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Field performance of a new formulation of dinotefuran 70% WG against sucking pests of paddy

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Abstract
A field experiment was carried out to evaluate the bio efficacy of dinotefuran 70%WG against Brown planthopper, *Nilaparvatha lugens* (Stal) (BPH) and White backed planthopper, *Sogatella furcifera* (Hoverth) (WBPH) and green leaf hopper *Nephotettix virescens* (Distant) (GLH) on paddy. The results revealed that application of dinotefuran 70% WG @ 61.6 *g.a.i*/ha was found to be excellent insecticide in suppressing the BPH population during *kharif* 2018 paddy crop by registering 85.24 %, 74.78 % and 85.59 % reduction over control of BPH, WBPH and GLH, respectively. The next best treatment was dinotefuran 70% WG @ 51.8 *g.a.i*/ha with 78.94 %, 71.27 % and 78.94 % reduction over control of BPH WBPH and GLH, respectively. The effect of these applications was also resulted on the yield attributes, with highest grain yield of 63.84 q/ha was observed in dinotefuran 70% WG @ 61.6 *g.a.i*/ha treated plot followed by Dinotefuran 70% WG @ 51.8 *g.a.i*/ha (60.76 q/ha) and did not have any severe depressing effect on the natural enemies in the field when applied at recommended doses.

Keywords: BPH, dinotefuran, GLH, paddy, plant hoppers

Introduction
Rice is obtained from paddy grain and it is a staple food for people all over the East, South and Southeast Asia [1]. Rice crop is extremely versatile and adaptive with a temperature range throughout the crop cycle is between 21˚C to 37˚C. As far as India is concerned it can be grown in almost all agro climatic zones, soil varieties and altitudes ranging from sea level to 3000 meters above mean sea level. Among the various constraints of rice abiotic factors *viz.*, temperature, rainfall, humidity and other climatic conditions affect the plant growth and ultimately crop yield. However, due to current agriculture production practices involving apply of synthetic fertilizers has made rice to attract more insect pests. Over 100 species of insect pests attack on rice ecosystem in various stages of the crop, in which Brown plant hopper *Nilaparvata lugens* (Stal) (BPH), white back plant hopper *Sogatella furcifera* (Hoverth) (WBPH), green leaf hopper *Nephotettix virescens* (Distant) (GLH) are the major insect pests of paddy [2]. Outbreak of these pests habitually leads to entire loss of the rice crop, if no effectual control measures are taken up. The loss in grain yield ranges from 10% in moderately affected fields to 70% in those fields which are severely affected [3]. Several cultural practices such as planting of rice with wider spacing, nutrient and water management and conservation of natural enemies, etc., have been suggested for effective management these sucking pests. However, the intensive and continuous cultivation of rice with excessive use of nitrogenous fertilizers has paved the congenial conditions for pest population outbreaks thus compelled the farmers to use insecticides for their suppression. In many rice growing areas of India, insecticides failed to give the desired level of control of the pest because of the development of resistance to insecticides and their negative impact on natural enemies due to which the pest has become unmanageable in several regions of India. These sucking pests of rice have also become resistant to some newer insecticides like imidacloprid, thiamethoxam and acetamiprid [4]. This scenario of resistance has forced farmers to apply these broad spectrum insecticides in heavy doses against recommended due to which diversity of natural enemies has been reduced and furthermore led to resurgence of sucking pests of rice. Keeping these points in view, an experiment was conducted in Agriculture Research Station, Gangavathi, University of Agricultural Sciences, Raichur, Karnataka to compare the relative efficacy of different

concentration of dinotefuran with conventional insecticides as standards against the three major sucking pests of rice (BPH, WBPH and GLH).

Materials and Methods

Experiment was carried out at Agricultural Research Station, during 2018 *kharif* season. Crop was cultivated with recommended package of practice of UAS, Raichur [5] except plant protection measures. All these insecticides were applied with knapsack sprayer and sprayed twice during cropping season. First spray was taken at 50 days after sowing (based on ETL) and second sprays at 25 days after first spray.

