J. of Plant Protection and Pathology, Mansoura Univ., Vol. 11 (11):595-599, 2020

Journal of Plant Protection and Pathology

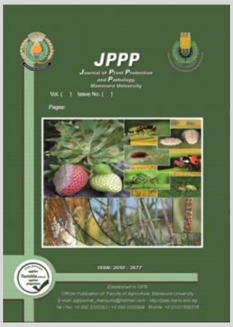
Journal homepage: www.jppp.mans.edu.eg
Available online at: www.jppp.journals.ekb.eg

Fluctuation of Nematode Populations in some Vegetable Hosts under Drip and Conventional Irrigation Systems

Cross Mark

Entsar H. Taha*

Department of Plant Protection, Faculty of Agriculture, Ain Shams University, Cairo, Egypt



ABSTRACT

Water shortages have increased Egyptian growers interest towards drip irrigation. Conventional and drip, are two types of irrigation systems which wereselected to investigate their effect on the fluctuation of the populations of some plant parasitic nematodes on growth of different vegetable host plants: tomato (*Lycopersicon esculentum*), eggplant (*Solanum melongena*), peppers (*Capsicum annum*), cucumber (*Cucumis sativus*), and cowpea (*Vigna sinenses*). The predominant genera of plant parasitic nematodes recovered from soil samples (Pi & Pf) were *Meloidogyne, Helicotylenchus, Pratylenchus, Paratylenchus, Rotylenchulus, Hoplolaimus, Tylenchorhynchus*, and *Xiphinema*. On the whole the results showed that, *Meloidogyne* and *Pratylenchus* were the most common plant parasitic nematode in the plant hosts (cucumber tomato eggplant peppers cowpea) and the nematode population were lesser in drip irrigated plants (97.3, 69.0, 87.0, 81.0, 83.3 and 71.3, 46.7, 69.7, 59.0 63.0) respectively, than those of conventional irrigation (104.3, 83.7, 93.0, 85.7, 88.0 and 75.3, 68.0, 80.3, 64.0, 72.3) respectively. We can conclude that, the drip irrigation system can be used as a Strategy of nematode pests in combination with different strategies without greatly affecting on the crop growth.

Keywords: Population fluctuation, plant parasitic nematodes, drip irrigation, conventional irrigation.

INTRODUCTION

Various biotic and abiotic factors inhibit vegetable production. One of the effective biotic factors in agricultural crops is the plant parasitic nematodes (Sasser & Freckman 1987). In fact, the damage of nematode infection on host plants greatly depends on the initial population of nematodes and detect of water irrigation. Damage the root system by nematodes can cause economic losses (Sasser 1987). In nematodes can affect the plant growth as well as the amount and quality of the yield (Khyami-Horani & Al-Banna 2006, and Strajnar *et al.* 2012).

Drip irrigation may have the ability to reduce soil moisture-sensitive plant diseases and pests (Shin 2005 and Mohawesh & Karajeh 2013). Also, soil moisture considered as one of the most important factor which can affect nematode population and infection (Hunter 2000: and Surega and Ramakrishnan 2017). Moreover, increasing water stress can increases the second larval stage mortality and reduces the eggs hatchability of *M. javanica* (Mohawesh & Karajeh 2013). However, this is may be related to a particular hosts and particular localities (Norton, 1978). In this respect, Poornima and Vadivelu, (1998) stated that, the population of *M. incognita* increased as the age of the host plant advances and highly increased on receipt of rain. It was also observed that, the host plant phenology is the major factor which affects the nematode population than ecological factors like water and temperature (Eapen 1993).

Nowadays drip irrigation system is considered as a successful applied method of irrigation in many crops, Therefor, our study has been focused on the fluctuation of nematode populations as well as plant growth in drip irrigation system comparing with those of conventional irrigation.

MATERIALS AND METHODS

1-Preparation of the field trials:

Experiments were carried out in field plots of Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima where the type of the soil is sandy clay soil. The field was divided into small plots (2x3m) forming two groups of plots with two different irrigation systems; the first; drip irrigation, while the second is conventional irrigation system. Each group consists of five plots and each one was cultivated with one of the vegetable host plants: tomato (*Solanum lycopersicum*) cv., eggplant (*Solanum melongena*) cv., peppers (*Capsicum annum*) cv., cucumber (*Cucumis sativus*) cv., and cowpea (*Vigna sinenses*) cv.. Also, some other two groups were established with sterilized soil and left with plants as control check.

