EVALUATION OF BIO-EFFICACY OF DINOTEFURAN 20% SG ON RICE BROWN PLANTHOPPER (BPH), *NILAPARVATA LUGENS* (STÅL) AND ITS PREDATORS

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Abstract: A field trial was conducted at Andhra Pradesh Rice Research Institute and Regional Agricultural Research Station, Maruteru during *rabi* 2008-09 to study the effect of dinotefuran 20 SG against brown planthopper and its predators. The results clearly indicated that dinotefuran 20 SG at all the three dosages tested found to be effective in controlling BPH and superior to check insecticides, imidacloprid 17.8 SL @ 22.5 g a.i./ha and buprofezin 25 SC @ 187.5 g a.i./ha. Dinotefuran 20 SG @ 25 g a.i./ha recorded significantly lowest per cent of white ears (6.11) and higher grain yields (5218 kg/ha) among the dosages tested and followed by dinotefuran 20 SG @ 40 g a.i./ha. It has no harmful effects on predators of BPH.

Key words: Rice, dinotefuran 20 SG, brown planthopper, mirid bug, spiders.

Introduction: Globally, more than 3 billion people from Asia and other countries depend on rice (*Oryza sativa*, L.) as their staple food, and by 2025 about 60% more rice must be produced to meet the needs of the growing population (Khush, 2005). Rice productivity is adversely impacted by numerous biotic and abiotic stresses. An approximate 52% of the global production of rice is lost annually owing to the damage caused by biotic factors, of which ~21% is attributed to the attack of insect pests (Yarasi *et al*., 2008). Among the 20 serious insect pests of rice, brown planthopper (BPH) [(Nilaparvata lugens (Sta°l) (Hemiptera: Delphacidae)] is a typical piercing–sucking insect pest, which feeds on phloem sap and thus affects the growth of rice and results in 'hopperburn' (Watanabe & Kitagawa, 2000). Furthermore, BPH also transmits viruses, such as the ragged stunt virus and grassy stunt virus, and associated diseases to rice plants (Jena *et al*., 2006). Outbreaks of BPH are very frequent in tropical Asia and have caused heavy rice yield losses in recent years (Normile, 2008). The insecticides though effective, their large scale and continuous use either causes pest resurgence (Tanaka *et al*., 2000) or the insect developed resistance to insecticides particularly to neonicotinoids like imidacloprid (Matsumura *et al*., 2008 and Lakshmi *et al*., 2010). Imidacloprid-resistant populations demonstrate significant cross-resistance to other neonicotinoid insecticides like thiacloprid, nitenpyram, acetamiprid, thiamethoxam and clothianidin, but not to dinotefuran (Tang *et al*., 2006). Owing to the development of resistance, there are now significant concerns over the viability of continuing to use imidacloprid and other neonicotinoids against BPH. Hence, a field trial was undertaken to assess the effect of dinotefuran 20 SG against BPH and its predators in irrigated rice.

Material and Methods: A field experiment was conducted under field conditions at A.P. Rice Research Institute and Regional Agricultural Research Station, Maruteru, West Godavari district during *Rabi* 2008-09 in irrigated rice. The experiment was laid out in a randomized block design using susceptible rice variety; Prabhat (MTU 3626) with seven treatments and each was replicated thrice. The plot size was 20 m^2 were separated from each other so as to prevent water movement from one plot to another. The treatments include dinotefuran 20 SG @ 25, 30 and 40 g a.i./ha, imidacloprid 17.8 SL @ 22.5 g a.i./ha, buprofezin 25 SC @ 187.5 g and thiamethoxam 25 WG @ 25 g a.i./ha and untreated check. Two to three seedlings were planted per hill with spacing of 15x15cm. The fertilizer, N: P: K was used at 120:60:40 kg/ha. The test insecticides were applied twice , at 60 and 70 days after transplanting as foliar spray with a knapsack sprayer @ 500 litres spray fluid / hectare at appropriate stage based on the planthoppers build-up. Care was taken to avoid drift of spray solution to adjacent plots.

The data on brown planthopper, predatory mirid bug (*Cyrtorhinus lividipennis*) and spiders were collected from 10 randomly selected hills in each plot at one day before and five and ten days after the treatment. Before harvest of the crop, white ears due to yellow stem borer and panicle bearing tillers were recorded from 10 randomly selected hills and computed per cent white ears. The data on planthopper numbers and mirid bugs were transformed to square root values and the data on per cent white ears to Arc Sin values. Similarly, grain yields from net plot were recorded and computed on hectare basis. The data was statistically analyzed and means were separated by L.S.D method (Cochran and Cox 1957). The results were presented in table 1, 2 and 3.

