Efficacy ofnovalnematicide on root-knot nematode, *Meloidogynejavanica* and establishment of recommended dose in mung bean(*Vigna radiata* L.)

ABSTRACT

The study was carried out to efficacy of newer nematicide (fluensulfone 2% GR) at different doses under field conditions on mung bean.Total seven treatments were used with different doses of fluensulfone 2% GR *i.e.*,T_1- fluensulfone 2% GR 10 kg/ha., T_2 - fluensulfone 2% GR 12 kg/ha., T_3 - fluensulfone 2% GR 14 kg/ha., T_4 - fluensulfone 2% GR 16 kg/ha., T_5- fluensulfone 2% GR 18 kg/ha., T_6- fluensulfone 2% GR 20 kg/ha.,T_7 - carbofuran 3G 50 kg/ha and T_8 - untreated check (control) maintained for comparison. The observations were recorded on plant growth characters (shoot length (cm), shoot weight (gm), root length (cm), and root weight (gm)) and nematode reproduction (number of galls per plant, number of egg mass per plant, number of eggs per egg mass, nematode juveniles per 200 cc soil and final nematode population). Treated plant with fluensulfone 2% GR with the dose of 20kg/ha found to be the best to given the maximum plant growth characters and minimized nematode reproduction.

Keywords: *Mung bean, Root-knot nematode, Meloidogyne javanica, Nematicide,and Management*

1. INTRODUCTION

"Mung bean (*Vignaradiata* L. Wilczek), commonly known as Mung bean or Moong, belonging to the family Leguminoceae and subfamily Papilionceae, isanherbaceous, annual crop, mostly grown under semi-arid and subtropical climate"[1]."Mung bean is widely used as human food, green manure, forage for livestock and for medicinal purposes"[2,3]. "As human food, it is consumed generally as boiled, or cooked with vegetables or meat, as well as a dessert or incorporated in bread or cake"[4]."The root-knot nematodes (*Meloidogyne*spp.) are considered as one of the most destructive pests of mung bean limiting its production" [5]. "Extent of damage caused by root-knot nematode invasion varies with the initial nematode density present in the soil, host, cultural conditions and weather parameters like temperature, moisture etc. *Meloidogynejavanica* may complete its biological cycle in about 30-34 days when soil temperatures range from 25–30°C" [6]."Root-knot nematodes (*Meloidogyne spp*.) are believed to be damaging approximately 50% of the global food grain production and thus, have been regarded as one of the most destructive plant pathogens" [7]."These soil pathogens cause typical root galls that interfere with nutrients and water absorption resulting in nutritional deficiencies reflected in leaf yellowing and stunted growth which affect the yield of crops both qualitatively and quantitatively"[8]."Severe economic losses up to 14 to 29% in mung bean has been reported" [9,10]."Management of nematode is much difficult as compare to other pathogen because nematodes mainly attack underground parts of plants"[11]. "Fluensulfone is a new nematicide of

the fluoroalkenyl group that has significantly reduced environmental impact with low toxicity to non-target insects and mammals.New non-fumigant nematicides (fluensulfone) were tested in sick field mung bean trials aiming to evaluate its efficacy on the control of *Meloidogyne javanica* soil and root populations and plant productivity. Fluensulfone is a new nematicide of the fluoroalkenyle chemical class that was registered in theUSA in 2014, capable of affecting the nematodes mobility, with an irreversible nematicidal activity, which differs from the nematostatic organophosphates and carbamates" [12]. "Studies on the appro-priate methods of application and efficacy of fluensulfone are still limited, as their mode of action remains unknown, however, some studies have shown the effectiveness of this nematicide in the control of *Meloidogyne"* [13,14,12].Present study the effect of various doses of fluensulfone and chemical check carbofuran 3G were investigated for the management of root knot nematode, *Meloidogyne javanica* affecting the mung bean (*Vigna radiata*).

