

# EFFECT OF VAM, *GLOMUS MOSSEAE* ON NEMATODES INFESTING BANANA UNDER COCONUT BASED HIGH DENSITY MULTISPECIES CROPPING SYSTEM

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**Abstract:** Vesicular Arbuscular mycorrhizal fungus, *Glomus mosseae* was found effective in reducing the nematode populations especially that of *Meloidogyne incognita* and *Radopholus similis* infesting banana besides enhancing growth and bunch weight under field conditions. There was 18 per cent increase in height, 2.5 per cent increase in the number of leaves, 30.7 per cent increase in leaf area, 35.7 per cent increase in bunch weight, 30 per cent increase in this number of hands, 39.6 per cent increase in number of fingers and 30.1 per cent increase in shoot weight in the *mycorrhizae* colonised plants when compared to that of control banana plants in the field.

**Key words:** banana, *M. incognita*, *R. similis*, VAM *Glomus mosseae*.

## INTRODUCTION

Banana is a herbaceous perennial widely grown as a component crop in the coconut based high density multispecies cropping system. Nematodes poses serious threat to banana production. They cause extensive root necrosis resulting in under utilization of fertilizers; delayed harvest and poor bunches of inferior quality. The burrowing nematode, *Radopholus similis* (Cobb) Thorne reported by Nair *et al.*, 1966 in Kerala is the most important nematode on banana. *Helicotylenchus multicinctus*, *Heterodera oryzicola*, *Meloidogyne incognita* and *Pratylenchus coffeae* are the other important parasitic nematodes on banana. In addition to these major nematode parasites on roots there are 146 species belonging to 43 genera of nematodes associated with *Musa* spp. (Gowen and Queneherve, 1990). The disease of banana caused by *R. similis* is known through out the world by different names of which the most common ones are blackhead toppling disease, root rot, black head and banana decline. As a result of burrowing nematode infestation on banana, several dark reddish brown lesions appear on the roots leading to root necrosis affecting the anchorage of the plant and reducing the up take of nutrients. This in turn affects the plant health leading to retarded growth, yellowing of leaves and reduction in bunch weight and size. Vesicular arbuscular mycorrhizae (VAM) is known to suppress nematode infestation in plants (Baltraschat, *et al.*, 1973; Sitaramaiah and Sikora, 1980; Suresh and Bagyaraj, 1984). *VA mycorrhizae* were reported to be effective against cyst nematodes *Heterodera* spp. (Fox and Spasoff, 1972; Jain and Sethi, 1988), root-knot nematodes (Sivaprasad *et al.*, 1990; Sikora and Schonbeck, 1975), *Radopholus similis* (Umesh *et al.*, 1988), *R. citrophilus* (Smith and Kaplan, 1988) and *Rotylenchulus reniformis* (Sitaramaiah and Sikora, 1980). Nematode -*mycorrhizae* interaction studies so far carried out are mostly under greenhouse/pot culture conditions using steam sterilized or fumigated soil. However, in field soil, there is always open competition between the different plant parasitic nematodes and the native mycorrhizal fungi. Hence, the present experiment was conducted in a coconut based high density multispecies cropping system to study the effect of VAM in reducing the nematode population in Banana.

## MATERIALS AND METHODS

Banana suckers var. Njalipoovan (20 numbers) were pared, dipped in 10 per cent

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Dithane M 45 suspension and then treated with phorate @ 0.05 g/cm<sup>3</sup> of soil to avoid nematode and fungal pathogens. These suckers were planted in 35x25x7.5 cm aluminium trays containing steam sterilised soil. After 45 days, the suckers were depotted, washed and all roots were removed, checked for nematode and fungal pathogens, if any and planted in 35 cm earthen pots containing steam-sterilised soil. Half the number of suckers were given mycorrhizal inoculation consisting of 100 g soil and mycorrhizal sorghum root bits from culture pot having 5000 chlamydo spores of *Glomus mosseae* (Nicol. and Gerd.) Gerd and Trappe.

After six months, mycorrhizal and non mycorrhizal suckers were planted in separate pits along with other crops viz. arecanut, pepper, cloves and cacao. VAM colonization in the inoculated plants just prior to planting in field was estimated as 1724 spores/ 100 g soil and 80% infection in roots. Soil samples were collected from the experimental plots. The nematode and mycorrhizal population was assessed at the start of the experiment in all plots. The nematodes identified were of *Hoplolaimus seinhorsti*, *Criconeoides sp.*, *R. similis*, *Rotylenchulus reniformis* and *Meloidogyne incognita*. The native VA mycorrhizal population were *Acaulospora bireticulata*, *Gigaspora aurigloba* and *Glomus fasciculatum*.

The influence of VAM on the growth of the seedlings was assessed in terms of vegetative growth parameters viz. height, number of leaves, leaf area etc periodically and the total number of leaves produced and total leaf area was calculated at the termination of the experiment using the formula LxBx0.65. Bunch weight, total number of hands and fingers per bunch was also recorded. Just prior to the termination of the experiment, nematode and VAM populations in soil and root was assessed.

