Efficiency of Amended Composts for Biocontrol of Root-Knot Nematode Infected Cantaloupe, Cucumis melo Var. Cantalupensis in Egypt

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ABSTRACT

Nematodes are considered a severe agricultural concern. Meloidogyne nematodes can attack a wide range of plants, necessitating a variety of management techniques to reduce their population. The current study compared AGRN compost, VERMI compost in solid and tea shapes, and COMPOSTIVE compost to oxamyl as a chemical nematicide on cantaloupe (Cucumis melo var. cantalupensis) infected with root-knot nematode to determine its effect on cantaloupe growth under greenhouse and plastic house conditions. The results showed that all treatments improved plant growth parameters significantly in greenhouse settings. They also lowered the final population and rate of Meloidogyne incognita reproduction in soil and roots. The COMPOSTIVE compost and VERMI compost tea had the best effect on decreasing root-knot nematode population in the soil, number of galls, and egg masses on roots under plastic house conditions. In comparison to untreated plants, all treatments increased fruit weight. They also improved the fruit quality, with 12.7 % Total soluble solids (TSS), 3.90 mg/100ml total protein, and 15.31 mg/100ml total sugar after treatment with COMPOSTIVE compost.

Keywords: Cantaloupe, Cucumis melo var. cantalupensis; compost; root knot nematode, Meloidogyne incognita

INTRODUCTION

Cantaloupe (Cucumis melo var. cantalupensis) is one of Egypt's most important and popular fruits, mostly eaten as a dessert and refreshing fruit. It contains vitamins, phenolics, and flavonoids as well as carbs and minerals (especially potassium). It is also low in fat and calories (about 17 kcal/100g). It moreover contains a significant amount of dietary fiber (Tamer et al., 2010, Shafeek, et al., 2015). The worldwide production of cucurbits was estimated at 234,143,923 tons from a harvested area of 8,315,995 ha in 2018. In 2019, the production volume of melons including cantaloupes in Egypt was approximately 0.74million metric tons (FAOSTAT, 2019).

Even though the pathogens causing illness in the root system are predominantly soil-borne pathogenic fungi (SBPF) and plant-parasitic nematodes (PPNs), there are several pathogen's linked with cucurbiteaeous crops (Alejandro et al, 2020). These infections share the same rhizosphere habitat, disrupting the host plant's vascular system and interfering with physiological processes such as water and nutrient intake. Phytonematodes control has traditionally relied heavily on chemical soil disinfestation. However, a change from chemical to non-chemical methods of management is happening to ensure that international rules are met in a more environmentally friendly manner.

By turning raw materials into a stable form, eradicating human and animal diseases, and recovering important plant nutrients, composting is a useful method for the management of urban and agro-industrial wastes (Lasaradi and Stentiford, 1998). Compost is a degraded organic material formed from plant biomass and animal waste that has been aerobically digested. It is high inaccessible soil nutrient and is commonly used to improve soil fertility in horticulture, agricultural field crops, gardens, and landscaping. Compost improves the physical and chemical qualities of the soil, resulting in increased agricultural yields (Martens, 2000). Furthermore, due to increased organic matter content and soil microbial populations, compost amendments are generally reported to improve soil quality (Chang et al., 2007). Improved plant growth, nutrient and water retention, and disease suppression are all agronomic effects of compost (Guo et al. 2019). Plant soil-borne diseases and pests, such as plant-parasitic nematodes, are also suppressed by it (Bailey and Lazarovits, 2003).

