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INTEGRATED CONTROL OF THE RENIFORM NEMATODE, *Rotylenchulus reniformis* ON SUNFLOWER.

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ABSTRACT

A greenhouse experiment was conducted in order to determine the impact of *Datura stramonium, Artemisia herba, Morus nigra, Salix babylonica* and *Eucalyptus camaldulensis* powders singly or integrated with oxamyl on reproduction of *R. reniformis* on sunflower cv. Vidoc-5 and the resulting effect on plant growth. Results indicated that all treatments improved sunflower growth, exceeded that of the nematode alone. The application of *D. stramonium* integrated with oxamyl, accomplished the highest values regarding the percentage of increase of the whole sunflower plant fresh weight which was amounted to 62.24 %, followed by *D. stramonium* alone (45.37 %), *A. herba* plus oxamyl (44.68 %) and *E. camaldulensis* plus oxamyl (39.51 %). Nematode population density in soil and within sunflower roots infected with *R. reniformis* were significantly suppressed in all treatments. Great suppression in nematode population was recorded with oxamyl giving reduction of 89.72 % followed by *D. stramonium* integrated with oxamyl (88. 54 %) and then *E. camaldulensis* plus oxamyl (86.96 %). Egg-mass numbers of *R. reniformis* on sunflower roots were significantly suppressed in all treatments compared to plants inoculated with nematode alone.

Keywords: sunflower, *Helianthus annus, Rotylenchulus reniformis,* oxamyl, plant products, *Datura stramonium, Artemisia herba, Morus nigra, Salix babylonica* and *Eucalyptus camaldulensis.*

INTRODUCTION

Sunflower (*Helianthus annus,* L.) is considered one of the most important economic cash crops in Egypt. It is used as source of edible oil. The reniform nematode, *Rotylenchulus reniformis* (Linford & Oliveira) is a serious pest on agricultural crops, mainly, sunflower in temperate and tropical regions results in yellowish leaves, stunting, poor plant growth and yield losses.

The chemical control of *R. reniformis* has successfully limited the detrimental effect of this nematode below damaging levels (Reddy & Khan, 1988; Lawrence *et al.,* 1990 and Sipes *et al.,* 1992). However, the environmental hazards, health risks and disturbance of the biological balance of nature are restrictions for the absolute use of nematicides. Also, the development of nematicide – resistant races of the target pest and the high cost are another restrictions for using nematicides. The previous restrictions enhanced scientists to find other atternative tactics to replace or minimize the use of nematcides.

Nowadays, integrated pest management using several control techniques with minimal use of nematicides received greater interest among nematologists, providing effective control against the target nematode and avoiding environmental pollution (Shahzad & Ghaffar, 1987; Reddy & Khan, 1988; Zaki & Bhatti, 1990; Vicente *et al.,* 1991; Mahmood & Siddiqui, 1993; Khan & Goswami, 1995; Oduor-Owino & Waudo, 1995; Khan & Saxena, 1997;

Nagesh *et al., 1997*,1998; Rao *et al.*, 1997 a, b, 1998; Anjun-Ahmed *et al.*, 1998; Walia *et al.*, 1999; Almihanna *et al.*, 1999; Farahat *et al.*, 1999 and Saikia *et al.*, 1999).

On the other hand, integrated control of nematodes using combination of nematicide and organic amendments have been studied by many workers with respect to root-knot nematodes (Bhattacharya & Goswami, 1988; Jain & Bhatti, 1988; Oduor-Owino *et al.*, 1996 and Amin & Youssef, 1997), however, little attention has been given to the combined effect of nematicide and organic amendments on *R. reniformis* (Gaur & Mishra, 1989 and Prasad *et al.*, 1997). In Egypt, El-Sherif *et al.* (2001) reported that *Vinca rosea* powder integrated with oxamyl caused significant and better increment in sunflower growth, head diameter, seed weight, seed yield/plant and seed oil percentage as well as significant reduction in number of the reniform nematode in soil and roots under greenhouse and field microplots conditions.

