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Effect of certain nematicides and oilcakes on the population of nematodes in nurseries of some fruit trees and changes in biochemical contents of seedlings

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Oilcakes of castor, mustard, neem and nematicides, i.e. Furadan 3G and Temik 10G when applied in nursery beds of apricot, lemon, pear, peach and walnut reduced the population of phytonematodes. Neem cake exhibited highest efficacy. Roots of seedlings raised in soil treated with oilcakes had higher amount of total free phenols, O-dihydroxyphenols and aminoacids compared to untreated and those treated with nematicides.

Systematic nematicides are used in the chemical control of plant parasitic nematodes, especially of those associated with perennial crops in nurseries (Maggenti & Hart, 1970 and Khan *et al.*, 1976). But their use by farmers is limited because of high level of toxicity and high cost/return ratio. The amendment of soil with oilcakes is effective in reducing nematode population of vegetables anf field crops but nothing is known about their use in managing nematode population in nurseries of fruit trees (Khan, 1977; Singh *et al.*, 1980a). Therefore, the efficacy of oilcakes was compared with nematicides in nurseries of fruit trees to manage nematode population and the results are reported.

MATERIALS &METHODS - Nursery beds measuring 10 sq. m. harbouring moderate to high populations of *Hoplolaimus indicus*, *Helicotylenchus indicus*, *Tylenchorhynchus elegans*, *Rotylenchulus reniformis*, *Meloidogyne incognita larvae*, *Criconemoides citri*, *Trichodorus minor and Xiphinema indicum* were thoroughly ploughed and treated with oilcakes of castor (*Ricinus communis* Linn.), mustard (*Brassica campestris* Linn.) and neem (*Azadirachta indica* Juss.) at the rate of 2 kg per 10 sq. m. plot. Furadan 3G and Temik 10G were applied at the rate of 25 g per 10 sq.m. plot. Beds receiving no treatments served as control. After 21 days, seeds of apricot (*Prunus armeniaca* Linn.), lemon (*Citrus aurantifolia* (Christm) Swing), pear (*Pyrus communis* Linn.), peach (*Prunus persica* Linn. Stokes) and walnut (*Juglans regia* Linn.) were sown. There were 3 beds for each treatment arranged in a randomised manner. Population of nematodes was determined both prior to treatment and 60 days after sowing by using Oostenbrink's elutriator and Baerman funnel (Southey, 1970).

For estimating total free phenols, O-dihydroxyphenols and aminoacids, roots were dried at 50±5°C, ground and passed through a 60 mesh sieve. Total phenols, O-dihydoxyphenols aminoacids were measured according to Mahadevan & Sridhar (1986).

RESULTS - The population of nematodes increased considerably in the untreated beds with different kinds of seedlings (Table 1). However, in beds treated with oilcakes and nematicides the population decreased. In untreated beds, the

Table 1 Efficacy of oilcakes and nematicides on the population of phytonematodes around the roots of fruit trees in nursery plots.

Crop	Treatment	Population of nematodes/200 g soil									
		Hop.	Hel.	Tyl.	Rot.	Mel.	Cr.	Tri.	Xip.	Total	Sap.
Apricot	Control	360	210	510	230	100	120	140	120	1790	1270
	Castor Cake	65	70	110	110	30	50	-	50	485	1160
	Mustard Cake	90	50	130	60	-	45	65	35	475	1230
	Neem Cake	40	-	80	60	-	40	-	20	240	1455
	Furadan 30	60	30	40	30	-	40	30	20	250	790
	Temik 10G	20	-	-	60	-	30	-	-	110	630
Lemon	Control	310	170	670	225	105	60	40	90	1670	1530
	Castor Cake	140	80	200	90	50	25	20	30	635	1610
	Mustard Cake	100	70	170	60	40	-	20	-	440	1685
	Neem Cake	80	70	115	70	55	-	-	-	390	1850
	Furadan 3G	60	50	120	40	20	10	-	30	300	955
	Temik 10G	30	40	95	-	20	10	-	-	195	730
Pear	Control	210	270	515	60	120	95	195	310	1755	1410
	Castor Cake	90	115	130	20	55	35	80	125	650	1680
	Mustard cake	70	120	90	25	30	55	55	100	545	1750
	Neem cake	20	100	60	10	25	20	30	60	305	1775
	Furadan 3G	60	45	80	-	10	30	40	70	315	1020
	Temik 10G	25	40	50	-	-	20	10	50	195	810

Table 1 Efficacy of oilcakes and nematicides on the population of phytonematodes around the roots of fruit trees in nursery plots. (Contad. from previous page)

Crop	Treatment	Population of nematodes/200 g soil									
		Hop.	Hel.	Tyl.	Rot.	Mel.	Cr.	Tri.	Xip.	Total	Sap.
Peach	Control	430	180	540	240	110	70	85	160	1815	1520
	Castor cake	120	75	120	110	55	45	30	60	615	1780
	Mustard cake	105	90	130	140	20	40	30	70	625	1640
	Neem cake	85	60	70	75	-	30	20	30	370	1820
	Furadan 3G	90	40	85	50	10	-	-	30	305	1040
	Temik 10G	30	20	60	45	20	-	-	30	205	455
Walnut	Control	290	150	495	110	80	110	170	210	1615	1250
	Castor Cake	90	40	115	40	20	60	50	30	445	1270
	Mustard Cake	80	-	100	30	-	70	55	70	405	1285
	Neem Cake	30	10	20	-	-	30	30	30	150	1410
	Furadan 3G	40	-	35	20	15	20	20	20	170	840
	Temik 10G	20	30	20	30	-	15	-	40	155	615
Initial polulation		260	110	490	170	120	70	80	130	1330	1240
L.S.D. (at 5% level).		2.71	1.02	1.53	1.07	0.85	1.02	1.52	1.63	4.21	6.57
L.S.D. (at 1% level).		3.24	1.76	2.09	1.42	1.17	1.49	2.02	2.18	5.68	8.86

Each value is an average of fice replicates.

