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CONTENTS

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Editorial

Our New Patron: It is with great pleasure we announce that Sri N. S. Vaidyanatha Iyer of Sengalipuram, near Kodavasal. Tanjore district, has become one of the Patrons of the Madras Agricultural Students Union. He is one of the leading mirasdars of Tanjore adopting scientific methods of cultivation and for the last one decade he has been a leading Seed Farm Ryot and has been supplying paddy seed to the Agricultural Department. He has been always ready to try and test any improvement suggested by the Department. Further his attitude in approaching the advocated methods with an open mind and communicating his findings to the departmental officers after trying them has been very helpful. These ideas he has spread to his tenants also and helped them in adopting scientific cultivation with the result that one of his tenants was awarded the District Prize for the highest yield obtained in paddy for the year 1952—'53. He has now announced that he is trying on his own an ancient method of cultivation the result of which he would be communicating in due course. It is highly encouraging to us to have such an enlightened farmer as a Patron from whom we may expect sympathetic examination of our research results.

The Food situation: The National Development Council in reviewing the Five Year Plan with regard to Agriculture have recorded that the food production progress was satisfactory mainly owing to favourable seasons and irrigation projects. It has also found that progress has not been enough in two items viz., production and distribution of improved seed and supply of adequate quantity of fertilizers and spread of co-operative movement. The International Food and Agricultural Organisation in its review of the world food situation has recommended several measures to ensure food supply for the whole world. On the whole it finds that food production is not at all enough to meet the world demand. However it is gratifying to learn that proposals have been made to safe guard the requirements

of the hungry millions and at the same time of the producer also. Measures for distribution of excess farm produce to needy countries through international agency instead of destroying them are being considered. In this connection our mirasdars and other farmers holding large areas can help considerably to remedy the defect noted by the National Development Council in running seed farms and supply of improved seeds and in furthering co-operative movements. They could also promote co-operative concerns for preserving excess farm produce in up to date silos etc., and arrange for their proper care.

Crop Competitions: The starting of the competition and award of prizes for the best producer has stimulated intensive farming throughout the length and breadth of India. It has also shown one thing clearly that the soils of India have not gone so sick or sterile but on the other hand respond very well to better cultivation and it is possible to treble the yield of all crops provided sufficient personal attention is bestowed on the cultivation. Now this idea that land could be made to produce larger harvest by simple methods of cultivation, use of improved seeds and greater personal care has to be brought home to the bulk of the cultivators. It may be well to encourage team spirit in them by opening competitions between villages and award of prizes to the performance of the village as a unit. It might in the long run lead to greater co-operation in many other activities also.

Our Printers: We have received the annual report of the Coimbatore Co-operative Printing Works for the year ending June 1953. The press has been functioning with great efficiency inspite of a number of difficulties. It is highly gratifying to learn that the press has renewed its entire printing outfit and is likely to expand its printing plant. It has been always a pleasure to us to deal with this press and we have found it highly efficient and always ready to oblige and suggest ways out. We wish that the press will progress year by year in its service to the public.

Education is what remains after you had forgotten what you tried to remember

Studies on Dormancy in Short-Term Rices*

By

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Introduction: 'Dormancy' or 'after ripening' of grain relates to the resting period from the time the seed is harvested till such time when good germination is obtained when sown. Dormancy is characteristic of only certain varieties of rice. Most of the short-term rice varieties in this State do not require any resting period, as they germinate almost immediately after harvest. In fact, the seeds of a few of them eg. PTB. 10 and ADT. 19 sprout even in the ears themselves with the moisture available at the time. The readiness to germinate may seem to be an advantage, as the seeds of those could immediately be used for seed purposes, if required. But in those places where harvests occur in wet season, eg. Kuruvai of Tanjore, Swarnavari of Chingleput or the first crop of Malabar, this property to germinate results in a huge waste and lowers the marketable value of the produce considerably. Such a produce is also unfit for seed purpose.

The present studies on dormancy were taken up to combine dormancy in the short duration strains, mostly non-dormant, evolved by the Department. In a preliminary investigation on the sprouting capacity of a large number of short duration varieties, mostly of exotic origin, and duration varying from 80 to 120 days (seed to seed) similar in duration to the departmental strains, it was found that 22 types out of a total of 140 tested gave sprouting values below 5%. Their yielding capacity was also determined in 16 series of tests with departmental strains of similar duration. To evolve short duration types resembling the popular strains of this state with dormancy of seed added on, hybridisation was undertaken and is being continued. Six dormant high yielding types (3,000 to 4,000 lb. grain per acre) were selected and used for hybridising the non-dormant and popular short duration strains of the State, viz. CO. 10, CO. 13, CO. 18, ADT. 3 and MTU. 15. The Rice Breeders' working party of the Food and Agricultural Organisation which met at Bankok had also stressed the need for the studies.

Previous work: No work seems to have been done in rice in this direction. Harrington and Knowles (1939) found large differences in the germinative capacity of wheat varieties ranging from 3·9% for dormant to 78·8% for non-dormant types immediately after harvest. In the crosses effected between dormant and non-dormant types of wheat they found that the several progenies of the hybrid line displayed more resistance to sprouting than the resistant parent variety itself. He was of opinion that the inheritance of sprouting resistance was not governed

* Paper awarded the Ramasastrulu Munagala Prize for 1953.

by a single gene and further stated that lines of higher sprouting resistance may be expected from crosses having at least one sprouting resistant parent. He believed that a cross between susceptible parents may result in certain lines more resistant than the parents.

Materials and Methods: In a preliminary investigation at the Paddy Breeding Station, Coimbatore in 1949 – '50, one hundred and forty short duration varieties with duration (seed to seed) not exceeding 120 days, mostly exotic, were studied for their capacity to germinate immediately after harvest, along with a few departmental strains of similar duration. Ripe panicles (ear-heads) were collected from the various varieties on the day of harvest and immersed on the same day in about half an inch of water kept in a shallow tray. Paddy Breeding Station well water was used for the purpose. This is the condition approximating to the one obtaining in the fields of the rice-growing tracts September – October at the time of the harvest of the short-term rices. Most of the grains in the panicles of many varieties sprouted on the third or fourth day itself, while in a few the germination was spread over a number of days; in yet a few others not a grain germinated in spite of keeping them steeped in water for 10 days. If no grain had germinated within the 10 days limit that variety was considered to be 'dormant'. Results of germination revealed, that out of 140 types and 9 departmental strains, 109 had germinated with the percentage varying from 91 to 100, while 18 varieties had values ranging from 11 to 90%, while yet another set of 22 types showed percentage of germination ranging from 1 to 5%. In table I are presented the particulars regarding dormant and non-dormant types.

Six varieties of these twenty-two from the last group with germination capacity ranging from 1 to 5% with the additional desirable agronomic qualities such as good tillering, optimum growth habit and good yield, were selected and used for hybridisation with short-term non-dormant strains evolved by the Paddy Section for induction of dormancy in these high yielding strains. Six sets of crosses were effected in 1950 – '51 and from them 11 F_1s were obtained.

		F_1 Group.			F_1 Group.
I.	T. 568 x ADT. 3 ..	1	IV.	T. 1926 x ADT. 3 ..	5
	x Co. 13 ..	2		x Co. 18 ..	6
II.	T. 1653 x ADT. 3 ..	3		x Co. 10 ..	7
III.	T. 1926 x Co. 10 ..	4	V.	T. 2024 x Co. 13 ..	8
				x MTU. 15 ..	9
			VI.	T. 2105 x Co. 13 ..	10
				x MTU. 15 ..	11

The 11 groups of F_1s were grown in 1951—'52 season and examined for all morphological characters including height, tillering capacity etc. besides their germinability at fortnightly intervals.

Ripe ears were collected from each of these F_1 plants on the day of harvest and from that day onwards fortnightly germination counts were

made in a method similar to the one by which the parents were tested, viz. by steeping the panicles in water in shallow trays. In the first test commencing on the day of harvest it gave an impression that 'dormancy' was a dominant character as all of them were resistant to sprouting. The second and later germination counts, however, showed that there were increases in sprouting values, the different sets of crosses behaving slightly differently. The results of the six fortnightly germination counts of the progeny and the corresponding male and female parents are presented in Table II (a) and (b).

From the table it will be seen that in the first test conducted on the day of harvest in 10 out of the 13 F_1-groups the values of germination were less than 5% and this can be taken as resistant to sprouting for practical considerations for the evolution of non-germinating short duration strains.

In 1952 – '53 season from the F_1 sets 22 F_2 plants were derived and studied for all the morphological characters in general and resistance to sprouting in particular.

It was found that in the case of an F_2 where the shape of grain (long and short), glume colour, (straw and brown furrows) and rice colour (red and white) differed, the segregations were of the following order.

1.	Long grain,	white rice,	straw lemma and palea.	
2.	Do.	red rice,	do.	
3.	Do.	white rice,	brown furrows	do.
4.	Do.	red rice,	do.	do.
5.	Short grain,	white rice,	straw lemma and palea.	
6.	Do.	red rice,	do.	
7.	Do.	whlte rice,	brown furrows	do.
8.	Do.	red rice,	do.	do.

Though the evolution of short-duration high-yielding dormant strains was the object of the cross, the nature of inheritance of the character "Dormancy" was also studied in 3 out of the 22 F_2 progenies where all the available plants were collected and germinability tested every fortnight, four times in all, commencing from the day of harvest. The results are presented in Table V. Variations in sprouting behaviour of F_2s, are presented in Table III.

From the sprouting behaviour of the various selections, it will be seen that in cross – T. 1926 x ADT. 3, out of 265 plants tested on the day of harvest, 227 failed to sprout while 38 panicles gave low values of 1 – 10 percent. In the second fortnightly test 78 plants germinated and 187 did not. In the third test (30 days after harvest) 99 did not sprout while 151 gave varying values from 1 to 80%. In the fourth test done after 45 days storage 39 selections remained absolutely dormant while 133 gave various sprouting values ranging from 1 to 100%. The distribution of germination percentage of the selections in crosses

T. 1926 x ADT 3 and T. 1936 x CO. 18 with reference to the four fortnightly tests is presented in Table IV.

Whether sprouting has any association with (1) colour of lemma and palea, (2) shape of grain and (3) colour of rice, the colour and shape characters were plotted for the various selections in the F_3 progenies tabulated against each germination group. The data are presented in Tables V (a), (b), and (c).

The range of variation in germinability of F_3 progenies and their averages under different morphological groups are presented in Table VI. Plate I figures 1 to 3 shows the variation in germinability of parents, F_2 and F_3 plants.

Discussion: By crossing dormant high-yielding varieties with non-dormant popular strains, dormant high-yielding strains are sought to be evolved. It is seen that the different combinations of parents differ in the behaviour regarding germinability in F_2 and F_3. It is possible that its inheritance is not simple and more genes than one are involved. The parents also differ in the degree of resistance to sprouting. This fact would show that possibly besides the main genes certain modifiers may also be at work. It was found possible, however, to combine dormancy with other factors and therefore dormancy is an inherited character. The study of the segregation in F_3 shows that it is possible to fix up a few cultures which are high yielding and resistant to sprouting from among the several cultures that remained dormant or started feebly germinating 45 days after harvest. As stagnated conditions are not likely to last for more than 10 or 15 days at a stretch dormancy for a period of 20 to 30 days after the grain becomes fully mature will be sufficient for the ordinary needs of the Delta ryots of Tanjore or the cultivators of *swarnavari* of Chingleput and the Malabar ryots raising their first crop. From an examination of 1435 progenies from 22 F_3 groups, 279 progenies were found to be resistant to sprouting either absolutely or giving germination below 5%. Through the task of fixing up cultures with as good yield as the popular strains with the dormant character added on by continuous experimentation in F_4 and further generations, the author is hopeful of obtaining useful strains to replace the non-dormant though high yielding strains of the State, at no distant date.

Summary: In a preliminary examination of about 140 short-term rice varieties mostly, of exotic origin it was possible to fix up 22 promising high yielding dormant types.

Crosses were effected between six of these dormant types and high yielding popular strains of the State.

The F_2s were tested for germinability at fortnightly intervals commencing from the day of harvest. The different F_2s behaved differently in germination increasing slowly from 0 to even 100% in the course of 60 days.

