

The role of magnetized water in root-knot nematode integrated management programs associated with grapevines in Minia Governorate

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Abstract

Preparing nematicides and irrigation by non-magnetized water or magnetized water gave different reduction percentages of the estimated nematode larvae of the Root-knot nematodes in the soil of grapevines rhizosphere at different periods from the application. The treatment by the mixture of Biozied 125g+Bioarc125g/100L./9 trees surpassed the other treatments recording 79% and 85.8 reduction on the average of root knot nematode number /250 g soil with the preparation and irrigation by non- magnetized and magnetized water, respectively. While the treatment with Bioarc alone was retarded recording average reduction 53.2% and 62.1% in root knot nematodes population. On the other hand potency of the bionematicides such as Bioarc and Biozied or their mixture increased gradually till the fourth month then declined. With chemical nematicide (Rugby) the reduction in population of root –knot nematodes gradually decreased it. This nematicide reduced nematode clearly in the first month whereas the nematode reduction was 67.4 % and 83.8% with the use of non-magnetized and magnetized water, respectively. It is worth to mention that preparation of Rugby by magnetized water gave more reduction in root-knot nematodes than using of non-magnetized water especially in the first month count whereas the reduction was 83.8 % versus 67.4% with non-magnetized water.

Abamectin behaved in the same trend of Rugby whereas their efficiency gradually weakened from 62.2% root-knot nematode reduction after one month to 46.7% after five months from application in usage of non-magnetized water for preparation of nematicides and irrigation.

1. Introduction

Plant parasitic nematodes are farmers' hidden enemies that threaten many crops with failure. Therefore, it was necessary to combat these pests in different ways, including the use of magnetized water, which may electrically disperse the nematode from reaching the roots of its host. Other advantage of using magnetized water is to increase the efficiency of nematicides in terms of their penetration and increase their permeability in plant tissues, which leads to the use of lower concentrations of nematicides, which reduces the severity of environmental pollution. Some researches on the magnetized water as a synergist of pesticides were achieved [1,2]. In addition, the magnetized water improves the characteristics of the plant [3,4,5,6,7]. This study aims to compare the efficiency of the use of some nematicides at different concentrations prepared with magnetized irrigation water with others prepared with non-magnetized irrigation water under field conditions on the initial effect of nematicides on nematodes associated with grape vines under field conditions in Minia Governorate, as well as the effect of irrigation with magnetized and non-magnetized water on the residual effect of tested nematicides and growth parameters of grape vines.

Materials and Methods

Two experiments were carried out in a grapevine orchard of the red Roomy cv. in Samalut district, Minia Governorate to evaluate some nematicides against root-knot nematodes associated with grapevines. These experiments were in the same time in two nearby orchards each irrigated by different irrigation machines. In the first experiment the different tested nematicides were prepared in magnetized water at the recommended spray rates. Each treatment was replicated four times and each replicate was represented by three vines. These replicates were distributed in a completely randomized design. After treatments, the irrigation was done in the quantities and at the recommended intervals with magnetized water, where a Biomagnetic Nefertari device (manufactured in Germany) was installed. In control treatment, magnetized water was used for irrigation without nematicides application.

Another experiment was conducted in another nearby orchard, using nonmagnetized water for preparing nematicides and irrigating the vineyards. The control treatment for this experiment was without the use of nematicides.

Tested bionematicides were:

-1 Biozied WP 2.5%

Active ingredient: (Trichoderma album)

Concentration :10 million spores/ g of the product

Usage: 250 g / 100 L. water / 9 trees.

-2BioarcWP 6%

Active ingredient: (Bacillusmegaterium(

Concentration: 25 million spores/g of the product

Usage: 250 g / 100 L. water / 9 trees.

Tested chemical nematicide was Rugby 60%, Cadusafos, O-ethyl S,S-bis(1-methylpropyl) phosphorodithioate

Usage: 50 ml /100 L. water.

Samples of one kilogram soil from rhizosphere per a replicate was mixed and transported to laboratory for taken sub-samples 250 g then extraction of nematodes was done and number of *Meloidogyne* spp. were counted [8]. These samples were taken pre- treatment then post treatment monthly for five months. To evaluate the efficiency of nematicides, reduction percentages estimated by [9] formula .

