EVALUATION OF SOME CHEMICAL NEMATICIDES AND ORGANIC FORMULATIONS IN MANAGEMENT OF ROOT KNOT NEMATODE MELOIDOGYNE SPP ON EGGPLANT.

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KeyWords: Meloidogyne spp., Nematicide, Protecto RZH, Vydate 24 L, Rugby 10 G, Rootex.

ABSTRACT

This investigation has conducted in yearly naturally infested plastic house with root knot nematode Meloidogyne spp located in Qoshtapa District- field of Haj. Kamil A. Abdulrahman which is located 12 km south of Erbil city during 2012-2013 agricultural season to evaluate the efficacy of two nematicides Vydate 24 L, Rugby 10 G and two organic formulations of Nematicide, Protecto RZH and their combinations with enrofloxacin compound - Rootex against root knot nematode (RKN) on eggplant Solanum melongena L.-Barcelona variety. Standard agricultural practices for eggplant cultivation under green houses in Iraq were applied; and all mentioned compounds were used in its recommended doses. After application of above treatments, Fresh and dry weights for both of foliage and root/plant, plant length, plant tillers number, fruit weight, root knots number, infected plant number were counted after 10 weeks from plant transplanting date in plastic house. Percentages of disease incidence, disease severity, disease control efficiency and gall index were computed for all applied treatments. Results showed that all compounds used in this investigation have had a significant increasing effect on both of fresh and dry weight of foliage as well as averages of plant height, number of tillers and weight of fruits. No significant effect had observed for these compounds on wet and dry weight of root system except the treatment of Rootex and the treatment of Nematicide + Rootex. Treatment with both of Protecto RZH + Rootex recorded highest averages of wet and dry foliage weight, plant height, tillers number and fruit weight 725 g, 115.9 g, 72.9 cm, 7.7 tiller and 78.4 g, respectively. Application with Rootex alone gave highest averages of wet and dry weight for root system 116.4 g and 36.7 g, respectively, while the treatment with both of Rugby 10 G + Rootex realized highest average of nematode control efficacy 47.6%. Significant decrease in disease incidence, disease severity and gall index of root knot Nematode on eggplant have observed in all treatments except Rootex treatment. Result showed also that all treatments except Rootex were achieved a significant increase in control efficacy percentage of the pest. Based on these results, we concluded the significant economic importance of root knot nematode on eggplant in green houses in Iraq and the possibility of its control for a good extend by using the combinations of each of Nematicide, Protecto RZH or Rugby 10 G with rootex at its used dosages in this investigation.
Introduction

Eggplant (Solanum melongena. L) one of the important vegetable crops grown in Iraq. It is planted in relatively wide area up to 3787 hectares with yearly production of 112640 tones (The Annual Report of Production of Agricultural crops 2010. Ministry of planning and development/Republic of Iraq). Eggplant infected by many insects and diseases which root-knot nematodes (RKN) Meloidogyne spp come in the forefront., RKN is considered the most important genus of plant nematodes at all.(Abo-Gharbiah, W.I. et al 2010) due to its heavy economic losses in agricultural production where the losses caused by plant diseases nematodes estimated up to 100 billion dollars annually, 50% of which are caused by (RKN) alone and may cause complete loss of the crop, as usually occurred in the case of severe infection in tomato.Hundred species belonging to the genus Meloidogyne have been described (Hunt DJ and Handoo Z.A. 2009) of which four are widespread and representing around 95% of the (RKN) in the agricultural land: M. Javanica, M. hapla, M. arenaria and M. incognita (Menjivar, R.D. et al 2012), All of these types have found in all Arab countries (Allouf , N. et al 2011)).Root knot nematode characterized by its wide host range and spread around the world on vegetables , fruits , field crops and ornamental plants, especially those planted in sandy and light soil so rarely survives an agricultural crop from its infection (Abo-Gharbiah, W.I. et al 2010), in addition to being high sexual efficient which makes it difficult to control(Fernandez .R.A. and E. Sikora 2005).Several control methods were used in control root-knot nematodes like chemical, agricultural and physical (soil solarization) , resistant varieties, plant extracts and organic compounds that work on the induction of plant resistance against nematodes, these control methods were used widely and gavevarious control degrees depending on control methods (Sikora, R.A and Fernandez 2005).Farmers relayed on nematicides as an essential method to plant parasitic nematodes included RKN since 1950 and still playing a well prominent role in increase the production as well as the ease of use and speed of getting results(Brand, D.C.R. et al 2010).As example, application of Cadusafos provided a maximum reduction of nematode infection with Meliodogyne incognita on tomato in green house condition. Cadusafos reduced the number of galls ,nematode population density by 96.49% ,99.6% respectively while Oxamyl reduced both parameters by 55.47 and 92.12 respectively( Raddy, H. M. et al 2013).Oxamyl in spite of it potential to provide some control of a number of nematode species, it does not control Meloidogyne javanica (Nancy,K.B. 2005). Although chemical nematicides are effective, easy to apply and show rapid effectsThe Environmental Protection Agency (EPA) banded many chemicals for its responsibility regard environmental pollution and nematode resistance, despite of its efficiency due to long persistence and high toxicity to humans and animals, environment and non-target organisms and thus disturbing the balance of bio-system., such as DD Mixture Dual methyl ethylene , dual bromide , chloride propane ,aldicarb, dazomet and carbofuran. Methyl bromide was already banned since 2005 in developed countries because of its bad effects on the ozone layer while the developing countries will stop its use by 2015 (Abo-Gharbiah, W.I. et al 2010, Brand, D.C.R. et al 2010).Based on that there is severe shortage in offered nematicides in our agricultural market and there is an urgent need to develop an efficient alternatives for banded range like plant extracts or organic formulations, which may less toxic to man and animals but as effective against nematodes as synthetic ones.

