Persistent Action of Oilcakes and Nematicides on the Population of Nematodes in Field. M. Mashkoor Alam, Abrar M. Khan and S. K. Saxena (Department of Botany, Aligarh Muslim University, Aligarh-202001, India) Received April 20, 1977. *Botyu-Kagaku*, 42, 119, 1977.

18. 油粕の殺線虫効果の持続性

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油粕を土壌に施与すると，線虫の数が減少することが古くから知られているが，その残効性がどれくらいなのかはよく知られていない．そこで，殺線虫剤と油粕の効力を連続した2シーズンで比較した．ヒマシ油，カラシ油，センダン油，落花生油の油粕と殺線虫剤の DD と Nemagon がトマト，馬鈴薯，大根畠の4種の線虫，*Hoplolaimus indicus*, *Tylenchorhynchus brassicae*, *Tylenchus filiformis*, *Meloidogyne incognita* の個体数を減少させた．しかも，効力は6カ月持続した．

Although considerable information is available with respect to the effect of oilcakes on nematode populations when applied to the soil (Lear[15], 1959; Mankau[19], 1963; Mankau and Minteer[20], 1962; Khan *et al.*[10,12,13], 1966, 1973, 1974; Singh[30], 1965; Singh and Sitaramaiah[31,32], 1966, 1971; Miller and Taylor[22], 1970; Gour and Prasad[7], 1970; Goswami and Swarup[6], 1971; Srivastava *et al.*[34], 1971; Mammen[17], 1972; Prasad *et al.*[27], 1972; Mathur and Prasad[21], 1973; Mishra and Prasad[24], 1974; Alam and Khan[2], 1974; Gowda and Setty[8], 1973; Reddy and Setty[28], 1975), but little is known about their residual effect on nematodes in succeeding crops (Singh and Sitaramaiah[31], 1966; Mishra and Prasad[24], 1974). Therefore, an attempt has been made to study the comparative effect of oilcakes and nematicides on the soil populations of plant parasitic nematodes around crops in two consecutive seasons.

Materials and Methods

A thoroughly ploughed field was divided into 10 sq meter beds, each with separate water channels. Beds were treated with DD (1, 2 Dichlor opropane+1, 3 Dichloropropene) at the rate of 450 *l*/hec, Nemagon(1, 2 Dibromo-3-chloropropane) at the rate of 55 *l*/hec with the help of hand injector; and with urea, compost and oilcakes of castor (*Ricinus communis* L.), mustard (*Brassica campestris* L.), neem/margosa (*Azadirachta indica* Juss.) and groundnut (*Arachis hypogaea* L.) at the rate of 110kg N/hec. Urea was supplemented with superphosphate and murate of potash at the rates of 55kg P and K/hec, while DD and Nemagon with N, P and K at the above rates. There were three beds for each treatment which were randomised. The beds were watered, and after 15 days of waiting period, four-week-old seedlings of tomato (*Lycopersicon lycopersicum* (L.)Karsten.) cv. Marglobe, tubers of potato (*Solanum tuberosum* L.) cv. Dehradun Gola and seeds of radish (*Raphanus sativus* L.)cv. Kannoji White were sown in November, 1970. Immediately after harvest, the beds were again prepared. To all the beds urea at the rate of 55kg N/hec, superphosphate and murate of potash at the rates of 27.5 kg P and K/hec were added. Seeds of corn (*Zea mays* L.)cv. Ganga-5 following tomato, bottlegourd (*Lagenaria leucantha* Rusby.) cv. Ribbed Long Green following potato, and sanhemp (*Hibiscus cannabinus* L.) cv. Punjab Special following radish were sown in March, 1971. Nematode populations before treatment and at the time of harvest of preceding as well as succeeding crops were determined from representative composit soil samples by using Oostenbrinks' elutriator combined with Baermanfunnels (Southey[33], 1970).

Results

Tomato cv. Marglobe/corn cv. Ganga-5 :

In the first season tomato cv. Marglobe was sown. The population of parasitic nematodes increased in inorganic fertilizer and compost

Table 1. Effect of organic amendments and nematicides on the population of nematodes infesting tomato cv. Marglobe, potato cv. Dehradun Gola and radish cv. Kannoji White in field.