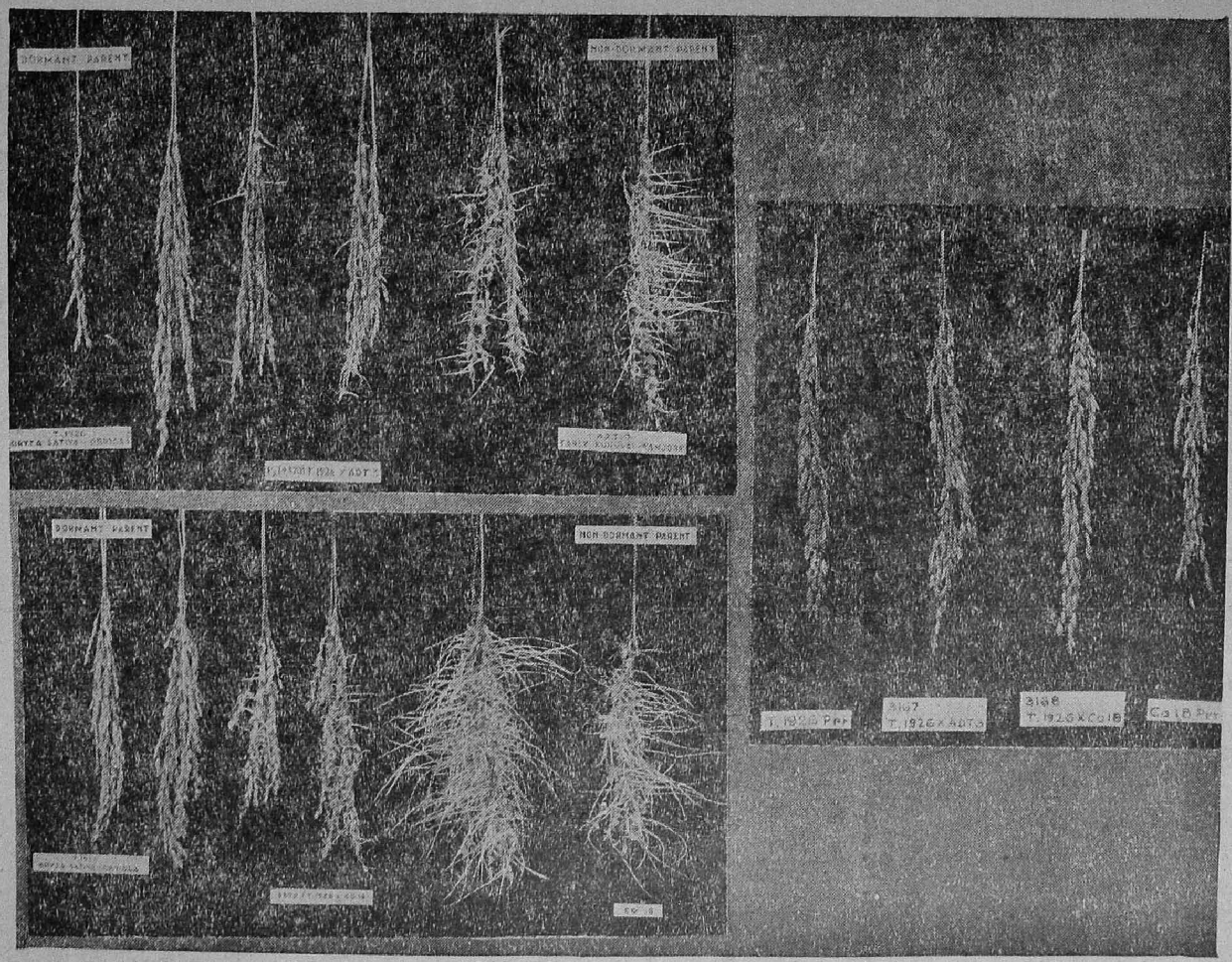

Fig. 1 & 2.

SECOND GENERATION CROSS PROGENIES.

(The wide variability in sprouting behaviour is in evidence)

(10 days after steeping in water)

Fig. 3.

SECOND GENERATION CROSS PROGENIES.

(with dormant and non-dormant parents)

(10 days after steeping in water)

Twenty-two F_3 groups comprising of 1425 progenies were studied under four fortnightly germination tests commencing from the day of harvest and 279 progenies promising from the point of view of yield as well as resistance to sprouting were carried forward for further tests in F_4.

The association, if any, existing between "dormancy" and colour of lemma and palea (glumes), shape of grain (long and short) and colour of rice (white and brown) was sought to be worked out.

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TABLE I

Dormant and non-dormant types and their yielding capacity

Number of type	Name of type	Acre yield (lb.)	Duration in days (Seed to Seed)	Day of harvest	Days after harvest				
					15	30	45	60	75
					Germination percentage				
	Dormant Types:								
1	T. 568 Americano-Italy ..	3433	106	Nil	Nil	Nil	26·9	39·7	100
2	T. 1653 Cateto Dourado-Brazil ..	3502	112	Nil	1·4	Nil	79·4	81·4	100
3	T. 1815 Ambar-Iraq ..	2964	112	Nil	Nil	4·3	3·7	57·5	70
4	T. 1926 O. Sativa-Orrisa ..	4408	88	Nil	Nil	5·1	84·7	100·0	100
5	T. 2024 T. 43 United Provinces ..	2420	102	Nil	0·6	21·5	79·4	82·0	100
6	T. 2105 D 52/37 British Guiana ..	2111	94	Nil	Nil	Nil	Nil	40·0	100

TABLE I *(Continued)*

Non-Dormant types:								
Co. 10 Gobikar ..	3000	120	47·1	86·9	100·0	95·8	100·0	100
Co. 13 Arupathan-kodai ..	3000	115	41·7	86·7	75·3	86·8	97·6	100
Co. 18 Vellaikar ..	2700	125	73·0	92·7	100·0	97·0	96·0	100
ADT. 3 Tanjore Early Kuruvai ..	3600	95	37·0	92·4	100·0	100 0	100·0	100
MTU. 15 Dalwa Sannam ..	2600	125	75·0	96·9	96·9	95·8	100·0	100

TABLE II (a)

Sprouting percentages of F_2 s

Serial No.	Female Parent	Male Parent	Dates of Germination Counts					
			1951	1952				
			25·12	10·1	25·1	9·2	26·2	12·3
1	T. 568	ADT. 3	..	2·1	43·0	55·0	96·0	100·0
2	T. 568	Co. 13	2·8	30·8	56·0	53·3	96·0	100·0
3	T. 962	ADT. 3	..	15·1	38·1	43·0	100·0	100·0
4	T. 962	Co. 13	..	12·7	79·0	95·7	100·0	100·0
5	T. 1653	ADT. 3	..	13·6	..	..	..	..
6	Co. 10	T. 1815	10·0	27·8	44·7	22·3	100·0	100·0
7	T. 1926	ADT. 3	0·8	12·4	69·3	88·9	100·0	100·0
8	T. 1926	Co. 18	1·3	29·3	30·7	76·2	100·0	100·0
9	Co. 10	T. 1926	2·2	48·0	79·0	96·4	100·0	100·0
10	T. 1926	Co. 10	..	21·4	75·3	74·3	100·0	100·0
11	T. 2024	Co. 13	8·0	26·7	..	..	..	..
12	T. 2024	MTU. 15	90·0	90·0	100·0	90·0	100·0	100·0
13	T. 2105	MTU. 15	..	12·2	78·8	92·4	100·0	100·0

TABLE II (b)

Sprouting percentage values of parents (Dormant and non-dormant) 1952

Dormant Parent	Dates of Germination						Non-dormant Parent	Dates of Germination					
	1951		1952					1951	1952				
	25/1	10/1	25/1	9/2	26/2	12/3		25/12	10/5	25/1	9/2	26/2	12/3
T. 568 ..	..	..	26·0	39·7	100·0		ADT. 3	1·8	45·5	77·8	62·5	100·0	100·0
T. 1653 ..	1·4	..	79·4	81·4	100·0		Co. 13	41·7	86·7	75·3	86·8	97·6	100·0
T. 1815 ..	..	4·3	3·7	57·5	70·0		Co. 10	1·0	59·7	88·0	93·9	100·0	100·0
T. 1926 ..	..	5·1	84·7	100·0	100·0		Co. 18	0·4	81·0	72·6	77·0	96·0	100·0
T. 2024 ..	0·6	26·5	79·4	82·0	100·0		MTU.15	5·1	67·6	83·5	82·8	100·0	100·0
T. 2105 ..	..	..	..	40·0	100·0		..	..	..	..	..	..	..

TABLE III

Variation in sprouting behaviour of the selection in F_2s.

Parents of the cross	Germination test once in 15 days	Germination percentage												Total germinated	Number not tested (as there were no ears)	Grand Total
		Nil	1—5	6—10	11—20	21—30	31—40	41—50	51—60	61—70	71—80	81—90	91—15			
T. 1926 x ADT. 3	I	227	30	6	..	2	..	..	..	..	..	..	..	38	..	265
Do.	II	187	62	7	7	..	2	..	..	..	..	..	..	78	..	265
Do.	III	99	42	27	29	26	12	4	5	4	2	..	..	151	15	265
Do.	IV	39	3	10	23	15	16	13	12	11	11	10	9	133	93	265
T. 1927 x ADT. 3	I	181	33	7	4	1	..	1	..	..	..	..	..	46	..	227
Do.	II	131	53	20	13	5	3	1	1	..	..	..	..	96	..	227
Do.	III	78	10	18	38	26	11	9	11	3	2	..	3	131	18	227
Do.	IV	21	2	7	12	19	19	24	8	13	12	16	6	138	68	227
T. 1926 x Co. 18	I	58	46	30	58	30	28	22	11	12	4	2	1	244	..	302
Do.	II	21	6	5	24	21	22	31	33	29	30	36	44	281	..	302
Do.	III	14	..	4	3	9	8	18	19	17	21	50	122	271	17	302
Do.	IV	3	..	..	..	1	3	3	3	6	9	39	163	227	72	302
Parents																
T. 1926	I	1	..	..	..	..	..	..	..	..	..	..	..	1	..	1
	II	1	..	..	..	..	..	..	..	..	..	..	..	1	..	1
	III	1	..	..	..	..	..	..	..	..	..	..	..	1	..	1
	IV	..	..	1	..	..	..	..	..	..	..	..	..	1	..	1
ADT. 3	I	..	..	..	..	..	1	..	..	..	..	..	..	1	..	1
	II	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1
	III	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1
	IV	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1
Co. 18	I	..	..	..	..	..	..	..	..	..	1	..	..	1	..	1
	II	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1
	III	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1
	IV	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1

TABLE IV

Distribution of F_3 generation—(T. 1926 x Co. 18)

	Female Parent	0	1—5	6—10	11—20	21—30	31—40	41—60	61—80	81—100	Male Parent
	T. 1926.										*Co. 18.*
I	Nil	58	46	30	58	30	28	33	16	3	73·0 %
II	Nil	21	6	5	24	21	22	54	59	80	92·7 %
III	9.8 %	14	..	4	3	9	8	37	38	172	100·0 %
IV	36·3 %	3	..	..	..	1	3	6	15	202	97·0 %

Distribution of F_3 generation—(T. 1926 x ADT. 3)

	T. 1926.										*ADT. 3*
I	Nil	227	30	6	..	2	..	..	..	..	37·0 %
II	Nil	187	62	7	7	..	2	..	..	..	92·4 %
III	Nil	99	42	27	29	26	12	9	6	..	100·0 %
IV	Nil	39	3	10	23	15	16	25	22	19	100·0 %

Distribution of F_3 generation—(T. 1926 x ADT. 3)

	T. 1926.										*ADT. 3.*
I	Nil	181	33	7	4	1	..	1	...	..	37·0 %
II	Nil	131	53	20	13	5	3	2	..	..	92·4 %
III	Nil	78	10	18	38	26	11	20	5	3	100·0 %
IV	6·5 %	21	2	7	12	19	19	32	25	22	100·0 %

TABLE V (a)

Sprouting percentage in relation to (1) colour of glumes (2) shape of grain and (3) colour of ries for F_3 9370—(T. 1926 x ADT. 3)

Germination percentage	Colour of glumes.			Shape of grain.			Colour of rice.		
	Brown	Dark brown	Total	T. 1928 type	ADT. 3 type	Total	White	Brown	Total
0	16	29	45	31	14	45	20	25	45
1—3	22	42	64	49	15	64	24	40	64
6—10	14	11	25	20	8	25	10	15	25
11—20	12	24	36	28	8	36	15	21	36
21—30	9	23	32	25	7	32	13	19	32
31—40	4	12	16	11	5	16	6	10	18
41—60	5	13	18	11	7	18	11	7	18
61—80	3	7	10	9	1	10	4	6	10
81—100	2	3	5	3	2	5	2	3	5
Total	87	194	151	187	64	251	103	146	251

TABLE V (a) *(Continuation)*

Proportion:	0·35	0·65	0·74	0·26	0·42	0·58
X^2	7·36		5·43		3·56	

Value of X^2 for P. 0·01 = 20·000 and for P. 0·05 = 15·507.

