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Research Article

Effect of Insecticidal Seed Treatment on Germination, Termite (*Odontotermes obesus* Rambur) damage and yield in Wheat under Rainfed Condition

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Abstract

Field experiment on the seed treatment for the management of termite infestation in wheat under rainfed condition was conducted during *Rabi* 2016-17 and 2017-18. Eight treatments including untreated check (control) were tested on wheat cultivar Maghar (K 8027). Seven insecticides *viz;* Thiamethoxam 25 WG @ 3.2 g, Acephate 50% + Imidachloprid 1.8 % @ 4.0 g, Fipronil 5 SC @ 10 ml, Imidacloprid 600 FS (48%) @ 4.0 ml, Clothianidin 50 WDG @ 1.5 g, Fipronil 40% + Imidacloprid 40 WG @ 3.0 g and Chlorantranil pride @ 3.0 ml were used for seed treatment of one Kg seed before sowing. Non-significant differences in germinability of seed were observed in all the treatments. The order of effectiveness of insecticides on termite damage was Fipronil 40% + Imidacloprid 40 WG > Fipronil 5 SC> Imidacloprid 600 FS (48%)> Clothianidin 50 WDG> Thiamethoxam 25 WG> clorantranil pride in both the years. Significantly higher seed yield of 21.0 q/ha was recorded in seed treated with Fipronil 40% + Imidacloprid 40 WG against untreated control (15.42q/ha) which was at par with Fipronil 5 SC (20.92 q/ha) and Imidacloprid 600 FS (48%) (20.58 q/ha) during 2016-17. In the year 2017-18 treatment Fipronil 40%+Imidacloprid 40 WG gave significantly higher grain yield of 20.46 q/ha against untreated control (15.33q/ ha) followed by Fipronil 5 SC (20.38 q/ ha) and Imidacloprid 600 FS (20.06 q/ ha).

Keyword: grain yield, insecticide, maghar (k 8027), wheat

1. Introduction

Wheat (*Triticum aestivum Linn.)* is one of the important cereal crops of India. It has been considered as integral component of food security system of several nations. It ranks first in world among the cereals both in respect of average area 215.61 m ha and production 713.2 m ton. Wheat is major staple food crop after rice in south east Asia (FAO..2013-14). In U.P. area production and productivity of wheat is 9.85 million hectare, 32.20 million metric ton and 32.69 q/ha respectively (Annual progress report of AICW&BIP 2018-19). Uttar Pradesh ranks first in area and production in India. Termite is the major pest of agricultural crops including wheat in tropical and subtropical regions of the world. The plants damaged by termite dries up and die and in turn the yield is reduced drastically, because the losses inflicted at or near maturity cannot be compensated (Verma and Kashyap, 1980). Usually in a termite colony 80 to 90 per cent individuals are workers and about ten percent are soldiers. The workers are mainly responsible for damaging the crop (Srivastava, 1993). On the basis of the above facts, the present study was taken up to manage the termite damage through insecticidal seed treatment and minimising the yield losses.

2. Materials and Methods

The experiment was conducted during the year 2016-17 and 2017-18 at Crop Research Farm, Nawabganj, C.S. Azad University of Agriculture & Technology, Kanpur. The experimental field was ploughed twice and soil was made fine. The experiment was laid out in randomized block design (RBD) with three replications. There were eight treatment namely; Thiamethoxam 25 WG @ 3.2 g, Acephate 50% + Imimdachloprid 1.8 % @ 4.0 g, Fipronil 5 SC @ 10 ml, Imidacloprid 600 FS (48%) @ 4.0 ml, Clothianidin 50 WDG @ 1.5 g, Fipronil 40% + Imidacloprid 40 WG @ 3.0 g, Chlorantranil pride @ 3.0 ml per Kg of seed and untreated control. Size of the plot was 4.0m x 5.0 m and fertilizer was applied @ 60 Kg N, 40 Kg P_2O_5 and 30 Kg/ha at the time of sowing. The seed of wheat cultivar Maghar (K 8027) was used @ 100 Kg/ ha for the experiment. Normal agricultural practices were followed to raise a good and healthy crop.

