

EFFICACY OF SOME FRIENDLY ENVIRONMENTAL AGENTS IN THE CONTROL OF PLANT PARASITIC NEMATODES ATTACKING TOMATO FIELDS

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ABSTRACT: *The efficacy of some friendly environmental agents against plant parasitic nematodes infesting tomato plants were evaluated under field conditions . Tested materials were : poultry and farmyard manure ; Vitavex ; Zinc; Ammonia; Biofly; Dimseisa and solarization singly and in different combinations in comparison with the chemical nematicides Vydate 10% G. Treatments were applied at the time of seedling planting . Soil and root samples were taken pretreatment and monthly intervals to the end of experiments to extract and count nematode population. Fruit firmness and Total soluble solids (T.S.S) , yields were determined . Results indicated that the best overall reduction of parasitic nematodes was achieved with poultry manure + Vitavex (77%), poultry manure + Dimseisa (75.5%), poultry manure + solarization (74.5%), poultry manure + Ammonia (73.8%), farmyard manure + Ammonia (71.4%), farmyard manure + Dimseisa (71.1%), poultry manures + Zinc (70.8%), while moderate reduction percentages were recorded with the treatments of farmyard manure + Zinc (68.6%), poultry manure + Biofly (68.3%), farmyard manure + Biofly (64.5%), farmyard manure + solarization (63.9%), and farmyard manure + Vitavex (62.5%), and finally {1P : 3F} gave (57.9%), where Vydate gave only (55.3%). Organic manures (poultry or farmyard), combined with Dimseisa or Biofly gave the best results in the direction of the firmness of tomato fruits, while the T.S.S values were improved with the treatments of poultry manure + Zinc, poultry manure + Biofly, poultry manure + Dimseisa, and farmyard manure plus Vitavex, in addition, the treatments of poultry manure + Zinc, farmyard manure + Zinc and poultry manure + Solarization gave the highest increase results in tomato yields.*

Key words : *Biological control , plant parasitic nematodes , Tomato , Friendly Environmental Agents*

INTRODUCTON

Manures have been used for over two millennia as organic fertilizers with minerals such as nitrogen, potassium and phosphorous, it have great benefit in increasing plant growth and better crop quality. Manures of domestic animals improve soil phase and seem to be more effective in increasing the fauna, because manures are favourite habitats for harmful and beneficial

insects , nematodes and mites. On the other hand some studies recorded that manures and mineral fertilizers have some substances during their breakdown which gave toxic effect to soil fauna, in addition it change soil pH water status and osmotic potential (Lyon *et al.*1952). In many cases, a high degree of biocontrol could be easily achieved by simply reintroducing parasites and predators back into the habitat in which pesticides destroyed the beneficial enemies. Therefore, considerable intensification of research is necessary in basic soil biology and on the complex interaction between manures and fertilizers and soil fauna, if soil zoology is to make farther major contributions to the proper management of agricultural and forest ecosystems (Marshall,1977) . From the previous points the aim of this study is to determine the effect of fifteen treatments (Biocides, some elements, organic manure, soil solarization) add to tomato soil under field conditions on plant parasitic nematodes, as well as their effects on tomato yield and some characters.

MATERIALS AND METHODS

The present studies were carried out at a field naturally infested with plant parasitic nematodes

1. Experimental design and samples :

The experiment was conducted in a tomato field (*Lycopersicon esculentum* var. Super Strain b) selected for this study during summer season from March, to June 2004. At transplanting time, the treatments were arranged as a completely randomized block design. Each treatment was replicated three times (three rows), each row consisted of 3 meter long and one meter wide. The distance between each two tomato plants was 30 cm., treatment as a none treated ones was used as check. Normal agricultural practices were followed without pesticide treatments.

Fifteen treatments were applied using biological control agents combined with farmyard or poultry manures (Table 1) , also other agents were tested as biocides (Vitavax, and Biofly as fungicides , *Beauveria bassiana*) , certain nutritive elements (Zinc and Ammonia), Solarization treatment, Demseisa powder and finally Vydate as a chemical pesticide for comparison. These substances were add before cultivation and used as shown in (Table 1). Three replicates, each of 100 g soil sample were taken from each treatment before planting, and monthly soil and root samples were taken from the rhizosphere area of tomato plants. Collected samples were transported immediately to the laboratory for extraction .

For nematode extraction modified Baermann funnels for 72 hours were used, different plant parasitic nematode genera were identified and counted using Hawksely counting slide with the aid of Stereomicroscope, key reference of Golden (1971) was consulted .