Conclusion: The character dormancy in germination is only feebly associated with colour of lemma and palea (glumes), shape of grain and colour of pericarp (colour of rice)

TABLE V (b)

Sprouting percentage in relation to colour of glumes, shape of grain and colour of rice for F_2 9371—(T. 1926 x ADT. 3)

Germination percentage	Colour of glumes.			Shape of grain.			Colour of rice.		
	Brown	Dark brown	Total	T. 1926 type	ADT. 3 type	Total	White	Brown	Total
0	22	16	38	23	15	38	11	27	38
1—5	14	14	29	21	7	29	5	23	28
6—10	11	15	26	16	10	28	12	14	26
11—20	17	22	39	29	10	39	12	27	39
21—30	10	19	29	22	7	29	10	19	29
31—40	6	3	9	4	5	9	4	5	9
41—60	13	13	26	17	9	25	9	17	26
61—80	4	6	10	7	3	10	5	5	10
81—100	..	4	4	2	2	4	..	4	4
Total	97	112	209	141	66	209	68	141	209
Proportion:	0·46	0·54		0·67	0·33		0·33	0·67	
Chi^2	9·52				6·73			19·24	

Value of Chi^2 for P. 0·01 = 20·090 and for P. 0·05 = 15·507.

Conclusion: The character dormancy in germination is associated with Brown pericarp (brown colour) of rice and only feebly associated with colour of lemma and palea (glumes) and shape of grain.

TABLE V (c)

Sprouting percentage in relation to colour of glumes, shape of grain and colour of rice

F_2 – 9372 – (T. 1926 x CO. 18)

Germination %	Colour of glumes			Shape of grain			Colour of rice		
	Straw	Brown	Total	Co. 18 type	T. 1926 type	Total	White	Brown	Total
0	2	0	2	2	0	2	2	..	2
1— 5	1	0	1	0	1	1	0	1	1
6—10	5	..	5	2	3	5	1	4	5
11—20	3	1	4	..	4	4	1	3	4
21—30	8	1	9	4	5	9	4	5	9
31—40	8	..	8	3	5	8	1	7	8
41—60	24	6	30	10	20	30	12	18	30
61—80	17	12	29	13	16	29	13	16	29
81–100	87	24	111	47	64	111	36	75	111
Total ..	155	44	199	81	118	199	70	129	199

TABLE V (c) *(Continued)*

Proportion	0·78	0·22	0·41	0·59	0·35	0·65
X^2		11·47		7·42	8·88	

Value of X^2 for P. O. 01 = 20·090 : For P. O. 05 = 15·507.

Conclusion: as in V (a).

TABLE VI

F_2	Type of grain	Germination	Lemma & Palea (Brown)		Lemma & Palea (Dark Brown)	
			Rice colour		Rice colour	
			White	Brown	White	Brown
9370	T. 1926	Average %	16·8	10·1	18·7	19·3
		Range	0—61·1	0—69·8	0—87·2	0—95·0
	ADT. 3	Average %	15·1	24·1	18·8	16·2
		Range	0—72·0	0—92·0	0—58·7	0—60·4
9371	T. 1926	Average	21·7	16·5	26·6	23·2
		Range	0—65·2	0—51·9	0—80·0	0–100·0
	ADT. 3	Average	20·8	15·0	21·5	25·4
		Range	0—59·4	0—63·6	6·7—60·9	0–100·0
			Straw white		Straw brown	
			White	Brown	White	Brown
9372	T. 1926	Average %	70·1	69·6	78·0	80·1
		Range	7·1–100·0	4·8–100·0	27·9–100	11·6 to 100·0
	Co. 16	Average	67·6	76·0	87·8	93·4
		Range	0–100·0	8 8 to 100·0	82·5–93·2	54·3–100·0

Soil Conservation in Madras State*

By

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Classification of area: Madras is the southernmost State in the Indian Union and extends to about 1,27,000 square miles. This area was classified as follows during the year 1950 – '51 :

S. No.	Classification	Million acres	Percentage to the total
1.	Forests	14·21	17·4
2.	Barren and unculturable lands	8·70	10·7
3.	Land put to non-agricultural uses	6·08	7.5
4.	Culturable waste	6·82	8·4
5.	Permanent pastures and other grazing lands	1·72	2·1
6.	Lands under miscellaneous trees, groves etc. not included in the net area sown	1·74	2·1
7.	Current fallows	6·17	7·6
8.	Other fallow lands	4·16	5·1
9.	Net area sown	31·82	39·1
	Total	81·42	100·0

Of the nett area sown, (31·82 million acres) the area under irrigation is only 9·06 million acres. The most striking facts revealed from the above land classification are that: (i) Forests cover less than 25% of the total area which is the limit accepted as generally necessary for the well-being of the nation. (ii) Of the nett areas sown over 71·5% of lands are dependent on monsoons as they have no protective irrigation. Thus, agriculture in Madras is still a gamble in rainfall.

Soils: The Soils of the state can be divided into (1) alluvial soils, (2) black soils, (3) red soils and (4) laterite soils.

Alluvial soils are found in the deltaic tracts of the Krishna, Godavari and the Cauvery and in portions of South Arcot and Tirunelveli districts and are estimated to cover about a million acres. The black soils cover about 10 million acres spread over many districts predominantly in the Deccan districts of Bellary, Kurnool and Cuddapah. The soils vary in depth and generally range from heavy clay to clay loam. The red soils cover about 20 million acres in the West Coast and the Central Districts. The laterite soils are found in the West Coast of Madras.

Crops: The important crops grown in Madras State can be conveniently grouped into Food and Non-Food crops. Food crops occupy

* A Paper read before the Soil Conservation Society of India at its annual meeting held at Naw Delhi in February 1953.

about 28·3 million acres and non-food crops about 8 million acres. Rice is the largest single food crop of the State and occupies on an average 10·9 million acres. The next largest area in the State is cropped with millets, the average area during the last decade being about 13 million acres. In the millets group, sorghum occupies the largest area. Pulses form another group of complementary foods occupying on an average 2·8 million acres. The three important non-food crops or commercial crops are groundnut, cotton and tobacco. The total area under these crops fluctuates between 7½ million and 10 million acres depending on prices and seasonal conditions

Season and rainfall: The rainfall of the State can be conveniently considered with reference to the following arbitrary divisions of the year: (1) January to March — the dry weather. (2) April and May — the hot weather. (3) June to September — the South-West Monsoon. (4) October to December — the North-East Monsoon.

Hyetographically, the State can be divided into seven zones with marked characteristics of their own. The names of districts comprising each zone and the average rainfall received per annum are furnished below:

S. No.	Zone	Name of District	Average rainfall per year
1	Northern Circars	Vishakapatnam, East Godavari, West Godavari, Krishna and Guntur	38·7″
2	Deccan	Kurnool, Bellary, Anantapur and Cuddapah	24·3″
3	The Carnatic	South Arcot, Chingleput and Nellore	46·6″
4	The Central Districts	North Arcot, Chittoor, Salem, Coimbatore and Tirunelveli	33·3″
5	Southern Districts	Tanjore, Madurai, Ramanathapuram and Tirunelveli	35″
6	West Coast	Malabar and South Kanara	135·4″
7	Nilgiris	Nilgiris	74·2″

The rains of the South-West Monsoon regulate the bulk of the sowings on the lighter classes of dry lands and are thus of the utmost importance to the State as a whole. If they are late the sowings on these soils will be untimely and invariably the crops fail. The South-West Monsoon rains are of great value to the State even when they fall beyond the State boundaries, for it is on them that the Krishna, the Godavary, the Pennar and Tambraparni depend for their supply of water. The rains of North-East Monsoon are chiefly of importance for the supply of rainfed tanks. Some dryland crops are raised under this monsoon particularly on the heavy black-soils. The rains of the dry weather are usually scanty and too unreliable to have any effect on agricultural practices.

Soil erosion: In common with the rest of India, no definite figures are available as regards the extent of soil erosion in Madras. Despite statistical deficiencies and paucity of accurate surveys, certain broad facts can be easily inferred. It is estimated that in India more than one-third of the agricultural lands are subject to erosion. It should be much more in Madras due to vagaries of rainfall, rolling topography, lack of forests and above all lack of conservation practices. A perusal of the land classification in Madras will show that over 71·5% of the nett areas sown (31·82 million acres) are dry lands (22·76 million acres) with protective irrigation. The dry lands of Madras are a vast undulating terrain with no plant cover or obstruction whatsoever. Most of the dry lands are subject to soil erosion. Subtle changes in the soil such as sheet erosion is seldom realised till rills or deep gullies are formed. An appreciable portion of good land is becoming sub-marginal and again a portion of the sub-marginal land is going out of cultivation. Soil erosion in Madras has assumed serious proportions and the State Agricultural Department has taken up the work of soil conservation.

Soil conservation: The work done on soil conservation in Madras is very little, when compared with the magnitude of the problem and can be broadly divided into two fields of activities namely Research and Extension.

Research: Soil Conservation Research in Madras State was mainly confined to the Agricultural Research Station at Hagari in Rayalaseema (Deccan) and Nanjanad in the Nilgiris. The work at the Agricultural Research Station, Hagari was more confined to dry farming and incidentally carried out certain studies on soil conservation. Similarly, the activities of the Agricultural Research Station, Nanjanad were mainly confined to potatoes and agronomic trials and incidentally observations were conducted in run-off plots to collect information on the extent of soil losses under different cropping practices.

Work done in Agricultural Research Station, Hagari: As already indicated, the work done on Soil Conservation at the Agricultural Research Station, Hagari is inter-linked with the dry farming work in that station. The Indian Council of Agricultural Research had sponsored a scheme of Dry Farming Research with a view to make arable farming a success in the famine-stricken dry farming areas. This co-ordinated work was started in five representative tracts namely Sholapur and Bijapur in Bombay, Raichur in Hyderabad, Rhotak in Punjab and Hagari in Madras. The Dry Farming Research in Hagari was in operation from 1934 to 1943 and the work was mostly confined to (i) Soil Physics and meteorology and (ii) Agronomy.

After several trials on the Dry Farming side the main conclusions arrived at for recomendation to the cultivators (which are

identical to the conclusions arrived at the other Dry Farming Research Station) are :—

(i) Construction of small earthen bunds 7″ high with Bund-Formers and dividing the land into compartments of 10 cents in area was found to be best on fairly level fields.

(ii) There seems to be no need to deep plough the black soils, unless they become foul with weeds. Light ploughing also has no beneficial effects on black soils of medium depth.

(iii) Harrowing 3 to 4 times as preparatory cultivation was the best.

(iv) The minimum significant dose of Farmyard manure was found to be 6,000 lb. or 6 cart loads per acre. Application of manure in rotation to a particular land at least once in three or four years is advised.

(v) Adoption of 18″ spacing for sorghum and 36″ for cotton was found to be the best as against the farmer's practice of 12″ to 15″ for sorghum and 24″ for cotton.

(vi) Two intercultures for sorghum and three for cotton were found to be sufficient. It may be necessary to give one or two more intercultures if the field becomes foul with weeds owing to any rains received after sowing.

(vii) Use of improved strains like 'T'-1 sorghum during the years of normal rainfall and M. 47-3 strain during years of deficient rainfall, K. 23 *Setaria* for a variety of soils ranging from sandy to deep black soils and K. 68 *Setaria* for deeper soils and tracts of scanty rainfall.

(viii) Providing permanent contour embankments along contours at suitable intervals to prevent run-off and soil erosion was suggested.

(ix) Contour farming, strip cropping and basin-listing were also recommended.

These recomendations were tried on a large scale under the Dry Farming Development Scheme that was in operation at the Agricultural Research Station, Hagari during the years of 1943 to 1948. One among important and notable trials by the Research workers was the bunding of 100 acres in the lands adjoining the Research Station and owned by private farmers. As a result of this trial, the Department advocated large-scale contour bunding to prevent soil erosion, conserve moisture and thereby improve the lands permanently, particularly in the Dry Farming areas.

Agricultural Research Station, Nanjanad: The work at this station was confined to observations in run-off plots 12 feet x 4 feet under different farming practices viz., (1) Farm method of cultivation, (2) Ryot's method of cultivation, (3) Indigenous grass cover and (4) Clean fallow.

The farm method of cultivation consists of ploughing and planting across the slope. The ryot's method of cultivation consists of forking and planting along the slope. The main conclusions and recommendations made to the farmers are :

(i) The steeper the slope, the greater were the losses of soil and water during heavy rains.

(ii) The soil and water losses were greater when the land was under potato than when a cereal crop was grown or when the land was left fallow.

(iii) In steep slopes, it is not advisible to leave the land bare, particularly after lifting the potatoes since the loose soil particles are easily washed down during the rains. A crop of green manure (Lupin in the Nilgiris) sown immediately after the potato harvest not only protects the land against erosion but also utilises the residual manure applied to the potatoes. The crop when ready can be ploughed into the soil, enriching it and thereby benefiting the following cereal or potato crop. It has been definitely established that potatoes following a green manure crop always give better returns which is due to both the prevention of soil erosion and the rich organic matter it supplies.

