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Evaluation of Fresh Poultry Manure as Organic Amendment for the Management of Root-Knot Nematode, *Meloidogyne incognita* in Flue-Cured Virginia (FCV) Tobacco Nursery

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ABSTRACT: Root knot nematodes pose serious threat to FCV tobacco production in Karnataka light soil region causing severe loss in yield and quality. Nematode management by use of carbofuran and dazomet 98% is quite possible, but indiscriminate use of such chemical nematicides leads to environmental pollution due to residues in water and soil. Hence, poultry manure, which is a locally available organic source, was evaluated against root-knot nematodes in FCV tobacco nursery for three years. Results revealed that, there was no adverse effect of poultry manure on tobacco seed germination. At 60 DAS, Poultry manure @ 200 g/m^2 was on par with poultry manure @ 250 g/m^2 in recording reduced Root-Knot Index (RKI) of 1.36 and 1.34 respectively and also was on par with neem cake + soil solarization (1.40) and dazomet @ 30 g/m^2 (1.22). Similarly application of Poultry manure @ 200 g/m^2 in FCV tobacco nursery beds resulted in 40% reduction in number of root galls /g root, 34% reduction in number of root knot nematode adult females/g root, 43% reduction in number of root knot nematode egg masses/g root and 36.9% reduction in root knot nematode soil population/100g soil compared to untreated check. Poultry manure @ 200 g/m^2 was on par with poultry manure @ 250 g/m^2 in recording significantly increased healthy and root-knot free transplantable seedlings to the tune of 48.0 and 59.0 per cent respectively compared to untreated check.

Keywords: Poultry manure, root-knot nematode, *Meloidogyne incognita*, FCV tobacco nursery

Flue-Cured Virginia (FCV) tobacco is an important cash crop cultivated under rainfed conditions in light soils of Karnataka. Root-knot nematode is a potential limiting factor causing yield reduction in both nursery and main field crop to the tune of 59.4% and 52.9% respectively (Hussaini, 1983). Losses caused by this nematode are very high, especially when they interact with other diseases causing pathogens like *Alternaria alternata* and *Fusarium oxysporum* fsp. *Nicotiana* (Karunakaramurthy *et al.*, 2001). Root-knot nematode infected FCV tobacco seedlings exhibit conspicuous galling with protruding slimy egg masses on the root system. Such infected seedlings, when transplanted cause stunted plant growth under main field conditions and may even collapse during un favourable weather situations such as drought resulting in gaps and subsequent yield loss. Actually the root knot nematode infection starts from the nursery beds as the seed germinate. Through the infected seedlings, the root knot disease reaches to the main fields. The nematode infected FCV tobacco plants develop a light yellowish cast in contrast to the normal green of healthy plants. Management of root-knot nematodes through the use of both fumigant and non-fumigant nematicides are quite possible and were widely reported (Ramakrishnan *et al.*, 1998). But, uses of such nematicides of chemical origin have limited practical value due to their exorbitant cost and residues they leave in soil and water environment. Moreover, utilization of organics against nematodes is an age-old practice, which is both cost-effective and environmental friendly. Organics such as animal refuses, agricultural by-products and poultry manure were reported to be effective against plant parasitic nematodes elsewhere in other crops (Badra & Oteifa, 1979). Availability of poultry manure in bulk quantity in and around FCV tobacco growing areas of Karnataka, prompted to evaluate it in varied doses against root-knot nematode in FCV tobacco nursery.

MATERIALS AND METHODS

The studies were conducted in CTRI Research Station, Hunsur farm in a root-knot nematode sick nursery plot. The mean initial root-knot nematode population in experimental site was 150 infective juveniles (J2s) per 100g. soil. Fresh poultry manure collected from nearby poultry farms was incorporated into raised nursery beds at varied dosage levels viz., 50, 100, 150, 200 and 250g / m^2 beds of one sq.m. dimension. The other standard treatments for the purpose of comparison, neem cake @ 400 g/m^2 + soil solarization for six weeks period and dazomet 98% @ 30 g/m^2 served as recommended checks along with one untreated control. For the treatment involving soil solarization, neem cake was added into raised nursery beds prior to soil solarisation. Solarisation of raised beds was done by covering them with transparent low density polythene (LDPE) film of 25µm thickness. After six weeks period, sheets were removed and seeds of FCV tobacco variety kanchan were sown on the well prepared nursery beds after two to three days waiting period. Fresh poultry manure was applied on to the raised nursery beds and waiting period of two weeks duration before sowing was given to facilitate its decomposition on the nursery beds. All the treatments were replicated thrice in randomized block design and the other cultural practices were followed as recommended. Observation on germination count at 15 DAS, plant growth parameters at 60 DAS, healthy transplants count at 60 DAS, total healthy transplants count at 80 DAS, Root-knot Index (RKI) at 45& 60 DAS , number of adult females/g. root, number of egg mass / g. root and final soil nematode population per 100g. soil at the time of seedling pulling were recorded and the data gathered were subjected to statistical analysis.

