Short Scientific Report

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Management of stem bleeding disease of coconut using *Trichoderma* sp. and organics

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Stem bleeding disease of coconut, caused by *Thielaviopsis paradoxa* (de Seyness) Von Hohnel is widely prevalent in all coconut growing regions in the tropics. The disease has been found to occur in all soil types, but more in laterite soils and sandy soils on the seashore or backwater areas. The characteristic symptom of the disease is the exudation of a dark brown gummy fluid from the growth cracks in the trunk, mostly at the lower portion of the trunk. The lesion traverse upwards and sometimes many lesions coalesce together forming larger patches. The tissues lying beneath the affected bark also show decay. In later stages, the symptoms are also seen on the crown of the affected palm. The outer whorl of leaves turn yellow gradually spreading to the inner whorl. The leaves droop one by one and fall prematurely. The stem apex gradually tapers and crown size is reduced. The fungus *Thielaviopsis paradoxa*, a weak pathogen, spreads through soil and enters the trunk only through wounds/growth cracks. Sanal Kumar *et al* (1990) reported that application of neem cake in the basins of affected palms reduces the population of *T. paradoxa* by encouraging the antagonistic population in soil. The recommended management practice for the disease by ICAR-CPCRI include chiselling the lesions on the trunk and treatment with Tridemorph (Calixin-5%) followed by hot coal tar after 2 days; root feeding with Calixin-5% thrice a year during June, September-October and January; and soil application of 5 kg neem cake per palm per year during the September-October months (Ramanujam *et al.*, 1997).

In order to assess the effectiveness of this recommended management practice in farmer's field of Alappuzha district an on-farm testing was taken up by KVK-Alappuzha during 2004-08. The management package was effective for controlling the disease but the recommended chemical Tridemorph (Calixin) was not available in the market. Swabbing of the lesions on the trunk with *Trichoderma viride* paste was also effective in controlling the lesions. Sreenivasulu (2006) reported that basal application of organic manure fortified with *Trichoderma viride* was effective in managing stem bleeding disease of coconut. Hence an on- farm trial was taken with the objective to refine the management package for stem bleeding disease of coconut using only bioagents/organic inputs.

The trial was conducted in Devikulangara and Thekkekkara Panchayaths of Alappuzha district for 4 years from 2008 to 2012. One hundred and twenty WCT coconut palms of more than 20 years age affected by stem bleeding were selected in 5 farmers' fields. Each location had 24 palms (6 palms per technology option) thus having a total of 30 palms per technology option. The following technology options were imposed for the management of the stem bleeding disease.

TO_1: Control (without any management practices); TO_2: Swabbing the lesions on the trunk

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(without chiselling) with *Trichoderma viride* paste of 2 x 10^8 cfu g^{-1} (100 g $100ml^{-1}$); TO_3: Swabbing the lesions on the trunk with *Trichoderma viride* paste; and application of neem cake (5 kg $palm^{-1}$ $year^{-1}$) + organic manure (FYM/Vermicompost) fortified with *Trichoderma* talc formulation of 2 x 10^8 cfu g^{-1} (1%); TO_4: Swabbing the lesions on the trunk with *Trichoderma viride* paste; and basal application of lime @1 kg $palm^{-1}$ $year^{-1}$ followed by application of neem cake (5 kg $palm^{-1}$ $year^{-1}$) + organic manure (FYM/Vermicompost) fortified with *Trichoderma* (1%) after two weeks of lime application. *Trichoderma viride* was obtained from Dept. of Microbiology, College of Agriculture, Vellayani, KAU, Thiruvananthapuram.

Before applying the treatments the initial disease index of all the palms were worked out using the formula,

DI = 1.8 l + 4.3 t

where, l is the lesion size expressed in 1000 cm^2 and t is the score for tapering (ranging from 0 to 4) (Mathew *et al.,*1989). Subsequently the disease index was recorded at the end of first, second and third year. Nut yield of the palms was also recorded before and every year after imposing the treatments.

