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Research Article

Managing soil borne nematodes using soil solarization and neem broadcasting through radionics computer

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Abstract
Soils are being cultivated under different crops. They are contaminated with microorganisms especially nematodes causing different diseases like root knots, these diseases negatively affect the plant, by reducing their quality and yields. Controlling nematodes with chemical nematicides affect the environment and increase the toxicity. The nematodes can be managed using soil solarization process, which is effective but time-consuming procedure. In this study, two types of nematodes, *Heterodera* spp. and *Meloidogyne* spp. were found in the soil samples of the study areas having almost the same population in all treatment plots. Neem and solarization were applied to the study area according to the plan. Soil solarization was applied to treatment I, neem as nematicide was broadcast through radionics computer to treatment plot II, and in the treatment plot III both (neem and solarization) was applied; control treatment plot was IV (no treatment of neem + solarization). The nematode mortality rate was 100% within 2 weeks in only neem (treatment II) was applied and 7 weeks in solarization (treatment I) was applied. Interestingly, it took three weeks' time in neem + solarization (treatment III) for 100% nematode mortality. Therefore, treatment II, resulted in 100% nematode mortality in two weeks, which saved time, water, cost of plastic sheet, and labor expenditures. Radionics-also called electromagnetic therapy, is a form of alternative medicine that claims that disease can be diagnosed and treated by applying electromagnetic radiation, such as radio waves, to the body from an electrically powered device. In this way, a trained and competent practitioner can discover the cause of disease within any living system, be it a human being, an animal, a plant, or the soil itself.

Keywords
Soil solarization,Neem, Radionics computer, Nematodes.

Introduction

Soil solarization (also called plasticulture, mulching) is a method of controlling soil borne nematodes and other organisms with increased temperature by solar heat in the presence of water under the transparent plastic sheet[1]. Below the plastic sheet, soil's top 5 cm (two inches) can get as hot as 43 to 60°C, but temperatures in soil solarization vary drastically from place to place. The primary aim of heat in the soil solarization method is to eradicate weeds and pests[2]. The main drawback of this process is that it is a long process of 4-8 weeks, which can only be applied during summer months (June to August) without applying any chemical pesticide[3]. The solarization process was started in Kuwait during summer 2001 in collaboration with International Center for Agricultural Research in the Dry Areas (ICARDA). Soil solarization was being adopted at different farms in Abdalli and Wafra Agricultural Areas of Kuwait in collaboration with ICARDA[4]. The solarization of soil is one of the preferred methods for disease control in organic gardening[5].

There is a new technology/method called radionics which means a method of diagnosis and treatment at a distance utilizing a specially designed instrument/ device called radionics computer[4,6]. Basic to radionic theory and practice is the concept that man and all life forms share a common ground in that they are submerged in the electro-magnetic field of the earth and, further, that each life form has its own electro-magnetic field which, if sufficiently distorted, will ultimately result in disease of the organism. Accepting that "all is energy," radionics sees organs, diseases and remedies as having their own particular frequency or vibration. These factors can be expressed in numerical values which are known in radionics as "rates" and radionic instruments are provided with calibrated dials on which such rates are set for diagnostic and treatment purposes[7]. Basic to radionics theory and practice is the concept that

everything which exists has a unique vibrational signature[8]. These signatures are represented in radionics by a system of codes, each of which is known as a rate. The rates are used as the focal point for both testing and treatment[9]. A radionics computer heals through the broadcasting of the appropriate frequencies to the target, in order to balance the disturbed frequencies of the target. It is a form of alternative medicine that claims that disease can be diagnosed and treated by applying electromagnetic radiation (EMR), such as radio waves, to the body (plant/soil/animal) from an electrically powered device[10]. Literature is very scanty to control the soil borne nematodes or microbes with radionics technology by broadcasting pesticide from far distance through radionics computer[11]. In radionics computer-based treatment, pesticides are not used as in conventional treatments. This technique works with the energy in the form of potentized remedies[10]. These remedies are not chemicals, so they have no toxic effect on target objects. *Riaz et al.,*[4] treated parasitic plant *Cuscuta* sp., using radionics rates of some materials through a radionics computer with 100% mortality. In another interesting work, powdery mildew on *Dalbergia sisso* has been controlled by treatment broadcasting through a radionics computer in India from Kuwait[11].

