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BETEL-VINE

(Concluded from previous issue)

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We are now in a position to sum up the results of the experiments in Plot 5 and of the control Plots 3 and 4, and to draw inferences.

1. The raised rows of Plots 5 all put together, have, every month, for 13 harvests, given an increased yield over the local rows all put together, the percentage increase being about 27 for the consolidated total yield.

2. The northern half as a whole, and the southern half as a whole, of Plot 5, have similarly shown that the raised rows have given a 27 % increase of yield over the local rows.

3. When we consider the 5 series of experiments separately, the 1st, 2nd and 4th series have given emphatically positive results in favour of the 'raised rows'; the 3rd and 5th series have given apparently negative results, but when allowance is made for the advantage of position and for the behaviour of contiguous series in the adjoining plots 3 and 4, they also bear out that the 'raised rows' have given a definite increase over the local rows.

4. While the tendency of the soil is for the yield to diminish as we go from south to north, raising the rows has counteracted this tendency.

5. All these, indirectly go to show that defective drainage is the chief factor responsible for the poor yield of the crop; for, raising improves drainage conditions and has given higher yields. Correlating the two, we have the inference, that improving the drainage will increase the yield. In our experiment, raising the beds, was one of the methods, by which drainage was sought to be improved.

Leaving these figures and the clear inferences they lead to, we have now to look to the lay out of the experiment in plot 5, and find out any defects before we can say that the increased yields which have been obtained and proved to be significant, are really due to the raising of the beds—and therefore to defective drainage.

The experiment in fact, was far from perfect, and the following defects could be noted :

1. The raising of the three alternate beds was done when the betel vine had grown to some height, and unequal conditions (number of plants, healthy and diseased specimens, etc.) prevailed in the several rows.

2. Originally, soil from Plot I was intended to be used, but, as this was found impracticable, tank silt was used to raise the rows, and it might be argued that the increased yield was due to the manurial capacity of tank silt and not to the raising itself.

3. The betel vine itself is peculiar, in that it has adventitious roots, and raising the beds after the crop is planted would have stimulated these roots to strike into the top soil applied fresh, the bottom roots stopping to function. In other words, the crop on the raised rows, can be likened to a new crop, and on the face of it, it is an error to compare it with the 'local' crop.

We are thus led to confess that unless these defects are obviated, we cannot lay too much value on these results, and at best, the experiment in Plot 5, should be regarded as a preliminary to further work and confirmation. The results however, are valuable, as an indication of the direction wherein lies the defect of the soil, if not as a positive confirmation of such indication.

The defects of Plot 5 were therefore eliminated, in Plot I, where the same experiment was repeated. Herein, the raising was done to a height of 1½ feet by tank silt. The local rows were dug out to the same depth and filled in with tank silt. Thus the local and the raised rows have the same soil. The planting was done after the raised beds had been formed and an equal number of plants put in each row. Thus all possible conditions equalised, any difference in yield can be attributed only to the 'raising', and figures obtained go to show, that what was indicated in Plot 5, with all its defects, of lay out, is amply borne out. Below is given a statement showing the yields of the raised and the local rows in Plot I month after month, and it will be seen that the Raised rows again show a 27 % increase over the 'Locals'

Month of harvest	Raiseds Lbs.	Locals Lbs.	Percentage increase of raised over locals
1. July 1927 ...	36·4	31·5	15·5
2. September ,, ...	93·8	65·6	43·0
3. October ,, ...	109·4	85·6	27·7
4. November ,, ...	207·0	163·9	26·3
,, ,, ...	144·0	94·6	51·0
5. January 1928 ...	149·5	117·1	27·6
6. February ,, ...	175·6	134·6	30·5
7. March ,, ...	139·2	109·7	27·5
8. April ,, ...	261·4	255·3	2·43
9. May ,, ...	213·2	193·8	10·0
10. June ,, ...	216·8	179·4	20·9
11. July ,, ...	233·6	193·1	21·0
12. August ,, ...	206·8	152·3	35·8
13. September ,, ...	276·7	236·9	16·8
14. October ,, ...	244·5	192·4	27·1
15. November ,, ...	321·3	235·3	36·6
16. December ,, ...	265·7	191·9	38·5
17. January 1929 ...	247·3	164·8	50·1
18. February ,, ...	260·6	195·8	33·1
19. March ,, ...	204·3	140·4	45·5
Total ...	4007·7	3134·0	27·9

Manurial Experiment. This experiment was conducted in Plot 2 which is divided into two halves, one being unlimed and the other limed at 1000 lbs. per acre. Within each half, there are thirty rows again, as in Plots I, III, IV and V, and every three rows were manured alternately with organic manure and mineral manures. The object of the experiment was mainly to test the tenacious belief held by ryots that earthworms are the cause of damage to the betel vine crop. By growing betel vine on rows manured with mineral manures like Potassium Nitrate and Super, the assumption is that we are minimising the chances of earthworm-breeding, for, earthworms require a lot of organic matter. If, therefore, the 'mineral manure' rows yield more than the 'organic manure' rows and, if it could also be shown that they contain less earthworms there is something to be said for the ryots' opinion. But, if the contrary is found to be the case, the earthworm theory will have to be exploded. The Entomologist, in fact, has been making a statistical survey of the earthworm population month by month, and his figures correlated with the harvest yields should be able to throw light on the question and clear the charges laid at the door of the earthworms. The lay out and the monthly figures connected with this experiment are sufficiently voluminous to deserve attention in a separate paper which can be done at a later date. So far, the following inferences can be made from the harvest records:

(1) The limed half is better than the unlimed half.

(2) Both in the limed and in the unlimed halves the organic manure rows have been giving slightly higher yields than the mineral manures and a higher percentage of good quality leaves.