Experimental layout: Randomized Complete Block Design (RCBD)
6 treatments 3 replications
Plot size: 5*5 m^2

Table 1: Treatment details

Sl. No	Treatment details	Dose(*g.a.i.*/ha)
1	Dinotefuran 70% WG	42.0
2	Dinotefuran 70% WG	51.8
3	Dinotefuran 70% WG	61.6
4	Dinotefuran 20%SG	40
5	Buprofezin 25% SC	200
6	Untreated control	--

Observations

Observations were made for plant hoppers (BPH, WBPH and GLH) on 10 hills, before imposition of the treatment and 3,7,10 and15 days after each spray and presented as average number of insects per hill and also per cent reduction over control was calculated after each spray. In addition to that, recorded the pre and post application effect of test chemical on natural enemies' population *viz*., predatory spiders and mirid bug per 10 hills present in the ecosystem during the study at intervals of before and 1, 5, 10 and 15 Days after last spray for all the treatments and presented number per hill. Further, these data were subjected to statistical analysis after transforming them to square root transformation (√x+1) and grain yield recorded at harvest was converted to quintal per ha prior to statistical analysis [6].

Results and discussion

The results of the investigation on the bio-efficacy of novel insecticide molecules against planthoppers conducted during kharif 2018-19 are presented here under:

Brown planthopper (BPH), *Nilaparvata lugens* (Stal)

Prior to imposition of insecticides, population of brown planthopper was uniform and crossed the economic threshold level which ranged from 18.10 to 20.42 brown hoppers per hill (Table 1). However, variation was observed only after imposition of the treatments. The recommended dose of dinotefuran 70% WG @ 61.6 *g.a.i*/ha recorded significantly less number of BPH (10.02 hoppers/hill) as compared to 20.02 hoppers per hill in untreated check at 3 days after first spray but it was at par with its middle dosage 51.8 and 42.0 *g.a.i*/ha. Similar trend was noticed at 7, 10 and 15 days after first spray. The recommended dosage of dinotefuran 70% WG @ 61.6 *g.a.i*/ha proved their efficacy in suppressing the BPH population even at 15 days after first spray with 78.31 per cent reduction over control.

Similar trend was noticed at 3, 7, 10 and 15 days after second spray also. dinotefuran 70% WG @ 61.6 *g.a.i*/ha was found to be effective and superior treatments in reducing BPH populations (1.98 hoppers/hill) with 92.18 per cent reduction over control followed by dinotefuran 70% WG @ 51.8 *g.a.i*/ha (3.31 hoppers/hill with 88.16 per cent ROC) dinotefuran 70% WG @ 42.0 *g.a.i.*/ha (4.15 hoppers/hill with 85.15% ROC) at 15 days after second spray (Table 1).

Over all, dinotefuran 70% WG @ 61.6 *g.a.i*/ha was found to be excellent insecticide in suppressing the BPH population with an average 85.24 % reduction over control during *kharif* 2018 paddy crop. [7] Indorsed the superior efficacy of dinotefuran against *Nilaparvata lugens*. Dinotefuran 20 SG at 30 and 40 g ai./ha was resulted to be effective against brown planthopper at 35 locations in India during 2009 [8].

White backed planthopper (WBPH), *Sogatella furcifera* Horvath

The population of WBPH was found to be uniform among the treatment before imposition of the treatment which ranged from 24.36 to 26.38 per hill which indicated the uniform distribution of WBPH population. Almost similar trend of effectiveness of dinotefuran 70% WG was observed against WBPH as it was observed against BPH.

There was a significant difference among the treatments 3, 7 and 10 days after first spray of application. All the insecticidal treatments recorded significantly lower population of WBPH than control at 3, 7, 10 and 15 days after first spray. The dose of dinotefuran 70% WG @ 61.6 *g.a.i*/ha recorded significantly less number of WBPH (18.81 hoppers/hill) as compared to 28.59 hoppers per hill in untreated check at 3 days after first spray and followed by its lower dosage dinotefuran 70% WG @ 51.8 *g.a.i*/ha and dinotefuran 70% WG @ 42.0 *g.a.i*/ha. Similar trend was noticed at 7, 10 and 15 days after first spray. The dosage of dinotefuran 70% WG @ 61.6 *g.a.i*/ha proved their efficacy in suppressing the WBPH population even at 15 days after spray with 58.50 per cent reduction over control and it was followed by same insecticide dosage of 51.8 *g.a.i*/ha with 55.42 per cent reduction over control (Table 2).

The periodical data on population of WBPH after second spray also revealed almost similar trend of effectiveness by dinotefuran 70% WG @ 61.6 *g.a.i*/ha as it was observed after first spray. Similar trend of effectiveness was observed at 3, 7, 10 and 15 days after spray against WBPH when compared to all treatments.