RESULTS AND DISCUSSION

Experimental results from Table 1, revealed that there was no adverse effect of poultry manure on tobacco seed germination. Poultry manure application in the nursery beds resulted in significant improvement in FCV tobacco seedling growth. Improvement in seedling growth characters due to application of poultry manure ranged from 6 to 32 per cent and 5 to 17 per cent in seedling height and seedlings weight respectively over untreated check. Similarly, nursery beds amended with poultry manure @ 200 g/m^2 recorded significantly increased number of total root-knot free healthy transplants (987/m^2) and was on par with poultry manure @ 250 g/m^2 (1056/m^2), neem cake @ 400 g/m^2 + soil solarization (990/m^2) and dazomet 98% @ 30g/m^2 (1065/m^2). At the time of seedling pulling for transplantation in main field (ie) at 80 DAS, all the treatments including

Table 1. Effect of poultry manure on FCV tobacco seedling growth and healthy transplants count in nursery

Treatments	Germination count	Seedling height (cm)	Seedling weight/ 10 seedlings (g)	Healthy Transplants Count (At 60 DAS)	Total Healthy Transplants Count	% increase over check
Poultry manure @50g / m^2	24.6	12.0	156.0	375	920	38.0
Poultry manure @100g / m^2	21.7	12.0	155.0	350	900	35.0
Poultry manure @150g / m^2	24.4	13.2	156.8	388	930	40.0
Poultry manure @200g / m^2	27.8	15.0	165.0	402	987	48.0
Poultry manure @250g / m^2	24.7	15.0	172.0	425	1056	59.0
Neem cake +Soil solarization	24.6	15.9	173.3	450	990	49.0
Dazomet 98%@ 30g / m^2	24.2	16.2	180.0	500	1065	60.0
Check	22.8	11.3	147.0	377	663	-
S.Em	-	0.69	4.38	23.4	39.30	
CD (P=0.05)	NS	1.90	12.09	64.9	108.6	

Table 2. Effect of poultry manure on root-knot nematode, *Meloidogyne incognita* multiplication and final soil nematode population in FCV tobacco nursery

Treatment	Root-Knot Index			No. of galls /g root	% Decrease over check	No. of adult females / g root	% Decrease over check	No. of egg mass /g. root	% Decrease over check	Final nematode Soil Population (/100cc soil)	% Decrease over check
	45 DAS	60 DAS	% Decrease over check								
Poultry manure @50g / m^2	2.36	2.40	27.4	10.0	18.0	13.33	14.0	9.00	15.0	115.6	25.5
Poultry manure @100g / m^2	1.56	1.90	42.6	9.00	27.0	12.00	23.0	7.67	28.0	114.3	26.4
Poultry manure @150g / m^2	1.60	1.91	42.3	8.33	32.0	10.67	31.0	8.00	25.0	113.6	26.8
Poultry manure @200g / m^2	1.30	1.36	58.9	7.33	40.0	10.33	34.0	6.00	43.0	98.0	36.9
Poultry manure @250g / m^2	1.13	1.34	59.5	7.00	43.0	10.33	34.0	5.33	50.0	91.0	41.4
Neem cake +Soil Solarization	1.33	1.40	57.7	7.33	40.0	11.00	29.0	6.00	43.0	100.6	35.2
Dazomet 98% @ 30g / m^2	1.13	1.22	63.1	6.67	45.0	9.67	38.0	5.00	53.0	73.0	52.9
Check	2.86	3.31	-	12.33	-	15.67	-	10.67		155.3	
S.Em	0.36	0.17		0.60		0.55		0.78		3.6	
CD (P=0.05)	1.06	0.46		1.67		1.53		2.21		11.1	

Table 3. Economics of poultry manure application for the management of root-knot nematode, *Meloidogyne incognita* in FCV tobacco nursery (for 100m^2 nursery)

Particulars	Conventional nursery (Rs/-)	Organic schedule (Rs/-)
Seed bed preparation, seed, sowing, watering and fertilizers	1800	1800
Cost of Farm Yard Manure	500	500
Cost of poultry manure @ 200 g/m^2	-	400
Weeding	900	900
Total cost	3200	3600
Additional cost over check	-	400
Number of Healthy transplants/100m^2	66300	98700
Number of excess transplants/100m^2	-	32400
Returns from excess transplants @ Rs.100/ 1000 transplants	-	3240
Net returns over check	-	2840
Incremental Cost Benefit Ratio	-	1:7.1

standard check treatments significantly decreased the root knot disease incidence (Table 2). Poultry manure @ 250 g/m^2 caused 48.9 % reduction in RKI (1.34) compared to untreated check (RKI 3.31) and was on par with poultry manure @ 200 g/m^2 (1.36), neem cake + soil solarization (1.40) and dazomet 98% @ 30g / m^2 (1.22). Reduction in final soil nematode population to the tune of 41.4% and 36.9% was also observed in beds treated with poultry manure @ 250g and 200g/ m^2 respectively compared to check Further application of poultry manure to FCV tobacco nursery beds to the tune of 50 to 250 g/ m^2 resulted in significant reduction ranging from 18 to 43% in number of galls /g. root, 14 to 34% in number of adult root knot nematode females / g. root and 15 to 50 % in number of egg masses/g. root (Table 2). Similar reduction in root-knot disease incidence in terms of RKI and final soil nematode population and subsequent improvement in okra pod yield due to application of organic amendments was earlier reported by Ramakrishnan *et al*. (1997). Reduction in *M. incognita* population in tomato plants due to application of poultry manure as soil amendment was also earlier reported by Chindo & Khan (1990). Jaykumar *et al*. (2004) had also reported reduction in root-knot index in tomato and subsequent increase in tomato growth characters due to application of fresh poultry manure. Present experimental results clearly exhibit the nematicidal nature of fresh poultry manure. Moreover presence of poultry manure in abundance in the poultry farms present in and around of FCV tobacco growing regions of Karnataka in India is an added advantage with reference to availability of the manure in ease to FCV tobacco growing community. In addition to this, economics of poultry manure application clearly says that, poultry manure application @ 200g/m^2 is an ideal dosage level with incremental cost benefit ratio of 1: 7.1 (Table 3) and also effective for the management of root knot nematodes in FCV tobacco nurseries raised in light soils of Karnataka.

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