(iv) The raising of green manure crop besides acting as a cover against soil erosion, results in adding to the permanent fertility of the soil and improving its water holding capacity, if practiced over a number of years. Ultimately even in years of deficit rainfall, fields over which such a judicious rotation has been adopted give optimum results in spite of adverse seasonal conditions.

(v) Sound cultural practices are very important to check erosion. The farm method of cultivation namely cultivation along contour—or at least across the slope is recommended as against the general ryot's practice of digging furrows with fork along the slope and planting along the slope. The Farm Method of cultivation also includes the application of manure commonly known as the 'Nanjanad Mixture' (500 lbs. of groundnut cake, 200 lbs. of sulphate of Ammonia, 350 lbs. of steamed Bonemeal, 336 lbs. of concentrated super and 2,224 lbs. of sulphate of potash over a basal dressing of 5 tons of Farmyard manure per acre).

The recommendations arrived at both the Research Stations were advocated to the farmers through the regular propaganda wing of the Department. In addition, Government desired to set up demonstration areas by the extension staff to serve as a model to the farmers.

Extension: It was widely recognised that soil erosion is taking a heavy toll in the Dry Farming Areas as well as in the heavy rainfall areas as there is no protection by way of plant cover or by supporting conservation practices. Encouraged by the results under the Dry Farming Scheme, and the dry farming development scheme conducted at the Agricultural Research Station, Hagari, the Madras Government decided to take up a large-scale contour bunding scheme in the dry farming areas of Rayalaseema for the economic development of this backward tract. The large-scale contour bunding work carried out in Bombay also gave sufficient encouragement. But the Government were faced with the question of lack of statutory powers to undertake Land Improvement Measures in private lands.

The Madras Land Improvement Scheme Act: *(Madras Act XXII of 1949):* With a view to empower the State Government to undertake Land Improvement Measures in private lands, the Madras Government enacted the Madras Land Improvement Schemes Act in 1949. Under this Act, powers were vested with the State Government to carry out any land improvement measures in a notified area and recover the cost thereof in full or in part in convenient instalments from the beneficiaries. This Act was first extended to the Bellary and Anantapur districts in Rayalaseema and the Government ordered to take up large-scale land improvement work in three select centres.

Soil Conservation Training at Sholapur: Having decided to take up large scale contour bunding schemes in Madras, the Government were faced with the problem of technical personnel. Selected officers of the Madras Agricultural Department were therefore sent for a short training at the Soil Conservation Institute at Sholapur under the control of Dr. J. K. Basu, Soil Physicist to the Government of Bombay. On completion of their training, these officers were entrusted with the Soil Conservation Work in Madras.

Soil Conservation in Rayalaseema: In persuance of the decision taken by Government to take up large-scale contour bunding work, three centres—Hagari and Alur in Bellary district and Guntakal in Anantapur district-were selected. The areas were selected on a water shed basis and the following soil conservation measures were proposed in consultation with Sri D. J. Ghandi, the then officer on special duty (Soil Conservation) with the Government of Iudia who had visited the areas selected: (i) Contour Cultivation. (ii) Contour Bunding. (iii) Strip Cropping. (iv) Gulley plugging. (v) Contour Trenching and Afforestation. (vi) Crop rotations. (vii) Use of Improved Strains, and (viii) manuring and other improved agricultural practices. The areas selected are typical black soils with slopes varying from 2 to 5% and lie in the semiarid tract having rainfall of about 20″ per annum. As a preliminary, topographic surveying was taken up in all the 3 centers and the area topographically surveyed is (a) Hagari — 6,049 acres. (b) Alur — 6,910 acres. (c) Guntakal — 6,845 acres. The areas actually covered under the scheme had to be limited to 4,800 acres as Government sanction are awaited for further extension. In this area, contour bunding, construction of waste weirs, gully plugging, contour trenching and afforestation, sowing of grasses on bunds etc., have been carried out by the Agricultural Department. The supporting agronomic practices are being advocated by the soil conservation staff. The salient features and experience gained in the scheme which may be useful to other soil conservation workers are furnished below:

Contour Bunding: The areas are typical black soils and over 4,800 acres had already been covered. Bunds $\frac{(12' + 2')}{2}$ x $2\frac{1}{2}'$ high were spaced at 3′ fall or 300′ intervals (whichever is less) with waste weirs at 1,000′ intervals or at natural drainage points. Direct contouring was not adopted and the alignments were finalised with reference to the nature of the holdings. Thus, it was possible to avoid zig-zag bends which are a hinderance to cultivation and fragmentation of holdings were also prevented. The cost of contour bunding including waste weirs roughly works to Rs. 80/- per acre on an average and to give economic relief to the ryots, Government have decided to recover only half the cost thereof and that too in 20 annual instalments.

Location and Size of Burrow Pits: It has been a controversial point as to where the burrow pits should be located. Taking several practical aspects and the views of the farmers into account it was decided to locate the burrow pits on either side of the bund. Experience in contour bunding particularly in Bombay had shown that burrow pits which are deep (say about a foot and above) do not get filled up quickly, as a result, an appreciable extent of land is lost to cultivation for at least a few years (say 3 to 4 years). It was therefore decided to have wide and shallow burrow pits not more than 6" in depth on either side of the bund 6' away from it. As the burrow pits were shallow and wide, they are ploughed and obliterated and cultivated immediately after the formation of the bunds.

Waste Weirs: Waste weirs of the surplus tank weir type 10 to 15 feet wide have been constructed at natural drainage lines with the crest at 1 foot above ground level. The crest level will be raised as and when the land gets silted up and it has been observed that the silting is very rapid. It is anticipated that the entire area will develop themselves into bench terraces. Pipe waste weirs have been found satisfactory for areas having a draining extension of less than 5 acres. As an additional protection to the waste weirs, grasses, particularly, *Cenchrus ciliaris* have been introduced and are establishing fairly well near the waste weirs. This is the first year of its introduction and its performance during summer has to be watched. A few photographs of the different types of waste weirs constructed are given in plate I.

Profitable use of bunds: With a view to utilise the bunds profiitably perennial and long duration crops like cotton (moco variety), castor etc and *Glyricedea* were sown on the bunds. This is the first year of their introduction and the results are encouraging. In adition grasses particularly *Cenchrus ciliaris* have been dibbled in rows on either slopes of the bund. Due to adverse seasonal conditions, the germination has been poor but the sowing of grasses will be continued when the monsoon sets in. It is encouraging to note that the ryots themselves have taken to growing vegetables like gourd varieties on bunds. Planting of palmyrah stones along the toe of the bunds in a few fields have been done by the soil conservation staff. The percentage of germination is poor but what little has germinated is coming up well. It may be added that palmyrah is an introduction to this tract. A few photographs of bunds planted with perennials and vegetables are given in plate II.

Contour Trenching and Afforestation: On a strict land use principle, uncultivable lands and barren hills that were situated within the catchments selected for soil conservation work was proposed to be seeded to trees. In these areas, trenches 2' wide and 1' deep at 40 to 50' horizontal intervals were dug on strict contour and on the refilled made

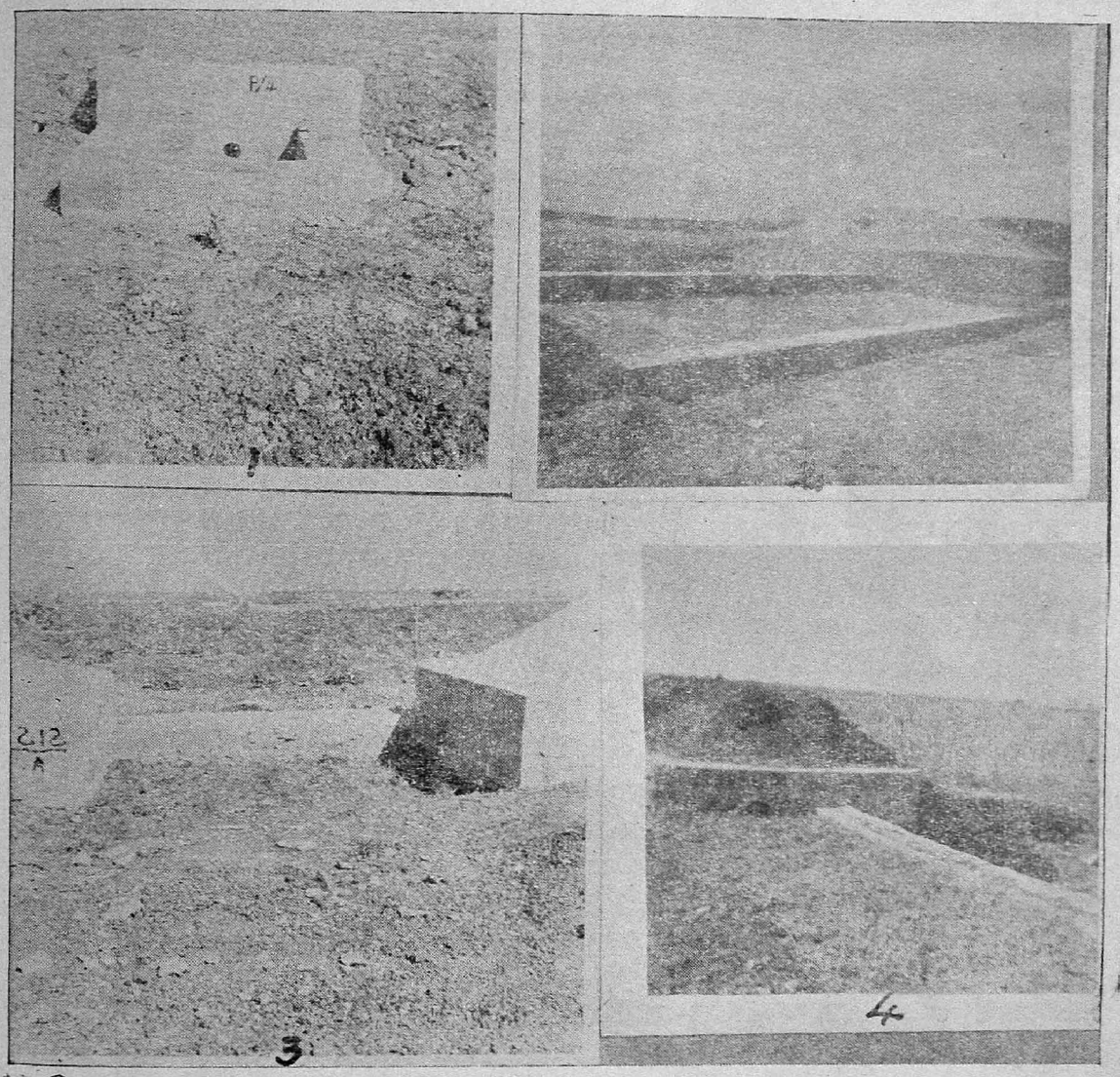

Fig. 1. Pipe sluice type waste weirs in Alur area – Note the front Cistern serving as drop in-lets.

Fig. 2. Spill-way type waste weirs in Alur area – Note the grouted rear aprons.

Fig. 3. Spill-way type waste weirs in Alur area – Note the wing walls and murram cover for bank connections.

Fig. 4. Spill-way type waste weirs in Guntakal area – Note the silting in one season.