2- Nematode extraction and estimation in the field:

Twenty-five samples of the field's soil were taken to estimate the initial population of nematodes (Pi) before planting. Five Samples were taken monthly during the cropping season, from March to June.

At the end of the experiment, soil and roots samples were collected. All IJs were extracted from roots by mist chamber for 7 days, and from soil by using the modified Baermman funnel technique. All IJs extracted were counted using light microscope and final population (Pf number of nematodes per 250g soil) of nematode were determined and recorded for all genera. Length of the root and shoot the plant were measured. fresh weight of root and shoot for plant were recorded.

3- Nematode identification:

The extracted nematodes were identified to generic level using identification keys depending on morphological characteristics (Mai *et al.*, 1964; and Bongers, 1988) based on the morphological characters of adult forms as described by Goodey and Goodey (1963), Mai and Lyon (1975), and Taylor and Sasser, (1978) and counted using counting slide under a compound microscope.

4- Measurement of plant growth parameters:

At the end of the experiments, five plants were selected randomly from each plot, and the following measurements

* **Corresponding author.**
E-mail address: entsar_elsayed@agr.asu.edu.eg
DOI: 10.21608/jppp.2020.128705

were recorded: length of shoot and root, fresh weight of shoots, and roots.

5- Statistical analysis

The data of all experiments were statistically analyzed using analysis of variance procedure propsped by Snedecor and Cochran (1969). The differences between means were compared using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Results

To compare between drip and conventional irrigation, soil samples were collected monthly during the period from March to June and nematodes were extracted and counted. The final nematode population (Pf) was recorded in the tables (1 - 5) for each plant host.

In both systems of irrigation, the nematode population started to build up gradually after planting (March) and reached their peak at the end of the growing season (June). The most dominant nematode genera extracted from soil samples were *Meloidogyne* followed by *Pratylenchus* while *paratylenchus* followed by *Xiphinema* were rarely found,

In cucumber under conventional and drip irrigation systems, the final nematode population associated with *Meloidogyne* and *Pratylenchus* were 104.3 and 75.3/250g soil, while reached 19.3, and 24.7 for *Paratylenchus and Xiphinema* respectively (Table 1). In drip irrigation, a significant reduction in soil population was recorded with *Meloidogyne*, *Rotylenchulus*, *Helicotylenchus*, *Paratylenchus*, *Tylenchorhynchus* and *Xiphinema* compared to those of conventional irrigation.

Table 1. Comparison of nematode population between drip and conventional irrigated cucumber plant.

	Type of Irrigation	Nematode population (250 g soil)							
		Meloidogyne	Pratylenchus	Rotylenchulus	Helicotylenchus	Hoplolaimus	Paratylenchus	Tylenchorhynchus	Xiphinema
March	drip	26.7 ^{e}	18.7 ^{c}	13.3 ^{d}	13.7 ^{e}	16.0 ^{e}	7.7 ^{e}	16.0 ^{d}	3.7 ^{e}
	conventional	27.7 ^{e}	20.0 ^{c}	19.0 ^{c}	17.3 ^{d}	20.7 ^{cd}	9.7 ^{de}	23.7 ^{c}	7.3 ^{d}
April	drip	45.7 ^{d}	22.0 ^{c}	15.7 ^{d}	15.0 ^{de}	19.3 ^{de}	11.3 ^{cd}	18.0 ^{d}	6.7 ^{d}
	conventional	50.3 ^{d}	24.7 ^{c}	21.3 ^{c}	21.3 ^{c}	23.7 ^{bc}	13.3 ^{bc}	24.0 ^{c}	9.7 ^{bcd}
May	drip	60.0 ^{c}	50.3 ^{b}	20.7 ^{c}	18.0 ^{d}	19.0 ^{de}	11.7 ^{cd}	20.3 ^{cd}	8.0 ^{cd}
	conventional	63.3 ^{c}	49.3 ^{b}	28.3 ^{b}	25.0 ^{b}	27.3 ^{b}	15.7 ^{b}	30.0 ^{b}	12.0 ^{b}
June	drip	97.3 ^{b}	71.3 ^{a}	27.7 ^{b}	24.3 ^{bc}	25.0 ^{b}	12.7 ^{bcd}	30.0 ^{b}	11.0 ^{bc}
	conventional	104.3 ^{a}	75.3 ^{a}	37.3 ^{a}	41.3 ^{a}	33.3 ^{a}	19.3 ^{a}	38.7 ^{a}	24.7 ^{a}

The means in the same column followed by the same letters have no significant differences at 0.05 probability level using Duncan test.