Because of its ability to demonstrate all of the known methods of nematode suppression by organic amendments, compost is being promoted as a long-term solution for managing plant-parasitic nematodes (PPNs). Oka (2010) lists the following mechanisms as examples: 1. the introduction or strengthening of hostile microorganisms, 2. the formation of nematode-killing substances during a breakdown, such as ammonia and fatty acids, 3. the release of nematicidal chemicals already present in soil amendments, 4. changes in soil physiology that are unfavorable for nematode behavior and 5. a rise in plant tolerance and resistance. Compost has a particular benefit over single-type techniques like nematicides. It also works well with other traditional pest-control strategies including crop rotation and the adoption of resistant crop varieties (Lopes et al. 2019). Furthermore, compost lends itself better to manipulation and management to achieve desirable microorganisms for phytonematodes control than other in situ settings, which arguably have equivalent or lower microbial diversity but greater protection and conservation concerns than compost. The ability of compost or compost-derived products to generate suppressive soils or plant development substrate is critical for long-term PPN suppression.
management (St. Martin and Ramsubhag 2015). According to St. Martin and Brathwaite (2012), the long-term viability of such a method is primarily achieved through modifying the rhizospheres and/or soil’s microbial makeup and activity. This is especially relevant because numerous biological control agents found in soils, such as nematophagous fungus, nematodes, bacteria, earthworms, and mites have a significant impact on nematode populations (Stirling 2018). Therefore, the objective of this study is to evaluate the effect of different types of commercial compost on root-knot nematode associated with cantaloupe and subsequently their effect on plant metrics under greenhouse and productive plastic house conditions.

MATERIALS AND METHODS

Nematode inoculum preparation:

The Hussey and Barker (1973) approach was used to isolate root-knot nematode eggs from egg masses on the roots of the tomato plant. According to Coyne et al., (2007), the eggs were transferred to flasks and incubated at 28°C for three days, after which the eggs hatched in water and active *M. incognita* juveniles (J2) were collected. As an inoculum, a calculated suspension containing 3000 newly hatched juveniles was used.

Tested Materials:

A- AGRN compost ®:

A native commercial formulation is organic manure 100% vegetable compost produced from the compost of medicinal and aromatic wastes without any other additives were provided by Beni Suef Organic Fertilizers Company in Egypt. AGRN compost was applied at 2-3 tons per feddan in the old land and 3-4 tons per feddan in the new land.

B- VERMI compost ®:

The commercial formula is organic manure with a high content of organic matter and enzymes (such as amylase, lipase, glycolytic digestion enzymes, and protease enzymes) provided by Archimega Company in Egypt. VERMI compost is the product of the decomposition process using red wobbler worms, tiger worms, African worms which digest animal and plant waste. Application rates in solid form were at a rate of 8 kg / Tree. If the compost is used in the form of compost tea, the preparation is done by soaking 10 kg of solid compost in 80 liters of water for 3 days with continuous stirring. Irrigation is done with compost tea weekly.

C- COMPOSTIVE compost ®:

The commercial liquid formula is organic manure with 70% organic additives, amino acids, humic acid, foliar acid, macro, and micronutrients for plants provided by Afcoo Company in Egypt. It is used at a gallon rate of 20 liters per feddan, diluted at a rate of 1:20 liters of water, which is irrigated weekly from germination until the fruit set.

D- Vydate®:

Oxamyl 10%G: Methyl N N-dimethyl-N [(methyl) carbamyl oxy]-1-thioxamidate was utilized at a rate of 20kg/feddan.

Greenhouse experiment:

The form of compost tea was prepared from VERMI compost by soaking 10 kg / 80 liters of water for 3 days with continuous stirring, use the resulting in irrigation for seedlings immediately after planting them. COMPOSTIVE compost was used in liquid form while other types of compost i.e. VERMI compost and AGRN compost were used in solid form to measure their effect on *M. incognita* (J2) infected cantaloupe, *Cucumis melo* var. *cantalupensis* cv. Rasto under greenhouse conditions during spring season 2021. The seeds were previously sown for germination in plastic pots with a diameter of 20 cm containing a mixture of 3 kg of clay and sandy soil (1:1 w/w). During germination, the pots were prepared for planting, where sterilized soil was mixed with sand in a ratio of 1:1 and added 4.5 kg of AGRN compost to 10.5 kg of sterile pre-prepared soil (1 compost: 2 sterilized soil) and 5 pots of 20 cm-d were filled with this mixture (each one weighing 3 kg). Five pots of (20 cm-d), as the application with VERMI compost which as solid shape applied at the same rate (1 compost: 2 sterilized soil). Twenty-five pots of sterilized soil (1:1) were filled for the rest of the treatments. After two weeks, seedlings were planted for each pot. Immediately after seedlings, 5 pots were irrigated with the previously prepared compost tea (VERMI compost) once a week. As for the COMPOSTIVE compost, it is also irrigated weekly after dilution at the rate of 1-liter compost: 20 liters of water and each pot received 250 ml/pot, and the rest of the week is irrigated with ordinary tap water. After 10 days of seedling, 30 pots of cantaloupe plants were inoculated with 3000 newly hatched (J2s) of *M. incognita* per plant. After a week of infection, 5 pots were treated with oxamyl at the rate of 0.5 g/pot. Five pots infected with *M. incognita* were left as control + (infected plant). Another five pots were left without any treatments as control - (untreated uninfected plants).