Over all, dinotefuran 70% WG 61.6 *g.a.i*/ha was found to be excellent insecticide in suppressing the WBPH population with an average 74.78 % reduction over control during *kharif 20*18 paddy crop. The present investigations are in line with [9] who also reported 87.56 and 89.4 per cent reduction in population of WBPH after application of pymetrozine 50 WG (Chess 50 WG) @ 350 and 400 g/ha, respectively. In the same way, [10] was also registered significantly less number of WBPH in Dinotefuran 20 SG and Triflumezopyrim 10.6 SC treatment was next best treatment.

Green leafhopper (GLH), *Nephotettix virescens* Dist

Before imposition of insecticides, population of green leafhopper was uniform and crossed the economic threshold level which ranged from 7.06 to 7.96 hoppers per hill (Table 3). However, variation was observed only after imposition of the treatments. The recommended dose of dinotefuran 70% WG @ 61.6 *g.a.i*/ha recorded significantly less number of GLH (3.91 hoppers/hill) as compared to 7.81 hoppers per hill

in untreated check at 3 days after first spray but it was at par with its middle dosage 51.8 and 42.0 *g.a.i*/ha. Similar trend was noticed at 7, 10 and 15 days after first spray. The recommended dosage of dinotefuran 70% WG @ 61.6 *g.a.i*/ha proved their efficacy in suppressing the GLH population even at 15 days after first spray with 78.25 per cent reduction over control.

Similar trend was noticed at 3, 7, 10 and 15 days after second spray also. dinotefuran 70% WG @ 61.6 *g.a.i*/ha was found to be effective and superior treatments in reducing GLH populations (0.77 hoppers/hill) with 92.93 per cent reduction over control followed by dinotefuran 70% WG @ 51.8 *g.a.i*/ha (1.29 hoppers/hill with 88.16% ROC) dinotefuran 70% WG @ 42.0 *g.a.i.*/ha (1.62 hoppers/hill with 85.23% ROC) at 15 days after second spray (Table 3).

Over all, dinotefuran 70% WG @ 61.6 *g.a.i*/ha was found to be excellent insecticide in suppressing the GLH population with an average 85.59 % reduction over control during *kharif 20*18 paddy crop. Not accurate but similar type of finding were reported by [11], he is concluded that the application of Imidacloprid 200 SL 150 ml/ha was the most effective against BPH, GLH and gall midge.

Impact on yield

Grain yield in all the dosages of insecticides was significantly higher when compared to untreated check (31.84 q/ha). Significantly higher grain yield of 63.84q/ ha was recorded in dinotefuran 70% WG @ 61.6 *g.a.i*/ha and it was followed by the dosage dinotefuran 70% WG (51.8 *g.a.i.*/ha (60.76q/ha) and dinotefuran 70% WG @ 42.0 *g.a.i./*ha (56.33q/ha) (Table 4).

Impact on natural enemies

In the field trial carried out to evaluate bio-efficacy of dinotefuran 70% WG at 61.6, 51.8 and 42.0 *g.a.i.*/ha in comparison to market sample as well as standard check insecticides against paddy pests in *kharif 20*18, the population of natural enemies like predatory mirid bugs and spiders were comparatively low in all the insecticidal treatment at 1 day before spray, 5 and 10days after spray when compared with untreated check. However, all treatments were statistically non-significant (Table 4). In the present study, dinotefuran was found to be quite safe to nymphs and adults of mirid bug (*C. lividipennis*). In all observations favourable ratio of BPH and mirid bug was noted after dinotefuran treatments which indicated that these insecticides were safe to the population of mirid bug. Dinotefuran is not a mutagen, neurotoxin or reproductive toxin. Spider population did not exhibit appreciable differences among the treatments in the experiment [12] & [13].

Conclusion

Management of planthoppers under transplanted paddy ecosystem through novel insecticides is practical and easily approachable to farming community. Based on the evaluations it can be concluded that, the granular insecticide dinotefuran 70% WG @ 61.6 *g.a.i.*/ha found overall superior in reducing the BPH, WBPH and GLH populations and obtaining the higher grain yield followed by dinotefuran 70% WG @ 51.8 *g.a.i.*/ha and dinotefuran 70% WG @ 42.0 *g.a.i.*/ha. There was no any adverse effect on the natural enemies *viz,* mirid bugs and spiders by these granular insecticides and these could be included in IPM and/ or IRM strategies to cater the needs of farming community.