In tomato plants under conventional and drip irrigation systems, 83.7 and 68.0 for *Meloidogyne* and *Pratylenchus*, respectively while the least number was recorded in *paratylenchus* (7.3) which followed by equal final populations in *Xiphinema*, *Tylenchorhynchus* and *Helicotylenchus* (15.7) (Table 2). However, under conventional irrigation *Meloidogyne* and *Pratylenchus* recorded: 98.3 and 77.7, respectively. While Paratylenchus was the least recorded nematode genera (16.7).

Table 2. Comparison of soil nematode populations (250 g) between drip and conventional irrigated tomato.

	Type of Irrigation	Nematode population (250 g soil)							
		Meloidogyne	Pratylenchus	Rotylenchulus	Helicotylenchus	Hoplolaimus	Paratylenchus	Tylenchorhynchus	Xiphinema
March	drip	26.3 ^{g}	15.7 ^{g}	13.7 ^{e}	14.7 ^{d}	11.7 ^{g}	7.7 ^{c}	8.3 ^{c}	7.3 ^{f}
	conventional	28.7 ^{g}	19.7 ^{f}	19.0 ^{d}	19.7 ^{c}	15.3 ^{ef}	9.7 ^{bc}	11.3 ^{c}	9.0 ^{ef}
April	drip	41.7 ^{f}	21.7 ^{ef}	14.3 ^{e}	19.3 ^{c}	14.7 ^{fg}	8.3 ^{c}	11.7 ^{c}	9.3 ^{ef}
	conventional	45.3 ^{e}	24.7 ^{e}	21.0 ^{cd}	24.3 ^{b}	18.3 ^{de}	10.3 ^{bc}	19.0 ^{b}	14.7 ^{cd}
May	drip	62.0 ^{d}	40.7 ^{d}	21.7 ^{cd}	21.3 ^{bc}	22.0 ^{bc}	8.3 ^{c}	18.3 ^{b}	11.7 ^{de}
	conventional	69.0 ^{c}	46.7 ^{c}	30.7 ^{b}	30.3 ^{a}	25.3 ^{b}	12.3 ^{b}	27.7 ^{a}	21.7 ^{b}
June	drip	83.7 ^{b}	68.0 ^{b}	23.0 ^{c}	15.7 ^{d}	19.3 ^{cd}	7.3 ^{c}	15.7 ^{b}	15.7 ^{c}
	conventional	98.3 ^{a}	77.7 ^{a}	43.7 ^{a}	33.0 ^{a}	31.7 ^{a}	16.7 ^{a}	31.3 ^{a}	28.0 ^{a}

The means in the same column followed by the same letters have no significant differences at 0.05 probability level using Duncan test.

At the end of the host plants, Eggplant, Pepper, and Cowpea under conventional and drip irrigation systems, growing season, in the *Meloidogyne* and *Pratylenchus* the final populations were 93.0, 85.7, 88.0 and 80.3, 64.7, 72.3 respectively. On the other hand, the least final populations were 13.3, 14.7, 13.7 and 14.3, 29.3, 34.3 for *paratylenchus* and *Xiphinema*, respectively (Tables 3, 4, and 5).

According to data in Figure 1, there was no significant reduction in the most of host plant parameters with the drip irrigation regime. In the most of the plant parameters, the plant growth in the drip irrigation was more than these of the conventional irrigation but it was not a significant increasing in most cases, except in the fresh weight of the plant roots which was more in the conventional regime. In cucumber the drip irrigation was significant increasing in the shoot length and the shoot and root fresh weight comparing with the conventional system.

Table 3. Comparison of nematode populations (250 g) between drip and conventional irrigated eggplant.