Present research is undertaken to evaluate the effectiveness of two nematicides and two organic formulations on their own, as well as in combination with enrooting stimulant organic compound against root-knot nematodes on eggplant crop in protected agriculture.

Materials and methods

This research conducted in a plastic house in Erbil Governorate- Qoshtapa District belonging to the grower Kamil A. Abdulrahman located 12 km south of Erbil city during 2012-2013 season, which is yearly, naturally infected with root knot nematode: Meloidogyne spp to evaluate efficacy of two nematicides and two organic compounds and one root formation stimulant compound as shown in Table (1). After soil preparation of the plastic house, which covers an area of 459 m 2 (51 m x 9 m) compound fertilizer Yara Mila Complex product by SQM Company, Holland applied at a rate of 25 kg / donum. This fertilizer contains macro and micro elements in proportions indicated against each of them as follows:N (12%), P(11%), K(18%), Mg(3%),S(8%) , Fe(0.2%), Mn (0.02%), Zn(0.02%), B(0.015%). Land divided into five sectors with length of 51 m, width 1 m each. Three sectors of which have chosen to represent the replicates of the experiment. Each replicate divided into ten experimental units with length of 4.5 m and distance within units is 0.5 m.Plastic pipes extended for plot irrigation by drip irrigation method. Seeds of eggplant Var. Barcelona seeded in nursery/ cork plates with 209 pore each on date of 23/08/2012 after filling these pores with sterilize Petmos and irrigated. In 10.11.2012 and after seedlings reached a suitable length carefully transferred to its permanent places in the plastic house at a rate of 16 seedlings / experimental unit on two sides, where the distance within plants is 0.4 m. completely randomized design(CRD) is applied and various ten treatments were randomly distributed over each replicate.

1. Control
2. Rootex @ 2.5 gm/liter of water
3. Nemaclean@ 3 ml/liter of water
4. Protecto RZH@3 ml/liter of water
5. Vydate 24 L@ 2.5 ml/Liter of water
6. Rugby 10 G@6 gm / M²
7. Rootex@ 2.5 gm/liter of water+ Nemaclean@ 3 ml/liter of water
8. Rootex@ 2.5 gm/liter of water+Protecto RZH@ 3 ml/liter of water
9. Rootex@ 2.5 gm/liter of water + Vydate 24 L@ 2.5ml/liter of water
10. Rootex@ 2.5 gm/liter of water+ Rugby 10 G@6 gm / M²

Each treatment were triple applied with interval of 15 days, first application has done one-day prior seedling transfer to the plastic house. Experiment ended by 20/12/2012. Samples have taken to get the required data for studied parameters. Wet and dry weight for both of foliage and root, length of plant, fruit weight and number of galls were measured. The nematode severity ratings of infected plants were assessed for galling according to the rating scale of Sasser and Taylor with few modification (Sasser, J.N. and A. L. Taylor, 1978) where 0 = No galls; 1 = 1-25 galls; 2 = 26-50 galls; 3 = 51-75 galls; 4 = 76-100 galls and 5 = More than 100 galls. Disease incidence, Disease severity and efficacy of control were calculated by following formula:

\[
\text{Disease incidence} = \frac{\text{Number of plant galled}}{\text{Total number of plant sampled}} \times 100
\]

\[
\text{Disease severity} = \frac{\Sigma (\text{Na of galled plants} \times \text{its galling degree})}{\text{Total galled plant no.} \times \text{highest galling degree}} \times 100
\]

\[
\text{Gall Index} = \frac{\Sigma (\text{Na of galled plants} \times \text{its galling degree})}{\text{Total galled plant}}
\]

(Esfahani, M. N. 2009)

Control efficacy percentage = \(\frac{m-n}{100-n}\) × 100 (Osman, H. A. et al 2008)

Whereas m and n stand for percentage of mortality in treated sample and control, respectively.