Crops	Treatments	Nematode population per 200g soil						
		Hop	Trh	Tyl	Mel	Oth	Total	Sap
Tomato	Inorganic fertilizers	152	215	151	290	—	808	760
	Compost	172	215	43	215	—	645	1849
	Castor cake	74	22	74	111	—	281	999
	Mustard cake	90	34	—	102	—	226	782
	Neem cake	84	42	—	84	—	210	1344
	Groundnut cake	45	14	—	105	—	164	315
	DD	14	—	—	12	—	26	378
	Nemagon	99	—	—	96	—	195	726
	L. S. D. (at 5% level)						42.6	
	L. S. D. (at 1% level)						58.7	
Potato	Inorganic fertilizers	484	425	210	690	48	1857	3420
	Compost	430	86	215	258	—	989	4902
	Castor cake	120	40	80	120	—	360	5280
	Mustard cake	32	—	96	48	—	176	2496
	Neem cake	38	38	38	110	—	224	5016
	Groundnut cake	42	—	84	120	—	246	2152
	DD	16	—	—	—	16	32	3120
	Nemagon	114	—	114	228	—	456	3116
	L. S. D. (at 5% level)						104.1	
	L. S, D. (at 1% level)						143.4	
Radish	Inorganic fertilizers	156	135	105	54	338	788	2430
	Compost	18	108	—	72	—	198	1710
	Castor cake	15	52	36	—	—	103	3408
	Mustard cake	96	—	16	—	32	144	2560
	Neem cake	75	25	16	—	15	131	4150
	Groundnut cake	19	18	12	—	—	49	2622
	DD	—	—	—	—	—	—	510
	Nemagon	—	16	—	—	—	16	1092
	L. S. D. (at 5% level)						93.8	
	L. S. D. (at. 1% level)						129.2	
Initial population of nematodes		145	110	110	200	25	590	500

Each value is an average of 3 replicates.
Hop=*Hoplolaimus indicus*, Trh=*Tylenchorhynchus brassicae*, Tyl=*Tylenchus filiformis*, Mel=*Meloidogyne incognita* larvae, Oth=Other Tylenchids, Total=Total Parasitic, Sap=Total saprozoic.

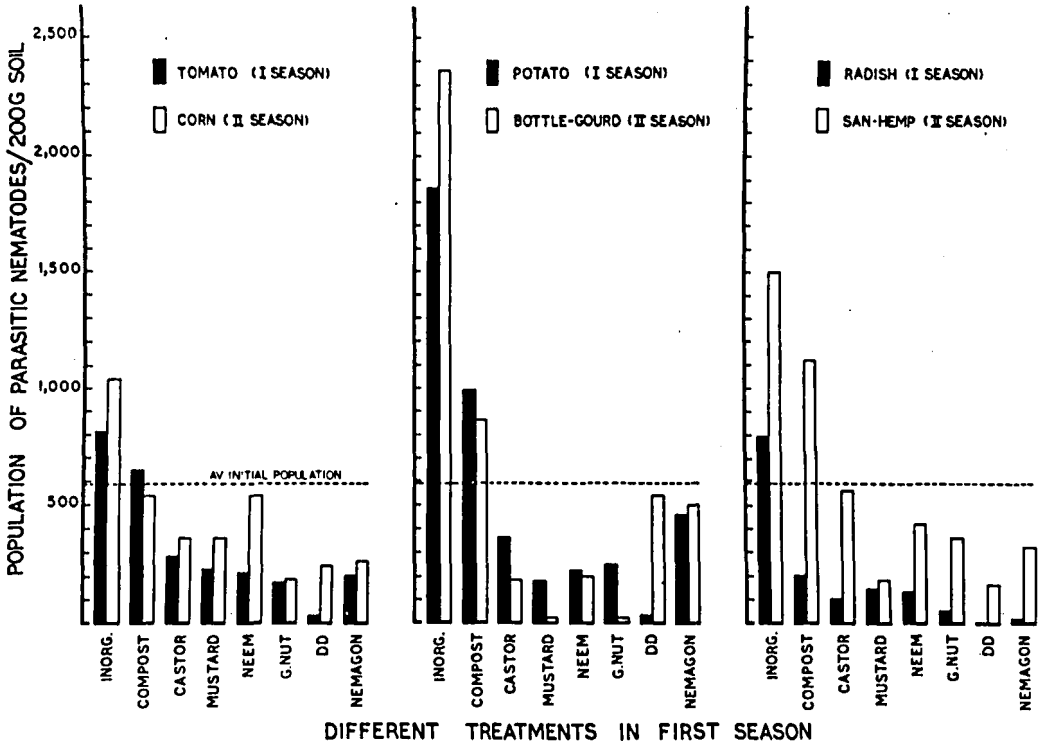

Fig. 1. Residual effect of different treatments on the population of plant parasitic nematodes.

treated beds and decreased in other treatments significantly. The initial population of 590 per 200g soil was changed to 808, 645, 281, 226, 210, 164, 26 and 195 in inorganic fertilizers, compost, castor, mustard, neem, groundnut cakes, DD and Nemagon treated beds respectively (Table 1, Fig. 1). When corn cv. Ganga-5 was sown in the next season, these populations were 1040, 540, 360, 360, 540, 180, 240 and 260 respectively (Table 2, Fig. 1). Therefore, in the next season the population of all the nematodes increased in all the beds, however, the increase was less in oilcakes and nematicides than inorganic fertilizers and compost treated beds.