All of the pots were organized in a randomized block configuration in the greenhouse at 26±4°C. The plants were harvested after sixty days of nematode inoculation. *M. incognita* juveniles were recovered from 250gm of dirt per pot using sieving and modified Baermann procedures (Goodey, 1963). Roots were stained with acid fuchsine in lactic acid and microscopically inspected for counting nematode developmental stages, females, galls and egg masses, according to Byrd et al. (1983). The root gall and egg mass index scales for 0-5 were used to record root galls and egg masses indices, with 0=no galls or egg masses, 1=1:2, 2=3:10, 3=11:30, 4=31:100, and 5>100 per root system (Taylor and Sasser, 1978).

Productive plastic house experiment:

In a plastic house (9mx60m), located in Nubariya at Buhaira Governorate. It is described as a newly reclaimed land and dry semi-desert region (sandy soil and 33±5°C) with heavily infested by root-knot nematode. Before the test began the number of root-knot nematodes in soil was estimated as the initial population independently for each treatment according to methods described by Christie & Perry, (1951) and Southey, (1970). Before planting, all treatments were set up as a complete randomized block design (RCBD) and replicated five times. Application by AGRN compost and VERMI compost was mixed with soil in solid form at a rate of 2-3 tons per feddan before seedling planting. After transplanting VERMI compost tea and COMPOSTIVE compost, were applied as a soil drench every week at intervals until holding flowers. Oxamyl was treated as a chemical nematocide at a rate of 20kg/feddan, and all treatment were replicated five times, each replicate containing ten plants. The economic production period of plants was 70 days from the seedling. The number of
nematodes in soil and root, galls, and egg masses per root was counted. The rate of nematode reproduction and percentages of reduction in nematode's final population (PT) were also calculated by the following formula:

\[
\text{Reduction}\% = \left( \frac{\text{PF in control} - \text{PF in treatment}}{\text{PF in control}} \right) \times 100
\]

Reproduction factor (RF) = \( \frac{\text{PF}}{\text{Pi}} \)

Fruits progressively produced on five cantaloupe plants were picked and weighted to calculate the final yield per plant for yield determination and quality characteristics.

Quality characteristics:

At the harvesting stage, 6 cantaloupe fruits were randomly selected from each treatment and quality characteristics in the fruit tissue were measured.

A- Total soluble solids (T.S.S.) were determined in fruits by hand refractometer (A.O.A.C., 2000).

B- To analyze crude proteins, Bradford’s 1976 method was employed.

C- The percentages of total sugars in fruit juice were determined according to the method described by Dubois et al. (1959).

Data Analysis

All of the experiments were examined separately. Duncan's Multiple Range Test (DMRT) was used to compare the treatment means (Gomez and Gomez 1984). WASP1 was employed for the analysis, with the crucial difference set at \( P \geq 0.05 \) and the results interpreted.

RESULTS AND DISCUSSION

Results

A- Efficacy comparative of certain commercial compost and chemical nematicide, and estimation of its reflection on growth parameters of cantaloupe, Cucumis melo var. cantalupensis infected by M. incognita under greenhouse conditions.