Data sets were analyzed using statistics packagename (MINITAB). Levels of significance, means and standard deviation were obtained for various data sets and means were separated by Duncan’s multiple range. The differences were accepted as significant at (P<0.01) for all experiment parameters except Control efficacy Parameter only as its differences accepted at (P< 0.01).

### Table 1: Nematicides and organic compounds used in the experiment:

<table>
<thead>
<tr>
<th>Sq</th>
<th>Trade name</th>
<th>Ingredient</th>
<th>Produced company</th>
<th>country</th>
<th>Using dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vydate 24 L</td>
<td>Oxamyl</td>
<td>DuPont</td>
<td>France</td>
<td>2.5 ml/L</td>
</tr>
<tr>
<td>2</td>
<td>Rugby 10 G</td>
<td>Cadsafus</td>
<td>FMC</td>
<td>Belgium</td>
<td>6 gm/M²</td>
</tr>
<tr>
<td>3</td>
<td>Nemaclean</td>
<td>Plant extract, amino acids</td>
<td>AMC Chemical</td>
<td>Spain</td>
<td>3 ml/L</td>
</tr>
<tr>
<td>4</td>
<td>Protecto RZH</td>
<td>Plant extracts, phosphor, Potassium,dilutants</td>
<td>Cosmocel</td>
<td>Mexico</td>
<td>3 ml/L</td>
</tr>
<tr>
<td>5</td>
<td>Rootex</td>
<td>P₃O₂ , Humic organic carbon, acids,N,K,Co, Organic Nitrogen, N</td>
<td>Cosmocel</td>
<td>Mexico</td>
<td>2.5 ml/L</td>
</tr>
</tbody>
</table>

### Results and discussion

The results shown in table (2) indicated that various treatments have had a significant clear effect (p< 0.01) on the fresh weight of foliage compared with control. The highest fresh wet of foliage was in treatment of Protecto RZH + Rootex 752.7 g, followed by treatment of Rootex + Rugby 743.6 g without a significant difference between the two treatments. Rootex treatment was the lowest in its fresh wet 692.5 g with a significant difference with control 676.7 g as well. As for the results on the dry weight of foliage, it took a similar trend of treatments impact on the fresh weight mentioned above; as various treatments have significant differences (p< 0.01) on the dry weight of foliage compared with control. The highest dry weight of foliage was 115.9 g in the treatment of Protecto RZH + Rootex, followed by treatment of Rootex + Rugby 114.4 g without a significant difference between them. Treatment with Rootex was the lowest in dry weight 106.6 g and without a significant difference with control treatment 104.1 g.

