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Editorial

The Fruit Industry:

The importance of fruit as an useful article of diet has been fully recognised from time immemorial. Fruits are wholesome, highly nutritive and form a good source for minerals and vitamins, which are so essential for growth and health. In spite of the recognition of value of fruits in human dietary it is a sad fact that in our country they still remain the monopoly of the rich and beyond the reach of the poor. Two facts, viz., limited production and high cost of the produce can be reckoned as contributory causes for the same.

Our country and South India in particular, is noted for its fruit wealth and is capable of producing a variety of choice fruits due to varied soil, climatic and other factors. Further as the yields of most of the fruit crops compare favourably with those in other countries it is time that we take stock of our position and adopt methods to increase production The first and the most important step for achieving this is to increase the area under various fruit crops Though there is a keen awakening among the ryots to devote a portion of their holding to fruits they are not all, in a position to do so due to the very limited availability of planting material The material produced on the Government Farms is so limited that it cannot meet even a fraction of the growing demand. Most of the fruits are long duration crops and it is of utmost importance that reliable planting material of choice and high yielding varieties is made available to the orchardist so that he may not come to grief when the plantation begins to bear. As a large proportion of the demand cannot be met by Government Farms, even if production is enlarged considerably, it is highly necessary that a system of licensing private nurserymen should be introduced forthwith so that the ryot can obtain his requirements with ease, and confidence. It is also imperative that along with this the ryot should also be educated on the improved cultural practices of the orchard. Though many such practices are now being advocated as a result of research work on the Fruit Research Station, Kodur, this can be best achieved only by

organising as many Fruit Farms as possible, in all the important fruit growing tracts of the province, which should conduct research and spread improved ideas to all the neighbourhood. We are quite sure that this is receiving the serious attention of the Government.

No amount of improvement in production will assure the prosperity of the industry unless the problem of disposal is also tackled side by side. Most of the fruits are seasonal and even with the limited production available now, it is not uncommon to see large quantities of good quality fruits perish due to lack of facilities for disposal It is here that the State can afford substantial help by providing quick and easy transport by rail at concessional rates so that the commodity can reach distant and favourable markets in short time. Though such help is absolutely necessary the fruit growers also should try their best to overcome these difficulties by organising themselves into co-operative societies which could tackle the problem of disposal very successfully, as is now being done by the Kodur Fruit Growers Co-operative Society. Such organisations will also be in a position to handle surplus produce better than individual growers, by providing large scale storage facilities, including cold storage, during seasons of plenty. Alongside with this scientific methods of preservation should also be encouraged. In countries like United States of America, Australia, New Zeland, etc., the fruit preservation industry has made rapid strides and preserved fruits form important articles of daily food. This industry which is in its infancy in South India has a great scope for development, especially in view of the variety of fruits like mangoes, bananas, guavas, citrus, papaya, melon, etc., available.

Finally as in any other industry progress can also be achieved in fruit industry through healthy competitions in exhibitions. The remarkable improvement of live-stock in Britain, to mention but one example, has not a little been due to the numerous shows and competitions, organised all over the country for over a century, The first provincial Fruit Exhibition which has just been successfully concluded in Madras was organised mainly to assess and portray the varied fruit wealth of our province. We hope that the show would have served the purpose of awakening a live interest among the growers besides promoting fruit consciousness among the public. We also hope that it would be an annual feature which would regularly bring most of the important fruit growers and allied interests together so that through repeated contacts, competitions and discussions the progress of the industry could be assured.

MANURIAL EXPERIMENT ON GROUNDNUT*

By

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Introduction.

Manurial experiments on groundnuts do not appear to have been conducted to any great extent in India, even though the crop attained commercial importance and occupied an area of two million acres as early as 1914 and over 8 million acres during 1938. The latest area statistics show that the acreage under groundnuts in India is roughly 7 millions. The few isolated experiments that were conducted in some of the Provinces indicate that the response of groundnuts to fertiliser application is to a large extent influenced by the nature and availability of plant food in the soil. On the black cotton soils of Bombay Presidency and the Central Provinces, nitrogenous manures are reported to have had no effect on the yield of groundnut(10) †. At Akola Experimental Station in Central Provinces, a definite response to the application of potassium sulphate has been obtained(10). On the Hebbal Farm in Mysore State, a combination of potassic and phosphatic manures has been found to be the best for application to red sandy loams (9). In Burma, in light sandy loam — alkaline and poor in all essential elements of plant food — nitrogenous manures alone have been found to have enhanced the yield(10).

Experiments conducted at Rhodesia have shown that nitrogenous fertilisers are not beneficial to groundnuts and that the response to phosphates is little unless the soil is of low fertiliy (1). Application of wood ash has resulted in increased yield and oil content in Philippine Islands (6). In North Carolina it has been found that potash is most essential for profitable production(3 4 and 11). At Georgia Coastal Plain Station, the need for a complete fertiliser for peanuts was evident, but on lands having leguminous green manure turned under nitrogen was reported to have had no effect, while potassium and phosphorus profitably increased the yields(7). At the Georgia Experiment Station also, best increase in yield was obtained on most soils with a complete fertiliser mixture (5). In Florida no profitable response was found either with single elements or their combinations(8). Comparatively large quantities of potash were required on the light soils of the Virginia Experiment Station(2).

The results of the manurial experiments on groundnut being thus varied it was considered desirable to conduct a well laid out experiment which included N, P and K and all their combinations in Madras

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† The numbers within brackets refer to Literature citations.

Presidency which claims about 50% of the area under the crop in India, in the Scheme of Research on Groundnuts financed by the Indian Council of Agricultural Research.

2. Location of the Experiment.

The trials were conducted at the Agricultural Research Station, Tindivanam for three successive years from 1937—38 to 1939—40, during the main rainfed season extending from July to December in each year. The Station, which is mainly intended for research work on groundnuts, is located in South Arcot District — the premier groundnut growing tract of the Madras Presidency.

(i) *Soil.* — The soil of this Station is typical sandy loam and is representative of a large portion of the groundnut tract of the Presidency. Soil depths vary from about 12 to 18 inches with an underlying layer of weathered rock and *Kankar* through which the roots of groundnuts do not readily penetrate. Chemically the soil is poor in organic matter and nitrogen as can be expected of sandy soils. It is also poor in phosphoric acid and potash contents. Lime is present in fair quantity in the upper layer of the soil and especially in the subsoil it is more pronounced. The figures of chemical analysis of the soil where the experiment was conducted are given below.—

		(Percent)
Moisture.	...	2·38
Loss on ignition.	...	1·88
Insolubles.	...	89·09
Iron.	...	5 24
Alumina.	...	1 95
Lime.	...	0·51
Magnesia	...	0·26
Potash.	...	0 08
Phosphoric acid.	..	0 003
Soda.	...	0·23
Sulphuric acid.	...	0 004
Carbon—dioxide,	...	0·177
	Total ...	99·424
Nitrogen.	...	0 029
Available Potash.	..	0 003
"	...	0·0003
pH value.	..	8 27

(ii) *Rainfall.* — In the South Arcot District, groundnut is sown immediately after the receipt of the south—west monsoon rains in July—August and is harvested with the closing rains of the north—east monsoon in December. The crop depends for its successful growth and yields on the even distribution of the two monsoons. In the three years the manurial experiment was in progress, the rainfall and its distribution have not been quite normal and were different from year to year with its consequent effect on yield. In 1937—38, the south—west monsoon broke out late in August and was characterised by heavy precipitations in the initial stages. The monsoon weakened later resulting in a period of

drought which in its wake brought about a severe insect attack by *Stomopteryx nerteria*. The heavy north—east monsoon affected the setting of pods and the yields were low averaging to only 800 lb. of pods per acre. In the second year, the sowing rains were received towards the end of July and south—west monsoon was well distributed. The north—east monsoon failed completely in the beginning and the few showers received late in the season totalled to only about 6 inches as against an average of 24 inches. The crop, however, put forth a second flush with the later rains and gave an acre yield of 1200 lb. of pods. In 1939—40, the monsoon was delayed till the second week of August. The north—east monsoon broke out towards the middle of September and proved normal both in the incidence of rainfall and its distribution. The yield averaged to 1,800 lb. of pods per acre. The actual rainfall received during the three cropping seasons is given in Table I.

Table I. Rainfall from Sowing to Harvest, Agricultural Research Station, Tindivanam.

Period in weeks.		1937—'38.		1938—'39.		1939—'40.	
		No. of Rainy days.	Rainfall in inches.	No. of Rainy days.	Rainfall in inches.	No of Rainy days.	Rainfall in inches.
July–Aug.	26— 1					*Sown on 10-8-'39.*	
	2— 8						
	9—15			*Sown on 16-8-'38.*		4	1·23
	16—22	*Sown on 24-8-'37.*		4	3·79	–	—
	23—29	1	3·30	2	0·13	–	—
Aug–Sep.	30— 5	3	1·09	1	0·27	1	0·12
	6—12	1	0·05	4	3·53	–	—
	13—19	1	1·15	2	1·18	2	2·70
	20—26	3	3·00	4	0·28	5	0·46
Sep–Oct.	27— 3	4	8·17	1	0·94	2	1·93
	4—10	2	0·45	1	0·04	1	0·17
	11—17	3	1 32	–	—	7	8·43
	18—24	1	0·28	1	0·10	4	0·67
	25—31	7	2·23	5	2·12	3	0·97
November.	1— 7	6	6·47	1	1·07	4	3·26
	8—14	3	5·52	–	—	6	1·83
	15—21	3	13·49	–	—	4	6·64
	22—28	–	—	1	0·12	–	—
Nov–Dec.	29— 5	2	0·56	–	—	–	—
	6—12	3	3 35	2	0·99	–	—
	13—19	1	0·14	–	—	1	0·24
	20—26	2	0·16	–	—	–	—
Dec–Jan.	27— 3	1	0·18	–	—	–	—
	4—10	–	—	1	0 14	2	0·11
	11—17	–	—	4	0·51	–	—
	18—24	*Harvested on*		*Harvested on*		*Harvested on*	
	25—31	22—1—1938.		11—1—1939.		18—1—1940.	
Total.		47	50·91	34	15·21	46	28·76

3. Experimental Details.

(i) Treatments. — The experiment was designed on an N, K, P basis and included combinations of them with and without a basal dressing of cattle manure. The different treatments and the rates of application of the different manures are given hereunder :

Sub-block (i)	*Sub-block (ii)*
Without a basal dressing of cattle manure.	With a basal dressing of cattle manure at the rate of three tons of cattle manure (loose box) per acre, i. e., 50 lb. N per acre.
CONTROL.	CONTROL.
n	*n*
p	*p*
k	*k*
np	*np*
nk	*nk*
pk	*pk*
npk	*npk*

Doses per acre:—

N.	11 lb.	about ½ cwt. of ammonium sulphate.
P_2O_5	42 lb.	about 2 cwt. of superphosphate (ordinary)
K_2O	54 lb.	about 1 cwt. of potassium sulphate.

