

Original Research Article

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Efficacy of *Glomus fasciculatum*, Org-Trichojal, Vermicompost and Carbofuran 3G in the Management of *Meloidogyne incognita* on Ivy Gourd

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ABSTRACT

The field experiment was conducted in the field of Department of Nematology located at Instructional-cum-Research Farm, AAU, Jorhat during the *rabi* season of 2017 to study the efficacy of *Glomus fasciculatum*, Org-Trichojal, vermicompost and carbofuran 3G in the management of *M. incognita* on Ivy gourd. The experiment was laid out in the plots of an area of 3.5m × 3.0m infested with *M. incognita*. Plots were prepared and recommended doses of manures and fertilizers were applied. Carbofuran 3G and liquid formulation of Org-Trichojal were applied in the spots at the time of planting in the respective treatment plots. Ivy gourd cuttings were planted in spots at a spacing of 1.5m x 1.5m (pit to pit). The experiment was laid out in randomized block design with treatments and each treatment was replicated three times. The different treatments: T₁ = *Glomus fasciculatum* @ 600 spores/m², T₂ = Org-Trichojal (5ml/1kg of vermicompost) @ 2 l/ha, T₃ = Vermicompost @ 2.5t/ha, T₄ = *Glomus fasciculatum* @ 300 spores/m²+ vermicompost @ 1.25t/ha, T₅ = Org-Trichojal 1 l/ha+ vermicompost @ 1.25t/ha, T₆ = Org-Trichojal @ 1 l/ha+ *Glomus fasciculatum* @ 300 spores/m², T₇ = *Glomus fasciculatum* @ 300 spores/m²+ Org-Trichojal @ 1 l/ha+ vermicompost @ 1.25t/ha, T₈ = Carbofuran 3G @ 1 kg a.i/ha prior to planting of cuttings, T₉ = Control. The result of the field data revealed that maximum plant growth parameters *viz.*, fresh weight of shoot, dry weight of shoot, fresh weight of root and dry weight of root, number of fruits and yield per plot whereas minimum root-knot index and nematode population over control were recorded in the treatment with *G. fasciculatum* @ 300 spores/m² + Org-Trichojal @ 1 l/ha + vermicompost @ 1.25t/ha.

Keywords

Glomus fasciculatum,
Meloidogyne incognita, Ivy gourd

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Introduction

Ivy gourd, (*Coccinia indica* L.) is a tropical perennial plant and belongs to the family, Cucurbitaceae. Ivy gourd is also known as ‘Kunduli’ in Assam. It is mostly grown in Tamil Nadu, Assam, West Bengal, Karnataka, Maharashtra, Bihar, Andhra Pradesh and Gujarat state of India. Ivy gourd is mostly termed as poor man’s vegetable (Singh and

Singh, 2014). It is a rich source of Vitamin A, iron, fiber as well as good source of protein. There are many pest and diseases attacks on *C. indica* under Assam.

Among them plant parasitic nematode such as *Meloidogyne* spp. attacks on it and reduces the yield. Basumatary *et al.*, (2018) reported 35.09% yield loss in Ivy gourd due to root-knot nematode infestation.

Chemical control found to be best for the control of it but they are very costly for the farmers point of view or they are hazardous to environmental. However, in concern of bad effect of chemicals, the popularity of application of different biocontrol agents found to be feasible because low cost of production, easy to apply, broad spectrum effect against wide range of pathogens and environmentally safe. Bharali *et al.*, (2019) reported that application of organic amendment improved the soil organic carbon and soil microbial biomass carbon.

Further they obtained that improve plant growth parameter or reduction in nematode multiplication with increasing the growth of biocontrol agents. However, many biocontrol agents are available in market but the application of native found to be very effective. Among them, Vesicular Arbuscular Mycorrhizal (VAM) fungi in vermiculite formulation, *Pseudomonas fluoresces* and *Trichoderma viride* are available in commercial formulation for use and are highly effective against plant parasitic nematodes.

