J. Sci. technol. (Dinajpur) Vol. 5: 10-16 (2007)
ISSN 1994-0386

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

S. M. E. Hassan[1], 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*.

[1]Department of plant pathology, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

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 (12.90cm) 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.

Treatments	Length of shoot (cm)	Length of root (cm)	Fresh weight of shoot (g)	Fresh weight of root (g)	N0. of gall/ g root
T_1	8.60	14.50	4.68	1.25	47.50
T_2	12.10	21.40	13.63	3.12	17.20
T_3	11.70	20.70	12.54	2.81	16.50
T_4	12.90	31.70	15.50	4.81	12.50
T_5	12.70	22.40	13.90	4.05	13.70
T_6	11.60	19.30	12.13	2.40	18.20
T_7	9.90	18.20	11.42	2.06	24.00
T_8	9.50	15.30	7.43	1.83	24.70
T_9	9.10	14.73	6.70	1.83	34.20
SE(M) ±	0.80	2.95	0.40	0.41	5.72
LSD($p \geq 0.01$)	3.17	8.63	1.59	1.64	1.44

Values are the mean of four replications.

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.

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

Treatments	No. of adult female / 10 galls	No. of eggmass / 10 galls	No. of L_2 stage / 10 galls	No. of L_3 stage / 10 galls	No. of L_4 stage / 10 galls
T_1	38.30	14.60	3.00	3.50	6.30
T_2	1.50	1.50	0.70	0.00	1.50
T_3	3.70	1.70	0.00	1.70	0.00
T_4	5.00	2.60	0.00	0.00	0.00
T_5	4.10	3.10	7.20	2.80	3.00
T_6	4.20	3.00	5.80	3.60	3.20
T_7	8.20	3.50	2.90	2.20	3.00
T_8	10.60	5.50	8.40	3.70	4.10
T_9	12.40	7.40	4.40	4.60	5.30
SE(M) ±	0.75	0.58	0.67	0.41	0.46
LSD ($p \geq 0.01$)	2.83	2.20	2.52	1.53	1.74

Values are the mean of four replications.

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.

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 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 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

Treatments	Length of shoot (cm)	Length of root (cm)	Fresh weight of shoot (g)	Fresh weight of root (g)	No. of gall/ g root
T_1	23.46	29.50	19.70	16.24	62.50
T_2	27.10	46.38	28.62	18.10	32.21
T_3	26.78	35.68	27.53	17.80	31.49
T_4	27.90	46.69	30.49	19.81	27.50
T_5	27.70	37.40	28.90	19.06	28.69
T_6	26.58	34.29	27.12	17.35	33.21
T_7	24.12	33.21	26.43	17.05	39.01
T_8	24.50	35.33	22.45	16.83	39.72
T_9	24.10	29.73	21.69	16.81	49.19
SE(M) ±	0.80	2.95	0.40	0.41	5.72
LSD ($p \geq 0.01$)	3.17	8.63	1.59	1.64	1.44

Values are the mean of four replications.

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.

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, T_1 (control) was found to give the highest significant number of galls (62.50) per g of root, while minimum (27.50) was also in T_4 treatment. The highest number (48.30) of adult females and eggmass (24.61) of *Meloidogyne javanica* were recorded in T_1 (Control) while the lowest adult female (11.48) and eggmass (11.48) were recorded in T_2 (600 ppm furadan) (Table 4). Maximum number of L_2 (18.39), L_3 (14.61) and L_4 (16.29) of *Meloidogyne javanica* were recorded in T_8 and T_9 and T_1 treatments while the minimum L_2 (10.00), L_3 (10.00) and L_4 (10.01) were recorded in T_3, T_2 and T_3 &T_4 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.

Treatments	No. of adult female / 10 galls	No. of eggmass / 10 galls	No. of L_2 stage / 10 galls	No. of L_3 stage / 10 galls	No. of L_4 stage / 10 galls
T_1	48.30	24.61	13.00	13.51	16.29
T_2	11.48	11.48	10.70	10.00	11.49
T_3	13.71	11.69	10.00	11.71	10.01
T_4	15.01	12.59	10.01	10.01	10.01
T_5	14.11	13.12	17.19	12.81	13.02
T_6	14.21	13.00	15.79	13.61	13.19
T_7	18.22	13.51	12.89	12.21	13.00
T_8	20.59	15.52	18.39	13.71	14.11
T_9	22.39	17.41	14.39	14.61	15.31
SE(M) ±	0.75	0.58	0.67	0.41	0.46
LSD ($p \geq 0.01$)	2.83	2.20	2.52	1.53	1.74

Values are the mean of four replications.

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.

All the treatments were recorded with identical shoot length and root weight, respectively (Table 3). With respect to the length of root, T_4 was found to have the highest length. Lower identical response was observed among the rest treatments T_1, T_2, T_3, T_5, T_6, T_8 and T_9. In respect of galling, T_1 (control) was found to give the highest significant number of galls. T_9 was recorded with higher number of galls. Lower identical response was found with T_8 and T_7. The lowest identical effect on the galling was noted with T_2, T_3, T_4, T_5 and T_6 (Table 3). The control treatment T_1 was recorded with the highest number of adult females of *Meloidogyne javanica* (Table 4). Lower and identical response was found among T_7, T_8 and T_9. The lowest and identical effect was recorded among the treatments T_2, T_3, T_4, T_5 and T_6 (Table 4). With respect to eggmass, the highest number was recorded with T_1. The rest treatments were noted with identical and lowest number. The highest and identical number of L_3 was recorded among the treatments T_1, T_2, T_3, T_5, T_6, T_8 and T_9. The lowest and identical number was found between T_2 and T_4. All the treatments were observed with identical effect in L_2 and L_4 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 popula1tion 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 nema population. These chemicals can successfully be used for nematode control, but field trial is necessary for recommendation.

