Journal of the Advances in Agricultural Researches (JAAR) Volume: 28 (3)

Nematicidal Effect of Certain Agrochemicals, Nutritional Compounds and Bio-Agents on The Population of Root-Knot Nematode (*Meloidogyne* Spp.) Infecting Potato

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DOI: 10.21608/JALEXU.2023.222890.1146

Article Information

Received: July 13th 2023

Revised: July 17 th 2023

Accepted: July 20th 2023

Published: September 30th 2023

ABSTRACT: The nematicidal effect of certain agrochemicals, nutritional compounds and bio-agents on the population of root-knot nematode (Meloidogyne spp.) infecting potato was evaluated through two seasons (2018/2019).

The overall reduction percentages in both seasons followed the same pattern and were almost parallel. Oxamyl, abamectin-2%, and azadirachtin were the most effective and significant treatments for decreasing the number of J_{2S} nematodes, with reductions of 77.72 and 85.16 %, 72.40% and 78.41 %, and 72.40% and 78.55% in both seasons, respectively. In both subsequent seasons, garlic oil (54.09 and 53.39%), chitosan (47.54 and 48.32%), and abamectin-1.8% (41.08 and 48.32%) had moderate overall reductions. The nutritional agrochemicals had the weakest overall reduction. potassium silicate (28.73 and 27.30%), EDDHA chelated iron (36.80 and 13.42%), and sulfuric acid (7.06 and 17.22%) for both seasons.

On the other hand, abamectin 2% and oxamyl treatments gave the greatest potato yield during both seasons.

Keywords *Potato, Nematodes, pesticides, oxamyl, abamectin, chitosan, silicate, eddha chelated iron, sulfuric acid, azadirachtin, garlic oil.*

INTRODUCTION

Potato (*Solanum tuberosum* L.) is the world's leading vegetable crop grown in 79% of the world's countries **(Janaki *et al.*, 2017)**. It is considered to be one of the most important vegetable crops belonging to the Solanaceae family, and it occupies, globally, the fourth position after rice, wheat, and maize in terms of world food production **(Abdeldaym *et al.*, 2018 and Abuarab *et al.*, 2019)**.

Potato is the third most consumed crop globally after rice and wheat. It is a short-duration crop, versatile in use, and suitable for growing in a wide range of environments, and its production is increasing rapidly **(Nasir and Toth 2022).** According to FAO statistics, the world production of potatoes reached 400 million tons, which were harvested from 19.25 million ha, in 2019 **(Ali *et al.*, 2021)**.

In Egypt, potato is one of the main crops and the second most important vegetable crop after tomato in economic value **(Abdeldaym *et al.*, 2018 and Abdeldaym *et al.*, 2019)**. Egypt is one of the top 20 producers of potatoes worldwide and the first largest producer and exporter of potatoes in Africa in 2019 (**Rabia *et al.*, 2021)**.

Nowadays, potato cultivation is facing several challenges to maintain and improve production, from the point of view of both quality and quantity. Potato plants typically face an increased number of abiotic and biotic stress combinations, which seriously affect their growth and production **(Abdallah *et al.*, 2021 and Cocozza *et al.*, 2021)**.

Root-knot nematodes (*Meloidogyne* spp.) are among the world's most damaging endoparasitic sedentary nematodes, especially *Meloidogyne incognita* that infect a wide range of plant hosts **(AbdelRazek and Yaseen, 2020)**.

The root-knot nematode is one of the major challenges in eggplant (*S. melongena* L.) production. Many plant-parasitic nematodes (PPNs) can penetrate the roots of this plant and feed on it, causing heavy losses in its yield. *Meloidogyne* spp. (root-knot nematodes, RKNs) and *Rotylenchulus reniformis* rank high among these parasites in Egypt **(Abd-Elgawad, 2021)**.

Among plant-parasitic nematode management strategies, chemical nematicides are the most frequently used. However, their potential negative impact on the environment and human health has led to restricted use of most nematicides. The use of root-knot nematode-resistant genotypes is an effective alternative strategy for nematode management that reduces nematode populations in soil **(Molinari 2011).**

Biological control or biopesticide is defined as an application of live microbes (bacteria and fungi) and their gene products, essential oils, plant extracts, individual and mixed acids such as organic and amino acids, natural bioactive substances, and industrial wastes **(Forghani and Hajihassani, 2020).**

Chemical pesticides are characterized by the rapid impact effect in reducing pest population, while microbial pesticides are needed along the latent period to cause a limited reduction of the pest population **(El-Ashry *et al*., 2020).**

Therefore, the present investigation was adopted to evaluate the nematicidal effect of abamectin (a microorganism-based chemical), oxamyl (a synthetic insecticide), azadirachtin (a botanical pesticide), garlic (a botanical pesticide), chitosan (a bio-based control agent), and potassium silicate (a nutritional agrochemical) on *Meloidogyne incognita* and their (implications for or bearing on or reflection on) potato yield.