(ii) Layout. — A split plot design randomised block layout replicated five times was adopted. The position of the sub-blocks receiving cattle manure within each block was fixed by randomisation. The eight treatments were also allocated at random in each sub-block. The gross size of plot was 60′ x 4½′ and the ultimate size at harvest after the rejection of border rows all round was 58½′ x3′ or 1/248 of an acre.

Between plots, a foot and half wide bund was raised and at the lower end of each plot a small outlet opened into a drainage channel. Manures were weighed correct to a gramme and applied uniformly to the well cultivated plot just before sowing and incorporated into the soil by working a hand junior hoe. The improved variety A. H. 25 (TMV.I) was sown with a spacing of 9″ either way.

The experiment was run for three seasons during 1937—38, 1938—39 and 1939—40. A field 2·40 acres in extent was divided into three portions for this purpose and one portion utilized for each year's experiment. The variation in the fertility of the land used for the three successive years was thus kept at a minimum.

4. Results and Discussion.

The effects of the different treatments on yield, vegetative development of plants, flowering and fruiting and the various qualitative characters of the produce are discussed below :

(*i*) *Yield* — The yield of well-dried pods under the different treatments in each of the years of the experiment is given in Table II.

Table II. Acre yield of pods in pounds.

Year.	Details.	No manure.	*n*	*p*	*k*	*np*	*nk*	*pk*	*npk*	Average.
1937-'38.	Sub-block without cattle manure ...	752	782	760	749	725	817	857	854	786
	Sub-block with cattle manure ...	728	686	801	802	763	797	806	866	781
	Average	740	734	780	775	744	807	831	860	784
1938-'39.	Sub-block without cattle manure ...	1119	1191	1110	1170	1179	1248	1209	1240	1183
	Sub-block with cattle manure ...	1227	1244	1227	1311	1269	1294	1336	1286	1274
	Average	1172	1218	1168	1241	1224	1271	1272	1263	1229
1939-'40.	Sub-block without cattle manure ...	1659	1652	1765	1793	1849	1827	1917	1928	1799
	Sub-block with cattle manure. ...	1714	1922	1991	1827	1965	1911	1933	1944	1901
	Average	1687	1786	1878	1809	1807	1969	1925	1936	1850

It is found that annual variations in yield have been very pronounced in this series of experiments. The average yield per acre of all the plots was 784 lb. in 1937-38, 1229 lb. in 1938—39 and 1850 lb. in 1939—40.

The yield data were statistically analysed every year. Except for P and K in the first and third years and K alone in the second year, all the other main effects and interactions did not attain the level of significance, A summary of the results in terms of main effects and interactions is furnished in Table III.

Table III. Main Effects and Interactions in pounds per acre.

Effect	1937—38	1938—39	1939—40	Three-year Average.
n	4·4	30·3	50·0	28·2
p	40·0	6·4	123·4*	56·6
k	69·0*	66·2*	70·5*	68·6
np	–8·3	–7·3	–30·4	–15·3
nk	25·7	–20·0	–14·6	–3·0
pk	14·8	5·2	–32·5	–4·2
npk	6·9	–12·3	5·6	0·1
Standard error	19·4	18·1	32·5	13·1
Critical difference (P = 0. 05)	38·0	35·5	63·8	

* Significant at 5 per cent level.

A substantial response to potash is indicated in all the years. In 1937—38 it has given an average increase in yield of 69 lb. per acre, in 1938—39, 66 lb., and in 1939—40, 71 lb., the three—year average being 69 lb. Phosphate gave 40 lb. per acre in 1937—38 and 123 lb. in 1939—40. In 1938—39, however, the response was very low. The average increase in yield due to phosphate during the three-year period came to 57 lb. per acre.

In order to examine as to how far the conclusions of the separate seasons can be regarded as generally true for the locality in question a combined analysis of the three years' data was also carried out. The results were more or less in conformity with the inferences drawn from the results of individual years. A significant *phosphate* x *years* interaction was also obtained showing a marked differential response of phosphate to seasons. Probably the yield response of groundnuts to phosphate is dependent upon the receipt of adequate and well-distributed rainfall during the period of crop-growth. In the year 1938—39 when no significant effect due to P was noticeable the rainfall received during the crop season was very low and badly distributed By far the major effect on yields was found to be due to the season.

To sum up K is found beneficial. Application of P has failed to supplement the yields in certain seasons. N does not appear to be of any advantage. Cattle manure, which was applied as basal dressing though it failed to show any significant effect on yield, seems to exert some beneficial effect in years of deficient rainfall.

(ii) Vegetative growth. — To study the effect of the different treatments on vegetative growth, measurements of the length of main axis and primaries, and counts of nodes for 25 plants per treatment were noted at flowering, two months after flowering, and at harvest time. No appreciable difference in growth of plants under the treatments could be detected.

(iii) Flowering and fruiting. — Fifty plants under each treatment were observed for daily flower production. These were separately harvested and counts of undeveloped 'pegs' (gynophores), 'tender pods', 'immature pods' and 'good pods' were made. The average number of flowers, total number of good pods, percentage of setting of good pods in individual treatments were worked out. The data are furnished in Table IV.

Table IV—Manurial experiment on Groundnut 1937—38—1939—40—Flowering and Fruiting Studies.

	1937–'38.				1938–'39.				1939–'40.			
	Average No. of Flowers.	Average No. of good pods.	Percentage of fertilisation.	Percentage of setting.	Average No of Flowers.	Average No. of good pods.	Percentage of fertilisation.	Percentage of setting.	Average No. of Flowers.	Average No of good pods.	Percentage of fertilisation.	Percentage of setting.
No manure.	22·6	5·2	49·2	25·2	39·6	8·3	49·1	19·5	36·2	10 7	42 2	25·8
n	25·8	5·6	43 8	21·6	47·7	8 9	40 0	17·5	33·9	10·5	48·7 *	32·7 *
p	28·7	5·0	43.3	24·6	41·0	8·0	48·7	18·8	34·7	9.8	51·5 *	34·3 *
k	24·1	5·0	42·1	21·3	48·9	8·4	42·9	18·6	34 3	11·5	47·4	31 2 *
np	25·1	5·4	42·7	21·2	44·8	9 2	48·0	20 2	41·3	10·3	42·3	29 6
nk	26 3	5·0	47·5	25·3	44·4	9 5*	47·9	19·6	38·9	11·5	43·3	27·7
pk	27·9	5 7	45 0	22 7	47·2	8·6	44 9	18·4	39·8	11·8	43·6	30·3 *
npk	25·2	6·0	45 1	24·9	47·1	9·1	45·6	18 6	40 0	8·7	46 8	31·6 *
cm	19 7	5·0	40·1	22 9	47·6	9 3	49·3	20 9	33·4	11 0	50·6 *	33·5 *
cm + *n*	20·7	4 5	36 8	21 7	44·8	7 8	48·8	18·6	38·2	11·0	48 1	31·8 *
cm + *p*	22 8	5·6	28·8	17·6	48 0	9 0	47 0	19·5	36 8	10·5	50 7 *	33 0 *
cm + *k*	23·6	5·0	41 9	20 9	50 0	9·3	45·5	17 2	37·0	10·8	48·5 *	30 4 *
cm + *np*	24·3	5·2	38·1	21·6	47·9	10·1*	50·4	20·5	38·1	11 0	47·0	31 1 *
cm + *nk*	21·8	5·5	38·9	18·9	48 9	9 6*	46·8	21·5	40 1	11·1	48·8 *	30 2 *
cm + *pk*	21·1	5·5	37 0	20·3	49·3	9 1	48·2	18 0	36·0	11·0	51·3 *	31 8 *
cm + *npk*	23·7	5·9	43 7	23·9	54·3	10·1*	44·6	19 3	43·0*	10·8	43.6	26·6
Significant or not	No	No	No	No	No	Yes	No	No	Yes	No	Yes	Yes
Critical difference (P = 0·05)						1·18			5·79		6·26	4·38

* Significant over no manure at 5 percent level.

Table V. Manurial experiment on groundnut 1937—38 to 1939—40.

QUALITATIVE DETERMINATIONS.

	1937—'38.					1938—'39.					1939—'40.				
	Percentage of kernels to pods.	Natural test weight of 1 M. M. of pods (in gms.)	Natural test weight of 1, M. M. of kernels (in gms.)	No. of kernels per pound	Oil content. (per cent)	Percentage of kernels to pods.	Natural test weight of 1. M. M of pods (in gms.)	Natural test weight of 1, M. M. of kernels (gms.)	No. of kernels per pound.	Oil content (per cent.)	Percentage of kernels to pods.	Natural test weight 1. M. M. of pods (in gems)	Natural test weight of 1. M. M. of kernels (in gms)	No. of kernels per pound	Oil content (per cent.)
No manure.	71·7	553	1262	1028	51·39	70·1	566	1181	953	48·56	74·5	607	1260	879	49·12
n	71·7	560	1247	1026	51·60	67 2	560	1178	988	49·11	74·7	613	1263	878	48·95
p	71·7	577	1269	1038	52·13	66 0	563	1174	967	47·94	74 8	612	1257	875	49·63
k	71·6	584	1262	1037	51·69	68 7	566	1176	938	49·78	74·4	614	1260	872	49 14
np	71·6	560	1262	1017	51 89	70·0	558	1176	955	48 98	74 7	612	1259	868	50 12
nk	71·6	577	1262	1023	52 03	70 3	578	1176	957	48 90	73·9	614	1259	877	50 71
pk	71·4	553	1255	1010	52 03	68·4	576	1180	942	49·14	73·9	610	1262	885	50 32
npk	71·5	577	1255	1015	51·91	71·8	555	1174	943	47·77	74 2	611	1258	884	50 69
cm	71·7	577	1255	1050	51 50	69·4	571	1178	936	49 14	74·7	611	1257	898	49 51
cm + *n*	71·7	577	1262	1032	51·73	71·1	565	1174	959	49·89	74 9	612	1259	884	50 83
cm + *p*	71·7	577	1262	1023	51·60	72·1	566	1180	957	48·51	75 2	615	1262	872	50.53
cm + *k*	71·5	584	1255	1030	51·76	69·8	570	1184	950	48·78	75·0	610	1260	906	49·25
cm + *np*	71.6	584	1262	987	50 55	69 2	571	1180	978	49·31	74 8	612	1258	884	49·73
cm + *nk*	71·6	577	1262	1012	51·20	68·3	564	1175	970	48 94	74·6	611	1258	880	49 96
cm + *pk*	71·6	577	1255	1044	51·95	71·0	573	1182	975	48·47	75 1	615	1260	883	50·48
cm + *npk*	71 6	577	1255	1034	51 61	68·5	564	1176	942	48 32	74·1	617	1260	871	49·95

(*) M, M. — Madras Measure — It is 108 cubic inches in capacity.