2. MATERIALS AND METHODS

The experiments on nematode management were conducted in root-knot nematode infected sick field, Division of Nematology at the Rajasthan Agricultural Research Institute (RARI), Durgapura, Jaipur (Rajasthan).An experiment was carried out to test the efficacy of various dose of newer nematicide (fluensulfone 2% GR). The required quantity of newer nematicide was measured separately for each replication with the doses of *i.e.*, T_1- fluensulfone 2% GR 10 kg/ha., T_2 - fluensulfone 2% GR 12 kg/ha., T_3- fluensulfone 2% GR 14 kg/ha., T_4- fluensulfone 2% GR 16 kg/ha., T_5- fluensulfone 2% GR 18 kg/ha., T_6- fluensulfone 2% GR 20 kg/ha. And T_7 - carbofuran 3G 50 kg/ha as a chemical check, T_8 - untreated check (control). Fluensulfone 2% GR mixed in soil at the time of sowing as per treatment wise and sowing of mung bean crop. The experiment was laid out in randomized block design (RBD) with 3 replications(750 m^2 each replication). Observations were recorded on plant growth parameters {shoot length (cm), root length (cm), shoot weight (gm), root weight(gm), yield (q/ha.)} and nematode reproduction (number of galls per plant, number of egg masses per plant, number of eggs per egg mass, nematode juveniles per 200 cc soil and final nematode population).

2.1 Statistical Analysis

After completion of experiment, data were statically analyzed for interpretation of research findings. The critical deference was calculated for comparison of treatment for significant at 5% level of significance. Summary table along with SEm±, CD and CV were worked out.

3. RESULTS

To test the efficacy of newer nematicide (Fluensulfone 2% GR) at different doses under field conditions in mung bean. Total seven treatments were used with different doses of fluensulfone 2% GR *i.e.*, T_1- fluensulfone 2% GR 10 kg/ha., T_2 - fluensulfone 2% GR 12 kg/ha., T_3 - fluensulfone 2% GR 14 kg/ha., T_4 - fluensulfone 2% GR 16 kg/ha., T_5- fluensulfone 2% GR 18 kg/ha., T_6- fluensulfone 2% GR 20 kg/ha., T_7 - carbofuran 3G 50 kg/ha and T_8 - untreated check was also maintained for comparison. The observations on plant growth characters (shoot length

(cm), shoot weight (gm), root length (cm), and root weight (gm)) and nematode reproduction (number of galls per plant, number of egg mass per plant, number of eggs per egg mass, nematode juveniles per 200 cc soil and final nematode population) were recorded.

3.1 Plant Growth Parameters:

Result showed that application of nematicidefluensulfone 2% GR 20 kg/ha was recorded as the most effective treatment with maximum plant growth characters {shoot length (57.33 cm), shoot weight (20.58 gm), root length (23.33 cm), root weight (13.50 gm) and Yield (q/ha) (6.72)} followed by fluensulfone 2% GR 18 kg/Ha, carbofuran 3G @ 50 kg/ha. While, minimum plant growth characters and maximum nematode reproduction was observed with untreated check.

3.2 Nematode Reproduction Parameters:

Result showed that significantly decreased number of galls per plant as compared to untreated check. Among application of nematicidefluensulfone 2% GR 20 kg/ha was recorded as the most effective treatment with minimum nematode reproduction parameter {number of galls per plant (10.67), number of egg mass per plant (7.67), number of eggs per egg mass (146.67), nematode juveniles per 200cc soil (165.67) and final nematode population (1332.33)} followed by fluensulfone 2% GR 18 kg/Ha, carbofuran 3G @ 50 kg/ha. While, minimum plant growth characters and maximum nematode reproduction was observed with untreated check.

4. DISCUSSION

"The findings of present investigation were similar with findings of studies have shown that fluensulfone has a broad range of effects that impact on nematode reproduction, development, feeding and motility and ultimately has nematicidal action. Whilst *C. elegans* is less susceptible to fluensulfone than *M. javanica"* [12]."Proved fluensulfone to be very effective in controlling root-knot nematodes, *Meloidogyne* spp. by soil application. whereas, fluensulfone can effectively control *Xiphinema* and *Longidorus* in fig plant especially by pre-planting treatment" [14]."Observed low rates of gall in lima bean when submitted to treatment with fluensulfone, this treatment also increased the productivity" [15]."Tested new non-fumigant nematicides (fluensulfone, fluopyram and fluazaindolizine) in greenhouse tomato to evaluate their efficacy on the control of Meloidogyne incognita in soil and root populations along with plant productivity" [16]. "Recorded metham sodium @ 45 ml/m 2 as the most effective fumigant followed by metham sodium @ 35 ml/m2 and STTC @ 45 ml/m2 over control to reduce nematode reproduction and enhance plant growth characters" [17]. "Studied the management of complex diseases caused by *Meloidogyne incognita* and Fusarium fungus and found the significant reduction in nematode population and maximum improvement in plant growth parameter with carbofuran treated plot"[18]. The observations of our study and other researchers show that use of chemical nematicide will reduce the nematode infestation in different crops and also increase the plant growth characters.

