Effect of Non-Chemical Soil Amendments in Controlling *Pratylenchus* Species in *Shefflera arboricola* variegata "Trinit"

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ABSTRACT

Investigation was carried out to find out the effect of soil amendments on Pratylenchus species, with compared to carbofuran , the most commonly used chemical to control plant parasitic nematodes in export foliage nurseries. Four soil amendments, crushed neem seeds ,compost, poultry manure and cow dung were incorporated to soil of Shefflera arboricola variegata "Trinit" plants. The experiment was laid out in a CRD and it was carried out under net house conditions, from January to July in year 2006.The results obtained showed that the Pratylenchus count of poultry manure and compost were having the least populations, second only to carbofuran treated plants after 7 weeks and the count was significantly lower than even carbofuran after 15 weeks. In concern of plant height and increase in leaf number cow dung and neem seed treated plants were having highest values. According to the results it can be concluded that incorporation of compost or poultry manure with combination of cow dung or neem seed may reduce the number of Pratylenchus species in soil and will increase the growth of Shefflera arboricola variegata "Trinit" plants . In addition these four soil amendments can be used in integrated nematode management programs.

KEYWORDS: Plant parasitic nematodes, *Pratylenchus* Species, *Shefflera arboricola* variegata "Trinit", Soil amendments.

INTRODUCTION

Nematode problem is becoming severe in foliage industry, especially in firms that are exporting foliage plants. For export market detection of undesirable organisms including nematodes may lead the foreign buyers' refusal of the plants and also black listing of suppliers. In nematodes concern the infestation should be at zero level. The acreages used for production of ornamental crops are low in comparison with the total land under cultivation, but the cash returns are high because of the intensive cropping (Reddy, 1988). So export foliage industry very much important as a source of foreign currency to Sri Lanka.

In concern with the pest and diseases in *Scefflera arboricola* variegata "Trinit" plants the most severe are nematodes and *Pratylenchus* species are most common among this. The roots are highly damaged and leaves get yellowish color (Khan and Reddy, 1992) and reduce the required quality for export market. Also these nematode damages lead to secondary infection by fungus as *Fusarium* species (Khan and Reddy, 1992) and ultimately cause dying of the plants.

Schefflera arboricola variegata "Trinit" is a highly demanded plant in current export market. The demanded ones are the air layered plants and tip cuttings and the sizes are varying according to the requirement of the buyer. If the mother plants are suffering from nematode attacks it will reduce the plant quality.

Chemical soil treatments are recognized as an essential means of controlling nematodes on number of cash crops in the tropics. Most commonly used types are nematicides as Phenomephos, fensulfothion, Oxamyl and carbofuran. The use of fensulfothion, Oxamyl and Carbofuran at 1kg/ha gives 70-90% reduction of Pratylenchus population (Pathak *et al.*, 1996))But they have disadvantages in being expensive and extremely toxic to man and animals when used improperly and their availability may be further curtailed because of their recent detection in ground water (Luc *et al.*, 1990). Mainly due to high expenditure on nematicides in Sri Lanka Carbofuran is commonly used.But it is also very poisonous substance and it's half life is 30-60 days in soil and less than 5 days in plants (Hill, 1975). So have to use Carbofuran with regular intervals and so on the cost and resistant build up is much higher.

It was found that nematode control can be achieved through cultural methods as soil amendments, growing trap crops and crop rotation. (Ekanayake *et al.*, 2003). Incorporation of locally available agricultural by-products as soil amendments into *Meloidogyne incognita* infested soil is an effective alternative to toxic nematicides in controlling root knot nematodes (Ekanayake *et al.*, 2003). So that may be effective for *Pratylenchus* species also.

The neem seed kernel and coat (MIshra and Vijayalakshmi, 1994) has an effect on *Meloidogyne* species in mungbean (Vigna unguiculata). According to Nishantha and Ekanayake(2000) poultry manure has an effect on *Meloidogyne* species on tomata (*Lycopersicum esculentum*) plants. Use of cattle manure and compost has shown an reduction in *Heterodera rostochiensis* on potato (*Solanum tuberosum*) (Mishra and Vijayalakshmi, 1994). Use of these amendments may have effects on *Pratylenchus* species and it can be effective for the

IPM package on controlling of plant parasitic nematodes in mother plant fields of *Schefflera arboricola* variegata "Trinit"plants.

Thus the aim of this study is to promote safe and low cost methods by assessing the use of effective non-chemical soil amendments and to increase the quality of *Schefflera arboricola* variegata "Trinit" plants on exportations.

MATERIALS AND METHODS

This study was carried out at the National Plant Quarantine Service (NPQS), Katunayake, Department Of Agriculture from January to July in year 2006.

The nematode infested soil was collected from infested mother plant beds of *Shefflera arboricola* variegata "Trinit"and 30 days old *Shefflera arboricola* variegata "Trinit" rooted cuttings were brought from ItaLanka Ceylinco Foliage Ltd, Atiyawala, Yogiyana. Then the soil was tested to find out the species of nematode found in the soil. Nematode culture was maintained in a cement tank in the net house of NPQS with regular irrigation.