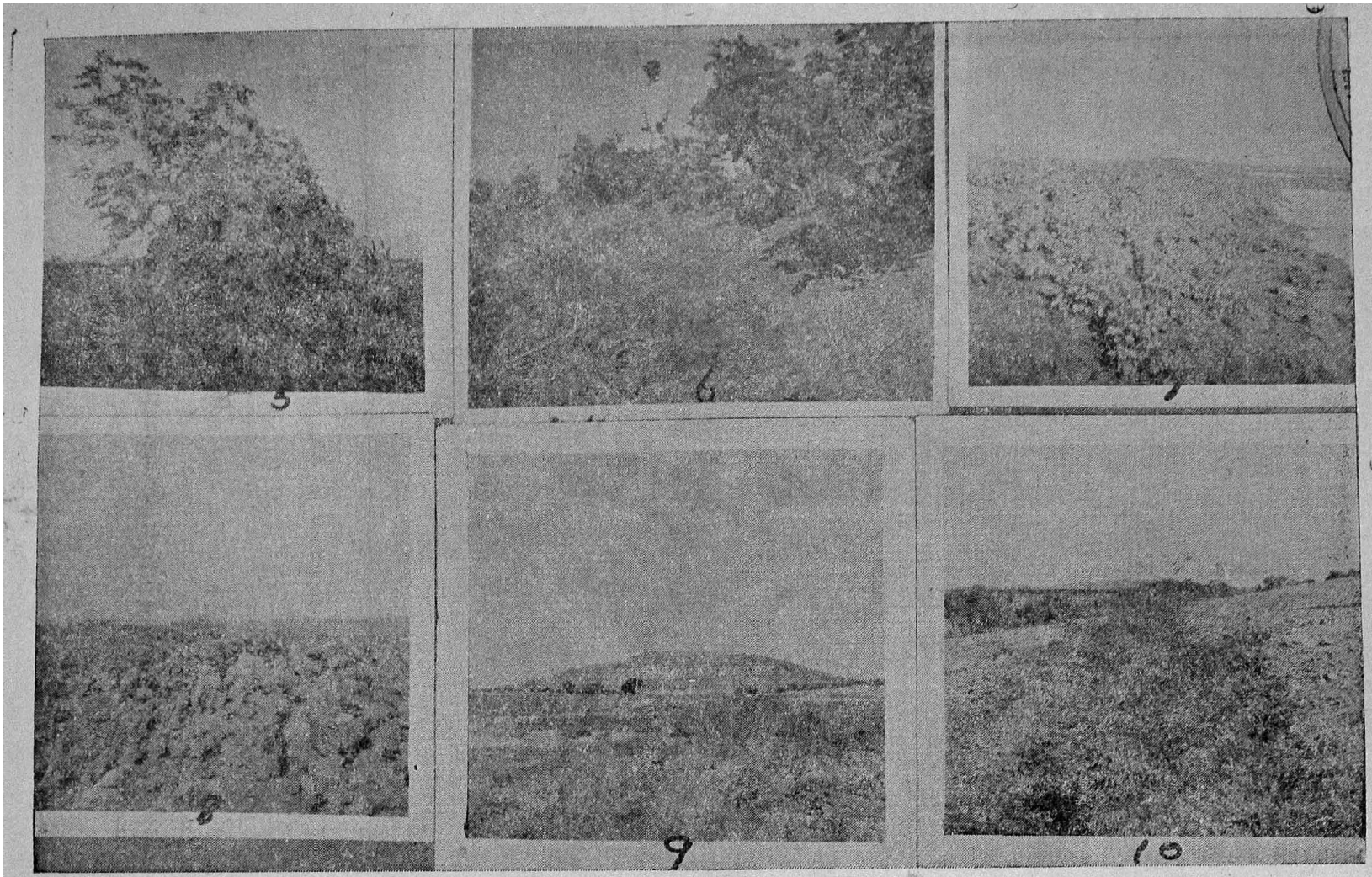

Fig. 5. Castor grown on bunds in Guntakal area – Note the luxurient growth in one season.
Fig. 6. Perennial Cotton (Moco) on bunds in Alur area – Note the vigorous growth in one season.
Fig. 7. Vegetables (gourd variety) on bunds in Guntakal area – These are sown by ryots
Fig. 8. Vegetables (gourd variety) on bunds in Guntakal area – These are sown by ryots.
Fig. 9. A general view of the contour trenched hillock in the Hagari area – Note the Contour Trenches seen from a long distance.
Fig. 10. A close view of the Contour Trenches in Hagari Centre – Note the thick growth of Prosopis sown in August 1951.

up soil, quick growing trees were sown. Notably, *Prosopis, Albezzia lebbeck, Neem, Delonix regia, Tamarind, Babul* etc., have been tried and found to thrive well. In an area of about 21 acres sown in August 1951, the seedlings are about 1' to 4' high. In another hillock extending over 57 acres, sowings were completed during May 1952. The results have not been so spectacular due to adverse seasonal conditions. The slopes in the contour trenched area vary from 15 to 30% and practically there is no soil except gravel and disintegrated rock. This is an example to show that even barren lands could be put to profitable use and afforestation is the ideal solution. The cost of contour trenching and afforestation works to Rs. 70/- on an average.

Soil Conservation in the Nilgiris: The plateau of Nilgiris, where the most important hill station—Ootacamund—is situated is dotted with innumerable hillocks. The rolling topography and the heavy rainfall added to the exploitive agricultural practices has caused large scale soil erosion. Cultivation of steep slopes even upto 1 in 1 is practised and under the Grow More Food Campaign, more forest areas were cleared, which resulted in widespread soil erosion. The havoc caused is so spectacular that even the public agitated for taking up soil conservation schemes to prevent further soil erosion. The State Government have sanctioned a pilot scheme to start with in Ketti Valley in Nilgiris. It is a self-defined catchment and topographic survey has been completed over 300 acres out of which 88·65 acres are proposed to be tackled first. The measures contemplated are: (i) Terracing. (ii) Bench terracing. (iii) Trenching and afforestation. (iv) Providing diversion channels. (v) Stream protection. (vi) Gulley plugging. (vii) Contour cultivation. (viii) Rotational cropping. (iv) Manuring and other improved agricultural practices.

The estimates have been just sanctioned and the provisions of the Madras Land Improvement Schemes Act are being evoked to complete the work. Simultaneously, topographic surveying and an erosion survey of the Nilgiris is being conducted by the special staff.

Soil Conservation Schemes as Famine Relief Measure: Soil Conservation Measures particularly contour bunding, gully plugging etc. are ideal famine relief measures. It is a famine averting measure as well, as it safeguards the crop during adverse seasonal conditions by conserving the little moisture. As the work involves mostly earth-work excavation, unskilled agricultural labour can be easily engaged on such work. The State Government considering all these aspects have ordered that contour bunding be included in the list of famine works in preference to orthodox famine relief works of dubious value like breaking metal road etc.

Due to widespread adverse seasonal conditions during 1951—'52 and 1952—'53, the Government were faced with the problem of providing work in the affected areas. Government ordered that a soil conservation scheme be taken up in Chittoor and Coimbatore. At present these two schemes are in operation and 3,600 acres have been covered.

The areas selected under the Famine Relief Projects are red soils. Therefore, bunds $\frac{6'-6''+1'6''\times 1'-6''}{2}$ high at 150' intervals have been adopted. Being a Famine Relief Measure and in view of the urgency of the scheme direct contouring was adopted, but care was taken to avoid zig-zag alignment and fragmentation of holdings. One of the encouraging signs in the famine relief works are that the owners themselves came forward to work or supply labour. With a view to provide economic relief, Government have proposed to recover only half the cost of land improvement measures which would be about Rs. 25/- on an average per acre and that too in 20 annual instalments.

Other Schemes: Numerous schemes for protecting the eroded lands in Madras State were investigated and are at several stages of scrutiny. But it is doubtful whether the State Government will be able to undertake them due to the financial stringency.

State Soil Conservation Board: On the recommendation of the soil conservation experts of the Government of India, the State Government have constituted a State Soil Conservation Board, with a view to initiate and co-ordinate land utilisation and soil conservation schemes. The Director of Agriculture, Joint Director of Agriculture, Secretary to Government and Heads of other Development Departments are members of the State Soil Conservation Board. The Hon'ble Minister for Agriculture is its Chairman and the Assistant Agricultural Engineer, Soil Conservation Scheme, Bellary is its Secretary. The Board meets once in three months to review the work done and scrutinise soil conservation schemes in the State. What has been done in soil conservation in Madras is negligible when compared to the magnitude of the problem. Finance has been the main bottleneck for further expansion but it is hoped that ere long it will be possible to undertake more projects both on the Extension and Research side of soil conservation and land utilisation.

Legume Inoculation

By

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Introduction: Crops are broadly classified as recuperative and exhaustive from the point of view of soil fertility. This character is utilised by the farmers in including recuperative crops in rotation with or in mixtures with exhaustive crops to maintain a balance of soil fertility. The so-called recuperative crops are not always builders of soil fertility. Under the best conditions these crops may help in increasing the nitrogen and the organic matter content of soils. Such crops belong to the family *Leguminosœ*. They are capable of assimilating the atmospheric nitrogen fixed by the bacteria present in the nodules of their roots.

We owe our knowledge on this subject to the famous German scientists, Hellriegal and Wilfarth, whose work in 1866 solved the mystery of nitrogen nutrition of plants which baffled many a famous scientist before. The production of a nodule on the roots of legumes is a pre-requsite for symbiosis. But, production of a root nodule alone is not the criterion of of nitrogen fixation. There are several factors which are involved in this. Among the root-nodule bacteria there are several types and strains which are specific for the different legumes.

It is a well established fact that a single strain of root nodule bacteria cannot gain entrance into the roots of all legumes and form nodules and fix atmospheric nitrogen. It can function only on a certain group of host plants. This is a definite character of each strain of organism. This inter-relationship is known as host-plant specificity. Unless an appropriate strain of root nodule bacteria is present in the soil, the legume cannot fix atmospheric nitrogen efficiently. This can be overcome by suitable bacterial inoculation.

Inoculation: The supply of efficient strains was originally accomplished by transferring a large amount of soil from a field where a previous crop of the same variety of legume grew successfully before. This process is very tedious, and time-consuming.

Modern advances in science have enabled us to cultivate selected strains of proved efficiency in pure culture on artificial media for inoculation of the seed prior to sowing. Initially liquid cultures were used but due to transport difficulties, this was abandoned and legume cultures are now being cultivated in pure state on soil medium and distributed for inoculation of the seed. Efficient strains of legume cultures are available with the Government Agricultural Chemist, Coimbatore for distribution to ryots on a limited scale for practically all the cultivated legumes of this State free of cost.

Inoculation experiments at Coimbatore: Experiments were conducted in 1·5 cent plots in duplicate at the Cotton Breeding Station, Coimbatore in 1935, and the data obtained is presented in Table I. The results show a definite increase in the total nitrogen content of legumes by inoculation on sunnhemp, green-gram and black gram.

Table II gives the increase in soil nitrogen due to inoculation. Red gram increased the soil nitrogen by 20% whereas sunnhemp and cluster beans were half as efficient as red gram.

Table I showing the effect of inoculation on the yield of legumes.

Variety of legume	Experimental area cents	Uninoculated		Inoculated		Percentage Increase	
		Dry wt. lb.	Total N. lb.	Dry wt. lb.	Total N. lb.	Dry wt. lb.	Total N. lb.
Green gram	0·5	10	0·13	12	0 17	20	30
Cluster bean	0·5	19	0·38	20	0·38	5·3	0
Sunnhemp	1·5	57	1·05	61	1·43	8	36·2
Red gram	1·5	44	0·84	57	1·1	31	32

Table II showing the nitrogen status of the soil due to cultivation of legume.

Name of the crop	Uninoculated Total nitrogen	Inoculated Total nitrogen
	%	%
Cluster bean	0·046	0·051
Sunnhemp	0·055	0·045
Red gram	0·055	0·066

N. B:— Percentage of nitrogen in the soil (before sowing 0 046%)

Another experiment was conducted at Coimbatore to determine the relative efficiency of some of the common green manure crops: Daincha, Sunnhemp, Pillipesara and Cowpea. They were grown and applied *in situ* and paddy was transplanted. The experiment was continued for eight years and at the end of this period it was found that the soil nitrogen was increased by 62·7% in daincha series, which was the highest value and 33·9% in cowpea series which was the lowest of all the four treatments.

Favourable Soil Conditions for Successful Inoculation: Inoculation of legumes with efficient strains of root-nodule bacteria can help only in fixing atmospheric nitrogen. It cannot rectify other soil defects which are limiting factors for successful growth of legumes. The following are the important limiting factors:

(1) *Lime and phosphate:* Legumes are heavy feeders of lime and phosphoric acid. If the soil is poor, the legume cannot come up well in spite of inoculation with efficient cultures. The soil should, therefore, be neutral and the lime status should be high.

Parretal (1 to 4) have shown that berseem was able to grow better and fix more atmospheric nitrogen by phosphate manuring. It

was reported that for every pound of P_2O_5 added, 2 lb. of nitrogen from atmosphere was fixed.

Some preliminary experiments (5) conducted by the Paddy Specialist at Coimbatore, Maruteru, Samalkot, Pattambi, Mangalore, and Tirurkuppam with an application of 30 lb. of P_2O_5 as superphosphate or bone meal compared with no phosphate on sunnhemp in the year 1949—'50, is summarised below :

Name of Station	Name of treatment	Crop showing increased yield	Percentage increase	Remarks
Coimbatore	Super	Sunnhemp	50	
Maruteru	,,	Paddy	10	Green manure crop received phosphatic manure
Samalkot	Super and bone meal	Pulse crop	8	Preceding paddy was manured. Not significant
		Pulse crop		Directly manured with phosphate, depressed yield by 8 to 19%. Not significant
Pattambi	Bone meal	Wild indigo	10	
	Super	,,		Depressed yield by 10%
	Super	Dhaincha	3–4	
		Paddy	1–2	Succeeding paddy crops
Mangalore	Bone meal	Black gram	33	
	Super		38	
Tirurkuppam	Super	Green manure crop	19	
	Bone meal	,,	3	
	Super	,,	21	1950–'51 experiment results significant

The success of phosphate manuring depends upon the placement and soil organic matter. If the organic matter content of soil is high better assimilation of phosphate is possible.