Keeping the above in view, an experiment was planned to compare the effects of soil solarization and neem, a non-chemical, broadcast through radionics computer to control soil borne nematodes during summer months of 2023 at Experimental Area, Amghara, Public Authority of Agricultural Affairs & Fish Resources (PAAFR), Kuwait.

Materials and methods

The experiment was conducted in Amghara area (29.2853°N, 47.7398°E) of the Public Authority of Agricultural Affairs & Fish Resources (PAAFR), Kuwait. The experiment was conducted in four plots; in each plot following type of treatment was applied (Figure 1).

Treatment I (T1) = solarization only; treatment II (T2) = neem only; treatment III (T3) = solarization + neem; treatment IV (T4) = Control To carry out the present experiment, the following major articles were utilized; radionics computer,

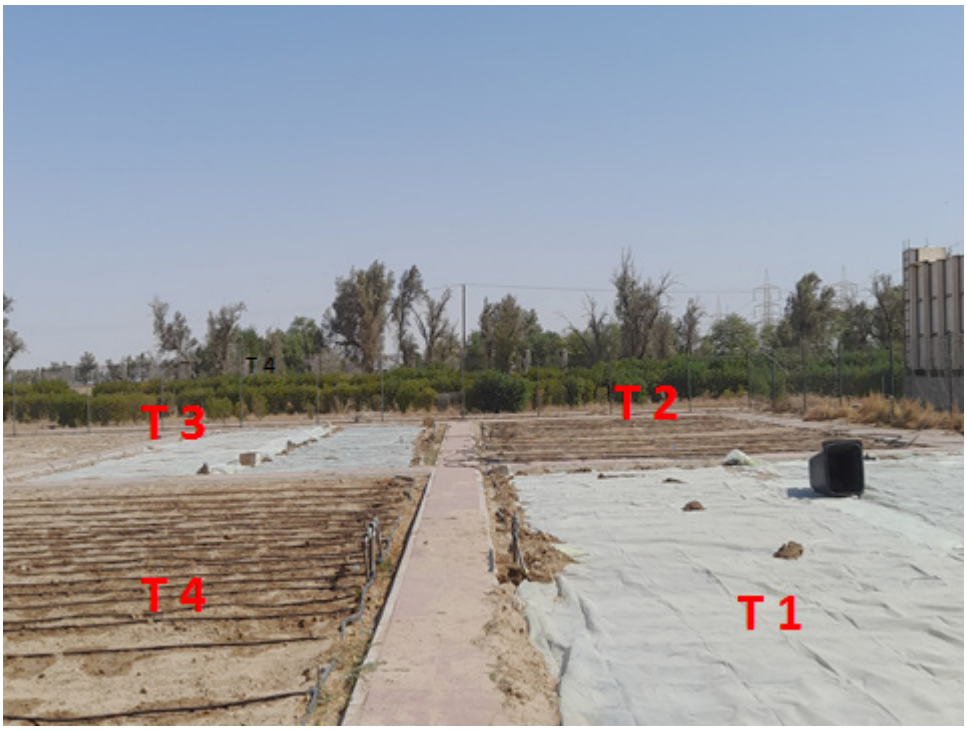

Figure 1. Place of experiment conducted in Amghara, T1, T2, T3 and T4 are the treatment plot areas

pendulum, sensor cord, radionics rates books, instruction manuals.

Radionics computer machine

Radionics, also known as electromagnetic therapy (EMT), which is a form of alternate treatment system. It asserts that plant disease or pests can be managed by application of electromagnetic radiation (EMR), for example radio waves, to the plant or pest from an electrically powered device[8,9]. Figure 2 shows the radionics machine. The machine has two cups in which the target samples are kept, to which electromagnetic waves are applied. These electromagnetic waves reach the target and manage the disease or pests. Radionic devices are based on the concept of radionics, which is a form of alternative medicine that claims to detect and manipulate supposed "energy fields" in order to diagnose and treat health conditions of soil, plant and animal.

