

Original Research Article

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Wheat Crop Damaged by Termite and Co-Related of Different Doses of Insecticidal Treatment Compared with Yield in Standing Crop

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ABSTRACT

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The experiment on wheat was conducted at Crop Research Farm, Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur during *Rabi* season 2014-15. The attack of termite was observed on 23.12.2014 in seedling stage and caused up to 30 per cent damage to wheat crop and co-related different doses of insecticides with yield. On wheat variety, K-402 (Mahi) and eight treatments with control. The damage of affected tillers/m row as minimum 0.40 and 0.41 per cent in the fipronil 5 SC @ 3.0 lit/ha and imidacloprid 600 FS @ 1.5 lit/ha. Grain yield g/m row and q/ha significantly higher in treated plot with fipronil 5 SC @ 3.0 lit/ha and imidacloprid 600 FS @ 1.5 lit/ha with 39.75q/ha and 39.25 q/ha respectively. All the insecticides were found to be effective in reducing the termite damage as compared to untreated checks.

Introduction

Wheat (*Triticum aestivum* L.) is one of most important cereal crops with annual global production over 600 MT from about 200 M hectares (FAO 2012). The cultivation of wheat started about 10,000 years ago as part of the Neolithic revolution which state a transition from hunting and gathering of food to settle agriculture. Earlier cultivated forms of wheat were diploid (einkorn) and tetraploid (emmer) with known initial origin of the south-eastern part of Turkey (Dubcovsky and Dvorak, 2007). Subsequent evolutionary adaptation and continuous research produced hexaploid bread wheat that is currently widely

adapted in about 95% area of world wheat. Globally, all crop production practices are being highly challenged by biotic and abiotic stresses. Biotic stresses especially insect pests and diseases causes devastating damage in terms of yield and quality. On average pests cause 20-37% yield losses worldwide which is translating to approximately \$70 billion annually (Pimentel *et al.*, 1997). In which, the termite acts as one of the major insect-pest of the crop in the country and particularly under rain fed situations. In the state of Rajasthan, the situation is more warming as the termite inflicts is heavy damage to the crop,

cultivated in sandy loam soil moisture regime (Parihar, 1981). The common insect pest that attack wheat crop are *Odontotermes obesus* Rambur, *Microtermes obesi* Holmgren, *Tanymecus indicus* Faust, *Agrotis ypsilon* Hub, *Atherigona naqvii* Styskal, *Sesamia inferens* Wlk, *Cirphis spp*, *Mythmina separate* Wlk, *Tetranychus spp*, *Rhopalosiphum maidis* Fitch, *R. padi*; *Microsiphum miscanthi* Takehashi, *Helicoverpa armigera* Hubner, *Empoasca devastans* ishida, *Chrotogonus brachypterus* Fabr, *Attractomorpha crenulata* Fabr, *Tetranychus spp*, *Spilorcera obliqua* Walk, *Scirtothrips dorsalis*, *Trichoplusia ni*, *Melongromyza phasesoli* Cog and *Agrister mancus* which, cause losses in the yield of wheat crop (Singh and Upadhyay, 1993 and Misra *et al.*, 2003).

In field condition the termite (*Odontotermes abesus* Rambur) is predominant insect-pest causing 20-40% damage to the crop particularly in rainfed condition (Misra *et al.*, 2003).

Termite is the major pest of agricultural crops in tropical and sub-tropical regions of the world. In Indian region, about 270 termite species have been recorded of which 40 species have been found injurious to economic plants. They belong to three important genera, *Angulitermes*, *Microtermes* and *Odontotermes* but also species i.e. *Microtermes obesi* and *Odontotermes obesus* account for almost 80 per cent of total loss in South Asia. Termites live in colonies which consist of over a few hundreds to a million individuals and their division of labour is based on caste system. Usually in a termite colony, 80 to 90 per cent individual are as workers and about 10 per cent soldiers (Srivastava, 1993).

Due to termite damage the plants is dry up and can be easily pulled up. The damage starts right from the sowing of the crop till

harvest. Damage due to termite may lead to poor germination in crop like sugarcane, wheat, gram, maize, cotton, groundnut, Chillies etc. however, their incidence in grown up plants, the yields are reduced drastically because the losses inflicted at or near maturity cannot be compensated (Verma and Kashyap, 1980).

