

(75)

FINAL REPORT

1. Institute Code No. Path X(131)

2. I. C. A. R. Code No. Pl-87/8-ICI-H20/2710

3. Name and Address of Research Institute/Centre:
Central Plantation Crops Research Institute, Regional Station,
Vittal 574 243, DK, Karnataka

4. Project Title: Investigations on leaf spot of arecanut prevalent in
North Kanara district.

5. Name and Designation of Project Leader:
B.Ramanujam, Scientist (Plant Pathology)

6. Name(s) and Designation(s) of Project Associates including Project Leader and work to be done:

Sl. No.	Name and Designation	Time spent	Work done
1.	B.Ramanujam, Scientist	10 man months	Item No. 1 & 4 of Technical programme
2.	R.Chandra Mohanan, Scientist SG	6 "	Item No.2 & 3 of Tech.progr- amme.

7. Location of Research Project with complete address (Division/Section/Sub-Centre)
Plant Pathology Section, CPCRI Regional Station, Vittal

8. Date of start April, 1987

9. Date of termination March, 1990

10. (a) Objectives (Not more than 150 words)

1. To investigate on the effect of different management practices adopted by the farmers on the incidence of leaf spot of arecanut in the district.
2. To identify the cause of the malady and to find out suitable control measures.
3. To study the susceptibility of different varieties/cultivars under field conditions.

(b) Practical Utility including background information (Not more than 150 words)

During the last few years severe incidence of leaf spot disease on arecanut was noticed as a serious problem in several gardens in North Kanara district especially in Sirsi and Yellapur areas leading to considerable economic loss. Severe leaf spot symptoms appear on 3-5 leaves of the outer whorls initially and these leaves dry off consequentl In the advanced stage the crown size is reduced.

A perusal of available literature indicates that no detailed investigations have been carried out on this malady. However, different species of fungi such as *Alternaria*, *Nigrospora*, *Phomopsis*, *Phyllosticta* sp. and *Colletotrichum* causing leaf spot and leaf blight on arecanut seedling from different arecanut growing areas were reported. Hence, the present study has been proposed which will help in suggesting suitable remedial measures for this disease.

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE

KASARAGOD-670 124, KERALA

R P F III

Project No. PATH. X (131)

Date of Start: April 1987

11. Technical Programme:

1. Survey of the affected gardens to study different management practices adapted by the farmers and to correlate these with the disease incidence--R.Chandra Mohan & B. Ramanujam.
2. Isolation of fungi/microorganisms and testing the pathogenicity -- B. Ramanujam and R. Chandra Mohanan.
3. Screening of fungicides (a) In vitro b) In vivo c) Field trial using promising fungicides with recommended management practices. B.Ramanujam and R Chandramohan
4. Screening of different varieties/cultivars under field conditions. R.Chandra Mohanan and B Ramanujam.

1a. Survey of the affected gardens in North Kanara District.

A total of fifteen areca gardens with different levels of management in Sirsi, Yellapur and Ankola taluks of the district were surveyed during pre-monsoon (April-May) and monsoon periods (July) in order to study the incidence pattern. The disease intensity was recorded in 25 palms in each garden and also the cultural practices followed in each garden were recorded. Based on the level management, the surveyed gardens were divided into two categories viz., 1. Well managed gardens and 2. Gardens with average maintenance. The percentage of palms affected and the disease index (DI) of each garden was calculated and presented under the two above category gardens during pre-monsoon (April-May) and monsoon (July) in the Table 1.

The disease was observed in all the gardens surveyed during pre-monsoon as well as monsoon periods. The disease index (DI) was more during monsoon period (18.5) than during pre-monsoon period (13.5). The disease index (DI) was slightly more in gardens with average maintenance (14.1 and 19.5 during pre-monsoon and monsoon respectively) in comparison with the disease index of well managed gardens (13.0 and 17.6 during pre-monsoon and monsoon respectively).

1.b. Incidence of leaf spot disease in South Kanara and Kasaragod districts.

A preliminary survey conducted in these areas indicated, moderate to severe incidence of leaf spot disease (similar to the leaf spot found in North Kanara district) in Puttur (Kavu, Haleneranki), Bantwal (Nerchal, Irea) of South Kanara district and Vorkady of Kasaragod district during the monsoon period. In these areas, the leaf spot disease was severe only during monsoon and gradually declined after ^{the} monsoon period.