2.1 Insecticidal application

The seed treatment with insecticides was done one day before sowing. From the E.C. formulation equivalent a.i. amount was diluted in water and uniformly sprayed on one Kg of seed kept in the tray. The seed was turned over frequently to ensure proper mixing and then was left over night for drying. On next day sowing was done in furrows behind the deshi plough and row to row distance was maintained at 23 cm apart. The amount of insecticides was calculated by formula given below:

$$\text{Quantity of the proprietary insecticides required} = \frac{\text{Percentage of active Ingradient in the spray solution desired} \times \text{Total quantity of spray solution required}}{\text{Percentage of the active ingredient of the Propriety insecticides.}}$$

The data on healthy and affected plant population per meter row length, number of affected and healthy tillers/ meter and total tillers were recorded after 3, 4 and 5 weeks after sowing from five marked spots. The severity of termite damage was determined by counting the damaged plants in two meter row length randomly from ten spots after 3, 4 and 5 weeks of sowing. Total plants from these spots were also counted in similar fashion. The final data is presented as per cent damaged plants per meter row. The per cent damage plants were calculated by using formula given by G.S. Deol (2003).

$$\text{Percent Damage plant} = \frac{\text{No. of damaged plants / m. row}}{\text{Total No. of plants / m. row}} \times 100$$

2.2 Grain yield

The effect of different insecticidal seed treatments on grain yield was measured in following two ways:

From pre marked spots and expressed in g/m row length.

From net plot including the pre marked spots and expressed in q/ ha.

2.3 Statistical analysis

All the percentage data was converted in angular transformed values and analyzed statistically. The critical difference and standard error of mean were calculated for the comparison of treatments against control.

3. Results and Discussion

The data recorded on various traits has been presented in Table 1 and 2. No significant effect on germinability of wheat was observed in all treatments in both the years. The incidence of termite upto 3 weeks of sowing was not observed in any treatment during both the years ie. 2016-17 and 2017-18. However, incidence of termite after 4 weeks of sowing was low in all treatments, which ranged from 0.39 to 0.64 per cent while in untreated control it was 3.27 per cent in 2016-17 and range from 0.45 to 0.73 per cent while in untreated plot it was 3.41 per cent in 2017-18. The incidence of termite damage after 5 weeks of sowing ranged from 1.57 to 1.71 per cent, in comparison to 3.46 per cent in untreated control in year 2016-17. In the year 2017-18, the termite damage ranged from 1.61 to 1.79 per cent in comparison to 3.61 per cent in control. The percent damage was statistically at par in plot treated with Fipronil 5 SC and Imidacloprid 600 FS. Minimum damage was recorded in plot treated with Fipronil 40% + Imidacloprid 25 WG which did not differ significantly from Acephate 50% + Imidacloprid 1.8% and Chlorantranil pride. All the insecticides were found to be effective in reducing termite damage as compared to untreated checks in both the years.

The damaged tillers/meter row were minimum (1.41%) in Fipronil 40% + Imidacloprid 40 WG which was as par with Fipronill 5 SC (1.50%) and Imidacloprid 600FS (1.53%) in the year 2016-17. In year 2017-18 it was 1.46% in Fipronil 40% + Imidacloprid 40WG treated plot, which was at par with Fipronil 5SC (1.50%) and Imidacloprid 600 FS (1.51%). All the insecticidal seed treatments showed control of damage over untreated check in minimizing the damage of tillers. The damaged tillers/ha in different treatments ranged from 3033.33 to 4916.66 against control

Table 1. Effect of insecticidal seed treatment on the germination, termite damage and yield during 2016-2017.

Treatments	Actual Dose gm/ ml/Kg of seed.	Confirmative test on germination (%)	Plant population/m row	Per cent damaged shoots/m row			Per cent damaged effective tillers/m row at crop maturity	No. of damaged effective tillers/ha at harvest	Grain yield	
				3 weeks	4 weeks	5 weeks			g/m row	q/ha
Thiamethoxam 25 WG	3.2g	91.0	33.73	0	0.57* (4.33)	1.69* (7.27)	1.57* (7.04)	3583.33 (59.86)	39.83	20.41
Acephate 50% + Imidacloprid 1.8 %	4.0g	93.0	34.53	0	0.64* (4.59)	1.71* (7.49)	1.70* (7.49)	4916.66 (70.11)	39.65	20.05
Fipronil 5 SC	10ml	92.0	33.86	0	0.41* (3.67)	1.57* (7.04)	1.50* (7.04)	3166.67 (56.27)	45.94	20.92
Imidacloprid 600 FS (48%)	4.0ml	91.0	35.60	0	0.48* (3.97)	1.64* (7.27)	1.53* (7.04)	3433.33 (58.59)	44.89	20.58
Clothianidin 50 WDG	1.5g	90.0	34.13	0	0.51* (4.09)	1.67* (7.27)	1.56* (7.04)	3533.33 (59.44)	40.84	20.50
Fipronil 40% + Imidacloprid 40 WG	3.0g	91.0	32.36	0	0.39* (4.01)	1.57* (7.04)	1.41* (6.80)	3033.33 (55.07)	47.16	21.00
Chlorantanil pride	3.0ml	95.0	35.90	0	0.64* (4.59)	1.70* (7.49)	1.60* (7.27)	4666.66 (68.31)	39.62	20.25
Control	-	94.0	34.03	2.91	3.27* (11.09)	3.46* (10.63)	3.75* (11.09)	16833.33 (129.74)	31.65	15.42
SEm±	-	NS	-	-	0.404	0.262	0.233	2.106	1.360	0.245
CD at 5%	-	NS	-	-	1.220	0.793	0.704	6.369	4.113	0.741

* Actual mean values, Figures within parenthesis represent angular transformed values

Table 2. Effect of insecticidal seed treatment on the germination, termite damage and yield during 2017-2018.