(2) *Adequate supply of moisture :* The legumes require sufficient amount of moisture for their growth. The nodulation stops if sufficient amount of moisture is not present. The results of the pot culture experiments conducted at Coimbatore are given below :

			Leaves	*Stems*	*Roots*	*Nodules*	*No. of nodules*
1/3	Saturation	Wet weight	2·18	4·68	13·17	..	..
		Dry ,,	0·67	1·71	1·80	..	..
1/2		Wet ,,	15·4	21·45	52·0	2·7	28
		Dry ,,	5 39	8·30	5·49	0·37	..
2/3		Wet ,,	14·74	17·23	43·65	1·49	43
		Dry ,,	4·60	6·50	5·01	0·24	..

It is seen that half saturation is the most optimum level of moisture favouring maximum growth. Excess of moisture is detrimental to the crop as air is excluded.

(3) *Alkalinity and Salinity:* The soil should be free from alkalinity or salinity for proper growth of legumes. Otherwise the crop will fail and the soil requires reclamation by the application of lime or gypsum, in conjunction with organic matter and leaching out the salts by flooding with good water and draining.

(4) *Soil nitrogen:* If the soil is already rich in nitrogen the root nodule bacteria of legumes cannot fix atmospheric nitrogen but feed on soil nitrogen like non-legumes. Under such conditions nitrogen fixation can be forced if legumes are grown after inoculation in mixture with cereals in the ratio of 1 : 3. For slow growing legumes, the ratio of the cereal should be decreased so that no smothering effect is observed. In which case half of legume to half of cereal may be satisfactory. The experiments done at Coimbatore and Pulses Sub-station at Vizianagaram definitely prove that growing legumes in association with cereals like sorghum results in increased yield of both the crops put together and in soil nitrogen.

If legumes are inoculated with efficient bacteria and grown in soil, adequately supplied with available phosphoric acid, lime, and moisture, of good drainage, free from alkalinity or salinity, we may expect a a fixation of 30 - 100 lb. of nitrogen from atmosphere which is equivalent to an application of 170 to 500 lb. of ammonium sulphate, the cost of cultivation being negligible.

Need for Inoculation could therefore be summarised as follows:

(1) When the particular legume is to be grown for the first time or after a long interval (4 to 5 years or more).

(2) When the growth of legumes is poor with stunted growth and pale leaves.

(3) When the nodules are not formed on the tap root or upper side roots.

(4) When the size of the nodules is very small, numerous and widely scattered, especially in the lower regions of the root system of legumes.

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A Note on Roselle—A Useful Economic Plant

By

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The variety *altissima* of the roselle plant (*Hibiscus sabdariffa*, L) commonly known as '*Kasigogu*' '*Pusa gogu*', or '*red gogu*' is cultivated in Madras State as a commercial fibre crop in dry lands in rotation with other crops and to a lesseer-extent in wetlands. Its growing popularity rests on its high yield, vigorous growth, capacity to resist drought and the plant is not damaged by cattle. This red-stemmed gogu variously named as 'roselle', 'sorrel', 'red sorrel', 'East Indian sorrel', 'thorny mallow', etc., has an additional appeal in its edible fruit. Howard and Howard (1911) state that almost every part of the plant can be utilised in some manner or other.

Roselle is a crop of some horticultural importance. The fleshy enlarged calyces which have a pleasant acid taste and a very attractive red colour are widely used in the preparation of chutneys in the Circars. The leaf is also put to a similar use. Crane (1949) has classified the plants of roselle into three groups based on the pigmentation, as follows: (1) Plants with stems, petioles, and clayces red, (2) Plants without red colouration, (3) Plants intermediate between the green and red types.

Of these the type with deep red pigmentation is considered to be the most useful for culinary purposes as it is associated with the least fibre content of the calyces and because of the brilliant colour which is imparted to the products made out of them. The plants of the variety *altissima* generally grow tall with a sparse branching habit and therefore the other types with their relatively short stature and multiple branching habit are chosen for either leaf or the fruit. One such type introduced for multiplication purposes described below, was raised at the College Orchard, Coimbatore during the year 1952—'53.

The plant: An annual, erect, short-branched shrub, producing many laterals; stem reddish with greenish blotches; side shoots red to deep red; leaf green with reddish or green veins; petiole red; pulvinus green in some cases and red in others; calyx red; corolla pink.

Propagation and details of performance: Roselle is generally raised from seeds. Seedlings may be transplanted with a spacing of three feet on field bunds. The plant can be propagated by rooting shoot cuttings. Thin, thick and medium type of shoot cuttings are found to root successfully recording in favourable months as in August to December at Coimbatore as high a success as 90 to 100 per cent. Plants

under shade are observed to crop better than those planted in open situations and can therefore be cultivated as an intercrop in orchards. Seedlings take five months for flowering whereas rooted shoot cuttings come to flower within three months after planting. The height attained by the former ranged from four to five feet while the rooted cuttings registered a height of three to four feet. It was possible to pick green leaves for consumption twice or thrice before the plants reached their full size and development. The flowering extends over a period of three months in the case of plants raised from seeds while in the plants raised from cuttings for a period of four months.

The edible calyces mature in about twenty days after blossoming. The calyces can be gathered when they are tender, plump, fleshy and of deep red colour. To extend the flowering period and to increase yields, it is desirable to pick the calyces promptly when they reach the above stage. The capsules begin to mature from the lower to the upper portions of the plant. When those in the middle portion of the plants are mature, the whole plant may be cut, dried sufficiently and threshed for seed collection.

Yield : An yield of about 1·5 oz. of seed per plant, 0 25 to 0·5 lb. of leaf and about 0·5 lb. of calyces was obtained under the conditions obtaining at Coimbatore. The yield per plant raised from cuttings was relatively less and amounted to only about half that obtained from seedlings. It is possible, however, that the yields would be appreciably higher under more favourable conditions. Wester (1920) remarks that under favourable conditions the crop can yield upto 10,000 to 14,000 lb. of calyces per acre.

The possible uses for the crop : In addition to the popular culinary uses of the leaf and calyces, there are other uses to which these may be put. Assay of a sample of the calyces by the Government Agricultural Chemist, Coimbatore gave the following analysis.

	Calyx.	Leaf.*
Moisture	88·26	86·2
Ash	0·87	1·0 (Mineral matter)
Crude proteins	1·46	1·7
Ether extractives (oil, etc.)	1·97	1·1
Crude fibres	1·58	
Carbohydrates	5·86	10·0
Lime	0·108	0·18
Phosphorus	0·052	0·04
Iron	0·021	0·0054
Acidity	1·83 C (X)	
	1·75 M (XX)	

(X—C. citric acid ; XX—M. Malie acic). * Adopted from Health Bulletin No. 23—The nutritive value of Indian Foods and the planning of satisfactory diets—revised and enlarged 1938—by W. R. Aykroyd, pp. 28.

A syrup made from the ripe calyces can be used pure or fortified with other fruit juices. A good jelly with a pleasing colour can also be made. A jelly "of satisfactory set and taste, with a dull scarlet colour" was obtained from the dried powder of the calyces by the Biochemist at the Fruit Technology Laboratory, Kodur. Among medicinal uses mention is made by Leupin quoted by Crane (l. c.) of a drug containing oxalic, citric, malic and tartaric acids obtained from the red types of roselle. The seed obtained from the *Altissima roselle* variety was also quoted by Crane (l. c.) citing George, (1923) to contain about 17% of an oil similar to kapok or cotton seed oil. Thus it is seen that roselle offers some scope for growing on field bunds as a good soil binder, provides material for culinary purposes and for making a jelly.

Acknowledgements: Grateful thanks are due to Sri M. S. Sivaraman, Director of Agriculture, Madras at whose instance the multiplication and distribution of this useful plant was taken up at the College Orchard, Coimbatore. Thanks are also due to the field staff who rendered assistance in the collection of field data and to the Government Agricultural Chemist and the Biochemist, Fruit Products Research Laboratory, Kodur P. O. for kindly furnishing the analysis of the sample and for the results of the trials on jelly making.

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A note on the propagation of Malta Lemon on the West Coast

Malta lemon is a quick-growing plant, which thrives well and bears heavy crops even under purely rainfed conditions on the West Coast. The fruits can be used for preparing squashes and also for other culinary preparations in the same way as the ordinary acid lime. The plant bears fruits almost throughout the year, particularly if it is watered periodically during the dry season.

At the Agricultural Research Station, Ambalavayal, Wynad, plants set out in 1946 and which started bearing early in 1948, have given an average annual yield of 150 fruits per plant, the maximum individual tree yield recorded being 600 fruits in certain years.

The usual methods of propagating the plant are by layering or by budding on any suitable rootstock but on the West Coast, it has been found that an easy method lies in rooting of hardwood cuttings. The layers as well as the rooted cuttings start bearing within about 18 months of planting. Raising layers or budded plants is a fairly laborious process and the number of layers that can be propagated even from a large-sized plant is limited. Further, in the process of layering many small shoots have to be cut and removed. In an observational trial conducted in July 1952, to find out if soft-wood cuttings which are normally wasted in the process of layering or taking hardwood cuttings could be profitably utilised for propagation, ten thousand cuttings were graded into five groups according to the thickness of the cuttings and planted in beds prepared with a mixture of ordinary soil, sand and compost in the ratio of 2 : 3 : 1. The number of cuttings of each group that sprouted were recorded thirty days after inserting the cuttings in the beds and at fortnightly intervals thereafter for two more fortnights. The data recorded are given below:

Thickness of cutting	No. of cuttings	30 days		45 days		60 days	
		Number sepa-rated	Percen-tage success	Number sepa-rated	Percen-tage success	Number sepa. rated	Percen-tage success
0·5 cm.	2,529	600	23·7	1,210	47·8	1,400	55·3
0·7 cm.	1,253	370	29·5	630	50 2	740	59·1
0·8 cm·	1,966	690	35·1	1,005	51·1	1,210	65·1
0·8 cm.	2,471	900	36·4	1,265	51·2	1,448	58·6
Over 1·2 to 1·3 cm.	1,800	820	45·5	1,090	60·5	1,402	77·8

From the data, it is evident that the cuttings with a diameter of 1·2 to 1·3 cm. offer the best material for propagation. No marked difference in the success in rooting of cuttings of 0·7 cm., and 0·8 cm. and 1·0 cm. diameter is noticed. It is thus brought out that propagation of

Malta lemon from shoot cuttings is to be preferred either to layering or budding in so far as the West Coast is concerned. The author's thanks are due to Sri P. G. Kurup, Pepper Specialist, for his guidance in the preparation of this note.

K. R. RAMAN, B. Sc. (Ag.), D. I. H.

Cultivation of Casuarina around pits

Along the sea-board, on the Masulipatam coast, there is the practice of raising casuarina gardens, around pits. By resorting to this method a return of over Rs. 100/-, per acre is secured per year, in this tract, as against lesser returns from other crops and systems of cropping. The method of raising casuarina around pits is different from the normal method of raising the crop. Fifty pits per acre are dug, at intervals of 30 feet from centre to centre of the pits. The diameter and depth of the pits are six feet roughly. The earth removed from the pits is spread all round the pit. In the ground so raised, 32 plants are planted in two concentric circles, around the pit. The plants are watered till they establish and in periods of drought till the third year. It is reported that, by adopting this practice, the growth and development of the girth of the plant, at the end of 3 years, is at least double that in the normal method. The earth removed from the pit and put around it for weathering is considered better than the soil *in situ*. The following is the expenditure and return from the culture of the crop, cut at the end of five years.

Expenditure :		Rs.	A.	P.
50 pits dug on contract in one acre, at 11 annas per pit	..	34	6	0
Cost of 1600 seedlings per acre, at 32 round each pit	..	5	8	0
Labour for planting – 4 men at Re. 1/- each	..	4	0	0
Watering for six months, on contract basis, in the first year	..	75	0	0
Watering for two months, in the second year	..	25	0	0
Harvesting labour in the fifth year for cutting and weighing at at Rs. 3—8—0 per ton, on a yield of 20 tons	..	70	0	0
Carting at Rs. 6/- per ton, on 20 tons	..	120	0	0
Total Rs.	..	333	14	0

Receipts :		Rs.	A.	P.
Cost of 20 tons of wood, at Rs. 40/- per ton	..	800	0	0
Loppings of dry wood from second year to fifth year	..	109	0	0
Loppings of the lower branches	..	100	0	0
Stumps and roots	..	10	0	0
Total Rs.	..	1010	0	0

Net Income for five years :
Rs. 1010—0—0 minus Rs. 333—14—0 or Rs. 676—2—0.
Annual return per year : Rs. 676—2—0 or Rs. 135—3—0.