Analyses. Besides mere record of harvest yields and linear measurements of leaf samples drawn at random, an attempt was also made to see if analyses of samples of leaves from the healthy, the diseased, the raised, and the local portions of the various plots could throw any light on the mineral matter content, and the physiological metabolism within the leaves. For this purpose, samples were collected from the September, October, and November yields of 1927 and these were analysed for their mineral and other constituents.

Results of analyses of Betel Leaves
HEALTHY AND DISEASED

	SEPTEMBER LEAVES		OCTOBER LEAVES				NOVEMBER LEAVES			
	Samples taken from all plots		Samples from plot 3		Samples from plot 4		Samples from plot 3		Samples from plot 4	
	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased
Original moisture ...	84·04	76·64	79·26	76·60	83·52	76·21	81·33	79·17	85·60	72·50
Organic matter ...	84·25	85·55	86·54	85·32	83·24	85·80	85·41	85·78	83·78	84·21
Insoluble mineral matter..	4·15	3·81	3·34	4·13	3·45	3·91	3·72	3·42	3·93	3·12
Soluble mineral matter...	11·60	10·64	10·12	10·55	13·31	10·29	10·87	10·80	12·29	11·67
Iron and alumina ...	0·66	0·44	0·55	0·44	0·60	0·68	0·63	0·67	0·67	0·72
Lime ...	1·82	2·02	1·28	1·54	1·49	2·30	1·32	1·79	1·36	1·92
Magnesia ...	1·32	1·79	1·82	0·83	1·40	1·16	1·91	1·38	1·51	1·41
Potash ...	5·13	3·83	4·17	3·87	4·24	3·09	4·22	3·71	3·98	3·41
Phosphoric acid ...	0·66	0·55	0·70	0·50	0·86	0·62	0·63	0·69	0·92	0·85
Nitrogen ...	3·04	1·75	2·64	2·32	2·74	2·40	2·53	2·38	2·78	2·63

Note. The results tabulated are the averages of duplicate analysis, except in the case of the November leaves. The analyses of the September and the October leaves showed close agreement in duplicate and hence the November samples were not done in duplicate.

Results of Analyses of samples of leaves drawn the Raised and Local portions, October 1927

Heads of analyses	Plot 5		Plot 1	
	Raised	Local	Raised	Local
Moisture	76·00	81·50	83·00	82·00
Organic matter	87·92	91·29	83·46	84·42
Insolubles	1·72	1·56	2·49	2·51
Solubles	10·36	7·15	14·05	13·07
Iron and alumina	1·10	·68	·95	·42
Lime	·79	·55	·95	·61
Magnesia	1·07	·74	1·28	·95
Potash	4·23	2·70	5·83	4·18
Phosphoric acid	·77	·42	·65	·81
Nitrogen	2·74	2·81	2·76	2·64

In addition to analysing the leaves, an attempt was also made to determine roughly the pH values of leaves by the colorimetric method. This had necessarily to be done under certain limitations and with certain handicaps. As the examination had to be carried out immediately after harvest, the necessary apparatus, chemicals and indicators had to be carried to the Vellalore Betel Vine Station, and even then, one could not command the facilities of an equipped laboratory, fitted with filter pumps, shaking machines etc.

Statement showing pH values of diseased and healthy betel leaves with different concentrations

Concentration	Kallas Variety		Karpurakodi Variety	
	Diseased	Healthy	Diseased	Healthy
150 gms. of leaves and 100 cc. of water ...	5·3	5·4	5·6	over 5·95
Do ...	4·8	5·2	5·6	over 5·95
Do ...	4·8	5·2	5·6	over 5·95
25 gms. of leaves and 100 cc. of water ...	5·6	5·95	...	...
Do ...	5·6	over 5·95	...	...
Do ...	5·6	over 5·95	...	...

The pH value figures show:

(1) that the diseased are more acid than the healthy leaves.
(2) the dilution increases the pH value.
(3) and that the pH value varies with the variety.

Interesting as these figures may be, we cannot say that they, as well as the results of the Chemical analyses will take us any further in arriving at the exact cause of the disease. The higher content of potash in healthy leaves will, however, seem to indicate that a potassic manure might do advantage to the crop. Potash, as an agent whereby disease resisting powers are developed, has been used in the case of other crops, and a useful line of attack will be to study the effect of potash as a fertilizer, on the incidence of disease on the betel vine.

Conclusion. The fact however remains, proved by the results of the drainage experiments, that defective soil conditions are the factors chiefly responsible for the poor growth of betel vine, and that drainage is the most important of these factors to be combated and overcome. In this connection, it will be interesting to read the report of the Government Agricultural Chemist, Bengal for the year 1925–26. Confronted with a similar problem he has arrived at similar conclusions, and attributes the poor yield of betel to defective drainage. But how is the ryot to tackle this problem effectively? Attention has already been drawn to the fact that raising the beds has its limitations and cannot be resorted to always especially in loose soils. It has been suggested that small hand pumps might be installed in betel vine gardens to pump out the excess of water stagnating in the field; to be practicable and successful economically, this has to be done as a co-operative concern. Again, the system of land tenure obtaining in the locality is to a certain extent responsible for the physical deterioration of the soil. In a six-year lease, the tenant tries to take as much profit as possible from the land, with the result, that the continuous cropping with crops like betel vine and sugarcane, keeps the land very much in shade, and minimises the chances of the soil to get aeration and weathering. A fallow now and then, or a less vegetative crop included in the rotation, will ameliorate the conditions. Co-operation again seems to be the only panacea; a little understanding between tenant and landlord, between one ryot and another will go a long way to remedy the defects of the soil.

I have finally to express my thankfulness to Mr. B. Visvanath the Government Agricultural Chemist, for his help and guidance in writing this paper.