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EFFECT OF ORGANIC AMENDMENTS ON THE GROWTH AND CHEMICAL COMPOSITION OF TOMATO, EGGPLANT AND CHILLI AND THEIR SUSCEPTIBILITY TO ATTACK BY *MELOIDOGYNE INCOGNITA*

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KEY WORDS

Amino acids Carbohydrates Chilli Eggplant Larval penetration *Meloidogyne incognita* Oilcakes Organic amendments Phenols Proteins Root-knot Tomato

SUMMARY

Fewer larvae of *Meloidogyne incognita* invaded and fewer galls were formed when seedlings of non-resistant varieties of tomato, eggplant and chilli were growing in soil to which oilcakes of mahua, castor, neem/margosa, mustard and groundnut had been added. Chemical analysis of plant tissue showed that, compared with untreated plants, plants growing in treated soil contained greater concentrations of phenols and frequently of amino acids, proteins and carbohydrates.

INTRODUCTION

Organic amendments have been shown to be effective in controlling plant parasitic nematodes affecting many crops[13,15]. But little is known about the chemical status of plants grown in soil amended with oilcakes. It is possible that the chemical composition might be modified in a way which was beneficial to plants being attacked by nematodes. Hence, we considered it desirable to investigate the chemical composition of tomato, eggplant and chilli seedlings grown in oilcake amended soil in relation to their susceptibility to attack by the root-knot nematode, *Meloidogyne incognita* (Kofoid & White) Chitwood.

MATERIALS AND METHODS

Oilcakes of mahua (*Madhuca indica* Gmel.), castor (*Ricinus communis* L.), mustard (*Brassica campestris* L.), neem/margosa (*Azadirachta indica* Juss.) and groundnut (*Arachis hypogaea* L.) were

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added at the rate of 1 g N per kg autoclaved soil contained in 15 cm clay pots. The pots were later watered to ensure proper decomposition of oilcakes. After a waiting period of one week, seeds of tomato (*Lycopersicon lycopersicum* (L.) Karsten.) cv. Marglobe, eggplant (*Solanum melongena* L.) cv. Pusa Purple Long and chilli (*Capsicum annuum* L.) cv. NP–46A were sown. When the seedlings were four-week old, they were carefully uprooted, washed and their chemical composition analysed. The roots were dried in an oven running at 50 $\pm$ 5°C and ground to 60 mesh powder. For all the estimations 100 mg samples were used. Total free phenols and total soluble carbohydrates were extracted following the methods of Biehn *et al.*[2] and Yih and Clark[18] respectively. Total free phenols were estimated following Bray and Thorpe[3] at 660 nm, total amino acids following Moore and Stein[12] at 570 nm, total proteins following Lowry *et al.*[11] at 660 nm and total soluble carbohydrates following Dubois *et al.*[5] at 490 nm in Bausch and Lomb Spectronic–20 colorimeter. The amounts of total free phenols, total free amino acids, total proteins and total soluble carbohydrates were calculated with the help of standard curve plotted by using p-cresol, leucine, egg albumin and glucose respectively.

Some of the seedlings, raised as above, were transplanted to acid-washed sand contained in 5 cm clay pots and inoculated with 1000 freshly hatched larvae of the root-knot nematode. After 24 hours these seedlings were removed and the roots were macerated in a waring blender and the numbers of larvae that had penetrated, determined by counting them in the aliquot[16].

The development of root-knot was studied by transplanting the seedlings into autoclaved soil/compost mixture contained in 10 cm clay pots to which 1000 larvae were added. The growth of plants and root-knot development were determined after 60 days. The root-knot index was rated as: 0 = no galling, 1 = light galling, 2 = moderate galling, 3 = heavy galling and 4 = severe galling.

RESULTS AND DISCUSSION

The results in Table 1 show that compared with those in unamended soil the seedlings of tomato, eggplant and chilli grew larger in the soil amended with oilcakes. When these seedlings were transferred to unamended soil and later inoculated with root-knot nematode, their growth was not so severely affected and fewer galls were found (Table 2).

Significantly fewer larvae penetrated the roots of plants raised in oilcake amended soil as compared to untreated control (Table 3). The numbers of larvae penetrating were decreased by as much as 42.86 % in tomato, 76.85 % in eggplant and 27.19 % in chilli.

It is well established that in resistant plants invasion of root-knot larvae[4,7] and root-knot development[1,9] is often inhibited. In the present study, the decrease in the numbers of larvae invading the roots of plants previously grown in oilcake amended soil and the subsequent reduction in root-knot development suggest that plants grown in oilcake treated soil have become less suitable as hosts for the nematodes, supporting the findings of van der Laan[17].