MATERIALS AND METHODS

The current experiments were carried out in the Army's Land, Six October farm – Food Security Sector–Station 19 –Pivot A, 60 km from Alexandria within the Nubaria City, Beheira Governorate, planted with the summer potato cultivar "Spunta". An analysis of random samples of soil was done before conducting the experiment and it was found that the soil was infested with root-knot nematodes.

Experimental design:

This experiment was designed in a randomized complete block design (RCRD) with three blocks This experiment consisted of nine treatments arranged in three replicates for each treatment. The experiment was carried out using nine chemicals, including chemical pesticides, fertilizers and natural materials, in addition to untreated check areas and also using margin areas to prevent the interaction between chemical pesticides, fertilizers and natural materials for comparison**.**

Chemicals used in the experiments:

- Oxamyl (Vydate 24% SL) ®
- Abamectin (VERTIMEC) 1.8 % EC) ®
- Abamectin (Tervigo 2% SC) ®
- Chitosan (Chitopower 5.5 % liquid polymer) ®
- Potassium silicate (Super silicate 50 %) ®
- Azadirachtin (Achook 0.15%) ®
- EDDHA- chelated iron (KELKAT 6 %) ®
- Sulfuric acid (Sulfuric acid 40 %) ®
- Garlic oil (Nematofera 1%) ®

Data recorded:

The soil samples were collected according to the method of **Barker (1985)**. Three sub-samples were collected from 10 to 35 cm depth of each replicate to form a composite sample of approximately 2 kg, which was then thoroughly mixed. The soil samples were collected directly before the treatment applications to identify the initial populations of parasitic nematodes. After applying the treatments, the soil samples were collected by 15 days post each of both applications. The No. of nematode/ 250g soil with all treatments were counted. The reduction percentages of infestation were calculated according to **Henderson and Tilton's (1955)** as follows:

$$\mathbf{Red.}\,(\%) = \{\,\mathbf{1} - \left(\frac{\mathbf{a}}{\mathbf{b}} \times \frac{\mathbf{c}}{\mathbf{d}}\right)\} \times \mathbf{100}$$

Where:

a = Population in treatment after treatment
b = Population in treatment before treatment
c = Population in check untreated (control) before treatment
d = Population in check untreated after treatment

Statistical analysis:

The obtained data of the measured parameters were subjected to computerized statistical analysis using COSTAT package for analysis of variance (ANOVA) and means of treatments were compared using LSD at 0.05 according to **Snedecor and Cochran (1990).**

RESULTS AND DISCUSSION

Results presented in Tables (1 and 2) illustrated the effect of certain agrochemicals, nutritional compounds and bio-agents on the population of root-knot nematode through two seasons against the root-knot nematode (*Meloidogyne* spp.) in soil cultivated with potato. Two applications of each treatment were carried out over an interval of 15 days. The juvenile counts were estimated after 15 days post-treatment. So, there were 3 counts at zero, 15, and 30 days post-treatment. In addition, the reduction percentage after each treatment as well as the mean of the general reduction percentages after both applications were calculated.

A. The Effect of different treatments on the root-knot nematode (*Meloidogyne* spp.) in soil

1. The first season

The obtained results before treatments in the first season (2018-2019), indicated that the mean number of root-knot nematodes, (J_2 nematodes/250g soil), varied considerably among the tested treatments.

The data obtained recorded significant difference in the mean number of nematodes (J_2 nematodes/250g soil) in the soil compared to the untreated check (control), except for the treatment with sulfuric acid at 40%, in which the mean number increased to 220.00 after it was 193.33 before the treatment **(Table 1)**. While, the lowest mean number of root-knot nematodes (116.67 J_2/250g soil) was recorded by oxamyl treatment, followed by abamectin 2% (123.33), azadirachtin (143.33), garlic oil (143.33), abamectin 1.8% (165), chitosan (173.33), potassium silicate (183.33), and EDDHA chelated iron 6% (183.33 J_2 nematodes/250g soil).

