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Comparative Efficacy of Some New Insecticides against Termites (*Odontotermes obesus* Rambur) on Wheat (*Triticum aestivum* L.) in Comparison to Yield under Field Conditions

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A B S T R A C T

The efficacy of different insecticides against the termites on wheat in comparison to yield under field conditions was studied at Research Farm of CSAUA&T, Kanpur UP. Among the various insecticides evaluated against the termites, fipronil 40% + imidacloprid 40% WG @ 1000g/ha, treated wheat plot showed minimum per cent damaged shoot/m row (6.02%) and in chlorantraniliprole 18.5% SC @ 200ml/ha, treated plot showed maximum per cent damaged shoot/m row (7.71%) in compare to untreated control (10.31%). Thiamethoxam 25% WDG @ 300g/ha (6.29%) and clothianidin 50% WDG @ 200g/ha (6.55%) were next effective pesticides to reduce the pest incidence significantly. All the treatments were also observed to be significantly superior over control.

Introduction

Wheat (*Triticum aestivum* L.) is one of most important cereal crops of the world and 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. Wheat is second important staple food crop after rice. Wheat flour is used in the form of chapatti, puri, bread, cake, sweetmeats, halwa, etc. It provides characteristic substance "Gluten" which is very essential for bakers. It provides 20 percent of total calories for human. Wheat grain contains 12.2 percent protein, which is more than other cereals. Wheat is one of the

leading cereal crops which have provided daily sustenance for a large proportion of the world's population for millennia. In india the wheat is growing about 29.60 million hectares and production 102.60 million tones with the productivity 33.71 q/hectares (Anonymous, 2019).

The major wheat growing states in india are Major wheat growing states in India are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar and Gujarat. 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). Termites, (*Odontotermes obesus* Rambur) are one of the most destructive polyphagous insect-pests of wheat and difficult to manage in loamy and sandy loam soils. Its attacks throughout the crop growth by feeding on roots or the root zone, the damage caused during seedling stage and near maturity results in yield losses to the tune of 60%. At present, insecticides are the mainstay for termite management strategies in crops and urban areas in India and the world (Peterson, *et al.,* 2006 and Potter, 2011).

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 ipsilon* Hubner, *Atherigona naqvii* Styskal, *Sesamia inferens* Walker, *Rhopalosiphum maidis* Fitch, *Microsiphum miscanthi* Takehashi, *Helicoverpa armigera* Hubner, *Spilosoma obliqua* Walker, *Scirtothrips dorsalis* Hood and *Trichoplusia ni* Huner, which cause losses in the yield of wheat crop (Singh and Upadhyay, 1993 and Mishra *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 (Mishra *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 investigation was carried out on wheat *var.* K-0402 (Mahi) during *rabi* season of 2017-18 at Research Farm, Nawabganj, C. S. Azad University of Agriculture and Technology Kanpur (U.P.).

The experiment was conducted for the control of termite in comparison to yield was laid out in Randomized block design (RBD) with 10 treatments, 3 replications and plot size measuring 4×5 m.

Insecticidal application

All the insecticides were applied after 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:-

$$\text{Quantity of the proprietary insecticide required} = \frac{\text{Percentage of active ingredient in the mix solution desired} \times \text{Total quantity of mix solution required}}{\text{Percentage of active ingredient of the proprietary Insecticide}}$$

Observations on termite infestation

The observation on plant population per metre row, number of affected tiller with healthy followed by total healthy tillers were recorded after 3rd, 4th and 5th weeks after sowing from five marked spots. The severity of termite damage can be determined by counting the damage plant in two metre row length randomly from ten spots after 3rd, 4th and 5th weeks after sowing. Total plants from these spots were counted 3rd, 4th and 5th weeks after sowing and the final data presented as per cent damaged plant per metre row. When the crop is nearing maturity but still green than damaged ear heads were counted and removed. The total number of damaged ear heads from the net plot (except the two border row) expressed number of damaged effective tillers/ha (Deol and Sekhon, 1998).

$$\text{\% damage plant} = \frac{\text{Number of plant damaged per meter row}}{\text{Total number of plant per meter row}} \times 100$$

Statistical analysis

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

Results and Discussion

The evaluate the efficacy of different insecticide under field condition on wheat crop in broadcasting of different insecticides after 1st irrigation as well as seed treatment in comparison to yield which was given a table 1 and 2.

The observation was recorded after 3rd, 4th and 5th weeks after sowing from five marked spots and the final data were presented as per cent damaged plant per metre row.