This study was conducted to evaluate the effect of the tested materials (AGRN compost, VERMI in solid and tea shapes, COMPOSTIVE compost, and oxamyl) on the population density of M. incognita infected cantaloupe plants. Generally, the current work showed that all tested treatments caused significantly increased growth parameters for cantaloupe plants compared with control and untreated plants as shown in Table (1). COMPOSTIVE compost and VERMI compost tea recorded the best treatments in enhancement length of shoot (60.2&54.5 cm) weight of shoot (22.7&23.8 g), length of root (13.7 &11.8 cm), the weight of root (8.6 & 7.3 cm) and shoot dry weight (3.2&3.7 g), respectively compared with the untreated plants. While nematicide oxamyl showed moderate increase in shoot fresh weight (18.5g) and shoot dry weight (2.6g).

Table 1. Growth parameters of cantaloupe plants, Cucumis melo, var. cantalupensis affected by different types of composts and infected with Meloidogyne incognita under greenhouse conditions 26±4 °C.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Shoot Length (cm)</th>
<th>Shoot Weight (g)</th>
<th>Root Length (cm)</th>
<th>Root Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRN compost</td>
<td>45.8c</td>
<td>14.5c</td>
<td>7.9d</td>
<td>6.4ab</td>
</tr>
<tr>
<td>VERMI compost</td>
<td>44.3d</td>
<td>12.3d</td>
<td>9.8e</td>
<td>5.3b</td>
</tr>
<tr>
<td>VERMI compost tea</td>
<td>54.5b</td>
<td>23.8e</td>
<td>11.8h</td>
<td>7.3ab</td>
</tr>
<tr>
<td>COMPOSTIVE compost</td>
<td>60.2a</td>
<td>22.7a</td>
<td>13.7j</td>
<td>8.6e</td>
</tr>
<tr>
<td>Oxamyl</td>
<td>49.5c</td>
<td>18.5b</td>
<td>10.2k</td>
<td>5.5b</td>
</tr>
<tr>
<td>Control +</td>
<td>28.3e</td>
<td>9.8e</td>
<td>5.1l</td>
<td>2.5c</td>
</tr>
<tr>
<td>Control -</td>
<td>53.2b</td>
<td>20.9b</td>
<td>14.7l</td>
<td>5.9b</td>
</tr>
<tr>
<td>LSD</td>
<td>4.8</td>
<td>1.75</td>
<td>1.1</td>
<td>2.4</td>
</tr>
</tbody>
</table>

- Each value presented the mean of five replicates. Control (+) = infected plant Control (-) = untreated uninfected plants
- Mean values followed by the same letter(s) did not significantly different at the 5% level by DMRT.

Data in Table (2) presented that all treatments resulted in a considerable reduction in the total number of root-knot juveniles in soil and roots of cantaloupe plants, with reproduction factor ranging from 0.27 for oxamyl to 1.56 for VERMI compost solid shape. However, some notable disparities between applications have emerged, oxamyl provided the greatest reduction in the nematode population with a reduction reached 92.6% followed by COMPOSTIVE compost and VERMI compost tea shape with a reduction percentage reached 79.4 and 69.4%, respectively. On the other hand, AGRN compost and VERMI compost solid shape ranked the next and had lower nematode population levels, with a reduction percentage of 63.9 and 57.3 %. All treatments considerably reduced root galling and the number of egg masses, with RGI ranging from 3.3 to 5.00 and EI ranging from 3.1 to 4.7. It was noted that treatment by VERMI compost in solid shape was the least effective in reducing the number of nematodes in soil and root.