At second application after 30 days from treatments, the results were in the same line. Where, the oxamyl treatment showed the lowest rate of the J_2 number with 66.67 J2/250g soil, followed by abamectin 2% (73.33), azadirachtin (76.67), garlic oil (120), chitosan (153.33), abamectin 1.8% (158.33), potassium silicate (203.33), EDDHA chelated iron 6% (203.33), and sulfuric acid (260.00), which compared with 286.67 J_2/250g soil in the untreated check (Table 1 and Fig. 1).

After 15 days from the first application as found in Table 1, only oxamyl and abamectin 2% SC led to a significant moderate reduction in the soil population densities of *Meloidogyne* spp. by 54.50 and 45.55%, followed by azadirachtin (38.83%), garlic oil (35.50%), chitosan (32.40%), and abamectin 1.8% EC (29.25%). The least effective treatments were the nutritional agrochemicals potassium silicate (24.74%), EDDHA-chelated iron (24.74%), and sulfuric acid (11.24%).

Meanwhile, in the second application (30 days) there was a significant increase in the overall reduction percentage in the soil population densities of *Meloidogyne* spp J_2s with treatment with oxamyl, abamectin 2% SC, and neem oil, recording 77.72, 72.40, and 68.96%, respectively. While there was a moderate reduction with garlic oil, chitosan, and abamectin (1.8% EC), the reductions were 54.09, 47.54, and 41.08%, respectively. In addition, nutritional agrochemicals had little effect on J2s population density, with EDDHA-chelated iron, potassium silicate, and sulfuric acid producing the least significant reductions of 36.80, 28.73, and 7.06%, respectively.

Root galls were reduced by 81.6%, 62.4%, and 61.5% when abamectin and oxamyl were treated as soil drenches, respectively. Another experiment was done by **Hala *et al.* (2010); Khalil *et al.*, (2012) and Saad *et al.*, (2017**) on potato cyst nematodes (PCN) with oxamyl treatments. They reported that cyst and juvenile numbers were lower in oxamyl-treated plots compared to control areas. Also, Meloidogyne, Ditylenchus, Radopholus, Hoplolaimus, and Tylenchorhynchus are all plant parasitic nematodes, and abamectin has been shown to lower their populations on multiple crops.

Table (1): Mean number and reduction percent of the root-knot nematode (*Meloidogyne* spp.) after two sequenced treatment applications during the 2018 season.

Treatments	No. Nematode/250g soil			Reduction% after 1st application	Overall reduction
	Pre-treatment	1st application	2nd application		
Oxamyl 24 %	200.00a	116.67d	66.67e	54.50	**77.72a**
Abamectin 2 %	176.67a	123.33d	73.33e	45.55	**72.40ab**
Abamectin 1.8 %	181.66a	165.00bcd	158.33cd	29.25	**41.08cd**
Azadirachtin 0.15 %	170.00a	133.33cd	76.67e	38.83	**68.96ab**
Garlic oil 1 %	173.33a	143.33cd	120.00de	35.50	**54.09bc**
Chitosan5.5 %	200.00a	173.33bcd	153.33cd	32.40	**47.54cd**
Potassium silicate 50%	190.00a	183.33bc	203.33bc	24.74	**28.73d**
EDDHA chelated iron 6%	223.3a	183.33bc	203.33bc	24.74	**36.80cd**
Sulfuric acid 40%	193.33a	220.00ab	260.00ab	11.24	**7.06e**
Untreated check	193.33a	246.67a	286.67a	0.00	**0.00e**

*** Means with the same letter(s) are not significantly different at 0.05 probability level.**

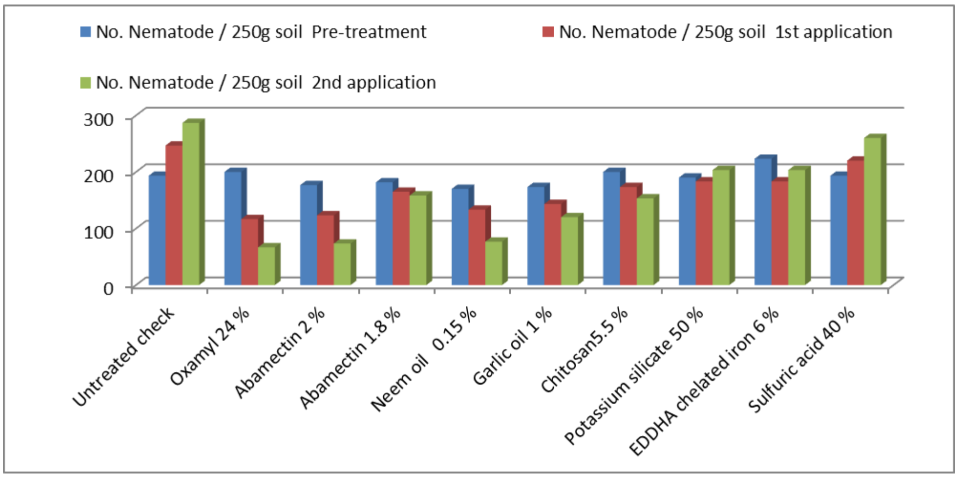


Fig. (1): Mean number of J_2 root-knot nematodes *Meloidogyne* spp. after both applications in the first season of 2018