Collection of soil samples

Soil samples were collected from each plot at three random places up to 30 cm depth before solarization in July, 2023. The soil samples were collected in a sterile polythene bag and shipped to the laboratory for further analysis. The soil samples were kept in the refrigerator at 4°C until used. Soil samples were checked for the presence of nematodes. The nematodes present in the soil samples were identified as procedure mentioned by[12].

Preparation of soil for treatments

Soil was loosened, organic manure was mixed and leveled properly and cleaning of area was done by collecting residues of previous crops and weeds from all plots.

Solarization of soil

After collection of soil samples, a drip irrigation hose was installed. The soil surface of treatment I and III was covered with transparent plastic sheet during July-September of 2023. All sides of the sheet were covered with soil to avoid escape of heat and moisture through evaporation[1]. After covering the plot with a transparent plastic sheet, water was applied through the drip irrigation system twice a week, which was sufficient to reach at 30 cm depth for 8 weeks.

Figure 2. A radionics computer machine

Laboratory studies

Preparation of soil samples used for diagnostic studies

The soil samples from all the four treatment plots were collected, from each treatment plot, three samples R1, R2, and R3 were collected. In the laboratory, all samples were properly mixed; 100 g soil from each sample was weighed and analyzed for the presence of nematodes. Following samples were collected from the treatment plots.

Samples from treatment I = (T1 R1, T1 R2, T1 R3)
Samples from treatment II= (T2 R1, T2 R2, T2 R3)
Samples from treatment III = (T3 R1, T3 R2, T3 R3)
Samples from treatment IV = (T4 R3, T4 R2, T4 R3)
(Where T = Treatment; R1, R2, R3 = Replication 1, 2 and 3)

Identification of soil borne nematodes before application of treatments

From the collected soil samples, nematode identification on the basis of morphology was carried out as per the procedure mentioned by[12].

Population of soil borne nematodes

The population of soil borne nematodes was calculated as per the following procedure. Collected soil from experimental plots, wrapped 100 g of soil sample in two layers of laboratory tissue paper. Placed the tissue wrapped soil in a glass dish on top of a fine mesh. Added deionized water to cover the mesh slightly with water and let the soil sample contact the water. Let the sample remain undisturbed for 1-3 days, this allowed the nematodes to crawl out of soil sample. It was made sure that the sail sample remain in contact with water, the glass dish did not become dry. The dish was covered with a plastic film to prevent desiccation[13]. Removed the bundled soil sample from glass dish, and using a bright field microscopy, observed the water sample for the presence of nematodes.

Radionics computer identification of nematodes to generic level with population density

Radionics computer technique was used to broadcast the electromagnetic waves to manage the nematodes population in the treatment plots[9,10]. Test tubes having 100g of soils samples (from treatment plots) were placed in the sample cup on the right side of the device one by one (Figure 3). Thereafter, in the radionics computer, the sensor was moved on the list of genera of nematodes. The movement of the pendulum was

Figure 3. Muhammad Riaz using radionics computer for diagnostic and broadcasting studies

noted. The number of three samples with positive response of pendulum was recorded. The same method was followed for all the treatment plots. The average number of nematodes are shown in Table 1.

Selection of pesticide

Response of the radionics computer was noted with a sensor on figures list 1 to 100[9] and the figure with positive response was recorded. Names of different nontoxic materials were noted on the paper. The soil samples were placed in the sample cup. Movement of the pendulum was recorded, showing the pesticide to be applied through a radionics computer[14]. Selection of an appropriate pesticide to manage the nematodes was selected using radionics computer[15]. Out of several things as pesticides, for example, eucalyptus, sea water, neem, oleander, and roundup, neem was selected using the radionics computer. Further, out of different methods of pesticide application such as fumigation, spray, broadcasting, nematicide application with irrigation, radionics selected broadcasting approach.