REFERENCES

Ahmad MU. 1977. A review of plant-parasitic nematodes in Bangladesh. A paper presented in a seminar in the Imperial College of Science and Technology, Univ. London, UK.: 3.

Bachmann F and Handschin G. 1975. Miral (R) (CGA 12223), a new broad spectrum soil insecticide and nematicide with systemic activity. In International Plant Production Congress (8th) Moscow, August 21-26. Reports and Information's Section III Part 1, Moscow, USSR: 59-71.

BBS. 2004. Statistical Year Book of Bangladesh 24th Edition, Bangladesh of Bureau of Statistics, Planning Division, Ministry of Planning Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

Broadley RA. 1979. Control of root-knot of potatoes on the Atherton Tablelands, North Queens land. Australian J. Experimental Agric. and Animal Husb. 19 (100): 624-625.

Gichure E and Ondieki J. 1984. Control of root-knot nematode Meloidogyne javanica on tomato cv. EarlyBeauty in Kenya by using four granular nematicides. Pakistan J. Nematol. 2(2): 91-97.

Hassan SME, Ahmed MU, Hassan MR, Rahman MM and Rahman MSq. 2004. Effect of soil organic amendments on the control of root-knot of potato. J. Sci. Tech. 2: 66-69.

Homeyer B. 1973. Curaterr (R) a root-systemic insecticide and nematicide. Mitteil ungen aus der Biologischen Bundesanstalt fur Landund Forstwirtschaft, Berlin-Dahlum 151:203.

Khan AA, Anjum. and Alam MM. 1985. Control of Meloidogyne incognita on tomato by chemical dips. Pakistan J. Nematol. 3(2): 105-109.

Kheir AM, Osman AA and Montasser SA. 1983. Efficacy of certain systemic nematicides in controlling *Meloidogyne javanica* infecting okra (*Hibiscus esculentus*) Pakistan J. Nematol 1(1): 49-55.

Koshy PK, Sundararaju P and Wilson KI. 1979. Efficacy of certain systemic nematicide against *Meloidogyne incognita* in a cardamom nursery. Nematologia Mediterranea 7 (2): 195-198.

Lamberti F and Ekanayake HMK. 1982. Chemical control of root-knot nematodes on snake gourd in Sri-lanka, Nematologia Mediterranea 10(2): 227-228.

Mahajan R. 1979. Efficacy of carbofuran for the control of *Meloidogyne incognita* on okra. Indian J. Nematol 8(1): 91-92.

Mattey J and Lopez R. 1979. Effect of six nematicides applied in bands or broadcast on the control of plant parasitic nematodes and the yield of lettuce 15 (Es) laboratorio de Nematologia.

Mello Filho A, DE T, Zem AC and Barbin D. 1977. Preliminary trials of chemical control of *Meloidogyne incognita* by systemic nematicides. Sociedade Brasileira de Nematologia: Vol. 47: 53-59

Mian IH. 1986. Plant parasitic nematodes associated with some crop species in Bangladesh. Bangladesh J. Plant Pathol.:73

Padilla CA and Lopez R. 1979. Effect of the application of granular nematicides on the control of *Meloidogyne spp.* on pea. 20 (ES) Laboratorio de Nematologia.

Rajendran G and Naganathan TG. 1978. Control of root-knot nematode in grapes, Vitis 17:271-273.

Rao VR and Singh DB. 1978. Chemical control of root-knot nematodes in okra with the aid of nematicides. Indian J. Horti. 35 (2): 151-154.

Rodriguez-Kabana R, Mawhinney PG and King PS. 1980. Efficacy of planting times injections to soil of liquid formulations of three systemic nematicides against root-knot nematodes in peanuts. Nematropica 10(1): 45-49.

Salem FM. 1979. The effect of the granular nematicides Nemacur and Temik on root-knot nematodes (*Meloidogyne spp.)* on tomato, Anzeiger fur Schadlingskunde Pflanzenschutz 52 (9): 135-134.

Singh RS. 1973. Plant Diseases, Oxford and IBH Publishing Co. 3rd Ed.: 512pp.

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.

Sultan MS and Singh I. 1987. Efficacy of some nematicides for the control of root-knot nematode (*Meloidogyne incognita*) infesting okra. J. Res. Punjab Agril. Univ. 24(2): 243-246.

Timm RW and Ameen M. 1960. Nematodes associated with commercial crops in East Pakistan. Agric. Pak. 11(3): 355-366.

Upadhyay KD, Singh G and Pandey RC. 1979. Relative efficacy of certain chemicals alone and in combinations against root-knot nematode, *Meloidogyne javanica* attacking tomato crop. Indian J. Nematol. 9(1): 36-38.

Valle-Lamboy S and Ayala A. 1976. Control of plantain nematodes with contact nematicides. Nematropica 6(2): 55-59.

Vovlas N and Lamberti F. 1974. Studies on the systemic action of some chemicals in the control of Root-knot nematode. Sociedad Europea de Nematologos Vol. 45, 1-7.

Zem AC, Zonon KI and Lordello LGE. 1982. Timing and dosage of corbofuran application for control of *Meloidogyne javanica* on potato. Sociedade Brasileira de Nematologia: Vol. 50, 233-245.