2. The second season

Regarding to the rate of mean number of (J_{2S}) / 250g soil in the second season of 2019, the results demonstrated that, 15 days after the first application, both oxamyl and azadirachtin were the most effective treatments, as it decreased the mean number rate to 113.33. However, these mean number rates (J_{2S}/250g soil) were significantly higher in the chitosan (183.33), abamectin 2% (186.67), garlic oil (196.67), and abamectin 1.8% (201.67) treatments. Also, as in the first season, the nutritional agrochemicals potassium silicate, EDDHA chelated iron, and sulfuric acid produced the highest mean values of 246.67, 283.33, and 296.67 J2S/250g soil, respectively, showing insignificant effects on Meloidogyne spp. the population density in soil (Table, 2).

Moreover, after 30 days from the first application, and 15 days from the second application, the treatments maintained their level of effectiveness in reducing the population density of juvenile nematodes (J_{2S}). The treatments of oxamyl, neem oil, and abamectin 2% SC recorded the lowest significant rate of *Meloidogyne spp.*, population density at 40.00, 76.67, and 80.00 J_{2S}/250g soil, respectively. The demonstrated moderate efficacy was obtained with the treatments of chitosan, garlic oil, and abamectin 1.8% EC, which demonstrated 146.67, 146.67, and 170.00 J_{2S}/250g soil, respectively. Conversely, these rates of averages showed a slightly decreased in potassium silicate, giving 246.67 J_{2S}/250g or an increase in the treatments of EDDHA chelated iron, and sulfuric acid, revealing 296.67 J_{2S}/250g for both (Table 2 and Fig. 2).

Data in Table 2 showed that neem oil, oxamyl, and abamectin 2% had relatively high reductions in the number of J_{2S} after the first application, with 57.59, 51.74, and 42.70%, respectively. Abamectin (1.8%), garlic oil, and chitosan recorded the lowest reductions by 29.99, 26.67, and 24.38%, respectively. As rational, the agrochemicals potassium silicate, sulfuric acid, and EDDHA chelated iron gave weakest reductions of 16.51, 5.64, and 5.32%, respectively.

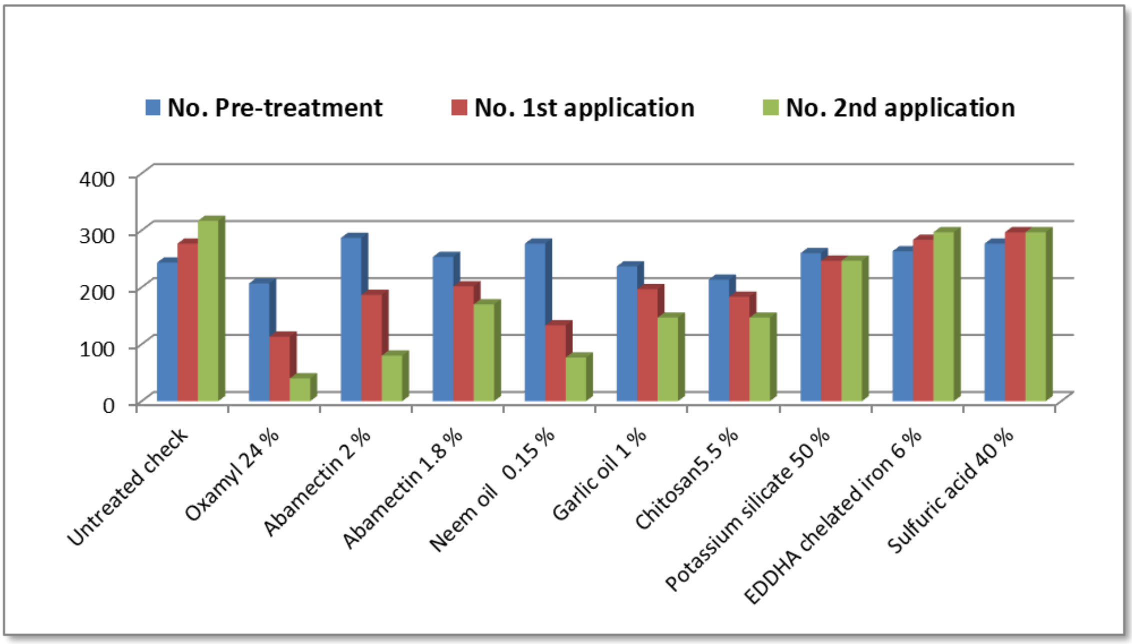
In addition, the overall reduction percentage of J_{2S} after the second application showed that only oxamyl, neem oil, and abamectin (2%) were the most effective treatments for reducing the number of J_{2S}, with reductions of 85.16, 78.55, and 78.14%, respectively. However, garlic, abamectin (1.8%), and chitosan showed moderate reduction percent of 55.39, 48.32, and 45.02%, respectively. Continuously, potassium silicate, sulfuric acid, and EDDHA chelated iron maintained the weakest efficacy, giving only reductions of 27.30, 17.22, and 13.42%, respectively (Table 2).