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Table (1): Structure and rate of application of different substances used in the experiments

Substances	Structure and rate of application
Farmyard manure	Mixture of cattle, sheep, goat dung ,soil, nutrition substances applied at 20 m ³ /feddan
Poultry manure	Mixture of chicken refuse, soil , nutrition substances applied at 5 m ³ /feddan
Vydate	Vydate 10%G: Oxamyl (2-(dimethylthio) glyoxal-0-methylcarbamoyl monoxime) was applied on small furrows at the rate of 10 kg/feddan.
Vitavax	Systemic fungicides from carboxmides group , also named carboxylic acid anilides or oxathiins . common name Carboxin , chemical name (5.6-dihydro-2-mythyl) 100 g / feddan
Biofly	Biofly is a liquid Bio-product contains Egyptian fungus race of <i>Beauvaria bassiana</i> used as liquid solution sprayed on the plants and soil at the rate of (150cm/fed)
Chelated Zinc	Chelated micro-element Zn was used as powder at the rate of (250g/fed) sprayed on the plants and soils, 3gm / litter / treatment
Ammonia	Ammonium sulphate 900gm/ treatment sprayed on the plants and soil
Solarization	Clear plastic 2 mm covered all soil of treatments .
Dimseisa	Damseisa <i>Ambrosia maritime</i> is a medicinal plant contained ses quiterpene lactones which consisted of demssin and ambrosine was used as dry powder of leaves and stems at the rate of 3 g/plant (100 kg/fed).

Yields of tomato were collected four times until the end of the experiment. Total soluble solids (T.S.S) were determined by the hand refractometer (Rick,1974). Fruit firmness (gm/0.17cm²) was determined by the fruit and vegetable tester (John Chatillon & Sons Inc.,Kew Gardens, New York, USA) using gauge 516-500 Mrper with a plunger diameter of 0.026 inc. Each fruit was tested at five positions. One near blossomed, one at the sholder and three in the middle, then the average was calculated.

2. Statistical analysis:

Results were subjected to the analysis of variance test (ANOVA) with mean separation at 5% level of significance by L.S.D test, (Costat 22, 1998). Reduction percentages were counted according to the formula of Henderson and Tilton , (Fleming and Retnakaran ,1985)

RESULTS AND DISCUSSION

The examination of pretreatment samples indicated that the dominant plant parasitic nematode genera in the soil of the experimental field were: *Meloidogyne*, *Pratylenchus*, *Paratylenchus*, *Tylenchorhynchus*, *Helicotylenchus*, *Xiphinema*, *Longidorus*, *Trichodorus*, *Aphelenchus*.

Data presented in Table (2) reported the average numbers of plant parasitic nematodes as affected by different treatments, in addition results in Table (3) showed the reduction percentages of plant parasitic nematodes.

Data Tables (2 & 3) indicated that the treatment of one part poultry manure + three parts of farmyard manure gave (30.5%) reduction in plant parasitic nematode population 30 days after treatment, raised to (65.1%), 60 days after treatment and became (78.1%), 90 days after treatment.

Vydate, gave (77.4%) reduction 30 days after application, decreased to (19%), (60 days) after application, then raised to (70.4%), (90 days) after application.

The treatment of farmyard manure (F) +Vitavex resulted (67.2%) reduction in parasitic nematode population, 30 days after application, raised to (72.1%), 60 days after application then decreased to (48.1%), 90 days after treatment, while the treatment of poultry manure (P)+Vitavex gave better results, where it reduced (63.6%)of plant parasitic nematode population, 30 days after treatment raised to (82.5%), (84.9%), 60 and 90 days after application, respectively.

As for (F)+Zinc and (P)+Zinc treatments, results indicated that it reduced (37.7, 54.9%)of plant parasitic nematode population, 30 days after treatments, respectively, raised to (69.7, 74.1%), 60 days after treatments, respectively, and reached (98%, 83.5%), 90 days after treatments, respectively.

Regarding to Ammonia plus manure treatments results reported that the treatment of (F)+Ammonia gave (59.7, 73.4, 81.1%) nematode reduction 30, 60, 90 days after application, respectively, while the treatment of (P) +Ammonia gave (56.4, 81.6, 83.4%), 30, 60, 90 days after application, respectively.

Regarding to solarization treatments, results indicated that solarization+(F) reduced plant parasitic nematode population by (34.5, 72.6, 84.6%), 30, 60, 90 days after application respectively, while the treatment of solarization + (P) gave (52.1, 81.2, 89.2, 89.6%) reduction perectages in nematode population, respectively.

