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Bio-efficacy of fipronil 0.6% GR as soil application against termite in wheat

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ABSTRACT

Field experiment was conducted for testing the bio-efficacy of fipronil 0.6% GR as soil application against termite in wheat. The soil application of fipronil 0.6% GR @ 240 g a.i./ha was highly effective followed by treatments with lower dosages of fipronil 0.6% GR *i.e.* @ 120, 60, 52.5 g a.i./ha against termite. The results of pooled data for per cent damaged effective tillers/m row showed that fipronil 0.6% GR @ 240 g a.i./ha was found to have lowest (1.88) per cent as compared to untreated check (37.76) while other treatments with different dosages of fipronil 0.6% GR were remained at par followed by phorate 10% G @ 1875 g a.i./ha and chloropyrifos 20% EC @ 600 g a.i./ha. The pooled data on grain yield indicated that higher yield was recorded in all doses of fipronil 0.6% GR as compared to untreated control. The phytotoxicity study indicated that no any adverse effect was observed on any foliar part of wheat.

Key words: *Odontotermes obesus, Microtermes obesi,* bio-efficacy, fipronil Among the biotic constraints, termite

Odontotermes obesus, Microtermes obesi, bio-efficacy, fipronil Among the biotic constraints, termite acts as one of the major insect-pest of wheat crop particularly under rainfed situations in the country. Termite is the major pest of agricultural crops in tropical and sub-tropical regions of the world along with South Asia (Geddes and Iles, 1991; Kishor *et al.*, 2017). *Odontotermes obesus (Rambur) and Microtermes obesi* are the most destructive polyphagous and predominant species of termite infesting in wheat and it is difficult to manage in loamy and sandy loam soils (Chhillar *et al.*, 2006; Peterson *et al.*, 2006 and Potter, 2011). But, *Odontotermes obesus* (Rambur) is the dominant species of termite in wheat (Gadhiya *et al.*, 2012). More infestation of termite was reported in Rajasthan in sandy loam soil moisture regime (Parihar, 1981). The predominant problem of termite in the wheat crop caused 20 to 40 per cent damage mostly in rainfed condition as reported by Mishra *et al.* (2003). The yield losses ranged from 43 to 80 per cent were recorded due to termite infestation in wheat (Roonwal, 1979, Sattar and Salihah, 2001; Chhillar *et al.*, 2006 and Kakde *et al.*, 2006). Since, termites are extremely difficult to manage, chemical pesticides are the only means for the management of termite (Rathour *et al.*, 2014). Chemicals insecticides like chloropyrifos, endosulfan, cypermethrin, imidacloprid, carbosulfan and triazophos were recommended for control of termite (Kumawat, 2001 and Rana *et al.*, 2001). Thus, considering the importance of pest, the present investigation was carried out to evaluate the bio-efficacy of fipronil 0.6% GR as

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soil application against termite in wheat under field conditions.

MATERIALS AND METHODS

Field experiments were conducted during Rabi seasons of 2015-16 and 2016-17 to *evaluate the bio-efficacy of fipronil 0.6% GR as soil application against termite in wheat* on cv. GW 496 at Wheat Research Station, S.D. Agricultural University, Vijapur, Gujarat. Experiments were laid out in Randomized Block Design (RBD) in three replications. The net plot size was 1.6 m x 4.0 m with row to row spacing of 20 cm. Eight treatments including different doses of fipronil 0.6% GR @ 45, 52.5, 60, 120, 240 g a.i./ha, phorate 10% G @ 1875 g a.i./ha, chloropyrifos 20% EC @ 600 g a.i./ha and untreated control were evaluated against termite in wheat under field condition (Table 2). Single application of various doses of fipronil 0.6% GR and phorate mix with sand @ 50 kg/ha was broadcasted at the time of sowing. Observations of termite affected plants per plot at 30th, 40th, 50th days after sowing and at maturity were recorded and per cent damaged effective tillers/m row was calculated by using the formula given below (Kishor *et al.*, 2017).

Per cent tillers damage =

$$\frac{\text{No. of tiller damage per meter row}}{\text{Total no. of tiller per meter row}} \times 100$$

Then, all the percentage data in all the treatments were subjected to angular transformations and analyzed statistically. The critical difference and standard error mean were calculated for the comparison of treatments and control. Moreover, observations for any adverse effects for phytotoxicity of different dosages of fipronil 0.6% GR on wheat were recorded at 1st, 3rd, 5th, 7th and 15th days after germination by using scale given in table 1 as reported by Rajeswaran *et al.* (2004).