Table (2): Mean number and reduction percentage of the root-knot nematode (*Meloidogyne* spp.) after two sequenced treatment applications during the 2019 season.

Treatments	No. Nematode / 250g soil			Reduction % after 1st application	Overall reduction
	Pre-treatment	1st application	2nd application		
Oxamyl 24%	206.67d	113.33e	40.00d	51.74	**85.16a**
Abamectin 2%	286.67a	186.67d	80.00d	42.70	**78.41a**
Abamectin 1.8%	253.33abcd	201.67cd	170.00c	29.99	**48.32b**
Azadirachtin 0.15%	276.67ab	133.33e	76.67d	57.59	**78.55a**
Garlic oil 1%	236.67bcd	196.67d	146.67c	26.87	**53.39b**
Chitosan5.5%	213.33cd	183.33d	146.67c	24.38	**45.02b**
Potassium silicate 50%	260.00abc	246.67bc	246.67b	16.51	**27.30c**
EDDHA chelated iron 6%	263.33ab	283.33ab	296.67ab	5.32	**13.42cd**
Sulfuric acid 40%	276.67ab	296.67a	296.67ab	5.64	**17.22c**
Untreated check	243.33abcd	276.67ab	316.67a	0.00	**0.00d**

***Means with the same letter(s) are not significantly different at 0.05 probability leve**l.

Fig. (2): Mean numbers of J_2 root-knot nematodes *Meloidogyne* spp. after both treatment applications in the second season of 2019.



Ultimately, after the first application in both successive seasons, a relative high efficacy, as measured by calculated reduction percentages, was determined with the treatments of oxamyl (54.50 and 51.74%), azadirachtin (38.83 and 57.59%), and abamectin 2% (45.55 and 42.70%), respectively. Meanwhile, low reduction percentages resulted from the treatments of garlic (35.50 and 26.87%), chitosan (32.40 and 24.38%), and abamectin-1.8% (29.25 and 29.99%) for the two successive seasons, respectively. Rationally, the nutritional agrochemicals had the weakest efficacy in reducing the population density of nematodes (J_{2S}), as follows: potassium silicate (24.74 and 16.51), EDDHA chelated iron (24.74 and 5.32), and sulfuric acid (11.24 and 5.64), respectively (Tables 1 and 2).

Finally, the overall reduction percentages of the *Meloidogyne spp*. nematode population density (J_{2S}) during both successive seasons are presented in Figure 3. Noteworthy, the overall reduction percentages were mostly on the same pattern and parallel in both seasons. Oxamyl, abamectin-2%, and azadirachtin were the most effective and significant treatments in reducing the numbers of J_{2S} nematodes, with overall reductions of 77.72 and 85.16%, 72.40 and 78.41%, and 72.40 and 78.55% in both seasons, respectively. The moderate overall reduction percentages in both subsequent seasons occurred in garlic oil (54.09 and 53.39%), chitosan (47.54 and 48.32%), and abamectin-1.8% (41.08 and 48.32%), respectively. The weakest overall reduction percentages resulted from the nutritional agrochemicals: potassium silicate (28.73 and 27.30%), EDDHA chelated iron (36.80 and 13.42%), and sulfuric acid (7.06 and 17.22%) for both seasons, respectively.

