	...	...	2·31	·64	...	...
,, height of main axis	...	...	...	...	...	...	...	...	27·98	...	...	...
,, length of earhead	...	...	...	...	...	...	...	...	7·44	·53	...	...
,, diameter of earhead	...	...	...	...	...	...	...	...	3·86	·52	...	...
,, length of peduncle	...	...	...	...	...	...	...	...	9 81	·20	...	...
,, number of earheads	...	...	...	...	...	...	...	...	6·50	·11	...	...
,, average yield per earhead ...	...	...	...	...	...	...	...	...	22·32	...	...	...
							P = ·05		P = ·05		P = ·05	
							X_1^2 = 11·07		X_2^2 = 11·07		X^2 = 19 68	

Table II.

Total correlation co-efficients.

Main earhead yield and other factors.

Correlates.	P. T. 17-G	P. T. 17-P	P. T. 72	P. T. 248	P. T. 331	M. S. 1354
Main earhead yield & surface area of earhead.	·66	·69	·74	·69	·57	·65
„ „ diameter of peduncle.	·69	·58	·65	·62	·63	·61
„ „ height of main axis.	·37	·48	·55	·61	·76	·46
„ „ length of earhead.	·51	·57	·44	·60	·45	·62
„ „ diameter of earhead.	·48	·56	·59	·44	·53	·55
„ „ length of peduncle.	·19	·05	·12	·10	·36	·31
„ „ number of earheads.	– ·10	– ·17	– ·07	– ·06	– ·01	– ·29
„ „ average yield per earhead.	·67	·67	·67	·72	·84	·58
Level of significance (P = ·01).	·23	·28	·23	23	·23	·23

Table IV.

Partial correlation coefficients.

Main ear-head yield and other factors.

r	P. T. 17/G.	P. T. 17/P.	P. T. 72	P. T. 248	P. T. 331	M. S. 1354
r_{12}	·66	·69	·74	·69	·57	·65
r_{13}	·69	·58	·65	·62	·63	·61
r_{14}	·37	·48	·55	·61	·76	·46
Level of significance (P = ·01)	·23	·28	·23	·23	·23	·23
$r_{12\cdot3}$	·39	·54	·56	·49	·27	·42
$r_{12\cdot4}$	·61	·65	·65	·59	·37	·57
$r_{13\cdot2}$	·59	·31	·36	·31	·41	·34
$r_{13\cdot4}$	·66	·43	·58	·54	·54	·56
$r_{14\cdot2}$	·20	·39	·40	·45	·68	·29
$r_{14\cdot3}$	·24	·25	·45	·53	·71	·37
Level of significance (P = 01)	·23	·28	·23	·23	·23	·23
$r_{12\cdot34}$	·36	·56	·49	·40	·09	·35
$r_{13\cdot24}$	·59	·17	·35	·31	·42	·33
$r_{14\cdot23}$	·17	·29	·39	·45	·68	·29
Level of significance (P = ·01)	·23	·28	·23	·23	·23	·23

Table V.

Multiple correlation coefficients.

Main earhead yield and other factors.

R	P. T. 17-G	P. T. 17-P	P. T. 72	P. T. 248	P. T. 331	M. S. 1354
r_{12}	·66	·69	·74	·69	·57	·65
$R_{1\cdot23}$	·79	·73	·78	·73	·67	·70
$R_{1\cdot24}$	67	·75	·78	·77	·80	·69
$R_{1\cdot34}$	·71	·61	·73	·74	·84	·67
Level of significance (P = ·01)	·27	·33	·27	·28	·28	·27
$R_{1\cdot234}$	·80	·75	·79	·79	·84	·73
Level of significance (P = ·01)	·29	·36	·29	·29	·29	·30

Table VI.

Tests of significance of the difference between $R_{1 \cdot 234}$ and r_{12}.

Selection.	$z_{1.234 - 12}$	Degrees of freedom.		P
		n_1	n_2	
P. T. 17-G	1·68	2	126	< 0·01
P. T. 17-P	1·08	2	126	< 0·01
P. T. 72	1·30	2	126	< 0·01
P. T. 248	1·60	2	81	< 0·01
P. T. 331	1·63	2	126	< 0·01
M. S. 1354	1·31	2	121	< 0·01

THE TOBACCO TRADE OF MADRAS,—PART I.

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Introduction. In the solution of marketing problems in the different crops, the study of the existing trade with special reference to general world position occupies an important part. With the exception of United States of America, India is the largest producer of tobacco (1000 million lb.) in the world. In the production of tobacco of commerce, Madras occupies the premier position among the provinces. In response to the preference for Empire tobacco accorded in 1919 and subsequently in 1925 there has been a corresponding increase in acreage and production, though not in the quality of the product, the character for which this commodity is most valued; consequently India has not derived as much benefit out of the preference as was expected. As the balance of trade in tobacco is unfavourable consideration of the external trade in this commodity with other countries requires earlier attention than that of the internal trade.

The imports of the following countries given below indicate the magnitude of the demand for tobacco. Quinquennial averages for such purposes are preferred to a single annual import figures from the consideration of peculiarities of the trade in this commodity.

Table I. *Imports of Principal Countries in million lb.*

Importing Countries.	Average of 1925—'29.	1930.
Germany	218	235
United Kingdom	203	223
China	105	124
France	92	155
Netherlands	70	70
Spain	54	57
Belgium	45	49
Czecho Slovakia	39	23
Poland	34	42
Austria	31	22
Argentina	24	23
Australia	22	20

Canada	17	17
Egypt	17	16
Italy	16	12
Switzerland	13	17
Japan	13	10
Sweden	12	10
Denmark	12	14
Irish free state	9	12
Finland	7	10
Norway	5	5
Total ...	1058	1166

The figures of production and exports of the principal producing countries disclose the probable competitors in the market.

Table 2. *Production and export in million lb.*

Country.	Production. 1930—'31.	Exports.		Remarks.
		1925—29	1930	
United States of America	1635	525	580	* Figures for production not available.
Dutch East Indies*	—	170	131	
Greece	153	109	108	
Brazil*	—	68	81	
Bulgaria	53	57	49	
Philippine Islands	102	48	50	
Cuba	82	42	59	
British India	1404	40	39	
Dominion Republic*	--	36	28	
Algeria	43	34	26	
Paraguay*	—	14	—	
Hungary*	—	12	23	
Russia	305	10	20	
Yugoslavia*	—	5	3	
Ceylon*	—	2	1	

The above figures indicate that India occupies the 8th rank in the magnitude of exports, a place not at all commensurate with its 2nd rank in the list of production. In India Madras ranks first in the production of tobacco of commerce.

External Trade (a) *Exports.* The exports of Indian tobacco to foreign countries and the share of Madras therein are examined with reference to the rebate of import duty. The quinquennial periods of 1914—15 to 1918—19, 1921—22 to 1925—26 and 1926—27 to 1930—31 are selected for elucidating the effect of the different amounts of rebate of import duty on Empire tobacco into United Kingdom. The first quinquennium represents the pre-preference period, the second the period of ⅙ rebate and the third the period of ¼ rebate of import duty.

The total export trade of India in tobacco rose up from Rs. 56 to 110 laks from the first to the third period; and the share of Madras which once formed only one seventh of the total exports (i.e. Rs. 9 lakhs) has now risen to over half of the exports (Rs 56 lakhs). The quantity and cost of exports given in table 3 indicate the growth in the value of exports and the share of Madras therein.