Randomly selected soil samples (each 30 g) from the culture were tested for nematode population in every week. Extraction of nematodes was done by Baermann Funnel Technique (Hooper, 1986).Higher population of nematodes was observed after five weeks (20 PPN/30g). Then forty two pots were filled with the soil from the culture (4 kg/pot) and infested *Shefflera arboricola* variegata "Trinit"plants were planted as one plant per pot. Shallow tray was kept under each pot to collect leaching water, that to prevent leaching down of nematodes from the pot, with water. They were kept under net house conditions and three weeks after planting randomly selected six pots were tested for initial nematode count by Baermann Funnel Technique.

Then a pot experiment was conducted under net house conditions, with the day temperature of 32^{0}C. The experiment was laid out in a Completely Randomized Design (CRD) with six treatments and each having six replicates.

The treatments used in experiment included:

T_1: Crushed Neem seed (115g/pot)
T_2: Compost (170g/pot)
T_3: Poultry manure (20g/pot)
T_4: Cattle manure (170g/pot)
T_5: Carbofuran (4g/pot)
T_6: Control (without applying any Treatment)

Thirty six pots with infested rooted cuttings were used for this experiment. The spacing between two pots was one and half feet. Equal volume of water was added for each plant daily with much attention to avoid overflowing.

Soil nematode count per each pot was taken two months after treatments (mid-count) and final nematode count was also taken, after three months.

The symptoms, plant height and number of compound leaves were recorded once in two weeks. The plants were examined for the symptoms as dead or devitalized bud, necrosis and discoloration of leaves and stunting of plants.

At the end of the experiment data were analyzed by using SAS computer program. General Linear Model was used to analyze the continuous data and count data were analyzed using CATMOD procedure (Thattil, 1999).

RESULTS AND DISCUSSION

1. Plant parasitic nematode count in soil.

Time and treatments both were having a significant effect on plant parasitic nematode count in the soil and also there was an interaction between time and treatment (table 1).

Table 1 - Effect of treatment, time and treatment time interaction on plant parasitic nematode count (mid-count):

Source	Probability values
Treatment	0.0000
Time	0.0000
Treatment*Time	0.0000
Likelihood Ratio	-

Probability< 0.05 – significantly different

When the mid count was compared to each other the lowest Plant Parasitic Nematode count was observed in T_5 (02) while T_3(03) and T_2(04) were second .T_4 (05) was having higher plant parasitic nematode count than above two , but that was lesser than T_1(11) (table2).

Table 2 - Effect of treatments on *Pratylenchus* count of *shefflera arboricola variegata* "Trinit":

Treatment	Pratylenchus count (Mid-count)
Crushed neem seeds	11^a
Compost	04^b
Poultry manure	03^{bc}
Cow dung	05^{ac}
Carbofuran	02^b
Control (no treatment)	26^d

Treatment means in the column having same letters are not significantly different by LSD 5%

With compared to the final count there was a rapid increase of *Pratylenchus* count in T_5 (Carbofuran). But the final count of T_1 (crushed neem seeds), T_2 (compost) and T_3 (poultry manure) were significantly different from the count of T_5 (carbofuran). The plant parasitic nematode count in the T_6 (control) had a continuous increase and it was much rapid during last 8 weeks (figure 1).

In carbofuran (T_5) treated pots the plant parasitic nematode population is low during first 7 weeks due to the effect of carbofuran, so on the root growth is better and plant characteristics are good. But with the time the nematicidal effects of carbofuran are reduced

gradually. Half life of Carbofuran is 30-60 days in soil (Hill, 1975).Therefore the plant parasitic nematode population increases. But due to the availability of larger amount of roots their damages are high and therefore the population increase is more rapid. So there was a huge difference (42) between the values of mid count (after 7 weeks) and the final count (after 15 weeks).