Mostly the termites live in underground nest with ramification of galleries in which they move about, it is rather difficult to locate and reach them. So before adoption of integrated management approach it is essential to know about life cycle of the pest. Termite is a social insect and its colony organization is based on cast system. In a colony, there are numerous workers, sliders and one queen. A king and good number of complementary or the colonizing forms of true but immature males and female. On the basis of the above facts, the present study was carried out to the termite and co-related of different doses of insecticidal treatment compared with yield in standing crop.

Materials and Methods

The present investigations were carried out at Research Farm, Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur, during the year 2014-2015. The experiment was conducted for the control of termite was laid out in Randomized block design (RBD) with 3 replications with plot measuring 4×5 m. The insecticides and their dose tested in the present investigation are given in the Table 1 while the details of insecticides regarding availability and manufacturing are given in Table 2.

Insecticidal application

All the insecticides were applied after germination of 1st irrigation of standing wheat crop. The E.C. formulation equivalent to a.i.

amount were mixed with soil /sand @ 80-100 kg/ha and then broadcasted evenly in the plot one day before the time of 1st irrigation. The amount of insecticide was calculated by formula

$$\text{Required amount of insecticides} = \frac{\text{Vol. of water (lit/ ha)} \times \text{Desired cons. (\%)}}{\text{Strength of insecticides formulation}}$$

Observations on termite infestation

The data on plant population per meter row, number of affected tiller with healthy followed by total healthy tiller were recorded after 3, 4 and 5 weeks after sowing from five marked spots. The severity of termite damage can be determined by counting the damage plant in two meter row length randomly from ten spots after 3, 4 and 5 weeks after sowing. Also total plants from these spots are counted 3, 4 and 5 weeks after sowing the final data presented as per cent damaged plant for meter row. When the crop is nearing maturity but still green than damaged ear heads should be counted and removed.

The total number of damaged ear heads from the net plot (except the two border row) should expressed number of damaged effective tillers per ha.

$$\text{Plant damage (\%)} = \frac{\text{Number of Plant Damaged per meter row}}{\text{Total number of plant per meter row}} \times 100$$

Grain yield

The effect of different insecticidal treatments on grain yield:

From per marked spots and expressed in g/m row length

From net plot

Including the pre marked spots an expression in q/ha.

Statistical analysis

All the percentage data were subjected to angular transformations and analysed statistically. The critical difference and standard error were calculated for the comparison of treatments and control.

Results and Discussion

Major insect pest of wheat and their natural enemies under experiment was conducted at Research Farm of Nawabganj C.S.A University of Agriculture and Technology Kanpur, during the cropping season, year 2014-15.

In the Table 3 the incidence of termite after 3 weeks of sowing and after treatment of 1st irrigation the incidence was very low in all the treatment, which range from 0.33 to 0.60 per cent, while in untreated plot it was 2.52 per cent. The incidence of termite after four weeks of sowing ranged 0.36 to 0.61 while in untreated plot 2.72 per cent. The incidence of termite after 5 weeks of sowing ranged 0.38 to 0.71 per cent in comparison to 2.63 per cent in untreated plot. The per cent damage shoot was statistically at par in plots treated imidacloprid @ 500 ml /ha fipronil 5 SC lower dose @ 2.5 lit/ha and imidacloprid 600 FS lower dose @ 1.0 lit /ha.

The minimum damage shoot were recorded in the plot treated with fipronil 5 SC @ 3.0 lit/ha and imidacloprid 600 FS @ 1.5 lit/ha which did not differ significantly from imidacloprid 17.8 % lower dose @ 400 ml/ha and chlorpyrifos @ 4.5 lit/ha. All the insecticides were found to be effective in reducing termite damage as compared to untreated checks.