In the first two years of the experiment when the seasons were not normal, the effect of the different treatments on flowering and fruiting phases of the crop was not quite clear. However, in the second year the average number of 'good pods' per plant under *np*, *nk* and *npk* with cattle manure and *nk* without cattle manure showed significant increase over no manure. In the final year of this trial the beneficial effects of cattle manure and its combination with artificials were largely in evidence. The artificials alone and in combinations (excepting *npk*) over a basal dressing of cattle manure have significantly improved the setting of good pods while in the absence of cattle manure, *np* and *nk* proved no better than no manure.

(iv) Qualitative characters — Qualitative analysis of the produce such as natural test weight (weight per unit volume) of pods and kernels, percentage of kernels to pods by weight (shelling percentage), number of kernels per pound and oil content of kernels for each treatment was carried out in all the three years and the results are given in Table V.

There are no great differences in favour of any manurial treatment. They are almost negligible when compared to the effect due to the season. The differences in the total rainfall and its distribution which have markedly affected the yields have also affected most of the qualitative characters.

5. Economics of Manuring.

The economics of manuring was worked out based on the cost of manures and the value of the produce that prevailed during the prewar period when the experiments were in progress. It was found that the value of the extra produce obtained as a result of the application of manures did not cover the cost of the manures used. The doses adopted in the experiment are also not remunerative even at current rates.

6. Conclusions.

The present series of experiments have been more of a preliminary nature indicating the way for future experiments. Application of potassium sulphate at 1 cwt. per acre has given significant increase in yield but the cost of manuring is not met by the value of the extra produce obtained Smaller doses of potassium sulphate must be tried to find out if the optimum required is below 1 cwt per acre. Cheaper sources of potassium must also be explored. Superphosphate has given significant increase in two years and it has increased the flowering and fruiting of groundnut. Its use in future trials, therefore, narrows down to finding the optimum dose per acre. Application of ammonium sulphate has not been found to be beneficial Cattle manure at 3 tons per acre has not been able to show its beneficial effects on yields. A higher dose may probably result in increased yields, particularly in years of deficient rainfall.

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PLANT RESOURCES IN AGRICULTURE

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Introduction.

In post-war planning it is important to tap all the possible plant resources of the country. Many of the agricultural departments are mainly concerned with the breeding of improved strains of crops of major importance. For some time the plant breeders were concerned with the cultivated plants only in their breeding programmes but later, some of the wild allies came in as parents in hybridisation. The importance of wild plants in such breeding programmes was more than emphasised by the survey of plant resources of the world by Vavilov. His work is by no means complete and India is yet an unexplored region. The survey has two main objects: (1) to investigate the possibilities of directly bringing the plant under cultivation and utilising the economic product it yields. (2) to use it as a parent in hybridisation programmes so as to transfer one or more of its valuable characters to its cultivated ally. Valuable progress has been made in Russia in both these directions.

In India, the only organisations that can take up this work are the Herbaria. There are three important herbaria in India viz., (1) the herbarium at Royal Botanic Gardens at Sibpur, Calcutta (2) the herbarium of the Madras Agricultural Department at Coimbatore, S. India and (3) the Forest herbarium at Dehra Dun. In spite of the fact that the Herbaria can play a vital role in the economic structure of a country the public of this country take very little interest in them. These organisations have so far served as centres for identification of the plants on the taxonomical scale and for this purpose have been collecting, drying and preserving type specimens. Huxley (1942) has rightly drawn attention to the new orientation that is necessary in the new systematics. The expanse of the world shows far more variations than what could be typified by the dried specimens of the Herbarium. And yet to indentify these variants, a well equipped herbarium is the first requisite and the time has come for us not only to identify these but to investigate to what possible use they could be put to.

If the economic resources of the vegetation of the country are to be fully utilised, it is not enough if a handful of plant breeders concentrate on the improvemnt of the cultivated crop plants of the country. It is essential that the whole country must be combed for varied types of plants

for varied purposes. An intensive programme of research on (1) new plants which may serve as economic resources (ii) new economic uses for known plants are necessary. The herbarium is an ideal organisation for such plant surveys. In this short note, a few activities of the Madras Herbarium are mentioned.

I. Fodder.

In view of the fact that there are specialists for important crops of the Presidency, the Madras Herbarium took upon itself the study of the fodder problem of this province. Important fodder grasses of the province were botanically studied and a book on the fodder grasses of Madras Presidency was published (1) Recently a survey of the fodder grasses of this presidency was carried out district-war and a map showing the important annual and perennial forms have been recorded for each district. (2) This information is very useful in formulating any future programme on pasture improvement. A survey of the fodder grasses of Chingleput District showed that nearly a hundred species of grasses occur in that district but not all of them are of fodder value. (3) Twenty-seven species are listed by us as of fodder value, but a preliminary trial in the tract is necessary before the important ones can be chosen for large scale multiplication in pastures, waste places and bunds. Our observations further reveal the fact that by choosing a few species suitable to appropriate environments such as road-sides, waste places, bunds, pasture areas and reserve forests, the unwanted and uneconomic grasses may be eliminated and their place taken up by more useful ones. That this is possible is shown by our observations at the Central Farm, Coimbatore, where Kolukattai grass (*Cenchrus ciliaris*) which was not common on road-side a few years ago is now the dominant type. This grass is the staple type for the Kangayam tract and is one of the most desirable types. Our survey in respect of Chingleput district has shown that though this district requires about 3656 million lbs. of fodder it actually produces only 3080 million lbs. There is thus an apparent deficit of 576 million lbs. which will be really more if the cattle are to be well fed. Establishment of a few high yielding good quality grasses in this district is likely to increase the fodder production.

At Coimbatore about 100 indigenous and 30 exotic species of grasses were collected and tried in small observation plots and out of these, 18 desirable and promising ones are under yield trial in bigger plots. These, grasses are valued for their yield, drought resistance, palatability and regenerating capacity after the receipt of first monsoon showers. *Panicum antidotale* the Australian drought resistant type is really drought resistant. It is green even during the worst summer months. On an average it yields 15 to 30 thousand lbs. per annum in 2 or 3 cuttings. It is highly desirable that this grass should be tried extensively in this province. *Cynodon*

plectostachyum is another introduced grass. At first it was reported to have cyanogenetic contents to a lethal extent to cattle, but the chemical analysis followed by feeding trials conducted by the Government Agricultural Chemist in collaboration with us have shown that it is harmless. This grass is of value not only as a fodder grass but also as a soil binder. It is quick growing and is easily propagated by cuttings. Growth measurements have shown that in one case it grew 26 feet in 63 days. It is superior to the common harıali *Cynodon dactylon* in its growth, yield and fodder value. We are mentioning here two types only as prominent examples and the remaining ten species are also likely to be useful to different tracts.

In solving the fodder problem it is necessary to introduce legumes in pastures to increase the feeding value of the same. In Europe clovers play this part in pastures, *Alysicarpus rugosus. A. longifolius* and *Rhynchosia minima* are found to be good as annual legumes in the pastures. Fifteen species of leguminous plants including Soya beans and Kudzu (*Pueraria thunbergiana* are just under trial this year. Though it is too early to judge *glycine javanica* collected in the nearby forests appears promising.

It is not sufficient if the fodder requirements of the cattle are sought to be met by the production of straw from cereal crops or of grasses in pasture lands. In dry areas such as the Ceded Districts, seasonal conditions are often highly precarious and fodder production from the above two resources fail. Therefore the problem in such and similar areas may be solved by extensively growing trees whose leaves are eaten by cattle. By virtue of their extensive root system and size, the trees are likely to bear leaves during famine periods and these can be utilised to tide over critical periods. These trees can be planted on roadsides and village common grounds and pasture areas. A search for such forage trees was made and a list of 72 trees has been published. Preliminary tests to judge the suitability of some of these to different tracts is a problem on hand

II. Famine Food.

The work of plant breeders is set at nought during periods of famine because most of the improved strains evolved by them are cultivable during normal periods only. During famine, the labouring class of people resort to eating the naturally occurring vegetation. From time immemorial the use of *Bassia latifolia* in famine periods is well known. The plant deserves to be grown all over the province for its many uses. Many of the grasses growing wild are of great use in this direction. The grass *Brachiaria ramosa* is reported to be used in Anantapur and Vizagapatam districts of the Madras Province and the grain is reported to be superior to the widely cultivated millet *Panicum miliare* (samai). A full knowledge of the natural flora that can be used as food will be useful to the State

Sixty-eight species of wild plants are listed in the Herbarium whose fruits are edible. (6) A list of 38 species of plants whose leaves are used as vegetables has been published. Many of these are wild and growing in field bunds and waste places. (6A) More extended search and trials among the flora of this presidency is expected to enlarge the list of wild plants which may yield edible products especially during periods of famine.

III Land Reclamation and Soil Conservation.

There are swampy and saline areas which can be reclaimed by raising suitable vegetation in the early stages. One species of grass, *Brachiaria mutica* is a useful type for reclaiming marshy areas. It is also a good fodder grass. We have started trials with this grass in Madura district. The saline soils which cannot bear any crop can be profitably turned into grassland with species like *Chloris barbata, C. bourneii* and *Sporobolus tremulus.* There is an urgent need for an intensive search for more species that may prove valuable in soil reclamation.

We have been very frequently addressed for suitable soil binders. For canal bunds, we have found that *Pennisetum hohenaekeri* (Avaru grass in Telugu or Manjapil in Tamil) is a very good one and the Madras P. W. D. has been every year addressing us for seeds of this grass. We have also tried *Cynodon Plectostachyum* but more extensive trials are necessary before we can recommend this to other areas. Mention may be made of *Clerodendron inermis* which is excellent in preventing erosion (by sea) along the sea shores. It is not enough if soil conservation is sought to be done by cultural practices in cultivated fields. It is essential to prevent erosion even in waste lands and the most efficient and economic method of doing it is to plant out natural vegetation to prevent erosion. *Peuraria thunbergiana,* which is reported to have been highly efficient in U. S. A. is under observation at Coimbatore.

IV Utilisation of wastes.

The herbarium is an ideal place for listing up plants which have potential uses for them. Suggestions for varied uses of many of the known plants can frequently emanate from the Herbarium Botanists. They are also in a position to state the locality where the plants are available. In addition to this it very often happens that exotic plants are introduced and these may prove useful or harmful. In either case, the Botanist has to note them; if useful, suggestions for proper utilisation are to be given.

In Madras a list of 20 introduced weeds has been published. (7) Possible uses for some of them have also been suggested. The following are some of the suggestions which we reproduce here.

Croton sparsiflorus: This has been analysed for use as manure. The Government Agricultural Chemist remarks "This contains fair amount of Potash and Nitrogen and can be very well used as a manure by composting" (8).

Tridax procumbens: This has been chemically analysed for use as fodder. The Government Agricultural Chemist remarks "The sample contains fairly good amount of food ingredients, but the fibre content is a little too high. Probably it is this factor that makes it more favoured by buffaloes than by cows The weed is particularly rich in lime content" (8). We have also noted that the oil from the fruits of *Thevetia nereifolia* can be used for lamps (9). Such and similar uses for very many plants have been recorded from time to time. Local enquiries and trials are likely to reveal new and unknown uses for many of the waste plants. It has been recently brought to our notice that the weed *Tridax procumbens* contains fungicidal properties.