	Type of Irrigation	Nematode population (250 g soil)							
		Meloidogyne	*Pratylenchus*	*Rotylenchulus*	*Helicotylenchus*	*Hoplolaimus*	*Paratylenchus*	*Tylenchorhynchus*	*Xiphinema*
March	drip	18.0 ^{e}	19.0 ^{f}	14.3 ^{f}	15.3 ^{d}	11.7 ^{e}	4.7 ^{e}	17.3 ^{e}	4.7 ^{c}
	conventional	25.0 ^{e}	20.3 ^{f}	21.0 ^{e}	20.3 ^{c}	17.3 ^{d}	7.3 ^{cd}	22.3 ^{de}	8.3 ^{bc}
April	drip	37.9 ^{d}	21.7 ^{f}	16.3 ^{f}	20.3 ^{c}	18.3 ^{d}	5.0 ^{d}	19.7 ^{e}	6.7 ^{c}
	conventional	45.3 ^{d}	26.3 ^{e}	25.3 ^{d}	23.0 ^{bc}	22.7 ^{c}	8.7 ^{bc}	29.7 ^{c}	8.3 ^{bc}
May	drip	61.0 ^{c}	41.3 ^{d}	19.7 ^{e}	21.0 ^{c}	23.0 ^{c}	5.0 ^{d}	26.0 ^{cd}	5.7 ^{c}
	conventional	63.3 ^{c}	50.3 ^{c}	35.0 ^{b}	25.7 ^{b}	39.7 ^{a}	11.3 ^{ab}	38.3 ^{b}	11.7 ^{ab}
June	drip	87.0 ^{b}	69.7 ^{b}	30.7 ^{c}	22.7 ^{bc}	27.0 ^{b}	5.7 ^{cd}	29.7 ^{c}	7.3 ^{bc}
	conventional	93.0 ^{a}	80.3 ^{a}	39.7 ^{a}	35.3 ^{a}	39.3 ^{a}	13.3 ^{a}	49.3 ^{a}	14.3 ^{a}

The means in the same column followed by the same letters have no significant differences at 0.05 probability level using Duncan test.

Data in Figure (2) demonstrated that, there were no significant differences in gall numbers in different plant hosts except in cucumber. In addition, there were no significant differences in the egg masses in all plant hosts.

Table 4. Comparison of nematode populations (250 g) between drip and conventional irrigated pepper.

	Type of Irrigation	Nematode population (250 g soil)							
		Meloidogyne	*Pratylenchus*	*Rotylenchulus*	*Helicotylenchus*	*Hoplolaimus*	*Paratylenchus*	*Tylenchorhynchus*	*Xiphinema*
March	drip	23.7 ^{f}	18.0 ^{f}	17.3 ^{e}	18.0 ^{e}	14.7 ^{d}	6.3 ^{d}	19.7 ^{e}	5.3 ^{f}
	conventional	26.7 ^{f}	20.0 ^{ef}	22.7 ^{d}	25.7 ^{d}	19.3 ^{c}	9.3 ^{bcd}	21.7 ^{e}	9.7 ^{de}
April	drip	37.7 ^{e}	22.3 ^{de}	16.0 ^{e}	18.7 ^{e}	14.7 ^{d}	7.0 ^{cd}	19.7 ^{e}	8.7 ^{e}
	conventional	42.3 ^{d}	25.0 ^{d}	22.3 ^{d}	25.7 ^{d}	19.7 ^{c}	11.3 ^{b}	24.0 ^{de}	11.7 ^{cd}
May	drip	60.7 ^{c}	37.0 ^{c}	29.0 ^{c}	28.0 ^{cd}	23.7 ^{b}	7.0 ^{cd}	26.3 ^{cd}	13.3 ^{c}
	conventional	63.3 ^{c}	38.7 ^{c}	33.3 ^{bc}	32.3 ^{c}	29.3 ^{a}	10.3 ^{bc}	31.7 ^{b}	25.3 ^{b}
June	drip	81.0 ^{b}	59.0 ^{b}	36.0 ^{b}	37.7 ^{b}	28.7 ^{a}	7.3 ^{cd}	29.3 ^{bc}	11.7 ^{cd}
	conventional	85.7 ^{a}	64.7 ^{a}	43.7 ^{a}	42.7 ^{a}	32.3 ^{a}	14.7 ^{a}	52.3 ^{a}	29.3 ^{a}

The means in the same column followed by the same letters have no significant differences at 0.05 probability level using Duncan test.

Table 5. Comparison of nematode populations in soil (250 g) between drip and conventional irrigated cowpea.