The reason for the low fresh and dry weight for foliage system of plants in the Rootex treatment and control may belong to the existence of nematode inoculum in high population in the plant’s root zone of these two treatments due to absence of any nematicidal activity there. Such heavy infestation will lead to additional severe injuries to the root systems of these plants increasing with time due to lack of nematicides or anti-nematode formulations in its root zone, which is further leading to a partial failure of the roots in performing its normal function in absorption of water and nutrients. Nematode as an obligate parasite causes the development of root-knot galls that drain the plant's photosynthate and nutrients, which represent the main source of plant requirements for the growth, and development of these plants (Al-Agidi, F. J. and A.I.H. Al-Mashhdaani 2013, Khalil, M.S.H. et al 2012). These results agreed with (Abo-Gharbiah, W.I. et al 2010, Al-
Agidi, F. J. and A.I.H. Al-Mashhdaani (2013). High fresh and dry weight of foliage for treatments of Rootex + Rugby and Protecto RZH + Rootex may belong to two reasons; first is concerned with its content of Rootex, which is working to promote better growth and developing of eggplants due to its rich content of nutrient elements and its capability to improve of enrooping process in treated plants (Maldonado, A.J. and Mendoza, A.B. 2012); beside the good efficacy of Rugby nematicide as a second reason; and its action in reduce nematode population in root and root zone for the applied plants and keeping root almost free from the infection and in well condition to absorb water and nutrients and synthesize plant growth regulators, which is responsible for division and elongation of plant cells that consequently participate in fresh and dry weight increase for foliage system. Same reasons could interpret the high fresh and dry weight for plant treated with Protecto RZH + Rootex beside unique efficacy of Protecto RZH as a natural repellent factor with allelochemical activity in reduction of pathogenic nematode population in root and adjacent soil without affecting the beneficial nematode population in the soil. In addition to promote healthy root development and increase crop productive potential due its rich content of Potassium and phosphor (Morales, I.A. et al. 2011). This result is agreed with (Abo-Ghabriah, W.I. et al. 2010, Al-Agidi, F. J. and A.I.H. Al-Mashhdaani 2013). For fresh weight of root system and as the statistical analysis of experiment data is revealed, root weight parameter is followed a different trend compared with foliage weight parameter. It is clear from table (2) that only Rootex treatment 116.4 g followed by Nemaclean + Rootex 103.1 g have had a significant increase ($p < 0.01$) of its fresh weight of root system compared with control 96.7 g. Treatment with Protecto RZH alone realized the lowest average of fresh weight of root system 90 g with a significant difference with control. As dry weight of root system parameter is concerned, almost it took a similar trend of fresh weight mentioned above. Causes for the significant high values of both of fresh and dry weight of plants treated with Rootex only may attributed for this treatment was not protected by any nematicide or organic formulation; which is consequently leading for severe infection by root knot nematode and its intensive activities in root system and concomitant increase in size (hypertrophy), in number (hyperplasia) of root cells and formation of giant cells, as well as increase the number and size of nuclei in which manufacturing and accumulating of proteins needed in the processes of growth and reproduction beside formation of new radical capillaries to compensate root affected by nematode injury, which contributes in increase the size and weight of the root. (Abo-Ghabriah, W.I. et al. 2010).

In addition, the extra weight found in the weight of plant roots in plant treated with Rootex whose main function is to stimulate treated plants to generate a new roots (Maldonado, A.J. and Mendoza, A.B. 2012), as well as plants treated with the organic formulation named Nemaclean being stimulates the formation of roots in addition to its main function as nematicide (Benavides-Mendoza, A. et al. 2009).

### Table 2: Influence of chemical nematicides and organic formulations on growth parameters of eggplants in plastic house

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant length cm</th>
<th>Plant tillers no.</th>
<th>Fruit weight g</th>
<th>Foliage Fresh weight g</th>
<th>Dry weight g</th>
<th>Roots Fresh weight g</th>
<th>Dry weight g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35$^{e}$</td>
<td>4.1$^{e}$</td>
<td>65.7$^{a}$</td>
<td>676.7$^{a}$</td>
<td>104.1$^{a}$</td>
<td>96.7$^{a}$</td>
<td>30.1$^{a}$</td>
</tr>
<tr>
<td>Nemaclean</td>
<td>56.4$^{a}$</td>
<td>5.6$^{c}$</td>
<td>74.3$^{b}$</td>
<td>728.5$^{b}$</td>
<td>112.2$^{b}$</td>
<td>100.6$^{b}$</td>
<td>30.4$^{b}$</td>
</tr>
<tr>
<td>Nemaclean + Rootex</td>
<td>65.7$^{a}$</td>
<td>7.5$^{a}$</td>
<td>77.8$^{a}$</td>
<td>739.6$^{a}$</td>
<td>103.1$^{a}$</td>
<td>103.1$^{a}$</td>
<td>31.2$^{b}$</td>
</tr>
<tr>
<td>Protecto RZH</td>
<td>53.7$^{c}$</td>
<td>5.5$^{c}$</td>
<td>67.7$^{c}$</td>
<td>716.8$^{c}$</td>
<td>110.3$^{c}$</td>
<td>90$^{c}$</td>
<td>28$^{c}$</td>
</tr>
<tr>
<td>Protecto RZH + Rootex</td>
<td>72.9$^{a}$</td>
<td>7.7$^{a}$</td>
<td>78.4$^{a}$</td>
<td>752.7$^{a}$</td>
<td>115.9$^{a}$</td>
<td>94$^{a}$</td>
<td>28.5$^{a}$</td>
</tr>
<tr>
<td>Vydate 24L</td>
<td>45.3$^{d}$</td>
<td>5.2$^{a}$</td>
<td>72.3$^{d}$</td>
<td>706.6$^{e}$</td>
<td>108.2$^{e}$</td>
<td>95.6$^{d}$</td>
<td>28.6$^{c}$</td>
</tr>
<tr>
<td>Vydate 24 L + Rootex</td>
<td>60.8$^{a}$</td>
<td>5.8$^{a}$</td>
<td>72.9$^{d}$</td>
<td>736.3$^{a}$</td>
<td>113.4$^{a}$</td>
<td>97$^{c}$</td>
<td>29.3$^{a}$</td>
</tr>
<tr>
<td>Rugby 10 G</td>
<td>49.9$^{f}$</td>
<td>5.2$^{d}$</td>
<td>70.9$^{d}$</td>
<td>719.9$^{c}$</td>
<td>110.8$^{c}$</td>
<td>90.8$^{c}$</td>
<td>28.4$^{a}$</td>
</tr>
<tr>
<td>Rugby 10 G + Rootex</td>
<td>72.8$^{a}$</td>
<td>6.8$^{a}$</td>
<td>76.1$^{b}$</td>
<td>743.6$^{b}$</td>
<td>114.4$^{a}$</td>
<td>93.1$^{d}$</td>
<td>29.1$^{a}$</td>
</tr>
<tr>
<td>Rootex</td>
<td>40.1$^{e}$</td>
<td>4.9$^{a}$</td>
<td>66.9$^{c}$</td>
<td>692.5$^{c}$</td>
<td>106.6$^{d}$</td>
<td>116.4$^{a}$</td>
<td>36.7$^{a}$</td>
</tr>
</tbody>
</table>