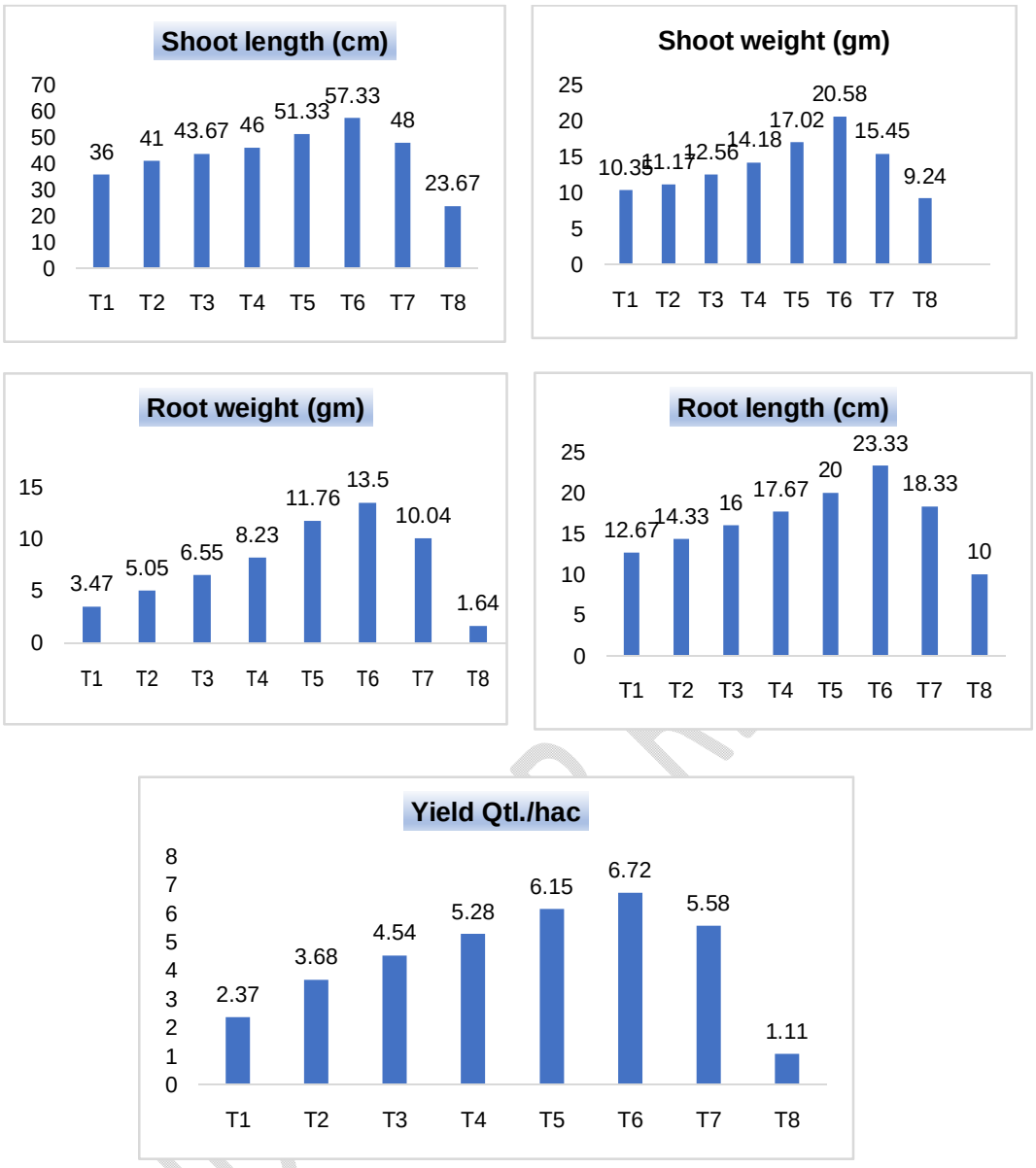
Table 1: Efficacy of newly nematicide on plant growth characters and nematode reproduction in sick field

