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Efficacy of Benfuracarb 3.0 G (Oncol) on Brinjal for Root Knot Nematode Control *Meloidogyne incognita*

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ABSTRACT

Root knot nematode (*Meloidogyne incognita*) is one of the most destructive pest which causes heavy loss under field condition. A detailed investigation was undertaken to determine the toxicity of seven treatments including Benfuracarb: Oncol 3G @20 kg/ha, Oncol@33 kg/ha, Oncol@50kg/ha and Oncol@80 kg/ha, Carbofuran 3G @66 kg/ha and Neem seed kernel @75 kg/ha against root knot nematode. The number of root knots were counted at 30 days and 60 days by uprooting 2 plants per replicate and brought to the laboratory and extracted using Cobbs Sieving and modified Biermann's funnel technique. All experiments were conducted in the Plant pathology section, College of Horticulture (VCSG UUHF), Bharsar, Pauri Garhwal.

The experiment was conducted in two different season and different years hence different results were found accordingly. In season 1, the maximum reduction in nematodes population was recorded in Oncol 3G @ 80 kg per ha treated plots with 48.78% and 74.49% reduction over untreated check at 30 and 60 days after treatment. Similar result was observed during the second season where the maximum reduction in nematodes population was recorded in Oncol 3G @ 80 kg per ha treated plots with 48.54% and 72.76% reduction over untreated check at 30 and 60 days after treatment. In case of yield, the maximum yield in first season was recorded in Oncol 3G @ 80 kg per ha treated plots which was of 26.18 tonnes / ha and the minimum yield in the same season was observed in untreated plots which was 17.44 t/ha. In second season, maximum yield of 25.72 tonnes / ha was recorded in Oncol 3G @ 80 kg/ ha treated plots while the lowest yield of 18.04 t/ha was observed in untreated plot. Also the maximum reduction in nematodes lesions was recorded in Oncol 3G @ 80 kg per ha treated plots with 54.49 and 74.10% reduction over untreated check in season 1 and in second season, the maximum reduction in nematode lesions was recorded in Oncol 3G @ 80 kg per ha treated plots with 48.54 and 71.70% reduction over untreated check.

Keywords Nematode, *Meloidogyne incognita*, Biermann's funnel, Laboratory, Extract.

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INTRODUCTION

Brinjal (*Solanum melongena*) commonly called as the eggplant is a plant species in the nightshade family Solanaceae. Botanically it is classified as a berry. It's a delicate, tropical perennial plant having spiny stems

and white and purple color flowers. Most commonly purple, the spongy, absorbent fruit is typically used as a vegetable in cooking (Priyadarshini *et al.* 2019). It is nutritionally low in macronutrient and micronutrient but has the high oil absorbing capability. It is estimated that the annual production of 13.37MT with a productivity of 17.3 tonnes per hac is found in the area of 0.61 million hac. In 2018, India and China combined accounted for 87% of the production in the world.

Brinjal is affected by many harmful insect pests like shoot and fruit borer, hadda beetle, root knot nematode, mites, jassids and many more, among these root knot nematode is the most destructive pest causing heavy loss under field condition. Root knot nematode (*Meloidogyne incognita*) is a round worm that feeds on and damage plants. It is the most devastating plant parasitic nematode which causes higher yield loss in brinjal production (Kumar *et al.* 2020). When the plant root gets infected with the nematode, it forms gall "knot" like structure. Nematode shows the symptoms like irregular patches and steaks but they may vary in size, shape and number. The nematode can survive at a temperature between 18˚C-22˚C. The root knot nematodes are the most important pest of brinjal and forms root galls which can lead to 30% of yield loss. Root knot nematode can be controlled by certain bio-agents, botanical and chemicals (Borkakati *et al.* 2019).

MATERIALS AND METHODS

We selected seven treatment and tried four replications. Test chemical Benfuracarb 3.0 G was applied at 20, 33, 50 and 80 kg/ha, Carbofuran 3G was applied at 66 kg/ha and Neem seed kernel was applied at 75 kg/ha as furrow application with soil just before transplanting. General agronomic practices were followed to raise the crop.