Applying Biofly as a biological control agent combined with farmyard manure or poultry manure resulted good results in parasitic nematode control, where the treatment of Biofly + (F) gave (38.5, 72.8, 82.2%) reduction in parasitic nematode population in the soil of tomato plants,30, 60, 90 days after application, respectively, while the application of Biofly + (P) resulted (45.6, 73.2, 86.1%) in nematode population 30, 60, 90 days after application, respectively.

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Table (2): Effect of different treatments on the population density of plant parasitic nematodes infected tomato plants under field conditions

Treatments	Aver. No. of plant parasitic nematodes / 100g soil				
	Pre-treatment	Days post-treatments			
		30 Days	60 Days	90 Days	Mean
1P : 3F	1180.0	1600.0	526.7	333.3	820.0
Vydate	1580.0	675.0	216.7	60.0	317.2
F. + Vitavax	1213.3	751.7	433.3	278.3	487.8
P. + Vitavax	1818.3	1250.0	406.7	353.3	670.0
F. + Zinc	1435.0	1691.7	555.0	300.0	848.9
P. + Zinc	1525.0	1300.0	503.3	323.3	708.9
F. + Ammonia	1573.3	1198.3	533.3	383.3	705.0
P. + Ammonia	1720.0	1416.7	403.3	366.7	728.9
F. +Solarization	1010.0	1250.0	353.3	200.0	601.1
P. +Solarization	1250.0	1133.0	300.0	166.7	533.2
F. + Biofly	1240.0	1441.7	430.0	283.3	718.3
P. + Biofly	1315.0	1353.3	450.0	236.7	680.0
F. + Dimseisa	1460.0	1383.3	396.7	286.7	688.9
P. + Dimseisa	1680.0	1270.0	400.0	325.0	665.0
Control	1280.0	2420.0	1633.3	1646.7	1900.0

P. means poultry manure F. means farmyard manure

Table (3): Reduction percentages of plant parasitic nematodes infected tomato crop as affected by different treatments .

Treatments	Reduction percentages %			Over all reduction
	30 Days	60 Days	90 Days	
1P : 3F	30.5	65.1	78.1	57.9
Vydate	77.4	19.0	70.5	55.3
F. + Vitavax	67.2	72.1	48.1	62.5
P. + Vitavax	63.6	82.5	84.9	77.0
F. + Zinc	37.7	69.7	98.5	68.6
P. + Zinc	54.9	74.1	83.5	70.8
F. + Ammonia	59.7	73.4	81.1	71.4
P. + Ammonia	56.4	81.6	83.4	73.8
F. + Solarization	34.5	72.6	84.6	63.9
P. + Solarization	52.1	81.2	89.6	74.3
F. + Biofly	38.5	72.8	82.2	64.5
P. + Biofly	45.6	73.2	86.1	68.3
F. + Dimseisa	49.9	78.7	84.7	71.1
P. + Dimseisa	60.1	81.3	85.0	75.5

P. means poultry manure F. means farmyard manure

The application of Dimseisa powder mixed with farmyard manure decreased (49.9, 78.7, 84.7%) nematode population, 30, 60, 90 days after application, respectively while the treatment of Dimseisa + (P) decreased plant parasitic nematode population (60.1, 81.3, 85%), 30, 60, 90 days after application, respectively.

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The overall reduction of plant parasitic nematodes Table (3) indicated that the pest nematode control was achieved with poultry manure + Vitavex (77%), (P) + Dimseisa (75.5%), (P)+ solarization (74.5%), (P)+ Ammonia (73.8%), (F)+ Ammonia (71.4%), (F)+ Dimseisa (71.1%), (P)+ Zinc (70.8%), while moderate reduction percentages were recorded with the treatments of (F)+ Zinc (68.6%), (P)+ Biofly (68.3%), (F)+ Biofly (64.5%), (F)+ solarization (63.9%), and (F)+ Vitavex (62.5%), and finally {1P : 3F} gave (57.9%), where Vydate gave only (55.3%).

Previous results indicated that the addition of manures and biological control agents highly improved the toxic effect of these materials against plant parasitic nematodes, in addition that the metabolism of the organic manures produced a lot of acids, phenols, enzymes and other substances which had a toxic effect on parasitic nematodes, in addition it activates the mode of action of biological control agents, moreover, the substances produced via organic manure analysis activates other beneficial soil fauna i.e. predacious nematodes and mites which play an important role in the control of parasitic nematodes.

