

YELLOW LEAF DISEASE OF ARECANUT : COMPREHENSIVE PACKAGE PLAN*

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Investigations on yellow leaf of arecanut were initiated in 1959 at the Regional Arecanut Research Station, Palode (now CPCRI Research Centre). Early observations suggested that the disease was of virus origin and that manuring and spraying with micronutrients served to check the yellowing of leaves. It was thought that if the disease were proved to be of virus origin, it would be difficult to cure it, but the life of the palm would be prolonged and chlorosis checked by application of fertilizers and spraying of micronutrients (Anonymous, 1961). Analysis of soil collected from different gardens showed that the soil was deficient in nitrogen, phosphorus and potash. These soils were acid and the pH ranged from 3.8 to 5.4. Manuring with NPK and application of lime to correct the acidity were thus indicated from the above study. Field experiments were, therefore, laid out at Palode to study if the incidence of yellow leaf could be prevented altogether or at least controlled by the application of macro and micronutrients simultaneously. It was also decided to lay out some 'package plan' trial in cultivators' gardens involving application of macro and micronutrients to the soil (Anonymous, 1963, 1964). Dastagir (1963) reported that application of NPK with lime reduced yellowing and arecanut trees responded well to this treatment in the yellow leaf affected areas of Mysore (now Karnataka). Based on the above initial observations on the recommendations of the Pal Committee (1960) and Lal Committee (1964), a comprehensive package plan scheme intended to investigate the role of macro and micronutrients in different combinations on the incidence and control of yellow leaf of arecanut was operated from 1965 to 1969 at four centres in the disease affected areas of Kerala and Karnataka States. The results of the trial are presented here.

Programme.—The field trials were conducted at Koothattukulam, Annamanada and Punalur (Kerala) and Jayapura (Karnataka) in private gardens. The laboratory work connected with the scheme was carried out at Vittal. The scheme envisaged studies from three angles, viz., (i) survey of the areas for studying the symptoms and spread of the disease and influence of rainfall, cultural practices, soil type, topography and water table on disease incidence, (ii) field experiments (with macro and micronutrients) in growers' fields; and (iii) chemical analysis of soil and plant tissues including nuts. To study the symptomatology, nature of spread and factors associated with the disease, a detailed survey of 200 gardens selected at random was taken up in the above-four affected tracts. The major part of the scheme was a field experiment having 13 treatments conducted in the four centres (Koothattukulam—6 nos., Punalur—7 nos., Annamanada—7 nos., and Jayapura—7 nos.).

Treatments.—The 13 treatments were as under:

- A. NPK (ammonium sulphate 140g, superphosphate 225g, and muriate of potash 115g, or wood ash 2 kg) plus 11 kg cattle manure per palm per year;
- B. Treatment A + lime 1 kg/palm;
- C. Treatment B + ferrous sulphate (57g/palm);
- D. Treatment B + sodium borate (23g/palm);
- E. Treatment B + zinc sulphate (23g/palm);
- F. Treatment B + manganese sulphate (68g/palm);
- G. Treatment B + magnesium sulphate (68g/palm);
- H. Control—healthy palms receiving garden owner's usual treatment:

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- I. Treatment B + manganese sulphate (68g/palm) + magnesium sulphate (68g/palm);
- J. Treatment I + zinc sulphate (23g/palm);
- K. Treatment I + sodium borate (23g/palm);
- L. Treatment I + zinc sulphate (23g/palm) + sodium borate (23g/palm); and
- M. Control—diseased palms receiving garden owner's usual treatment.

Soil and leaf samples were collected to study the prenutritional status of soil and leaf. Data on yield of nuts, colour of foliage, and discolouration of nuts were recorded.