T. No.	Treatments	Dose (kg/ha)
T_1	Oncol 3G	20
T_2	Oncol 3G	33
T_3	Oncol 3G	50
T_4	Oncol 3G	80
T_5	Carbofuran 3G	66
T_6	Neem seed kernel	75
T_7	Untreated check	-

Procedure for assessment of pest:

1. The number of root knots were counted at 30 days and 60 days by uprooting 2 plants per replicate.
2. We selected four spots per replicate at random near the root zone of the crop for counting the nematodes population. From each replicate, 250 g soil soil were collected at a depth 10-20 cm around the roots before the application, 30 and 60 days after application and brought to the laboratory and extracted using Cobbs Sieving and modified Biermann's funnel technique. The number of nema todes present in each soil were counted number under microscope.
3. Yield data from all the pickings was recorded plot wise and computed to hectare.
4. The population of natural enemies associated with brinjal were recorded in treated and control plots in randomly selected 10 plants in each plot by visual count.

RESULTS AND DISCUSSION

The experiment was conducted during two consecutive years which were March 2018 and March 2019. Therefore, a slight difference was found in the nematode population, nematode lesions and the yield after the application of selected treatments. Here, all the observation and results are explained in brief.

Nematodes in soil

Season – 1 (Summer 2018)

The maximum reduction in nematodes population was recorded in Oncol 3G @ 80 kg per ha treated plots with 48.78 and 74.49% reduction over untreated check at 30 and 60 days after treatment, followed by Oncol 50 kg/ha with 47.56 and 73.15% reduction over untreated check at 30 and 60 days after treatment, both the treatments were on par with each other and significantly superior than other treatments Oncol 3G @ 33 kg/ha, Carbofuran 3G @ 66 kg/ha, Oncol 3G @ 20 kg/ha and Neem seed kernel @ 75 kg/ha, similar results about were seen in the research done by Kankam and Sowley (2016), whereas the nematode population increased from 56.50 to 113.38 at 60 days

Table 1. Efficacy of Oncol 3.0 G against root knot nematode (*Meloidogyne incognita*) in soil (Season – 1, 2018)

Sl. No.	Treatments	Dose (kg ha^{-1})	Number of nematodes present in the soil PTC	30 DAA	60 DAA	Reduction over control (%) at 30 DAA	Reduction over control (%) at 60 DAA
1	Oncol 3G	20	57.10* (7.59)	47.48 (6.93)	38.24 (6.22)	44.92	66.27
2	Oncol 3G	33	57.20 (7.60)	46.15 (6.83)	34.56 (5.92)	46.46	69.52
3	Oncol 3G	50	57.40 (7.61)	45.20 (6.76)	30.44 (5.56)	47.56	73.15
4	Oncol 3G	80	56.75 (7.57)	44.15 (6.68)	28.58 (5.39)	48.78	74.79
5	Carbofuran 3G	50	57.45 (7.61)	48.40(6.99)	34.28 (5.90)	43.85	69.77
6	Neem seed kernel	75	56.80 (7.57)	55.90 (7.51)	52.64 (7.29)	35.15	53.57
7	Untreated check	-	56.50 (7.55)	86.20 (9.31)	113.38 (10.89)	0.00	0.00
	SE(m)		0.95	1.05	1.86		
	CD (p=0.05)		0.41	0.43	0.63		

*= Mean of four replications; DAA – Days after application, Values in the parenthesis are square root transformed values.

after application in untreated check (Table 1). Similar results were seen on jute crop infected with root knot nematodes (Khan 2004).

Season – 2 (Summer 2019)

Similar trend was observed during the second season. The maximum reduction in nematodes population was recorded in Oncol 3G @ 80 kg per ha treated plots with 48.54 and 72.76% reduction over untreated check at 30 and 60 days after treatment, followed by Oncol 50 kg/ha with 46.51 and 71.31% reduction over untreated check at 30 and 60 days after treatment, both the treatments were on par with each other and significantly superior than other treatments Oncol 3G @ 33kg/ha, Carbofuran 3G @ 66 kg/ha, Oncol 3G @ 20kg/ha and Neem seed kernel @ 75 kg/ha which was in confirmation with the findings of Jada *et al,* (2011), whereas the nematode population increased from 64.46 to 124.38 at 60 days after application in untreated check (Table 2).