Table 1 Phytotoxicity scale

Rating	Phytotoxicity (%)
0	0
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

RESULTS AND DISCUSSION

There was no termite damage observed during 30th, 40th and 50th days after sowing in all the treatments in the year 2015-16. The lowest (3.76) per cent damaged effective tillers/m row was recorded in treatment of fipronil 0.6% GR @ 240 g a.i./ha and it was at par with lower dosages of fipronil 0.6% GR *i.e.* @ 120, 60 and 52.5 g a.i./ha which recorded 4.23, 4.40, 5.58 per cent plant damage, respectively (Table 2). The result on number of effective tillers/ha revealed that the lowest (2811) damage was recorded in fipronil 0.6% GR @ 240 g a.i./ha and it was at par with fipronil 0.6% GR @ 120 g a.i./ha (2907) followed by fipronil 0.6% GR @ 60 g a.i./ha (3167). During 2016-17, there was no termite damage observed during 30th, 40th and 50th days after sowing in all the treatments. The data on per cent damaged effective tillers/m row showed that there was no

damage observed in treatment of fipronil 0.6% GR @ 240 g a.i./ha (Table 2). However, minimum damage (2315) was noticed in fipronil 0.6% GR @ 120 g a.i./ha followed by fipronil 0.6% GR @ 60 g a.i./ha (3088) and fipronil 0.6% GR @ 52.5 g a.i./ha (3174). The result on number of damaged effective tillers/ha revealed that the lowest damaged (2315) was recorded in fipronil 0.6% GR @ 240 g a.i./ha followed by fipronil 0.6% GR @ 120 g a.i./ha (2719) as compared to the untreated check (3816) where highest damage of termite was recorded. The pooled data of per cent damaged effective tillers/m row showed that fipronil 0.6% GR @ 240g a.i./ha was found to have lowest (2563) per cent damage as compared to untreated check (4229) and different dosages of fipronil 0.6% GR remained at par followed by phorate 10% G @ 1875 g a.i./ha and chloropyrifos 20% EC @ 600 g a.i./ha.

The grain yield (g/m row) recorded during 2015-16 showed that highest yield (52 g/m) was harvested from the plot treated with fipronil 0.6% GR @ 240 g a.i./ha followed by fipronil 0.6% GR @ 120 g a.i./ha as (47 g/m) as compared to untreated check (23 g/m). Similarly, the grain yield of wheat recorded during 2016-17, showed that highest yield (55 g/m) was recorded in treatment of fipronil 0.6% GR @ 240 g a.i./ha and it was at par with fipronil 0.6% GR @ 120 g a.i./ha (50 g/m) and fipronil 0.6% GR @ 60 g a.i./ha (47 g/m). In the same way, pooled data on grain yield in both g/m and q/ha has indicated that higher yield was recorded in the all treatments of fipronil 0.6% GR as compared to untreated control (Table 3). Therefore, based on pooled data of two years experiments, treatment with fipronil 0.6% GR @ 240 g.a.i./ha has found to be the best treatment against termite infesting wheat. However, treatment with different dosages of fipronil 0.6% GR *i.e.* @ 120, 60 and 52.5 g a.i./ha remained at par with fipronil 0.6% GR @ 240 g.a.i./ha which indicated that fipronil 0.6% GR is very effective as its lower dose.

The phytotoxicity study in both the years has indicated that no any evidence of adverse effect on any foliar part of wheat was reported which proved that fipronil 0.6% GR at different dosages @ 240, 120 and 60 g.a.i./ha was safe for soil application against termite infesting wheat (Table 4). Report has suggested that highest grain yield data computed on q/ha basis was obtained in treatment of fipronil against termite in wheat (Anonymous, 2014). Good control of termite by application of fipronil has also been reported (Henderson and Forschler, 1996 and Lopez *et al.*, 1998). Similar results were also reported where soil application of fipronil 0.3% GR @ 25 kg/ha in sugarcane and wheat was observed in reducing termite damage and maximum germination as reported by Singh *et al. (2010)* and Tomar (2013) respectively. Another report also supported the above finding where different insecticides were used to control termite infesting in wheat and found significant control with fipronil 5 SC @ 3.0 lit/ha and imidacloprid 600 FS @ 1.5 lit/ha (Kishor *et al.*, 2017). Report also suggested that higher application rates of insecticides like imidacloprid, fipronil and bifenthrin in loamy soil resulted in greater availability of these insecticides which ultimately helps in controlling problem of termite in field condition (Saran and Kamble, 2008. The lowest mean per cent damage tillers per meter row was recorded with treatment of fipronil 5 SC followed by treatments of endosulfan 35 EC, imidacloprid 200 SL, thiamethoxam 70 WS and bifenthrin 10 EC as compared to untreated control as reported by Bali *et al. (*2010).

