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COMPARATIVE PERFORMANCE OF OIL SEED CAKES AND PESTICIDES IN THE MANAGEMENT OF ROOT KNOT DISEASE OF DAVANA[1]

by
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Summary. Greenhouse studies were carried out to determine the comparative performance of oil-seed cakes of neem (*Azadirachta indica* Juss.), mahua (*Madbuca indica* Gmel.), castor (*Ricinus communis* L.) and the pesticides aldicarb, carbofuran and bavistin against the root knot nematode, *Meloidogyne incognita* infecting davana (*Artemisia pallens*). Neem oil seed cakes performed best and significantly increased the growth/yield of the crop, followed by aldicarb, castor cake, carbofuran, bavistin and mahua cake. Treatment of the soil with the oil seed cakes and pesticides considerably decreased the population of root knot nematode in Davana. Mahua cake and bavistin gave poor results.

Davana (*Artemisia pallens* Wall.) is an important aromatic plant in U.S.A., Europe, Japan and India, the oil from it being extensively used in food and flavour industries throughout the world. In India, the commercial cultivation of davana is adversely affected by root knot nematodes (*Meloidogyne incognita* and *M. javanica*), which can cause more than 50% reduction in the yield of essential oil (Haseeb and Pandey, 1990). The present studies were undertaken to determine the comparative performance of different oil seed cakes and pesticides in the control of root-knot nematodes and production of davana.

Materials and methods

Field soil (autoclaved sandy loam) was treated with the following oil seed cakes and pesticides: neem (*Azadirachta indica* Juss), mahua (*Madbuca indica* Gmel.), castor (*Ricinus communis* L.), at the rate of 1 g nitrogen/kg of soil (i.e. 18g, 25g and 40g of each oil seed cakes respectively/kg of soil), aldicarb at 0.002 g a.i./kg, carbofuran at 0.0015 g a.i./kg and bavistin at 0.001 g a.i./kg of soil. Earthern pots (15 cm diameter) were filled with treated soil which was watered for two weeks before planting sixteen day old healthy davana seedlings except for the pots treated with chemical pesticides which were planted after one week. Six days later the seedling in each pot was inoculated with 1000 freshly hatched second stage juveniles of *M. incognita* (Kofoid *et* White) Chitw. separately. The pots were arranged randomly in the glasshouse with each treatment replicated five times including the untreated-uninoculated and untreated-inoculated controls. The experiment was terminated ninety days after inoculation and the effects on root gall formation, nematode population, plant growth in terms of root and shoot length, fresh and dry root shoot weight and yield were determined. The oil was extracted with the Clevenger apparatus (Clevenger, 1928).

Root galling was rated 0 to 4 (Taylor and Sasser, 1978), where 0 = no galls or infection, 1 = slight infection (1-25%), 2 = moderate infection (26-50%), 3 = severe infection (51-75%) and 4 = very severe infection (76-100%). Final nematode populations in the soil were extracted by Cobb's sieving and decanting technique followed by Baermann funnel (Southey, 1986) and the populations of nematodes in the roots were estimated by the sodium hypochlorite method (Hussey and Barker, 1973).

Results and discussion

The results (Table I) indicate that soil treatment with different oil seed cakes (neem and castor) and pesticides

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(aldicarb and carbofuran) significantly increased the growth and yield of davana. The maximum values of root and shoot length, fresh and dry weight occurred in soil treated with neem cake followed by aldicarb, carbofuran and castor cake as compared with untreated soil to which nematodes had been added. Treatment by mahua cake and bavistin did not significantly increase growth and yield. However, root-knot nematode populations and root-knot indices (RKI = 1.4) were very low in soil treated with mahua cake (Table II). Treatment with oil-cakes of neem or castor or with the pesticides aldicarb or carbofuran gave a significant (P = 0.05) increase in oil yield compared with the untreated-inoculated control (Table I). Oil yields were maximum from plants grown in untreated and uninoculated soil followed respectively by those of neem cake, aldicarb, carbofuran, castor cake, bavistin or mahua cake treated soils.

Treatments with different oil seed cakes and pesticides significantly reduced root knot formation compared with the untreated-inoculated control (Table II). The maximum reduction in root galling occurred in soil treated with neem cake, mahua cake or aldicarb (RKI = 1.4 for each).

TABLE I - *Effect of oil seed cakes and pesticide treatments on the growth and oil yield of davana infected with* Meloidogyne incognita.

Treatments	Length (cm)		Fresh weight (g)		Dry weight (g)		Percent Oil yield
	Root	Shoot	Root	Shoot	Root	Shoot	
Untreated-Uninoculated	10.5 cd	64.1 abc	15.9 bc	66.9 a	3.7 bc	21.8 b	0.37 a
Untreated-Inoculated	7.1 f	54.4 d	6.2 e	46.3 c	1.8 d	14.7 d	0.25 e
Neem cake	14.2 a	66.9 a	17.7 a	69.8 a	4.1 a	23.9 a	0.36 ab
Mahua cake	8.2 ef	55 d	6.3 e	48.6 c	1.9 d	15.3 d	0.27 d
Castor cake	11.5 bc	62.8 bc	13.9 d	59.5 b	3.4 c	19.5 c	0.33 c
Aldicarb	12.5 b	64.9 ab	16.7 ab	66.6 a	3.9 ab	21.9 b	0.35 bc
Carbofuran	11.4 bc	60.9 c	14.9 cd	60.1 b	3.4 c	19.9 c	0.33 c
Bavistin	9.1 de	55.8 d	6.2 e	46.8 c	1.9 d	15.4 d	0.27 d

Means in each column followed by the same letters do not differ significantly (P<0.05) according to Duncan's multiple range test.

TABLE II - *Effects of oil-seed cakes and chemical pesticides on* M. incognita *reproduction and root knot index in davana.*

Treatments	Nematode population in total root	Nematode larvae in total soil	Total nematode population (root+soil)	Reproduction factor (Rf = Pf/Pi)	Root-knot index (RKI)
Untreated (control)	5809 a	4480 a	10289 a	10.3 a	3.6 a
Neem cake	1063 cd	1093 e	2156 d	2.2 d	1.4 c
Mahua cake	415 d	1253 cde	1668 d	1.7 d	1.4 c
Castor cake	1672 bc	1893 bcd	3565 bc	3.6 bc	2.4 b
Aldicarb	1216 bc	1200 de	2416 cd	2.4 cd	1.4 c
Carbofuran	1494 bc	1946 bc	3440 bc	3.4 bc	2.4 b
Bavistin	1525 b	2160 b	3685 b	3.7 b	2.6 b

Columns with same letters are not significantly (P<0.05) different according to Duncan's multiple range test. Rf (reproduction factor) = Pf (final nematode population) / Pi (initial nematode population).

Carbofuran, castor cake and bavistin were less effective (RKI value from 2.4 to 2.6). Maximum root galling occurred in untreated and inoculated plants (RKI = 3.6). The largest decrease in multiplication of the root-knot nematode was found in mahua cake treated soil (Rf = 1.66) followed by neem cake (Rf = 2.15), aldicarb (Rf = 2.41), carbofuran (Rf = 3.44), castor cake (Rf = 3.56) and bavistin (Rf = 3.68). In untreated and inoculated soil nematode multiplication was high (Rf = 10.28).

In most tropical countries the use of organic materials to control plant parasitic nematodes has been of increasing interest because they are readily available, less expensive than chemicals and also have no hazardous effects on the environment. The results presented here indicate that neem oil seed cakes could be used by farmers to control root-knot nematodes on davana and to improve plant growth through their fertilizer effect.

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