Root knot lesions

Season – 1 (Summer 2018)

The maximum reduction in nematodes lesions was recorded in Oncol 3G @ 80 kg per ha treated plots with 54.49 and 74.10% reduction over untreated check at 30 and 60 days after treatment, followed by Oncol 50 kg/ha with 51.56 and 72.61% reduction over untreated check at 30 and 60 days after treatment, both the treatments were on par with each other and significantly superior than other treatments Oncol

Table 2. Efficacy of Oncol 3.0 G against root knot nematode (*Meloidogyne incognita*) in soil (Season – 2, 2019).

Sl. No.	Treatments	Dose (kg.ha^{-1})	Number of nematodes present in the soil PTC	30 DAA	60 DAA	Reduction over control (%) at 30 DAA	Reduction over control (%) at 60 DAA
1.	Oncol 3G	20	66.45 (8.18)	53.24 (7.33)	41.28 (6.46)	42.42	66.81
2.	Oncol 3G	33	64.34 (8.05)	51.26 (7.19)	39.26 (6.31)	44.56	68.44
3.	Oncol 3G	50	64.38 (8.05)	49.46 (7.07)	35.68 (6.01)	46.51	71.31
4.	Oncol 3G	80	64.28 (8.05)	47.58 (6.93)	33.88 (5.86)	48.54	72.76
5.	Carbofuran 3G	50	64.84 (8.08)	52.44 (7.28)	39.42 (6.32)	43.28	68.31
6.	Neem seed kernel	75	63.66 (8.01)	58.74 (7.70)	54.38 (7.41)	36.47	56.28
7.	Untreated Check	-	64.46 (8.06)	92.46 (9.64)	124.38 (11.17)	0.00	0.00
	SE(m)		0.79	0.65	0.64		
	CD (p=0.05)		2.43	2.00	1.96		

*= Mean of four replications, DAA – Days after application. Values in the parenthesis are square root transformed values.

Table 3. Efficacy of Oncol 3.0 G against root knots of nematode (*Meloidogyne incognita*) in brinjal crop (Season – 1, 2018).

Sl. No.	Treatments	Dose (kg ha^{-1})	Root knots/lesions at 30 DAA	Root knots/lesions at 60 DAA	Reduction over control (%) at 30 DAA	Reduction over control (%) at 60 DAA
1	Oncol 3G	20	7.45 (2.82)	7.88 (2.89)	33.78	57.84
2	Oncol 3G	33	6.25 (2.60)	6.11 (2.57)	44.44	67.31
3	Oncol 3G	50	5.45 (2.44)	5.12 (2.37)	51.56	72.61
4	Oncol 3G	80	5.12 (2.37)	4.84(2.31)	54.49	74.10
5	Carbofuran 3G	66	6.45 (2.64)	7.06 (2.75)	42.67	62.23
6	Neem seed kernel	75	6.95 (2.73)	8.24 (2.96)	38.22	55.91
7	Control	-----	11.25 (3.43)	18.69 (4.38)	0.00	0.00
	SE(m)		0.12	0.15		
	CD (p=0.05)		0.36	0.46		

*= Mean of four replications; DAA – Days after application. Values in the parenthesis are square root transformed values

3G @ 33kg/ha, Carbofuran 3G @ 66 kg/ha, Oncol 3G @ 20kg/ha and Neem seed kernel @ 75 kg/ha, whereas the number of nematode lesions increased from 11.25 to 18.69 at 60 days after application in untreated check (Table 3) which was proved with the findings of Khan *et al.* (2010).

Season – 2 (Summer 2019)

Similar trend was observed during the second season. The maximum reduction in nematode lesions was recorded in Oncol 3G @ 80 kg per ha treated plots with 48.54 and 71.70% reduction over untreated check at 30 and 60 days after treatment, followed by Oncol 50 kg/ha with 37.58 and 70.67% reduction over untreated check at 30 and 60 days after treatment, both the treatments were on par with each other and significantly superior than other treatments Oncol 3G @ 33kg/ha, Carbofuran 3G @ 66 kg/ha, Oncol 3G @ 20kg/ha and Neem seed kernel @ 75 kg/ha, whereas the number of nematode lesions increased from 12.56 to 23.46 at 60 days after application in untreated check (Table 4), Bhosle *et al.* (2012) also found almost same results in his trials.