* Means in a column followed by the same letter(s) are not significantly different at $p < 0.01$, according to Duncan’s Multiple Range Test
For other three-plant growth parameters of plant length, plant tillers number and fruit weight it look that almost came in harmony with foliage weight data. Table 2- revealed that plant of all treatments realized a significant increase (p< 0.01) in its plant length averages compared with control. Highest plant length were with Protecto RZH + Rootex treatment 72.9 cm followed by Rugby + Rootex treatment 72.8 cm with no significant difference between them while, the lowest plant height was 40.1 cm with rootex with a significant increase on control 35 cm. For plant tiller number, all treatments have a significant increase (p< 0.01) in this parameter compared with control. Highest average for tiller number observed in plants treated with Protecto RZH + Rootex 7.7 followed by plants treated with Nemaclean + Rootex 7.5 with no significant difference between them. The lowest average in this parameter was recorded in plants applied by Rootex with a significant increase on control (Abo-Gharibiah, W.I. et al 2010).only some treatments had a significant increase (p< 0.01) in fruit weight compared with control. Highest average for fruit weight was in plant treated with Nemaclean +Rootex 77.8 g followed by Rugby + Rootex 76.1 g. Realizing of the highest averages of plant length, plant tillers number and fruit weight in Plants applied with Protecto RZH +Rootex, Rugby + Rootex and Nemaclean + Rootex respectively may belong to two reasons. Firstly, the high efficacy of Protecto RZH, Rugby and Nemaclean in killing or repelling root knot nematode in root and root zone and preventing its destructive role on whole plant growth activities and secondly, high potential of Rootex as an effective root stimulant and its great role in promoting growth and development of treated eggplants (Maldonado,A.J. and Mendoza,A.B. 2012).

Table -3: Influence of chemical nematicides and organic formulations on nematode infection parameter of eggplants in plastic house

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Disease incidence%</th>
<th>Gall index</th>
<th>Disease severity%</th>
<th>Control efficacy %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>66.7 a</td>
<td>3.0 a</td>
<td>30 a</td>
<td>0.0 c</td>
</tr>
<tr>
<td>Nemaclean</td>
<td>36.7 b</td>
<td>1.0 d</td>
<td>10 d</td>
<td>41.2 a</td>
</tr>
<tr>
<td>Nemaclean + Rootex</td>
<td>36.7 d</td>
<td>1.1 d</td>
<td>10.7 d</td>
<td>41.2 a</td>
</tr>
<tr>
<td>Protecto RZH</td>
<td>43.3 c</td>
<td>1.2 d</td>
<td>12 d</td>
<td>31.7 b</td>
</tr>
<tr>
<td>Protecto RZH + Rootex</td>
<td>36.3 d</td>
<td>1.2 d</td>
<td>12 d</td>
<td>42.1 a</td>
</tr>
<tr>
<td>Vydate 24 L</td>
<td>53.3 b</td>
<td>2.1 b</td>
<td>21.3 b</td>
<td>31.8 b</td>
</tr>
<tr>
<td>Vydate 24 L+ Rootex</td>
<td>53.3 b</td>
<td>1.7 c</td>
<td>16.7 c</td>
<td>40.1 a</td>
</tr>
<tr>
<td>Rugby 10 G</td>
<td>46.7 c</td>
<td>1.3 cd</td>
<td>13.3 cd</td>
<td>40.1 a</td>
</tr>
<tr>
<td>Rugby 10 G + Rootex</td>
<td>43.3 c</td>
<td>1.2 d</td>
<td>12 d</td>
<td>47.6 a</td>
</tr>
<tr>
<td>Rootex</td>
<td>66.7 a</td>
<td>2.5 b</td>
<td>24.7 b</td>
<td>-0.8 c</td>
</tr>
</tbody>
</table>