We wish to mention here another important but little utilised waste plant of our province, and which we had occasion fo study. We refer to the sea weed *Gracillaria lichenoides.* Due to war, there was dearth for the imported agar-agar, a product much used in culture media and in medicine. This product is prepared from the Red alga *G. lichenoides* which is found in sea.

A survey by us revealed the presence of this sea weed in immense quantities in the Ramnad District sea coast starting from Kilakarai down to Rameswaram. At present a few local merchants collect *G. lichenoides* and after some crude washing and drying, the material is exported to Ceylon. Mixed with sugar, 'Halwa' is prepared. Sometimes, the poor prepare 'Kanchi' when other staple grains are not available to them. The Government Agricultural Chemist, Coimbatore, has already studied the process of manufacturing the finished product agar agar (10). The finished products of the Government Agricultural Chemist's laboratories are found to well satisfy B. P. Standards. The State can build a flourishing industry with this raw material to manufacture agar.

During our survey in these coastal areas we found large quantities of sea weeds going to waste year after year. Local trials by the Agricultural Department showed that there is good scope for utilising the sea weeds as manure. Preliminary trials reveal that not all the sea weeds compost equally well. Extensive studies to utilise these sea weeds at least as manure is highly desirable.

The utilisation of sea flora in the preparation of iodine, alginic acid, etc., are too well known to be mentioned here, but what we wish to

emphasise is that these plants exist in large quantities along the coast of our Province and any serious attempt for utilisation of these is bound to be crowned with success.

Another product which forms a good source of raw material for industry is the tender seedlings of Palmyra Palm (*Borassus flabellifer*). There are a large number of trees in this province. Our investigations have shown that the seedlings form an excellent source for starch. The first swollen leaf, which is ensheathed by the cotyledonary tube when the seed germinated is found to contain good amount of starch. Chemical analysis of the crude preparation showed that it contains 72 to 88 per cent of starch and that it is a good substitute for arrow-root starch. However feeding trials are to be conducted before this recommendation is placed before the public. This finding is particularly useful now as the Government have launched total prohibition. The palmyra palm, instead of being tapped for sugar manufacture, can be allowed to fruit and from the seedlings starch can be prepared. The starch in addition to being a food product can be used as a raw material in industry.

Conclusion.

In this short note we have attempted to bring out the role of plant survey in Agriculture by mentioning a few instances from the recent work of the Madras Herbarium. We feel that for maximum utilisation of the plant rosources of the conntry from the point of view of Agricultural progress, every Agricultural Department of this country must build up and maintain a valuable Herbarium with facilities to acclimatise and study live plants. Apart from its value to the Agricultural progress of the country, these serve the needs of the research workers of the various university colleges who are working in taxanomical studies. The utility of the extensive exploration of the flora, cultivated and wild, has been well brought out by Vavilov. Recent advances in crop breeding technique necessitate that the plant breeder must have a collection of all variable types of cultivated as well as allies and progenitors of cultivated plants. While crop specialists confine themselves to the crops in their charge, the herbarium Botanist is left with all other vegetation of the country. Leaving apart the considerations regarding the expansion of staff, etc., we feel that an interest must first be created in the public for the following reasons (1) it must be in constant touch with the herbarium and make use of all the available information relating to identifications, uses, availability, etc,. of the local flora (ii) it must act as a reporting agent and inform the herbarium authorities the various uses to which the local flora are put to, and (iii) it must take to plant collecting as a hobby. If such Herbaria are built up and botanical surveys reorganised there is vast scope in this country to discover new plants of economic value or to acclimatise exotic ones.

VI Literature

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6	Do	A note on the edible fruits found wild in the Madras Presidency. *M A J XXVIII*, 1940, p. 170.
6	(A) Chandrasekara Iyer, S N.	A few important cultivated and wild leafy vegetables of S India *M A J XXIX*, 1941, p. 137.
7	Tadulingam, C. & Narayana, G V.	Some introduced weeds of South India. Proc. Econ Biol. Assn. CBE., Vol I. 1933, p. 53
8	Chandrasekara Iyer, S. N.	Two exotic weeds — How best to use them. *M A J XXVIII* 1940, p. 377.
9.	Do	Wealth from waste. *M A J. XXX*, 1942, p 392
10	Karunakar, P D.	A simple method for the manufacture of agar—agar from *Gracilaria lichenoides Curr Sc.* 13. April 1944. p. 99.
11.	Huxley, J S.	New Systematics (1942)

Conclusion.

The following species are recommended for extensive trials:—

1. Chionachne semiteres Fisher.
2. C Koenigii, Thw
3. Sehima nervosum, Stapf
4. Amphilophis pertua, Stapf
5. Chrysopogon montanus, Trin
6. Dichanthium caricosum, A Camus
7. D annulatum, Stapf
8. Heteropogon contortus, Beauv
9. Iseilema laxum, Hack.
10. I. anthephoroides, Hack.
11. Eremopogon foveolatus, Stapf.
12. Andropogon pumilus, Roxb.
13. Panicum antidotale, Retz.
14. Cenchrus Ciliaris, L.
15. C. setigerus, Vahl
16. Enteropogon monostachyos, Schum.
17. Cynodon Dactylon, Pers.
18. C. plectostachyum
19. Chloris Bournei, Rang & Tad
20. Panicum maximum, Jacq
21. Pennisetum, purpureum.
22. P. clandestinum, Hochst.
23. Sorghum sudanense, Stapf.
24. Chloris gayana, Kunth.

These grasses may be tried under natural conditions in waste lands, pastures and in reserve forests. By such trials, the fodder output from waste lands, pastures and grazing areas can be increased. At present, even some of the improved strains of crops, are not extensively cultivated because of the low yield or quality of the straw. G. E. B. 24 of Madras can be quoted as an instance. If the fodder output from other sources is increased there will certainly be greater output of grain from cultivated fields.

Production Efficiency in Agriculture

By

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It will come as a strange surprise to many of us to hear that efficiency of production in agriculture of the United States of America is anything but satisfactory. This is sought to be proved in an article entitled 'How efficient is American agriculture' by Theodore W. Schultz in the *Journal of Farm Economics*, August 1947. This article would naturally provoke in us the desire to examine the efficiency of production in our agriculture, but with what standards we have yet to decide. Efficiency of production in agriculture is difficult to Judge, unlike in well established industries. In the latter, practically all the factors are controlled and the in-put and out-put in production are easily worked out in cash value and efficiency is determined in a simple manner. But in agriculture, besides the known factors of capital and labour, there are unknown and uncontrolled factors of the soil and climate. Hence comparisons between crop and crop or between tract and tract in the strict sense will have no value. Only broad comparisons can be made to give us an idea of the efficiency of the controlled factors as implements, machines or human labour.

In the above article we have been given an opportunity to see how efficiency in agriculture has been judged in the U. S. A. The following table shows one method of judging efficiency of production according to the human factor for the year 1939.

Region.	Value of product per man equivalent in dollars.	Relative to Pacific.
Pacific	1558	100
Mountain	1423	91
W. N. Central	1286	83
New England	1244	80
E. N. Central	1197	77
Middle Atlantic	1129	72
W. S. Central	700	45
South Atlantic	608	39
E. S. Central	486	31

The west (Pacific) is said to be most efficient in production and hence the comparison. If the efficiency in the West may be taken to be good or very satisfactory, it is argued why it should be so low in other parts and this is termed 'mass inefficiency.'

Another table published in the same journal is also interesting. It is as given below :—

Size of Farm.	Total agrl. output percent.	Value of product per farm Dollars.	Farms Total.		Labour force Percent.	Value of Product per man equivalent in dollars, in 1939.
			No. in Millions.	Percent.		
Small farms	32·5	Upto 1499	4·6	77	65·6	62 to 837
Large farms	67·5	1500 and over	1·4	23	34·4	1087 to 2850

From the above table it may be inferred that as it is in India the small farms of the U. S. A. are also not economically sound compared to the larger ones which really constitute two third of the total agricultural output of the country, though they are only one-third in number. Hence it is concluded that "farm people in the large group for the most part work hard and long, but their output has relatively little value, they are under-employed; their human resources are poorly utilised." We are constrained to remark that U. S. A., is no better than India in this respect.

Again a comparison is made between the value of output per man in agriculture to that in manufacturing industry. The difference is found to be great, as much as 2 to 4 times of production in industry compared to the best production in agriculture. In India this difference is bound to be more. It is also interesting to study the comparison made between different countries of the world in the matter of man output in agriculture. The comparison is made with what is called *Colin* Clark's international unit for the year 1940. The following table gives the figures.

Country.	Productivity per male producer in terms of Colin Clark's International unit.
New Zealand	2444
Australia	1524
Argentine	1233
Pacific (U. S. A.)	1102
U. S. A.	661
Denmark	642
Canada	618
Holland	579
Germany	490
Great Britain	475
France	415
Belgium	394

Figures have not been given for other countries or for India.

Turning to our country we are accustomed to compare production largely in terms of yield per acre. We have not come to the stage on economic studies in our country to compare overall efficiency of man, the most important factor in production, as has been done in the U. S. A. Such a comparison shows how human energies have been utilised in different degrees, how in most cases they have been wasted and how it is necessary, in national interest, to conserve it to the utmost by improving the methods of production. For this purpose we should judge the efficiency of production by taking into account the production per unit of human labour in-put. The average number of units of human labour employed in the production of a crop and the quantity or value per unit can be worked out. Such figures worked out for the same crop as paddy or cholam, grown in different tracts of the country when compared will clearly bring out the different degrees of efficiency of the human labour in the different areas. It will be certainly revealing and we can draw our own conclusions in the matter of efficient or inefficient utilisation of the valuable human labour. In the same manner, other crops, particularly the commercial crops, can also be compared. The great idea is to judge whether human energies in production have been utilised to same extent, or rather to produce the same value in every kind of production. If in the pacific region the value per man is 1558 dollars, it is not known why it should be only 486 dollars in the E. S. Central area? There is therefore great waste of human energies in other tracts resulting in mass inefficiency.

It is worthwhile working out production value figures per human labour unit with reference to some of the important crops of our Province and draw relevant inferences in regard to the efficiency in production. The following table may be considered to be self-explanatory, and as a preliminary step in the understanding of the problem.

Crop.	Total man labour in-put per acre	Total Value of production per acre Rs.	Value of production per man labour Rs'	Period of Production months
Paddy (Guntur)	32	240	7·5	5
Tobacco virginia (Guntur)	58	764	13·2	6
Paddy (Combatore)	50	330	6·6	5
Cambodia cotton ,,	54	360	6·7	7
Cholam irrigated ,,	52	260	5·0	3½
Sugarcane ,,	150	1900	12·7	12
Cholam dry (Guntur)	26	120	4·7	4½

Note:— Woman labour employed has been converted into man labour in the ratio of 2 : 1.