1.c. Symptomology:

The leaf spot disease was observed in the palms of all age groups, but the severity of the disease was more in young palms. The survey conducted in North Kanara district revealed that 70-80% of affected palms were below 10 years.

The leaf spot was noticed only on the levels of inner whorls and about one to six leaves in each palm were affected. The highest disease intensity was observed on the lower most leaf and the intensity gradually decreased in the upper leaves.

Brown to dark brown or black, round spots of various sizes (2-10mm) with a broad or narrow yellow halo appear initially and these spots enlarge to the size of 20-30mm and Coalesce to form large blighted areas in the advanced stages. Some of the spots showed a central dried greyish portion with dark fructifications (Pycnidia) of the fungus on the upper surface.

2.a. Etiology:

Isolation of fungi/microorganisms was carried out on PDA from the leaf spot affected samples collected from Bairumbe, Puttanamane, Shirvalli, Gundagal (North Kanara), Vittal, Kavu (South Kanara) and Vorkady (Kasaragod). Samples showing leaf spots of different sizes and colour were plated separately and the fungi isolated were recorded separately.

Phyllosticta arecae Hohnel and Colletotricum gloeosporioides, Penz were the most commonly isolated fungi from all the types of leaf spots. P. arecae grew on PDA as dark green colonies with abundant Pycnidia white, C. gloeosporioides produced colonies ^{with} abundant greyish wooly mycelium and single celled cylindrical conidia. The identification of the above two fungi was confirmed by C.M.I. (IMI Nos.324014 and 324026).

The frequency of isolation of these two fungi varied from place to place and the same is presented in Table 2. In Sirsi and Yellapur areas of North Kanara district, 63.5% samples yielded P. arecae, 20% yielded C. gloeosporioides and 8.5% samples yielded P. arecae and C. gloeosporioides together in which both the fungi were isolated from the same spot. However, in South Kanara and Kasaragod areas, 28% samples yielded P. arecae, 30% samples yielded C. gloeosporioides ^{and} 38% samples yielded both P. arecae and C. gloeosporioides.

2b. Pathogenicity tests:

Artificial leaf inoculation of arecanut seedlings of six months old with spore cum mycelial suspension of P. arecae and C. gloeosporioides separately and in combination produced typical leaf spots as observed in nature.

Hence, P. arecae and C. gloeosporioides were established as casual agents of the leaf spot disease of these areas. These two fungi were reported to cause leaf spot disease in arecanut by earlier workers.

3.a. In vitro evaluation of fungicides against P. arecae and C. gloeosporioides

Since both P. arecae AND C. gloeosporioides were known to cause leaf spot disease on arecanut, fungicidal evaluation was carried out against both these fungi. Nine fungicides namely Bavistin 50/WP, Blitox 50% W (Copper oxychloride), Dithane M-45 (Mancozeb) Dithane Z-78 (Zineb), Foltaf 80%W (Captafol) Cuman.L (Ziram) and Bordaueux mixture were evaluated at different concentrations on PDA by poisoned food technique. Three replications were maintained for each fungicide and the plants were incubated at $25 \pm 2^\circ\text{C}$. Radial growth of this fungi was recorded on 10th day after inoculation. The percentage of inhibition of growth was calculated from the mean colony diameter by using Vincent equation and presented in Table 3.

Bavistin (0.05%), Dithane M-45 (0.3%), Foltaf (0.2%) and Cuman L (0.3%) inhibited the growth of both fungi completely while Bordaueux mixture (1%) inhibited 85.7% growth of P. arecae and 81.6% growth of C. gloeosporioides. Hence these five fungicides were selected for field trials at Sirsi and Yellapur areas of North Kanara District.

- - -

3.b. Fungicidal field trials at Sirsi and Yellapur arease of North Kanara district.

Three field trials were laid out in three separate gardens (each garden serving as one replication) located in Sirsi and Yellapur areas. The selected five fungicides served as five treatments and each treatment had 75 palms distributed in the three selected gardens. The treatments were given as foliar sprays for three rounds, once during pre-monsoon (June) and twice during monsoon period (July and September) at 45 days interval. About one to one and half litres of spray fluid was sprayed on all the leaves, both sides. Triton AE sticker^k was added to the fungicidal solution at 0.1% conc. before spraying.