	Type of Irrigation	Nematode population (250 g of soil)							
		Meloidogyne	*Pratylenchus*	*Rotylenchulus*	*Helicotylenchus*	*Hoplolaimus*	*Paratylenchus*	*Tylenchorhynchus*	*Xiphinema*
March	drip	20.7 ^{f}	20.7 ^{e}	16.0 ^{g}	14.3 ^{f}	12.0 ^{f}	4.3 ^{e}	12.0 ^{e}	6.3 ^{e}
	conventional	22.0 ^{f}	23.7 ^{de}	23.3 ^{ef}	16.0 ^{ef}	15.3 ^{ef}	7.7 ^{cd}	16.3 ^{e}	8.7 ^{e}
April	drip	27.3 ^{e}	26.0 ^{de}	20.7 ^{f}	18.7 ^{de}	18.7 ^{de}	5.7 ^{de}	15.3 ^{e}	10.0 ^{de}
	conventional	30.3 ^{de}	28.7 ^{d}	25.0 ^{de}	21.3 ^{d}	22.3 ^{d}	8.3 ^{cd}	21.7 ^{d}	14.0 ^{c}
May	drip	33.0 ^{cd}	41.0 ^{c}	27.7 ^{cd}	29.0 ^{c}	30.0 ^{c}	6.7 ^{cde}	25.3 ^{cd}	13.0 ^{cd}
	conventional	37.3 ^{c}	46.3 ^{c}	32.0 ^{b}	34.3 ^{b}	34.7 ^{b}	11.3 ^{ab}	33.3 ^{b}	28.3 ^{b}
June	drip	83.3 ^{b}	63.0 ^{b}	30.3 ^{bc}	30.7 ^{c}	32.3 ^{bc}	9.3 ^{bc}	27.0 ^{c}	14.7 ^{c}
	conventional	88.0 ^{a}	72.3 ^{a}	42.7 ^{a}	43.3 ^{a}	44.7 ^{a}	13.7 ^{a}	45.3 ^{a}	34.3 ^{a}

The means in the same column followed by the same letters have no significant differences at 0.05 probability level using Duncan test.

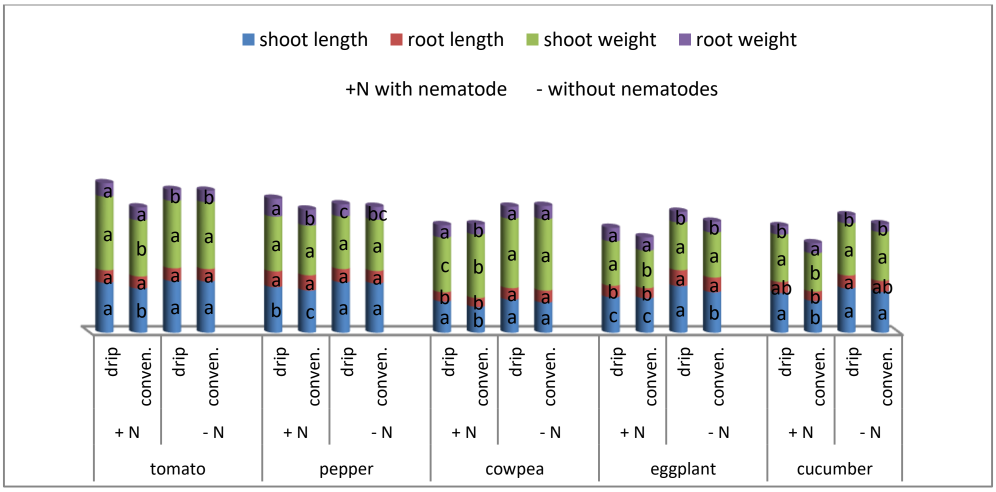


Figure 1. The plant growth parameters in infected and un-infected different plant hosts under two conditions of irrigation (drip and conventional irrigation systems).

The means in the same column followed by the same letters have no significant differences at 0.05 probability level using Duncan test.

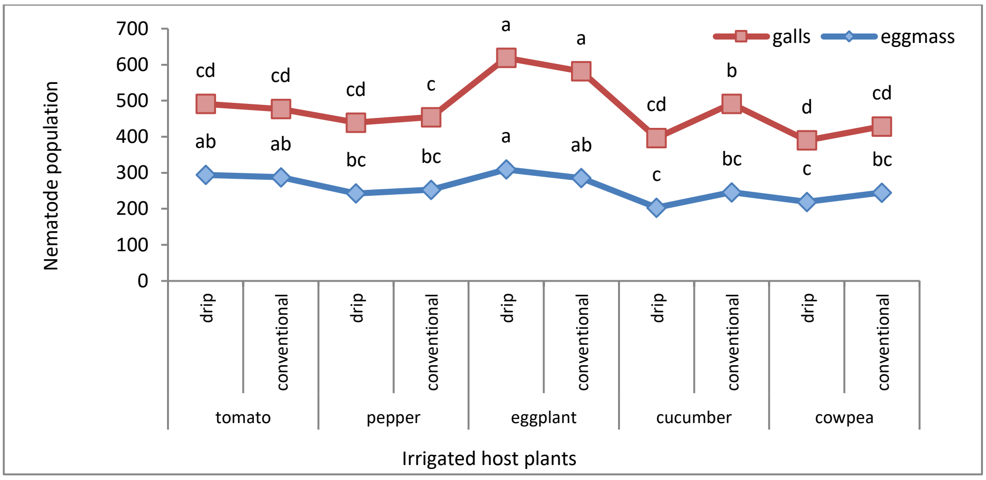


Figure 2. Nematode parameters in infected different plant hosts under two conditions of irrigation (drip and conventional irrigation systems).

