J. Agric. Sci. Mansoura Univ., 34 (3): 2289 - 2296, 2009

ROLE OF CROP ROTATION ON *Rotylenchulus reniformis* POPULATION WITH REFERENCE TO ITS MANAGEMENT ON COTTON PLANT, *Gossypium barbadense* IN CEMENT BINZES UNDER OUTDOOR CONDITIONS.

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ABSTRACT

Population behavior of *Rotylenchulus reniformis* as artificial infestation on winter crop i.e. Egyptian clover, *Triffolium alexandrinum* or broadbean, *Vicia faba* preceding cotton cv. Giza 45 as summer crop through crop rotation system as well as its management using certain organic matters i.e. camel, horse manures, dried leaf powder of perwinkle and adhatoda in comparison with a herbicide (Emax) and a nematicide, (oxamyl) during the growing season 2005/2006 was studied within cement binzes under outdoor conditions. Results reveal that *R. reniformis* population fluctuated in soil of winter crops, increased from 200 individuals per 250 g. soil as the initial population to 264 or 300 individuals per 250 g. soil of Egyptian clover or broadbean in December 2005 and then declined down to 170 or 190 individuals / 250 g. soil in March, 2006 where soil temperature reached 19±5ºC, respectively, after cotton cv. Giza 454 seeds sowing. With respect to its management on cotton, oxamyl sharply suppressed nematode population below the economic threshold level that was 125 individuals per 250 g. soil throughout the growing season. Periwinkle dried leaf powder ranked second to oxamyl in suppressing nematode count, followed by Emax and camel manure with values of 78.92%, 69.95% 68.35% and 56.87%, respectively. Also, rate of nematode build-up on cotton roots under stress of the various tested treatments was adversely affected with range between 0.11 to 1.11 vs 1.04 folds for the check one . Oxamyl treatment had the lowest rate of nematode build-up (0.11), while adhatoda powder had the highest one (4.20). Meanwhile, cotton yield, percentage increase values was 41.6%, 33.0%, 25.0 and 15.0% for oxamyl, periwinkle powder, Emax and camel manure , whereas, the lowest values were recorded by horse manure (8.3%) and adhatoda powder (5.0%), respectively.

Keywords: Cotton, *Gossypium barbadense* , reniform nematode, *Rotylenchulus reniformis,* seasonal fluctuation, organic manures, oxamyl, Emax

INTRODUCTION

Cotton, *Gossypium barbadense* constitutes one of the main agriculture national income of Arab Republic of Egypt, In certain cotton fields, plants exhibit symptoms of decline which account for a considerable loss in yield. Such phenomenon is attributed to various complex biotic and non-biotic factors. In many of the cotton growing areas of the world, several plant parasitic nematode are known to cause serious damage to cotton. The reniform nematode, *Rotylenchulus reniformis,* the lesion nematode, *Pratylenchus brachyurus*, the root-knot nematode, *Meloidogyne incognita*, and the sting nematode, *Belonolaimus longicaudatus* (Salem, 1970, Star and Page, 1990 ; El-Sherif, 1976 and Crow *et. al*., 1997) are examples of the

most devastating nematode pests of cotton. The first three nematode species are widely distributed in the cultivated cotton areas of Egypt, causing remarkable crop losses. In recent survey of plant parasitic nematode associated with the rhizosphere of cotton cvs, Giza 86 and 45 grown in fourteen locations of season 2005 and 2006, twelve nematode genera i.e. *Tylenchus, Tylenchorynchus, Xiphinema, Meloidogyne, Rotylenchus, Hirschamanniella, Trichodorus , Hoplaimus, Rotylenchulus*, *Helicotylencus, Psilenchus* and *Pratylenchus* for Dakahlia, whereas, nine only i.e. *Meloidogyne*, *Tylenchus, Tylenchorynchus, Heterodera, Dorylaimus, Hirschamanniella, Helicotylencus, Aphelehus* and *Psilenchus* for Damaita, that were recorded in cotton cv. Giza fields surveyed, (El-Sherif *et.al.* 2007). Moreover, they also found that cotton cv. Giza 86 appeared to encounter the highest number of nematode genera (10) while, Giza 45 gained (5) only. Meanwhile , they also said that based on root gall index and R factor of *M. incognita* infecting cotton cultivars tested, Giza 89 was scored as resistant, while Giza 45 as well as Giza 86 were rated as susceptible hosts, since their root gall indices were 2.5 and 4 with R factor values of 0.4, 2.3 and 1.11, respectively. Due to the lack information concerning the seasonal change of *R*. *reniformis* population in winter crops preceding summer crop such as cotton as well as its management on cotton using certain organic matters, the present investigation deals with the following points: (1) Influence of preceding winter crops on the population of *R*. *reniformis* infesting cotton plant cv. Giza 45 as summer crop under outdoor conditions, and (2) *R*. *reniformis* mangemnt on cotton plant cv. Giza 45 using certain organic matters in comparison with a herbicide or a nematicide under outdoor conditions at 27±3ºC**.**