Method of application

Potency or dose diagnosis through radionics computer

Radionics rate or codes of Neem was dialed on the radionics rate section of the computer. Potency or dose of neem to be applied was detected by adopting the methodology of the radionics computer for this purpose given in the manual[9,10].

Preparation of soil samples for studies during treatment period

A small quantity of soil from treatment I was properly mixed and put in a small glass test tube marked as treatment I. This sample in a small test tube worked as delegate or representative sample of the treatment plot I. Same procedure was adopted for rest of the treatment samples.

Application of treatments as per plan of experiment

For this purpose, we followed the treatment program. For application of neem broadcast treatment, soil samples of treatment II and III were kept in test tubes, which were placed in the treatment cup of the computer. Treatment was applied / broadcast to the plots according to the instructions of the manual[3]. The treatment was applied detected time period in minutes.

Weekly data recorded during treatments periods

The samples from all 4 treatment plots in small tubes were used for nematode mortality percentage. Response of the computer was recorded weekly starting from 13/7/2023. Weekly data were recorded till the end of the experiment in September, 2023. Table 3 shows the time period in weeks taken to kill 100% nematodes in the treatment plots (Table 5).

Collection of samples after completion of experiment in September, 2023

Three samples from each plot were again collected in September, 2023 and marked as

Samples from treatment I = (T1 R1, T1 R2, T1 R3)
Samples from treatment II = (T2 R1, T2 R2, T2 R3)
Samples from treatment III = (T3 R1, T3 R2, T3 R3)
Samples from treatment IV = (T4 R3, T4 R2, T4 R3)
(Where T = Treatment; R1, R2, R3 = Replication 1, 2 and 3)

Table 1. Population density of living nematodes (per 100 g soil) in different treatment plots before treatments as detected by radionics computer

S. No.	Treatment plot no.	Average of R1, R2, R3
1	Plot 1	57
2	Plot 2	66
3	Plot 3	72
4	Plot 4	30

R1, R2, R3 are the sample replication of a treatment plot

Results and discussion

Nematodes were present almost in all the soil samples of all four treatment plots collected before treatment in July, 2023, mentioned in Table 1. Two types of nematodes were detected, namely *Heterodera* sp. and *Meloidogyne* sp. Both genera showed almost the same population counts in 3 plots. *Heterodera* sp. was not observed in treatment plot 4, but only *Meloidogyne* was present, as shown in Table 2. Solarization was applied in treatment plot I and III on 13/7/2023. Neem was applied by broadcasting through

Table 2. Identification and population density of living nematodes in 100g soil samples before soil solarization (TP = treatment plot)

S. No.	Nematode genera	Nematode population before treatment				
		Radionics computer response	TP 1	TP 2	TP 3	TP 4
1	*Anguina*	Negative	---	---	---	---
2	*Aphelenchoides*	Negative	---	---	---	---
3	*Atylenchus*	Negative	---	---	---	---
4	*Belonolaimus*	Negative	---	---	---	---
5	*Circonema*	Negative	---	---	---	---
6	*Criconemoides*	Negative	---	---	---	---
7	*Ditylenchus*	Negative	---	---	---	---
8	*Dolichdorus*	Negative	---	---	---	---
9	*Dorylaimus*	Negative	---	---	---	---
10	*Helichotylenchus*	Negative	---	---	---	---
11	*Hemicyclophora*	Negative	---	---	---	---
12	*Hemicirconemoides*	Negative	---	---	---	---
13	*Heterodera*	Positive	28	32	35	0
14	*Hoplolaimus*	Negative	---	---	---	---
15	*Longidorus*	Negative	---	---	---	---
16	*Meloidodera*	Negative	---	---	---	---
17	*Meloidogyne*	Positive	29	34	37	30
18	*Neccobus*	Negative	---	---	---	---
19	*Paratylenchus*	Negative	---	---	---	---
20	*Pratylenchus*	Negative	---	---	---	---
21	*Rodopholus*	Negative	---	---	---	---
22	*Rotylenchulus*	Negative	---	---	---	---
23	*Rotylenchus*	Negative	---	---	---	---
24	*Spraeronema*	Negative	---	---	---	---
25	*Trichodolrs*	Negative	---	---	---	---
26	*Tylenchorhynchus*	Negative	---	---	---	---
27	*Tylenchulus*	Negative	---	---	---	---
28	*Tylenchus*	Negative	---	---	---	---
29	*Xiphinema*	Negative	---	---	---	---
Total number of living nematodes			57	66	72	30