HOP. = *Hoplolaimus indicus*; Hel. = *Helicotylenchus indicus*, TYL. = *Tylenchorhynchus elegans*, Rot. = *Rotylenchulus reinformis*, Mel. = *Meloidogyne incognita larvae*, Cr. = *Criconemoides citri*, Tri. = *Trichodorus minor*, Xip. = *Xiphenema indicum* and Sap = Saprozoic forms.

Table 2 Changes in total phenols, O-dihydroxyphenols and amino acids contents in samplings of certain fruit trees grown in soil treated with certain oilcakes and nematicides.

Crops	Treatments	Total phenols (mg/100 mg)	O-dihydroxyphenols (mg/100 mg)	Aminoacids (mg/100 mg)
Apricot	Control	0.5	0.03	0.5
	Castor Cake	0.8	0.04	0.6
	Mustard Cake	0.7	0.04	0.7
	Neem Cake	0.8	0.04	0.7
	Furudan 3G	0.5	0.03	0.5
	Temik 10G	0.5	0.04	0.5
Lemon	Control	0.5	0.03	0.4
	Castor cake	0.7	0.04	0.5
	Mustard cake	0.9	0.05	0.7
	Neem cake	0.9	0.05	0.6
	Furadan 3G	0.5	0.03	0.4
	Temik 10G	0.5	0.03	0.5
Pear	Control	0.6	0.04	0.4
	Castor cake	0.7	0.05	0.5
	Mustard cake	1.0	0.05	0.6
	Neem cake	1.0	0.06	0.5
	Furadan 3G	0.6	0.04	0.4
	Temik 10 G	0.6	0.04	0.4
Peach	Control	0.8	0.05	0.7
	Castor cake	0.9	0.07	0.9
	Mustard cake	1.1	0.08	0.9
	Neem cake	1.2	0.08	0.9
	Furadan 3G	0.8	0.05	0.7
	Temik 10G	0.8	0.05	0.7
Walnut	Control	0.8	0.05	0.6
	Castor cake	0.8	0.06	0.8
	Mustard cake	1.0	0.06	0.8
	Neem cake	1.1	0.06	0.8
	Furadan 3 G	0.8	0.05	0.6
	Temik 10G	0.8	0.05	0.6
	L.S.D. (at 5% level)	0.027	0.0034	0.030
	L.S.D. (at 1% level)	0.035	0.0047	0.041

Each figure is a mean of ten replicates.

population of *Hoplolaimus indicus* increased around apricot, lemon, peach and walnut and decreased in pear when compared with initial population; however, that of *Helicotylenchus indicus*, *Tylenchorhynchus elegans* increased around the roots of all the fruit trees. The population of *Rotylenchulus reniformis*, increased around all the crops except pear and walnut; *Trichodorus minor* and *Criconemoides citri* around apricot, pear and walnut and *Xiphinema indicum* around pear, peach and walnut. None of the fruit seedlings supported the multiplication of *Meloidogyne incognita*. Of the oilcakes tested, maximum reduction in population of plant nematodes occurred in neem cake treated beds which might be due to the presence of active nematicidal principles like nimbidin and thionimone. In oilcake treated beds, the population of saprozoic nematodes and rhizosphere fungi like *Aspergillus* sp., *Mucor* sp., *Rhizopus nigricans* and *Trichoderma* sp., increased.

Results presented in Table 2 show that free phenols and OD phenols were high in the roots of fruit crops grown in soil amended with oilcakes compared to the control. Maximum increase occurred in those grown in soil amended with neem cake. However, highest increase in the level of amino nitrogen in those grown in soil amended with mustard cake. No significant change in the level of free phenols, OD phenols and amino nitrogen was recorded in the roots of plants grown in soil treated with nematicides.

DISCUSSION Reduction in population of nematodes as a result of oilcake treatment may be partly due to nematoxic substances such as phenol, fatty acids, aminoacids, organic acids, carbohydrates and gases released from the oilcakes during decomposition (Singh & Sitaramaiah, 1970, Khan *et al.*, 1974) or due to increased population of saprozoic nematodes and saprobic fungi especially *Aspergillus* sp. and *Trichoderma* sp. The treatment became inhibitory because the parasitic nematodes failed to compete with increased micro-organisms and due to decomposition products of microbial activity. The appearance of these products in soil may be one of the factors responsible for suppression of nematodes (Singh *et al.*, 1983).

An increase in phenols and aminoacids in roots may partly be due to increase in polyphenol oxidase activity resulting from nematode infection (Zinoveva, 1979) and partly due to release of phenols from the decomposition of oilcakes that are absorbed by plants (Alam *et al.*, 1977). The increased phenolic level in plants brings about certain physiological changes which may impart resistance to plants against nematode attack (Singh & Chaudhury, 1973; Giebel, 1974 and Singh *et al.*, 1980b).

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