EFFEC7 OF SIDE DRESSING OF FURADAN 5G AND MIRAL 3G AS LIQUID AGAINST ROOT-KNOT (MELOIDOGYNE JAVANICA) OF BRINJAL

S. M. E. Hassan¹, S. M. M. Hossain, M.U Ahmad and M. R. Hasan

ABSTRACT

Furadan 5G and Miral 3G were tested as side dressing of brinjal plants in pots against root-knot (Meloidogyne javanica). The two chemicals in higher concentrations (600 ppm and 880 ppm, respectively) either alone or in combination gave superior response in plant growth characters with corresponding lower number of galls, adult females and egg masses.

Key words: Root-knot, Brinjal, Furadan, Miral, Control

INTRODUCTION

Brinjal (Solanum melongena L.) is a popular, cheap and easily available vegetables round the year in Bangladesh. It is mostly cultivated in the winter season. It ranks as one of the topmost vegetables in the tropics on the basis of production and economic importance. In Bangladesh, 22.5 and 37.5 thousand hectare area are under its cultivation and the total production is 118.3 and 240.1 thousand m.ton in both kharif and rabi season, respectively (BBS 2004). It has nutritive value having carbohydrate, protein, fat, vitamin and minerals. Bangladesh lies in the sub-tropical region having hot and humid climate. The soil and climatic condition of Bangladesh has made her an ideal abode for nematodes. Several hundred species of nematodes are known to feed on living plants as parasites causing a variety of plant diseases. Among, 15 genera of plant parasitic nematodes associated with commercial crops in Bangladesh, root-knot nematode Meloidogyne spp. were the most abundant and wide spread (Timm and Ameen, 1960; Ahmad, 1977 and Mian, 1986). Furadan (Carbofuran 5G) and Miral 3G are systemic in action used as nematicide for different crops (Vovlas and Lamberti, 1974 and Rodriguez - Kabana et al. 1980) and are available in the market of Bangladesh. The liquid forms of Furadan 5G and Miral 3G are used in this study either alone or in combination to detect the effect of liquid application on the incidence of root-knot nematode (Meloidogyne javanica) of brinjal were not yet studied in northern region of Bangladesh. With this view in mind, the present research work has been undertaken to see the effect of Furadan 5G and Miral 3G either alone or in combination on the incidence of root-knot disease of brinjal caused by Meloidogyne javanica.

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MATERIALS AND METHODS

The pot experiment was conducted both in the laboratory and net house of Plant Pathology Department, Hajee Mohammad Danesh Science & Technology University, Dinajpur. Pot soil was prepared by mixing sandy loam soil, sand and well decomposed cowdung (ratios 2:2:1). The mixed soil was sterilized and placed in the pots. Healthy, mature and disease free brinjal seeds were taken after surface sterilization. Raising of seedlings was done in two earthen pots treated as seed beds. Healthy and uniform sizes of seedlings of 30 days were uprooted with special care. After placing the seedlings on the respective pots, adequate moisture was ensured with the supply of water for seven days. Altogether, nine treatments including control having four replications were used. Different concentrations of Furadan 5G and Miral 3G in liquid forms were used singly and in combination as side dressing as treatments which were $T_1 =$ control, $T_2 = 600$ ppm Furadan, $T_3 = 880$ ppm Miral, $T_4 = T_2 + 440$ ppm Miral, $T_5 = 300$ ppm Furadan + $T_3$, $T_6 = 300$ ppm Furadan + 440 ppm Miral, $T_7 = 300$ ppm Furadan + 220 ppm Miral, $T_8 = 150$ ppm Furadan + 440 ppm Miral, $T_9 = 150$ ppm Furadan + 220 ppm Miral. Inoculation was done at 10 days of transplantation. After 60 and 90 days of inoculation, plants were uprooted and of length of shoot and root, fresh weight of shoot and root were measured and counting of galls was done following the method of Hasan et al. 2004. Then galls were crushed one after another to count the adult males or females, L_2, L_3, and L_4 stage(s) in 10 galls per treatment