The present investigation was conducted to study the impact of *Datura stramonium, Artemisia herba, Morus nigra, Salix babylonica* and *Eucalyptus camaldulensis* powders singly or combined with oxamyl on reproduction of *R. reniformis* infecting sunflower and the resulting effect on plant growth under greenhouse conditions.

MATERIALS AND METHODS

Fresh leaves of thorn apple, *Datura stramonium;* santonica, *Artemisia herba;* mulberry, *Morus nigra;* weeping willow, *Salix babylonica* and blue gum, *Eucalyptus camaldulensis* were sun-dried and powdered. Plastic pots 10- cm diam. were filled with 250 gm steam sterilized sandy : loam soil (1:1) and amended with particular dose of 0.50 gm powder of the previous mentioned plants, separately.

Oxamyl 10% G as nematicide was used alone at the recommended dose (0.03 gm) or in combination with powder at half recommended dose (0.015 gm). All components were added simultaneously, following the incorporation of powder alone or in combination with oxamyl into soil pots. Seeds of sunflower (*Helianthus annus*, L.) cv. Vidoc-5 were planted in pots following the addition of the six components (*Datura stramonium, Artemisia herba, Morus nigra, Salix babylonica, Eucalyptus camaldulensis* and oxamyl). Plants were thinned to one plant per pot after germination and inoculated with 2000 4th stage juveniles (immature females) of *R. reniformis*. Inocula were obtained from a pure culture of *R. reniformis* propagated on pigeon pea, *Cajanus* spp. in the greenhouse. Inoculated plants free of powders or oxamyl were served as control. Pots neither treated with nematode nor powders were also included.

Treatments were as follows:

1- N + thorn apple, 2- N + thorn apple + oxamyl (0.015 gm),
3- N + santonica, 4- N + santonica + oxamyl (0.015 gm),
5- N + mulberry, 6- N + mulberry + oxamyl (0.015 gm),
7- N + weeping willow, 8- N + weeping willow + oxamyl (0.015 gm),
9- N + blue gum, 10- N + blue gum + oxamyl (0.015 gm),
11- N + oxamyl (0.03 gm), 12- N alone (control), and
13- Plant free of N or any treatment.

Each treatment was replicated four times. Pots were randomly arranged on a greenhouse bench at 28 ± 5 °C. Plants received water as needed. Forty-five days after inoculation, plants were removed. Data dealing with lengths and weights of fresh shoot and root were recorded. Shoot dry weights were also measured. Vermiform stages of *R. reniformis* were extracted from soil by sieving and modified Baerman techniques (Goodey, 1957). Roots were stained by acid fuchsin in acetic acid according to Byrd *et al.* (1983), and examined for number of nematode stages, and egg-masses.

Data were also subjected to analysis of variance (ANOVA) (Gomez and Gomez, 1984) and means were compared by Duncan's multiple-range test (Duncan, 1955). This work was undertaken in the greenhouse of Tag El-ez, Research Station, Tag El-ez, Temai El-Amdeed, Dakahlia Governorate.

RESULTS AND DISCUSSION

The impact of plant powders of *D. stramonium, A. herba, M. nigra, S. babylonica* and *E. camaldulensis* with or without oxamyl on plant growth response of sunflower cv. Vidoc-5 infected with *R. reniformis* are presented in Table (1). It was evident that all treatments improved sunflower growth, exceeded that of the nematode alone as well as nematode-free plants.

Regarding data on the fresh weight of the whole plant, *D. stramonium* mixed with oxamyl accomplished the highest percentage of increase which was amounted to 62.24 %, followed by *D. stramonium* alone (45.37 %), *A. herba* plus oxamyl (44.38 %) and *E. camaldulensis* plus oxamyl (39.51 %), whereas, the least values of this plant growth parameter were achieved by the application of *M. nigra* (20.88 %), followed by *S. babylonica* plus oxamyl (20.00 %) and then *S. babylonica* alone (19.32 %) (Table 1). Similar results were noticed with shoot dry weight. However, concomitant treatments using powders mixed with oxamyl showed better increase of the whole plant percentages than those of any component alone. Moreover, significant differences for plant growth parameters were also noticed among most treatments as compared with nematode alone (Table 1).