CONCLUSION

Thus, it can be concluded that soil application of fipronil 0.6% GR @ 240, 120 and 60 g.a.i./ha at the time of sowing has found to be highly effective for controlling problem of termite infesting in wheat without showing any adverse effect of phytotoxicity and also gave higher yield as compared to untreated control.

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Table 2 Effect of insecticidal treatments on termite infesting wheat

S. N.	Treatments	Dose (g a.i. /kg)	% damaged effective tillers/m row			No. of damaged effective tillers/ha		
			2015 -16	2016 -17	Pooled	2015 -16	2016 -17	Pooled
1	Untreated control	-	39.56*c (40.57)**	35.95*f (34.46)**	37.76*d (37.51)**	4642+d (1461235)++	3816+f (27998)++	4229+f (744616)++
2	Fipronil 0.6% GR	45.0	5.90a (1.07)	6.34c (1.24)	6.12a (1.15)	3341b (214842)	3261de (41098)	3301cd (127970)
3	Fipronil0.6% GR	52.5	5.58a (0.95)	5.34bc (0.87)	5.46a (0.91)	3313b (206215)	3174d (53348)	3244cd (129781)
4	Fipronil 0.6% GR	60.0	4.40a (0.60)	4.39bc (0.59)	4.40a (0.59)	3167b (166311)	3088cd (59405)	3128bc (112858)
5	Phorate 10% G	1875.0	11.57b (5.58)	18.74d (10.32)	15.16b (7.95)	3416bc (240005)	3393de (47187)	3405cd (143596)
6	Chloropyrifos 20%EC	600.0	29.78c (24.71)	26.14e (19.41)	27.96c (44.12)	3659c (343416)	3566ef (31902)	3613e (187659)
7	Fipronil 0.6% GR	120.0	4.23a (0.55)	1.28ab (0.50)	2.76a (0.52)	2907a (113350)	2719b (74220)	2813a (93785)
8	Fipronil 0.6% GR	240.0	3.76a (0.44)	0.00a (0.00)	1.88a (0.22)	2811a (98292)	2315a (83911)	2563a (91101)
	S.Em. + T		1.94	1.39	1.67	84	120	102
	Y × T		-	-	0.82	-	-	53
	C.D. at 5% T		5.88	4.23	5.00	255	365	306
	Y × T		-	-	NS	-	-	NS
	C.V.%		-	-	-	-	-	-

*Figures followed within same column are Arcsin percentage transformation

**Figures given in parenthesis are Reangular value

+Figures followed within same column are Logarithmic transformation

++ Anti-logarithmic transformed values in parenthesis

Table 3 Grain yield

S. N.	Treatments	Dosage (g a.i./kg)	Grain yield					
			g/m			q/ha		
			2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
1	Untreated control	-	23c	26c	25e	18.82	19.58	19.20
2	Fipronil 0.6% GR	45.0	28c	31bc	30cd	21.39	22.19	22.67
3	Fipronil 0.6% GR	52.5	41b	44ab	43b	23.19	23.96	23.91
4	Fipronil 0.6% GR	60.0	44ab	47a	46ab	23.87	24.69	23.53
5	Phorate 10% G	1875.0	28c	31bc	30cd	22.38	23.13	24.67
6	Chloropyrifos 20% EC	600.0	25c	28c	27de	19.69	20.47	22.94
7	Fipronil 0.6% GR	120.0	47ab	50a	49a	25.42	26.20	23.79
8	Fipronil 0.6% GR	240.0	52a	55a	54a	26.23	27.03	23.36
	S.Em. ± T		3	2.77	2.89	1.78	1.78	0.38
	Y × T		-	-	1.40	-	-	1.08
	C.D. at 5% T		8	8.39	8.68	NS	NS	NS
	Y × T		-	-	NS	-	-	0.77
	C.V.%		13.31	12.29	14.18	13.59	13.13	12.74

Table 4 Phytotoxicity of higher dosage of fipronil 0.6% GR on wheat (pooled data of 2015-16 and 2016-17)

SN	Treatments	Dosages (g a.i. /ha)	Phytotoxicity (%)				
			Leaf injury	Chlorosis	Necrosis	Wilting	Epinasty	Hyponasty
1	Untreated check	-	0	0	0	0	0	0
2	Fipronil 0.6 % GR	60.00	0	0	0	0	0	0
3	Fipronil 0.6 % GR	120.00	0	0	0	0	0	0
4	Fipronil 0.6 % GR	240.00	0	0	0	0	0	0

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