RESULTS AND DISCUSSION

After 60 days of inoculation, significantly maximum length of shoot (12.90 cm) and root (31.70 cm) as well as fresh weight of shoot (15.50 g) and root (4.81 g) were recorded in $T_4$ (600 ppm furadan and 440 ppm miral) over the control ($T_1$) treatment with significant reduction of number of galls / g of root (Table 1). The minimum length of shoot (8.60 cm) and root (14.50 cm) as well as fresh weight of shoot (4.68 g) and root (1.25 g) were recorded in control treatment. In case of galling, $T_1$ (control) was found to give the highest significant number of galls (47.50) per g of root, while minimum (12.50) was also in $T_4$ treatment. The highest number (38.30) of adult females and eggmass (14.60) of *Meloidogyne javanica* were recorded in $T_1$ (Control) while the lowest adult female (1.50) and eggmass (1.50) were recorded in $T_2$ (600 ppm furadan) (Table 2). It is interesting to note that $L_2$ was not found in $T_3$ and $T_4$ treatments, where as $L_3$ was not found in $T_2$ and $T_4$ (Table 2). Moreover, $L_4$ stage was not recorded in $T_3$ and $T_4$ treatments.
Table 1. Effect of side dressing of Furadan 5G and Miral 3G on plant growth and galling incidence of brinjal inoculated with *Meloidogyne javanica* after 60 days of inoculation.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Length of shoot (cm)</th>
<th>Length of root (cm)</th>
<th>Fresh weight of shoot (g)</th>
<th>Fresh weight of root (g)</th>
<th>No. of gall/ g root</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>8.60</td>
<td>14.50</td>
<td>4.68</td>
<td>1.25</td>
<td>47.50</td>
</tr>
<tr>
<td>T2</td>
<td>12.10</td>
<td>21.40</td>
<td>13.63</td>
<td>3.12</td>
<td>17.20</td>
</tr>
<tr>
<td>T3</td>
<td>11.70</td>
<td>20.70</td>
<td>12.54</td>
<td>2.81</td>
<td>16.50</td>
</tr>
<tr>
<td>T4</td>
<td>12.90</td>
<td>31.70</td>
<td>15.50</td>
<td>4.81</td>
<td>12.50</td>
</tr>
<tr>
<td>T5</td>
<td>12.70</td>
<td>22.40</td>
<td>13.90</td>
<td>4.05</td>
<td>13.70</td>
</tr>
<tr>
<td>T6</td>
<td>11.60</td>
<td>19.30</td>
<td>12.13</td>
<td>2.40</td>
<td>18.20</td>
</tr>
<tr>
<td>T7</td>
<td>9.90</td>
<td>18.20</td>
<td>11.42</td>
<td>2.06</td>
<td>24.00</td>
</tr>
<tr>
<td>T8</td>
<td>9.50</td>
<td>15.30</td>
<td>7.43</td>
<td>1.83</td>
<td>24.70</td>
</tr>
<tr>
<td>T9</td>
<td>9.10</td>
<td>14.73</td>
<td>6.70</td>
<td>1.83</td>
<td>34.20</td>
</tr>
<tr>
<td>SE(M) ±</td>
<td>0.80</td>
<td>2.95</td>
<td>0.40</td>
<td>0.41</td>
<td>5.72</td>
</tr>
<tr>
<td>LSD (p≥ 0.01)</td>
<td>3.17</td>
<td>8.63</td>
<td>1.59</td>
<td>1.64</td>
<td>1.44</td>
</tr>
</tbody>
</table>

Values are the mean of four replications.

T1 = control
T2 = 600 ppm Furadan
T3 = 880 ppm Miral
T4 = T2 + 440 ppm Miral
T5 = 300 ppm Furadan + T3
T6 = 300 ppm Furadan + 440 ppm Miral
T7 = 300 ppm Furadan + 220 ppm Miral
T8 = 150 ppm Furadan + 440 ppm Miral
T9 = 150 ppm Furadan + 220 ppm Miral.