Table 3. *Share of Madras in the Tobacco Trade of India.*

Period.	Manufactured.		Manufactured.					
			Cigars.		Cigarettes.		Other sorts.	
	Quantity in 1000 lb.	Cost in Rs. 1000.	Quantity in 1000 lb.	Cost in Rs. 1000.	Quantity in 1000 lb.	Cost in Rs. 1000.	Quantity in 1000 lb.	Cost in Rs. 1000.
Pre-preference	24045	4155	1260	1125	175	230	415	115
Share of Madras.	2961	630	502	302	—	—	35	25
1/6 rebate.	31581	9072	369	422	60	72	701	301
Share of Madras.	9106	3166	94	118	48·1	53	61	49
¼ rebate.	28769	10290	266	292	288	280	495	133
Share of Madras.	14085	5242	67	78	280	271	12·1	5·4

Though the quantity of unmanufactured tobacco exported remained constant the value had risen from 41 to 102 lakhs in spite of the fall in the price per pound of tobacco. It is therefore evident that there is vast improvement in the quality of the produce. The share of Madras increased from 6 to 52 lakhs. There is a decline in the cigar trade from 11 to 2 lakhs owing to the fact that the cigarette has gained favour since the war, the end of pre-preference period. Though an increase is indicated in the cigarette trade, the cost of the total Indian Exports has not increased much, while the participation therein of Madras has tantamount identified itself with the total exports.

Tobacco Unmanufactured. In the demand for unmanufactured tobacco it is found that the British Empire takes a major portion of the exports and that other foreign countries have very unsteady demands for Indian tobacco. France, in the pre-preference period and Germany in the 1/6 rebate period have shown some attention to Indian tobacco while Japan and Netherlands have been regularly purchasing a fairly large quantity of their requirements from India since the institution of the rebate. Among the British Empire, the United Kingdom, Aden and Dependencies, Straits Settlements, Hongkong and Federated Malay States come in the order of their purchases of Indian tobacco. It is interesting to note the growth of their purchases given in table 4.

Table 4.

Quantity of Exports to British Empire Countries. (*In million lb.*).

Country.	Period		
	Pre-preference.	⅙ rebate.	¼ rebate.
United Kingdom	3·0	5·6	10·0
Aden and Dependencies	5·6	4·9	5·9
Straits Settlements	2·2	3·7	3·6
Hongkong	1·9	2·8	1·7
Federate Malay States	—	1·2	1·5
Total British Empire	14·5	20·5	22·6
Total Indian Exports of Un-manufactured tobacco	24·0	31·5	28·8

We will next proceed to examine the needs and requirements of each of the importing countries.

United Kingdom. Barring Germany, United Kingdom is the largest tobacco market in the world. With the increase in the consumption of tobacco per capita and with the change in the method of usage from the pipe to the cigarette since the Great-war, the kind and quality of tobacco required for this market are different from what they were before. Tobacco suited to cigarette manufacture is in greater demand than the pipe and cigar tobaccos which have a fairly good position. Of the total purchases of 200–225 million pounds of leaf, 160–180 million pounds are obtained from United States of America. Against such a large quantity, purchases from India figuring to the extent of only 10 million pounds cut a very poor figure considering the Indian production of leaf and the rebate of import duty on Empire tobaccos. The bright flue cured tobacco from the Virginia Carolina belts is largely purchased.

Of the Indian Exports, only about 10 to 15 percent is fit for use in cigarettes, while the rest is used for pipes. Most of the tobacco of Madras is raised on heavy clay soils of Guntur etc., which give heavy 'body' to the leaf. Very little is produced on the sandy loams resembling those of Virginia and Carolina and as such the prospect of most of the Indian flue cured leaf to participate in the cigarette tobacco trade of United Kingdom is not yet near at hand.

Other Countries. Japan and Netherlands are the only two countries which purchase a fairly large quantity of tobacco from India. The requirements of the former is of two-fold nature, one, for the preparation of cigarettes suitable for home consumption and for re-export to India, and two, for exporting to China after the necessary treatment. Netherlands purchase leaf suitable for cigars.

Tobacco Manufactured Cigars. The export of cigars has dwindled from about 1¼ million pounds to a ¼ million pounds and Straits Settlements used to be the chief customer, Madras supplying nearly half the demand.

Table 5. *Quantity of Exports in million lb.*

Country.	Period.		
	Pre-preference.	1/6 rebate.	¼ rebate.
Straits settlements.	1·05	0·19	0·14
Total Indian Exports.	1 26	0·37	0·27
Share of Madras.	0 50	0·09	0·07

Burma is one of the chief competitors in this trade. Owing to the settling of Indians permanently in Straits Settlements the particular kind of Cigar-makers also found greater employment there. Since then she had reduced her purchases of manufactured cigars, while she increased her purchases of unmanufactured tobacco for local manufacture of cigars.

Tobacco Manufactured Cigarettes. Trade in this form of export is of recent origin and of very little quantity as compared to other forms of export, Ceylon is the chief purchaser and Madras is the largest supplier.

Table 6. *Quantity of Cigarettes (in 1000 lb.)*

Country.	Period.	
	1/6 rebate.	¼ rebate.
Ceylon.	47	206
Total Indian Exports.	60	288
Share of Madras.	48	280

(b) *Imports.* The imports have improved in more than one direction. The rise in the imports of unmanufactured tobacco is about 15 times what it was in the pre-preference period, while the rise in the import of unmanufactured cigarettes is only twice the imports in the pre-preference period. The reason for this is obvious as there is at present larger manufacture in India of cigarettes from leaf imported from foreign countries.

Table 7. *Quantity of Indian Imports in 1000 lb.*

Form of Import.	Period.		
	Pre-preference	⅙ rebate	¼ rebate
Unmanufactured	325	3765	4522
Share of Madras	118	2018	2406
Manufactured—Cigars	53	29	35
Share of Madras	0·9	0·4	0 26
Manufacturad Cigarettes	2623	3288	4573
Share of Madras	167	231	402
Other sorts	640	306	268
Share of Madras	30	223	19

In the imports of unmanufactured tobacco into India over 95 per cent. is from United States of America. The leaf from United States of America is considered to be superior in all the qualities required for the manufacture of high class cigarettes. Similarly over 96 per cent. of the imports of Cigarettes, and tobacco for pipes and cigarettes is from United Kingdom.

III. Tariff and Protection. All forms of tobacco imports are taxed. The tariff on imported tobacco has been Rs. 2 per pound and ¼ rebate (Rs. 0—8—0) was accorded since 1926 for leaf from British colonies. This was originally programmed to be in effect for 10 years. The budget 1934—35 has passed increased taxation to Rs. 2—6—0 per pound (Standard) and Rs. 1—14—0 preferential. Cigarettes cost not exceeding Rs. 10—8—0 per 1000 have been taxed at Rs. 8—8—0 per 1000 and those cost exceeding above Rs. 10—8—0 have been taxed at Rs. 12 per 1000. This however was somewhat protective to the cigarette industry of India. But in 1934—35 this has been changed to Rs. 5—15—0 per 1000 cigarettes plus 25 per cent *ad valorem.* This change has been proposed by the Finance Member Sir George Schuster as he felt that the heavy duty existing prior to 1934—35 on cigarettes had adversly effected the imports and reduced the revenue. He felt that the cigarettes made wholly or mainly of Indian leaf has always enjoyed the shelter of a somewhat heavy revenue duty on the imported commodity. He said " My remarks relate to a very important trade that exists in this country in a type of cigarettes which even when made in India are made exclusively or almost exclusively from imported tobacco and experience indicates that we have not adjusted probably the relation between the import duty on raw leaf and the import duty on finished article. Under our present tariff, the duty on cigarettes works out at *something like* double the duty on the tobacco used in making similar cigarettes in India, and the result has been to divert the manufacture of the great majority of the leading brands of cigarettes to factories in India belonging to the same interests as previously imported these brands from abroad ". The results of the alteration is very serious and significant on its effect as can be observed from table 8.

