

## MANAGEMENT OF STEM BLEEDING DISEASE OF COCONUT WITH FUNGICIDES AND A BIOCONTROL AGENT

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### ABSTRACT

A field trial was conducted in the stem bleeding (a soil borne disease caused by *Thielaviopsis paradoxa*) affected gardens using either of two systemic fungicides, carbendazim and tridemorph; one biocontrol agent, *Gliocladium virens*, one sealant viz., coal tar and two organic amendments, neem cake and farm yard manure in various combinations. Observations after four years of treatment showed the lowest disease index (2.62) and the highest nut yield (59.4 nuts/palm/year) in the palms treated with tridemorph 4% (root feeding and wound dressing) along with coal tar sealing and soil application of *G. virens* + neem cake + FYM.

### INTRODUCTION

Stem bleeding disease of coconut, caused by *Thielaviopsis paradoxa* (de Seyn) von Hohnel is one of the important soil borne diseases of coconut and is widely prevalent in different coconut growing areas of the country. The pathogen which is commonly present in the soil finds its entry into coconut stem through growth cracks present on the stem and causes cortical decay. The disease is characterized by the exudation of reddish-brown liquid usually at the base of the stem. In the advanced stages, the bleeding patches extend upwards, stem gets tapered and crown size gets reduced leading to gradual reduction in yield. The earliest recommendation for the control of the disease was chiselling of the affected tissues and application of hot coal tar. This did not always result in giving effective control of the disease (Nambiar and Kalpana Sastry, 1988). Soil drenching with Calixin 0.1% (Radhakrishnan; 1990) and root feeding with Bavistin 5% or Calixin 5% (Ramanujam *et al.*, 1993) have been found to reduce the disease to some extent. A local isolate of *Gliocladium virens* was found to be inhibitory to *T. paradoxa* *in vitro* (Sanal Kumar *et al.*, 1993). Soil application of neem cake to the affected palms was found to reduce the

population of *T. paradoxa* and encourage the antagonistic population in soil (Sanal Kumar, 1990). The present study aims to develop an integrated control measure for the disease using fungicides, coal tar, biocontrol agent and organic amendments.

### MATERIALS AND METHODS

Field trial was laid out in three stem bleeding affected gardens located in Uduma (2 plots) and Edaneer (1 plot) villages of Kasaragod district in Kerala State. In this trial, two systemic fungicides viz. carbendazim 2.5% (Bavistin 5%) and tridemorph 4% (Calixin 5%) were evaluated along with a biocontrol agent, *Gliocladium virens* (Uduma isolate), coal tar and organic amendments in various combinations for the management of the disease. Fungicides were applied to the affected palm through root feeding (R.F) and also through wound dressing (W.D) after chiselling the bleeding patches on the stem. Coal tar was used for sealing the exposed lesions on the stem. The biocontrol agent *G. virens* (G.v.) was applied to the soil at the basin of affected palm for reducing the pathogen population in the soil. Neem cake (NC) and farm yard manure (FYM) were applied to the soil not only as organic amendments but also as food base for biocontrol agent *G. virens*.

The trial consisted of eight treatments with eighteen replications. The treatments were imposed for four years during 1993-96 as presented in tables.

For root feeding with fungicides in the treatment Nos. 1,2,4 and 5, a healthy root from the palm was exposed, top excised and immersed in 100 ml fungicide suspension, taken in a polythene bag till it is completely absorbed (2-3 days). Root feeding with the respective fungicide was carried out thrice a year (Jan, June and Oct). For wound dressing (WD) in the treatment Nos. 1, 2, 4 and 5, the bleeding patches on the stem were completely chiselled out with a sharp knife and painted with the respective fungicide (50-200 ml/palm depending upon the lesion area) followed by sealing the exposed lesions with warm coal tar (100-300 g/palm) after three days. For the palms in the treatment Nos. 3 and 6, coal tar was applied immediately after chiselling the bleeding patches. Wound dressing with fungicides and or coal tar was carried out once in a year (October). For soil application of the *G. virens* in the treatment Nos. 3,4 and 5, *G. virens* was grown on sterilized rice bran +neem cake (1:1 w/w) in autoclavable polypropylene bags for 15 days at room temperature. *G. virens* inoculum @ 1 kg/palm mixed with 5 kg of neem cake and 50 kg of FYM was applied to the basins of each palm during October every year. Neem cake @ 5 kg/palm and FYM @ 50 kg/palm were also applied to the basins of the palms in the treatment Nos. 1,2, 6 and 7. NPK fertilizers @ 500g: 320g: 1200 g/palm/year were applied in two split doses (June and Sept.) to all the experimental palms in the treatment Nos. 1,2,3,4,5,6 and 7. The palms without any treatment served as control (Treatment No. 8)

All the experimental palms in the trial were indexed for disease using the formula,  $D.I = 1.8 l + 4.3t$ , where  $l$  is the lesion area expressed in  $1000 \text{ cm}^2$  and  $t$  is the visual

score (0-4) for stem tapering (Jacob Mathew *et al.*, 1989). The pre-treatment observations on D.I. were recorded during December 1992, before starting the trial in January 1993 and thereafter the disease index was monitored at quarterly intervals during 1993-96. The data on the yield of experimental palms were recorded once in two months during 1992 (pre-treatment), 1993, 1994, 1995 and 1996. The data on disease index and yield were analysed statistically using analysis of variance, where the variations in the pre-treatment values were nullified mathematically.