Table 2. Effect of side dressing of Furadan 5G and Miral 3G on the population of *Meloidogyne javanica* after 60 days of inoculation.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>No. of adult female / 10 galls</th>
<th>No. of eggmass / 10 galls</th>
<th>No. of L2 stage / 10 galls</th>
<th>No. of L3 stage / 10 galls</th>
<th>No. of L4 stage / 10 galls</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>38.30</td>
<td>14.60</td>
<td>3.00</td>
<td>3.50</td>
<td>6.30</td>
</tr>
<tr>
<td>T2</td>
<td>1.50</td>
<td>1.50</td>
<td>0.70</td>
<td>0.00</td>
<td>1.50</td>
</tr>
<tr>
<td>T3</td>
<td>3.70</td>
<td>1.70</td>
<td>0.00</td>
<td>1.70</td>
<td>0.00</td>
</tr>
<tr>
<td>T4</td>
<td>5.00</td>
<td>2.60</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>T5</td>
<td>4.10</td>
<td>3.10</td>
<td>7.20</td>
<td>2.80</td>
<td>3.00</td>
</tr>
<tr>
<td>T6</td>
<td>4.20</td>
<td>3.00</td>
<td>5.80</td>
<td>3.60</td>
<td>3.20</td>
</tr>
<tr>
<td>T7</td>
<td>8.20</td>
<td>3.50</td>
<td>2.90</td>
<td>2.20</td>
<td>3.00</td>
</tr>
<tr>
<td>T8</td>
<td>10.60</td>
<td>5.50</td>
<td>8.40</td>
<td>3.70</td>
<td>4.10</td>
</tr>
<tr>
<td>T9</td>
<td>12.40</td>
<td>7.40</td>
<td>4.40</td>
<td>4.60</td>
<td>5.30</td>
</tr>
<tr>
<td>SE(M) ±</td>
<td>0.75</td>
<td>0.58</td>
<td>0.67</td>
<td>0.41</td>
<td>0.46</td>
</tr>
<tr>
<td>LSD (p≥ 0.01)</td>
<td>2.83</td>
<td>2.20</td>
<td>2.52</td>
<td>1.53</td>
<td>1.74</td>
</tr>
</tbody>
</table>

Values are the mean of four replications.

T1 = control
T2 = 600 ppm Furadan
T3 = 880 ppm Miral
T4 = T2 + 440 ppm Miral
T5 = 300 ppm Furadan + T3
T6 = 300 ppm Furadan + 440 ppm Miral
T7 = 300 ppm Furadan + 220 ppm Miral
T8 = 150 ppm Furadan + 440 ppm Miral
T9 = 150 ppm Furadan + 220 ppm Miral.
T₉ = 150 ppm Furadan + 220 ppm Miral.

After 90 days of inoculation, significantly maximum length of shoot (27.90 cm) and root (46.69 cm) as well as fresh weight of shoot (30.49 g) and root (19.81 g) were recorded in T₄ (600 ppm furadan and 440 ppm miral) over the control (T₁) treatment with significant reduction of number of galls/g of root (Table 3).

**Table 3. Effect of side dressing of Furadan 5G and Miral 3G on plant growth and galling incidence of brinjal inoculated with Meloidogyne javanica after 90 days of inoculation**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Length of shoot (cm)</th>
<th>Length of root (cm)</th>
<th>Fresh weight of shoot (g)</th>
<th>Fresh weight of root (g)</th>
<th>No. of gall/ g root</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>23.46</td>
<td>29.50</td>
<td>19.70</td>
<td>16.24</td>
<td>62.50</td>
</tr>
<tr>
<td>T₂</td>
<td>27.10</td>
<td>46.38</td>
<td>28.62</td>
<td>18.10</td>
<td>32.21</td>
</tr>
<tr>
<td>T₃</td>
<td>26.78</td>
<td>35.68</td>
<td>27.53</td>
<td>17.80</td>
<td>31.49</td>
</tr>
<tr>
<td>T₄</td>
<td>27.90</td>
<td>46.69</td>
<td>30.49</td>
<td>19.81</td>
<td>27.50</td>
</tr>
<tr>
<td>T₅</td>
<td>27.70</td>
<td>37.40</td>
<td>28.90</td>
<td>19.06</td>
<td>28.69</td>
</tr>
<tr>
<td>T₆</td>
<td>26.58</td>
<td>34.29</td>
<td>27.12</td>
<td>17.35</td>
<td>33.21</td>
</tr>
<tr>
<td>T₇</td>
<td>24.12</td>
<td>33.21</td>
<td>26.43</td>
<td>17.05</td>
<td>39.01</td>
</tr>
<tr>
<td>T₈</td>
<td>24.50</td>
<td>35.33</td>
<td>22.45</td>
<td>16.83</td>
<td>39.72</td>
</tr>
<tr>
<td>T₉</td>
<td>24.10</td>
<td>29.73</td>
<td>21.69</td>
<td>16.81</td>
<td>49.19</td>
</tr>
</tbody>
</table>