radionics computer in treatment plot II, and III on the same day. While the treatment plot IV was kept as control without any treatment.

The effect of neem and solarization on the nematode population was recorded by using the samples collected before treatments (Table 2). The mortality of nematodes in treatment plots was recorded weekly starting from 13/7/2023, no effect was observed on the nematode mortality and it was considered it 0%, mentioned in Table 3. After start of the experiment, observation after one week on 20/7/2023, neem treatment showed the effect in both treatment plots II and III, rate of nematode mortality was 22% and 28%, respectively, data shown in Table 3. Interestingly, the mortality was 10% in solarization treatment plot I and 0% in the control treatment plot IV. After two weeks, the plot with neem treatment II, showed maximum mortality of nematodes 100%, followed by treatment plot III, showed a mortality rate of 78%, treated with neem plus solarization. In treatment plot I with simple solarization, the nematode mortality was only 39%, while the treatment plot IV (control) showed only 10% mortality. The higher rate of nematode mortality in treatment plots was due the effect of radiations, which was not given to the control plot[16]. Though, there was 10% nematode mortality rate in control treatment, which might be due to natural reasons or because of higher soil temperature.

After 3 weeks of the start of experiment on 3/8/2023, data was recorded again. In treatment plot III, the rate of nematode mortality was 100% (neem and solarization), while in treatment plot I with simple solarization, rate of nematode mortality was 58%. Similar to the result after one week, in treatment plot IV, the rate of nematode mortality was only 14%, much lesser than the treated plots. At the end of the experiment of radionic pesticide broadcast, after 7 weeks in treatment plot I resulted in nematode mortality of 100%, while in treatment plot IV, it was only 55%, data shown in Table 3.

The results showed that neem treatment by broadcasting through a radionics computer was very effective, time saving and economical[17]. After two weeks of neem treatment, the nematode mortality was 100% in treatment plot II, while, it was only 78% in case of treatment plot III with neem and solarization. Since the treatment plots I and II were given water, therefore, the nematodes became active and able to survive with moisture and tolerated wet heat. In case of simple neem treatment (treatment II) and without covering with plastic sheet (no solarization), the soil become dry, moreover water was not applied, therefore rate of nematode mortality was higher. This dryness in soil with high temperature resulted in killing of nematodes in two weeks, data shown in Table 3. Our results are in corroborations with *Giannakou et al*.,[18],

Table 3. Weekly nematode mortality data in (%) during treatment period (TP = treatment plot) as detected by radionics computer

Weekly data recorded on date	TP = 1 only solarization	TP = 2 only neem treatment	TP = 3 Solarization and neem treatments	TP = 4 Control	Treatment Period
13/7/2023	0	0	0	0	0 Week
20/7/2023	10	20	28	0	1 week
27/7/2023	39	100	78	10	2 weeks
3/8/2023	58	-	100	14	3 weeks
10/8/2023	70	-	-	23	4 weeks
17/8/2023	82	-	-	36	5 weeks
24/8/2023	94	-	-	47	6 weeks
31/8/2023	100	-	-	55	7 weeks
7/9/2023	-	-	-		8 weeks
56 days	**49 days**	**15 days**	**21 days**	**56 days**	**8 weeks**

who also reported the role of nematicide (non-radiation pesticide) and solarization to control the root knot nematodes.