Table 2. Influence of different types of composts on root-knot nematode (Meloidogyne incognita) population infected cantaloupe plant Cucumis melo var. cantalupensis under greenhouse conditions 26±4 °C.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Developmental Stage</th>
<th>Females</th>
<th>Final population</th>
<th>RF</th>
<th>Reduction %</th>
<th>No. of Egg masses/1g root</th>
<th>Galls/1g root</th>
<th>RGI</th>
<th>No. of Egg masses/1g root</th>
<th>EI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRN compost</td>
<td>1150.4c</td>
<td>92.5e</td>
<td>75.2f</td>
<td>1318.1c</td>
<td>1.32</td>
<td>63.9</td>
<td>80.3a</td>
<td>4.5</td>
<td>69.8b</td>
<td>4.3</td>
</tr>
<tr>
<td>VERMI compost</td>
<td>1336.3b</td>
<td>142.3b</td>
<td>82.4b</td>
<td>1560.1b</td>
<td>1.56</td>
<td>57.3</td>
<td>112.1b</td>
<td>5.0</td>
<td>79.4a</td>
<td>4.7</td>
</tr>
<tr>
<td>VERMI compost tea</td>
<td>989.7d</td>
<td>75.7e</td>
<td>54.8d</td>
<td>1120.2d</td>
<td>1.12</td>
<td>69.4</td>
<td>89.3e</td>
<td>4.3</td>
<td>51.1c</td>
<td>4.1</td>
</tr>
<tr>
<td>COMPOSTIVE compost</td>
<td>623.3e</td>
<td>87.8d</td>
<td>41.5e</td>
<td>752.6e</td>
<td>0.75</td>
<td>79.4</td>
<td>76.5d</td>
<td>4.5</td>
<td>39.4e</td>
<td>3.8</td>
</tr>
<tr>
<td>Oxamyl</td>
<td>228.4f</td>
<td>17.4e</td>
<td>26.2f</td>
<td>272.0f</td>
<td>0.27</td>
<td>92.6</td>
<td>27.5e</td>
<td>3.3</td>
<td>15.5c</td>
<td>3.1</td>
</tr>
<tr>
<td>Control +</td>
<td>3323.5a</td>
<td>243.4a</td>
<td>89.4a</td>
<td>3656.3a</td>
<td>3.66</td>
<td>0.0</td>
<td>235.7a</td>
<td>5.0</td>
<td>87.6e</td>
<td>4.8</td>
</tr>
<tr>
<td>LSD</td>
<td>45.07</td>
<td>4.38</td>
<td>5.79</td>
<td>51.13</td>
<td>-</td>
<td>-</td>
<td>0.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Each value presented the mean of five replicates. N = M. incognita (3000 Juveniles/ plant). RGI=Root gall index, EI= Egg masses index
Control (+) = Infected plant
Mean values followed by the same letter(s) did not significantly differ at the 5% level by DMRT.
B- Efficacy comparative of certain commercial compost and chemical nematicide, and estimation of its reflection on growth parameters of cantaloupe *Cucumis melo* var. *cantalupensis* infested by *Meloidogyne* spp. under plastic house conditions.

Data in Table (3) refer to the effectiveness of commercial compost understudying and oxamyl on RKN population density and yield of cantaloupe plants grown in plastic house. Where, oxamyl had the greatest nematode population reduction (88.3%), followed by COMPOSTIVE compost and VERMI compost tea (72.9 and 67.4 %, respectively), with the rate of nematode reproduction being the slowest (0.50 & 0.60), then AGRN compost which gave 64.4% nematode population reduction and 0.77 for reproduction factor. On the other side, solid VERMI compost had the least effect on nematode reproduction (58.6 %), as well as the highest rate of nematode reproduction (0.77). In terms of the root galls, all treatments significantly reduced the number of galls on cantaloupe plants as compared to untreated plants (control). A similar trend was noticed with egg masses numbers where treatment with COMPOSTIVE compost recorded the least number of egg masses (118.3 egg masses / 5 g. root) after nematicide oxamyl.

Table (3) shows that all tested commercial compost understudying and oxamyl have substantial differences in cantaloupe yield (Kg/plant). COMPOSTIVE compost and oxamyl (315.7 and 257.8 %) had the highest yield percentage, followed by VERMI compost tea and solid one (207.8 and 130.4%). AGRN compost exhibited considerable yield improvements (69.6%), compared with control, whereas control produced the lowest yield where the fruit weight was 1.42 kg/plant.

