Short communications

Effect of intercrops on the intensity of basal stem rot of coconut and soil microbial population

A. Karthikeyan and R. Bhaskaran
Coconut Research Station, Tamil Nadu Agricultural University, Veppankulam 614 906, Tamil Nadu, India.

Accepted 13 June 2001

ABSTRACT

Growing intercrops in basal stem rot affected coconut plantations reduced the incidence of the disease. Among the intercrops, banana was very effective in containing the disease. Intercropping in diseased plantations increased the coconut yield. The population of fungi, actinomycetes and the antagonistic organism *Trichoderma* spp increased significantly in soils of intercropped coconut. The population of bacterial biofertilizers phosphobacteria, *Azotobacter* and *Azospirillum* was also higher in intercropped plots.

Keywords : *Ganoderma lucidum*, biological control, *Cocos nucifera*, intercropping

Basal stem rot caused by *Ganoderma lucidum* (Leys). Karst is a lethal disease affecting coconut production in major coconut growing states of India. The disease is also known as Thanjavur wilt or *Ganoderma* wilt. The Characteristic symptoms of the disease are oozing out of brown liquid from the basal portions of the stem, drooping of lower leaves, heavy button shedding, upward extension of stem decay and death of Palm (Bhaskaran *et al.* 1989). Sporophores of *G. lucidum* appear at the base of the trunk prior to wilting or just after death of the palm. Integrated disease control measures including chemical and biological methods have been reported (Bhaskaran 1993). In recent years, several attempts have been made to screen the antifungal properties of some plant extracts against fungal pathogens. Beye (1978) reported the usefulness of constituents of higher plants as a possible alternative source to pesticides on account of their non phytotoxic, more systemic, easily biodegradable and host metabolism stimulatory nature. Raising intercrops like banana, turmeric, cocoa and pineapple in coconut gardens increased coconut yield and were found to be highly profitable to the farmers. *In vitro* studies indicated that banana rhizome extract and *Tephrosia* root extract were highly inhibitory to the growth of *Ganoderma lucidum*, the pathogen causing basal stem rot of coconut (Bhaskaran *et al.* 1988). In the present study, the effect of raising intercrops as a biological method of controlling basal stem rot of coconut has been reported.

MATERIALS AND METHODS

Field experiments were conducted during 1992-95 in basal stem rot endemic area of Thambikkottai village, Thanjavur district of Tamil Nadu, India to study the effect of different intercrops on the severity of basal stem rot disease of coconut palms, nut yield and the soil microbial population. The trial was laid out in randomized block design with seven treatments and three replications. Six intercrops viz. Desmodium (*Desmodium tortuosum*), Calopogonium (*Calopogonium muconoides*), Kolingi (*Tephrosia purpurea*), Sunnhemp (*Crotalaria juncea*), Turmeric (*Curcuma domestica*) and Banana (*Musa* sp) were raised in 0.25 acre plot each with an equal area for control plot without intercrop. The experimental palms were 30 years old East Coast Tall coconut palms. Disease index of basal stem rot and nut yield of coconut palms in different treatments were recorded.

Disease index (D.I) = 23.6 + 17.7h + 3.6r 0.6l

Where,

h - height in meters upto which bleeding has spread in the stem;

r - reduction in leaf size in 0-4 scale;

l - number of functional leaves in the crown.

An index score of less than 15 can be considered as mild, 15 to 40 as moderate and above 40 as severely diseased.

Rhizosphere soil samples were collected from the intercropped coconut palms in the effective root zone area of 2 m radius and at 15-30 cm depth for estimation of soil microbes. Soil microbial population in different treatments were estimated one year after initiation of the experiment by employing serial dilution plate technique (Waksman 1927). Fungi, bacteria, actinomycetes and the antagonist *Trichoderma* spp were enumerated by

using Potato Dextrose Agar (PDA), Nutrient Agar (NA), Kuster's Agar (KA) and Elad and Chet's (1983) selective medium respectively. The population of physiological groups of organisms or bacterial biofertilizers:phosphobacteria, *Azotobacter* and *Azospirillum* were estimated using selective media; modified Pikovskaya's medium, Jensen's medium and Nitrogen free maleic acid medium respectively. Antagonism between the pathogen *G. lucidum* and the bacterial biofertilizers was assessed by employing the standard agar disc method (Johnson *et al* 1960).

RESULTS AND DISCUSSION

The results revealed that, in general, all intercrops reduced the intensity of basal stem rot disease of coconut. Among the intercrops studied, banana was the most effective in containing the disease by registering only 3.6% increase in disease incidence as against 45.0 % in control(Table 1). Increased yield of 112 nuts per palm per annum was recorded in coconut intercropped with banana as compared to 53 nuts in control plot without intercrop. Menon and Nayar (1978) reported that growing elephant foot yam and yam as intercrops in coconut plantations affected with wilt reduced the severity of the disease and increased the coconut yield.