The damage of affected tillers /m row as minimum 0.41 per cent in fipronil 5 SC @ 3.0 lit/ha which was at par with affected tillers

recorded in imidacloprid 17.8 % SL @ 500 ml/ha (0.59 per cent) fipronil 5 SC lower dose @ 2.5 lit/ha (0.67 per cent) and imidacloprid 600 FS @ 1.0 lit /ha (0.46) per cent. All the insecticide treatment should superiority over untreated check in minimizing the affected

tillers. The damage number of affected tillers /ha in different ranged from 3416.66 to 8766.66 while it was 145250.00 in untreated plots. All the treatment showed minimum damage number of the affected tillers/ha compared to untreated (check) (Table 4).

Table.1 Insecticides and their dosage used in experiment

Insecticides	Trade Name	Dosage (g a.i/ha)	Actual dose/ha
Fipronil	Regent	125	2.5 lt
Fipronil	Regent	150	3.0 lt
imidacloprid	Imiden	80	400 ml
imidacloprid	Imiden	100	500 ml
imidacloprid	Gaucho	480	1.0 lt
imidacloprid	Gaucho	720	1.5 lt
chlorpyrifos	Lethal	900	4.5 lt

Table.2 Details of Insecticides used in experiment

Insecticides	Formulation	Source of supply
Fipronil	5 SC	M/S Byer crop science India Ltd, Mumbai.
imidacloprid	17.8%SL	Agro sciences India Pvt.Ltd, USA.
imidacloprid	600 FS	M/S Byer crop science India Ltd, Mumbai.
chlorpyrifos	20 EC	M/S Is agro (Asia) agro chemical Pvt. Ltd. Mumbai,

Table.3 Effect of insecticidal treatment through broadcasting on per cent damage shoot/m row

S. No.	Treatments	Dose g a.i/kg	Actual Dose(Ha)	Plant Population/m row	Per cent damaged shoot/m row		
					3 weeks	4 weeks	5 weeks
1.	fipronil 5 SC (Regent)	125	2.5 lit	40.73	0.50 (6.063)	0.52 (4.144)	0.61 (4.507)
2.	fipronil 5 SC (Regent)	150	3.0 lit	47.60	0.33 (3.380)	0.36 (3.452)	0.38 (3.559)
3.	imidacloprid 17.8%SL	80	400 ml	41.00	0.57 (4.349)	0.58 (4.367)	0.69 (4.773)
4.	imidacloprid 17.8%SL	100	500 ml	40.30	0.37 (3.513)	0.47 (3.976)	0.46 (3.876)
5.	imidacloprid 600 FS	480	1.0 lit	45.66	0.37 (3.513)	0.41 (3.669)	0.45 (3.859)
6.	imidacloprid 600 FS	720	1.5 lit	43.53	0.36 (3.379)	0.40 (3.619)	0.42 (3.710)
7.	chlorpyrifos 20 EC	900	4.5 lit	42.83	0.60 (4.453)	0.61 (4.472)	0.71 (4.831)
8.	untreated check	-	-	40.43	2.52 (9.140)	2.72 (9.318)	2.63 (9.341)
	S. Em ±	-	-	-	0.136	0.164	0.140
	CD at 5%	-	-	-	0.408	0.509	0.416

*Figure in parentheses represents angular mean value

Table.4 Effect of insecticidal treatment damage affected tillers and grain yield

S. No.	Treatments	Dosage g a.i/kg	Actual Dose\ Ha	damaged effective tillers/m row at maturity stage	N0.of damaged effective tillers/ha at maturity stage	Grain yield	
						g/m row	q/ha
1.	fipronil 5 SC (Regent)	125	2.5 lit	0.67 (4.695)	7050.00 (83.953)	73.82	38.41
2.	fipronil 5 SC (Regent)	150	3.0 lit	0.41 (3.669)	3416.66 (58.447)	78.49	39.75
3.	imidacloprid 17.8%SL	80	400 ml	0.71 (4.835)	7766.00 (88.115)	72.23	37.50
4.	imidacloprid 17.8%SL	100	500 ml	0.59 (4.410)	4291.66 (79.290)	77.23	38.91
5.	imidacloprid 600 FS	480	1.0 lit	0.46 (3.882)	4450.00 (66.614)	77.26	38.16
6.	imidacloprid 600 FS	720	1.5 lit	0.44 (3.799)	4386.66 (66.115)	77.76	39.25
7.	chlorpyriphos 20 EC	900	4.5 lit	0.78 (5.062)	8766.66 (93.627)	73.16	36.25
8.	untreated check		-	2.82 (9.673)	14250.00 (119.348)	67.44	30.02
	S.Em±			0.089	1.614	1.015	0.628
	CD at 5%			0.280	4.894	3.078	2.406