Yield

Season – 1 (Summer 2018)

The yieild from all the pickings were recorded and expressed as yield/ha. Maximum yield of 26.18 tonnes / ha was recorded in Oncol 3G @ 80 kg per ha treated

Table 4. Efficacy of Oncol 3.0 G against root knots of nematode (*Meloidogyne incognita*) in brinjal crop (Season – 2, 2019).

Sl. No.	Treatments	Dose (kg ha^{-1})	Root knots/lesions at 30 DAA	Root knots/lesions at 60 DAA	Reduction over control (%) at 30 DAA	Reduction over control (%) at 60 DAA
1	Oncol 3G	20	8.24 (2.96)	7.68 (2.86)	34.39	67.26
2	Oncol 3G	33	8.16 (2.94)	7.24 (2.78)	35.03	69.14
3	Oncol 3G	50	7.84 (2.89)	6.88 (2.72)	37.58	70.67
4	Oncol 3G	80	7.46 (2.82)	6.64 (2.67)	40.61	71.70
5	Carbofuran 3G	66	8.36 (2.98)	7.42 (2.81)	33.44	68.37
6	Neem seed kernel	75	9.34 (3.14)	9.56 (3.17)	25.64	59.25
7	Control	-	12.56 (3.61)	23.46 (4.89)	0.00	0.00
	SE(m)	0.15	0.09			
	CD (p=0.05)	0.46	0.29			

*= Mean of four replications, DAA – Days after application, Values in the parenthesis are square root transformed values.

Table 5. Effect of Oncol 3G on yield of brinjal (season – 1, 2018).

Sl. No.	Treatments	Dose (kg.ha^{-1})	Fruit yield (t ha^{-1})
1	Oncol 3G	20	22.45* (28.27)
2	Oncol 3G	33	24.15 (29.43)
3	Oncol 3G	50	25.20 (30.13)
4	Oncol 3G	80	26.18 (30.77)
5	Carbofuran 3 G	66	23.36 (28.90)
6	Neem seed kernel	75	20.15 (26.67)
7	Control	-	17.44 (24.67)
	SE(m)		0.54
	CD (p=0.05)		1.66

*Mean of four replications; DAA – Days after application, Values in the parenthesis are square root transformed values.

Table 6. Effect of Oncol 3G on yield of brinjal (season – 2, 2019).

Sl. No.	Treatments	Dose (kg.ha^{-1})	Fruit yield (t ha^{-1})
1	Oncol 3G	20	21.86* (27.87)
2	Oncol 3G	33	23.56(29.03)
3	Oncol 3G	50	24.86 (29.90)
4	Oncol 3G	80	25.72 (30.47)
5	Carbofuran 3 G	66	23.24 (28.82)
6	Neem seed kernel	75	19.74 (26.36)
7	Control	-	18.04 (25.12)
	SE(m)		0.61
	CD (p=0.05)		1.87

*Mean of four replications; DAA – Days after application, Values in the parenthesis are square root transformed values.

plots followed by Oncol 50 kg/ha with 25.20 tonnes/ ha, Oncol 3G @ 33kg/ha, Carbofuran 3G @ 66 kg/ ha, Oncol 3G @ 20kg/ha and Neem seed kernel @ 75 kg/ha with 24.15 t/ha, 23.36 t/ha, 22.45 t/ha and 20.15 t/ha respectively. The lowest yield of 17.44 t/ha was recorded in untreated control (Table 5).