However, application of VAM fungi improve the uptake of phosphate as well as other mineral nutrients like N, K, Ca, S, Zn, Cu and S from soils (Smith, 1987). They also improve water transport in plants (Safir *et al.*, 1971) and helps the plant to withstand under stress conditions like high temperature (Marx and Bryan, 1971). VAM fungi compete with plant parasitic nematodes for space and they formed herting network on the rhizoplane of root.

Kurulkar *et al.*, (2019) showed that biological control of *M. incognita* by native isolates of *T. harzianum* and they reported that isolate not only parasitized to the eggs and juveniles of *M. incognita* but also improved the plant growth parameters of okra and reduced the

nematode multiplication in soil. The virulence of biocontrol agent against pathogen is reduced after sometimes so that further screening of promising biocontrol agent should be monitored against pathogen for their virulence.

The use of native biocontrol agents for the controlling of plants appears to be beneficial because they are easy to apply and showed less environmental risk (Cofrancesco, 2000). Hence the present study was undertaking to determine the efficacy of *Glomus fasciculatum*, *Org-Trichojal*, vermicompost and carbofuran 3G in the management of *M. incognita* on Ivy gourd.

Materials and Methods

The field experiment was conducted in the field of Department of Nematology located at Instructional-cum-Research Farm, AAU, Jorhat during the *rabi* season of 2017 to study the efficacy of *Glomus fasciculatum*, *Org-Trichojal*, vermicompost and carbofuran 3G in the management of *M. incognita* on Ivy gourd. The experiment was laid out in the plots of an area of 3.5m × 3.0m infested with *M. incognita*.

Initial nematode population of the whole plot was recorded. Plots were prepared and recommended doses of manures and fertilizers were applied. Pure culture of *G. fasciculatum* was obtained from the Department of Nematology, AAU, Jorhat and liquid formulation of *Trichoderma harzianum* (*Org-Trichojal*) was obtained from Mycology Research Section, Department of Plant Pathology, AAU, Jorhat.

Infested soil of *G. fasciculatum*, carbofuran 3G and liquid formulation of *Org-Trichojal* was applied in the spots at the time of planting in the respective treatment plots. Ivy gourd cuttings were planted in spots at a

spacing of 1.5m x 1.5m (pit to pit). The experiment was laid out in randomized block design with treatments and each treatment was replicated three times. The different treatments: T₁= *Glomus fasciculatum* @ 600 spores/m², T₂ = Org-Trichojal (5ml/1kg of vermicompost) @ 2 l/ha, T₃ = Vermicompost @ 2.5t/ha, T₄ = *Glomus fasciculatum* @ 300 spores/m²+ vermicompost@ 1.25t/ha, T₅ = Org-Trichojal 1 l/ha+ vermicompost @ 1.25t/ha, T₆ = Org-Trichojal@ 1 l/ha+ *Glomus fasciculatum* @ 300 spores/m², T₇ = *Glomus fasciculatum* @ 300 spores/m²+ Org-Trichojal @ 1 l/ha+ vermicompost @ 1.25t/ha, T₈ = Carbofuran 3G @ 1 kg a.i/ha prior to planting of cuttings, T₉ = Control.

Observations were taken at full maturity from all plants of each plot (6 plants /plot). Plants from each plot were uprooted. Initial nematode population in soil, fresh and dry weight of shoots and roots, number of fruits per plot, fruit yield per plot, root-knot index and final nematode population in soil were recorded.

Results and Discussion

The data on efficacy of *G. fasciculatum*, Org-Trichojal, vermicompost and carbofuran 3G in the management of *M. incognita* on Ivy gourd were presented in Table 1 and 2. Figure 1, 2 and 3. After harvesting of crop it was observed that the maximum increase in plant growth parameters viz., fresh weight of shoot (260.2 g), dry weight of shoot (150.23 g), fresh weight of root (162.56 g) and dry weight of root (46.11 g) were recorded in the treatment with *G. fasciculatum*@ 300spores/m² + Org-Trichojal @ 1 l/ha + vermicompost @ 1.25t/ha. Kakati and Mahanta (2013) reported that application of *G. fasciculatum*, *T. harzianum*, neem cake and carbofuran 3G were found to be effective in increasing the fresh and dry weight of shoot and root on cucumber.