Concerning data in Table (2), it was evident that nematode population density in soil and within sunflower roots infected with *R. reniformis* were significantly suppressed in all treatments with rates of nematode build-up ranged from 0.167 to 0.278 as compared to nematode alone (1.624). Oxamyl gave great suppression in nematode population with reduction of 89.72 % followed by *D. stramonium* mixed with oxamyl (88.54 %) and then *E. camaldulensis* plus oxamyl (86.96 %) (Table 2). With respect to the egg-mass number of *R. reniformis* on sunflower roots, a significant suppression in all reatments was detected as compared to plants inoculated with nematode alone. However, no significant differences were observed among other treatments (Table 2).

Table (1): Plant growth response of sunflower cv. Vidoc - 5 infected with *R. reniformis* as influenced by some organic soil amendments singly or integrated with oxamyl under greenhouse conditions.

Treatments	Plant growth response*							
	Length (cm)		Fresh weight (gm)		Fresh Wt. of the whole plant (gm)	Increase %	Shoot dry* weight (gm)	Increase* %
	Shoot	Root	Shoot	Root				
D. stramonium	74.75 b	12.20 ab	7.90 bc	7.00 a	14.90	45.37	2.59 ab	181.52
D. stramonium + oxamyl	78.30 a	12.90 a	9.55 a	7.08 a	16.63	62.24	2.75 a	198.91
A. herba	72.50 bcd	12.00 ab	6.96 cde	6.65 a	13.61	32.78	2.20 cd	139.13
A. herba + oxamyl	73.25 bc	11.55 bc	8.10 b	6.73 a	14.83	44.68	2.48 abc	169.56
M. nigra	69.22 de	10.55 cd	6.45 e	5.94 bc	12.39	20.88	1.99 d	116.30
M. nigra + oxamyl	70.32 cde	10.73 cd	7.04 cde	5.78 cd	12.82	25.07	2.02 d	119.56
S. babylonica	68.93 e	10.52 cd	6.45 e	5.78 cd	12.23	19.32	1.98 d	115.22
S. babylonica + oxamyl	69.65 de	10.57 cd	7.00 cde	5.30 d	12.30	20.00	2.00 d	117.39
E. camaldulensis	71.70 bcde	11.48 bc	6.61 de	6.90 a	13.51	31.80	2.40 bc	160.87
E. camaldulensis + oxamyl	73.00 bc	11.57 bc	7.55 bcd	6.75 a	14.30	39.51	2.43 abc	164.13
Oxamyl	71.25 cde	11.98 ab	6.98 cde	6.43 ab	13.41	30.83	2.06 d	123.91
Nematoda alone	54.63 f	9.73 d	5.06 f	5.19 d	10.25		0.92 e	
Plant free of nematode	71.88 bcde	12.55 ab	7.04 cde	6.85 a	13.89	35.51	2.15 cd	133.70

* Each value presented the mean of four replicates.

Means in each column followed by the same letter(s) did not differ at < 0.50 according to Duncan's multiple-range test.

Table (2): Rate of build-up and egg-mass numbers of *R. reniformis* infecting sunflower cv. Vidoc-5 as affected by some organic soil amendments singly or integrated with oxamyl under greenhouse conditions.