**Table 1. Effect of VAM (*G. mosseae*) on the growth and yield of Banana in field (Mean of 10 plants)**

Treatment	Ht (cms)	No. of leaves	Bunch wt. (kg)	No. of hands	No. of fingers	Shoot weight	Leaf area (cm <sup>2</sup> )
Control	359.6	23.6	5.0	6	69.5	15.93	3331.31
Mycorrhizal	424.4 (18)	24.2 (2.5)	6.78 (35.7)	7.8 (30)	97 (39.6)	20.72 (30.1)	4353.63 (30.7)

\* Figures in parentheses are percentage increase over control.

**Table 2. Nematode and mycorrhizal population associated with control and *Glomus mosseae* inoculated banana plants in the field.**

Treatment	Nematode population		Mycorrhizal population	
	Soil (250g)	Root (50g)	Resting spores Soil (50g)	Root colonization
Control	<i>Meloidogyne incognita</i> - 88	<i>M. incognita</i> - 198	<i>Glomus mosseae</i> - 17	84%
	<i>Hoplolaimus seinhorsti</i> - 127	<i>H. seinhorsti</i> - 2	<i>Acaulospora bireticulata</i> - 57	
	<i>Helicotylenchus abunaamai</i> - 16	<i>R. similis</i> - 120	<i>Glomus fasciculatum</i> - 39	
	<i>Xiphinema elongatum</i> - 10		<i>Gigaspora aurigloba</i> - 17	
	<i>Rotylenchulus reniformis</i> - 23			
	<i>Diphtherophora sp.</i> - 2			
Mycorrhizal	<i>Radopholus similis</i> - 14			100%
	<i>M. incognita</i> - 22	<i>M. incognita</i> - 7	<i>G. mosseae</i> - 147	
	<i>H. seinhorsti</i> - 167	<i>H. seinhorsti</i> - 1	<i>A. bireticulata</i> - 44	
	<i>X. elongatum</i> - 7	<i>R. similis</i> - 41	<i>G. aurigloba</i> - 17	
	<i>R. reniformis</i> - 62		<i>G. fasciculatum</i> - 68	
	<i>R. similis</i> - 3			
	<i>Macroposthonia oachirai</i> - 1			

All the banana plants in the control plot and mycorrhizal plot came to bearing. But there was significant increase in the bunch weight and other growth characters in the VA mycorrhizae colonized plants. There was 18 per cent increase in height, 2.5 per cent increase in the number of leaves, 30.7 per cent increase in leaf area, 35.7 per cent increase in bunch weight, 30 per cent increase in the number of hands, 39.6 per cent increase in the number of fingers and 30.1 per cent increase in shoot weight in the mycorrhizal plants when compared to that of control banana plants in the field (Table 1.). The increase in the growth of mycorrhizal banana plants when compared to the control plants supports the growth promoting ability of VAM. It was proved that mycorrhizal inoculation at the time of raising nursery was found to be effective in reducing the nematode infestation especially the population of *R. similis* and *M. incognita* in the roots of banana (Table 2). The VAM *G. mosseae* ameliorates the ill effects of the nematode infestations. Reddy *et al.*, (1996) reported that *G. mosseae* when applied with neem oil cake was very effective in reducing the *R. similis* population in the roots and soil of banana plants. *G. fasciculatum* was also reported to reduce the *R. similis* population in soil and roots of banana plants (Umesh *et al.*, 1988). Inoculation of *mycorrhizae* during raising nursery of the crops was found effective in improving the vegetative growth of the plants in the field and also helped to reduce the nematode infestation. Mycorrhizal infection and corresponding increase in growth of plants was more in the case of plants grown in mycorrhizal plot. But plants in the control plot also developed infection from the *mycorrhizae* naturally occurring in the field. The mycorrhizal species present in the roots were isolated by collecting the roots and then the roots were washed free of soil and mixed with wet steam sterilised soil in earthen pots. Sorghum seeds were sown and raised up in these pots as bait plants for isolating the spore types. In addition to the introduced mycorrhizal spore type (*G. mosseae*), *Acaulospora bireticulata*, *Gigaspora aurigloba*, *G. pellucida*, *Glomus fasciculatum* and *Sclerocystis rubiformis* were isolated from roots which belong to the native mycorrhizal population (Table 2).

In a similar interaction study of VAM fungus, *Glomus fasciculatum* and *R. similis* the multiplication of nematodes in the root was suppressed and soil population was significantly lower. The banana plants inoculated with mycorrhizae also recorded higher N.P.K., Ca, Mg, Sugar, Phenols, and amino acids suggesting VAM as a potential biocontrol agent in the management of *R. similis* (Umesh *et al.*, 1988). So VAM inoculation in the nursery itself was found effective in reducing the nematode population and also effective in enhancing the growth and yield of banana plants especially the bunch weight, number of hands and number of fingers.

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