Results and Discussion

Preparing nematicides and irrigation by non-magnetized water or magnetized water gave different reduction percentages of the estimated nematode larvae of the Root-knot nematodes in the soil of grapevines rhizosphere at different periods from the application. Table (1&2) explain that the treatment by the mixture of Biozied125g+Bioarc125g/100L./9 trees surpassed the other treatments recording 79% and 85.8 reduction on the average of root knot nematode number /250 g soil with the preparation and irrigation by non- magnetized and magnetized water, respectively. While the treatment with Bioarc alone was retarded recording average reduction 53.2% and 62.1% in root knot nematodes population. Other researches illustrated the efficacy of Biozaid and Bioarc as bionematicides [10] (Heba and Rania ,2016).On the other hand potency of the bionematicides such as Bioarc and Biozied or their mixture increased gradually till the fourth month then declined. This result may be owing to the propagation of these bionematicide spores in soil so their potency gradually increased especially in fertile land.[11] mentioned that Trichoderma-Based biostimulants modulate Rhizosphere microbial populations and improve N uptake efficiency, yield, and nutritional quality of leafy vegetables. It was obvious that the mixture of Bioarc and Biozaid

It is worth to mention that with chemical nematicide (Rugby) the reduction in population of nematodes gradually decreased it may be due to degradation of chemical nematicides. This nematicide reduced nematode clearly in the first month whereas the nematode reduction was 67.4 % and 83.8% with the use of non-magnetized and magnetized water, respectively while in the last month post treatment nematode reduction with Rugby treatment was 40.6 %and 50.4% with the use of non-magnetized and magnetized water, respectively (in Rugby preparation and soil irrigation). This result mayhap attributed to the degradation of chemical nematicides in soil. [12] indicated

that Accelerated microbial degradation of organophosphate and carbamatenematicides and other chemical nematicides is a phenomenon whereby biodegradation in the soil is increased. It was obvious that magnetized water in preparing nematicides and irrigated vines enhancing the efficiency of nematicides. It is worth to mention that preparation of Rugby by magnetized water gave more reduction in root- knot nematodes than using of non-magnetized water especially in the first month count whereas the reduction was 83.8 % versus 67.4% with non-magnetized water. Some researches were achieved on the magnetized water as a synergist of pesticides [1,2.]

Abamectin behaved in the same trend of Rugby whereas their efficiency gradually weakened from 62.2% root-knot- nematode reduction after one month to 46.7% after five months from application in usage of non-magnetized water for preparation of nematicides and irrigation. The utilization of magnetized water in preparation of Abamectin and irrigation of grapevines realized reduction in root-knot nematodes by 82.2% and 66.0 % after the 1st month and 5th post treatment, respectively.

Figure (1) illustrates the comparison between the efficiency of nematicides prepared by magnetized water with the irrigation by magnetized water and nematicides prepared by non-magnetized water with the irrigation by non-magnetized water on root- knot nematodes infesting grapevines.

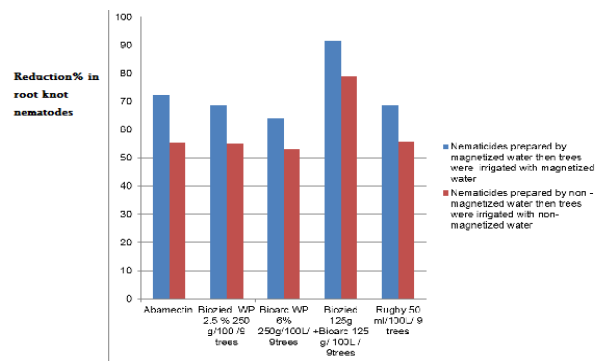


Fig (1): Comparison between the efficiency of nematicides prepared by magnetized water with the irrigation by magnetized water and nematicides prepared by nonmagnetized water with the irrigation by nonmagnetized water on root knot nematodes infesting grapevines

Table (1): Nematicidal effect of some nematicides prepared by non-magnetized water with the irrigation by non-magnetized water on *Meloidogyne* spp. associated with grapevines in Minia Governorate

Treatment	Pre-treatment Count/250 g soil	Average numbers of Root-knot nematode J2/ 250g soil Post treatment					Total	Post-treatment average count	Reduction % (Efficiency of nematicide %)
		1 month (R%)	2 Months (R %)	3 Months (R%)	4 months (R%)	5 Months (R%)			
Abamectin	1074	418 62.2	478 61.9	560 56.7	711 48.4	800 46.7	2967	593.4	55.3
Biozied WP 2.5 % 250 g/100L./9 trees	1270	786 45.3	721 51.4	663 56.6	588 63.9	767 56.8	3525	705	55.1
Bioarc WP 6% 250g/100L./9 trees	1362	857 44.4	869 45.3	798 51.3	674 61.4	744 60.9	3942	788.4	53.2
Biozied 125g+Bioarc125g/100L./9 trees	982	356 68.0	316 72.4	237 80.0	195 84.5	286 79.2	1390	278	79.0
Rugby 50ml/100L.	1081	399 67.4	457 63.8	526 59.6	679 51.1	897 40.6	2958	591.6	55.7
Control	970	1098	1132	1167	1245	1356	5998	1199.6	