Deputy Director of Agriculture, Eluru.

MULUKUTLA SATYANARAYANA.

Cost of cultivation of Jute in the Bhimunipatnam tract of the South Visakapatnam district

Jute is extensively cultivated in the Bhimunipatnam and Vijayanagaram tracts of South Visakapatnam district, including most of the area in North Visakapatnam district. It is cultivated for the purpose of fibre. Fibre is extracted in the normal way: (1) cutting the stems at base and heaping them in bundles and drying in sun for a period of 15 days, (2) wretting them in a pond for a period of one month, (3) removing them from the pond and extracting the fibre, (4) heaping the extracted fibre, washing it well and drying it either in sun or shade for a period of one or two days and (5) bundling the fibre. Each of such bundle weighs about 2 to 3 lb.

The cost of cultivation of jute per acre is given below :

Item No.	Item	Cost Rs. A. P.
1.	Cost of labour { Cattle	60—0—0
	Human	136—4—0
2.	Cost of manures (silt in this case)	10—0—0
3.	Cost of irrigation	.....
4.	Cost of seeds	3—0—0
5.	Preparation for the market	54—0—0
6.	Marketing	12—12—0
7.	Miscellaneous charges (included in the item No. 6).	
8.	Assessment on land	14—0—0
9.	Total expenditure (rounded off)	290—0—0
10.	Yield in lbs. { Fibre one ton	
	Straw or by product nil	
11.	A. Price per unit { Fibre. Rupees 150 per candy	
	Straw ... nil	
	B. Receipts	672—0—0
12.	Profit per acre	382—0—0

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AGRICULTURAL NEWS LETTERS

"Sowings of Mungari Cotton": The proportion of groundnut to mungari cotton has been very high this year due to, the prevailing high rates of groundnuts and also because of the ryots' preference of Laxmi cotton to mungari cotton. Laxmi cotton sown along with Farm cotton gave almost double the yield of Farm cotton in addition to fetching a better price. For this reason, the area sown to Laxmi cotton is expected to be equal to the area sown under Farm Cotton this season.

2. **Storing cotton seed:** Use of good seeds is essentially a part of good agriculture. For obtaining good yields it is imperative that we should use good seeds too. The Agricultural Department has been engaged in the evolution of superior strains in each of the important crops cultivated in this State, which by virtue of their inherent quality, have given increased yields ranging from 10 to 25% over the unselected bulk and are popular. Seed production and seed storage go together. Normally in cotton, seeds do not require to be stored for more than five months, that is, the period intervening between the harvest of one crop and the sowing of the next. But sometimes it so happens that seeds are not fully utilised for sowing during one season, when either a season is missed by the ryot or when a season is entirely unfavourable. Unfortunately a prejudice is entertained by some cultivators against using the seeds of one season, for sowing in the next. The seeds, when old, are alleged to become poor in viabiliity and incapable of giving normal yields when sown. Due to this erroneous belief, valuable seeds got during one season and left over after the season's sowings, are, instead of being preserved for the next year, used for purposes other than sowing, mainly as cattle feed.

Experiments conducted at the various Research Stations of our State which represent the different Cotton tracts go to disprove this popular belief. These experiments were conducted from 1948 to 1952 both with the American and Desi types of cotton seeds. Seeds were stored in single or double gunny bags and were also dried in the sun every month. This latter trial was done in order to find out the truthfulness of a belief among some cotton growers of the Tinnies tract that Cotton seeds should not be sun dried if good germination is to be ensured. The results have conclusively proved that these beliefs are groundless. Cotton seeds have been found to keep up good viability even after a period of two years' storage and even when they were sun dried every month. It was also sought to obtain data on yield and quality of the produce when such old seeds are sown. Seeds preserved over one season and seeds from the immediate previous harvests were sown and a comparison in crop performance, made between the two. The results have been very encouraging in that there was observed to be no difference, either in quantity or in quality, between the produce obtained using old and new seeds.

It is therefore to our benefit to store the seeds left over at the end of one season, either in single or double gunnies according to facilities available. If possible, seeds may be dried periodically, which will help also to see that no insect damage is done to the seeds. Such preserved seeds can safely be sown in the ensuing season and still normal yields obtained.

3. **Green Leaf manuring with special reference to Ipomea Cornea:** Application of green manure is one of the most economical and effective methods of not only adding nitrogen to the soil but also improving the soil texture. This is especially useful for wetland paddy cultivation.

There are two usual methods of applying green manure to the paddy crop. One is by growing green manure crops like *Sesbania speciosa*, Daincha, sunhemp. Pillipesara, indigo etc. 'in situ' and ploughing it in. This method is called green

manuring. The other is by cutting green leaf (including young shoots) from green leaf giving plants and applying the same to the crop. The first method is preferable, because the usually grown green manure crops being leguminous, have the peculiar property of fixing atmospheric nitrogen in their root nodules, and thus add considerable quantity of nitrogen to the soil when ploughed into the soil. But this method is possible only when there is sufficient moisture in the field after a crop of paddy for proper germination of the green manure seeds and when there is at least two to three months' interval between the crops of paddy when double cropping is the practice. Growing green leaf yielding plants on big bunds and vacant spaces nearby the paddy area and applying the leaf from these plants to the paddy crop before planting is essential for attaining increased yields and improving the soil texture.

Glyricidia maculata is one of the plants recommended for this purpose. At the College Farm, Bapatla another plant useful for the purpose is also grown on field bunds along with *Glyricidia maculata*. It is called *Ipomea cornea*.

The spread and the total green matter obtained from a one year old *Ipomea cornea* plants are very much more than those of a *Glyricida maculata* plant of approximately the sams age. Though the percentage of easily decomposable material is more in the case *Glyricida*, the amount of such material per plant was much greater in the case of *Ipomea cornea*. *Ipomea cornea* stands pruning fairly well, and after the first cutting (i. e. about one year after planting) the next cutting can be taken in about four to five months. It can be easily propaged by cuttings which establish quickly when planted in the rainy season at the time of planting of paddy.

Ipomea cornea bears big light violet flowers of ornamental value and the plant itself with its leaves and bushy habit is ornamental, and can be profitably planted along paths and roads.

4. **Mangosteen—A remunerative fruit crop for South India:** Mangosteen, a delicious tropical fruit has been in cultivation in the Kallar and Burliar Fruit stations for the past 40 years. Experience gained at these stations has shown that this crop is highly remunerative. On an average the profit per tree during the last ten years worked out to Rs. 11/- which amounts roughly to Rs. 700/- per acre. The crop at Kallar Fruit station, during the year 1952–'53 has given a record average yield of 1,075 fruits per tree returning a net income of Rs. 3,540/- from an acre of plantation.

The above return was based on the moderate prices charged at the station and as such the income is calculated to be much more at competitive rates. Mangosteen is one of the very few luscious fruits of the tropics. The longevity of trees is invariably more than a century. Considering the great demand for the fruit and the very limited area at present, under the crop in South India, it is definitely one of the most promising crops for extended cultivation with immense profit. (Director of Agriculture, Madras).

ESTATE AND COLLEGE NEWS

The Agricultural College took part in a number of competitions both literary and games during this month. The College was awarded the second place in the inter-collegiate dramatic competition held at Coimbatore. Sri F. Andrade IInd B. sc. (Ag.) class was awarded the second individual cup. The College also took part in the University Inter-collegiate Debate competitions held: English at Tirupati, Tamil at Salem and Kannada at Mangaloro. Sri Sundaram Subramaniam IInd year student was awarded the first prize (a gold centered silver medal) in the Essay competition held by the S. P. C. A., Coimbatore. A variety entertainment in aid of the Students' Club was held with Sri K. Sreenivasan, Manager, Kasturi Mills, presiding. There was a large gathering and the performance was much appreciated.

Sports: The newly instituted Coimbatore District Hockey Association shield was won by the Agricultural College team. The College became District hockey champions by winning the knock out tournament. The football team has come to the finals in the Palghat Asher Memorial Cup Tournament. In the Madras University, Coimbatore Division Sports the College shared the championship honours with the Government Arts College, Coimbatore with 45 points each. Sri B. M. Ponnappa of the Final Year won the first prize in the Madras Forest College Open Invitation one mile race.

Social Service League: The night school is running regularly and the attendance is encouraging.

EXTRACTS AND GLEANINGS

Water for Poultry: It is often stated that feeding is the most important single factor in poultry raising. Water is an essential nutrient and the best of feed will fail to achieve satisfactoy results unless supplemented with an adequate supply of suitable water. Its importance should be readily realised when the following points are considered: (a) The body of a hen is almost two-thirds water, (b) Eggs are approximately two-thirds water. (c) Egg production is closely related to water consumption. (d) A fowl consumes more than twice as much water as feed (by weight) and considerably more in hot weather. A low intake of water results in slow growth among chickens and growing stock, and decreased egg production from the layers. The supply of water to poultry should be looked at from the angle of quality as well as quantity, for when poultry are deprived of sufficient water the effect is dramatically shown in sharply decreased egg production, and even neck moulting.

One reason why the quality of water supplied to poultry is frequently given but little attention is because the effects of poor-quality water-except in cases of poisoning and disease outbreaks—are not so spectacular, but experiments have shown the close relation between water consumption and egg production, whence it follows that anything tending to lower the intake of water will be in some degree detrimental to the birds' efficiency. Stagnant, salty, or over-medicated water is not so attractive to birds as clean fresh water and will be consumed in lesser quantities—with the previously mentioned results. Sometimes it is argued that fowls prefer dirty water because after rain they may be seen drinking muddy water from various small pools around the yards. Rain water is often fresher than that from the average water trough with its content of decaying feed, washed from beaks, and the sides often covered with green slime. Bore water containing up to 200 grains of salt per gallon may be used for poultry, but concentrations much heavier than this could cause mortality, especially among chickens, which appear more susceptible to excessive doses of salt. In any case it is preferable where possible to supply salt in feed and provide fresh drinking water. Medications such as bluestone (copper sulphate) and Condy's crystals (permanganate of potash) which are in common use, should not be given unless on veterinary advice. Bluestone may have some value in fungal diseases but is of no value for the treatment of roundworms, although it is frequently employed for this purpose. Over-dosage will prove harmful to poultry. Homemade "tonic" concoctions and "cure-all" medicines frequently do more harm than good and it is recommended that nothing which may possibly cause a lowering of water consumption should be added to water for poultry. Of course this excludes ethical medications for specific diseases, added to water for limited periods—such as the sulpha drugs for coccidiosis.

Frequent cleaning of troughs is advocated to maintain the water in fresh condition and as a measure of disease control. Troughs should be so located that water does not become overheated, droppings are excluded and dampening of litter or surroundings is avoided. Watering facilities should be provided in a shaded position close to the houses. In intensive or semi-intensive houses they should be attached to the outside of the shed and provided with a grille and shade skillion. A raised wovenwire platform is the position for water utensils in a brooder house. Tables of estimated average water requirements are oftcn published but rarely agree exactly and are of use only as guides. They should never be taken as maximum requirements as water consumption varies with factors other than age—such as type of feed, temperature, condition, and breed. The safost policy is to provide ample clean water so that it is available to the birds at ali times. (From Australian Government Trade Information Service AGN/427).

Controlled ripening of Bananas: It has been found that in shipment of Bananas premature ripening is activated by the production of ethylene by a few fruits. This can be checked by the presence of a small quantity of ozone. The ripening can be restimulated by dosing them with ethylene. (Science and Culture, Vol. 13, 1953. p. 194).

The keeping quality of eggs can be enhanced by dipping the eggs in mineral oil and cold storing them. The eggs from peak laying season may thus be made available at scarcity times without deterioration in quality. (Ibid. p. 193)

Rice in Ancient India: Amongst the plant remains from the excavations at Hastinapura 24 miles from Muttra were obtained certain charred remains of grains. These have been analysed and found to be of rice. It has been estimated that these remains must belong to a period between 1,000—750 B. C. (ibid. p. 207).