## RESULTS AND DISCUSSION

The disease indices (D.I.) of the eight treatments recorded during pre-treatment (1992) and post-treatment (1993, 94, 95 and 96) are presented in Table - 1. The post-treatment D.I. of the eight treatments recorded in 1996 were comparatively higher (2.62-9.84) than their pre-treatment D.I. in 1992 (2.12-2.46) and showed an increase in D.I. ranging from 14.4-326.0%. However among the eight treatments tested, the palms in treatment Nos. 1 and 2 (Carbendazim/ Tridemorph + coal tar+soil amendments), 3 (*G. virens* + coal tar + soil amendments) and 4 and 5 (Carbendazim/ Tridemorph+coal tar + *G. virens* + soil amendments) showed lesser increase in D.I. (14.4-117.9%) compared to the treatment Nos. 6, 7 and 8, where the D.I. has gone up by 193.1-326.0%. The D.I. of the treatment Nos. 1,2,4 and 5 observed in 1996 (3.87, 3.47, 3.07 and 2.62 respectively) did not differ significantly from each other and similarly treatment Nos. 1,2 and 3 were statistically on par. Although the treatment Nos. 1,2,4 and 5 were statistically on par, the treatments No. 4 and 5 showed slightly lower D.I. (3.07 and 2.62 with an increase in D.I. of 35.8 and 14.4% respectively) compared to the D.I. of treatment Nos. 1 and 2 (3.87 and 3.47 with an increase in D.I. of 58.6 and 45.2% respectively). This indicates the superiority

of the comprehensive treatments 4 & 5 (fungicide + coal tar + *G.virens* + soil amendments) over the treatment Nos. 1 & 2 where only fungicide + coal tar + soil amendments were used without biocontrol agent. The superiority of comprehensive treatments in reducing the disease spread may be due to effective control of pathogen in the coconut stem through fungicides and coal tar and in soil through *G. virens* and soil amendments. Between the two comprehensive treatments (4 & 5), treatment No. 5 where tridemorph was used, not only recorded lower D.I. (2.62 with an increase in D.I. of 14.4%) but also completely arrested the disease spread after two years of treatment (1994). This indicates the distinct advantage of using tridemorph (Tr. 5) over carbendazim (Tr.4). A similar trend was observed in treatment Nos. 1 & 2 also. The treatment No. 3 which showed D.I. of 4.75 is on par with the treatment Nos. 1 and 2. The treatment No. 6 (coal tar + organics + NPK) with DI

of 7.21 was comparatively less effective in reducing the disease spread. The D.I. of control palms, where no treatment was imposed, was found to be the highest among the eight treatments (9.84 with an increase in D.I. of 326.0%) followed by the treatment No 7 where only soil amendments were applied. (8.76 D.I. with an increase of 313.2%).

The yield (nuts/palm/year) of the eight treatments recorded during pre and post-treatment (1992-96) are presented in Table-2. The post-treatment yield recorded in 1996 indicate an increase in the yield ranging from 11.1-41% in the treatment Nos. 1,2,3,4 and 5 which had comparatively lower D.I. (2.62-4.75) during post-treatment period. Among these five treatments, the treatment No. 5 (Tridemorph RF & WD + coal tar + *G. virens* + soil amendments) showed the highest nut yield (59.4 nuts/palm/year with an increase of 41.1% yield over pre-treatment) followed by the treatment

Table-1: Stem bleeding management trial (Disease index)