Treatment	Plant Growth Characters				Yield q/ha	Nematode Reproduction				
	Shoot length (cm)	Shoot weight (gm)	Root length (cm)	Root weight (gm)		No. of galls/ Plant	No. of egg masses/ Plant	Number of eggs/egg mass	Nematode juvenile/ 200cc soil	Final nematode population
T1	36.00	10.35	12.67	3.47	2.37	55.33	54.33	207.00	582.00	11,757.67
T2	41.00	11.17	14.33	5.05	3.68	46.67	44.67	194.00	541.67	9,114.00
T3	43.67	12.56	16.00	6.55	4.54	39.00	37.00	184.67	506.67	7,222.66
T4	46.00	14.18	17.67	8.23	5.28	29.00	27.00	173.00	426.67	5,038.33
T5	51.33	17.02	20.00	11.76	6.15	15.33	13.67	155.33	228.33	2,417.66
T6	57.33	20.58	23.33	13.50	6.72	10.67	7.67	146.67	165.67	1,332.33
T7	48.00	15.45	18.33	10.04	5.58	21.00	19.00	165.33	247.67	3,440.33
T8	23.67	9.24	10.00	1.64	1.11	87.33	90.00	261.67	659.33	24,105.33
SEm±	1.94	0.53	0.64	0.18	0.18	2.77	3.08	4.80	22.32	564.85
CD 5%	5.67	1.55	1.87	0.52	0.54	8.10	9.02	14.05	65.30	1,729.90
CV	7.74	6.66	6.71	4.11	7.18	12.61	14.56	4.47	9.21	12.14

1. Initial Nematode Population – 441J2/ 200cc Soil 2. Average value of three replication

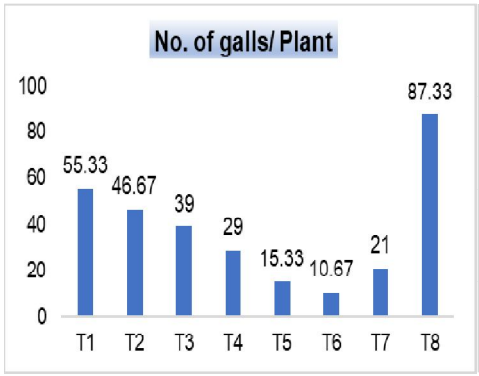
T_1- Fluensulfone 2% GR @ 10kg/ha T_2- Fluensulfone 2% GR @ 12kg/ha T_3- Fluensulfone 2% GR @ 14kg/ha T_4- Fluensulfone 2% GR @ 16kg/ha

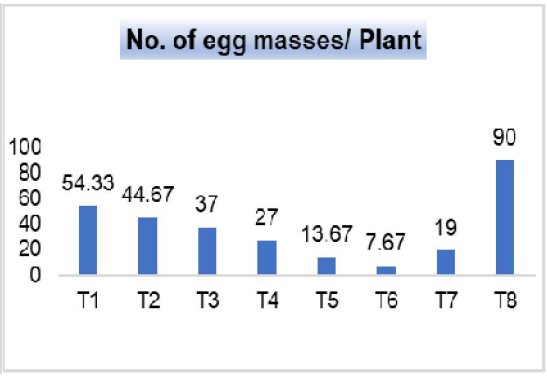
T_5- Fluensulfone 2% GR @ 18kg/ha T_6- Fluensulfone 2% GR @ 20kg/ha T_7- Chemical check (carbofuran 3G @ 50 kg/Ha) T_8- control