After completion of the treatment period, fresh soil samples were collected from each treatment plots and checked for nematode viability in September, 2023 and the results are mentioned in Table 4 and 5. This study showed that neem broadcasting treatment using a radionics computer is far better and economical than

Table 4. Population density of living nematodes in the experimental area after treatments

S. No.	Treatment plot No.		Population after treatment				
			R 1	R 2	R 3	Total	Average
1	1	Negative in 7 weeks	0	0	0	0	0
2	2	Negative in 2 weeks	0	0	0	0	0
3	3	Negative in 3 weeks	0	0	0	0	0
4	4	Positive in 8 weeks	44	44	44	132	44

Table 5. Identification and population density of living nematodes in soil samples after solarization process in treatment plots (TP)

S. No.	Nematodes genera	Population after treatment				
		Radionics computer response	TP 1	TP 2	TP 3	TP 4
1	*Anguina*	Negative	---	---	---	---
2	*Aphelenchoides*	Negative	---	---	---	---
3	*Atylenchus*	Negative	---	---	---	---
4	*Belonolaimus*	Negative	---	---	---	---
5	*Circonema*	Negative	---	---	---	---
6	*Criconemoides*	Negative	---	---	---	---
7	*Ditylenchus*	Negative	---	---	---	---
8	*Dolichdorus*	Negative	---	---	---	---
9	*Dorylaimus*	Negative	---	---	---	---
10	*Helichotylenchus*	Negative	---	---	---	---
11	*Hemicyclophora*	Negative	---	---	---	---
12	*Hemicirconemoides*	Negative	---	---	---	---
13	*Heterodera*	Negative	0	0	0	0
14	*Hoplolaimus*	Negative	---	---	---	---
15	*Longidorus*	Negative	---	---	---	---
16	*Meloidodera*	Negative	---	---	---	---
17	*Meloidogyne*	Positive	0	0	0	44
18	*Neccobus*	Negative	---	---	---	---
19	*Paratylenchus*	Negative	---	---	---	---
20	*Pratylenchus*	Negative	---	---	---	---
21	*Rodopholus*	Negative	---	---	---	---

table 5. (continued).

S. No.	Nematodes genera	Population after treatment				
		Radionics computer response	TP 1	TP 2	TP 3	TP 4
22	*Rotylenchulus*	Negative	---	---	---	---
23	*Rotylenchus*	Negative	---	---	---	---
24	*Spraeronema*	Negative	---	---	---	---
25	*Trichodolrs*	Negative	---	---	---	---
26	*Tylenchorhynchus*	Negative	---	---	---	---
27	*Tylenchulus*	Negative	---	---	---	---
28	*Tylenchus*	Negative	---	---	---	---
29	*Xiphinema*	Negative	---	---	---	---
Total number of nematodes			0	0	0	44

solarization.

This new technology can be used for diagnosis, selection and application of treatment, finding out the effectiveness/results of treatments through Radionics Computer at any time in all fields of agriculture, human and animal lives. Its use should be encouraged, because in agriculture, it can be used to investigate, control insect pests, plant diseases, nematodes, weeds and other problems. The positive aspects of radionics approach are; the soil can be treated any time of the year without using any chemical pesticide. The method is very quick and time saving, further treatment can be applied even if crops are present in the field or greenhouse. The radionics computer technique is a very safe and environmentally friendly, there is no question of toxicity or contamination of soil, product or environment. The radionics computer technology is very simple and easy to use. The main drawback with this technique is that people are not aware about it. Moreover, this instrument is not available in most of the laboratories. Another limitation is to convince the people to use this approach instead of using chemicals as pesticides. Since a common man believes that pests cannot be managed by such radio magnetic technique. The future prospects of this technique seem to be bright, since people are moving towards organic farming and minimizing the use of harmful chemicals. The usage of radionic computer approach will certainly manage the diverse types of pests, therefore, will save the environment from toxic chemicals.

Competing interests

The authors declare that they have no competing interests.

Author contributions

Conceptualization, writing original draft preparation, MR, FAK, formal analysis; VK, data curation; VK; Formal analysis; review and editing; MR, VK. All authors have read and agreed to the published version of the manuscript.

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