The comparison made in the above table is simple and straight and excludes from consideration many other inherent factors which affect production. In the American comparison, evidently, the production over one year per man equivalent in distinct tracts has been taken into consideration. This equivalent is probably arrived at as so many labour days on all the farms situated in a homogeneous locality and the total production on all the farms for the year divided by the number of man labour days will give the production per man equivalent. Applying the same procedure for our country we have to divide our province into so many homogeneous tracts, where production is more or less similar, and work out the number of man labour days in such farms for a given period or a year. Two women may be taken to be equivalent to a man. This requires detailed economic study of the holdings in every representative tract as has been done in America.

A comparison made on these lines, i. e., on the American model, gives a very good idea of the extent to which the human resources are utilised in each tract The aim is naturally to conserve human energies and utilise it to the maximum production value during a given period. It implies the utilisation of labour to the maximum efficiency possible and eliminate the slack period which is so common in the agricultural industry of our country. In tracts where the off-season periods are longer such as in the dry areas the value of production per man equivalent is bound to be low, unless alternative industries are introduced to produce other goods of utility.

A detailed and comprehensive economic survey of hundreds of holdings in each homogeneous tract is a prerequisite for any study, in this or other directions and we are in this respect far behind the U. S. A. and other western countries.

In conclusion it should be pointed out that judging efficiency of production particularly in agriculture is no easy matter and sometimes may lead to controversy in the matter of standards to be set up, among economists interested in the subject. This article has been written as a preliminary discussion of the subject with a view to stimulate interest among students of agriculture and invite criticism from those who take interest in the economic and social improvement of agricultural labour in our province.

A NOTE ON SOIL EROSION AND USEFUL SOIL BINDERS IN THE WEST COAST

By

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The ravages effected by soil erosion are well-known and people are becoming alive to the dangers caused by it to land and to agriculture. The problem is serious in the west-coast where the land and cultivated fields are full of ups and downs and where the rainfall is about 150 inches in a year of which about 100 inches of rain are received in as many days from June to September every year. Further the soils are mostly light and sandy. During the monsoon it is a common sight to find a small rut or a foot-path developing into a deep gully overnight; field bunds, embankments of channels, river sides, road sides and even railway embankments are often washed off causing serious damage. In cultivated fields, levelling and bunding are certainly important operations for guarding against surface wash; but an unprotected bund is no proper safeguard at all, and in the light or loamy soils a rat hole or a crab-hole can lead to the washing away of a good bund in a short while. So the problem resolves itself to soil binders. By these are meant plants or other materials which help to bind or keep together soil particles and resist their being washed off by rain or flowing water or blown off by strong winds. For nature's scourge there must be nature's remedies and man's search for a solution lies in observing what nature does to combat the evil. Most of the innumerable hills and highlands of the West coast look barren without any high-growing vegetation, still the soil there, is mostly intact in spite of heavy rains. This is due to the fact that there is thick growth of wild grass growing naturally and the matted roots act as soil binders. The trouble starts when man interferes with nature indiscriminately and destroys natural vegetation. Also it is a matter of common observation that along the banks of the many rivers in the West coast, the trouble is least where there are trees particularly the coconut. This is due to the effect of their roots. In loose or sandy soils, the coconut, in particular, has the good habit of forming an impregnable mass of roots which can withstand any amount of erosion by water.

Soil erosion a serious problem in the west-coast.

Thus in nature, we have grasses and trees including shrubs which act as effective soil binders. But there are grasses and grasses and trees of various sorts, and all are not equally good and cannot be. Therefore, the question often asked is "what is the best soil binder for this or that locality". Various plants have been suggested by botanists and agriculturists from time to time. Even *Spinifex squarrosus*, a spiny grass growing on the beach, and *Ipomaea pes-caprae* a creeper, have been

recommended for certain localities along with a host of others like *Pandanus* and the Palmyrah In fact any plant that has a good and matted root system will serve the purpose, provided it is a hardy perennial. But wild plants cannot always suit man's purposes and the species chosen should serve not only as good soil binders but shonld also be useful otherwise. So our search for suitable material should be made among our cultivated plants also.

At the Coconut Research Station in South Kanara (west coast), various plants have been under observation in this connexion of soil preservation for some years. The most useful of these are mentioned hereunder.

The Thin or Dry Napier Grass — (*Pennisetum Sp.*) This was introduced at the Coconut Station in 1941 as a fodder grass and has become quite a success in the soils here, growing profusely to a height of 4—5 feet during the south-west monsoon and yielding even 10,000 lb. of green stuff per acre in a season, under favourable conditions. Though the leaf is rather coarse; it is excellent for making silage. The fodder problem is acute in the west-coast during the summer months. The use of this plant for fodder is perhaps too well-known to need further emphasis here. In the laterite soils of the Pilicode station it has almost become a weed, though there is no fear of its turning out to be a pernicious one. It's rapid multiplication is due to the ease with which it propagates itself by seed and by slips. Being a prolific seeder, large quantities of the fuzzy seeds produced in the summer months are blown off by wind, and they sprout with the rains in all sorts of places wherever they happen to get lodged. Slips, however are much better for controlled multiplication; if these are planted with the monsoon rains in June or August, they establish themselves quicker and give cuttings sooner.

Dry Napier Grass. The good fodder grass which is even better as a soil binder.

However the most important consideration about the plant here is the root system, which consists of a thick mat of roots about the surface of the soil. The grass is a perennial and though it dries off during the later summer months the underground rootstocks manage to live through the summer and sprout with the first rains. Close-planted at about six inches apart on any bund or a slope or boundary mud walls it acts as an effective binder and protects the soil. It is, therefore, worth while planting this grass in all suitable places both for protecting the soil and for fodder. Hundreds of pounds of the seed have been distributed during the last few years even in the districts outside the west-coast and still there is demand for the seed and slips for planting.

2. The spear grass — (*Heteropogon contortus*) — This is another perennial fodder grass found wild in most districts of the Province. Growing from seed or slips it easily establishes itself when planted during

the rains. It is quite a good soil binder, and has been found to be an excellent protection for bunds and edges of foot-paths and slopes of terraces at tne Coconut station and elsewhere.

3. The Coconut palm — (*Cocos nucifera*) — This is too well—known to need any special introduction. The different parts of the palm, alive or dead are put to a variety of uses. But curiously enough, few people seem to realise how effective and useful its root system is in preventing the erosion of the soil. A few seedlings planted at the surface of the soil at a distance of 3 to 6 feet along a channel or a river bund which is subject to periodical breaches effectively check the damage, as the plants grow up and spread their roots. In grown up trees thus planted, the root system will be found to be as effective as a concrete embankment. At the same time the trees may be made to yield well by thinning off the weaker ones, by leaving one every ten feet or so. As the primary object of the planting is for protecting the soil, thinning the trees may be done only when the palms are about seven or eight years old, by which time the root system is thickly spread and well established and the trees begin to yield nuts. Further the husk of the coconut is also a useful material in controlling surface wash which is sometimes inevitable through water vents. If such places are partially blocked by a few layers of coconut husk, the soil that is being washed off is caught up in the fibres of the husk and water alone is allowed to escape slowly.

The palm that protects bunds.

It is, therefore, highly desirable that we make use of the common plants described above and protect the 'good earth' from erosion and its consequent evils.

Hybridisation in Sweet Potatoes

By

S. SAMPATH & K. K. BHANUMURTY

(Agricultural College, Baptala)

The Crop: The sweet potato (*Ipomea batatas. Lam*) is a quick growing high yielding crop grown in a small scale througout the Presidency. Though not an important cash crop, as a combined vegetable and food crop, it is an important supplement to the food supply of the Province. Because of its merits it is grown in all the tropical and extra-tropical regions of the world. The cultivation and technology of the crop are very advanced in other countries e. g. Java, Philippines, Southern United States and West Indies. It has not been intensively studied and its cultivation developed in India, probably due to its low economic status, but is now attracting considerable attention owing to the present food crisis.

Varieties and Breeding: Though the genus *Ipomea* is a large family of climbers spread all over the world, the crop has originated in tropical America and thence spread to other countries. There are many varieties in Sweet Potatoes and the clones are classified on the basis of tuber characters. Thomson (5) lists about 40 varieties based on North American collections. The plant is bound to have undergone further variation under cultivation in Asia. A similar crop called 'Kumarah' grown in New Zealand is considered a different species by taxonomists. The crop has attracted the attention of plant breeders and Mendiola (3), quotes the success of Dutch workers in Java in increasing the yield of local crop by 100 % by breeding and selection. Therefore it can be claimed that there is scope for improvement of this crop for our Province, by importation, clonal selection and hybridization. The modern trend is to renew vegetatively propagated crops like sugarcane and potatoes periodically, by seed-produced forms. The present note deals with observations on hybridization and seed setting in this plant, based on studies made at Benares, Coimbatore and Bapatla.

Self Sterility: A salient feature of this crop is the difficulty of seed setting. In countries like Southern United States of America, it is reported that the flowering is sparse, though at Benares it was found to flower freely. The varieties differ in the extent of flowers. For example, of four clones grown at Bapatla one strain gave only two flowers from vines covering about two cents in area. Both at Coimbatore and Bapatla, it was seen that flowering and chances of seed setting are optimum during the cool months from December to February. Even if the vines flower freely, no seed may set as there is a high degree of self-incompatibility. Only pollen from a different clone can normally fertilise a flower. In this connection, occurrence of seed setting reported from Agricultural Research Station, Pattambi is probably due to presence of different clones in the same area, and cross pollination by insects. Mendiola (3) considers that the honey bee may be the insect concerned.

Material and Methods: Because of the self-sterility pollination technique was simplified. No bagging or emasculation was attempted. Pollen grains were not collected separately, but the burst authers were merely rubbed on the stigma of pistillate parent. It was observed that all the flowers were open by 8 A. M. with brust authers, and all whithered the same day. All pollination was done between 8 and 10 A. M. The material consisted of six unnamed clones. These clones, differed in the presence or absence of purple colour in stem leaves and tubers as well as in the shape of the leaves.

Results: It was found that even with the simple technique used hybrid seeds can be obtained. A trial with four seeds showed all four to be viable, all sprouting in two days when the seed coat was scarified. The seeds form only when morphologically distinct varieties are crossed. Hitherto

seeds were formed only in crosses between purple pigmented and non-pigmented types. At Coimbatore four capsules were obtained from twenty flowers pollinated. At Bapatla ten capsules set in 180 flowers cross pollinated. At Bapatla it was found that the pigmented types gave proportionately more capsules than unpigmented clones. An attempt was made to correlate differences in flower structure with cross compatibility. The results were inconclusive owing to small number of crosses made. The feature concerned is in the height of anthers in relation to style and stigma, or a type of heterostyly. Mendiola (3) recognises five phenotypes. In the five epipetalous stamens, the filaments are unequal. In the different phenotypes, the tallest anther may be distinctly below the stigma, just touching the stigma, or projecting above the stigma. By measurements, two lengths of style were noted, one about 14 mm. total length and the other about 16 m.m. The present observation is that similar stylar types can be crossed. Incidental to this study it was found that varieties differ in the development of fine hairs on and around the ovary, the pappus being well developed, slight or absent. After getting crossed seeds, the expectation that the parent types will be heterozygous was verified. Two seeds from one capsule gave one purple coloured and one geen seedling.