The data on disease intensity such as, number of leaves affected in each palm and scoring of each affected leaf (based on the leaf area affected) were recorded in all palms before and after treatments. The disease index (DI) was calculated by using Mc[†] Kenny formula. The mean disease index (DI) of each treatment during pre-treatment (June) and post-treatment (July, Sept. and Nov.) is presented in Table 4.

Of the five fungicides tested, Foltaf, 0.2%, Dithan M-45, 0.3% and Bavistin, 0.05% were found to be promising in reducing the leaf spot disease of arecanut as indicated by the post treatment disease index (DI). Cuman L 0.3% was the least effective in reducing the disease.

3.c. Fungicidal field trials at Kavu and Haleneranki in South Kanara district.

Two field trials were laid out in two different gardens at Kavu and Haleneranki villages in Puttur Taluk (S.K). Three promising fungicides viz., Dithane M-45 (0.3%), Bavistin (0.05%) and Foltaf (0.2%) were selected for the trial based on the previous field trial experiments at Sirsi and Yellapur. Each treatment had

60 palms in six replications distributed randomly in the two selected gardens. Another 60 palms which were not sprayed served as control.

Four rounds of sprays with each selected fungicide were given to the palms in the trial. The first round of spray in the month of June and the remaining three rounds in July, August and September at monthly intervals were given.

The data on disease incidence was recorded in all the palms in the trial every month starting from June to November. Based on this, the disease index (DI) was calculated for each treatment and presented in Table 5.

The post-treatment disease index^(D.I) of the palms sprayed with the three fungicides (10.1 to 13.3) was significantly less in comparison with the D.I. of unsprayed palms (21.7) and hence all the three fungicides tested viz., Dithane M-45, 0.3%, Bavistin, 0.05%, and Foltaf, 0.2% were effective in reducing the leaf spot disease of arecanut. The D.I. of the palms sprayed with Dithane M-45, 0.3% and Foltaf, 0.2% were 10.1 and 10.9 respectively and hence these two fungicides were almost at par in controlling leaf spot disease. Bavistin, 0.05% sprayed palms^{showed} slightly higher DI (13.39) in comparison with the D.I. of palms sprayed with Dithane M-45 and Foltaf (10.1 and 10.9)

- - -

4. Screening of arecanut varieties for field resistance/
tolerance for leaf spot disease.

Arecanut seedlings of the eleven indigenous and exotic accessions were planted in three private areca gardens, severely affected by leaf spot in Sirsi and Yellapur areas during the year 1988. The accessions planted were 1) Sirsi - local, 2) South Kanara - local 3) VTL-3, 4) VTL-11 5) VTL-17, 6) Mohitnagar 7) Hirehalli dwarf, 8) Depoli 9) Thirthahalli - local 10) VTL-12, 11) A.Triandra. Ten seedlings of each accession were planted in each garden. The disease intensity was recorded in all these seedlings during monsoon periods of 1988 and 1989, and disease index was calculated for each accession.

Disease incidence was observed in all the ten accessions. Highest disease index was observed in A.triandra, followed by Sirsi-loacal and VTL-11, while lowest disease index was observed in VTL-3 followed by VTL-12 and VTL-17.

- - -

Table 1. Incidence of leaf spot of arecanut in well managed gardens and gardens with average maintenance during pre-monsoon (April-May) and monsoon periods (July).

Sl. No.	Location of the garden	A. Well managed gardens				B. Gardens with average maintenance			
		Pre-monsoon (April)		Monsoon (July)	Pre-monsoon (April)		Monsoon (July)		
		Percentage of affected palms (%)	Disease index (D.I.)	%age of afftd. palms (%)	D.I.	Percentage of affected palms (%)	Disease index (D.I.)	Percentage of affected palms (%)	Disease index (D.I.)
1	A. Bairumbe, Sirsi B. Kowlahadde, Sirsi	31.4	10.9	40.1	16.2	40.2	14.8	56.3	19.8
2	A. Puttanamane, Sirsi B. Bharthanahalli, Yellapur	42.8	14.4	51.2	24.0	38.2	14.4	46.3	17.8
3	A. Nernahalli, Sirsi B. Gundagal, Yellapur	26.1	13.3	29.2	15.8	31.8	15.8	51.4	20.3
4	A. Kodla gudde, Ankola B. Shirvalli, Yellapur	34.5	12.6	42.1	18.0	44.9	14.3	62.8	23.2
5	A. Hulekal, Sirsi B. Idagungi, Yellapur	23.1	13.8	49.8	14.4	27.8	12.6	36.9	16.4
	Mean	31.5	13.0	42.4	17.6	36.6	14.1	50.7	19.5