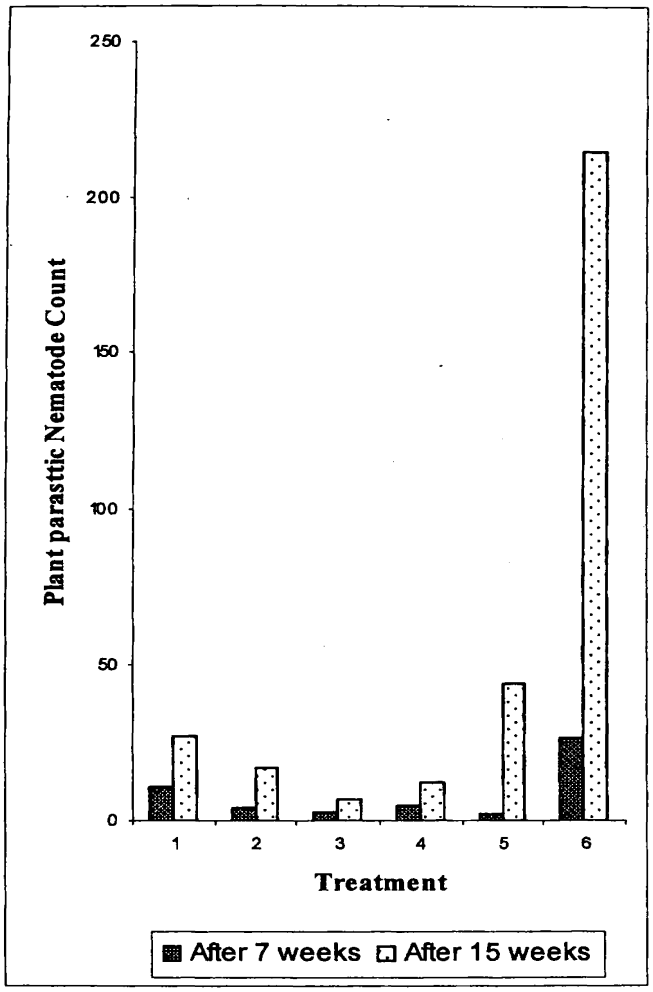

Figure 1: Variation of plant parasitic nematode *(Pratylenchus)* count with the time:

Also the long term effects of poultry manure (T_3) and compost (T_2), on parasitic nematodes had been exceeded even carbofuran. It is known that higher soil organic matter content protects plants against nematodes by increasing soil water-holding capacity and enhancing the activity of naturally-occurring biological organisms that compete with nematodes in the soil (Peet, 1995). This may be the reason for reduction of plant parasitic nematodes in poultry manure and compost treated soils.

In concern with poultry manure, it can reduce the acidity in soil due to content of Calcium (Wijewardane, 2003). The best suited pH for *Pratylenchus* species is pH 6.0 (Gaur, 1994). So addition of poultry manure ultimately can reduce the number of *Pratylenchus* species in soil, by creating unfavorable environments.

2. Growth Parameters.

(A) Plant Height:

Increase in plant height was highest (7.87cm) on the plants treated with crushed neem seeds and that is not significantly different from the height of cow dung treated plants (6.22cm). Carbofuran treated plants were having second highest increase (4.55cm). The plants treated with compost and poultry manure were at third and height of plants treated with poultry manure was not significantly different from control plants (table 3).

(B)Leaf Number:

The highest number of leaves can be obtained in T_1(crushed neem seeds). Leaf number of T3 (poultry manure), T_4(cow dung) and T_5(carbofuran) were at second. The number of leaves in T_2 (compost) treated plants were the least among treatments, but it was higher than the leaf number of T_6 (control) plants (table 3).

Table 3 - Effect of treatments in increase in height of *shefflera arboricola variegata* "Trinit":

Treatment	Increase in height (cm)	Leaf Number
Crushed neem seeds	7.87^{a}	09^{a}
Compost	3.37^{c}	03^{c}
Poultry manure	2.60^{cd}	04^{bc}
Cow dung	6.22^{a}	06^{b}
Carbofuran	4.55^{b}	04^{bc}
Control (no treatment)	2.43^{d}	00^{f}
LSD	2.13	2.07
CV %.	15	22

Treatment means in the column having same letters are not significantly different by LSD 5%.

Bhatti and Paruthi (1998) has reported that the use of compost resulted in improved plant growth and subdued multiplication of the nematodes. In this experiment it had been observed that the reduction of *pratylenchus* count was there, but the improvement of plant growth was poor. The reason may be that the dosage of compost should not be sufficient enough to supply the required amount of N, P, K and other elements to the *Shefflera arboricola* variegata "Trinit"plants.

In cow dung treated plants the nematode count was not much lower, but the growth parameters were better. The reason may be that the dosage was not enough to reduce the *pratylenchus* count in soil, but it could supply the required amount of elements to the *Shefflera arboricola* variegata "Trinit" plants. So the plant could tolerate the damages by *Pratylenchus* species. Wijewardane (2003) has reported that due to the content of high amount of micro and macro organisms in soil it can create antagonistic effect to nematodes in vegetables. This could be resulted in lower damage to the *Shefflera arboricola* variegata "Trinit"plants also.

According to Nishantha and Ekanayake (2000) Phytotoxic effects of poultry manure has resulted in slow growth of *Shefflera arboricola* variegata "Trinit"plants.

CONCLUSION

It could be concluded that the use of all four soil amendments has an effect on reduction of *Pratylenchus* species in *Shefflera arboricola* variegata "Trinit"plants.

In concern with the Pratylenchus count, poultry manure and compost are better, while cowdung and crushed neem seeds are better in concern with the growth parameters of *Shefflera arboricola* variegate "Trinit" plants. Therefore it could be suggested to use poultry manure or compost in combination with crushed neem seeds or cowdung for better results in *Shefflera arboricola* variegata "Trinit"plants.

Pratylenchus species in *Shefflera arboricola* variegata "Trinit"plants can be managed effectively by the integration of components such as the use of above soil amendments.

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