Discussion: It is apparent that hybridisation and breeding of this crop is practicable and easy. A good case can also be made out for commencing improvement of this crop. It is also apparent that the genetics of colour, of leaf lobing, of heterostyly, of compatibility and of pappus development, will be of great interest and can be analysed incidental to breeding work. Because of the high number of chromosomes in this species ($2n = 90$) it is doubtful if cytogenetical line of improvement will be practicable. Interspecific hybridisation with *Ipomeis* other than 'Kumarah' of New Zealand will be difficult—vide King and Bamford (2).

The small percentage of capsules formed in the total number of flowers crossed can be explained. The reason is probably cytological and not to faulty pollination which was done without any injury to floral parts. Satyanarayana Rao (4) has shown that meiosis in the anthers shows abnormality. This abnormality does not seriously reduce pollen production, but can cause sterility of ovules. For pollen mother cells are many per anther while megaspore cell is only one per ovule.

In view of the discrepancy in the chromosome number counted in this species—84 according to Kano (1) and 90 according to Rao (4) occurrence of aneuploids in the crop varieties is possible and may account for sparse flowering of some varieties.

Both of us wish to acknowledge our indebtedness to various officers of the Agricultural Department, in general and to the Principal, Agricultural College, Bapatla, in particular for help in starting this work.

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GLEANINGS

Contagious Abortion.

A vigorous campaign against contagious abortion (Brucellosis) in dairy herds is to be launched in South Australia The executive of the South Australian Dairymen's Association has approved a comprehensive and carefully designed plan for the vaccination of heards on the Murray Swamps. Operat ons will be under the direction of the State Agriculture Department. Vaccination will be confined to female calves 4 to 8 months old. Local committees will be set up in each district by the Dairymen's Association to distribute and collect application and agreement forms, and collect fees. Cost of inoculation will be one rupee a calf. The vaccine to be used is called "Strain 19" — a very weak one of the causal organism, which does not spread readily to other cattle, and rarely causes abortion. Inoculated calves build up in their bodies a resistance to the disease which enables them, when they reach breeding age and become pregnant, to withstand an infection which would produce a high proportion of abortions in unvaccinated heifers. Abortion is only one of the sequels to the invasion of a dairy herd by Brucella abortus. There is also an upset in the breeding plan, decreased milk yield, a high incidence of retained membranes, and subsequet temporary or permanent sterility. Hither to the only means of control has been by a blood test, and slaughter or segregation of infected animals. Research work has only recently given to the dairying industry the new method of calf vaccination.

D. D. T. Successes.

In Australia initial results of D. D T. tests have proved encouraging against:— Aphids (except Grey Aphid of cabbage), Bean Fly, Green Vegetable Bug, Tomato Leaf Hopper, Cotton Jassid; Cabbage Moth and Cabbage White Butterfly, Climbing Cutworms (e. g Corn Ear Worm), Potato Moth, Beet Worm; Codling Moth, Pear Slug; Sorghum Midge; Buffalo Fly, Cattle Tick Tests are proceeding, and official recommendations for control of these pests are due soon. D. D T has not proved effective against the various mites, e g Red Spider, Bryobia Mite

Australian Rice Production is Mechanised.

Leberal use of fertilisers, lavish use of water and mechanisation from ploughing to harvesting make Australian rice cultivation the most efficient in the world Overall rice yield per acre is 1 75 tons, but many farmers produce 2 long tons of 4,480 lb. per acre and crops of 4 tons to the acre have been taken under ideal conditions. Mechanisation is the secret. With mechanisation it has been possible to develop the largest rice farm in the world at Wakool where 4,100 acres are under cultivation. From this mammoth farm, 8,000 tons of rice was harvested in two months by 81 men using machinery. The first step in establishing an Australian rice farm is a close contour-survey of the land. Substantia

check banks are then built to hold irrigation water to a depth from 6 to 10 inches. The land is ploughed and cultivated by multiple disc ploughs and harrows drawn by tractors. The whole operation is similar to that used in the type of power farming practised by Australian wheat growers. When the seed bed is ready, rice is sown in the dry soil by a combination-cultivator-seed-drill of the type used in Australia for planting wheat and other cereals. Sulphate of ammonia is used as a fertiliser. Sowing is done in October, after which the land is flooded from irrigation canals and then immediately drained. After germination and growth of 4 to 6 inches, the land is flooded again. This usually happens in November, after which the water is held at depths of 6 to 10 inches until the rice matures. After the rice matures, the water is drained off and harvesting proceeds in April, May and June, These are the months of late autumn and early winter in Australia. Harvesting of rice in Australia is carried out by tractor-drawn, power-driven, combination reaper-threshers which reap, thresh and bag the crop in one operation. These machines, developed and built in Australia are each capable of harvesting up to 900 bushels of paddy rice a day. The plant is a development of the Australian machine designed for harvesting wheat and other grains, but has special attachments to enable the heavier rice crop to be gathered Each farm has its own complete plant for sowing, cultivation and harvesting. Although Australian methods of production are most efficient, her total crop is small. This is because only a small region in the Murrimbidgee Irrigation Area of New South Wales is being used for rice cultivation. Water shortage is a constant problem in Australia and it is only in such places where vast irrigation schemes make possible the great amount of water needed, that rice cultivation is possible. Even so, Australia was able to supply almost the whole of its home market with rice before the war. Today, there is no rice on the Australian market. There has been none available to Australian housewives since 1942. Other peoples to whom rice is a staple diet receive the whole of Australia's output with the exception of a small amount available to certain classes of invalids.

Bee-Keeper Takes Wing.

A Western Australian apiarist, an airman in World War II, uses a Moth plane to spot likely honey flows in forest country, and the easiest tracks to them. He also flies scout hives into forest country that looks good from the air. He lands the plant in a nearby paddock (field), and carries the hives to the best sites. If the scout hives show that the honey flow is good, apiaries are moved in by truck From his low-flying plane, he says, he can judge the density of forests, and the quantity of blossoms. This flying apiarist believes that the future for Western Australian bee-keepers will be prosperous. Reafforestation by the Western Australian Foresst Department has given them security, and the flow from honey-producing eucalypts has been so rich that some apiarists in the eastern states have trucked their bees 2,500 miles west to the south-western forests of Western Australia. Britain wants Australian honey and the British Food Mission has undertaken to buy up to 6,000 tons at a guaranteed price of £ A3 / 12 / 6 a cwt. (£ A 378 a ton). The total Australian honey production for the 1946—47 season was close to 32,000,000 lb (From Australian Agricultural News letters release Nos. 127 and 190.)

COTTON RAW, THE MADRAS PROVINCE.

The receipts of loose cotton at preeses and spinning mills in the Madras Province from 1st February 1948 to 30th April 1948 amounted to 45,926 bales of 400 lb. lint. The receipts in the corresponding period of the previous year were 46,209 bales. 107,254 bales mainly of pressed cotton were received at spinning mills and 17,226 bales were exported by sea while 29,297 bales were imported by sea mainly from Karachi and Bombay. (From the Director of Agriculture, Madras.)

Weather Review—For April 1948.

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal 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	0·20	—0·40	4·30	South.	Coimbatore C B.S. *	0 57	—2 08	1·90
	Calingapatam	1 50	+ 0·80	2·70		Coimbatore	0 20	—1·40	1·30
	Vizagapatam	0·30	—0·40	1 60		Tiruchirapalli	1·70	0 00	3·40
	Anakapalli *	0 04	—1·37	0·96		Negapatam	0 00	—1·10	1·92
	Samalkota *	0·00	—1·33	0·78		Aduturai *	0·06	—1·56	3·84
	Maruteru *	0 00	—0 66	1·50		Pattukottai	0 37	—2·62	4·89
	Cocanada *	0·00	—0·60	0·10		Madura	0 40	—1·80	2·80
	Masulipatam	0 00	—0·70	3 52		Pamban	0 10	—1·80	3·90
	Guntur *	0 55	—0 34	0·10		Koilpatti *	2·02	—1·58	6 02
	Guntur (District Agricultural Office)	0 00	...			Palamkottah	4·50	+ 2 00	11·00
						Ambasamudram	0·84	—3 22	7·88
	(Agricultural College, Bapatla.)	nil.	—0 67	3·39	West Coast.	Trivandrum	4·20	—0·30	7·30
						Cochin	1 90	—3·00	6 90
Ceded Dists.	Kurnool *	1 30	+ 0·70	1·50		Calicut	4·00	+ 0 40	9 50
	Nandyal *	0 95	+ 0 18	0 95		Pattambi *	0·87	—3·22	4·53
	Hagari *	1·27	+ 0 15	1·28		Taliparamba *	2 88	—0·26	4·17
						Nileshwar *	1·03	—2 12	2·64
	Siruguppa *	1·69	+ 0 88	1·70		Pilicode *	0 94	—2 41	3 24
	Bellary	2·10	+ 1·30	2·10		Mangalore	1 20	—0·40	3·70
	Rentichintala	3·20	...	3 30		Kankanady *	2·04	+ 0·12	3·58
	Cuddapah	0·50	—0·10	5·50					
	Anantharajapet*	0·85	+ 0 19@	1·12					
Carnatic	Nellore	0 00	—0·50	1·20	Mysore & Coorg	Chitaldrug	1·00	0 00	1·30
						Bangalore	1·00	—0 60	1 40
	Buchireddi-palam *	2·29	+ 1·38	3 69		Mysore	2·20	+ 0 90	3·10
						Mercara	6·90	+ 4·40	7·30
	Madras	0·90	+ 0·30	3·10					
	Tirurkuppam	0 00	—2·25@	2 82					
	Palur *	0·00	—2·41	5 23					
	Tindivanam *	0 17	—0·94	2·51	Hills.	Kodaikanal	2·00	—2 80	13·00
	Cuddalore	0 00	—1·00	3·50		Coonoor *	1·92	—4 94	11·43
						Ootacamund *	3·77	—0·80	6 25
Central.	Vellore	0·40	—0·60	2 00		Nanjanad *	7·38	+ 2 85	9·47
	Gudiyattam *	0 43	—0 36	1·35					
	Salem	0 80	—1·10	1·30					
	Coimbatore A.C.R.I *	0 40	—2·33	1·43					

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

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

(3) @ Only is these two stations average of five years data is taken as the normal.

(4) For departure from normal the figure as it is given in Indian Daily Weather Report dated 30—4—'48 is presented in this table for those places that are not having meteorological stations belonging to the Madras Agricultural Department.

(5) ... Data not available.

WEATHER REVIEW FOR APRIL 1948.