Table 8.

Level of price of cigarettes per 1000.	Prior to 1934-35.			From 1934-35.				Difference between column No. 4 & 8.	Remarks.
	Cost.	Duty.	Total.	Cost.	25% advalorem.	Duty.	Total.		
1	2	3	4	5	6	7	8	9	10
Cigarettes—Cost not exceeding Rs. 10/8 per 1000.									
Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
1 0 0	1 0 0	8 8 0	9 8 0	1 0 0	0 4 0	5 15 0	7 3 0	-2 5 0	
1 4 0*	1 4 0	8 8 0	9 12 0	1 4 0	0 5 0	5 15 0	7 8 0	-2 4 0	* Cost of some of the cheapest Cigarettes manufactured in India.
5 0 0	5 0 0	8 8 0	13 8 0	5 0 0	1 4 0	5 15 0	12 3 0	-1 5 0	
10 0 0	10 0 0	8 8 0	18 8 0	10 0 0	2 8 0	5 15 0	18 7 0	-0 1 0	
10 4 0	10 4 0	8 8 0	18 12 0	10 4 0	2 9 0	5 15 0	18 12 0	Nil.	
10 8 0	10 8 0	8 8 0	19 0 0	10 8 0	2 10 0	5 15 0	19 1 0	+0 1 0	
Cigarettes—Cost exceeding Rs. 10/8 per 1000.									
10 10 0	10 10 0	12 0 0	22 10 0	10 10 0	2 10 6	5 15 0	19 3 6	-3 6 6	
15 0 0	15 0 0	12 0 0	27 0 0	15 0 0	3 12 0	5 15 0	24 11 0	-2 5 0	
20 0 0	20 0 0	12 0 0	32 0 0	20 0 0	5 0 0	5 15 0	30 15 0	-1 1 0	
24 4 0	24 4 0	12 0 0	36 4 0	24 4 0	6 1 0	5 15 0	36 4 0	Nil.	
24 8 0	24 8 0	12 0 0	36 8 0	24 8 0	6 2 0	5 15 0	36 9 0	+0 1 0	
30 0 0	30 0 0	12 0 0	42 0 0	30 0 0	7 8 0	5 15 0	43 7 0	+1 7 0	

It is therefore obvious that the difference between the duty prior to 1934-35 and that from 1934-35 per 1000 together with advalorem becomes a minimum at a cost of Rs. 10-4-0 per cheap cigarettes and Rs. 24—4-0 for costly ones. Though he felt and meant that the cheap cigarette made wholly or made mainly in Indian leaf has always and should also in future continue to enjoy the shelter of a heavy revenue duty on the imported commodity, the change in the tariff existing prior to 1934-35 to what is experienced now, frustrates the above object and is by no means an insiduous one. The cheap cigarette of Indian manufacture has been dealt a blow and the costly imported cigarette has been given a pat and even the erstwhile manufacture of costly cigarettes in India almost exclusively from imported tobacco has been threatened with ruin. The reasons are not far to seek. India imports every year about 4·5 million pounds of unmanufactured leaf costing only Rs. 37 lakhs, over 95 per cent. of which is from United States of America, and 4·7 million pounds of cigarettes, costing about Rs. 1·9 crores, over 96 per cent. of which is from United Kingdom.

The increase in duty on unmanufactured tobacco, by restricting the imports of fine flavoured leaf, acts detrimentally on Indian manufacture of Cigarettes as such leaf is undoubtedly required for purposes of blending. The above duty coupled with the lowering of import duty on costly cigarettes, favouring larger imports of cigarettes into India, stifle the growing industry in India of the manufacture of costly cigarettes mainly and partly from the imported leaf. This industry when allowed to grow under the shadow of progressively increasing tariffs on imported cigarettes is likely to further stimulate the production of similar leaf in India and the exploration of tracts and methods suited to the same, as such stimulus has already indicated in itself in the wider cultivation of cigarette types. The state of affairs as they stand at present are in no way favourable to the cigarette industry of India.

Taxation. Tobacco taxation is being considered in India. At the present there is no excise tax on the production of Cigarettes and other tobacco products in India. The Government of India considers it most difficult, if not impossible, to administer an excise tax law, so long as production of tobacco products is in the hands of a large number of small producers.

However, the Government of India recently invited the provincial governments to increase their revenue through a license tax on retailers of tobacco products and the Government of Bombay Presidency has announced its intention of extending to the entire Presidency the dealer-license-system, which already exists in the Bombay city. A license will have to be purchased by all dealers in tobacco products except the grower. It is likely that all the provinces will follow the lead taken by the Bombay Presidency. At present the tobacco licensing bill is published and being discussed in the Madras legislative council. The bill provides that no person shall sell or expose for sale any tobacco except under a license granted by the Collector. But exception is made in the case of growers and manufacturers who will be free to sell tobacco grown or manufactured by them to other growers or manufacturers or licensed vendors. Manufactured tobacco is divided into 2 classes (1) Class A comprising cigars, cheroots, cigarettes, cigarette—tobacco and (2) class B, comprising all other kinds of manufactured tobacco.

The bill also provides for the grant of licenses for the exclusive privilege of selling by retail in defined areas all forms of tobacco except manufactured tobacco of class A. The monopoly holder may lease or assign the privilege, but neither he nor his lessee or assignees can excercise the right of retail vend unless and until he has received a license in that capacity from the Collector. Licenses on payment of fixed fees will be granted for the retail sale of manufactured tobacco of class A. Sir Charles A. Souter, the revenue member, in this connection said "Our first idea was that we should raise this tax by a system of monopoly. This system is not a new one in this presidency by any means. We in fact started the whole of abkari system by monopoly vending which gradually gave way to our present system. A monopoly has not got the objection of something new and not understood by the presidency. It may be that the monopoly vending of tobacco might cause a considerable dislocation of the trade and what is more important from our point of view probably cause very considerable opposition. But we do not want to cut out the possibilities of monopoly vending altogether. Therefore we came to the conclusion that we should have an alternative system which is now embodied in the present bill, that in the system of fixed fees for the right to sell tobacco with the proviso that if, in the future Government should think it advisable to introduce monopoly vending they should have power to do so. And the intention of the Government is, if this House should pass this bill, to introduce only a fixed fee system of licensing the sale of tobacco".

This works as a disability for the several tobacco trading firms who act as intermediaries between the growers and manufacturers. Next to the Imperial Tobacco Company's interests it is these wholesale exporters who are not growers themselves but have been responsible for stabilising the tobacco trade and for really giving the tobacco grower the required incentive. Such license on the free trading will bring about artificial inflation and deflation of prices as it suits the purpose of varied interests, which in its turn will recoil on the grower and manufacturer.

All small manufacturers and those who have recently entered the trade and as such have not been purchasing their requirements directly from the grower are hard-hit by this bill, as they, with their scanty finances and experiences can least stand the brunt of competition against well established manufacturing firms. A more closer impact than before is brought about by this bill between the smaller and larger firms in the purchase of their requirements and the chances are that the former are outwitted ultimately, and if they prefer to make their purchases through some purchasing firms naturally their initial cost of raw material will be higher than that of the larger firms who buy directly from the grower. The subtlety of implication will unravel itself in clearer perspective when the system of monopoly is introduced after the licence system is worked through for some years.

IV. Balance of Trade in Tobacco. The balance of trade has been progressing very unfavourably, but the imports have by no means decreased even after an advent of progressive industrialisation in this direction.