Table 3. Effect of different types of composts on the population density of *Meloidogyne* spp. infested cantaloupe *Cucumis melo* var. *cantalupensis* and their effects on fruit weight under plastic house conditions 33±5°C.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Final Population, (Pf)</th>
<th>RF</th>
<th>Red. %</th>
<th>No. galls/5g Root</th>
<th>No. Egg masses/5g root</th>
<th>Fruit Weight (kg/plant)</th>
<th>Increasing %</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRN compost</td>
<td>2062.7 e</td>
<td>0.66</td>
<td>64.4</td>
<td>195.3 b</td>
<td>182.9 b</td>
<td>2.73 d</td>
<td>69.6</td>
</tr>
<tr>
<td>VERMI compost</td>
<td>2398.4 b</td>
<td>0.77</td>
<td>58.6</td>
<td>215.8 b</td>
<td>200.5 b</td>
<td>3.01 e</td>
<td>130.4</td>
</tr>
<tr>
<td>VERMI compost tea</td>
<td>1886.8 d</td>
<td>0.60</td>
<td>67.4</td>
<td>172.5 c</td>
<td>169.2 c</td>
<td>3.92 b</td>
<td>207.8</td>
</tr>
<tr>
<td>COMPOSTIVE compost</td>
<td>1569.2 e</td>
<td>0.50</td>
<td>72.9</td>
<td>125.3 d</td>
<td>118.3 d</td>
<td>6.24 a</td>
<td>315.7</td>
</tr>
<tr>
<td>Oxamyl</td>
<td>679.3 f</td>
<td>0.26</td>
<td>88.3</td>
<td>35.6 c</td>
<td>27.6 c</td>
<td>5.65 a</td>
<td>257.8</td>
</tr>
<tr>
<td>Control +</td>
<td>5793.9 a</td>
<td>1.9</td>
<td>-</td>
<td>256.9 a</td>
<td>248.5 a</td>
<td>1.42 e</td>
<td>-</td>
</tr>
<tr>
<td>LSD</td>
<td>84.76</td>
<td>-</td>
<td>-</td>
<td>30.29</td>
<td>29.71</td>
<td>0.70</td>
<td>-</td>
</tr>
</tbody>
</table>

Number of initial population = 3127 / 250g soil.
Reproduction factor (RF) = final population/initial population.
Mean values followed by the same letter(s) did not significantly differ at the 5% level by DMRT.

Data also represented that all tested treatments affected fruit quality. The highest proportion of total soluble solids (TSS) was induced by Oxamyl and COMPOSTIVE compost at 12.5 and 12.7 %, followed by VERMI compost tea and solid one at 11.8 and 11.3 %, and AGRN compost which had the lowest percentage at 10.9 % (Fig.1).

Figure 1. Total soluble solids (TSS) in cantaloupe fruits *Cucumis melo* var. *cantalupensis* affected by various types of compost and infection with root-knot nematode under plastic house conditions.

In terms of the estimated percentage of total protein in cantaloupe juice, it was found that the oxamyl treatment had the highest percentage of total protein at 4.73mg./100ml juice fruits, while the fruits of the AGRN compost had the lowest percentage at 1.52mg./100ml. (Fig2).

Also, when estimating the effect of treatments on the percentage of total sugar in cantaloupe juice, it was found that the highest content of total sugar measured in mg/100ml, was performed in the juice produced from the COMPOSTIVE compost treatment (15.31 mg/100ml) while the fruits of the untreated plants (control) had the lowest percentage at 5.13 mg/100ml (Fig3).

Figure 2. Total protein in cantaloupe fruits *Cucumis melo* var. *cantalupensis* as affected by various types of compost and infection with root-knot nematode under plastic house conditions.

Figure 3. Total sugar in cantaloupe fruits *Cucumis melo* var. *cantalupensis* as affected by various types of compost and infection with root-knot nematode under plastic house condition.
Discussion

When compared to the control treatment, the current study discovered that different types of compost had a positive effect on plant growth, which is similar to Jimenez et al. (1997), who discovered that compost manure application significantly increased vegetative growth parameters of melon plants such as stem length, the number of leaves/plant, and dry weight, as well as fruit yield. In another study, Shafeek et al. (2015) discovered that organic manure (Nile compost) increased plant growth and fruit yield. The higher level of organic manure’s superiority in vegetative development could be related to its favorable effect on soil's physical characteristics (Marculescu et al., 2002 Ozores-Hampton et al., 2011) or the gradual release of nutrients (Eissa, 1996). This finding is in line with Liu et al. (2019), who found that adding organic manures such as barnyard manure, green manure, and compost to soils improved soil conditions by releasing organic acids, nitrogen compounds, and other compounds having stimulating properties.