MATERIALS AND METHODS

A. Seasonal fluctuations of reniform nematode, *Rotylenchulus reniformis* population on certain winter crops followed by cotton plant through crop rotation under outdoor conditions.

In order to study the seasonal fluctuation of *R. reniformis* population through crop rotation under outdoor conditions, Egyptian clover, *Triffolium alexandrinum* or broadbean, *Vicia faba* as winter crops were chosen in this study followed by cotton plants as summer crop during the growing season of 2005/2006. To do this procedure, nine cement binzes (60×100cm) for each winter crop, i.e. Egyptian clover or broadbean was cultivated in steam-sterilized sandy loam soil (1:1, v:v) and artificially infested with 200 immature females of *R. reniformis* before sowing . Soil samples (250 g. per each binz / crop / replicate) was separately collected in a plastic bag monthly after seed germination starting by 15th November, 2005 until 15th March, 2006. Soil samples were kept in the refrigerator at 4 ºC until nematode extraction. Nematode extraction was carried-out through sieving and modified Baermann-technique (Goodey, 1957), fixed the nematode suspension with 4% formalin, then examined under the stereomicroscope, determined the number by the Hawksely counting slide and recorded. Soil temperature was

monthly recorded during the course of the work. At the end of March 2006, cotton cv. Giza 45 seeds as summer crops were planted at the level of 15 seeds with 5 seed / location at three locations per each binz after harvesting Egyptian clover as well as broadbean and the agriculture practice for cotton cultivation was previously done according to the Egyptian procedure. Fifteen days after cotton seeds germination, cotton seedlings were thinned into one seedling / location with three cotton seedling per each binz. At the middle of April and May (15th , 2006), soil samples was separately taken from binzes of cotton seedling and the levels of nematode (*R. reniformis*) per 250g. soil were recorded.

B. Management of *Rotylenchulus reniformis* on cotton plant cv. Giza 45 by certain organic matters in comparison with a herbicide or a nematicide under outdoor conditions at 27±3ºC.

In order to do such experiment, two animal wastes, i.e. camel or horse manures, two dried leaf plant powders, i.e. periwinkle, adhatoda at the rate of 5 g/ plant with five plants / binz in comparison with a herbicide (Emax) (0.3g / plant) and Vydate (Oxamyl 24% L.) (0.3 ml / plant) and three binzes were left with nematode at the level of 156 individuals (Pi) / 250 g. soil for the preceding broadbean and 150 individuals (Pi) / 250 g soil for Egyptian clover on 15th May, 2006. Forty five days from adding all tested materials, soil samples from each binz / replicate / treatments were continuously taken in plastic bags until the end of the experiment, kept in the refrigerator at 4 ºC until nematode extraction. Nematode extraction /treatment / replicate was proceeded as mentioned before examined and recorded. Soil temperature was also taken and recorded monthly at time of sampling. At the end of the experiment on 15th October, 2006, cotton yield was collected per replicate/ treatment and recorded.

RESULTS AND DISCUSSION

1. Seasonal fluctuations of *Rotylenchulus reniformis* population on winter crops followed by summer crop rotation under outdoor conditions.

Data in Tables (1&2) illustrate the seasonal fluctuation of *R. reniformis* population on certain winter crops i.e. Egyptian clover or broad bean in monthly in 250 g. soil cultivated in artificial infested soil of cement binzes (60×100cm) during the season of 2005 /2006. Results indicate that *R. reniformis* population fluctuated in soil of winter crops i.e. either Egyptian clover or broad bean, since its values was 128 or 200 individuals /250 g. soil in November 2005, increased up to 264 or 300 individuals /250 g. soil in December then declined down to 170 or 150 individuals /250 g. soil in January 2006 due to temperatures at this time of the year that were recorded to be 19±6ºC, 17±4ºC and then 12±5ºC, respectively. The nematode population continued to decline in soil of either winter crops under study until March with average number of 170 or 190 individuals /250 g. soil at soil temperature of 19±5ºC, even after sowing cotton seeds c. Giza 45 at the end of March, followed by April and May with average number of 150 or 100 and

150 or 156 individuals /250 g. soil, respectively, at soil temperature ranged from 20±5ºC to 24±3ºC.