Data presented in Table (4) indicated that the treatments of (P)+ Dimseisa, (F)+ Dimseisa, and (P)+ Biofly recorded (26.7, 24.1, 23.5%) increase in the firmness of tomato fruits, respectively, in comparison with control treatment, followed by (F)+ Vitavex (10.2%), (F) + Biofly and (F)+ Zinc (8%), (P) + Solarization (7.5%). The treatments of Vydate, poultry manure + Vitavex gave (5.3%), while farmyard or poultry manures plus Ammonia gave only (3.7, 2.1%) respectively, in comparison with control treatment.

The treatments, (P)+ Zinc, (F)+ Solarization, 3 parts of farmyard manure : 1 part of poultry manure gave negative firmness values (-17.7, -8.0, -6.4%) respectively.

Regarding to T.S.S values results Table (4) indicated that the highest increase in T.S.S values was recorded with (P)+ Zinc (18.4%), (14.3%) with both (P)+ Biofly and (P)+ Dimseisa, (12.3%) with (F)+ Vitavex, in comparison with control treatment. In addition, moderate increase value in the T.S.S of tomato fruits was registered with the treatment of 3 (F): 1 (P) (5.1%). T.S.S values were reduced with the rest treatments (F)+ Solarization (-16.3%), (F)+ Ammonia(-8.2), (F) + Zinc (-8.2%), (P)+ Ammonia (-7.7), (P)+ Solarization (-7.2%), Vydate (-6.2%), (F)+ Biofly (-5.1%), (P)+ Vitavex (-3.6%), and (F)+ Dimseisa (-2.1%), in comparison with control treatment.

Results on the yield of tomato fruits (Table 4) indicated that all treatments increased tomato yields except the treatments of Dimseisa + (P) and Dimseisa + (F) which reduced the yield by (-8%), (1.8%), respectively. The highest increase percentage values of tomato yield, were recorded with the treatment of (P)+ Zinc which gave (116.8%), followed by (F)+ Zinc (77%), (P)+ solarization (61.1%), while the treatments of (F)+ Vitavex, 3 (F): 1 (P), and Vydate gave (50%), (49.6%), (45.6%), respectively.

Table (4): Some fruit characters of tomato crop as affected by different biocontrol agents used against plant parasitic nematodes.

Treatments	Firmness (gm/0.17cm ²)		T.S.S (%)		Yield (Kg/30 plant)	
	Overall mean	*%	Overall mean	*%	Overall mean	*%
1P : 3F	218.8	-6.4	5.1	5.1	84.5	49.6
Vydate	246.3	5.3	4.6	-6.2	82.3	45.6
F.+ Vitavax	257.5	10.2	5.5	12.3	84.8	50.0
P.+ Vitavax	246.3	5.3	4.7	-3.6	76.8	35.8
F. + Zinc	252.5	8.0	4.5	-8.2	100.0	77.0
P. + Zinc	192.5	-17.7	5.8	18.4	122.5	116.8
F.+ Ammonia	238.8	2.1	4.5	-8.2	76.8	35.8
P.+ Ammonia	242.5	3.7	4.5	-7.7	78.8	39.4
F.+ Solarization	215.0	-8.0	4.1	-16.3	59.8	5.8
P.+ Solarization	251.3	7.5	4.5	-7.2	91.0	61.1
F. + Biofly	252.5	8.0	4.6	-5.1	71.5	26.5
P. + Biofly	288.8	23.5	5.6	14.3	60.8	7.5
F. + Dimseisa	290.0	24.1	4.8	-2.1	55.5	-1.8
P. + Dimseisa	296.3	26.7	5.6	14.3	52.0	-7.9
Control	233.8	-	4.9	-	56.5	-

P. means poultry manure F. means farmyard manure - means decrease %

A moderate increase values were recorded with the treatments of (P)+ Ammonia (39.4%), (P)+ Vitavax and (F) + Ammonia (35.8%), (F)+ Biofly

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(26.5%) . The least increase percentage values of yield were recorded with (P)+ Biofly (7.5%), (F)+ solarization (5.8%).