The means in the same line followed by the same letters have no significant differences at 0.05 probability level using Duncan test.

Discussion

In fact, a variety of biotic and abiotic factors affect the nematode populations in soil. Plant-parasitic nematodes are mostly aerobic and aquatic animals which requiring proper moisture level and aeration from the soil (Kim, 2015; and Moore and Lawrence, 2013). Therefore, water is a critical factor that affects the survival of nematodes (Prot 1979; and Towson & Apt 1983). For this reason, any suitable irrigation style may consider as a control key which could affect nematode parameters, and so it can be used for management of plant parasitic nematodes without any negative effect on host plant growth under field conditions accompanied by optimum environmental conditions (Mohawesh & Karajeh 2014). Seemingly any reduction effect on the host plant growth at low irrigation levels is highly related to the soil type of the field.

The present result is in accordance with those of Karajeh & Mohawesh (2016) who reported that, the final population of plant parasitic nematodes, root galling number of egg-masses per root system were obviously lower in the drip irrigated fields compared with the full irrigation. In this regard, drip irrigation can provide the plant with optimum water levels, which reduce the effect of nematode stress (Funt *et al.,* 1982). This may be due to maintain a relatively dry soil in addition to maintaining crop water needs (Browne *et al.,* 2002).

The present study indicated that, the population of *M. incognita Rotylenchulus sp., Helicotylenchus sp. Xiphinema sp., Pratylenchus sp.* and *Tylenchorynchus sp.* increased in both irrigated system at the advanced of the host plant and this is may be due to availability of more roots to feed upon as the plant grows in worm months from March to June. Conversely, Surega & Ramakrishnan (2017) found that, the nematode population reduced with the plant growth in cold months from Jan to Mar. this must be due to the production of new root biomass.

The infective juveniles of *M. javanica* highly accumulated at the highest moisture content and this is considered as the optimum conditions for mobility (Prot 1979). In contrast, the low soil moisture levels in drip irrigation may able to inhibit and control the activity of *M. hapla* (Couch & Bloom 1960) in addition to decrease the root infection by nematodes (Zhang & Schmitt 2001) the present data fit these findings.

In contrast of our data, several studies showed that plant growth may be inhibited at low water levels below plant requirements because of the osmotic adjustment (Tüzel *et al.* 2001). It is may be due to restricting the development of transpiring leaf area in the water-stressed plants (Sharp *et al.* 1996). These results are in agreement with the findings of Mahadeen *et al*. 2011 and Kirnak *et al.* (2001) who reported that the continue elongation of some roots to at low soil water levels may completely inhibited shoot growth.

In conclusion, as referred before, Generally the nematode populations which were recorded during four months were lesser in drip irrigated host plants compared to conventional irrigated plants. Therefore, drip irrigation can be used for the management of some plant parasitic nematodes without any negative impact on particular plant hosts growth under field conditions.

REFERENCES

Bongers, T., 1988. De Nematoden van Nederland. KNNV. Utrecht, The Netherland, p. 408.

Browne, G.T., DeTar, W.R., Sanden, B.L. and Phene, C.J. 2002. Comparison of drip and sprinkler irrigation systems for applying metham sodium and managing stem rot on potato. Plant Disease. 86, 1211-1218.

Couch HB, Bloom JR. 1960. Influence of soil moisture stresses on the development of the root-knot nematode. Phytopathology. 50:319–321.

Duncan, A. W. 1955. Multiple range and multiple F test. Biometrics 11:1-42.

Eapen S.J., 1993. Seasonal variations of root knot nematode population in a cardamom plantation. Indian Journal of Nematology, 23: 63-68.

Funt, R.C., Krusberg, L.R., Ross, D.S. and Goulart, B.L. 1982. Effect of post plant nematicides and trickle irrigation on newly planted peach trees. Journal of American Society of Horticulture Science. 107, 891- 895.