Borah and Phukan (2003) studied that mycorrhizal plants had higher plant growth parameters than non-mycorrhizal and nematode inoculated plants. Zhang *et al.*, (2009) found that mycorrhizal colonization increased shoot dry weight, shoot length, root fresh weight and shoot P concentration on cucumber. Similar observations were made by Hajra *et al.*, (2013) on sponge gourd.

Weeder *et al.*, (2008) reported that Trichoderma is highly rhizosphere competent *i.e.*, able to colonize on roots as it develops, thus promote plant growth. It may also exert several mechanisms such as tolerance to stress through enhanced root and plant development, induced resistance, inactivation of pathogen's enzymes in improving plant growth and suppressing plant pathogens. The maximum number of fruits and yield per plot were recorded in the treatment with *G. fasciculatum* @ 300 spores/m²+ Org-Trichojal @ 1 l/ha+ vermicompost @ 1.25 t/ha. All the treatments were found to be effective in increasing the yield of Ivy gourd over control.

There was an increase of 69.24 per cent yield in the treatment *G. fasciculatum* @ 300 spores/m²+ Org -Trichojal @ 1 l/ha+ vermicompost @ 1.25 t/ha over control (Table 4). Similar observations were made by Khan *et al.*, (2009) on pointed gourd, Kakati and Mahanta (2013) on cucumber. Minimum number of fruits and yield were recorded in carbofuran 3G @ 1 kg a.i/ha and control.

The results were in agreement with Krishnaveni and Subramanian (2004) who reported that all the biological control treatments as soil and seed application were effective in controlling the pest and increasing yield of cucumber cultivar cucumber green long. Similar observations were also made by Khan *et al.*, (2009) on pointed gourd, Ortas (2010) on cucumber. Jain and Hasan (1994) reported that hyphal network produced by

VAM fungus increased the absorption area of root system and thereby aided better water uptake and translocation of nutrients particularly Phosphorus. The maximum reduction of root-knot index and nematode population over control were recorded in the treatment with carbofuran @ 1kg a.i/ha followed by *G. fasciculatum* @ 300 spores/m²+ Org - Trichojal @ 1 l/ha+ vermicompost @ 1.25 t/ha. Similar observations were made by Mukhopadhyay *et al.*, (2006) on pointed gourd, Kakati and Mahanta (2013) on cucumber.

Anonymous (2006) observed that carbofuran 3G @ 10 g/plant was effective in reducing the nematode population. This report was also in agreement with Sitaramaiah and Viswakarma (1978) reported that spot application of chemicals was superior to row application or broadcasting. The reduction in number of galls and eggmasses and also the nematode population in soil in mycorrhizal treatments may be due to increased resistance by mycorrhizal plants to nematodes or due to

colonization of the roots by *G. fasciculatum* which mechanically prevents the entry of *M. incognita* into the roots of tomato (Mittal *et al.*, 1991). Khan *et al.*, (2009) reported that vermicompost is effective in reducing root-knot index and other nematode population in pointed gourd. Arancon *et al.*, (2003) reported that soils from all of the vermicompost treated plots contained smaller populations of plant parasitic nematodes than soil from inorganic fertilizer-treated plots.

Conversely, populations of fungivorous nematodes and to lesser extent bacterivorous nematodes increased in the vermicompost treated plots in comparison with those in plots treated with inorganic fertilizers. In the present study, the treatment with *G. fasciculatum* @ 300 spores/m² + Org-Trichojal @ 1 l/ha+ vermicompost @ 1.25 t/ha was found to be best in increasing the fresh and dry weight of shoot and root, number of fruits and yield of Ivy gourd per plot.