During this month thundershowers were widespread in Mysore, Malabar and Mangalore. Localised thundershowers were also had in southern portion of Malabar, southeast Madras and Kurnool. Places like Mysore and Mangalore had both widespread and localised showers. There were a few occasional thundershowers in North Madras Coast, South Hyderabad, Calicut, Kodaikanal and Southeast Madras.

A violent dust storm occurred in Vellore, causing much anxiety for about fifteen minutes. There was a gale at Siruguppa on 26—4—'48 when the wind velocity of 20·5 per hour was recorded at the time of observatians Palamcottah received heavy rains amounting to 7·50", which is 2·00" above normal of the place for the month of April.

There were frequent western disturbances affecting North-West Frontier Province, west and southwest Punjab, northeast Baluchistan and north Rajputana. A depression formed in the north Andaman Sea was centered at 0800 hours I. S. T within 1 degree of Latitude 14° N, Longitude 95·5° E.

The trough of low pressure noticed in the Arabian Sea on 10—4—1948 became less marked on the very next day itself and thus became unimportant thereby affecting adversely the rainfall of the West coast for this period.

A feeble secondary 'low' over north Rajputana and south Punjab due to the western disturbance on 22—4—1948 moved into the east United Provinces and there itself became unimportant on the third day of its appearance,

Weather report for the Meteorological observatories at the Agricultural College and Research Institute and Cotton Breeding Stations at Coimbatore for the month of April 1948.

Report No, 2/48		Reading for the observatories at A C R I. (0822 hours)	Cotton Breeding Station (0722 hours)
Absolute Maximum in shade	...	100 2° F	102 0° F
Absolute Minimum	...	69 2° F	67·8° F
Mean Maximum		97·27° F	98 2° F
Departure from normal	.	+ 2 24 ° F	+ 2·70° F
Mean minimum in shade	.	73 56° F	73 00° F
Departure from normal	...	+0 51° F	+ 0 90° F
Total rainfall for the month	.	0 40"	0·57"
Departure from normal	...	—2 33"	—2—08"
Heaviest fall in 24 hours	...	0 21"	0 17 "
Total number of rainy days	...	1	1
Mean daily wind velocity	...	1·5 miles per hour	3 0 miles per hour
Departure from normal	:	+ 0 6 "	+ 0·40 "
Mean humidity	...	68 7 %	75·8 %
Departure from normal	...	—1·9 %	—0 9 %

SUMMARY.

Practically the entire month had a dry weather. The day temperature was appreciably above normal while the night temperature was slightly above normal. The total rain received during this moth was below the normal of the locality for this particular month The weather was fairly windy In short severity of summer was felt throughout the month.

M. B. V. N, and C. B M

B. Sc. Ag. EXAMINATION 1948.

List of successful candidates.

First Examination. Aeron, D. S. Abdul Khadir, N. P Adinarayanan N. P Ananthauarayanan, K K Annappan, R. S Appayya, K. M Balasubrahmanyam, H. Balasubrahmanyam Somasundaram. Balasubrahmanyam Srinivasan. Balasubrahmanyam, T. V. Balasubrahmanyam, V Boominathan, H Chandramathi, P. S. (Miss) Chandrasekaran. P (Cannanore) Chandrasekaran, (Palghat) Dorai Raj, V. Doraiswami, R Ganapathi, N K. Gopalan, S. Govindan, V R. Guruswami. V. D Jaganathan, K Jaganatha Hegdae, K. Jayaraman, R. Jayaseelan, D S. Kalyanasundaram, T R, Kasiviswanathan, S. Krishnamoorthi, K. A. Krishnamoorthi, R Kunhan Raja, P. Mani, P. S. Marappan, P V Moosa Barami, K. P Narasimhamoorthi, G. M. Narayanan, A Narayanan, C. Narayanan, C. K Narayana Kutti Nair, T Nataraja Rathnam, N. Navaladi Kuppuswami, V. Parthasarathy, D. R Parthasarathi, S. S. Perumal, A. S. Pranatharthiharan, S N Purushotaman, P S. Radhakrishna Alwa. Raghavachari, S Raghava Panikkar, K Raghu Shetty, K. Rajagopal, R. Rajagopalan, B V. Rajagopalan, M. Ramasubrahmanyam, S. Ramaswami, K R. Ranganathan, K. S. Ranganathan, S. Rebello, N. S P. Sahasranaman, K. N. Sargunam Davis Peter. Seshadri, V S Sethumadhavan, K. Shanmugnam, C Sivasankaran, S. Srinivasamoorthi, M. Srinivasan, V. Subrahmanya Bharathi, M. Subrahmanyam. M. Subrahmanyam, P T Swaminathan, K Syed Salimuddin Razvi Vamana Bhat Venkatraman, S Venkatraman C. N. Venkatramani, B. Venkatrangan, R. Vijayaraghavan, A. P. Willam, P. Yeswantha Ail. Kalyanai Kutti. (Miss) Venkatraman, A

Second Examination. Appadorai, R. Appayya, K C Balasubrahmanyam, A. Balasubrahmanyam, C R Balasubrahmanyam, K M Balasubrahmanyam, K. R. Balasundaram, I Barathan, P Bhaskara Rao, U K (Ref) Chacko, C. I. Chandrarsekaran, S. Chandrasekaran, T. L. Chandrasekara Rao, B. Chenna Bassiah, H S M Chockalingam, M Damodaran, V. K Dorai, S Ebenezar, J. (Ref.) George. P. F Gnanavaram, I (Ref) Gopalakrishnan, V. Gopalan, V Gopinatha Rao, P. V Ibrahim Saheb, S P Iyam Perumal, S Jagannathan, S. (Ref) Jaya Raj M. V. John Knight. Balraj, J J. Karuppannan, G. Krishnamoorthi, C (Ref) Krishnamoorthi, J Krishnamoorthi, P Krishnamoorthi, P S (Ref.) Laxshmanan, V. Mahudeswaran, K. (Ref.) Manicka Raj, V Mathew, K T Muthurasan, G Muthiah, V. Muthuswami, K. Nalla Goundar, S. C. Padmanabhan Rao, T R Periaswami, S, Perumal, K (Ref.) Pinagapani, N. Prabuswami, G R (Ref.) Purnapragnachar, H. Radhakrishnan, G Rajagopalan, D. S, Rajagopalan, G Ramachandran, K Ramadoss, R (Ref) Ramakrishnan S Ramakrishnan, S. R. Ramakrishna Nambiar, C Ramakrishna Rao, J Raman, M V. (Ref.) Rama Rao, B. K. Ramesan, V. Rangaswami Reddiar, S. Ravindra Poonja Sanjeevi, P S Sankaranarayanan, R. Sankaran Kutti, M M Sankarayya, M. (Ref.) Selvaranga Raju, G Sethumadhavan, R Sethumadhavan, V Shanmugham, S Sofayappan, B. Sridhara Sastry, J Srinivasan, K Sri Veera Royan Raja, K C (Ref) Stephen Mathias Subbiah, V Suryanarayana, B. V Suryanarayanamoorthy K. Swaminathan, S Vaidyanathan, R. Varadarajan, E N. Vasudeva Rao, C Vedachalam, D Venkata Cheenyalu, V. Venkatraman, V Venkataswami, S Venkateswaran, A. N Vijayan, P. K. Vinayakam, S Viswanatham, M. A. Venkateswara Rao, S (Ref.) Vittal, T M. Ramachandra Rao, M

Final Examination. Abdul Basheer. Anantha Rao, K. Anthony Reddi, Y. Appa Rao, A. Appaiyan, M C. Arumuga Velu Babu Rao, G. Balasubramani, M. Bangarayya M Braj Mohan Patnaik Chandrasekaran, N R Doraiswami, K Durga Prasad, S Ernest, R. S. Gajapathi, V. Gopalakrishnan, A Govindan, M Jaya Raman, M V. Kamalanathan, S Kannan, S Koyamu, K. Krishna prasad, V S

Krishna Rao, R. Krishnaswami Rao, T. B. Laxshminarayana Rao, K. Lingannan, K. Minakshisundaram, D Muthukrishnan, C R. Muthuswami, S Kunjamma, K. (Miss.) Nageswara Rao, S. Narasimha Reddi, B. C. Pattabi Raman, R. Poornachandra Rao, V. Radhakrishna Menon, K. Radhakrishna, T. V. Raghunatha Reddi D. Rajagopalan, K. Rajanna, B. Raja Padmanabhan, A K. Ramachandra Maiar, P. Ramachandran, M. Ramalingeswara Rao, M Raman, A. Ramani, P. Rama Rao, C. Rama Rao, P. V. Ramaswami, N Ranga Mannar, D. Sambandan, C. N Sankara Rao, S M Satyabalan, S. Seshagiri Rao, M. Sitharaman, S. Sitharama Rao. A. Sitharamayya, D Siboram Mahapatro. Somalingam, R. Somanna, K. B. Srinivasan, P. R. Srinivasa Rao, K. Srinivasa Rao, V Subrahmanyam, K. Sundaram, V. P. Sundara Raman, M. Syed Sheriff. Thomas, M Umamaheswara Rao, P. Vaidyanathan, R. Vasudeva Rao, S Vasudeva Singh, B. Venkata Rao, M. Venkatesan, C. Venugopal, V. Viswanathan, A R. Rathnakara Bhatkal Venkateswara Rao, N. Abdul Kareem, (Ref) Abdul Azeem, (Ref) Sitha Rama Rao, K. Srinivasan, V.

DEPARTMENTAL NOTIFICATIONS.

GAZETTED SERVICE — POSTINGS AND TRANSFERS.

Name of officers	From.	To.
Sri K. Bushnam,	P. A. to D. A O., Anantapur,	D A. O, Ellore
„ R. Govinda Ramayya,	D A O, Ramnad,	Special D. A O., Pattukottai, Cauvery Mettur Project, area.
Janab Muhámed Kasim Adeni,	D A O, Ellore,	D A. O, Chicacole.
„ Mohammad Oboidulla Shaw Sahib,	Special D A O, Pattukottai,	D. A. O, Saidapet.
Sri M. Subramania Pillai,	(on leave)	Special D A O., Madura Crop cutting Experiments
Janab P P. Syed Mohammad Sahib,	D. A O., Calicut,	D. A. O., Ramnad.
Sri M P. Sankaran Nambiar,	D A. O, Calicut,	Special D A O, Calicut (Crop cutting Experiments)
„ M. Jeevan Rao,	P. A. to D A. O., Bellary,	D A O, Bellary.
„ K. Venkataraman,	(D A. O, on leave)	D. A. O, Chittoor.
„ K. Sivasankara Menon,	(on leave)	D A O, Calicut.

LEAVE.

Name of Officers	Period of leave
Dr S. Kasinatha Iyer, Asst. Agricultural Chemist, Coimbatore,	L. A. P. for 2 months and 19 days from 12—4—1948.
Sri M. Gopala Chetty, D A. O. Vellore.	L. A. P. for 4 months from 1—4—1948.
Sri A. Ramaswami Iyer, Officiating D. D. A., Tanjore,	L. A P. and half average pay from 1—5—1948 to 89—7—1948 preparatory to retirement.
Sri M. Satyanarayanamurthi, D. A. O., Bllary,	L. A P for 4 months from the date of relief.