Table 9. *Balance of trade in lakhs of Rupees.*

Period.	Exports.	Imports.	Difference of exports over imports.
Pre-preference	56·5	132·3	– 75·8
Share of Madras	9·4	9·1	+ 0·3
⅙ rebate	98·7	205·6	– 106·9
Share of Madras	33·9	33·2	+ 0·7
¼ rebate	110·0	248·6	– 138·6
Share of Madras	56·0	37·7	+ 18·3

The balance of trade for Madras is not bound to be what is indicated in the table as a large amount of rail-borne trade in cigarettes takes place between Calcutta and Madras.

V Conclusion. In the production of tobacco among the several countries in the world, India ranks second, and Madras, among the several provinces of India stands first. But the Indian exports occupy only an eigth place, which is not at all commensurate with her rank in production. Countries like Nyasaland, Southern Rhodesia of far recent agricultural development and those like Dutch East Indies and Greece, which do not possess as much variety of climatic and agricultural conditions have been able to occupy a very important position in the world trade in this commodity.

The opinions elicited by the Indian Trade Commissioner from the several tobacco firms in the United Kingdom have been very favourable to the Indian cultivator, if only he could supply continuously leaf of uniform quality and at cheaper prices than at present. A difference of 7d per pound more in the case of Indian flue cured leaf (1s–3d) than that (8d) of non Empire tobacco of similar quality prevents larger purchase of Indian leaf in the United Kingdom market. This difference is not because of the higher costs of production in India than in other competing Empire countries (Nyasaland, Southern Rhodesia, Canada etc.) or non-Empire countries (United States of America etc.). In fact the prices (5 to 6 annas per pound) received by the Indian cultivator for the flue cured tobacco are just about equal to, if not on average, lower than those (12 to 14 cts) or 5¼ to 6¼ annas per pound received by the United States of America farmer in United States of America for the same quality. Similarly the Rhodesian farmer is also receiving 7·6 d per pound of flue cured leaf. It is therefore clear that the price paid to the Indian tobacco farmer is the same as that received by the tobacco farmer in other Empire and non-Empire countries. The same preferential duty as that of India operates on the imports from the several Empire countries into United Kingdom. But the Indian leaf is found to be priced 7d higher than that of other Non-Empire countries w[illegible]ar even higher duties, and even far less agriculturally deve-lo[illegible]untries like Nyasaland etc. are able to compete successfully w[illegible]ia. Obviously therefore the exporting agencies should be be[illegible]is kind of show. Under the above circumstances the present ta[illegible] further enhance the middleman's charges much to the detriment of the tobacco grower. Though it appears more advantageous to reduce the percentage of moisture to less than 10 per cent in which case the advantage in the preference duty will be $3\frac{1}{8}$d per pound of unstripped leaf and $2\frac{5}{8}$d per pound of stripped leaf, the disparity in the prices cannot intelligibly be explained except by the presumption arrived at above.

Table 10. *Table showing the rates of full and preferential duty.*

Customs duties.	Rates of duty per pound			
	Full	Preferential.	Preference difference.	
Tobacco Unmanufactured.				
Unstripped.	£. s. d.	£. s. d.	s. d.	s. d.
Containing 10% or more moisture.	0—9—6	0—7—5½	2—0½	0—3⅛
„ less than 10%	0-10—6	0—8A2⅞	2—3⅝	
Stripped.				
Containing 10% or more moisture.	0—9—6½	0—7—5⅞	2—0⅝	0—2⅝
„ less than 10% „	0-10—6½	0—8—3¼	2—3¼	

Now in view of the exporting agencies jeopardising the interests of the Indian tobacco grower in the United Kingdom market it is hoped the Government will be able to investigate into the causes and rescue the grower from this predicament.

If by the tobacco licensing bill the intention of the Government was only to raise more revenue, the increasing imports of cigarettes should have been taxed further. When the tobacco was treated as a luxury, the consumer should be taxed. Among the consumers the consumer of the costly goods should be taxed more than the consumer of the cheaper goods as with the former only it is a luxury. Increased tax on imported cigarettes and imported leaf, the latter being at a slower pace, while swelling the revenues, would have contributed to greater protection for local manufacture, and stimulation of growing suitable types for the same. It is more desirable that the tax should be administered at the factory itself as in the case of matches, than at intermediate places as the wholesale and retail dealers and this was characterised by the Government itself as "Vexatious".

Most of the Indian tobacco exported is best suited to pipe tobaccos. Generally there is keen competition in the pipe tobacco market, but a fair amount of room exists in the cigarette tobacco market for suitable types. The internal Indian market is also of great importance as the cost of imports in cigarettes is as great as Rs. 1 9 crores. The growing demands for cigarette tobacco both in India and in foreign markets indicate the rich future that lies in the lap of lighter types of tobacco. Samples of American types grown in India were generally liked in the United Kingdom market. The Indian Sun-cured cigarette types of tobacco could not be relied upon due to larger quantities of moisture than required. The flue-cured types had met with a fair amount of appreciation, but the price quoted was too high to attract attention. Therefore in view of the change in the outlook of the commerce in tobacco, survey and fixation of definite zones for cigarette and pipe tobaccos have to be made towards a progressive stabilisation and improvement in the trade.

With the establishment of more responsible agencies for marketing and espousing the cause of Indian tobacco in the foreign markets, the balance of trade would ultimately become favourable to India commensurate to her unique position as a tobacco producer of the world.

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CHEMICAL PROBLEMS IN CROP PRODUCTION

BY SIR EDWARD JOHN RUSSEL, O.B.E., D.Sc., F.R.S.

The classic chemical problems in crop production centre round the feeding of plants. It was in 1840 that Liebig by chemical reasoning and Lawes by empirical trials applied in practice the knowledge gained by plant physiologists about the nutrition of plants. Up to that time many agriculturists, knowing nothing about the scientific evidence to the contrary, had assumed that plants feed on the organic matter in soil. Liebig in his vigorous writings showed them that this was not so; he pieced together the scientific knowledge and gave a convincing picture of the plant deriving most of its food from the air in the form of carbon dioxide and oxygen, and the remainder from the soil, water and simple compounds of nitrogen, phosphorus, sulphur, potassium, calcium, magnesium, iron and other elements. These are then built up into the complex carbohydrates, proteins and other substances which finally form the plant tissues. Liebig argued that the soil resources could be increased by the addition of the appropriate chemical compounds, and Lawes showed how to do it; he set up experimental fields at Rothamsted and a factory in London, thus starting the artificial fertiliser industry which has now grown to such enormous dimensions that some 35 to 40 million tons are made annually in the different countries of the world. There are many technical problems connected with the industry that could profitably be discussed, but I shall confine myself to those relating to the agricultural side. For many years these were mainly concerned with showing how to fit the fertilisers into everyday farm use. The results were very striking.

Crop increases of 30 or 50% were not uncommon; the cereal crops were greatly increased by nitrogenous manures, and the very important root crops by superphosphate; the Rothamsted field plots started in 1843 afforded such striking demonstrations as farmers had never before seen. In the words of Gilbert, the distinguished collaborator of Lawes, the unmanured crops growing alongside of their neighbours might almost be fancied to say: "If you won't feed me I won't grow." Those were spacious days for the farmer; prices were high and costs low; there was no need for stinginess in applying fertilisers. They were put on the ground in adequate amounts and a good response fully repaid the cost.