Finally, it could be concluded that the used materials i.e. organic manures (poultry or farmyard), combined with Dimseisa or Biofly gave the best results in the direction of the firmness of tomato fruits, while the T.S.S values were improved with the treatments of (P)+ Zinc, (P) + Biofly, (P)+ Dimseisa, and (F)plus Vitavax, in addition, the treatments of (P)+ Zinc, (F)+ Zinc and (P)+ Solarization gave the highest increase results in tomato yields, therefore, it could be recommend that the addition of poultry manure or farmyard manure combined with Zinc or Dimseisa or Biofly significantly reduced plant parasitic nematode populations and improve the characters of tomato yield in addition , that these materials increase tomato yield up to (100%), putting in our consideration that the agricultural soils are poor in Zinc element which play an important role in the most of physiological processes for both animals and plants, therefore it is necessary to add this element to soils, moreover, organic manures had an important role as a reservoir of beneficial soil faunae beside its role as a main source for fertilizers and improve soil properties .These results are in harmony with those obtained by Abu-Blan *et al.* (1990); Ali and Sweelam (1996) ; Ibrahim, and Ibrahim (2000); Riegel, and Noe (2000); Oka, and Pivonia (2002); Siddiqui, and Shaukat (2002); Meher, *et al.* (2003); Ostrec, and Grubisic (2003); Stevens, *et al.* (2003) ; Jayakumar, *et al.* (2004) Koenning, and Barker (2004) ; Sharma, *et al.* (2004) and Siddiqui, (2004) .

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كفاءة بعض المواد الصديقة للبيئة في مكافحة النيماطودا المتطفلة على نباتات الطماطم

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الملخص العربي

أجريت تجربة حقلية لدراسة تأثير بعض المواد الصديقة للبيئة والتي لا تسبب أضراراً صحية لكل من الحيوان والإنسان مثل الأسمدة العضوية والمواد البيولوجية والعناصر الغذائية والمستخلصات النباتية وذلك بتطبيقها عند زراعة الشتلات منفردة أو بالخلط مقارنة بالمبيد الجهازى (فايديت) على النيماطودا المتطفلة على نباتات الطماطم .

حيث تم زراعة طماطم صنف (سوبر استرين بي) في تجربة تامة العشوائية على مساحة ٤٠٠ متر مربع . وأخذت عينات شهرية وفي نهاية التجربة تم اخذ قياسات خضريه وثمرية . وقد أثمرت التجارب على تواجد عديد من الاجناس النيماطودية المتطفلة على الطماطم والناقلة للأمراض الفيروسية مثل :

Meloidogyne , Pratylenchus , Paratylenchus , Tylenchorhynchus , Helicotylenchus , Xiphinema , Longidorus , Trichodorus , Aphelenchus.

وأشارت النتائج إلى تفوق معاملات { سماد دواجن+مبيد فطري Vitavax ، سماد الدواجن+مستخلص نباتي (الدميسية) ، سماد دواجن+مشمع تغطية (Solarization) ، سماد دواجن+أمونيا ، سماد بلدي+أمونيا ، سماد بلدي+مستخلص نباتي (الدميسية) ، سماد دواجن+زنك } حيث أعطت نسبة موت للنيماطودا المتطفلة على النبات بنسبة (٧٧,٠ % ، ٧٥,٥ % ، ٧٤,٣ % ، ٧٣,٨ % ، ٧١,٤ % ، ٧١,١ % ، ٧٠,٨ %) على التوالي . وأظهرت معاملات { سماد دواجن+زنك ، سماد دواجن+بيوفلاي ، سماد بلدي+بيوفلاي ، سماد بلدي+مشمع تغطية ، سماد بلدي+مبيد فطري } نسبة موت متوسطة حيث كانت (٦٨,٦ % ، ٦٨,٣ % ، ٦٤,٥ % ، ٦٣,٩ % ، ٦٢,٥ %) على التوالي . أما معاملات المبيد النيماطودي (الفايديت) فقد أظهرت نسبة موت قدرت بـ (٥٥,٣ %) .

أظهرت نتائج محصول الثمار أن أعلى محصول سجل مع المعاملة (سماد دواجن+زنك) وأقل كمية محصول سجلت مع المعاملة (سماد دواجن+بيوفلاي) .

ومن الملاحظ أن سماد الدواجن + الزنك أدت إلى زيادة محصول الطماطم يليها استخدام السماد البلدي مع الزنك وذلك عند المقارنة بمحصول الغير معاملة وعموما جميع المعاملات أدت إلى زيادة محصول الطماطم ما عدا معاملة سماد الدواجن مخلوطا مع مبيد (البيوفلاي) وذلك عند المقارنة بالغير معاملة .

يوصى بالبحث باستخدام سماد الدواجن + الزنك أو السماد البلدي مع الزنك حيث أعطت أعلى كمية من محصول الطماطم ذو المواصفات التجارية القياسية .