Results of the field survey and field experiments are presented below:

Results

(i) *Field Survey*.—(i) It showed that 85% of the disease affected gardens had laterite soil and the remaining black loamy soil. The texture of the soil was sandy to sandy loam in 80% of the cases. The soils were mostly shallow with 74% of the gardens having less than 50 cm depth of soil. The topography of the gardens was fairly level in 50% of the cases and in the remaining it ranged from slight slope to steep hills. In Annamanada, 82% of the gardens got submerged during monsoon. The drainage provided was adequate in only 37% of the gardens and almost nil to inadequate in the rest. The intensity of soil erosion also varied from garden to garden. It was negligible in 40% of the gardens while the rest were subject to erosion to varying degrees.

In 90% of the gardens, spacing was irregular and inter-crops like coconut, pepper, banana, tapioca etc. were being grown. Manuring was not being practised in 28% of the gardens and only bulky organic manures were being applied in 45% of the gardens. In the rest both organic and inorganic manures were being applied. Of the disease affected gardens, 50% were being irrigated and the rest rainfed.

About 62% of the palms showing the symptoms of the disease were in the age-group 5-25 years and about 25% were in the prebearing age. The oldest leaf was invariably the first to turn yellow. Later,

yellowing gradually spread to upper leaves. In about 80% of the gardens, the appearance of the disease was reported to be sporadic. The leaf size was reduced in about 60% of the cases with 70% trees showing yellowing in more than three leaves. In 50% of the cases, foliage yellowing followed by necrosis and fall of tissues were confined to tip of leaves while in 37% severe yellowing was noticed. The kernel was discoloured in 43% of the cases and nuts fell prematurely in 60% palms.

The spindle bug was found in serious proportions in 38% of infected gardens.

(ii) *Field Experiment*.—(a) *Yield*.—The yield of arecanut is given in Table I. In view of the differences in cultivation practices, soil, topography etc., the yields obtained in the four locations Jayapura (Karnataka) and Annamanada, Koothattukulam and Punalur (Kerala) are considered separately. In general, there was a general increase in yield in the Karnataka unit in the 3rd and 4th year (*i.e.*, 1968 and 1969) after the commencement of the experiment (0.02 to 55.34% more yield than during the initial two year 1966 and 1967). The trend in the Kerala units was different. There was a reduction in yield (0.74% to 4.59%) in eight out of 13 treatments and increase in yield (2.41% to 10.04%) in the remaining five treatments.

(b) *Yellowing of foliage*.—Yellowing of foliage was recorded during May and August of each year using an index specially developed for this. The data for 1969 are given in Table II. The intensity of yellowing was minimum in May (*i.e.*, before the onset of south-west monsoon) and maximum in August (*i.e.*, mid-monsoon). In all the Kerala centres (Annamanada, Koothattukulam and Punalur) the various treatments failed to produce any significant changes between May and August. At Jayapura (Karnataka) though the treatment differences were significant, the data were not consistent with the observations of early years.

(c) *Kernel discolouration*.—The data are given in Table III. The percentage of discoloured nuts varied from centres to centre. It was more in the Kerala centres, as compared to the Karnataka gardens. Within the three centres of Kerala, maximum discolouration was seen in Koothattukulam. However, the differences in kernel discolouration due to treatments were not significant in any of the centres.

Discussion

Analysis of soil samples collected from the experimental plots prior to the application of treatments showed that the soils were acidic with pH values ranging from 4.2 to 5.4. Organic carbon content was medium to high. Available nitrogen ranged from 124 to 441 ppm and available phosphorus content was low to medium (Anonymous, 1969). The results of the present field experiments with macro- and micronutrients showed no tangible improvement in the general condition of the trees by way of either reduction in foliage yellowing or discolouration of kernel. Though the yield of arecanuts had registered decreases in a majority of the treatments, only a few of the treatments showed good responses in

Kerala. In Jayapura, a general increase in yield was noticeable though the influence of nutrients on improvement in colour of foliage or kernel was not consistent. Further, the results of the experiment indicated that nutrition alone may not be a cause of the disease. Whether low nutrition status of the soil and other factors like shallow soil or high water table act as predisposing factors could not be determined by these studies.