The chemical composition of the seedling roots was also affected by the treatments (Table 1). The concentration of total free phenols was significantly increased in seedlings raised in oilcake amended soil as compared to those from

Table 1. Effect of organic amendments on plant growth and chemical composition of the roots

Crops	Treatments	Weight (g)		Amount of chemicals (mg/100 mg roots)			
		Shoot	Root	Phenols	Amino-acids	Proteins	Carbohy-drates
Tomato	Untreated	0.86	0.10	0.54	0.86	2.32	1.15
	Mahua cake	1.20	0.30	0.68	1.70	2.18	1.60
	Castor cake	1.50	0.36	0.84	2.50	2.44	1.66
	Mustard cake	1.60	0.33	0.61	1.57	2.32	1.02
	Neem cake	1.26	0.23	0.90	1.10	2.14	1.90
	Groundnut cake	1.86	0.26	1.36	2.12	2.80	2.20
	L.S.D. (5%)	0.50	0.22	0.05	0.61	0.12	0.11
	L.S.D. (1%)	0.68	0.31	0.04	0.84	0.17	0.14
Eggplant	Untreated	0.56	0.08	1.02	0.55	3.64	1.00
	Mahua cake	0.80	0.23	1.26	0.66	3.84	1.20
	Castor cake	1.13	0.30	1.16	0.53	3.04	1.55
	Mustard cake	1.16	0.26	1.36	1.52	4.40	0.85
	Neem cake	1.00	0.20	1.74	1.52	5.24	0.85
	Groundnut cake	1.30	0.30	1.85	0.87	5.38	1.30
	L.S.D. (5%)	0.47	0.17	0.07	0.08	0.11	0.12
	L.S.D. (1%)	0.64	0.24	0.10	0.11	0.15	0.17
Chilli	Untreated	0.63	0.06	0.88	0.65	3.90	1.33
	Mahua cake	0.80	0.36	2.40	0.43	4.42	2.50
	Castor cake	0.86	0.33	1.02	0.66	4.44	1.60
	Mustard cake	0.90	0.30	1.86	1.42	4.38	1.15
	Neem cake	0.73	0.20	2.72	1.21	4.83	1.36
	Groundnut cake	0.96	0.26	1.52	1.38	5.35	1.58
	L.S.D. (5%)	0.26	0.20	0.10	0.06	0.12	0.06
	L.S.D. (1%)	0.36	0.27	0.14	0.08	0.16	0.08

Each value is an average of three replicates.

untreated control. The increases ranged between 12.96–151.85% in tomato, 13.73–81.37% in eggplant and 15.91–209.09% in chilli. It seems likely that the humic fractions of decomposing organic matter were the source of their phenols which were taken up by the plant roots[8,10].

From these studies it seems likely that, as a consequence of the increase in the concentration of phenolics in seedlings grown in oilcake amended soil, larval invasion into the roots was decreased. Galling was also decreased, probably

Table 2. Effect of preceding application of organic amendments on root-knot development and plant growth

Crops	Preceding treatments	Weight (g)				Root-knot index
		Uninoculated		Inoculated		
		Shoot	Root	Shoot	Root	
Tomato	Untreated	3.26	0.86	1.26	0.40	4.00
	Mahua cake	2.96	1.03	2.13	0.53	2.83
	Castor cake	4.23	1.50	2.66	0.66	3.00
	Mustard cake	4.76	1.60	2.43	0.70	2.66
	Neem cake	4.40	1.10	2.16	0.76	2.83
	Groundnut cake	5.03	1.73	2.53	0.83	2.83
	L.S.D. (5%)					0.94
	L.S.D. (1%)					1.29
Eggplant	Untreated	3.73	1.16	1.23	0.30	4.00
	Mahua cake	4.16	1.40	2.03	0.56	2.83
	Castor cake	5.66	1.60	3.06	0.90	2.66
	Mustard cake	6.50	1.73	4.66	0.96	2.83
	Neem cake	5.33	1.36	3.36	0.76	2.50
	Groundnut cake	6.20	1.80	4.36	1.00	2.83
	L.S.D. (5%)					0.80
	L.S.D. (1%)					1.10
Chilli	Untreated	2.46	0.76	1.46	0.16	4.00
	Mahua cake	2.86	0.83	2.50	0.40	2.33
	Castor cake	2.80	1.06	2.66	0.50	2.33
	Mustard cake	2.90	1.03	2.40	0.53	2.50
	Neem cake	2.96	0.96	2.16	0.43	2.16
	Groundnut cake	3.33	1.20	2.46	0.53	2.06
	L.S.D. (5%)					0.76
	L.S.D. (1%)					1.05

Each value is an average of three replicates.

because fewer larvae invaded. There are indications in the literature that resistant varieties contain increased amount of phenolics[6,14].

There was no definite trend in the contents of total free amino acids, total proteins and total soluble carbohydrates (Table 1), which indicate that there is not much role of these compounds in the induction of tolerance in plants against nematode attack.

Table 3. Effect of preceding application of organic amendments on the number of root-knot larvae invading within 24 hours

Preceding treatments	Number of larvae penetrated per plant		
	Tomato	Eggplant	Chilli
Untreated	840	920	787
Mahua cake	480	320	573
Castor cake	760	693	593
Mustard cake	640	440	613
Neem cake	667	400	587
Groundnut cake	627	213	587
L.S.D. (5%)	48.76	175.96	120.84
L.S.D. (1%)	67.18	242.44	166.60

Each value is an average of three replicates.

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