The effect of various compost on the population density of root-knot nematode was also observed. Under greenhouse conditions, the number of nematodes in the soil and on the roots was considerably decreased by all of the treatments evaluated. Among the tested treatments, COMPOSTIVE compost which contains organic additives, amino acids, humic acid, and folic acid was the best treatment and gave a significant decrease in the nematode population. Ozores-Hampton (2002) found that using organic amendments reduced the number of phyto-parasitic nematode populations in soil. On the root of the cantaloupe plant, VERMI compost tea reduced the number of galls and egg masses dramatically. This was confirmed by Zuhair et al., 2022, who found a significant decrease in the number of root-knot-infested plants in the vermicompost injected soil. Many elements interact to impact the composition of compost and compost end products, including the nature of the feedstock, the composting process employed, compost additives, particle size, microbial community, pH, temperature, oxygen concentration, and the C/N ratio, moisture content (St. Martin and Ramsubbhag 2015). These variables can also be tweaked to create compost capable of producing PPN-resistant soils.

Organic materials’ influence on the soil nematode community, as well as their usefulness in suppressing plant-parasitic nematodes, has been linked to their chemical composition in several studies (Li et al., 2018; Tariq et al., 2018). Changes in the physical and biological qualities of the soil, making it less suitable for plant-parasitic nematode growth, could potentially explain the reduction in plant-parasitic nematodes with the addition of compost (Oka, 2010). Compost is a rich source for varied microorganisms with the ability to modulate numerous PPNs via distinct mechanisms of action, according to Neher et al. (2010).

In a productive house experiment, using compost resulted in a considerable increase in crop weight when compared to untreated nematode-infected plants. This viewpoint is shared by Tabarant, (2011); Djigal et al. (2012), who acknowledged that nematodes have lower yields. Agronomic effects of compost include increased plant development, nutrition and water retention, and disease control, according to studies by Guo et al. (2019). Furthermore, all of the treatments dramatically lower the final populations of root-knot nematodes. Compost supplements may suppress nematodes in a variety of ways, including direct toxicity of breakdown products, a rise of naturally nematode-antagonist microorganisms on the compost substrate, or even the generation of systemic acquired resistance in plants (Zhang et al. 2011).

Total soluble solids (TSS), total protein, and total sugar were found to be enhanced by various composts. These results were similar to those of Shafeek et al. (2015), who found that adding organic manure to cantaloupe plants boosted plant growth, fruit yield, and physical and chemical fruit quality characteristics. These findings could be attributed to organic manure’s role in increasing soil porosity, aeration, water holding capacity, and cation exchange capacity (CEC), all of which encourage soil microorganisms’ biological activities and lead to the breakdown of organic matter, releasing N, P, and K, as well as other nutrients, into the soil solution (Ozores-Hampton et al., 2011). Absorption would be increased and nutrient uptake might be stimulated if these nutrients were accessible in the soil solution. These findings corroborated those of Melloni et al. (1995); Pinamontiaet al. (1997); Jianming et al. (2008); Sarhan et al. (2011) and Adebayo et al. (2014), who found that increasing the amount of compost used resulted in the highest TSS, total sugars, protein, vitamin C, and moisture content in cucurbit fruits.

As a result, using compost will lessen the negative impacts of nematicides, such as pollution, health risks to the environment, and consumer food. The findings also support those of Sarwaet et al. (2010), who found that using compost not only supplements chemical fertilizers but also reduces pollutants. In this cultural system, this will result in higher production and higher income for the agricultural community.

CONCLUSION

Chemical nematicides are being phased out of agricultural systems in favor of environmentally friendly biocontrol alternatives. Compost could be improved as a biocontrol product for the development of nematode-resistant soils. To produce a compost that can build and sustain nematode suppressive soils, the feedstock and composting procedures should be carefully selected. Compost will not only supplement artificial fertilizers, but it will also help to minimize pollution. In this cultural system, this will result in higher production and higher income for the agricultural community.

REFERENCES