Improvement of Ground-nut in Belgian Congo: In the Belgian Congo ground-nut is cultivated almost exclusively by the natives alone and in some parts it forms the sole source of edible oil for them. In 1950 were sown 2,50,000 ha. and a yield of 650 Kg/ha. of nuts was obtained. Threefourths of this produce is consumed within the territory and only ¼ left for export. The several methods of improvement employed are 1. selection, 2. hybridisation and 3. cultural. Particular attention is paid to the oil, and protein contents, percentage of decortication, acidity lower than 4%, the size, shape, number and colour of grains, the pod formation and habit of plants (two extreme types viz., spreading and erect with numerous intermediaries). The variety Spanish is theoretically preferred since this has several advantages plus dormancy of seeds but the yield is not high and duration is long. About 200 collections of types from U. S. A., Brazil, Uruguay Argentina, Nigeria, Mozambique, Senegal, S. Africa etc. are maintained. Three series of hybridisation trials have been raised viz. Series. A. Akabumba var. rose grains, 50·7% oil content X Tubeya Illunga 317/1. red grained, 47% oil content. Series B. Tubeya Illunga 48·6% oil content X Sandoa A. 1050, grains rose, oil 49% and series C. A. 65 red grained oil 46·7% X Kigan grains red, oil 46·8%. Amongst agronomical trials are included time of sowing and effect on yield, method of sowing, presoaking of seeds, machine decortication, influence of size of grain on the crop, the seed rate, depth of sowing, time of harvest, methods of drying, method of preservation of pods with seeds in situ, cultures pure and mixed, (mixtures—maize-groundnut ; groundnut-cotton tried). (Bull. d' Inform. Inst. National. Congo Belge. vol. II. no. 3. 1953).

OBITUARY.

The Madras Agricultural Students' Union regrets to report the death of Sri K. Ramanujachariar, retired Agricultural Demonstrator, on 11th November 1953. He was an active member of the Madras Agricultural Students' Union till his retirement in 1945. May his soul rest in peace.

CROP AND TRADE REPORTS

Cotton Raw in the Madras State: The receipts of loose cotton at presses and spinning mills in the Madras State from 1st February 1953 to 9—10—1953 amounted to 234,145 bales of 392 lb. lint. The receipts in the corresponding period of the previous year were 284,981 bales. 340,043 bales mainly of pressed cotton were received at spinning mills and 120 bales were exported by sea while 1,142 bales were imported by sea. The progressive totals being 9135 exported and 72,322 bales imported during 1—2—1953 to 9—10—1953. (M. S. SIVARAMAN, Director of Agriculture, Madras.)

West Bengal 1953—'54 First Forecast of Sugarcane Crop: 47,000 acres have been estimated to be under Sugarcane crop this year compared to 50,300 acres and 52,300 acres reported respectively in the corresponding and final forecast of last year.

Third and Final Forecast of Gram: 410,000 acres have been estimated to be under gram this year compared to 487,700 acres last year. The estimated outturn of gram for the State as a whole is 139,000 tons this year compared to 164,400 tons last year. The average rate of yield per acre for the State as a whole is estimated at 9·23 maunds this year compared to 9·17 maunds last year.

Forecast of Summer Gingelly: The area sown with the crop is estimated at 5,300 acres this year compared to 7,100 acres last year. The total outturn of the crop of the state as a whole is estimated at 900 tons this year compared to 1,520 tons last year. The average outturn per acre of the crop for the State as a whole is estimated at 4·52 maunds this year compared to 5·82 maunds last year. (Director of Agriculture, West Bengal.)

Weather Review — For the month of October 1953.

RAINFALL DATA

Division	Station	Total rainfall for the month in inches.	Departure fromnormal in inches	Total since 1st January in inches	Division	Station	Total rainfall for the month in inches.	Departure fromnormal in inches	Total since 1st January in inches
Orissa & Circars	Gopalpur	1·9	—6·7	43·0	Central Contd.	Vellore	8·1	+ 1·3	28·2
	Calinga-patnam	6·7	—1·2	44·3		Gudiyatham*	8·2	+ 2·4	24·0
	Visakha-patnam	8·1	+0·3	32·1		Salem	12·7	+ 6·3	49·8
	Arakuvalley*	..	..	..		Coimbatore (A. M. O.)*	8·5	+ 2·5	30·1
	Anakapalle*	..	..	..		Coimbatore	8·6	+ 2·3	29·6
	Samalkot*	10·4	+1·6	37·5		Tiruchirap-palli	13·9	+ 7 6	36·5
	Kakinada	17·7	+9·2	40·0					
	Maruteru*	9·0	+1·0	38·4	South	Naga-pattinam	4·8	— 5·8	19·4
	Masuli-patnam	11·1	+2·5	39 6		Aduturai*	6·7	+ 0·8	19·0
	Guntur*	..	..	..		Pattukottai*	8·8	+ 3·6	21·3
	Agrl. College, Bapatla*	..	..	..		Madurai	11·0	+ 3·6	38·5
						Pamban	10·0	+ 1·9	16·7
	Agrl. College, Farm, Bapatla*	..	..	..		Koilpatti*	7·4	+ 1·4	20·1
						Palayam-cottai	5·5	— 1·6	16·1
	Renta-chintala	8·4	+3·4	32·3		Amba-samudram*	9·2	+ 2·8	24·1
Ceded Districts	Kurnool	10·0	+6·8	33·5	West Coast	Trivandrum	20·7	+10·0	66·3
	Nandyal*	8·0	+4·1	30·4		Fort Cochin	20·2	+ 6·8	104·8
	Hagari*	..	..	..		Kozhikode	13·2	+ 2·1	97·0
	Siruguppa*	4·8	+0·3	23·5		Pattambi*	15·8	+ 7·1	79·7
	Bellary	11·3	+7·1	27·9		Taliparamba*	12·1	+ 8·4	104·8
	Cuddapah	6·7	+1·8	19·4		Wynaad*	11·8	+ 3·2	86·4
	Kodur*	..	..	..		Nileshwar*	17·3	+10·7	125·7
	Anantapur	12·7	+8·8	34·1		Pilicode*	..	..	..
						Mangalore	9·3	+ 2·0	113·8
Carnatic	Nellore	15·9	+6·3	26·3		Kankanady*	8·7	+ 1·4	117·8
	Buchireddi-palem*	..	..	..	Mysore & Coorg	Chitaldrug	9·6	+ 4·8	19·1
	Madras (Meenam-bakkam)	18·7	6·7	31·0		Bangalore	19·8	+13·9	47·1
						Mysore	14·8	+ 8·9	37·1
						Mercara	11·5	+ 3·2	129·0
	Tirur-kuppam*	20·0	+10·9	33·9	Hills	Kodaikanal	19·8	+ 9·6	58·5
	Palur*	12·8	+5·8	33·6		Coonoor*	14·4	+ 5·3	55·0
	Tindivanam*	8·5	+3·2	27·1		Ootacamund*	16·7	+ 8·5	58·4
	Cuddalore	14·5	+3·0	34·5		Nanjanad*	15·4	+ 7·2	72·6
Central	Arogyavaram (Chittoor dt.)	13·9	+8·5	31·9					

Note :— 1. * Meteorological Stations of the Madras Agricultural Department.

2. Average of eight years data for Arakuvalley is given as normal.

Weather Review for October, 1953

A weak low pressure area lay over Bihar and the adjoining areas on 1-10-1953 and this became unimportant on the evening of the following day itself. During the commencement of the month a cyclonic circulation lay over the south peninsula upto 7,000' above sea level, but this moved into the Arabian sea on the very next day. Another cyclonic circulation appeared over the Deccan on 5-10-1953 and this weakened on 8-10-1953. On 8-10-1953 itself a weak trough lay over the south-east and the adjoining east-central Arabian sea. This persisted upto 13-10-1953, when it became unimportant off the Malabar-Kanara coast. The monsoon withdrew from the country, outside the south peninsula on 9-10-1953. A long pressure wave began to move across the south Bay of Bengal on 11-10-1953 and this moved away westwards across the comorin area on 14-10-1953. Consequently a low pressure area appeared over the south-east Bay of Bengal, which moved slightly westwards and became less marked on 18-10-1953. In the meanwhile on 17-10-1953 a trough also lay over the south-east Arabian sea off the Malahar coast, which concentrated into a depression with its central region at 08·30 hours I. S. T. on 20-10-1953, near about Lat. 10° N, Long. 68° E, weakened again and passed away westwards on 22-10-1953. During this period on 19-10-1953 a trough of low existed in the south-east Bay of Bengal and the adjoining south Andaman Sea, which concentrated into a depression, centred at 08·30 hours. I. S. T. on 21-10-1953 near about Lat. 11° N, Long. 83° E. This depression lay close to the coast near Nellore on 22-10-1953, weakened on the same day and moved westwards across the south Peninsula as a low, which entered into the east Arabian sea off the Kanara coast on 25-10-1953 and persisted there upto the end of the month and weakened.

On 23-10-1953 a low pressure wave was moving westwards across the Andaman sea and caused markedly unsettled conditions in the south-west Bay of Bengal, where a depression formed on 26-10-1953, which moved north-westwards and was centred at 150 miles east of Nellore on the morning of 27-10-1953. This depression weakened on the very next day to a low pressure area off the circars coast and persisted there upto the end of the month. Under the influence of the two depressions rainfall was widespread in the Region with locally heavy falls, especially in coastal Andhradesa from 21-10-1953 to 27-10-1953. Three western disturbances moved across the extreme north of the country during this month.

The noteworthy rainfalls and the zonal rainfall for the month are furnished hereunder :

Noteworthy Rainfalls for the Month

S. No.	Date	Name of place	Rainfall for the past 24 hours (in inches)
1	7—10—1953	Hindustan Air port, Bangalore	6·7
2	21—10—1953	Pamban	5·1
3	21—10—1953	Cuddalore	4·0
4	22—10—1953	Kakinada	7·6
5	22—10—1953	Masulipatnam	7·2
6	22—10—1953	Ongole	7·3
7	22—10—1953	Nellore	6·3
8	26—10—1953	Trivandrum	7·3

Zonal Rainfall

S. No.	Name of Zone	Rainfall for the month (in inches)	Departure from normal (in inches)	Remarks
1	Orissa and Circars ..	9·16	+ 1·26	Above normal
2	Ceded districts ..	8·92	+ 4·82	Far above normal
3	Carnatic ..	15·07	+ 5·98	do.
4	Central ..	10·56	+ 4·41	do.
5	South ..	7·98	+ 0·84	Just above normal
6	West Coast ..	14·34	+ 5·74	Far above normal
7	Mysore and Coorg ..	13·93	+ 7·70	do.
8	Hills ..	16·58	+ 7·65	do.

Agricultural Meteorology Section, Lawley Road Post, Coimbatore } C. B. M. & M. V. J.

Departmental Notifications

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Srinivasan	S. D. O. Vellore	Asst. in Pulses, Coimbatore
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Secretary,
M. A. S. Union.

Announcement

INDIAN DAIRY SCIENCE ASSOCIATION

ESSAY CONTEST

The Indian Dairy Science Association has pleasure in announcing as Essay Contest organised with the aim of stimulating interest in dairy science and of focussing attention on the vital importance of dairy industry in the economic development of our country as well as in the improvement of the health of the population. *The Contest is open to all bonafide students of dairy institutes, agricultural and veterinary colleges and other educational institutions.*

2. The subject of the essay will be "Application of Refrigeration in Improving the Dairy Trade in India".

The essay should particularly aim at focussing attention on the importance and scope of refrigeration in the dairy trade and include concrete suggestions for the practical application of refrigeration methods in the handling, storage and marketing of milk and milk products under different conditions prevailing in this country, along with a discussion of the economic aspects involved.

3. Each essay must be written *in English and must not exceed 3,000 words* or 10 foolscap pages of typed matter (with 2" margin and double spacing). The essay must deal directly with the problem and its solution. The logical development of the subject, clarity of thought, considered in judging the merits of the essay.

4. *Three typed copies* of the essay must be submitted to the Hon. Secretaries. Indian Dairy Science Association, Hosur Road, Bangalore 1, so as to reach them *not later than 15th January 1954.*

5. Each copy of the essay must be signed by the candidate and must bear his or her full name and complete postal address. The essay must also be accompained by a certificate from the Principal, Director, or Head of the Institution to the effect *(a)* that the candidate submitting the essay is *bonafide* student of the Institution, *(b)* that he/she is studying for.....course (or has appeared for an examination in.....course, the results of which have not yet been announced) and *(c)* that to the best of his knowledge the essay is the original work of the student.

6. Two Medals, one gold and another silver, donated by The Blue Star Engineering Co. (Bombay), will be awarded to the two best essays submitted by the students in the order of merit. The essays will be judged by a Committee of Referees nominated by the Association and the decision of the Judges will be final and binding on all concerned. If in the opinion of the judges, the essays received are not upto the standard, no prizes will be awarded.

7. The results of the contest will be announced in the Press and the prize-winners will be informed individually. The prizes will be distributed offically at the Annual General Body Meeting of the Association to be held in March/April 1954.

8. All essays submitted for the contest will become the property of the Association who will have the sole right to publish, use or quote the material or otherwise dispose of it in any manner it thinks fit.

9. Any other information required can be obtained from :

THE HON. SECRETARIES,
Indian Dairy Science Association,
Hosur Road, BANGALORE 1.