SE(M) ± 0.80  2.95  0.40  0.41  5.72

LSD (p≥ 0.01)  3.17  8.63  1.59  1.64  1.44

Values are the mean of four replications.
T₁ = control  
T₂ = 600 ppm Furadan  
T₃ = 880 ppm Miral  
T₄ = T₂ + 440 ppm Miral  
T₅ = 300 ppm Furadan + T₁  
T₆ = 300 ppm Furadan + 440 ppm Miral  
T₇ = 300 ppm Furadan + 220 ppm Miral  
T₈ = 150 ppm Furadan + 440 ppm Miral  
T₉ = 150 ppm Furadan + 220 ppm Miral.

The minimum length of shoot (23.46 cm) and root (29.50 cm) as well as fresh weight of shoot (19.70 g) and root (16.24 g) were recorded in control treatment. In case of galling, T₁ (control) was found to give the highest significant number of galls (62.50) per g of root, while minimum (27.50) was also in T₄ treatment. The highest number (48.30) of adult females and eggmass (24.61) of *Meloidogyne javanica* were recorded in T₁ (Control) while the lowest adult female (11.48) and eggmass (11.48) were recorded in T₂ (600 ppm furadan) (Table 4). Maximum number of L₂ (18.39), L₃ (14.61) and L₄ (16.29) of *Meloidogyne javanica* were recorded in T₈ and T₉ and T₁ treatments while the minimum L₂ (10.00), L₃ (10.00) and L₄ (10.01) were recorded in T₃, T₂ and T₃ & T₁ respectively (Table 4).
Table 4. Effect of side dressing of Furadan 5G and Miral 3G on the population of Meloidogyne javanica after 90 days of inoculation.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>No. of adult female / 10 galls</th>
<th>No. of eggmass / 10 galls</th>
<th>No. of L2 stage / 10 galls</th>
<th>No. of L3 stage / 10 galls</th>
<th>No. of L4 stage / 10 galls</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>48.30</td>
<td>24.61</td>
<td>13.00</td>
<td>13.51</td>
<td>16.29</td>
</tr>
<tr>
<td>T2</td>
<td>11.48</td>
<td>11.48</td>
<td>10.70</td>
<td>10.00</td>
<td>11.49</td>
</tr>
<tr>
<td>T3</td>
<td>13.71</td>
<td>11.69</td>
<td>10.00</td>
<td>11.71</td>
<td>10.01</td>
</tr>
<tr>
<td>T4</td>
<td>15.01</td>
<td>12.59</td>
<td>10.01</td>
<td>10.01</td>
<td>10.01</td>
</tr>
<tr>
<td>T5</td>
<td>14.11</td>
<td>13.12</td>
<td>12.81</td>
<td>13.61</td>
<td>13.19</td>
</tr>
<tr>
<td>T6</td>
<td>14.21</td>
<td>13.00</td>
<td>15.79</td>
<td>13.61</td>
<td>13.00</td>
</tr>
<tr>
<td>T7</td>
<td>18.22</td>
<td>13.51</td>
<td>12.89</td>
<td>12.21</td>
<td>13.00</td>
</tr>
<tr>
<td>T8</td>
<td>20.59</td>
<td>15.52</td>
<td>18.39</td>
<td>13.71</td>
<td>14.11</td>
</tr>
<tr>
<td>T9</td>
<td>22.39</td>
<td>17.41</td>
<td>14.39</td>
<td>14.61</td>
<td>15.31</td>
</tr>
</tbody>
</table>

SE(M) ± 0.75 0.58 0.67 0.41 0.46

LSD (p≥ 0.01) 2.83 2.20 2.52 1.53 1.74

Values are the mean of four replications.