Goodey, T., and J. B. Goodey. 1963. Soil and freshwater nematodes. London: Methuen.

Hunter J.J. 2000. Plant spacing effects on root growth and dry matter partitioning of Vitis vinifera cv. Pinot noir/99 Richter and implications for soil utilisa-tion. Acta Horticulturae 526: 63-74. DOI: 10.17660/ActaHortic. 2000.526.4.

Karajeh, M., Mohawesh, O. 2016. Root-knot nematode (Meloidogyne javanica) – deficit irrigation interactions on eggplant cropped under open field conditions. Journal of Horticultural Research. 24:1. 73- 78.

Khyami-Horani H., Al-Banna L. 2006. Efficacy of Bacil-lus thuringiensis jordanica against Meloidogyne javanica infecting tomato. Phytopathologia Medi-terranea 45(2): 153-157. DOI: 10.14601/Phyto-pathol_Mediterr-1826.

Kim YH. 2015. Predatory nematodes as biocontrol agents of phytonematodes. In: Askary TH, Martinelli PRP, editors. Biocontrol agents of phytonematodes. CABI; Oxfordshire, UK: pp. 393–420.

Kirnak H., Kaya C., Tas I., Higgs D. 2001. The influence of water deficit on vegetative growth, physiology, fruit yield and quality in eggplant. Bulgarian Jour-nal of Plant Physiology 27(3-4): 34-46.

Mai, W. F., and H. H. Lyon. 1975. Pictorial key to genera of plant-parasitic nematodes. Ithaca, NY: Cornell University Press, USA.

Mai, W.F., Lyon, H.H., Kruk, T.H., 1964. Pictorial Key to Genera of Plant Parasitic Nematodes. Plates Reproduced by Art Craft of Ithaca Inc. Ithaca, New York

Mahadeen A.Y., Mohawesh O.E., Al-Absi K., Al-Shareef W. 2011. Effect of irrigation regimes on water use efficiency and tomato yield (Lycopersicon esculen-tum Mill.) grown in an arid environment. Archives of Agronomy and Soil Science 57(1): 105-114.

Mohawesh O., Karajeh M. 2013. Effects of deficit irriga- tion on tomato and eggplant and their infection with the root-knot nematode under controlled en- vironmental conditions. Archives of Agronomy and Soil Science 60 (8): 1091-1102.

Mohawesh O., Karajeh M. 2014. Effects of deficit irriga-tion on tomato and eggplant and their infection with the root-knot nematode under controlled en-vironmental conditions. Archives of Agronomy and Soil Science 60(8): 1091-1102. DOI: 10.1080/03650340. 2013. 871385.

Moore SR, Lawrence KS. 2013. The effect of soil texture and irrigation on Rotylenchulus reniformis and cotton. J Nematol. 45:99–105.

Muwaffaq Karajeh and Osama Mohawesh. 2016. root-knot nematode (meloidogyne javanica) – deficit irrigation interactions on eggplant cropped under open field conditions Journal of Horticultural Research, vol. 24(1): 73-78

Norton, D.C. 1978. Ecology of Plant Parasitic Nematodes. John Wiley and Sons. Inc. New York, USA, p. 263.

Poornima, K., S. Vadivelu. 1998. Pathogenicity of *Meloidgyne incognita* to turmeric (*Curcuma longa* L.). Proceeding of the Third International Symposium of Afro-Asian society of Nematologists, April 16-19. Coimbatore, India. pp. 29-31.

Prot JC. 1979. Horizontal migrations of second-stage juveniles of Meloidogyne javanica in sand in concentration gradients of salts and in a moisture gradient. Rev Nematol. 2:17–21.

Sasser J. 1987. A perspective on nematode problems worldwide. pp. 1-12. In: Proceedings Nematodes Parasitic to Cereals and Legumesin Temperature Semiarid Regions, Larnaca, Cyprus. ICARDA, Aleppo, Syria.

Sasser, J., D. Freckman. 1987. A world perspective on nematology: The role of the society. pp. 7-14. In: Veech J. and Dickson D. (eds). Vistas on Nema-tology. Society of Nematologists, Hyattsville, Maryland. 509 pp.

Sharp R., Boyer J.S., Nguyen H.T., Hsiao T.C. 1996. Genetically engineered plants resistant to soil drying and salt stress: How to interpret osmotic relations. Plant Physiology 110(4): 1051-1053. DOI: 10.1104/pp. 110.4.1051.