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TABLE I

Effect of application of macro and micronutrients on yield of arecanuts (Mean No./tree/year)

Treatment	Jayapura (Karnataka)			Anamanada, Koothattukulam and Punalur (Kerala)		
	1966 & 1967	1968 & 1969	% difference	1966 & 1967	1968 & 1969	% difference
A	371.53	371.59	+ 0.02	132.22	126.14	-4.59
B	321.83	323.24	+ 0.43	128.80	153.33	+9.04
C	369.06	392.22	+ 6.27	127.23	123.92	-2.60
D	326.75	455.61	+39.43	124.99	141.54	+13.24
E	298.23	342.57	+14.86	111.67	129.05	+15.56
F	295.21	336.50	+ 5.30	135.85	112.88	-16.90
G	343.15	343.37	+ 0.06	131.95	128.00	-2.99
H	430.98	520.35	+12.87	119.44	122.33	+2.41
I	235.80	443.99	+55.34	138.02	133.44	-3.31
J	373.55	454.62	+21.70	149.83	157.00	+4.78
K	282.27	356.26	+26.21	128.36	127.40	-0.74
L	285.24	307.87	+ 7.93	123.62	118.37	-4.24
M	286.04	356.32	+24.56	124.41	120.37	-3.24

TABLE II

Effect of application of macro and micronutrients on yellowing of leaves (Mean score/tree) (1969)

Treatment	Annamanada		Koothattukulam		Punalur		Jayapura	
	May	August	May	August	May	August	May	August
A	0.20	0.76	0.03	1.22	1.23	2.81	1.04	4.73
B	0.14	0.57	0.35	1.26	1.07	2.15	0.93	4.68
C	0.51	1.27	0.51	1.85	1.27	2.83	1.02	4.49
D	0.39	1.04	0.63	1.71	1.96	2.81	0.95	4.30
E	0.24	0.92	0.39	1.41	0.68	2.33	0.80	4.46
F	0.22	0.37	0.30	1.60	0.98	2.76	0.75	4.38
G	0.57	0.88	1.05	2.27	1.24	2.80	1.01	4.47
H	0.27	0.83	0.42	0.01	0.43	2.15	0.84	0.74
I	0.35	1.08	0.33	1.56	1.64	3.48	1.53	4.80
J	0.67	0.75	1.00	1.65	1.03	2.99	0.80	4.22
K	0.69	0.99	0.73	1.30	0.71	2.35	1.70	4.95
L	0.31	0.38	0.51	1.34	1.29	3.29	1.66	4.64
M	0.05	0.49	0.43	1.87	1.13	2.64	0.73	4.64
S.E./plot	0.41	0.74	0.55	0.70	0.71	0.95	0.68	0.51
S.E./diff. between 2 treatments	0.24	0.43	0.32	0.40	0.50	0.67	0.36	0.27
Over all mean	0.35	0.79	0.51	1.54	1.13	2.72	1.02	4.27
CV (%)	117.14	93.67	107.84	45.45	62.83	34.93	66.67	11.94
CD (P=0.05)	0.72	0.54

TABLE III

Effect of application of macro and micronutrients on kernel discolouration (Mean/tree) 1969

Treatment	Annamanada	Koothattukulam	Punalur	Jayapura
A	4.45	48.12	18.37	9.86
B	nil	27.10	14.61	2.14
C	3.90	23.41	14.87	2.14
D	5.28	46.89	12.71	3.41
E	3.75	47.86	23.94	nil
F	3.62	45.67	22.60	nil
G	2.50	15.92	23.77	5.00
H	4.73	11.80	39.43	1.71
I	3.88	11.33	29.00	9.14
J	4.87	43.10	16.73	2.57
K	0.57	5.83	22.43	nil
L	1.67	4.32	12.23	5.00
M	3.33	39.63	31.29	5.57
S.E./plot	5.95	24.77	15.60	8.55
S.E./difference between 2 treatment mean	3.44	24.77	8.34	4.57
Over all mean	3.27	28.54	21.69	3.58
C.V. (%)	181.96	86.79	71.92	238.83