As years went by, costs began to rise and prices to fall; the margin of profit became exceedingly narrow and finally disappeared. New and more economical method were required and the chemist was called in to find how little of the various fertilisers needed to be added to soils to serve for a particular crop. The first hypothesis had been that plants took from the soil those things they needed, and if, therefore, one wished to discover the fertiliser requirements of plants it was only necessary to find out what quantities of fertiliser constituents the plant contained. Average crops were therefore analysed so as to discover the amounts of phosphorus, potassium, nitrogen, etc., present; the soils were also analysed to find the amounts per acre of these elements present in suitable form for plant nutrition, and a simple subtraction sum showed how much, if any, artificial fertiliser need be supplied. The method was much used some 30 or 40 years ago; it was highly developed in the United States by Cyril Hopkins, who spoke of drawing up the "invoice of the Soil":

Phosphate in crop	30 lb. per acre.
" " soil	600 " " "
Average of good soils in district	2000 " " "

There seems sufficient phosphate for a number of crops, but, as the amount is far below the average content, there will certainly be need for phosphatic fertiliser *if the average soils are known to respond*—which in the region in question they were. This procedure was simple; it had, however, the weakness that it was not adequate—for two reasons: (1) one cannot say exactly how much available plant food there is in the soil; and (2) the plant is not a fixed definite entity, it has considerable range of variation.

It might seem relatively easy to determine how much phosphate or potash a given soil contains, but actually the total values given by ultimate analysis have had only limited utility. Hopkins was able to get something out of them, as also was Prescot in Australia, but in normal English experience they are not helpful. Better results have been obtained by adopting some analytical method that distinguishes between the more and the less soluble constituents—a distinction first emphasised by Daubeny in 1845 and reduced to laboratory terms by Dyer in 1894: indeed Dyer's method still remains the most useful we have.

The amounts of nutrient and other materials in the plant, however, are not determined by the needs of the plant but by the quantities available. The plant roots act like a partially permeable membrane; they absorb some of everything that is soluble in the soil; not, however, in the proportion in which it exists in the soil, but in a proportion modified by certain characters of the plant. This is well illustrated by the following figures showing the mineral constituents of grasses and clovers growing intermingled on the Rothamsted grass plots:

Variation in Composition of Mineral matter in plants growing side by side (Rothamsted Park Grass).

	Per cent in pure ash.	
	Grass.	Legumes.
CaO	7·6—11·8	21·4—30·3
MgO	2·4— 3·7	3·6— 7·5
K_2O	22·6—37·9	11·2—31·3
Na_2O	0·4— 5·3	0·6— 9·6
P_2O_5	5·7— 9·7	5·1— 8·6
SiO_2	17·3—36·6	1·3— 1·9

Some of these absorbed substances greatly stimulate the production of carbohydrates and proteins in the plant: others do not. The final composition of the plant is, therefore, profoundly affected by the compositions of the soil, and, except in cases of extreme deficiencies, is not a good index of the fertiliser requirements of the plant.

A different approach has, therefore, become necessary. It is recognised that the subject is much more complex than had been supposed and it has had to be put on a much broader basis. The purpose of modern work is to discover the factors that govern the growth and composition of plants, and, having done that, to find the simplest and most economical method of bringing them under control. The study of soil fertility thus resolves itself into two parallel sets of investigations. Plant physiological work shows what the plant needs in order to attain its maximum growth; more precisely, how growth is affected by variations in the conditions, especially in the supplies of nutrients, water and air for the root, reaction of the medium, etc. Studies by soil investigators show how far a particular soil is likely to satisfy the conditions for full plant growth, and how it can be made to do so better than it naturally would. Soil fertility is dependent on five main factors: namely, adequate plant food supplies: adequate water supply; adequate space for the root system; air supply to the roots; and absence of injurious substances. In practice, these are closely linked. A food supply adequate for one level of water supply is quite inadequate for another. F. G. Gregory and F. Crowther made some good experiments in the Sudan showing that, as the amount of irrigation water increased, the response to added nitrogen fertiliser also increased. It is, therefore, impossible to speak of the adequacy of the soil supplies of plant food except in terms of water supply. The same holds true of the other conditions of growth, particularly of air supply, which is largely a matter of soil texture.

The relation between the quantity of nitrate in the soil and the quantity of nitrogen present in the plant is fairly simple. The total quantity of nitrogen in the crop is roughly proportional to the supply, but the way in which the nitrogen is used varies according to the amount present and the water supply. The added nitrogen can lead to corresponding increase in crop without particular change in nitrogen content, or, if for any reason it fails to increase the yield, it can cause an increase in nitrogen content that may become very marked.

Extreme cases being omitted, the variations in composition due to increases in nitrogen supply are much less than the increases in yield. The first increments of nitrogen give considerable increments of crop; later ones give less. So the percenitage of nitrogen in the crop, and especially in the grain, is first unchanged or even falls as the nitrogen supply increases, but with later increments of nitrogen it rises steeply. Over a fairly wide range, the nitrogen content is more affected by the water supply than by the nitrogen supply. This is what happens in normal fertility conditions ; it holds not only for nitrogen but for the other elements that increase plant growth. The fertiliser causes the plant to grow more but does not much affect its composition or its quality.

Thus, sulphate of ammonia, in conjunction with superphosphate and potassic fertilisers, usually increases the potato crop by some 15 to 20 cwts. per acre for each cwt. that is given up to 2, 3, or sometimes 4 cwts. per acre. The change in composition is only slight, as also is the change in marks assigned by an expert chef for quality. On the other hand, the effect of soil differences is very great, as shown by a comparison of the Rothamsted with the Woburn results:—

Marks for quality of Steamed Potatoes (1929).

Cwt. K_2O per acre	Woburn (Light soil)	Rothamsted (Heavy soil)	Cwt. N per acre.	Woburn (Light soil)	Rothamsted (Heavy soil)
0	32·6	28·5	0	34·4	29·2
0·5	33·6	29·5	0·3	33·3	29·3
1·0	34·5	29·6	0·6	32·9	29·1

Percentage of Dry Matter in Tubers grown with Different Potassic Fertilisers.

K_2O per acre.		No of potassic fertilisers.	Sulphate of potash	Muriate of potash.	30% potash rate of dressing salt.
1·0	Woburn, 1929	27·5	26·7	26·2	24·8
1·0	Rothamsted, 1929	26·1	25·9	24·9	24·2
0·8	„ 1930	23·1	23·3	22·7	22·1
0·8	„ 1931	20·9	20·5	20·2	20·2
0·8	„ 1932	22·6	22·1	...	...

Remarkable results are obtained when one gets away from the normal fertility range to the extremes of deficiency or excess. The form of the plant changes, in extreme cases, considerably ; this is well shown in the Rothamsted experiments with mangolds. A large excess of nitrogen and a prolonged deficiency of potassium bring about striking changes in the plant and affect its reaction to insect and fungus attack. Wallace at Long Ashton has shown that nitrogen starvation of apple trees heightens the colour of the fruit.

Although it is not possible to lay down precise fertiliser recipes, crops do show certain general requirements. Practically all crops respond to nitrogenous fertilisers. Root and potato crops frequently respond also to superphosphate, and grass land to basic slag; leguminous crops, mangolds, potatoes and fruit commonly, to potassic fertilisers also. Wallace has shown that potassic and nitrogenous fertilisers are, as a rule, the most important fertiliser elements for fruit, phosphate being advantages only for cover crops and for straw berries. In the west country at least, the potassium supply is the key to the successful nutrition of fruit trees, and by extending the use of potassic fertilisers, it has been possible to extend fruit growing and improving greatly the yields and quality in existing plantations. Trees suffering from shortage of potassium show a curiously high phosphorus content.

Differences in composition of the crop may have far-reaching consequences. Varieties of wheat have been bred at Svalof for resistance to winter frost; successful ones are found (Bengt Lidfores; Akerman) to contain a higher percentage of sugar in the leaf than the others. It is not supposed that the sugar confers frost resistance ; the evidence is rather that the freezing of water in the intracellular spaces of the leaf causes water to pass out from the cell. making the cell sap more and more concentrated till finally the protein is irreversibly precipitated, apparently by a salting-out process, and the cell then dies. Maximov has shown, however, that the presence of sugar in the sap protects the protein against precipitation.