Table 1: Bio-efficacy of dinotefuran 70% WG against brown planthopper, *N. lugens* on paddy during *kharif* – 2018

Sl. No	Treatment details	Dose (*g.a.i./*ha)	No. of BPH/ hill												Mean of % ROC
			First spray					% ROC	Second spray					% ROC	
			1 DBS	3 DAS	7 DAS	10 DAS	15 DAS		1 DBS	3 DAS	7 DAS	10 DAS	15 DAS		
1	Dinotefuran 70% WG	42.0	19.65 (4.88)	13.09^{c} (4.04)	10.77^{c} (3.69)	9.24^{c} (3.45)	8.88^{c} (3.68)	66.09	11.59^{c} (3.84)	8.70^{c} (3.37)	6.78^{c} (3.03)	4.55^{c} (2.56)	4.15^{c} (2.47)	85.15	75.62
2	Dinotefuran 70% WG	51.8	18.10 (4.71)	10.40^{ab} (3.62)	9.62^{b} (3.52)	8.46^{b} (3.34)	7.93^{b} (3.50)	69.72	10.82^{b} (3.72)	7.20^{b} (3.11)	5.14^{b} (2.70)	3.72^{b} (2.36)	3.31^{b} (2.27)	88.16	78.94
3	Dinotefuran 70% WG	61.6	20.02 (4.94)	10.02^{a} (3.52)	7.70^{a} (3.18)	6.15^{a} (2.90)	5.68^{a} (3.15)	78.31	8.49^{a} (3.34)	5.40^{a} (2.75)	3.53^{a} (2.32)	2.43^{a} (2.03)	1.98^{a} (1.90)	92.18	85.24
4	Dinotefuran 20%SG	40	19.26 (4.85)	13.87^{d} (4.12)	11.93^{d} (3.87)	10.02^{cd} (3.57)	9.49^{cd} (3.92)	63.76	13.34^{d} (4.09)	9.78^{d} (3.56)	7.40^{cd} (3.15)	5.02^{cd} (2.66)	4.69^{cd} (2.60)	83.22	73.49
5	Buprofezin 25% SC	200	18.86 (4.80)	16.95^{e} (4.56)	12.33^{e} (3.94)	10.77^{de} (3.70)	10.34^{de} (4.17)	60.52	15.38^{e} (4.37)	11.49^{e} (3.82)	8.01^{e} (3.26)	5.21^{de} (2.71)	4.86^{de} (2.63)	82.61	71.56
6	Untreated control	--	20.42 (4.99)	20.02^{f} (4.94)	21.18^{f} (5.07)	24.64^{f} (5.44)	26.19^{f} (5.61)		27.79^{f} (5.78)	26.54^{f} (5.65)	27.05^{f} (5.71)	27.42^{f} (5.74)	27.95^{f} (5.79)		
S.Em (±)			0.21	0.18	0.22	0.26	0.32		0.24	0.25	0.20	0.18	0.19		
CD @ 5 %			NS	0.54	0.65	0.71	0.95		0.70	0.73	0.59	0.52	0.56		
CV (%)			8.74	7.88	6.97	8.45	7.05		8.11	9.08	8.64	9.11	8.47		

Note: DBS=Day before spray; DAS= Day after spray; ROC-Reduction over Control; Figures in the parenthesis are √ x+1 transferred value; NS-Non Significant

Table 2: Bio-efficacy of dinotefuran 70% WG against white backed planthopper, *S. furcifera* on paddy during *kharif* – 2018

Sl. No	Treatment details	Dose (*g.a.i./*ha)	No. of WBPH/ hill												Mean of % ROC
			First spray					% ROC	Second spray					% ROC	
			1 DBS	3 DAS	7 DAS	10DAS	15DAS		1 DBS	3 DAS	7 DAS	10DAS	15DAS		
1	Dinotefuran 70% WG	42.0	25.15 (5.57)	20.22^{c} (5.01)	18.22^{c} (4.76)	15.45^{c} (4.43)	14.92^{c} (4.36)	52.26	18.02 (4.73)	12.25^{d} (3.98)	10.00^{d} (3.63)	7.94^{c} (3.27)	7.17^{c} (3.13)	80.01	66.13
2	Dinotefuran 70% WG	51.8	26.30 (5.69)	19.33^{ab} (4.91)	17.17^{b} (4.65)	14.45^{b} (4.28)	13.93^{b} (4.22)	55.42	15.78 (4.47)	9.92^{b} (3.62)	7.62^{b} (3.22)	5.50^{b} (2.80)	4.70^{b} (2.63)	87.12	71.27
3	Dinotefuran 70% WG	61.6	26.38 (5.70)	18.81^{a} (4.85)	16.33^{a} (4.55)	13.57^{a} (4.16)	12.97^{a} (4.09)	58.50	14.76 (4.33)	8.60^{a} (3.39)	6.19^{a} (2.94)	4.01^{a} (2.47)	3.13^{a} (2.25)	91.06	74.78
4	Dinotefuran	40	25.14	20.34^{cd}	18.26^{cd}	15.62^{cd}	15.14^{cd}	51.55	16.83	11.05^{c}	9.86^{c}	7.99^{cd}	7.29^{cd}	80.07	65.81