Population of fungi, actinomycetes and

Table 1. Effect of intercrops on the intensity of basal stem rot and nut yield of coconut palms#.

Intercrop	Disease index (%)			Nut yield palm^{-1} year^{-1}	
	Initial 1992	1995	Increased over initial	Initial 1992	1995
Calopogonium	33.7(35.49)@	53.3(46.89)	19.6 (26.3)	68	79
Desmodium	20.0(26.57)	33.3(35.24)	13.3 (22.0)	72	84
Tephrosia	26.7(31.11)	33.7(35.49)	7.0 (15.3)	63	82
Sunnhemp	30.3(33.40)	40.0(39.23)	9.7 (18.2)	73	86
Turmeric	20.0(26.57)	33.3(35.24)	13.3 (21.4)	81	95
Banana	26.7(31.11)	30.3(33.40)	3.6 (10.9)	85	112
Control (without Intercrop)	33.3(35.24)	78.3(62.4)	45.0 (42.1)	74	53
C.D(P=0.05)	4.36	6.99	-	7	14

Mean of three replications
@ Data in the parentheses are arcsin transformed values

Trichoderma increased significantly in the intercropped fields as compared to control. *Trichoderma* population was highest in banana and sunnhemp intercropped fields. There was no significant difference in bacterial population due to intercropping. However, the population of bacterial biofertilizers: phosphobacteria, *Azotobacter* and *Azospirillum* was found to be enhanced in intercropped fields (Table 2).

Isolates of *T. harzianum* and *T. viride* were found to be antagonistic to the pathogen *G. lucidum*

Table 2. Effect of intercrops on soil microbial population

S.No. Treatment	Microbial Population (CFU/ g of soil)*						
	Fungi (10^3)	Bacteria (10^6)	Actinomycetres (10^5)	Trichoderma	Phosphobacteria	Azotobacter	Azospirillum
1. Calopogonium	36	16	36	132	22	34	32
2. Desmodium	44	18	46	134	20	20	21
3. Tephrosia	48	20	53	106	20	32	30
4. Sunnhemp	45	18	46	135	26	28	29
5. Turmeric	42	18	30	98	25	20	22
6. Banana	56	16	39	132	16	24	25
7. Control (without Intercrop)	27	13	16	68	8	16	17
C.D(P=0.05)	7	N.S	6	8	3	4	3

* Mean of three replications

under *in vitro* conditions (Bhaskaran 1990). Increased population of antagonistic organisms *Trichoderma* spp, other fungi and actinomycetes in the rhizosphere of coconut palms in the intercropped plots may be the reason for reduction in intensity of basal stem rot. *In vitro* studies conducted in our laboratory showed that there was no antagonism between *G.lucidum* and the bacterial biofertilizers Phosphobacteria, *Azotobacter* and *Azospirillum*. The effect of these biofertilizers on disease suppression may be due to the increase in plant growth and nutrient availability.

REFERENCES

Beye F 1978 Insecticides from the vegetable kingdom. Plant Res. Dev., 7:13-22.

Bhaskaran R, Ramadoss N and Suriachandraselvan M 1988 Effect of plant extracts on the growth of *Ganoderma* spp associated with Thanjavur wilt disease of coconut. In: National Seminar on Management of Crop Diseases with Plant Products and Biological Agents (Abrstr.), Agricultural College and Research Institute, TNAU, Madurai, India. P.24.

Bhaskaran R, Rethinam P and Nambiar KKN 1989 Thanjavur wilt of coconut. J.Plantation Crops. 17(2):69-79

Bhaskaran R 1990 Biological control of Thanjavur wilt disease of coconut. National Symposium on Biocontrol of Root Diseases (Abstr.), Annamalai University, Annamalainagar, India. pp.7-8.

Bhaskaran R 1993 Integrated management of basal stem rot disease of coconut. Indian Coconut Journal. 24(4):5-8.

Elad Y and Chet L 1983 Improved selective media for isolotion of *Trichoderma* spp. or Fusarium spp. Phytoparasitica. 11:55-58.

Johnson LF, Curl EA, Bond JH and Fribourg HA 1960 Methods for Studying Soil Microflora Plant Disease Relationships. Burgers Publishing Co., Minneopolis. PP.46-84.

Menon KS and Nayar TVR 1978 Effect of intercropping with tuber crops in root (wilt) affected Coconut garden. PLACROSYMI. Edited by E.V. Nelliat *et al.* CP CRI, Kayankulam, Kerala, India. p. 416-424.

Waksman SA 1927 Principles of Soil Microbiology. Williams and Wilkins, Baltimore, Md. PP.897.