Comparison of inorganic and organic nematicides on the population of soil nematodes in hybrids of *Saccharum* species

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ABSTRACT

Organic nematicides such as neem cake, press mud, groundnut oil cake, neem mark and cotton seed oil and inorganic nematicides such as carbofuron, phorate and aldicarb have been found to have inhibitory effect against the soil nematodes including plant parasitic nematodes of sugarcane crop. The percent reductions of nematode population with the organic and chemical nematicides were studied. Among the organic amendments neem cake recorded the maximum reduction of nematode population density of 89.36 per cent and the cotton seed oil cake the minimum 60.84 per cent compared with control plots. Among the chemical nematicides, carbofuron reduced the population density of nematodes to the maximum, i.e. being 100 per cent followed by phorate while aldicarb recorded the minimum compared to the population density of control.

Key words: Groundnut, oilcake, Neem mark, cotton seed oil, nematicides aldicarb, phorate, carbofuron.

INTRODUCTION

Plant parasitic nematodes are important pathogens of all cultivated crops including sugarcane, which is a± major agricultural crop produced in many countries with tropical and sub-tropical climates. The problems caused by phyto-nematodes are common, which was highlighted by Severino *et al.* (2010). At present 48 genera and 310 species of endo and ecto parasitic nematodes species have been reported to be associated with rhizosphere soil and root of sugarcane (Cadet and Spaull, 2005). Species of five genera namely Pratylenchus, Hoplolaimus, Helicotylenchus, Tylenchorhynchus and Meloidogyne is listed as the major plant parastitic nematode with a wide distribution and common occurrence in sugarcane soils of India (Mehta, *et al*., 1992).

These plant parasitic nematodes cause much damage to sugarcane crop. The chemical nematicides such as carbofuran, aldicarb etc. are used to control the plant parasitic nematodes (Varaprasad and Mathur, 1980). The chemical nematicides may be useful and effective in the control of plant parasitic nematodes, but they harm do and cause environmental pollution. Not only this, the chemical nematicides are so expensive that small farmers cannot afford it (Mohan and Subhashini, 2010). The organic amendments are also used to control such plant parasitic nematodes (Singh and Sitaramaiah, 1973; Mohammad Akhtar and Abdul Malik, 2000). Stirling *et al.* (2005) reported the control of population of *Pratylenches zeae* and *Tylenchorhynchus annulatus* in amended soil were reduced by 85% and 71% respectively in sugarcane fields. This study is undertaken to compare the effectiveness of chemical and organic amendments.

MATERIALS AND METHODS

Field trials were conducted to compare in detail the population dynamics of sugarcane nematodes as affected by application of organic amendments with those affected by application of chemical nematicides and with increase in nematode population in control plots.

Nematode infested field was selected at Kullapuram village in Madurai district of Tamil Nadu, India. The total area of the field was 0.4 ha, divided into 27 plots, each plot measuring 148 m^2 divided into 20 rows. The experiment was laid out in a randomized block design with three replications. Nine treatments were tested including five organic nematode controlling products and three chemical nematicides. The organic products tested were press mud (PMC, filter cake), groundnut oil cake, neem cake, cotton seed cake and Neemark (a product of West Coast Herbochem Private Limited, Mumbai, containing active azardiractin, a free flowing granular form). The dosages of organic amendments applied viz., pressmud at 40 tonnes/ha, groundnut oil cake, neem cake and cotton seed cake were at 5kg /ha and Neemark at 20 kg /ha. The granular chemical nematicides tested were phorate 10% at 1.5kg a.i/ha, aldicarb 10%g at 1.5kg a.i/ha and carbofuran 3g at 1.5 kg a.i/ha

Soil samples were collected from each plot using a screw type augur at regular monthly intervals for a period of eight months from five different spots in each plot at a depth of 20 cm. The soil was mixed in a plastic basin collected in polythene bag labeled and brought to the laboratory for further analysis. Two hundred and fifty ml of soil was taken from each sample and analyzed for nematode population adopting the wet decanting and sieving technique of Cobb (1918) and net-ring technique (Nirmala, 1993).

RESULTS AND DISCUSSION

The statistical analysis showed that the nematode population density of each species identified is highly significant with the treatments applied and the interaction between the species density and treatment is not significant (Table 1). The highest reduction of nematode population was recorded in the treatment with carbofuran (105.38 %) followed by neem cake (89.36 %), phorate (86.71 %), press mud (85.63 %), aldicarb (81.41 %), groundnut oil cake (75.66%), neemark (73.38%) and cotton seed oil (60.84%) compared with control. Among the chemical nematicides, carbofuran reduced the population density of nematodes to the maximum (105.38%). Among organic amendments, neem cake recorded the maximum reduction of nematode population density (89.36%) and the cotton seed oil cake (60.84%) the minimum, compared with control treatments.

Effect of inorganic and organic amendments on the activity and survival of nematodes have been studied by many workers (Kaushal and Seshadri, 1989). Among the chemical nematicides tested, carbofuran reduced the nematode population effectively followed by phorate and aldicarb, while among organic amendments neem cake reduced the population of nematodes to the maximum per cent followed

Table 1. Effect of inorganic and organic nematicides on the soil nematodes total populations

Months	Treatments Population in 100ml of soil								
	Carbofuran	Neem Cake	Phorate	Press mud	Aldicarb	Ground nut oil cake	Neemmark	Cotton seed oil	Control
1	257	288	267	309	273	327	330	325	325
2	126	140	182	173	201	194	162	202	318
3	101	120	107	124	135	121	136	137	295
4	102	146	127	115	115	116	125	135	299
5	105	117	104	102	133	113	108	140	267
6	111	105	116	112	115	118	122	137	209
7	110	90	127	110	111	116	119	133	210
8	130	119	116	110	92	110	126	119	214
Mean	130± 18.49	141± 21.97	143± 9.67	144± 24.78	147± 21.38	152± 26.85	154± 25.82	166± 24.34	267± 17.52

by press mud, groundnut oil cake, neem and cotton seed oil cakes (Mehta *et al.*, 1994)

It has been observed that the chemical nematicides gave more efficient control of nematode population density than the organic amendments for an immediate control. The chemical nematicidies applied to readily fumigated the soil and reduced the population density. The immediate and high reaction of chemical nematicides was already studied by Kaushal and Seshadri (1989). The nematicidal properties are also affected by environmental factors of soil such as soil porosity, water content, organic matter content and temperature (Jenkins and Taylor, 1967).