Treatments	Actual Dose gm/ ml/ Kg of seed	Confirmative test on germination (%)	Plant population/m row	Per cent damaged shoots/m row			Per cent damaged effective tillers/m row at crop maturity	No. of damaged effective tillers/ ha at harvest	Grain yield	
				3 weeks	4 weeks	5 weeks			g/m row	q/ha
Thiamethoxam 25 WG	3.2 g	94.0	30.70	0	0.64* (4.59)	1.75* (7.49)	1.63* (7.27)	3616.66 (60.13)	45.83	18.71
Acephate 50% + Imidacloprid 1.8 %	4.0 g	90.0	33.83	0	0.73* (4.6)	1.79* (7.49)	1.78* (7.49)	3758.33 (61.30)	44.48	18.22
Fipronil 5 SC	10.0 ml	95.0	33.83	0	0.51* (4.09)	1.62* (7.27)	1.50* (7.04)	3200.00 (56.56)	47.83	20.38
Imidacloprid 600 FS (48%)	4.0 ml	90.0	32.4	0	0.57* (4.33)	1.66* (7.27)	1.51* (7.04)	3383.33 (58.16)	44.10	20.06
Clothianidin 50 WDG	1.5	95.0	31.40	0	0.58* (4.37)	1.75* (7.49)	1.56* (7.04)	3566.66 (59.72)	47.30	19.17
Fipronil 40% + Imidacloprid 40 WG	3.0 g	92.0	35.4	0	0.45* (3.85)	1.61* (7.27)	1.46* (6.80)	3163.33 (56.24)	47.96	20.46
Chlorantaniliprid 18.5SC	3.0 g	91.0	31.23	0	0.69* (4.76)	1.76* (7.49)	1.73* (7.49)	3716.66 (60.96)	47.83	18.25
Control	-	92.0	33.9	3.05	3.41* (10.63)	3.61* (10.49)	3.84* (11.24)	17583.33 (132.60)	32.66	15.33
SEm±		NS	NS	-	0.11	0.52	0.06	1.44	0.38	0.24
CD at 5%		NS	NS	-	0.37	1.79	0.20	3.84	1.30	0.82

* Actual mean values, Figures within parenthesis represent angular transformed values

(16,833.33) in the year 2016-17 and 3163.33 to 3758.33 against control (17,583.33) in the year 2017-18. All the treatrments showed significantly lower number of affected tillers /ha as compared to untreated checks in both the years. Anonymous (2013) found that the per cent damage shoots/meter row recorded after 5 weeks of sowing per cent damaged shoot/m row was maximum (0.75%) in Carbosulfan 25 DS while it was minimum in Clothianidin 50 WDG (0.1%). They also observed that at the ear head stage again Clothianidin 50 WDG recorded lowest per cent damage effective tillers/m row and was at par with firponil 5 SC and Thiamethoxam 70WS. According to the Bhanot *et al.* (1991) Aldrin, chlorpyriphos and endosulfan reduce termite damage. The most effectively grain yield was increased by treatment with Formothion, Aldrin, Chlorpyriphos followed by Endosulfan and Carbaryl.

Grain yield (g/m row and q/ha) was significantly higher in plots treated with Fipronil 40% + Imidacloprid 40 WG (21.0 q/ha) followed by Fopronil 5 SC (20.92 q/ha) and Imidacloprid 600 FS (20.58 q/ha) in 2016-17. In the year 2017-18 the grain yield was significantly higher in treatment with Firponil 40% + Imidacloprid 40WG (20.46 q/ha) followed by firponil 5SC (20.38 q/ha) and Imidacloprid 600 FS (20.06 q/ha).

According to Anonymous (2013) the grain yield obtained from various treatment revealed that Clothianidin treated plots gave significantly higher grain yield (27.10 q/ha) than untreated control while all the insecticidal treatments were at par with each other and gave significantly higher grain yield than untreated check.

Conflict of Interest

Authors declare that they have no conflict of interest.

Ethical Compliance Statement

NA

Author's Contribution

JK, PKG, JBK: Collection of literature, Conceptualization, Compilation, Writing original draft; SVS, CK: Final editing, Proof Reading

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