Results and Discussion

Brown plant hopper: There was no significant difference in BPH population among the treatments before the application of treatments. At five days after the first spray, all the insecticide treatments except imidacloprid 17.8 SL @ 22.5 g a.i./ha (256.67) were significantly superior in checking the brown

planthopper population than the untreated control (348.67). Among the insecticide treatments, dinotefuran 20 SG @ 25 g a.i./ha(180.0) recorded significantly lower number of BPH per 10 hills and was on par with thiamethoxam 25 WG @ 25 g a.i./ha (199), dinotefuran 20 SG @ 40 g a.i./ha (210.33) and dinotefuran 20 SG @ 30 g a.i./ha (213). At ten days after the first spray, the efficacy varied and BPH population in various treatments differed. The lowest population of BPH was recorded in thiamethoxam 25 WG @ 25 g a.i./ha (207.67), dinotefuran 20 SG @ 25 g a.i./ha (209.33) and dinotefuran 20 SG @ 40 g a.i./ha (232) than untreated control (497.67) and were followed by buprofezin 25 WP @ 187.5 g a.i./ha (250) and dinotefuran 20 SG @ 30 g a.i./ha (257). Imidacloprid 17.8 SL @ 22.5 g a.i./ha treated plots recorded higher population of BPH (453.33).

All the treatments were significantly superior in checking the BPH populations than the untreated control (369.67) at five days after the second spray. Dinotefuran 20 SG @ 40 g a.i./ha (104) and dinotefuran 20 SG @ 25 g a.i./ha (112.67) recorded significantly lower number of BPH. These were followed by dinotefuran 20 SG @ 30 g a.i./ha (138.67), thiamethoxam 25 WG @ 25 g a.i./ha (144.33) and imidacloprid 17.8 SL @ 22.5 g a.i./ha (239). At ten days after the second spray also all the insecticide treatments were effective over the untreated control (254.67) in checking the BPH populations. Among them, dinotefuran 20 SG @ 25 g a.i./ha (90) was significantly superior over the other insecticide treatments and was followed by other two dosages *viz*., dinotefuran 20 SG @ 30 g a.i./ha (101) and 40 g a.i./ha (108.67), imidacloprid (115.33) and buprofezin 25 WP @ 187.5 g a.i./ha (117.33) and thiamethoxam 25 WG @ 25 g a.i./ha (126.33) (Table 1).

White ears: The differences in % white ears were significant among the treatments. Dinotefuran 20 SG @ 25 g a.i./ha recorded lowest % white ears (6.11) and was followed by dinotefuran 20 SG @ 30 g a.i./ha (7.27), imidacloprid 17.8 SL @ 22.5 g a.i./ha (7.61) and dinotefuran 20 SG @ 40 g a.i./ha (9.71). Buprofezin 25 WP @ 187.5 g a.i. /ha recorded highest % white ears (13.24) than the untreated control (10.62) (Table 1).

Grain yield: Dinotefuran 20 SG @ 25 g a.i. /ha (5218 kg/ha) and dinotefuran 20 SG @ 40 g a.i./ha (5038 kg/ha) recorded significantly higher grain yield and were followed by buprofezin 25 WP @ 187.5 g a.i./ha (4764 kg/ha). The other insecticide treatments recorded lower grain yield (Table 1).

Mirid bug (*Cyrtorhinus lividipennis)*: There was no significant difference in mirid bug population among the treatments before the application of treatments, at five and ten days after first spray. But at five and ten days after the first spray there was reduction in mirid bug populations in all the insecticide treatments compared to previous counts may be because of lower population of BPH as the predators were mostly density dependant in nature, but not due to the treatment effect. The imidacloprid (109.0) and untreated control (111.010) plots at five days and untreated control (95.67) at ten days after the second spray recorded significantly high number of mirid bugs (Table 2).

Spiders: The differences in spider numbers among the various treatments were not significant at all the observations made (Table 3).

The results of the present findings are in accordance with the findings of Bao *et al*. (2009), who reported that in addition to direct toxicity dinotefuran could reduce the fecundity of BPH to a significant extent and induces macropterous adults of BPH.