*D.I. is calculated based on the number of leaves affected and visual scoring of each affected leaf.

Table 2. Isolation of fungi from leaf spot samples collected from different localities.

Sl. No.	District	Location	Number* of samples plated	Number of samples yielded					
				P. arecae alone	C. Glucosporioides alone	P. a + C. g together	Other fungi**		
1	North Kanara	Bairumbe (Sirsi)	50	32	8	6	4		
2	North Kanara	Puttanamane (Sirsi)	50	29	11	7	3		
3	North Kanara	Shirvalli (Yellapur)	50	28	15	4	3		
4	North Kanara	Gundagal (Yellapur)	50	38	6	1	5		
		Total	200	127 (63.5%)	40 (20%)	18 (9%)	15 (8.5%)		
5	South Kanara	Vittal	50	13	19	19	5		
6	South Kanara	Kavu	50	17	14	15	4		
7	Kasaragod	Vorkady	50	12	13	19	6		
			150	42 (28%)	45 (30%)	47 (32%)	15 (10%)		

* The samples collected from each location includes leaf spots of different types.

** Other fungi includes, Aspergillus, Botryodiplodia, Fusarium, Pestalotia, Helminthosporium.

Table 3. Effect of nine fungicides at different concentrations on the growth of P. arecae and C. gloeosporioides.

Sl. No.	Fungicides	Conc. (%)	Percentage of inhibition of growth	
			<u>P. arecae</u>	<u>C. gloeosporioides</u>
1	Bavistin 50% WP (Carbendezim)	0.025	100.0*	88.7*
		0.05	100.0*	100.0*
		0.1	100.0*	100.0*
2	Calixin 80% EC (Tridemorph)	0.05	100.0*	18.3
		0.1	100.0*	25.3
		0.2	100.0*	29.5
3	Kitazin 48% EC (Kitazin)	0.5	43.7	23.9
		0.1	55.4	26.7
		0.2	73.7	49.2
4	Dithane-M-45 (Mancozeb)	0.1	87.7	59.2
		0.2	100.0	83.3
		0.3	100.0	100.0
5	Dithane Z-78 (Zineb)	0.1	61.3	19.7
		0.2	72.1	25.3
		0.3	78.4	29.5
6	Foltaf 80% W (Captafol)	0.05	77.3	54.8
		0.1	100.0	82.6
		0.2	100.0	100.0
7	Cuman L (Ziram)	0.1	86.7	80.2
		0.2	100.0	88.4
		0.3	100.0	100.0
8	Blitox 50% W (Copper oxychloride)	0.1	62.3	28.1
		0.2	76.0	39.4
		0.3	80.0	45.0
9	Bordaeux mixture	1%	85.7	81.6

* Fungicidal

Table: 4. Effect of five fungicides on the incidence of leaf spot disease of arecanut in North Kanara District.

Sl. No.	Fungicides	Disease index (Mean of 75 palms)				
		Pre-treatment (June)	Post treatment			
			July	Sept.	Nov.	Mean of post tr.mt.
1	Bavistin 50% WP 0.05% (Carbendezim)	12.8	14.1	15.4	15.9	15.1
2	Dithane M-45, 0.3% (Mancozeb)	12.4	13.7	14.3	14.0	14.01
3	Foltaf 80% W, 0.2% (Captafol)	13.6	14.5	15.2	14.6	14.8
4	Cuman L, 0.3% (Kiram)	13.1	16.9	18.9	19.0	18.5
5	Bordaeux mixture, 1%	13.6	16.7	18.5	18.9	18.0
6	Control	13.4	19.5	21.6	22.2	21.1

AV. SE of diff. between two treatment means 0.87
C.D. (P=0.05) 1.91

Table: 5. Effect of three fungicides on the incidence of leaf spot of arecanut in South Kanara district.