Potato cv. Dehradun Gola/bottlegourd cv. Ribbed Long Green:

The population of all the parasitic nematodes was increased in inorganic fertilizers and compost treated beds and was significantly inhibited in other treatments in the first season. The final population in inorganic fertilizers, compost, castor, mustard, neem, groundnut cakes, DD and Nemagon treated beds was 1857, 989, 360, 176, 224, 246, 32 and 456 respectively, as against 590 per 200g soil of initial level (Table 1, Fig. 1). In the next season the corresponding figures for the population were 2360, 860, 180, 20, 200, 20, 540 and 500 respectively (Table 2, Fig. 1). Here, the residual effect was prominent in oilcake treated beds.

Radish cv. Kannoji White/san-hemp cv. Punjab Special:

Significant reduction in the population of parasitic nematodes was noticed in the first season in all the treatments except inorganic fertilizers, where there was an increase. The initial population of 590 per 200g soil was changed to 788, 198, 103, 144, 131, 49, nil and 16 respectively in inorganic fertilizers, compost, castor, mustard, neem, groundnut cakes, DD and Nemagon treated beds (Table 1, Fig. 1); while it was further changed in the next season to 1500, 1120, 560, 180, 420, 360, 160 and 320 respectively (Table 2, Fig. 1). Here,

Table 2. Residual effect of organic amendments and nematicides on the population of nematodes infesting conn cv. Ganga-5 (following tomato cv. Marglobe), bottlegourd cv. Ribbed Long Green (following potato cv. Dehradun Gola), and san-hemp cv. Punjab Special (following radish cv. Kannoji white) in field.

Crops	Preceding treatments	Nematode population per 200g soil						
		Hop	Trh	Tyl	Mel	Oth	Total	Sap
Corn	Inorganic fertilizers	420	340	200	80	—	1040	1320
	Compost	180	220	80	60	—	540	800
	Castor cake	120	140	80	20	—	360	1360
	Mustard cake	200	140	—	20	—	360	1040
	Neem cake	100	240	140	60	—	540	1080
	Groundnut cake	40	20	100	20	—	180	460
	DD	—	200	40	—	—	240	1340
	Nemagon	240	20	—	—	—	260	400
	L. S. D. (at 5% level)						64.99	
	L. S. D. (at 1% level)						90.20	
Bottlegourd	Inorganic fertilizers	600	580	400	720	60	2360	1080
	Compost	160	200	200	300	—	860	560
	Castor cake	100	40	40	—	—	180	1760
	Mustard cake	20	—	—	—	—	20	1420
	Neem cake	80	40	40	40	—	200	1680
	Groundnut cake	20	—	—	—	—	20	1120
	DD	160	260	20	100	—	540	1140
	Nemagon	160	20	80	240	—	500	580
	L. S. D. (at 5% level)						142.99	
	L. S. D. (at 1% level)						198.45	
Sanhemp	Inorganic fertilizers	220	520	420	320	20	1500	1300
	Compost	160	460	400	100	—	1120	920
	Castor cake	60	200	200	100	—	560	2080
	Mustard cake	—	80	80	20	—	180	1220
	Neem cake	60	180	180	—	—	420	1540
	Groundnut cake	120	160	80	—	—	360	1320
	DD	20	140	—	—	—	160	620
	Nemagon	40	240	—	20	20	320	1540
	L. S. D. (at 5% level)						114.39	
	L. S. D. (at 1% level)						158.76	

Each value is an average of 3 replicates.
Hop=*Hoplolaimus indicus*, Trh=*Tylenchorhynchus brassicae*, Tyl=*Tylenchus filiformis*, Mel=*Meloidogyne incognita* larvae, Oth=Other Tylenchids, Total=Total parasitic, Sap=Total saprozoic.

the population build-up in oilcakes and nematicides treated beds was much less than inorganic fertilizers and compost treated beds.