The mean disease index before treatment application was found to range from 20.5 to 20.8 (Fig. 1). After three years TO_4 has recorded the lowest disease index of 19.3 and the control palms recorded the maximum disease index of 21.7. Even though the change in disease index values appears to be marginal, the effect on disease control has been significant. This is attributed to the reduction in the lesion size by 722 cm^2 in TO_4 compared to an increase of lesion size by 500 cm^2 in the control, without much variation in the average tapering score during this period. This is supported by results of a similar study for the management of stem bleeding by Ramanujam *et al.* (1997) which reported that even in the best management practice for the disease control and higher yield, the disease index slightly increased by 0.33 after four years. It could also be observed that the reduction is considerable after two years indicating that the package should be applied for a minimum period of two years.

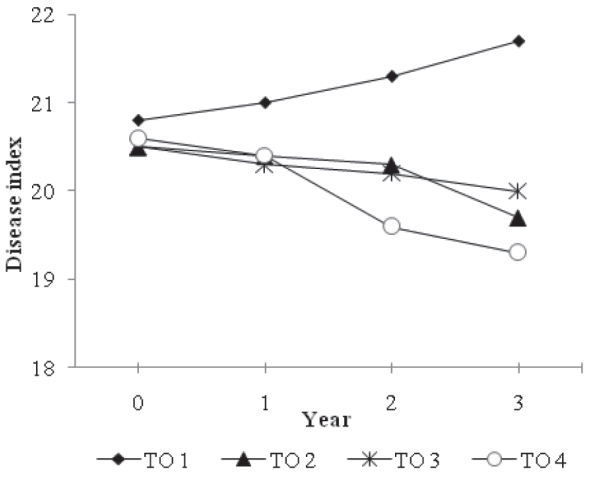

Fig.1. Effect of different management packages on disease index

Nut yield recorded in the beginning and after one, two and three years of treatment application are presented in table 1. The treatments had significant influence on the yield of palms after one year onwards. The yield increased gradually in all the technology options while the disease index decreased. The complete package of swabbing the lesions on the trunk with *Trichoderma* paste; and basal application of lime @ 1 kg $palm^{-1}year^{-1}$ followed by application of neem cake (5 kg $palm^{-1}$ $year^{-1}$) - organic manure (FYM/Vermicompost) mixture fortified with *Trichoderma* after two weeks of lime application (TO_4) resulted in a yield increase of 91.6 per cent from 36 to 69 nuts $palm^{-1}$ $year^{-1}$.

Table 1. Effect of different management packages on nut yield

Treatment	Nut yield $palm^{-1}$ $year^{-1}$			
	Initial	After 1 year	After 2 year	After 3 year
TO_1	30.2	25.8	20.0	14.2
TO_2	33.2	32.6	37.6	38.8
TO_3	36.0	41.6	44.8	57.6
TO_4	35.6	47.8	55.0	68.8
CD (0.05)	NS	5.7	5.58	6.33

The untreated palms recorded a decrease in nut yield from 30 to 14.

Organic management package including the application of lime, organic matter fortified with *Trichoderma* and swabbing *Trichoderma* paste on

the affected portions significantly increased the nut yield besides arresting the spread of the disease. Even though considered as saprophytes which multiply inside the dead tissues, some *Trichoderma* strains are reported to be endophytes which colonize not only roots, but also the above ground parts of plants (Bailey *et. al*., 2006). This ability of *Trichoderma* may have aided the control of the disease even when applied without chiselling the affected portions, leading to reduction in lesion size and prevention of spread. The partners observed that this management package prevents further spread of the disease. They have also observed flowering of some diseased palms, which hitherto did not, after the treatment with *Trichoderma*.

The organic package comprising of *Trichoderma*, neem cake and lime could effectively manage the stem bleeding disease of coconut as revealed by the decrease in disease index and increase in yield from second year onwards. The partner farmers were not only convinced by the results of this eco-friendly technology, but learnt the method of multiplication, application, and mode of action of *Trichoderma* also. Application of *Trichoderma* in the soil facilitates an increase in soil population of the organism which can prevent the horizontal spread of the disease to nearby healthy palms. Being a simple and feasible bio–control method, farmers could manage the disease themselves without depending on a skilled labour for the purpose.

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