Season – 2 (Summer 2019)

Maximum yield of 25.72 tonnes / ha was recorded in Oncol 3G @ 80 kg/ ha treated plots followed by Oncol 50 kg/ha with 24.86 tonnes/ha, Oncol 3G @ 33kg/ha, Carbofuran 3G @ 66 kg/ha, Oncol 3G @ 20kg/ha and Neem seed kernel @ 75 kg/ha with 23.56 t/ha, 23.24 t/ha, 21.86 t/ha and 19.74 t/ha respectively which was also in agreement with Javed *at el*. (2008). The lowest yield of 18.04 t/ha was recorded in untreated control (Table 6), these results are in conformity with Raddy *et al.* (2013).

bable 7. Effect of Oncol 3G on natural enemies of brinjal (Season – 1, 2018)

Sl. No.	Treatments	Dose (kg ha^{-1})	No. of natural enemies/plant 30 DAA Spiders	Beetles	60 DAA Spider	Beetles
1	Oncol 3G	20	0.20	0.15	0.25	0.10
2	Oncol 3G	33	0.25	0.20	0.20	0.15
3	Oncol 3G	50	0.20	0.15	0.25	0.20
4	Oncol 3G	80	0.20	0.20	0.15	0.25
5	Carbofuran 3G	66	0.25	0.26	0.27	0.26
6	Neem seed kernel	75	0.20	0.15	0.30	0.10
7	Control	-	0.25	0.15	0.25	0.20

Table 8. Effect of Oncol 3G on natural enemies of brinjal (Season – 2, 2019).

Sl. No.	Treatments	Dose (kg ha^{-1})	No. of natural enemies/plant 30 DAA Spiders	Beetles	60 DAA Spider	Beetles
1	Oncol 3G	20	0.25	0.10	0.27	0.12
2	Oncol 3G	33	0.20	0.10	0.21	0.16
3	Oncol 3G	50	0.20	0.20	0.26	0.22
4	Oncol 3G	80	0.15	0.15	0.16	0.26
5	Carbofuran 3G	66	0.25	0.10	0.25	0.12
6	Neem seed kernel	75	0.21	0.15	0.31	0.17
7	Control	-	0.30	0.24	0.28	0.22

Natural enemies

The natural enemies population has been recorded in all the treatments at 30 and 60 days after application for both the seasons did not showed any adverse effects (Tables 7-8).

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REFERENCES

Bhosle BB, Sehgal M, Patait DD, Yada SM, Bora BC, Chaudhary BN (2012) Efficacy of nematicides in management of root-knot nematode (*Meloidogyne incognita)* in Okra in farmer's participatory mode. *Pak J Nematol* 30 (1) : 67-73.

Borkakati RN, Venktesh MR, Salkia DK (2019) Insect pests of brinjal and their natural enemies. *J Entomol Zool Stud* 7(1): 932-937.

Jada MY, Gangula DT, Jacob I (2011) Efficacy of Carbofuran in controlling root-knot nematode (*Meloidogyne javanica*) on Cultivars of Groundnut (*Vigna subterranean* L.) in Yolo, Nigeria. *Ind J Agron.*

Javed N, Gowen SR, El-Hassan SA, Inam-ul-haq M (2008) Efficacy of neem (*Azadirachta indica*) formulations on biology of root-knot nematodes on tomato. *Crop Prot* 27(1): 36-43.

Kankam F, Sowley ENK (2016) Evaluation of neem products for the control of root-knot nematode of chilli pepper. *Arch Phytopathol Pl Prot* 49 : 111-119.

Khan MR (2004) Chemical approach for Managing Root-knot Nematode race 2, infecting jute. *Nematol Medit* 32: 195-199.

Khan MR, Mohiddin FA, Khan Mohd (2010) Management of root-knot disease in eggplant through the application of biocontrol fungi and dry neem leaves. *Turkish J Biol* 36 (2): 161-169.

Kumar R, Arumugam S, Premalakshmi V (2020) Evaluation and variability studies in local types of brinjal for yield and quality (*Solanum melongena* L.). *Elect J Pl Breed* 3(4): 977-982.

Priyadarshini DS, Singh J, Sharma D (2019) Morphological characterization of brinjal (*Solanum melongena* L.) germplasm. *J Pharmacog Phytochem* 8 (2) : 1574-1578.

Raddy HM, Ali AF, Montsser SA, Abdel-Lateef MF, Samadisy AM (2013) Efficacy of six nematicides and six commercial bioproducts against root-knot nematode (*Meloidogyne incognita*) on tomato. *J Appl Sci Res* 9 (7): 4410-4417.