Treatments	Nematode population in *			Total	Rate of build-up	Reduction %	Egg-masses *
	Soil	Root					
		Develo-pmental stage	Females				
D. stramonium	395.00 cd	19.30 bc	15.73 b	430.00 cd	0.215	86.76	8.73 b
D. stramonium + oxamyl	347.50 de	12.43 cd	12.35 b	372.30 de	0.186	88.54	7.08 b
A. herba	407.50 c	18.42 bc	16.90 b	442.80 c	0.221	86.37	10.02 b
A. herba + oxamyl	397.50 cd	11.70 cd	15.18 b	424.40 cd	0.212	86.93	8.45 b
M. nigra	495.00 b	17.81 bc	17.84 b	530.60 b	0.265	83.66	10.34 b
M. nigra + oxamyl	480.00 b	16.25 bcd	15.82 b	512.10 b	0.256	84.23	8.52 b
S. babylonica	512.50 b	22.02 b	20.45 b	555.00 b	0.278	82.91	10.23 b
S. babylonica + oxamyl	492.50 b	18.46 bc	17.39 b	528.30 b	0.264	83.73	8.05 b
E. camaldulensis	420.00 c	18.25 bc	15.57 b	453.80 c	0.227	86.03	8.58 b
E. camaldulensis + oxamyl	395.00 cd	15.27 bcd	13.20 b	423.50 cd	0.212	86.96	6.75 b
Oxamyl	315.00 e	9.55 d	11.06 b	333.90 e	0.167	89.72	6.43 b
Nematode alone	2975.00 a	123.7 a	149.6 a	3248.00 a	1.624	0.00	60.30 a

*** Each value presented the mean of four replicates.**
Means in each column followed by the same letter(s) did not differ at < 0.50 according to Duncan's multiple-range test.

From the previous findings it can be concluded that all treatments tested showed better results in reducing nematode population and improving plant growth of sunflower. *Datura. stramonium* integrated with oxamyl showed better performance in promoting plant growth as well as reducing nematode population. These findings are in accordance with those reported by Gaur & Mishra (1989) and Prasad *et al.*, (1997) who stated that combination of chopped leaves of *Calotropis procera* and seed treatment with nematicides was effective in reducing *R. reniformis*. Results of El-Sherif *et al.* (2001) in respect to *Vinca rosea* powder integrated with oxamyl on *R. reniformis* infecting sunflower support also our findings.

In conclusion, it may be noted that powders of certain plants singly or integrated with oxamyl could possess antihelminthic properties against plant parasitic nematodes on such crops and could promise to be used in crop management practices.

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المكافحة المتكاملة للنيماتودا الكلوية "روتيلنكيولس رينوفورمس" على عباد الشمس

أشرف السعيد محمد خليل ــ صلاح محمد عبدالمؤمن ــ هناء سيدهم زوام

معهد بحوث أمراض النباتات ــ مركز البحوث الزراعية ــ الجيزة

تم دراسة تأثير إضافة مسحوق الأوراق الجافة لنباتات الداتورة والشيح والتوت الأسود والصفصاف المتهدل والكافور مع أوبدون مبيد الأوكساميل على تعداد النيماتودا الكلوية ونمو نباتات عباد الشمس صنف فيدوك ــ٥ تحت ظروف الصوبة وأوضحت النتائج ما يلى:ــ

ــ سجلت جميع المعاملات المختبرة تحسنا ملحوظا فى النمو الكلى لنباتات عباد الشمس مقارنة بالكنترول (النيماتودا فقط).

ــ حققت معاملة الداتورة سواء كانت مع أو بدون المبيد عند نصف الجرعة (٠,٠١٥ جرام/نبات) أعلى نسبة زيادة في الوزن الكلي للنبات مقارنة بالكنترول يليها معاملة الشيح والمبيد معا ثم معاملة الكافور مع المبيد وذلك بنسبة زيادة تصل إلى ٦٢,٢٤ % ، ٤٥,٣٧ % ، ٤٤,٦٨ % ، ٣٩,٥١ % على التوالي.

ــ كان لجميع المعاملات المختبرة تأثير واضح فى خفض أعداد النيماتودا معنويا مقارنة بالكنترول.

ــ سجلت معاملة المبيد فقط أعلى نسبة انخفاض فى تعداد النيماتودا (٨٩,٧٢ %) يليها معاملة الداتورة والمبيد معا (٨٨,٥٤ %) ثم معاملة الكافور والمبيد معا (٨٦,٩٦ %).

ــ حققت جميع المعاملات المختبرة إنخفاضا معنويا فى تعداد كتل بيض النيماتودا الكلوية مقارنة بالكنترول.