There are also some unexpected results. The same sugar that is associated with frost resistance also makes the leaves attractive to hares, so that winter resistant varieties tend to be eaten more than others.

The composition of the crop naturally affects its value as food, especially as animal food; this is particularly so for grass, which forms a large part, sometimes indeed the whole, of the food of the animals. In its early stage, grass is richer in protein and in mineral matter than at any later period; it therefore, has high feeding value and efforts are now being made to preserve dried young grass for winter feeding. Among its other valuable constituents is carotene, the precursor of vitamin A, and the cause of the rich yellow colour is cream. Experiments at Jeallot's Hill have shown that yellow cream can be obtained in winter if the animal is given some of this dried grass.

In southern hemisphere, notably Australia and South Africa, and occasionally in England and Scotland, pronounced deficiencies of calcium, phosphorus, or other elements sometimes occur in soil, causing equally pronounced deficiencies in composition of vegetation and these lead to marked nutritional troubles with the animals. These were first studied by Arnold Theiler and his colleagues in South Africa and the subject is being developed at the Rowett Institute, Aberdeen. Typical analyses of herbage associated with healthy and with diseased conditions of the animals are as follows :—

Percentage of Mineral Constituents in Dry Matter of Herbage.

	Scottish hill pastures		Kenya		New South Wales	
	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased
CaO ...	0·65	0·21	1·00	0·49	0·465	0·168
P_2O_5 ...	0·67	0·29	0·93	0·19	0·184	0 047
K_2O ...	2·66	1·51	2·25	0·83	0·143	0·087
Na_2O ...	0 37	0·12	0·07	0 02	...	...
Cl ...	0 64	0·52	0·42	0·18	...	..
N ...	2·50	2·05	...	...	...	...
Total ash ...	7·18	5·33	...	...	...	...
Silica-free ash ...	5·85	2·82	...	...	...	...

The remedy consists in supplying the missing elements as "licks" or in fertilisers,

Where the diet includes a number of foods (as the ordinary human diet), differences in composition of individual foods tend to even out, so that for practical purposes the composition of individual items has usually little dietetic significance.

The factor of competition comes into play and introduces complications when several plants are growing together, such as the mixture of leguminous and non-leguminous plants grown for silage or fodder purposes or occurring naturally in grass land. Leguminous plants derive their nitrogen from the bacteria living in the nodules on their root; these fix nitrogen from the air and make the plants independent of nitrogenous fertiliser. The non-leguminous plants, however, are much favoured by nitrogenous fertiliser and grow so vigorously that they tend to crowd out the leguminous vegetation. Thus, it may happen that additions of nitrogenous fertiliser cause no increase in the amount of protein produced per acre. Phosphates, on the other hand, favour the leguminous plants, so that these increase when phosphatic fertiliser is supplied. This accounts for the remarkable improvements effected by basic slag on pasture land.

In regard to these principal elements of plant nutrition, it is now recognised that more and better field experiments are needed to provide the main facts on which the agricultural chemist can then proceed to work. The methods of field experiments have recently been completely overhauled; the experiments:, of course, can never be exact, but they are now done in such a way that each experiment gives a measure of its own error. Simultaneously, chemical examination of the soils is made.

In recent years, it has been found that certain elements other than the classical ones are needed in very small amounts. Larger quantities become harmful, but the proper small quantity is indispensable.

Boron has been much studied at Rothamsted. Miss Warington found that it is essential for the proper devolopment of broad beans, and later workers have shown that other plants need it also. Sugar beet affords an interesting example; in absence of the necessary trace of boron, a certain disease appears, which has caused some trouble in Central Europe and in the Irish Free State.

Manganese has been studied by Samuel and Piper at the Maite Institute, Adelaide. A trace of manganese sulphate (1 part per million) was found to be essential to the growth of plants, In its absence oats become liable to the grey fleck disease.

Allison in Florida has shown that minute traces of copper are essential to plant growth: he has obtained dramatic increases of yield on the Everglade soils by additions of traces of copper sulphate We have, however, not yet found soils in this country that respond to copper salts. Zinc appears to be essential, at any rate for fruit trees; in its absence the curious rosettee diseases set in.

Lithium salts are stated by Sir Rowland Biffen to confer resistance to mildew and yellow rust on wheat grown in pots.

Molybdenum salts injected into plants have been found by Miss Sheffield to induce a trailing habit of growth and also to produce symptoms apparently identical with those of virus disease in *Solanum nudiflorum*. W. A. Roach shows that the roots of fruit trees vary in their power of assimilating molybdenum from the soil: some can do it and others cannot.

Some of these curious stimulating substances are organic. They were first called auximones or growth promoters; now they are called auxins or growth enzymes. Owing to the difficulty of working with them, it has not always been possible to distinguish their effects from those of the inorganic promoters, and some of the auximone effects of the older workers are probably attributable to iron. But there are cases where the active agent is an organic substance, though, owing to difficulties of working, it is not possible to be quite sure. F. W. Went and Kozl have recently isolated, from the growing point of plants, an auxin which increases the growth of the upper parts by stimulating the elongation of the cell, and restricts the growth of the roots; they have gone so far as to ascribe the formula $C_{18}H_{32}O_5$ to one form of the auxin, and $C_{18}H_{30}O_4$ to another.

A remarkable substance has recently been isolated by H. G. Thornton at Rothamsted. The invasion of the root hairs of leguminous plants by the nitrogen-fixing bacteria is preceded by an excretion from the roots, which causes the bacteria in the soil to multiply. In turn, the bacteria excrete something which causes the root hairs to multiply and to curl; on the inner bend of curl, the bacteria enter. This substance has been isolated and is being studied.

The late S. U. Pickering obtained evidence of plant excretions capable of injuring other plants: these results have never yet been satisfactorily explained. There is much empirical knowledge about the harmful effect of growing plants on soil: fruit stocks, for instance, cannot be raised in succession on the same land, but new land is needed for each crop. Whether this is the result of excretions or of exhaustion of some essential minor element is not known.

The growing plants also affect the soil in other ways. Wallace has shown that grass grown as a cover crop raises the potassium and the iron content of the soil water and may thus cure iron and potassium deficiencies on certain soils; it also lowers the N/K ratio. He thus explains the paradoxical result that clean culture of fruit is not always the best: weeds in the orchard have their uses.

The production of cellulose in the plant is now being studied at Rothamsted, by A. G. Norman, and is opening up considerable possibilities in view of its importance in industry.

The ripened seed has its own group of problems. Barley has been studied most completely and L. J. Bishop has found surprising regularities in the make-up of the grain under various conditions of growth. The nitrogen content may vary from 1·2 to 2·4 per cent. and the proteins and carbohydrates change correspondingly, but always in accordance with a definite pattern which remains constant for any given variety. The value of barley for brewing depends to a considerable extent on the quantity of nitrogen compounds present, large amounts being detrimental, especially for beers that have to be kept for some time before consumption. The value of wheat for baking, on the other hand, is usually enhanced by high protein content, but it is also much affected by the physical state of the protein.

Many of the chemical problems in agriculture are shifting over to the direction of physical chemistry and especially to the branch that deals with colloids.

—*Journal of the Chemical Society*, Jan. 1935.

Correspondence.

To The Editor, Madras Agricultural Journal, Lawley Road P. O.

Sir,

With reference to a short note under the caption " A note on the occurrence of *Pempheres affinis of Hibiscus esculentus* in Malabar " published in the May issue of your Journal, I would like to point out that the phenomenon of the occurrence of Pempheres, sought to be conveyed as a new discovery, has already been known at least since December 1935. It is not my intention to enter into a controversy in regard to any claim for priority in the matter of this observation. My purpose is simply to draw the attention of your readers to the following facts which may serve to elucidate the question at issue.