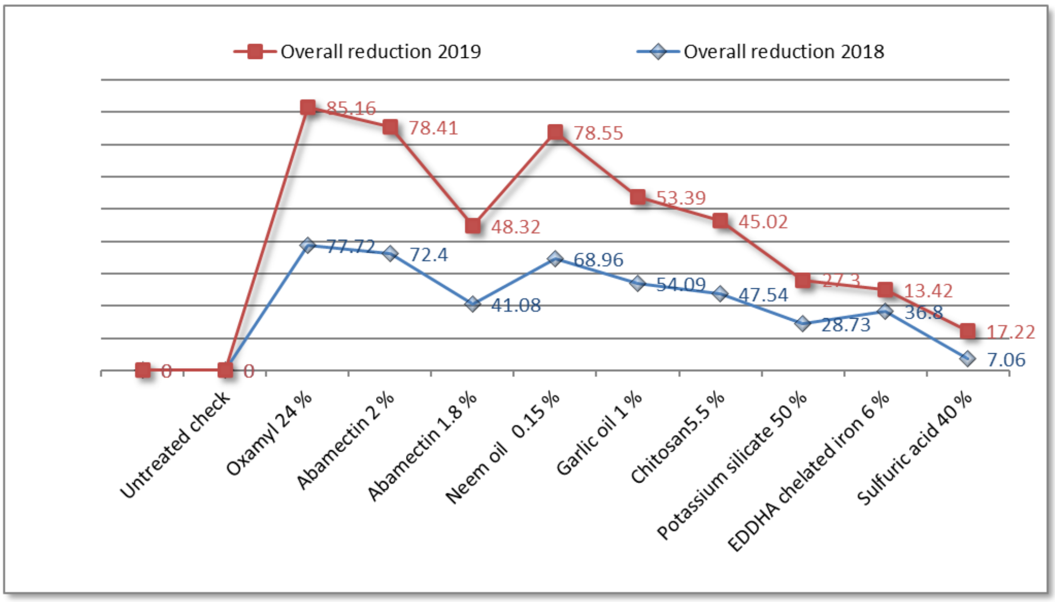


Fig. (3): Overall reduction percent of root-knot nematodes *Meloidogyn spp.* by the tested treatments in both seasons.

Tervigo (abamectin 2%) was shown to be more effective than the other treatments in lowering root nodes (61.37%) and nematode populations (80.48%) **(Salam and Qais, 2018)**. The root-knot nematodes population on tomatoes was reduced by 82.1% after treatment with fosthiazate and abamectin. In addition, abamectin decreased galls/root system by 67.2%. In a greenhouse experiment (**Saad *et al*., 2012)**. In the experiment of "Spunta" potato tuber sprouts in pots with soil infected with *G. pallida*. Abamectin was found to be successful in lowering the population on potato crops, suggesting its potential utility in organic farming and integrated pest management (**Sasanelli *et al*., 2020)**.

Neem oil has insecticidal, fungicidal, bactericidal, and nematicidal activities (**Gajalakshmi and Abbasi, 2004**). The oxamyl and Neem Azal treatments decreased nematode reproduction by 83.3% and 71%, respectively (**Trifonova, 2012).** Moreover, Garlic extracts (oil or aqueous) have been shown to be effective against nematicidal nematodes in a number of scientific studies (**Abd Elgawad *et al*., 2009; El-Nagdi *et al*., 2014; Kouamé *et al*., 2021**). Garlic's activity may be due to its abundance of pyruvic acid, ammonia, and diallyl disulfide (**Osman *et al*., 2005**). It also enhances catalase and β-1,3-glucanase activities, potentially causing tomato plant resistance (**Abd Elgawad *et al*., 2009**). Additionally, garlic produces an organosulfur compound called allicin, which is unstable and decomposes into dithiines and diallyl polysulfides (**Block, 2010**). In a greenhouse study, the root-knot nematode (*Meloidogyne incognita*) population in tomato plants was reduced by an estimated 86.27 and 77.98% after being treated with aqueous and oil extracts of garlic clove, respectively (**El-Nagdi *et al*., 2014**). Also**,** using different doses of garlic aqueous extract caused reductions in soil populations ranging from 17.69% to 53.56% (**Kouamé *et al*., 2021).**

The application of chitosan in agriculture is one of the proposed alternatives to synthetic pesticides and has nematicidal activity (**El-Sayed and Mahdy, 2015; Alfy *et al*., 2020**). Also, silicon was found to slow down the development of *M. incognita* larvae and females in cotton plants (**Santos *et al*., 2021**). It also stopped second-stage juveniles of *M. paranaensis* from moving, which seems to help reduce the nematode population. (**Bicalho *et al*., 2019**). Potassium silicate may be able to get rid of plant parasitic nematodes because it can make phenolic compounds or hydrogen peroxide, which make PPNs less likely to be there (**Zhan *et al*., 2018 and Sakr, *et al*., 2022**).