In the Table-1 the incidence of termite after 3 weeks of sowing and before one days treatment of 1st irrigation the incidence was very low in all the treatments, which ranged from 2.72 to 3.05 per cent, it was non significant without treatment. The incidence of termite after four weeks of sowing ranged 0.50 to 0.81 per cent while in untreated plot 3.28

per cent, and termite after 5 weeks of sowing ranged 1.18 to 1.80 per cent in comparison to 3.26 per cent in untreated plot.

The percent damage shoot was statistically minimum damage in as recorded in the plot treated with fipronil 40% + imidacloprid 40% WG @ 1000g/ha and thiamethoxam 25% WG @ 300/g which was at par clothianidin 50% WDG @ 200g/ha and fipronil 5% SC @ 2.5 lit/ha which did not differ significantly acephate 50% WP + imidaclorpid 1.8% SP @ 350g/ha, thiamethoxam 35% FS @ 250ml/ha, imidacloprid 600 FS (48%) @ 300ml/ha, imidacloprid 17.8% SL @ 400ml/ha and chorantaniliprole 18.5% SC @ 200ml/ha (Fig. 1).

Table.1 Effect of insecticidal treatment through broadcasting on per cent damage shoot/m row

S. No.	Treatments	Actual Dose/ Ha	Plant Population/ m row	Per cent damaged shoot/m row		
				3 weeks	4 weeks	5 weeks
1.	Thiamethoxam 25% WG	300g	37.60	2.96	0.56 (4.29)	1.22 (6.29)
2.	Imidacloprid 17.8% SL	400ml	35.47	2.81	0.74 (4.93)	1.77 (7.49)
3.	Acephate 50 % WP + imidacloprid 1.8% SP	350g	34.37	2.88	0.67 (4.69)	1.43 (6.80)
4.	Fipronil 5% SC	2.5lit.	35.67	3.03	0.65 (4.62)	1.41 (6.80)
5.	Thiamethoxam 35% F.S.	250ml	34.83	2.77	0.70 (4.80)	1.57 (7.04)
6.	Imidacloprid 600 FS (48%)	300ml	34.78	2.85	0.72 (4.87)	1.68 (7.27)
7.	Clothianidin 50% WDG	200g	33.78	3.05	0.62 (4.52)	1.35 (6.55)
8.	Fipronil 40% + Imidacloprid 40 WG	1000g	34.34	2.72	0.50 (4.05)	1.18 (6.02)
9.	Chlorantraniliprole 18.5% SC	200ml	34.60	3.01	0.81 (5.16)	1.80 (7.71)
10.	Control	-	33.66	2.84	3.28 (10.31)	3.25 (10.31)
	S. Em ±	-	NS	NS	0.10	0.24
	CD at 5%	-	-		0.32	0.85

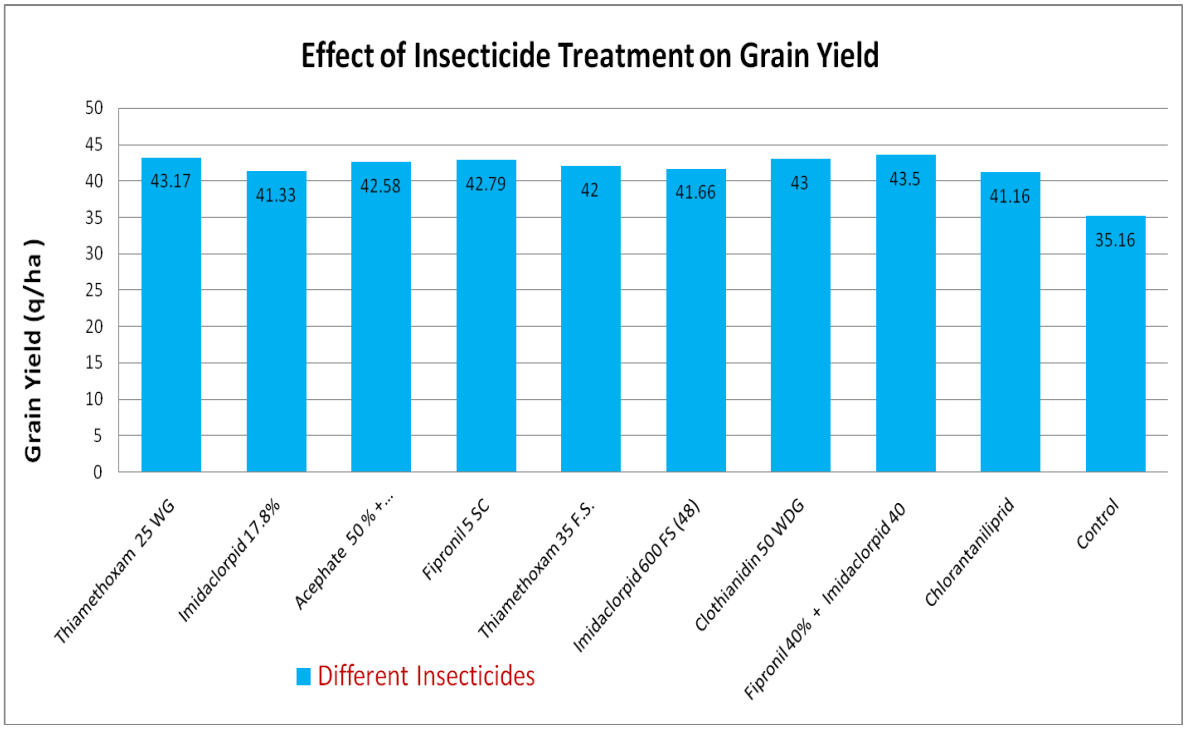
*****Figure in parentheses represents angular mean value