The present findings are in agreement with those of Osman (1977) who reported that winter crops, which commonly precede tomato cultivated resulted in variable degrees of root-knot nematode infecting tomato plants.

Table (1): Cotton renifom nematode, *Rotylenchulus reniformis* population change in soil of winter crops of Egyptian clover and broad bean preceding cotton cv. Giza 45 as summer crop during the growing season of 2005/2006 under outdoor conditions at 18±5ºC.

Months	*Average number of *Rotylenchulus reniformis* on (A) : winter crops		
	Broadbean	Egyptian clover	Temperature
November 2005	200	128	19±6
December	264	300	17±4
January 2006	170	150	12±5
February	130	110	14±5
March	170	190	19±5
(B); Summer crop, cotton cv. Giza 45			
April	150	100	20±5
May	150	156	24±3

Initial population = 200 immature females of *R. reniformis* (Pi)
***Each figure = mean of three replicates.**

Table (2): Fluctuation of *R. reniformis* number, rate of reproduction and reduction during cotton growing season 2006 following winter crops as affected by certain organic amendments under outdoor conditions at 27±3ºC.

Months / Treatments	*Average number of *R. reniformis* per 250g. soil during cotton growing season 2006							
	June	July	August	September	October (PF)	Cumulative Number	No. Of folds	% Red.
Camel manure	120	129	120	125	44	538	0.28	56.89
Horse manure	114	160	112	120	117	623	0.76	50.08
Periwinkle powder	110	80	60	65	60	375	0.39	69.95
Adhatoda powder	111	120	110	132	170	643	1.11	48.48
Emax	120	105	50	60	60	395	0.38	68.35
Oxamyl	80	60	50	55	18	263	0.11	78.92
N alone	296	290	252	250	160	1248	1.04	-----

Initial population = 153 individuals /250 g. soil.
Rate of reproduction (Pf) = (Final population /(Pf / intial population) (Pi).
***Each figure = mean of three replicates**

2. Management of *Rotylenchulus reniformis* on cotton plant cv. Giza 45 by certain organic matters in comparison with a herbicide or a nematicide under outdoor conditions at 27±3ºC.

Data in Tables (2&3) Figure (1) show the effect of certain organic matters i.e. camel, horse manures, dried leaf plant powders of periwinkle and adhatoda in comparison with a herbicide (Emax) and Oxamyl on controlling *R. reniformis* and cotton growth yield during cotton growing season of 2006, following the winter crops i.e. Egyptian clover or broad bean of 2005 under outdoor conditions at 27±3ºC. Data reveal that treatment with oxamyl or a herbicide (Emax) or periwinkle dried leaf plant powder, obviously, reduced and maintained the population of *R. reniformis* at the lowest level through the growing season of cotton. On the other hand, adhatoda treatment dropped the population till August then reached its maximum almost as the check (untreated) during October, where, camel or horse manures treatments dropped nematode population in June (-5 or -11), increased up to (+4 or +35), in July and then, sharply declined again in August, September and October, respectively. (Table 3).

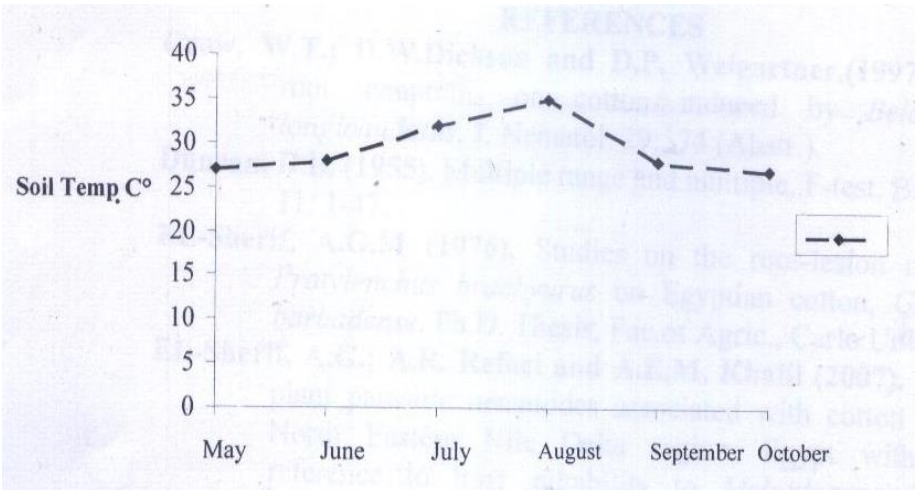
Table (3): Rate of cotton raw yield increase as affected by *Rotylenchulus reniformis* infection under the stress of certain organic amendments treatments in comparison with a herbicide and oxamyl during growing season 2006 under outdoor conditions at 27±3ºC.