In pursuance of the general programme of a preliminary survey of Pempheres and parasites a tour in certain parts of Malabar was undertaken in December 1935 and in the course of this investigation this problem has been studied and reported upon as may be evident from the following extracts from my monthly report for December 1935. " The most striking item of new knowledge that has emerged from this preliminary survey is the discovery of heavy Pempheres infestation in Bendai (*Hibiscus esculentus*) plants in a variety of ecologically different tracts including great elevations like Manantoddy. Until this visit no such profuse breeding has been noted. In fact the question of Pempheres breeding on Bendai was considered uncertain. The absence of the weevil in cottons wild and cultivated and allied plants even when growing adjacent to infested Bendai plants and the occurrence of the same in scores breeding profusely on Bendai plants tend to throw some light on its original habitat which still remains largely a matter of conjecture. It has also enlarged its known range of distribution. This observation also lends strong support to the supposition that Bendai is probably one of the more natural hosts of the weevil."

It is also stated by the writer of the note that he observed the presence of Pempheres adults on Bendai plants on the farm as early as the year 1933. It may be significant in this connection to point out that, in a joint paper on Pempheres problem by the author of the note and others published in June 1934, Madras Agricultural Journal, Vol. XXII, No. 6, p. 208, no mention of this observation seems to have been made. On the other hand the following statement recorded in that paper argues against the proposition "The only feature that makes a measure of control such as this somewhat hopeful is, that the insect so far as our experiments go, is unable to breed, leaving a few Corchorus plants, on any plant other than cotton" (p. 208).

The following extract from a letter written by the Farm Manager, Taliparamba under date 2—12—1935 in reply to my enquiry about the occurrence of Pempheres on cotton, Bendai or other allied plants in the farm and its neighbourhood speaks for itself. After stating that cotton, Bendai or other alternate hosts are not available on the farm he writes as follows :—"I have even enquired of the Entomology assistant about the occurrence of this pest on any of the local plants and he says that he has not come across this pest or the parasites on them."

I have presented these extracts for the information of your readers and I refrain from making any comments.

A. C. & R. I.,
11—6—'36.

P. N. Krishna Ayyar,
Parasitologist.

II

To The Editor, Madras Agricultural Journal, Lawley Road P. O.

Dear Sir,

In the May issue of your Journal under Research Notes I was glad to read Mr. Gopal Menon's note on the occurrence of *Pempheres affinis*, F in Malabar. I may, however, give for the information of Mr. Menon and others who are interested in this subject, that this is not the first record of this weevil in Malabar. For, I noted the same on *Hibiscus esculentus* in N. Malabar (over fifteen years ago and have recorded the fact on p. 321 of the Report of the Preceedings of the 3rd Entomological Meeting Pusa 1919. Mr. Menon has evidently overlooked this previous record.

T. V. Ramakrishna Ayyar.
Girja Farm
Mundur (S. Malabar.)

AGRICULTURAL JOTTINGS.

BY THE DEPARTMENT OF AGRICULTURE, MADRAS.

Transplanting Paddy in Anantapur. In Anantapur taluk noted for its very low rainfall and absence of any large irrigation systems, approximately 20,000 acres are under paddy. As can be expected the supply of water in tanks is precarious and irregular. The local practice of raising the crop is by broadcasting when tanks receive their full supply. No advantage is taken of small supplies of water reserved in July and August, but cultivation is delayed till December leading to wastage of water. In order to remedy this defect the Department of Agriculture has been doing propaganda and demonstration in raising dry nurseries of paddy in July and August with the available supply of water and starting cultural operations taking advantage of early rains and in transplanting seedlings in August and September. In spite of strong opposition from a section of Ayacutdars to open the sluices in August, demonstrations were conducted under Anantapur and Singanamala tanks during the three years 1932—35. It was demonstrated that the increased yield by transplanting varied from 9—12 % and the extra produce was valued at about Rs. 5 per acre. It is interesting to note that the methods recommended are gaining ground also under spring channels and wells. In one particular village (Illur) it is reported that broadcasting has been completely replaced by transplanting. At present about 10 % of the total area is under this new method.

Paddy work in Pattambi (Malabar). As a result of an intensive study and careful testing of a very large number of pure line selections isolated from the major varieties grown on the West Coast, ten high yielding strains have been released from the agricultural station at Pattambi. Most of these are red riced varieties. A majority of them are intended for the first crop. These strains with the exception of one have given 10—22 % more yield than the ryots' bulk. One strain has also been produced for South Kanara which gives 18 % increase in yield over the bulk and which has also been found to stand inadequate water supply.

Rotations and Manuring Sugarcane in Palur (South Arcot). Ryots in South Arcot are known to apply very large doses of manure to sugarcane as compared with ryots in other parts of the Presidency. The reason is that in view of the profits accrued from sugarcane ryots have been accustomed to follow a close rotation so that sugarcane is grown almost every other year in the same land. A long standing crop like it exhausts the soil and if the field is cultivated every other year with it needs heavy dressings of manure. A rotation experiment conducted for 10 years in the Palur agricultural station showed that growing sugarcane every other year is detrimental to the soil, that it is economical to grow it once in three years and that good yields of cane could be obtained if grown on the same land once in four years.

In the case of manures, a trial started in 1928 and concluded recently indicated that Fiji B, the standard variety of South Arcot responds to heavy manuring up to 200 lb. of Nitrogen per acre applied in the form of an oil-cake (groundnut) and Ammonium Sulphate mixed in the proportion of 3 : 1. Applying manures in 3 doses is preferable to applying them once or twice. To obtain the maximum returns it is advisable to add Potassic and phosphatic manures to the nitrogenous manures. It is also noticed that sodium nitrate by itself is inferior to a mixture of groundnut cake and ammonium sulphate.

Green Manure crops and Insects. Sunnhemp, Dhaincha and other green manure crops which are grown in the summer months are often subject to insect attacks. Caterpillars are the worst offenders. At the Aduturai research station, it was found recently that on Dhaincha a bug acted as an efficient predator on all caterpillars including the hairy variety. The Entomological Assistant is devoting his special attention to this bug and is trying to introduce it in places where it is not present in numbers to see if they would check caterpillar pests there.

College News & Notes.

Mr. R. C. Broadfoot, Principal left for England on leave and Mr. R. W. Littlewood officiating Principal has taken over charge,

Jubilee celebrations. The Managing Committee is busy making preparations, for the Jubilee celebrations, and it is hoped that with the co-operation of all the officers of the department, the function will be a grand success.

Students. The college reopened after the vacation, and the Second and Third year Classes have settled themselves for work. The first year class will join in the first week of July.

Selection Committee. The committee for selection of students for the college, consisting of the Director of Agriculture, the Principal, Rao Sahib J. Ponnai Gounder and Mr. N. Sivaraj were at Coimbatore, on the 24th and 25th instant.

An omission. The names of Messrs. P. Jeevana Rao and C. Krishna Nair were inadvertently omitted in the list of resident members, despatched last month to the members. These names may be kindly included in the list.

* * * * * * * *

Nomination Papers. Members of the Union are reminded that the last day for sending Nominations for election of office bearers in 1936 is the 15th of July.

Weather Review (MAY 1936).

General. Scattered thunderstorms caused widespread rain in the Peninsula, North Madras Coast, Malabar and in South-east Madras during the first half of the month when typical hot weather conditions prevailed associated with the normal pressure distribution and high day temperatures in the interior of the Peninsula.

A temporary advance of the monsoon occurred off the Ceylon and South Malabar coast about the beginning of the third week of the month and locally heavy rainfall occurred there on the 20th and 21st.