	20%SG		(5.57)	(5.04)	(4.77)	(4.45)	(4.38)		(4.60)	(3.79)	(3.60)	(3.28)	(3.25)		
5	Buprofezin 25% SC	200	24.47 (5.49)	21.14^{de} (5.12)	19.06^{e} (4.88)	16.51^{e} (4.57)	16.10^{e} (4.51)	48.48	18.12 (4.76)	13.52^{e} (4.15)	11.59^{e} (3.87)	9.80^{e} (3.59)	9.15^{e} (3.49)	75.21	61.84
6	Untreated control	--	24.36 (5.48)	28.59^{f} (5.90)	29.46^{f} (6.01)	30.32^{f} (6.08)	31.25^{f} (6.18)		33.76 (6.42)	34.57^{f} (6.49)	35.23^{f} (6.54)	35.80^{f} (6.59)	36.46^{f} (6.65)		
S.Em (±)			0.28	0.26	0.25	0.24	0.23		0.26	0.20	0.17	0.15	0.15		
CD @ 5 %			NS	0.76	0.74	0.69	0.69		0.75	0.58	0.49	0.43	0.46		
CV (%)			7.85	8.49	8.12	9.44	6.98		7.59	8.13	7.73	6.99	9.45		

Note: DBS=Day before spray; DAS= Day after spray; ROC-Reduction over Control; Figures in the parenthesis are √ x+1 transferred value; NS-Non-Significant

Table 3: Bio-efficacy of dinotefuran 70% WG against green leaf hopper, *N. virescens* on paddy during *kharif* – 2018

Sl. No	Treatment details	Dose (*g.a.i./ha*)	No. of green leafhopper / hill												
			First spray					% ROC	Second spray					% ROC	Mean of % ROC
			1 DBS	3 DAS	7 DAS	10DAS	15DAS		1 DBS	3 DAS	7 DAS	10DAS	15DAS		
1	Dinotefuran 70% WG	42.0	7.66 (1.90)	5.11^{c} (1.58)	4.20^{c} (1.44)	3.60^{c} (1.35)	3.46^{c} (1.44)	66.11	4.52 (1.50)	3.39^{c} (1.31)	2.64^{c} (1.18)	1.77^{c} (1.00)	1.62^{c} (0.96)	85.23	75.67
2	Dinotefuran 70% WG	51.8	7.06 (1.84)	4.06^{b} (1.41)	3.75^{b} (1.37)	3.30^{b} (1.30)	3.09^{b} (1.37)	69.73	4.22 (1.45)	2.81^{b} (1.21)	2.00^{b} (1.05)	1.45^{b} (0.92)	1.29^{b} (0.89)	88.16	78.94
3	Dinotefuran 70% WG	61.6	7.81 (1.93)	3.91^{a} (1.37)	3.00^{a} (1.24)	2.40^{a} (1.13)	2.22^{a} (1.23)	78.25	3.31 (1.30)	2.11^{a} (1.07)	1.38^{a} (0.90)	0.95^{a} (0.79)	0.77^{a} (0.74)	92.93	85.59
4	Dinotefuran 20%SG	40	7.51 (1.89)	5.41^{d} (1.61)	4.65^{d} (1.51)	3.91^{d} (1.39)	3.70^{cd} (1.53)	63.76	5.20 (1.60)	3.81^{d} (1.39)	2.89^{d} (1.23)	1.96^{d} (1.04)	1.83^{cd} (1.01)	83.21	73.48
5	Buprofezin 25% SC	200	7.36 (1.87)	6.61^{e} (1.78)	4.81^{e} (1.54)	4.20^{e} (1.44)	4.03^{e} (1.63)	60.52	6.00 (1.70)	4.48^{e} (1.49)	3.12^{e} (1.27)	2.03^{de} (1.06)	1.90^{e} (1.03)	82.56	71.54
6	Untreated control	--	7.96 (1.95)	7.81^{f} (1.93)	8.26^{f} (1.98)	9.61^{f} (2.12)	10.21^{f} (2.19)	-	10.84 (2.25)	10.35^{f} (2.20)	10.55^{f} (2.23)	10.69^{f} (2.24)	10.90^{f} (2.26)	-	
S.Em (±)			0.08	0.07	0.09	0.10	0.12		0.09	0.10	0.08	0.07	0.07		
CD @ 5 %			NS	0.21	0.25	0.28	0.37		0.27	0.28	0.24	0.20	0.22		
CV (%)			9.25	8.06	7.93	7.88	8.67		9.67	8.94	7.59	8.24	7.68		