*Means in a column followed by the same letter (s) are not significantly different at p<0.01 and 0.05 for control efficacy column only, according to Duncan’s Multiple Range Test.

Table- 3 indicated influence of various treatments on root knot nematode infection parameters. Disease incidence, disease severity, gall index and nematode control efficacy. For disease incidence, it is clear from the table that all treatments except Rootex are significantly decreased (p< 0.01) in its disease incidence percentage compared with control 66.7%. Lowest disease incidence was 36.7% realized by Protecto RZH + Rootex treatment followed by each of Nemaclean and Nemaclean + Rootex treatments 36.7% with no significant difference between them while the highest disease incidence percentage found in Rootex treatment 66.7% which is the same value for control as well. As for disease severity and gall index parameters, table- 3 showed that all treatments were significantly decreased (p< 0.01) in its disease severity percentage and gall index values compared with control. Lowest disease severity percentage and gall index were realized by Nemaclean 10%, 1.0 followed by Nemaclean + Rootex 10.7%, 1.1 respectively with no significant difference between them while the highest values were observed with Rootex treatment 24.7%, 2.5 respectively with no significant difference with control 30%, 3.0 respectively.

As disease control efficacy for each treatment involved in this investigation is concerned, table -3 indicated that all treatments except Rootex alone have realized a significant control efficacy (p< 0.05) compared with control. Highest disease control efficacy realized by treating plant with Rugby +Rootex 47.6% followed by Protecto RZH + Rootex 42.1% with no significant difference between them while the lowest disease control efficacy found with plant treated with Rootex alone - 0.8% which is even below control 0% but with no significant difference between them.Good efficacy of Protecto RZH and Nemaclean in decrease nematode
incidence, severity, gall index and consequently increase its control efficacy could attributed for the capability of Protecto RZH to show good effect in reducing *Meloidogyne* spp without affecting the beneficial nematode population in the soil (Morales, I.A. et al 2011). This result agrees with (Istephan, Z.A. et al 2003) that phosphor additives to piled soil had participated in reduce RKN infection. Nematicale and due to its potential in killing nematodes at all of its stages of life cycle without chemical interference. Nematicale destroys nematode eggs and creates a hostile environment in the soil, which complicate reproduction and proliferation of plant parasitic nematodes in addition to its activity as a bio-stimulant product to promote the production of main and secondary roots (Benavides-Mendoza, A. et al 2009), this result agrees other studies (Rodriguez-Kabana, R.A. et al 1982; Hafez, S. L. et al 1996) for nematode could managed through adding N element to piled soil through fertilization with ammonia and amino acids. Good efficacy of Rugby 10 G as a strong organophosphorous nematicide is behind its significant nematode control efficacy as it acts by impairing nematode neuro-muscular activity, thereby, reducing their movement, invasion, feeding and consequently the rate of development and reproduction (Al-Agidi, F. J. and A.I.H. Al-Mashhdaani 2013). Former studies supported that Cadusafos exhibited the highest nematicidal activity among other nematicides tested (Zaki, M.J. and M.A. Maqbool, 1995; Abdul-rehman et al 2006; Osman, H.A. et al 2008; Maher etal, 2010; Dubey and Trivedi, 2011; Khalil, M.S.H. et al 2012; Al-Agidi, F. J. and A.I.H. Al-Mashhdaani 2013). for the good affectivity of treating with cadusaf in nematode management in the soil. None of nematicidal or repellency activity available in Rootex could explain its observed action in increase of root knot nematode incidence, severity, gall index and consequently extremely decreased of its control efficacy and may even increase plant sensitivity for nematode infection which might explain the negative value (-0.8%) for its control efficacy achieved.

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