Table.1 Effect of *Glomus fasciculatum*, Org-Trichojal, vermicompost and carbofuran 3G on plant growth parameters and yield of Ivy gourd

Treatment	Fresh weight of shoot (g)	Dry weight of shoot (g)	Fresh weight of root (g)	Dry weight of root (g)	No. of fruits /plot	Yield/plot (g)	% increase over control
T ₁	156.57 ^e	78.17 ^e	134.60 ^d	28.37 ^{ef}	48.60 ^d	814.43 ^{cd}	38.62
T ₂	195.50 ^d	95.80 ^d	135.20 ^d	30.60 ^e	48.77 ^d	798.14 ^d	35.85
T ₃	215.57 ^c	115.60 ^c	147.93 ^b	40.00 ^c	52.97 ^c	896.93 ^{bc}	52.67
T ₄	198.62 ^d	99.50 ^d	140.37 ^c	34.80 ^d	45.60 ^{de}	776.10 ^{de}	32.10
T ₅	233.86 ^b	140.93 ^b	150.10 ^b	43.07 ^b	57.55 ^b	908.27 ^b	54.60
T ₆	201.34 ^d	116.22 ^c	146.70 ^b	38.40 ^c	43.50 ^e	809.98 ^d	37.87
T ₇	260.20 ^a	150.23 ^a	154.23 ^a	46.12 ^a	63.24 ^a	994.29 ^a	69.24
T ₈	149.07 ^e	60.40 ^f	130.23 ^e	26.03 ^f	42.93 ^e	697.80 ^e	18.77
T ₉	134.97 ^f	51.49 ^g	120.87 ^f	21.33 ^g	36.53 ^f	587.49 ^f	
S.Ed (±)	4.97	2.35	1.73	1.27	1.91	39.61	
CD (0.05)	10.54	4.99	3.67	2.71	4.06	83.98	

Mean followed by the same letter in the superscript(s) are statistically *at par*

Table.2 Effect of *Glomus fasciculatum*, Org-Trichojal, vermicompost and carbofuran 3G on the development of *Meloidogyne incognita* on Ivy gourd

Treatments	Root- knot index	Final nematode population (250 cc soil)	% decrease over control	% increase/ decrease over INP
T ₁	3.67 ^b	215.23 (14.68) ^b	45.12	-15.92
T ₂	3.33 ^{bc}	208.43 (14.45) ^{bc}	46.86	-18.58
T ₃	3.33 ^{bc}	194.27 (13.95) ^{bcd}	50.47	-24.11
T ₄	3.00 ^{bc}	201.93 (14.22) ^{bcd}	48.51	-21.12
T ₅	3.33 ^{bc}	189.17 (13.77) ^{cd}	51.77	-26.10
T ₆	3.00 ^{bc}	198.93 (14.11) ^{bcd}	49.28	-22.29
T ₇	2.67 ^{cd}	190.50 (13.65) ^d	51.43	-25.58
T ₈	2.00 ^d	161.07 (12.71) ^e	58.93	-37.08
T ₉	4.67 ^a	392.23 (19.79) ^a		+53.21
S. Ed(±)	0.39	0.36		
CD (0.05)	0.84	0.77		

*Mean followed by the same letter in the superscript(s) are statistically *at par*. Values within parentheses are square root $\sqrt{(x + 0.5)}$ transformed data. (+)= Increase, (-) Decrease, INP= Initial Nematode Population (256.00)