B. Effect of the treatments on potato yield in both seasons of 2018 and 2019

In comparison to control plants, the data shown in Table 3 illustrated the effect of the tested treatments against root-knot nematodes (*Meloidogyne* spp.) on the mean yield weight/ replicate area of 25 m^2 (kg/25 m^2) in both seasons. According to statistics from the 2018 growing season, abamectin (2%) and oxamyl treatments produced the highest yields of potatoes, with output rates of 91.33 and 90.00 kg/25 m^2 indicating an increase over the untreated control of 16.0 and 14.00%, respectively. Then came next, potassium silicate, azadirachtin, garlic oil, chitosan, and abamectin (1.8%) with production of 87.00, 85.00, 84.00, 84.00, and 81 kg/25 m^2, exhibiting increased percentages of 10.5, 8.0, 6.6, 6.7, and 2.9% over the untreated check. However, because sulfuric acid and EDDHA-chelated iron were ineffective against root-knot nematode juveniles (J_2) in soil, there was also no discernible increase in potato output, with 79.00 and 74.33 kg/25 m^2 reflecting increases of 0.4 and -5.6%, respectively, compared to a yield of 78.67 kg/25 m^2.

For the second season of 2019, the yield of potatoes increased by 9.6% to 4.6% compared to the untreated control, except for the sulfuric acid and EDDHA-chelated iron treatments, which both decreased the yield by 3.8%. The increased yield ratios occurred in oxamyl, abamectin (2%), azadirachtin, garlic oil, potassium silicate, abamectin (1.8%), and chitosan, giving 87.67, 86.33, 85.67, 85.00, 85.00, 83.67, and 83.33 kg/25 m^2, resembling increase percentages of 9.6, 7.9, 7.1, 6.3, 6.3, 4.6, and 4.1% over the untreated control (Table 3).

Despite the fact that the values of potato yield ratios and the percentage increases that resulted from the treatments were slightly differentiated between both seasons, they merely followed the same trend and were paralleled in their attitudes (Figure 4). Evidently, potassium silicate increased potato output while having little to no direct effect on the juveniles of the root knot nematode (J_2).

Similar to what we found, **Desaeger and Csinos (2006)** found that oxamyl spraying reduced nematode infestation and increased yields on double-cropped squash by 30-75% after fumigation. Crop yields increased by 10%-15%, with minimal loss in subsequent crops. A similar study by **El-Tanany *et al*. (2018)** found that abametin (Tervigo®), azadirachtin (Achook®), and oxamyl (Vydate®) all decreased the number of nematodes and increased the amount of fruit that could be grown. Abamectin improved chemical properties, particularly vitamin C content, while oxamyl and azadirachtin increased solid-soluble content. **El-Sherif *et al*. (2015)** conducted a greenhouse experiment to test the effectiveness of potassium silicate against *Meloidogyne incognita* on the cucumber plant Hybrid Alpha. Results showed that various methods and times of silicate addition significantly improved plant growth parameters and reduced nematode criteria. **Asif *et al*. (2017)** found that chitosan, alone or combined with agricultural waste, reduced root-knot indices and nematode populations, improving eggplant growth and yield characteristics under greenhouse conditions. **Elkelany *et al*. (2020)** examined the efficacy of chitosan, rhizobacteria, and Bacillus subtilis. The number of nematodes decreased dramatically, and several indices measuring plant growth increased. Root galls were also decreased by chitosan treatment. In sum, under greenhouse circumstances, eggplant growth metrics were significantly improved.

Table (3): The efficacy of single treatments against *Meloidogyne spp*. on potato yield during the 2018–2019 seasons.

Treatment	Mean of yield weight per replicate area of 25 m^2 ($Kg/25 m^2$) in both seasons			
	2018		2019	
	Yield weight ($Kg/25 m^2$)	Increase %	Yield weight ($Kg/25 m^2$)	Increase %
Oxamyl 24 %	90.00 a	14.4	87.67 a	9.6
Abamectin 2 %	91.33 a	16.0	86.33 a	7.9
Abamectin 1.8%	81.00 bcd	2.9	83.67 ab	4.6
Azadirachtin 0.15 %	85.00 abc	8.0	85.67 a	7.1
Garlic oil 1 %	84.00 abc	6.7	85.00 a	6.3
Chitosan 3 %	84.00 abc	6.7	83.33 ab	4.1
Potassium silicate 50 %	87.00 ab	10.5	85.00 a	6.3
Eddha chelated iron 6 %	79.00 cd	0.4	77.00 c	-3.8
Sulfuric acid 40 %	74.33 d	-5.6	77.00 c	-3.8
Untreated check	78.67 cd	0.0	80.00 bc	0.0