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Table 1. Effect of Dinotefuran 20 SG on BPH, white ears during *Rabi* 2008-09

S. No	Particulars	Dose g (a.i./ha)	Brown Plant hopper (no.s/ 10 hills) *					% WE**	Yield (Kg/ha)
			Before spray	1st Spray		2nd Spray			
				5 DAS	10 DAS	5 DAS	10 DAS		
1	Dinotefuran 20 SG	25.0	124.00 (11.00)	180.00 (13.20)	209.33 (14.30)	112.67 (10.50)	90.00 (9.5)	6.11 (14.30)	5218
2	Dinotefuran 20 SG	30.0	149.00 (12.2)	210.00 (14.50)	257.0 (16.00)	138.67 (11.80)	101.00 (10.00)	7.27 (15.80)	4634
3	Dinotefuran 20 SG	40.0	152.33 (12.30)	210.33 (14.50)	232.0 (15.20)	104.00 (10.00)	108.67 (10.40)	9.71 (17.90)	5038
4	Imidacloprid 17.8 SL	22.5 g	174.67 (13.00)	256.67 (16.00)	453.33 (20.60)	239.00 (15.40)	115.33 (10.60)	7.61 (15.90)	4637
5	Buprofezin 25 SC	187.5 g	152.00 (12.30)	245.67 (15.50)	250.00 (15.70)	157.67 (12.50)	117.33 (10.80)	13.24 (21.23)	4764
6	Thiamethoxam 25 WG	25 g	132.67 (11.50)	199.00 (14.00)	207.67 (14.40)	144.33 (12.00)	126.33 (1122)	8.20 (16.60)	4452
7	Untreated Control	-	205.67 (14.30)	348.67 (18.60)	497.67 (22.10)	369.67 (19.20)	254.67 (16.00)	10.62 (18.90)	4354
F test			NS	Sig	Sig	Sig	Sig	Sig	Sig
CD			-	2.95	5.33	2.23	135	3.63	331
CV (%)			11.79	10.91	17.69	9.57	6.74	11.85	4.04

Table 2. Effect of Dinotefuran 20 SG on mirid bug during *Rabi* 2008-09							
S. No	Particulars	Dose g (a.i./ha)	Mirid bug No.s/10 hills *				
			Before spray	1st Spray		2nd Spray	
				5 DAS	10 DAS	5 DAS	10 DAS
1	Dinotefuran 20 SG	25.0	101.0 (10.04)	85.67 (9.15)	104.33 (10.16)	73.0 (8.53)	60.0 (7.74)
2	Dinotefuran 20 SG	30.0	127.0 (11.26)	96.67 (9.79)	120.33 (10.97)	84.0 (9.15)	71.0 (8.43)
3	Dinotefuran 20 SG	40.0	135.67 (11.62)	93.33 (9.66)	114.33 (10.69)	71.67 (8.42)	78.0 (8.83)
4	Imidacloprid 17.8 SL	22.5 g	140.0 (11.79)	105.00 (10.23)	153.67 (12.35)	109.0 (10.43)	78.67 (8.85)
5	Buprofezin 25 SC	187.5 g	130.0 (11.36)	113.67 (10.64)	122.67 (11.03)	86.33 (9.29)	78.33 (8.85)
6	Thiamethoxam 25 WG	25 g	115.0 (10.72)	94.67 (9.71)	105.33 (10.26)	84.0 (9.16)	74.33 (8.62)
7	Untreated Control	-	145.67 (11.97)	131.33 (11.41)	148.67 (12.09)	111.0 (10.50)	95.67 (9.75)
F test			NS	NS	NS	Sig	Sig
CD			-	-	-	1.09	0.97
CV (%)			9.64	8.72	9.26	6.56	6.22

Figures in parenthesis are Square root transformed values
Figures in parenthesis are arc sine transformed values
DAS – Days after spray, WE- White ears

Table 3. Effect of Dinotefuran 20 SG on spiders during *Rabi* 2008-09							
S. No	Particulars	Dose g (a.i./ha)	Spider No.s/10 hills				
			Before spray	1st Spray		2nd Spray	
				5 DAS	10 DAS	5 DAS	10 DAS
1	Dinotefuran 20 SG	25.0	18.3	26.0	20.0	24.0	23.3
2	Dinotefuran 20 SG	30.0	19.3	21.3	21.3	20.0	22.0
3	Dinotefuran 20 SG	40.0	21.7	21.0	24.7	20.7	22.0
4	Imidacloprid 17.8 SL	22.5 g	20.3	20.3	24.0	21.7	20.7
5	Buprofezin 25 SC	187.5 g	20.3	21.7	25.0	21.0	23.7
6	Thiamethoxam 25 WG	25 g	20.7	19.7	24.3	20.0	28.0
7	Untreated Control	-	19.3	21.0	25.0	21.7	24.0
F test			NS	NS	NS	NS	NS
CD			-	-	-	-	-
CV (%)			9.86	15.21	16.47	8.58	12.45

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