Months / Treatments	Average number of *R. reniformis* per 250g. soil during cotton growing season 2006 below or above the economic threshold level and cotton yield						
	June	July	August	September	October	Kentars cotton yield per feddan	% Increase of raw cotton yield
Camel manure	-5	+4	-5	0	-81	6.9	15.0
Horse manure	-11	+35	-13	-5	-8	6.5	8.3
Periwinkle powder	-15	-45	-65	-60	-65	8.0	33.3
Adhatoda powder	-14	-5	-15	+7	+45	6.3	5.0
Emax (herbicide)	-5	-20	-75	-65	-65	7.5	25.0
Oxamyl(nematicide)	-45	-65	-75	-80	-117	8.5	41.6
N alone	+171	+175	+125	+125	+45	6	----

Feddan = 4200 m^2
Kentar raw cotton = 150Kg.
Hectar = 10.00 m^2

Generally the population level sharply suppressed after harvesting to a level below the initial density in most treatment (Fig. 1) Obviously, the economic threshold level of *R. reniformis* population was about 125 individuals /250 g. soil throughout the cotton growing season (Fig. 1). Data also reveal that oxamyl sharply suppressed nematode population below the economic threshold level, followed by the herbicide (Emax) and dried leaf plant powder of periwinkle treatments during June, July August, September and October. With adhatoda treatment the same result was obtained except in September and October at which time nematode population was 7 and 45 individuals above the threshold level (Table, 3). Among the tested organic

matters, Periwinkle dried leaf powder ranked first in suppressing the cumulative number of *R. reniformis,* followed by camel manure with value of 69.95% and 56.89%, respectively. As a whole oxamyl treatment gave the highest reduction percentage in suppressing nematode population with value of 78.92% followed by periwinkle dried leaf powder (69.95%), then the herbicide (Emax) (68.35%), and camel manure (56.89%), respectively.



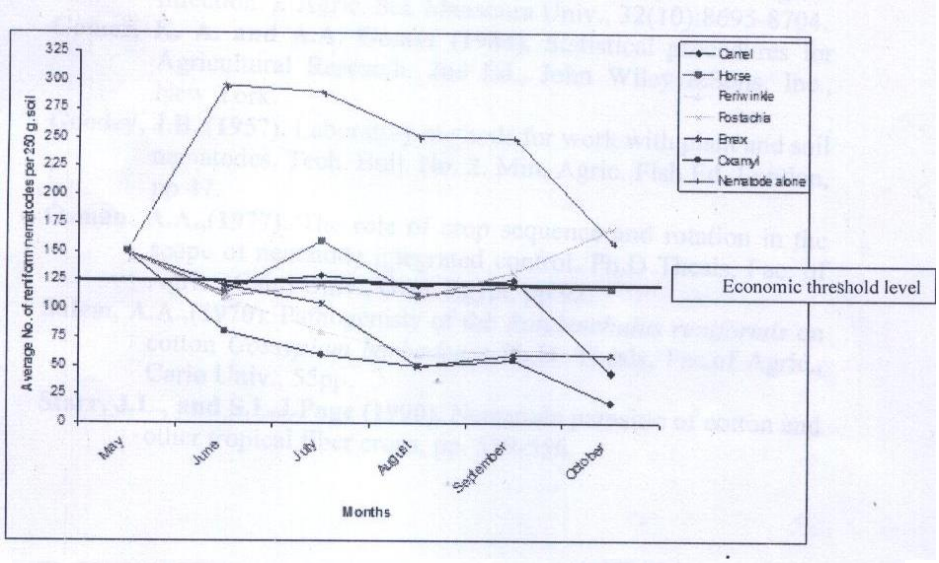


Fig. (1): Average number of *Rotylenchulus reniformis* on cotton plant as affected by the addition of certain treatments.