SUBORDINATE SERVICE.

APPOINTMENTS.

Sri C, R. Kulasekharan, B. Sc., Ag. an outsider is appointed as Agricultural Demonstrator, Ayangudi, Cauvery Mettur Project area.

Sri G. V. Rama Rao, B. Sc., Ag. an outsider is appointed as Agricultural Demonstrator, E Godavari.

Sri Dasari Koteswara Rao, M Sc., is appointed as Assistant in Mycology Agricultural College, Coimbatore

Sri K. Venkateswaralu, Agricultural Demonstrator, Dhone, appointed under emergency provisions, is terminated with effect from the date of relief to enable him to undergo the deploma course in the Fruit and vegetable preservation and canning at the Indian Institute of Fruit Technology, New Delhi.

POSTING AND TRANSFERS.

Name of Officers	From	To
Sri S. Anatham Pillai,	A. D., Ayengudi,	A. D , Polur.
,, K. Ramanarayana Menon,	Asst in Oilseeds, A. R. S., Nileshwar,	Coconut Nursery Scheme a Pattamabi.
,, U. Sanyasi Rao,	F. M Arakuvally Scheme,	A. D , Kurnool.
,, T. V. Krishnaswami Rao,	A. D , Kurnool,	F. M., Arakuvelly Scheme.
,, K. Sitarama Iyer,	A D.. (on leave),	A. D , Tindivanam.
,, C. Venkatachalam,	A. D , Rajahmundry,	A. D , Vegetable Scheme.
,, K. Ambikacharan,	A. D., Vegetable Scheme,	A. D., Gudur.
,, P. N. Krishnaswami Rao,	Asst. in Cotton A. R. S., Nandyal (on leave),	Asst. in Cotton, Coimbatore.
,, S. Krishna Naik,	F. M., (on leave)	A D., Tiruvarur.
,, Y. Nagabushana Rao,	A. D., Sompeta,	F. M., A. R. S., Anakapalle.
,, M. L. Narayana Reddy,	F. M., A. R S., Anakapalle,	A. D., Sompeta.
,, G, Konda Reddy,	(on leave),	P. A., to D. A. O., Ananatapur.
,, K. K. Banumurthi,	Asst. to Cytogeneticist Bapatla,	Teaching Asst. in Ento Bapatla.
,, S. Sethuraman,	Teaching Asst. in Ento Bapatla,	Asst. in Cytogenetics Bapatla.
,, G. Venkatakrishnan,	A. D., Devakottah,	P. A., to A. D. O., Sattur.
,, D. Sitaramaswami,	A. D., Peddapuram,	A. D , Yellavaram.
,, R. Narayanamurthi,	Marketing Asst. Guntur.	Marketing Asst. Salem
,, G. V. Raghvulu,	Marketing Asst. Bezwada,	Marketing Asst Guntur.
,, V. Mahimai Doss,	A. D., (on leave),	A. D., Madura.
,, A. G, Kesava Reddy,	Pulses Asst. Coimbatore,	A. D., Tadpatri.
,, D. V, Ramana Rao,	A D., Tadpatri,	Pulses Asst. Coimbatore.
,, K. V. Seshagiri Rao,	A. D., Hindupur,	F. M., Bhagavati Farm, Siru.
,, M. Pitcheswara Rao,	F. M., Bhagavati Farm, Siru,	A. D., Peddapuram.
,, D. Krishnaswami Naidu,	A. D., Kadiri,	A. D., Kalahasti.
,, C. Srinivasan,	A. D., Kalahasti,	A. D., Punganur.
,, S. Annaswami Ayyar,	A. D., Palur.	A. D., Wilathukulam.
,, N. Ranganathachar,	A. D., Wilathakulam,	F. M., A. R. S., Aduthurai.

Name of Officers	From	To
,, K. R. Narayanaswami,	F M., A. R. S., Aduthurai,	A. D , Travancore.
,, S. Krishnamurthi Rao,	F. M , A. R S , Siruguppa,	P. A , to D. A. O., Bellary.
Janab Muhammad Baig Sahib,	A. D , Allagadda,	A D., Hindupur.
Janab Syed Ahammadullah Sahib,	Marketing Asst Kurnool,	Marketing Asst Salem
Sri P S. Athmarama Iyer,	Marketing Asst Musri,	Marketing Asst. Trichi.
,, E. S. Kothandaraman,	Marketing Asst. Trichi,	Marketing Asst. Musri.
,, C. Raman Moosad,	A D., (on leave),	A. D., Calicut.
,, P. K. Natesa Iyer,	A. D , Calicut,	A. D , Palghat.
,, N. S Vaidyanathan,	A. D , Palghat,	A. D., Alathur
,, B. G. Narayana Menon,	A D , Salem,	A. D., Ponnani.
,, O. V. Umerkutty,	A D., Ponnani,	A D., Vattankulam.
,, K. V. Narasimhalu,	Cotton Asst A R S., Palur,	A. D., Vayalpad.
,, K. Saptharishi,	Asst in Mycology, Coimbatore,	Asst. Paddy, Coimbatore.
,, V. Ramaswami Mudaliar,	Cotton Asst. (on leave),	Cotton Asst. A R S., Narasaraopet.
,, G. R. Padaki,	Cotton Asst. Narasaraopet,	Cotton Asst. A. R. S., Nandyal
,, P. Rama Doss,	Cotton Asst. Nandyal,	A. D., Narasaraopet.
,, V. Kumaraswami,	A. D., Narasaraopet,	A. D., Cocanada.
,, M. Kalimuthu,	A. D., (on leave),	A D., Paramakudi.
,, A. R Krishnamurthi Iyer,	A D., (on leave),	A D , Arantangi.
,, R. Narasimhachari,	Botany Asst. (on leave),	Ento-Mycology, Tanjore.
,, Y. Venkataswami,	A D., Nandigama,	A. D , Dhone.
,, S. V. Ramachandran,	P A., to D. A. O., Cuddalore,	P. A , to D. A. O., Saidapet.
,, P. S. Venkata-Subramaniam,	P A to D. A. O., Saidapet,	F M , A. R S., Tindivanam.
,, M. N. Meenakshi-Sundaram,	F. M , A. R S , Tindivanam,	F. M., C. F , Orchard, Coimbatore.
,, B. P. Pappaiah,	Asst. F. M , (on leave),	A. D., Parvatipur.
,, K Subba Rao,	A. D., Madkasira,	F. M., A. R. S., Siruguppa.
,, N. Ranganatha Rao,	Asst. in Cotton, A. R. S , Palur,	Asst. in Chemistry
Janab P. M. Syed Sahib,	Asst. (on leave),	Asst. in Oil-seeds A. R S., Nileshwar.
Sri N. V Sundaram,	Coconut Nursery Scheme at Pattambi,	Asst in Mycology, Coimbatore
,, N Srinivasa Rao,	A. D , Gooty,	A. D , Rajahmundry
,, G. V. Rama Rao,	A D , Rajahmundry,	A. D Nandigama
,, G. Doraiswami,	A. D., Kallakurichi,	A. D., Vridachalem
,, K. K. Subramania Iyer,	A D., Virdachalem.	A. D , Tindivanam
,, V. Srinivasan,	A. D , Pulses Asst Salem,	Asst in Pulses, Coimbatore,
,, A. K Nagaratnam,	Asst. in Pulses, Coimbatore,	Asst in Pulses, Salem.
,, C Hanumantha Rao,	A. D., Vizayanagaram,	A. D , Vizagapatam.
,, B Madhava Rao,	A. D., Vizagapatam,	A. D., Vizayanagaram.
,, D. Srinivasa Rao,	F. M., (on leave),	A. D., Kothapetam.
,, K. Sithapathi Rao,	A. D , Kothapetam,	A. D., Allagadda.

LEAVE.

Name of Officers.	Period of Leave.
Sri. M. Damodara Prabu, F. M. A. R. S., Nileshwar.	L. A. P. for 4 months.
„ S. V. Hariharan, A. D Arantangi.	Earned leave on M. C. for 2 months from 23—3—1948 extraordinary leave for 1 month from 23—5—1948.
„ Kesavunni Nambiar, A. D., of B. Koteswar Arecanut processing and Marketing Vettamkulam,	L. A. P. for 3½ months preparatory to retirement.
„ G A. Balraj, Asst. A. D. Kumbakonam,	L. A. P. for 1 month on M. C. from the date of relief.
„ N Krishna Pillai, P. A. to D. A. O., Ramnad,	L. A. P. for 1½ month from the data of relief
Miss. C. K. Soumini, Asst. in Mycology, Coimbatore,	Leave on half average pay on M. C. for 45 days from 17—4—1948.
Sri. N. Narayana Iyer, A D Madurantakam,	L. A. P. for 3 months from 27—3—1948.
„ N. Srinivasa Rao, Teaching Asst. Agricultural College, Coimbatore,	L. A. P. for 1 month and 15 days from 15—4—1948.
„ A. Mariakulandai, Asst to Govt Agrl. Chemist, Coimbatore,	L. A. P. for 37 days from 30—4—1948.
„ V. Butchiraju, A. D., Yellavaram,	L. A. P. for 3 months preparatory to retirement from the date of relief.
Janab. A. Azimndden Sahib, A. D. Hosur,	Earned leave for 30 days from 10—5—1948.
Sri. K. Govinda Kurup, A. D., Peruntalmanna,	Earned leave for 30 days from 10—5—1948.
„ K. Achuthan Nambiar, Ento-Mycology Demonstrator, Tanjore.	L. A. P. for 45 days from 15—5—1948.
„ B. M. Pinto, Sims Park, Coonoor,	Leave on half average pay for 90 days from 9—5—1948.
„ C. S. Krishnaswami Ayyar, Teaching Asst. in Agrl, Coimbatore,	L. A. P for 45 days from 1—5—1948.
„ S. V. Ramachandran, P. A. to D. A. O., Cuddalore,	Extension of L. A. P. for 1 month from 5—5—1948.
„ K. Ambikacharan, A. D., Vegetable Scheme, Madras,	L. A. P. for 2 months from the date of relief.
„ K. R. Sundaresen, A D., Tirutani,	Earned leave for 60 days from 15—5—1948.
„ M. K. Gopalan, (On leave)	Extension of leave on half average pay for 4 months from 4—2—1948.
„ M. Kalimuthu. A. D. (On leave)	Extension of L. A. P. on M. C. for 48 days from 9—5—1948.
„ B. M. Pinto. Sims Park, Coonoor.	Extension of earned leave for 30 days from 9—5—1948.
„ A R. Krishnamurthy, A. D. (On leave)	Extension of L. A. P. for 1 month from 12—5—1948.
„ G. Ranganathaswami, A. D., Kalyandrug,	L. A. P. on M. C. for 2 months from date of relief.
„ G. R. Padaki, Asst. in cotton,	Earned leave for 45 days from 8—5—1948.