The nematode population build-up depends on the initial population of nematodes in the soil whereas the final population P_f is always correlated with P_i (Mehta *et al*., 1992). Hence, in fields where Pi is higher, application of chemical nematicides would reduce the population level at period of germination and initial growth. So, further population development could be prevented beyond the economic threshold level. When the initial population of nematode is less then control will be very effective and will not need more application of chemical nematicides.

Application of organic amendments resulted in lower control in the nematode population when compared with chemical nematicides. This may be due to the fact that soil nematode population is reduced when the organic amendments undergo decomposition. The decomposition process in soil is generally slow. During the decomposition of organic materials, volatile fatty acids ammonia and hydrogen sulphide gas are released. Such gases are toxic to plant parasitic nematodes and reduce the population (Singh and Sittaramiah, 1970). The beneficial effect of organic amendments for the control of plant parasitic nematodes differs. Their decomposition by micro-organisms has been reported by Singh and Sitaramaiah (1970). Further, they noted that reduction of nematode population, the organic amendments are also directly beneficial to the field crop by providing additional nutrients to the same. The chemicals are effective for immediate short duration control and organic amendments for long duration. Organic amendments not only help in the reduction of soil nematode population but also prevent pollution created by the chemical nematicides. The toxicity of chemical nematicides such as soil fumigants or non-fumigants has been reported by Bell *et al*. (2011). Hence, the regular use of organic amendments should be recommended as far as possible in controlling the soil nematodes in sugarcane fields depending on the nematode population level.

REFERENCES

Bell, W. J., Adam, K., Hinz, J., Riggs, J. and Knake, R. 2011. In. United States Patent Application Publications. No: US 2011/0200571 A1. Pp.1sss.

Cadet, P. and Spaull, V. W. 2005. Nematode Parasites of Sugarcane. 645 – 674 PP. in Luc, M., Sikora, R. A. and Bridge, J. Eds. Plant parasite Nematodes in Subtropical and Tropical agriculture. 2nd E. Cambridge, MA: CABI Publishing.

Cobb, N. A. 1918. Estimating the nematode population of the soil. *Agri. Tech. Circ. Bur.Pl.* And *U.S. Department of Agriculture* **1**:48.

Kaushal, K. K. and Seshadri, A. R. 1989. Effectiveness of chemicals against *Heterodera avanae* Woll. on wheat. *Indian Journal of Nematology,* **19**:41.

Jenkins, W. R. and Taylor, D. P. 1967. Chemical control In. Plant nematology, Ed. Peter Gray Reinhold publishing corporation, New York, 222-223 **PP.**

Mehta, U. K., Sundararaj, P., Nalini Natesan, 1992. Horizontal and vertical distribution of *Pratylenchus zeae* for five consecutive years in a sugarcane field. *Afro – Asian Journal of Nematology,* **2**:67-73.

Mehta, U. K. Sundararaj, P. and Natesan, N. 1994. Effect of fine oil cakes on control of *Pratylenchus zeae* in sugarcane. *Nematologica Mediterranea,* **22***:*219-220.

Mohammad Akhtar and Abdul Malik. 2000. Roles of organic soil amendments and soil organisms in the biological control of plant-parasitic nematodes: a review. *Bioresource Technology*, **74** (1): 35-47.

Mohan, K. and Subhashini, S. 2010. Effect of organic amendments on parasitic nematodes of Okra (*Abelmoschus esculentus* L.). *Journal of Theoretical and Experimental Biology,* **7** (1 and 2): 53-55.

Nirmala, P. 1993. Studies on biology of root-knot nematode, *Meloidogyne* spp. Goeldy, 1892. and the resulting bio-chemical changes in sugarcane roots. In: Ph.D thesis submitted to Bharathiar University, Coimbatore, India.

Severino, J. J., Dias – Arieira, C. R. and Tessmann, D. J. 2010. Nematodes associated with sugarcane (*Saccharum*. spp) in sandy soils in Parana, Brazil, Nematropica **40**:111-119.

Singh, R. S. and Sittaramiah, 1970. Control of plant parasitic nematodes with organic soil amendments. Proceedings of the National Academy of Sciences.**16**:287-297.

Singh, R. S. and Sittaramiah, 1973. Control of plant parasitic nematodes with organic amendments of soil. Final Technical Report. Effect of organic amendment, green manuring and inorganic fertilizers in root-knot of vegetable crops. Research Bulletin Experimental Station & College of Agriculture. No **6**: 289 **PP**.

Stirling. G. R., Wilson. E. J., Stirling, A. M., Pankhurst, C. E., Moody, P.W., Bell, M. J., and Halpin, N. 2005. Amendments of Sugarcane trash induce suppressiveness to plant – parasitic nematodes in sugarcane soil. *Australasian Plant pathology*. **34;** 203-211.

Varaprasad, K. S. and Mathur, V. K. 1980. Efficacy of carbofuran and aldicarb sulfone seed treatment on plant growth and against *Meloidogyne incognita* on sugarbeet. *Indian Journal of nematology*, **10**:130-134.

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