Conditions became unsettled in the South-east of the Bay and a depression formed in the centre of the Bay on the 23rd. This caused an extension of the monsoon into Lower Burma and the Andamans. The depression moved towards Bengal and crossing the South Bengal coast as a cyclonic storm of severe intensity on the 27th night, filled up over East Bengal by the 29th after causing widespread and locally heavy rain on the Orissa Ganjam coasts, and in Bengal and Lower Burma during its traverse.

The Arabian sea branch of the monsoon remained fairly active on the Malabar coast, though showing signs of weakening about the 30th.

Rainfall was on large excess in the South Malabar coast and in the Circars and locally in the Tinnevelly district. Elsewhere it was practically normal.

Day temperatures were generally in excess in the interior of the Peninsula during the first three weeks. Rentachintala recording 112° on one occasion.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	9·5	+7·5	14·3
	Berhampore *	4·1	+2·3	9·6
	Calingapatam	3·3	+0·7	6·5
	Vizagapatam	3 9	+1·9	9·0
	Anakapalli *	7·9	+5·9	- -
	Samalkota*	2 2	+0·8	11·9
	Maruteru *	2·7	+1·4	7·0
	Cocanada	3·4	+1·4	10·0
	Masulipatam	6·9	+5·6	11·7
	Guntur*	5·5	+3·4	14 9
Ceded Dists.	Kurnool	1·1	0	3·6
	Nandyal *	0·8	-0·7	2·5
	Hagari *	2·8	+0·8	4·4
	Bellary	1·7	-0·3	2·1
	Anantapur	3·0	+0·9	3·9
	Rentachintala	3 9	—	3·9
	Cuddapah	1·1	-0·5	2·2
	Anantharajupet *	1·9	—	—
Carnatic	Nellore	0·4	-0·4	2·6
	Madras	0	-1·1	4·0
	Palur *	1·5	-0·4	5·9
	Tindivanam *	1·8	+0·3	6·3
	Cuddalore	1·5	+0 9	5·9
Central	Vellore	2·4	+0·1	4·1
	Salem	7·5	+2·8	12·4
	Coimbatore	2 1	-0·3	6·0
	Coimbatore Res. Inst. *	2 0	-1·2	5·8
	Trichinopoly	1·3	-1·7	7·2

Division	Station	Actual for month	Departure from normal @	Total since January 1st
South	Negapatam	0·1	-1·5	8·9
	Aduthurai *	0·3	-1·9	6·1
	Madura	0·6	-2·3	8·4
	Pamban	0·5	-0·3	8·5
	Koilpatti *	2·4	+0·4	8·6
	Palamkottah	5·6	+4·0	11·3
West Coast	Trivandrum	19·7	+11·2	23·2
	Cochin	31·0	+19·3	35·7
	Calicut	18·0	+9 5	29·5
	Pattambi *	12·1	+3·2	18 5
	Taliparamba *	9·8	+1·1	11·7
	Kasargode *	13·3	+5·9	15·7
	Nileshwar*	9 6	-0·6	11·9
	Mangalore	8 5	+2·3	12·5
Mysore and Coorg	Chitaldrug	1·9	-2·2	2·7
	Bangalore	6·5	+0·6	7·6
	Mysore	9·4	+1·8	12·5
	Mercara	9·6	+3·9	13·8
Hills.	Kodaikanal	7·0	+1·0	14·3
	Coonoor*	2 9	—	26·2
	Ootacamund *	8 4	+1·7	13·8
	Nanjanad *	8·4	+2·1	14·5

* Meteorological Stations of the Madras Agricultural Department.

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

Weather Report for the Research Institute Observatory.

Report No. 5/1936.

* Absolute maximum in shade.	102°F
* Absolute minimum in shade.	71·8°F
* Mean maximum in shade.	98·7°F
Departure from normal (of the month).	+ 4·4°F
* Mean Minimum in shade.	74·8°F
Departure from normal (of the month).	+ 0·9°F
Total Rainfall.	2·04″
Departure from normal.	- 1·17″
Heaviest fall in 24 hours, (record on 21—5—1936).	0 83″
Total number of rainy days.	3 days.
Mean daily wind velocity.	2 2 M. P. H.
* Mean humidity at 8 hours.	71·4 %
Departure from normal. (of the month).	- 3·3 %

* Temperatures were recorded only upto 20th of May.

General. Severe hot weather conditions prevailed during the first fornight of the month with day temperatures in large excess of normal. The absolute maximum recorded was 102° on the 6th.

The temporary advance of the monsoon on the West coast, reduced the temperature in the second half of the month.

Rainfall was 2·04″ which was 1·17″ below normal.

P. V. R. & D. V. K.

Departmental Notifications.

Appointment. S. Venkataramanappa, B. Sc. Ag. is reappointed to the M. A. Subordinate Service and is posted to Vellore.

Leave. K. Ambikacharan A. D. Hindupur l. a. p. on M. C. for 3 months from 16—4—36. T. D. Eswara Iyer, Asst. Farm Manager, Sim's Park, Coonoor, l. a. p. for two months from 1—6—36, M. Eggiaswamy Iyer, A. D Chengam l. a. p. for 3 months from 8—6—36. P. K. Natesa Iyer, A. D. Srivalliputhoor, l. a. p. for 3 months from 15—5—36. C. Jaganatha Rao, Assistant in Cotton, l. a. p. for 2 months and 15 days from 3—5—36. S. V. Kuppuswamy, Asst. in Soil Physics l. a. p for 2 months from 22—4—36. N. Kesava Iyangar, Assistant in Cotton Dry Farming Station, Hagari, leave out of India on half average pay for 27 months from 15—8—36. V. S. Narayanaswamy Iyer, A. D. Tanjore, l. a. p. for 4 months from 22—6—36.

Transfer. Guruswami Naidu. F. M. Kalahasti to Live Stock Section, Hosur. A. R. Krishnamurti Iyer, to revert to the Department from Borstlal School, Tanjore. K. Venkataswami, A. D. Vellore on probation to be F. M. Millet Station, Coimbatore. P. V. Venkateswaran, F. M. Millet Section to be Lecturer in Agriculture, vice S. Narayana Iyah on other duty. K. Sanjivi Shetty, A. D. Bellary to be F. M. Kasargod M. Bhavani Sanker Rao F. M. Kasargod, to be Assistant to O. S. S. in Neleshwar. N. Ganeshamurti, Assistant, O. S. S. to report himself to D. D. viii circle.

Gazettee Notifications. Mr. T. Murari to be Dy. Director of Live Stock. Mr. Kunhikutti to be Supt. Live Stock Station, Hosur. Mr. T. G. Anantaraman to be Offg. Asst. Marketing officer vice Mr. K. Gopalakrishna Raju, on leave. Mr. C. Ramaswami to be marketing officer. Mr. C. R. Sreenivasan, Supt. A. R. S. Pattambi, to be Marketing officer during the period of leave of Mr. C. Ramaswami

ANNOUNCEMENT

DIAMOND JUBILEE OF AGRICULTURAL EDUCATION IN INDIA

&

THE SILVER JUBILEE OF M. A. S. U.

WILL BE HELD ON

29th, 30th, 31st JULY & 1st AUGUST

His Excellency Sir K. V. Reddi Naidu Garu, Offg. Governor of Madras will inaugurate the Proceedings on the 29th July at 11-30 A.M. and visit the Exhibition in the afternoon.

The first Session of the Conference will be held on Thursday the 30th July. **The Hon. Mr. P. T. Rajan**, Minister for Public Works will preside.

The College Day Sports will be held on Saturday the 1st August.

The Annual General Body Meeting of the M. A. S. U. will be held on Sunday the 2nd August at 8-30 A. M.