Shin S.H. 2005. Effect of irrigation systems, partial root zone drying irrigation and regulated deficit on plant parasitic nematode populations in grapevine. M. Sc. Thesis. The University of Western Aus-tralia, 75 p.

Snedecor, C.W. and Cochran, W.G., (1969). Statistical methods. 6th ed. Iowa State Univ. Press, Ames, lowa, USA.

Strajnar P., Širca S., Urek G., Šircelj H., Železnik P., Vodnik D. 2012. Effect of Meloidogyne ethiopica parasitism on water management and physiological stress in tomato. European Journal of Plant Pathol-ogy 132(1): 49-57. DOI: 10.1007/s10658-011-9847-6.

Surega R. & S. Ramakrishnan. 2017. Comparison of nematode population and their seasonal fluctuation in turmeric (curcuma longa l.) under conventional and drip irrigation methods. Journal of Entomology and Zoology Studies. 6 (3): 478-481.

Taylor, A.L., Sasser, J.A., 1978. Biology, identification and control of root-knot nematodes (Meloidogyne spp.). A Cooperative Publication of the Department of Plant Pathology, North Carolina State University and the United States Agency for International Development. Raleigh, NC. p. 111.

Towson A.J., Apt W.J. 1983. Effects of soil water poten-tial on survival of Meloidogyne javanica in fallow soil. Journal of Nematology 15(1):110-115.

Tüzel, I.H., Tüzel, Y., Gül, A., Altunlu, H. and Eltez, R.Z. 2001. Effect of different irrigation schedules, substrates and substrate volumes on fruit quality and yield of greenhouse tomato. Acta Hort. 548:285-292.

Zhang F, Schmitt DP. 2001. Plant-parasitic nematodes in the Waimanalo, Hawaii irrigation system from watershed to farm. J Nematol. 33:294–296.

التذبذب فى أعداد النيماتودا فى بعض نباتات الخضر تحت نظام الرى بالتنقيط والرى بالغمر

انتصار حلمى طه*
قسم وقاية النبات كلية الزراعة جامعة عين شمس

ادت ازمة المياه المتصاعدة وخاصة فى الاونة الاخيرة الى زيادة اهتمام المزارعين فى مصر بنظام الرى بالتنقيط للتوفير فى مياه الرى ومن هذا المنطلق جاءت فكرة هذا البحث بدراسة تاثير نظام الرى بالغمر والتنقيط على التذبذب فى اعداد بعض انواع النيماتودا الممرضة للنباتات على بعض العوائل النباتية المختلفة. تم تقسيم الحقل التجريبى الى احواض صغيرة (2 x 3 م)، وتم زراعة كل حوضين بعائل نباتى من العوائل النباتية الاتية: طماطم، باذنجان، فلفل، خيار ولوبيا، بحيث يتم رى احد الاحواض بنظام الغمر والاخر بنظام التنقيط لكل عائل نباتى. ومن خلال تسجيل أعداد النيماتودا النباتية المختلفة المصاحبة لكل عائل نباتى والتذبذب فى اعدادها تحت نظامى الرى المتبعين تبين الاتى: تم تسجيل الانواع الاتية من النيماتودا النباتية فى الحقل المستخدم: نيماتودا تعقد الجذور، نيماتودا التقرح، النيماتودا الدبوسية، النيماتودا الكلوية، النيماتودا التاجية، النيماتودا الخنجرية ونيماتودا التقزم. حيث كانت أعداد النيماتودا سابقة الذكر أعلى فى الاحواض التى تم ريها بنظام الغمر عن المروية بنظام التنقيط، وكانت اكثر الانواع تسجيلا هى نيماتودا تعقد الجذور تحت نظام الغمر (104.3- 83.7- 93.0- 85.7- 88.0) ونيماتودا التقرح تحت نفس النظام (75.3- 68.0- 80.3- 64.0- 72.3) فى حين كانت الاعداد اقل من ذلك تحت نظام الرى بالتنقيط حيث كانت (97.3- 69.0- 87.0- 81.0- 83.3) بالنسبة لنيماتودا تعقد الجذور و 71.3- 46.7- 69.7- 59.0- 63.0 بالنسبة لنيماتودا التقرح. اعتمادا على النتائج المتحصل عليها فانه من الممكن اتباع نظام الرى بالتنقيط كاحد وسائل خفض اعداد النيماتودا النباتية ضمن برامج المكافحة المتبعة بدون تاثير معنوى على صحة عوائلها النباتية.