(R%) = Reduction percentage in the number of root knot nematode larvae

Table (2): Nematicidal effect of some nematicides prepared by magnetized water with the irrigation by magnetized water on *Meloidogyne* spp. associated with grapevines in Minia Governorate

Treatment	Pre-treatment Count/250 g soil	Average numbers of Root-knot nematode J2/ 250g soil Post treatment					Total	Post-treatment average count	Reduction % (Efficiency of nematicide %)
		1 month	2 months	3 months	4 months	5 months			
Abamectin	1154	214 82.2	251 79.6	376 69.6	419 66.8	496 66.0	1756	351.2	72.5
Biozied WP2.5 % 250 g/100L 9 trees	1324	540 60.8	450 68.1	430 69.7	390 73.0	560 66.6	2370	474.0	67.7
Bioarc WP 6% 250g/100L 9 trees	1415	635 56.9	645 57.2	590 61.1	495 68.0	600 66.4	2965	593.0	62.1
Biozied 125g+Bioarc125g/100L 9 trees	1123	240 79.5	210 82.4	140 88.4	105 91.4	190 86.6	885	177	85.8
Rugby 50ml/100L	1246	210 83.8	366 72.4	418 68.7	560 58.9	782 50.4	2336	467.2	66.1
Control	1230	1280	1310	1318	1345	1556	6809	1361.8	

(R%) = Reduction percentage in the number of root knot nematode larvae

References

- [1]Rania Ahmed Abd El-Wahab Magnetic Water as Synergist of Pesticides Against *Monachacartusiana*. International Journal of Biochemistry, Biophysics & Molecular Biology.2016; 1(2): 42-45.
- [2]Saadoon M. S., Jabbar A. S. and Gad S.B.Efficiency of using magnetized water in improving *Meloidogyne incognita* control by three concentrations of Aloe vera extract on cucumber plant. Plant Archives.2019;19 (1) :721-727.
- [3]Hozayn M., Abd El-Monem A.A. and Abdelraouf R.E. Magnetic technology, a novel tool for correction ground water and improving crops and water productivity. The first international conference "Water desalination in the Arab world", 26 May, 2013, Cairo, Egypt.
- [4]Sadeghipour, O. and AghaeiP.. Improving the growth of cowpea (*Vigna unguiculata* L. Walp.) by magnetized water, Journal of Biodiversity and Environmental Sciences.2013;3 (1): 37-43.
- [5]Hozayn M., Abdel-Monem A.A, Elwial T.A. and Abdalla M.M. Future of magnetic agriculture in arid and semi-arid regions.The Scientific Papers.Series A. Agronomy.2014; Vol. LVII, 197- 204.
- [6]Teixeira da Silva J. A. and DobránszkiJ. Impact of magnetic water on plant growth. Environmental and Experimental Biology.2014; 12: 137–142
- [7]HozaynM.,Korayem A.M., Mohamed M.M.M. and Abd ElMonem A.A. Effect of magnetic water on growth, yield and

quality of groundnut infected with root-knot nematode (*Meloidogyne arenaria*) in sandy soil. Egyptian Journal of Agronomy.2017; 16 (2): 115-126.

[8]Thorne, G. (1961): Principles of Nematology. Mcgrow-Hill Book Co., Inc. New York, 553 pp.

[9] Henderson C. F. and Tilton, E. W. Tests with acaricides against brown wheat mite. J. Econ. Entomol.1955, 48: 157-161.

[5]Hozayn M., Abdel-Monem A.A, Elwial T.A. and Abdalla M.M. Future of magnetic agriculture in arid and semi-arid regions.The Scientific Papers.Series A. Agronomy.2014; Vol. LVII, 197- 204.

[10] Heba Al-Ghnam A. A. and Rania Whahdan H. A.. Influence of Some Bionematicide and Entomopathogenic Nematodes Against *Meloidogyne incognita* and *Rotylenchulus reniformis* Infecting Papaya Plant.. Plant Prot. and Path., Mansoura Univ.2016;Vol.7 (12) ,855–860.

[11] Fiorentino N., Ventrino V., Woo SL., Pepe O., De Rosa A., Gioia L., Romano I. , Lombardi N., Napolitano M., Colla G. and Roupheal Y. *Trichoderma*-Based Biostimulants Modulate Rhizosphere Microbial Populations and Improve N Uptake Efficiency, Yield, and Nutritional Quality of Leafy Vegetables. Front. Plant Sci.2018; 9:743.

[12]Hugo H.J., Mouton C., and MalanA.P. Accelerated Microbial Degradation of Nematicides in Vineyard and Orchard Soils. S. Afr. J. Enol. Vitic.2014; Vol. 35, No. 1: 157-164.