T1 = control  
T2 = 600 ppm Furadan  
T3 = 880 ppm Miral  
T4 = T2 + 440 ppm Miral  
T5 = 300 ppm Furadan + T1  
T6 = 300 ppm Furadan + 440 ppm Miral  
T7 = 300 ppm Furadan + 220 ppm Miral  
T8 = 150 ppm Furadan + 440 ppm Miral  
T9 = 150 ppm Furadan + 220 ppm Miral.

All the treatments were recorded with identical shoot length and root weight, respectively (Table 3). With respect to the length of root, T4 was found to have the highest length. Lower identical response was observed among the rest treatments T1, T2, T3, T5, T6, T7 and T9. In respect of galling, T1 (control) was found to give the highest significant number of galls. T9 was recorded with higher number of galls. Lower identical response was found with T3 and T7. The lowest identical effect on the galling was noted with T2, T3, T4, T5 and T6 (Table 3). The control treatment T1 was recorded with the highest number of adult females of Meloidogyne javanica (Table 4). Lower and identical response was found among T7, T8 and T9. The lowest and identical effect was recorded among the treatments T2, T3, T4, T5 and T6 (Table 4). With respect to eggmass, the highest number was recorded with T1. The rest treatments were noted with identical and lowest number. The highest and identical number of L3 was recorded among the treatments T1, T2, T3, T5, T6, T8 and T9. The lowest and identical number was found between T2 and T4. All the treatments were observed with identical effect in L2 and L4 stage, respectively (Table 4).

Valley-Lamboy and Ayala (1976) also observed the increase of plant height after 60 days of treatment with Furadan 5G or mocap 10G against Radopholus similis and Meloidogyne incognita. Similarly, Mello-Filho et al. (1978) reported a better above ground development of Furadan 5G treated plants after 90 days of transplanting. The reports made by Homeyer (1973), Koshy et al. (1979), Broadley (1979), Padilla and Lopez (1973) and Zem et al. (1982) also are in consonance with the present findings. Bachmann and Handschin (1975) found that Miral was effective in the reduction of Meloidogyne population and controlling Aphelenchoides ritzemabosy. Observations made by Rao and Singh (1978), Rajendran and Naganathan (1978), Mahajan (1979), Mattey and Lopez (1979) and Salem (1979) also supported the effectiveness of applications of carbamate and other chemicals in relation to suppressions of galls produced.
by different *Meloidogyne* spp. attacking different crops. Working with granular form of carbofuran and aldicarb, Sultan and Singh (1947) observed decreased larval population in okra var. Pusa sawani infected with *Meloidogyne incognita*. Khan et al. (1985) also observed that aldicarb or carbofuran at 100 and 1000 ppm were highly toxic to *Meloidogyne incognita* and inhibited larval hatching when applied to infested tomato seedlings, Lamberti and Ekanayake (1982), Kheir et al. (1983) and Gichure and Ondieki (1984) also gave similar reports. Similar reports were also made by Upadhyay et al. (1979) and Singh and Bindra (1979). Less number of *Meloidogyne* larvae in soils and galls in roots of tomato were noted by Gamaa et al. (1986). Furadan 5G and Miral 3G, appeared superior for increasing growth of plants with corresponding decrease in nematode population. These chemicals can successfully be used for nematode control, but field trial is necessary for recommendation.

**REFERENCES**


Singh I and Bindra OS. 1979 Effect of carbofuran as seed treatment and granular soil treatment alone and in combination on nematodes associated with maize, Indian J. Nematol 8(1): 89-91.