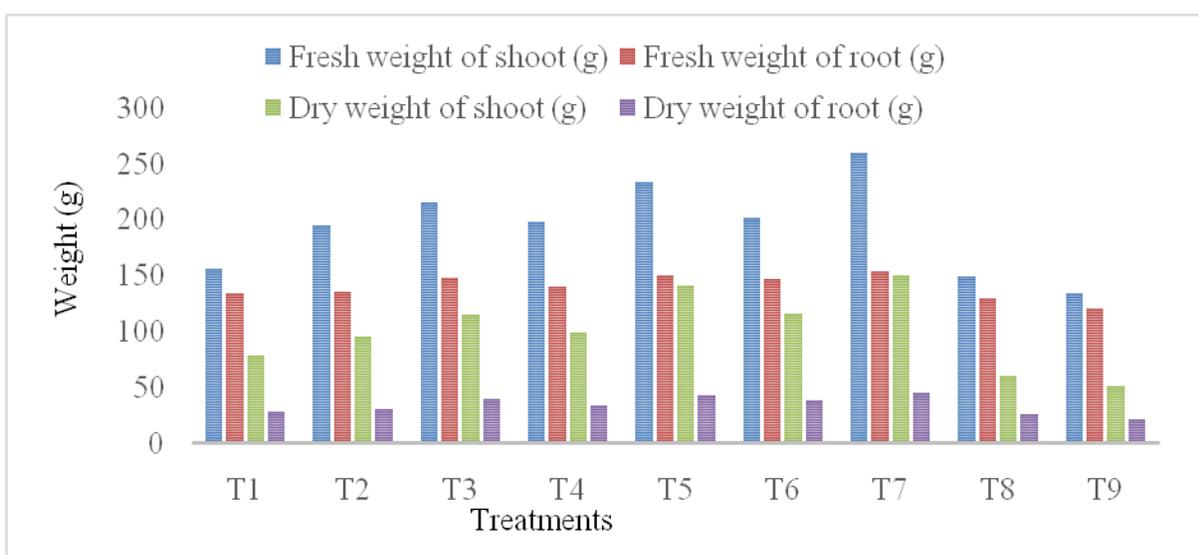


Figure.1 Effect of different treatments on plant growth parameter of Ivy gourd in *M. incognita* infested soil



Figure.2 Effect of *Glomus fasciculatum*, Org-Trichojal, vermicompost and carbofuran 3G on root growth of Ivy gourd

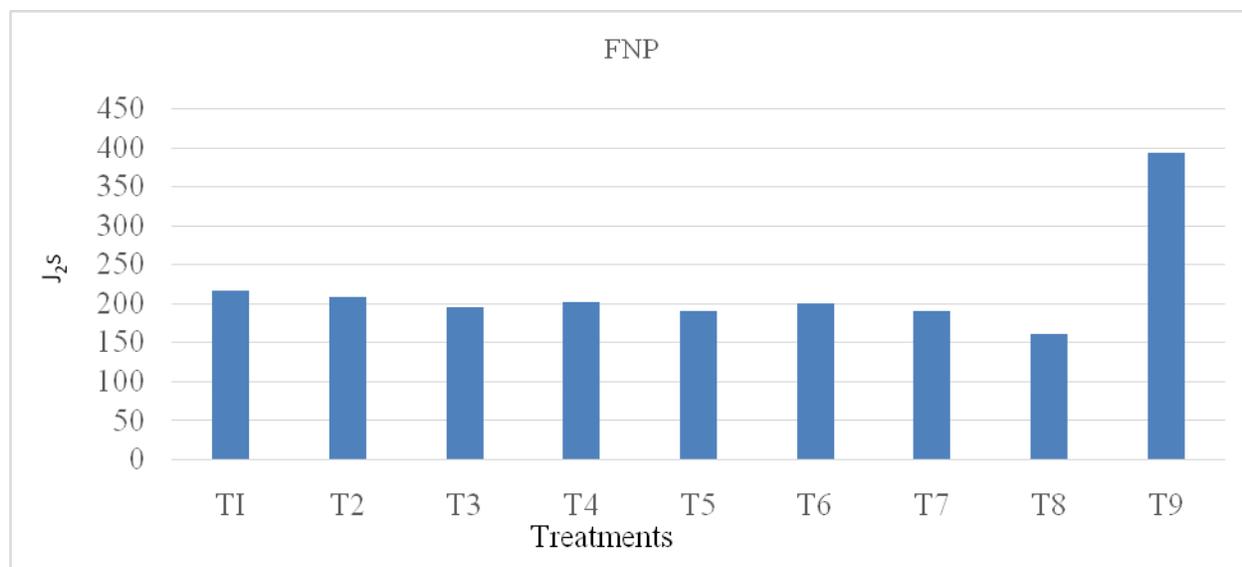


Figure.3 Effect of different treatments on final nematode population of *M. incognita* in soil

All the treatments were found to be effective in increasing the yield of Ivy gourd over control. The treatment with carbofuran 3G @ 1 kg a.i/ha was found to be effective in reducing the root-knot index and final nematode population in soil

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