Also, rate of nematode build-up on cotton roots under stress of the various tested treatments was adversely affected. Such rates ranged from 0.11 to 1.11 vs 1.04 folds for the check one. Oxamyl treatment had the lowest rate of nematode build-up with value of 0.11, while, adhatoda powder had the highest rate one (1.11). It is worthy to note that all tested treatments kept *R. reniformis* in low number below the economic threshold level which was recorded to be 125 individuals / 250 g. soil during cotton growing season 2006 except that of adhatoda at the end of cotton season (Fig. 1). Meanwhile, oxamyl gave the highest percentage increase of cotton yield (41.6%), followed by periwinkle dried leaf powder (33.0%), then herbicide treatment (25.0%), and camel manure (15.0%), whereas, adhatoda dried leaf powder had the lowest percentage increase of cotton yield (5.0%) and horse manure (8.3%) comparing to nematode alone, respectively.

The present findings are in agreement with those of Osman (1977) who said that the effect of Vydate (oxamyl) spray on tomato infected with *M. javanica* indicated that this compound resulted in more than 90% nematode reduction and significantly increased the plant growth. Also, results of the present work are supported by those of El-Sherif (1976) who reported that aldicarb as a nematicide in particular, controlled *P. brachyurus* and obviously increased cotton yield. The economic threshold level was determined as 100 nematode 250 g. soil throughout cotton growing season)El-Sherif, 1976).

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دور دورة المحاصيل علي تعداد نيماتودا "روتيلنكيولس رينفورمس " بالاشارة الي مكافحتها علي القطن المصري "جوسبيم باربادنس" في احواض اسمنتية تحت ظروف نصف حقلية"

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تم دراسة سلوك اعداد النيماتودا " روتيلنكيولس رينفورمس " كعدوي صناعية علي المحاصيل الشتوية البرسم او الفول البلدي السابقة للمحصول الصيفي القطن صنف جيزة ٤٥ خلال نظام دورة المحاصيل وكذا مكافحتها باستخدام بعض المحسنات العضوية مثل مخلف الجمل والحصان والمساحيق الجافة لاوراق نبات الونكا والبوستاشيا مقارنة بمبيد حشائش ايماكس ومبيد نيماتودي الاوكساميل خلال موسم النمو ٢٠٠٥/٢٠٠٦ في احواض اسمنتية تحت ظروف نصف حقلية

واسفرت النتائج علي ما يلي:

١. تذبذب اعداد نيماتودا " روتيلنكيولس رينفورمس" في ترب المحاصيل الشتوية وزادت من ٢٠٠ فرد/٢٥٠ جرام تربة كتعداد بدائي الي ٢٦٤ او ٣٠٠ فرد /٢٥٠ جرام تربة للبرسيم او الفول البلدي في ديسمبر ٢٠٠٥ ثم انخفض الي ١٧٠ او ١٩٠ فرد /٢٥٠ جرام تربة في مارس ٢٠٠٦ عند درجة حرارة ١٩±٥°م علي التوالي بعد زراعة بذور القطن جيزة ٤٥.
٢. اما بخصوص مكافحتها علي القطن اعطي معاملة المبيد انخفاضا شديدا في اعداد النيماتودا اقل من مستوي الحد الاقتصادي الحرج الذي سجل ١٢٥ فرد /٢٥٠ جرام تربة طول الموسم.
٣. سجلت معاملة المسحوق الجاف لاوراق نبات الونكا المركز الثاني بعد معاملة المبيد الفايديت يليها ومعاملة مبيد الحشائش ايماكس في خفض اعداد النيماتودا يليها المخلف العضوي للجمل بقيم ٧٨,٢٩% و ٦٩,٩٦% و ٦٨,٣٥% و ٥٦,٨٦% علي التوالي.
٤. كما تاثر معدل تكاثر النيماتودا بجميع المعاملات المستخدمة في المكافحة بدرجة واضحة تتراوح مابين ٠,١١ الي ١,١١ مقابل ١,٠٤ مرة للنيماتودا وحدها.
٥. اعطيت المعاملة بالمبيد الاوكساميل اقل القيم في معدل تكاثر النيماتودا ٠,١١ بينما المسحوق الجاف لاوراق البوستاشيا اعطي اعلي معدل تكاثر للنيماتودا (١,١١).
٦. كانت اعلي نسب الزيادة في محصول القطن الخام (الزهر) هي ٤١,٦% و ٣٣,٠% و ٢٥,٠% و ١٥,٠% لكل من مبيد الاوكساميل ومسحوق الونكا ومبيد الحشائش "ايماكس" ومخلف الجمل بينما اقل نسب زيادة لمحصول القطن الزهر تحقق بواسطة مخلف الحصان (٨,٣%) والمسحوق الجاف لاوراق البوستاشيا علي التوالي.