Sl. No.	Treatment	Disease index (Mean of 60 palms)							Mean of post treatment
		Pre treatment	Post treatment						
		June	July	Aug	Sept.	Oct.	Nov.		
1	Bavistin, 0.05% (Carbendezim)	9.93	14.73	16.21	14.41	11.68	8.31	13.09	
2	Dithane M-45, 0.03% (Mancozeb)	10.88	13.10	13.95	10.86	8.58	6.10	10.51	
3	Foltaf, 0.2% (Captafol)	10.72	13.56	14.53	11.80	8.93	6.95	11.16	
4	Control	9.87	23.36	24.43	22.58	19.93	5.71	21.41	

AV. SE of difference between two treatments Means 0.27
C.D. (P=0.05) 0.57

Summary

A new leaf spot disease was observed in Uttar Kannada in the early eighties. Moderate to severe incidence of the disease was noticed in several gardens in Uttara Kannada, parts Dakshina Kannada and Kasaragod districts. In Uttara Kannada, the disease was observed throughout the year with a peak during S.W. monsoon, while in Dakshina Kannada and Kasaragod areas the leaf spot incidence was observed mainly during S.W. monsoon. The intensity of leaf spot disease was found to be more in young palms (<10years) on outer whorls of 3-4 leaves.

Brown to dark brown ^d Black lesions of various sizes with a yellow halo appear initially on the leaflets. These lesions coalesce with each other to form large blighted patches in the later stages. Leaf shredding, drying and drooping of the affected leaves were noticed in the advanced stages.

Phyllosticta arecae, Hohnel, and Colletotrichum gloeosporioides Penz, were the most commonly and consistently isolated fungi from the lesions. The pathogenicity of these two fungi on arecanut seedlings was established by artificial inoculation.

In vitro evaluation of fungicides against P. arecae and C. gloeosporioides indicated that Bavistin 0.05%, Dithane M-45 0.3%, Foltaf 0.2% and Guman L 0.3% inhibited the growth of fungi completely (100%), while Bordeaux mixture (1%) inhibited 85.7% growth of P. arecae and 81.6% growth of C. gloeosporioides. The field control trial carried out at Sirsi and Yellapur and Kavu and Haleemraulli (D.K.) revealed that Dithane M-45, 0.3% and Foltaf 0.2% were effective in reducing the disease intensity as indicated by the Post-treatment disease index.

.....

13. Approximate expenditure incurred in the Project: (Give reasons for variation, if any, from original estimated cost)

Rs.99,200/-

14. Publications and material (one copy each to be supplied with this proforma)

- a) Research papers A paper on 'Control of Leaf spot of Arecanut' will be prepared for publication.
- b) Popular articles -
- c) Reports -
- d) Seminars and workshops (Relevant to the Project) in which the Scientists have participated:

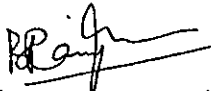
- e) Material developed (such as new varieties of crops or breeds of farm animals, implements, products, etc.)

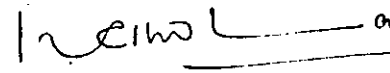
15. Details (Nos. etc.) of Field/Laboratory Note books and final material and their location

Log book containing all the data of the work done under this project is with B.Ramanujam, Scientist (Plant Pathology), CPCRI, Regional Station, Vittal

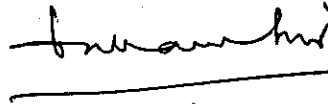
16. Comments/suggestions of Project Leader regarding possible future line of work that may be taken up arising of this project:

17. Signatures with name of Project Leader and Associates:

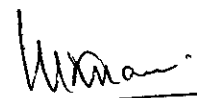

(B. Ramanujam)
Project Leader


(R. Chandra Mohanan)
Associate


18. Signature (with comments, if any) of Head of Division/Section/Station:



19. Signature (with comments, if any) of Director:


Director
Central Plantation Crops Research Institute
P.O. KUDLU, KASARAGOD 570124

o/e. Copy to PMT section, CPRI, Kasaragod.

Issued :- 
26/11 6/11/30