Sl. No.	Treatment	Disease Index				
		1992 (pre-treatment)	1993	1994	1995	1996
			← post-treatment →			
1.	Carbendazim 2.5% RF & WD + coal tar and soil application NC+FYM+NPK	2.44	3.13 <sup>ab</sup>	3.47 <sup>a</sup>	3.69 <sup>a</sup>	3.87 <sup>ab</sup> (+58.6%)
2.	Tridemorph 4% RF&WD+coal tar and soil application NC+FYM+NPK	2.39	2.96 <sup>a</sup>	3.23 <sup>a</sup>	3.36 <sup>a</sup>	3.47 <sup>ab</sup> (+45.2%)
3.	Chiselling+coal tar and soil application G.v.+NC+FYM+NPK	2.18	3.46 <sup>ab</sup>	4.27 <sup>ab</sup>	4.58 <sup>ab</sup>	4.75 <sup>ab</sup> (+35.8%)
4.	Carbendazim 2.5% RF & WD + coal tar and soil application G.v+NC+FYM+NPK	2.26	2.77 <sup>ab</sup>	2.96 <sup>a</sup>	3.07 <sup>a</sup>	3.07 <sup>a</sup> (35.8%)
5.	Tridemorph 4% RF&WD+coal tar and soil application G.v+NC+FYM+NPK	2.29	2.51 <sup>a</sup>	2.62 <sup>a</sup>	2.62 <sup>a</sup>	2.62 <sup>a</sup> (+14.4%)
6.	Chiselling+coal tar and soil application NC+FYM+NPK	2.46	4.28 <sup>b</sup>	5.69 <sup>b</sup>	6.98 <sup>c</sup>	7.21 <sup>c</sup> (+193.1%)
7.	Soil application NC+FYM+NPK	2.12	4.01 <sup>b</sup>	5.87 <sup>b</sup>	7.09 <sup>c</sup>	8.76 <sup>d</sup> (+313.2%)
8.	Control (without any treatment)	2.31	4.14 <sup>b</sup>	5.94 <sup>b</sup>	8.01 <sup>c</sup>	9.84 <sup>d</sup> (+326.0%)
	LSD(CD)		1.02	1.39	1.54	1.48

The figures in paranthesis indicate % increase in D.I. in 1996 over pre-treatment (1992). The figures followed by the same alphabet are at par statistically.

Table-2: Nut yield as influenced by stem bleeding management

Sl. No.	Treatment	Yield (Nuts/palm/year)				
		1992 (pre-treatment)	1993 ← post-treatment →	1994	1995	1996
1.	Carbendazim 2.5% RF&WD +coal tar and soil application NC+FYM+NPK	37.3	39.0 <sup>b</sup>	41.6 <sup>bc</sup>	45.4 <sup>b</sup>	48.7 <sup>bc</sup> (+30.6%)
2.	Tridemorph 4% RF&WD+coal tar and soil application NC+FYM+NPK	36.2	38.2 <sup>b</sup>	42.0 <sup>b</sup>	46.1 <sup>b</sup>	49.8 <sup>bc</sup> (+37.6%)
3.	Chiselling+coal tar and soil application G.v.+NC+FYM+NPK	40.6	38.7 <sup>b</sup>	41.0 <sup>bc</sup>	44.2 <sup>b</sup>	45.1 <sup>c</sup> (+11.1%)
4.	Carbendazim 2.5% RF & WD +coal tar and soil application G.v.+NC+FYM+NPK	38.4	40.6 <sup>ab</sup>	44.6 <sup>ab</sup>	49.8 <sup>b</sup>	53.8 <sup>ab</sup> (+40.1%)
5.	Tridemorph 4% RF&WD+coal tar and soil application G.v.+NC+FYM+NPK	42.1	45.4 <sup>a</sup>	50.7 <sup>a</sup>	56.9 <sup>a</sup>	59.4 <sup>a</sup> (+41.1%)
6.	Chiselling+coal tar and soil application NC+FYM+NPK	43.4	41.1 <sup>ab</sup>	38.7 <sup>bc</sup>	37.1 <sup>c</sup>	38.2 <sup>d</sup> (-12.0%)
7.	Soil application NC+FYM+NPK	42.8	40.2 <sup>ab</sup>	37.9 <sup>bc</sup>	36.2 <sup>c</sup>	30.8 <sup>e</sup> (-28.0%)
8.	Control (without any treatment)	41.7	38.8 <sup>b</sup>	35.7 <sup>c</sup>	32.2 <sup>c</sup>	28.3 <sup>e</sup> (-32.1%)
	LSD(CD)		5.87	6.12	6.93	6.78

The figures in paranthesis indicate % increase (+) or decrease(-) in yield in 1996 over pre-treatment (1992)  
The figures followed by the same alphabet are at par statistically.

No. 4 (53.8 nuts/palm/year with an increase of 40.1%). However, these two treatments were on par. This may be not only due to the lowest post treatment D.I. recorded in this treatment but also due to the complete arrest of the disease spread after two/three years of treatment. The yields recorded in treatment Nos. 1, 2 and 3 were comparatively lower (48.7, 49.8 and 45.1 nuts/palm/year with an increase of 30.6%, 37.6% and 11.1% respectively) and *did not differ* significantly from each other. The differences in the yields recorded in these treatments may be due to the corresponding differences in their post treatment D.I. The post treatment yields of the treatment Nos. 6, 7 and 8 observed in 1996 showed reduction ranging from

12.0-32.1% compared to their pre-treatment yields. This is corroborated by the post treatment D.I. recorded in these treatments (7.21-9.84).

The data on the post treatment disease index as well as yield indicate that the treatment Nos. 4 and 5 (Carbendazim/ Tridemorph RF & WD + coal tar + *G. virens* + NC+FYM+NPK) were comparatively better in reducing disease spread and in increasing yield.

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