Table.2 Effect of insecticidal treatment damage affected tillers and grain yield

S. No.	Treatments	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.	Thiamethoxam 25% WG	300g	1.27 (6.29)	3000.00 (54.77)	95.04	43.17
2.	Imidacloprid 17.8% SL	400ml	1.65 (7.27)	5233.33 (72.34)	88.61	41.33
3.	Acephate 50% WP + Imidacloprid 1.8% SP	350g	1.46 (6.80)	4700.00 (68.55)	91.03	42.58
4.	Fipronil 5% SC	2.5lit.	1.40 (6.80)	4166.66 (64.54)	92.75	42.79
5.	Thiamethoxam 35% FS	250ml	1.51 (7.04)	4816.66 69.40	90.05	42.00
6.	Imidacloprid 600 FS (48%)	300ml	1.61 (7.27)	49.83.33 (70.59)	89.16	41.66
7.	Clothianidin 50% WDG	200g	1.36 (6.55)	3750.00 (61.23)	93.63	43.00
8.	Fipronil 40% + Imidaclorpid 40% WG	1000g	1.21 (6.29)	2333.33 (48.30)	96.08	43.50
9.	Chlorantraniliprole 18.5% SC	200ml	1.68 (7.27)	5316.66 (72.91)	87.72	41.16
10.	Control	-	2.91 (9.81)	14240.00 (119.33)	68.11	35.16
	S. Em ±	-	0.28	1.53	1.08	0.31
	CD at 5%	-	O.85	4.69	3.50	1.03

*Figure in parentheses represents angular mean value

Fig.1



All the insecticides were found to be effective in reducing termite damage as compared to untreated (control). All the treatment showed minimum damage number of the affected tillers/ha compared to untreated (control) Table-2.

The damage of affected tillers/m row as minimum 1.21 and 1.27 per cent in fipronil 40% + imidacloprid 40% WG @ 1000g/ha and thiamethoxam 25% WG @ 300g/ha, which was at par with affected tillers recorded in clothianidin 50% WDG @ 200g/ha (1.36 per cent) fipronil 5% SC @ 2.5 lit/ha, (1.40 per cent). All the insecticides treatment should superiority over untreated check in minimizing the affected tillers. The damage number of affected tillers/ha in different ranged from (2333.33 to 5316.66) while it was 14240.00 in untreated plots. The minimum damaged number of effective tiller/ha were recorded fipronil 40% + imidacloprid 40% WG @ 1000g/ha and thiamethoxam 25% WDG @ 300g/ha treated plot followed by clothianidin 50% WDG @ 200g/ha and fipronil 5% SC@ 2.5lit/ha.

Effect of grain yield

Grain yield g/m row and q/ha was significantly higher in treated plot with fipronil 40% + imidacloprid 40% WG @ 1000g/ha (96.08 g/m row and 43.50 q/ha) and thiamethoxam 25% WG @ 300g/ha (95.04 g/m row and 43.17 q/ha) followed by clothianidin 50% WDG @ 200g/ha (93.63 g/m row and 43.00 q/ha), fipronil 5% SC @ 2.5 lit/ha (92.75 g/m row and 42.79 q/ha), acephate 50% WP + imidacloprid 1.8% SP @ 350g/ha (91.03 g/m row and 42.58 q/ha), thiamethoxam 35% FS 250 ml/ha (90.05g/m row and 42.00 q/ha), imidacloprid 600 FS 48% @ 300 ml/ha (89.16 g/m row and 41.66 q/ha), imidacloprid 17.8% SL @ 400g/ha (88.61 g/m row and 41.33 q/ha) and chlorantraniliprole 18.5% SC @ 200 ml/ha (87.72 g/m row and 41.16 q/ha).

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