*Figure in parentheses represents angular mean value

Effect of grain yield

Grain yield g/m row and q/ha was significantly higher in treated plot with fipronil 5SC @ 3.0 lit/ha (78.49 g/m row and 39.75 q/ha) and imidacloprid 600 FS @ 1.5 lit /ha (77.76 g / m row and 39.25 q /ha) followed by imidacloprid 17.8 % SL @ 500 ml/ha (77.23 g/m row and 38.91 q/ha), fipronil 5 SC lower dose @ 2.5 lit / ha (73.82 g /m row and 38.41 q/ ha imidacloprid 600 FS lower dose @ 1.0 lit/ ha (77.26 g/m row and 38.16 q/ ha), imidacloprid 17.8% SL lower dose @ 400 ml/ha (72.23 g/m row and 37.50 q/ha) and chlorpyriphos 20 EC @ 4.5 lit /ha (73.16 g /m row and 36.25 q/ha).

Our results were supported by the result of Anonymous (2014) The minimum per cent damaged of effective tillers /m row was lowest fipronil 5 SC at 125 g a.i./ha (4.83:12.58), at par with fipronil 0.3 G at 60 g a.i./ha (5.20:13.13) and imidacloprid 600 FS at 720 g a.i. /ha (6.60:14.89), followed by its lower dose 480 g

a.i. /ha (7.10:15.45), fipronil 0.3 G at 52.5 g a.i./ha (7.95:17.38) and its lower dose 45 g a.i./ha (8.00:16.39). The recommended insecticide chlorpyriphos (10.70:19.07) was less effective as compared to other insecticides in protection as compared to maximum damaged in (13.20:21.30) untreated check. On the basis of number of damaged effective tillers /ha showed that highest damage was recorded in untreated check (151.67:23425). Whereas the lowest damage was observed in the fipronil 5 % SC at 125 g a.i./ha (85:7242) and fipronil 0.3 G at 60 g a.i. /ha (93.33:8715), imidacloprid 600 FS at 720 g a.i. / ha (95:9042), all these doses were statistically at par followed by imidacloprid 600 FS at 480 g a.i. / ha (111.67:12492). The chlorpyriphos (128.33:16375) treatment was least effective against termite. The grain yield data computed on q/ha basis revealed that the highest yield was obtained in fipronil 5% SC at 125 g a. i. /ha, (30.39), which was at par with imidacloprid 600 FS at 720 g a. i. / ha (29.45) and fipronil. 0.3 G

at 60 g a. i./ha (29.19), followed by imidacloprid 600 FS at 480 g a. i. /ha (28.66). Whereas, chlorpyrifos treatment gave significantly higher yield (24.53) as compared to minimum yield (24.53 q/ha) in untreated check. However, chlorpyrifos treatment was least effective and poor in production as compared to newer insecticides when applied as broadcasting in wheat standing crop.

It can be concluded that the shoot damage at 3,4, and 5 weeks after sowing and damage of effective tillers at heading stage due to termite was significantly lowest recorded on the crop grown treated with fipronil 5 SC @ 3.0 lit /ha and imidacloprid 600 FS @ 1.5 lit /ha, which provided statistically superior seed yield also during the year.

The present investigation was carried out to incidence of termite after three week of sowing and after first irrigation. The incidence was very low in all the treatments. The minimum damage in as recorded in the plot treated with fipronil 5 SC @ 3.0 lit/ha and imidacloprid 600 FS @ 1.5 lit/ha. Which did not differ significantly from imidacloprid 17.8% SL lower dose @ 400 ml/ha and chlorpyrifos 20EC @ 4.5 lit/ha. All the insecticide was found to be effective in reducing termite damage as composed to untreated checks.

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