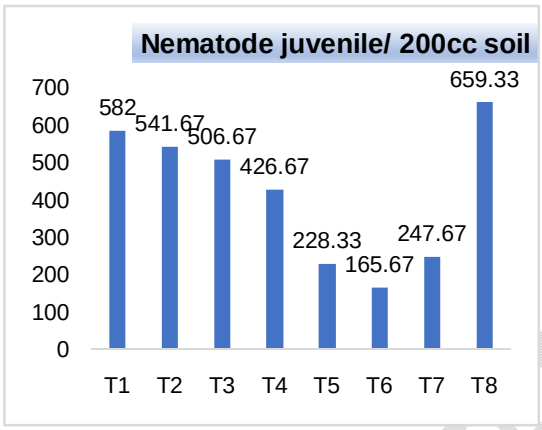


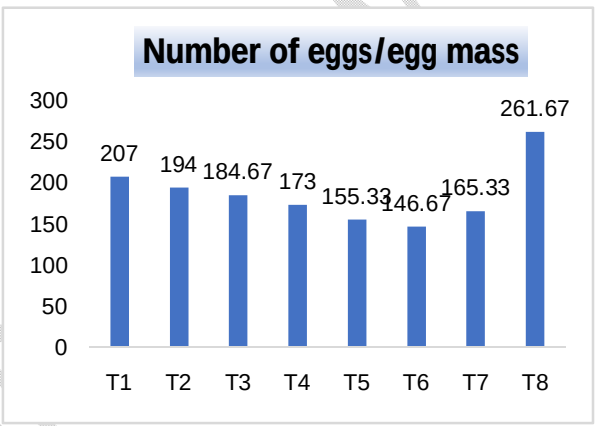
T_1- Fluensulfone 2% GR @ 10kg/ha
T_2- Fluensulfone 2% GR @ 12kg/ha
T_3- Fluensulfone 2% GR @ 14kg/ha
T_4- Fluensulfone 2% GR @ 16kg/ha
T_5- Fluensulfone 2% GR @ 18kg/ha
T_6- Fluensulfone 2% GR @ 20kg/ha
T_7- carbofuran 3G @ 50 kg/Ha
T_8- control

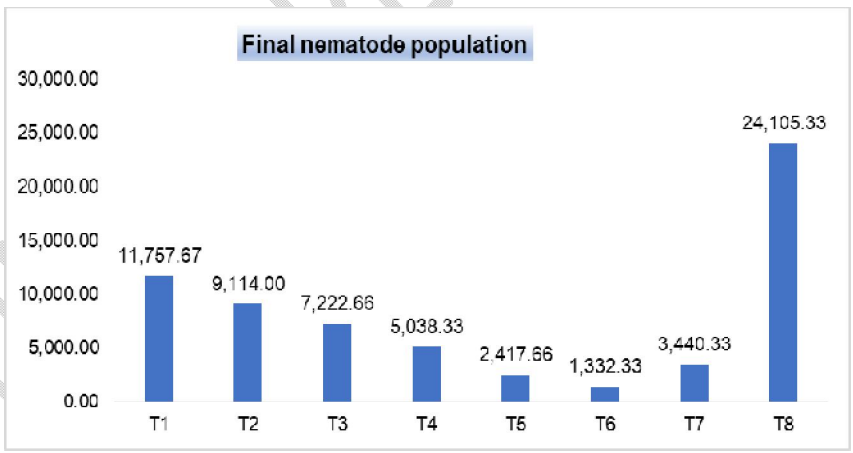
Fig.-1. Efficacyofnewer nematicide on plant growth characters in mung bean infected with root-knot nematode, *M. Javanica*











T_1- Fluensulfone 2% GR @ 10kg/ha
T_2- Fluensulfone 2% GR @ 12kg/ha
T_3- Fluensulfone 2% GR @ 14kg/ha
T_4- Fluensulfone 2% GR @ 16kg/ha
T_5- Fluensulfone 2% GR @ 18kg/ha
T_6- Fluensulfone 2% GR @ 20kg/ha
T_7- carbofuran 3G @ 50 kg/Ha
T_8- control

Fig.-2. Efficacyofnewer nematicide on nematode reproduction in mung bean infected with root-knot nematode, *M. Javanica*

5. CONCLUSION

Root-knot nematode is considered one of the serious pests that cause huge economical loss to different agricultural plants and reduce the production. Our study demonstrated that fluensulfone is an effective tool for managing *Meloidogyne javanica* in mung bean. In addition, the low worker safety concerns, easy of application. The newer nematicidefluensulfone 2% GR with the dose of 20 kg/ha was found the best in giving maximum plant growth parameters of mung bean and minimum population of *Meloidogyne javanica*.

Disclaimer (Artificial intelligence)

I hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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