Discussion

It is abundantly clear from the above that oilcakes considerably suppressed the populations of *Hoplolaimus indicus*, *Tylenchorhynchus brassicae*, *Tylenchus filiformis* and *Meloidogyne incognita* infesting tomato, potato and radish. However, the efficacy varied for different nematodes in different crops. These results are, in a way, in accord with those of Lear[15] (1959), Mankau[19] (1963), Mankau and Minteer[20] (1962), Khan *et al.*[12,13] (1973, 1974), Gour and Prasad[7] (1970), Prasad *et al.*[27] (1972), Mathur and Prasad[21] (1973), Mishra and Prasad[24] (1974), Alam and Khan[2] (1974) and Reddy and Setty[28] (1975).

Further, the results clearly demonstrate that beneficial effect of oilcakes persisted even after a lapse of six months when corn, bottlegourd and san-hemp have been grown in the following season. Similar results have been obtained by Singh and Sitaramaiah[31] (1966) and Mishra and Prasad[24] (1974).

The inorganic fertilizers and compost, on the other hand, failed to exhibit any nematicidal property (Alam and Khan[2], 1974).

Various explanations have been given for the control of nematodes as a result of application of organic matter to the soil. These include, the predaceous and parasitic activity of soil biota on plant parasitic nematodes (Linford[16], 1937; Mankau[18], 1962; Oteifa *et al.*[25], 1961), changes in physico-chemical properties of soil (Ahmad *et al.*[1], 1972), toxicity of decomposed products of organic amendments (Eno *et al.*[5], 1955; Patrick *et al.*[26], 1965; Sayre *et al.*[29], 1965; Walker[35], 1971; Miller *et al.*[23], 1973; Khan *et al.*[11], 1974) and others. Oilcakes are made-up of various complex organic substances which are decomposed rather slowly (Daji and Iyengar[4], 1971), therefore their nematicidal properties persisted for longer duration. Poor results from amending the soil with compost may be due to the fact that very little or no toxic principles are released as it is already decomposed before its application to fields.

DD and Nemagon were also found to be highly efficacious against plant parasitic nematodes. These results are in agreement with those of Alam *et al.*[3] (1975), Kirmani *et al.*[14] (1975) and Reddy and Setty[28] (1975). These test nematicides also showed residual effect in the subsequent crops (Hodges and Lear[9], 1973), which might have been due to the fact that they drastically reduced the nematode population to such a low level in the first season that its build-up to higher level required more time during the consecutive season.

Summary

Oilcakes of castor, mustard, neem and groundnut and two nematicides viz., DD and Nemagon considerably suppressed the population of *Hoplolaimus indicus*, *Tylenchorhynchus brassicae*, *Tylenchus filiformis* and *Meloidogyne incognita* around tomato, potato and radish. The beneficial effect of these treatments persisted even after a lapse of six months when corn, bottlegourd and san-hemp were grown in the following season. Inorganic fertilizers and compost failed to exhibit nematicidal property.

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野外におけるスカシバガ類の性フェロモンとその幾何異性体の共力および阻害作用

Field Euidence of Synergism and Inhybition in the Sesiidae Sex Pheromone System. M. G. Karandions, J. H. Tumlinson and T. D. Eichlin: *J. Chem. Ecol.*, 3, 57 (1977).

スカシバガの仲間の性フェロモンとしては今までに E, Z-3, 13-octadecadien-1-ol acetate (E, Z-3, 13-ODDA) が *Synanthedon pictipes* (lesser peachtree borer) より，また Z, Z-3, 13-ODDA が *Sanninoidea exitiosa* (peachtree borer) から Tumlinson らにより同定されている．そこで E, Z : Z, Z : Z, E-(3, 13-ODDA) の幾何異性体3種を組合せて，Wisconsin 州のサクランボ園においてスカシバガ類のトラップ試験をおこなった．

結果

1) Z, E 異性体は単独ではスカシバガ類をトラップできない．
2) *S. pictipes* では Z, E 異性体に協力作用がある．
3) *S. scitula* および *S. exitiosa* は Z, Z 異性体に誘引される．
4) Z, Z 異性体の E, Z 異性体への添加はその *S. pictipes* に対する誘引性を例えば添加量が 0.5% 以下でも完全に阻害する．
5) E, Z 異性体の Z, Z 異性体への添加はその *S. scitula* に対する誘引性を阻害する．
6) *S. fatifera* が Z, Z 異性体に，*S. viburni* が E, Z+Z, Z 異性体混合物 (10 : 1) にそれぞれ1例ずつ誘引された．
7) *S. pictipes* ではフェロモン源 (E, Z 異性体) より約 6m 隔れた4隅で Z, Z 異性体を気散させた場合その誘引力が85%減少した．(山岡亮平)