Note: DBS=Day before spray; DAS= Day after spray; ROC-Reduction over Control; Figures in the parenthesis are √ x+1 transferred value; NS-Non-Significant

Table 4: Impact of dinotefuran 70% WG on natural enemies in paddy ecosystem during *kharif*-2018 and yield

Sl. No	Treatment details	Dose (*g.a.i./ha*)	No. of mirid bugs/ hill					No. of spiders/ hill					Yield (q/ha)
			1 DBS	3 DAS	7 DAS	10 DAS	15 DAS	1 DBS	3 DAS	7 DAS	10 DAS	15 DAS	
1	Dinotefuran 70% WG	42.0	6.96 (2.92)	3.85^{b} (2.29)	4.82^{b} (2.49)	4.07^{b} (2.33)	3.75^{b} (2.25)	4.82 (2.50)	4.39^{b} (45.21)	5.56^{b} (2.65)	4.82^{b} (2.50)	4.07^{b} (2.33)	56.33
2	Dinotefuran 70% WG	51.8	6.21 (2.78)	3.42^{bcd} (2.18)	4.07^{cd} (2.33)	3.32^{c} (2.15)	2.68^{cd} (1.99)	5.67 (2.68)	3.75^{cd} (2.24)	4.71^{c} (2.47)	4.07^{c} (2.32)	3.32^{cd} (2.15)	60.76
3	Dinotefuran 70% WG	61.6	5.78 (2.66)	2.57^{ef} (1.97)	3.10^{f} (2.11)	2.35^{ef} (1.90)	1.82^{f} (1.75)	5.24 (2.58)	2.68^{f} (1.98)	3.53^{f} (2.20)	2.57^{f} (1.97)	2.14^{efn} (1.85)	63.84
4	Dinotefuran 20%SG	40	5.56 (2.64)	3.64^{bc} (2.25)	4.49^{bc} (2.43)	3.10^{cd} (2.11)	3.00^{c} (2.08)	5.46 (2.63)	4.17^{bc} (2.36)	4.49^{cd} (2.43)	3.75^{d} (2.27)	3.42^{c} (2.18)	59.61
5	Buprofezin 25% SC	200	6.31 (2.80)	3.00^{de} (2.08)	3.75^{de} (2.26)	2.89^{de} (2.05)	2.46^{de} (1.94)	6.10 (2.76)	3.42^{de} (2.16)	4.39^{cde} (2.41)	3.32^{de} (2.15)	2.46^{e} (1.94)	53.44
6	Untreated control	--	6.53 (2.85)	8.88^{a} (3.24)	10.91^{a} (3.56)	14.45^{a} (4.07)	15.52^{a} (4.19)	5.14 (2.57)	8.35^{a} (3.15)	9.20^{a} (3.30)	11.02^{a} (3.58)	13.16^{a} (3.88)	31.84
S.Em ±			0.22	0.16	0.18	0.16	0.16	0.18	0.21	0.19	0.17	0.15	1.63
CD AT 5 %			NS	0.46	0.52	0.46	0.44	NS	0.60	0.55	0.48	0.43	4.29
CV (%)			7.59	8.47	7.16	6.91	7.55	7.08	8.11	8.45	7.94	7.37	7.48

NS= Non significant; Values are mean of three replications; DBS=Day before spray; DAS= Day after spray; NS= Non significant; Figures in the parenthesis are √ x+1 transferred value.

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