***Means with the same letter(s) are not significantly different at 0.05 probability level.**

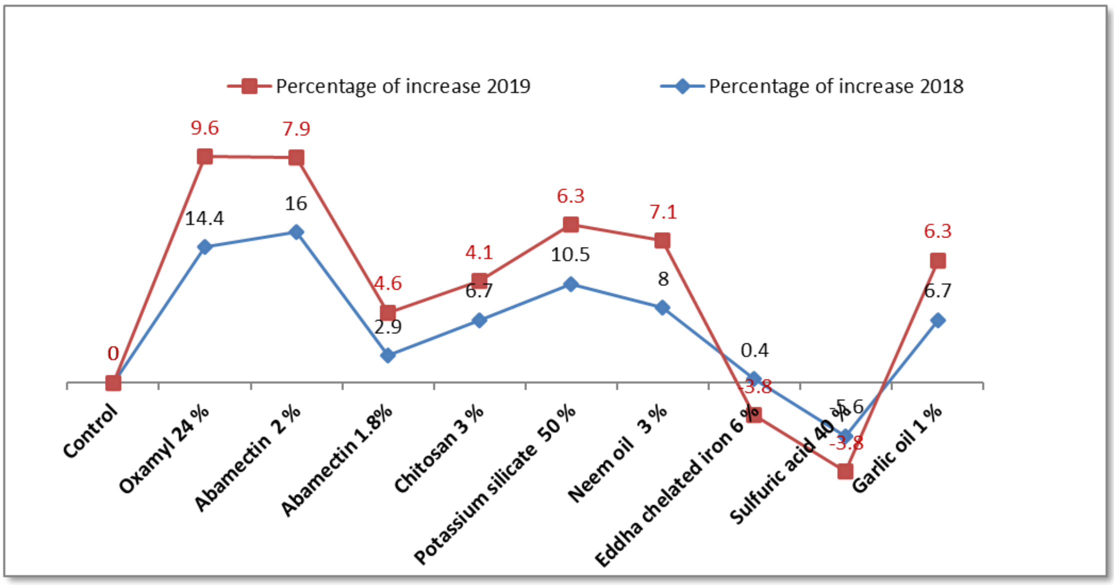


Fig. (4): The percentage increase in yield for single treatments against *Meloidogyne spp*.

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الملخص العربي.

التأثير الابادى النيماتودى لمبيدات نيماتودية ومغذيات ومركبات حيوية على تعداد نيماتودا تعقد الجذور التي تصيب نباتات البطاطس

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تم تقييم تأثير بعض المواد الكيميائية (مغذيات نباتية ومركبات طبيعية حيوية) على تعداد نيماتودا تعقد الجذور (Meloidogyne spp.) التي تصيب البطاطس خلال موسمي الزراعة 2019/2018. حيث اظهرت النتائج انة في كلا الموسمين، كانت نسبة التخفيض الإجمالية على نفس النمط تقريبا ومتشابهة تقريبًا.

من خلال النتائج المتحصل عليها اتضح ان الاوكساميل و الابامكتين 2 % و الازديراختين أكثر االمعاملات فاعلية وأهمية لتقليل أعداد النيماتودا J2S ، جاءت نسب الانخفاض كالاتي 77.72٪ و 85.16٪ و 72.40 و 78.41٪ و 72.40 و 78.55٪ في كلا الموسمين على التوالي. بينما باقي المركبات جائت نسب الخفض كالتالي زيت الثوم (54.09 و 53.39٪) والشيتوزان (47.54 و 48.32٪) والأبامكتين 1.8٪ (41.08 و 48.32٪) بنسب خفض معتدلة تقريبا. بينما أعطت المغذيات النباتية أضعف نسب انخفاض عام. كالتالي سيليكات البوتاسيوم (28.73 و27.30٪) والحديد المخلّب EDDHA (36.80 و13.42٪) وحمض الكبريتيك (7.06 و17.22٪) لكلا الموسمين. من ناحية أخرى ، كانت النتائج التي تم الحصول عليها في محصول البطاطس هي الأعلى في معاملات (الأبامكتين 2 % و الأوكساميل) خلال الموسمين.