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Enhanced effectiveness of selected insecticides against rice planthoppers and yellow stem borer using organosilicone adjuvant EK-Boond under field conditions

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ABSTRACT

Field experiments were conducted during *Kharif* 2013 and *Rabi* 2013–14 to evaluate the effectiveness of selected insecticides applied with and without the organosilicone adjuvant EK-Boond against major insect pests of rice. The experiment comprised eight treatments involving rynaxypyr 20 SC, acephate 95 SG and dinotefuran 20 SG applied alone and in combination with EK-Boond (200 ml ha⁻¹), along with water + EK-Boond and untreated control. The experiment was laid out in a randomized block design with three replications. Observations on planthopper population, yellow stem borer incidence, natural enemies (spiders and mirid bugs), and grain yield were recorded. Results indicated that addition of EK-Boond considerably enhanced the efficacy of insecticides against planthoppers. During *Kharif*, dinotefuran 20 SG + EK-Boond recorded the lowest planthopper population (93.67, 40.00 and 77.00 insects per 10 hills at 70, 80 and 90 DAT, respectively), whereas the corresponding insecticide applied without adjuvant recorded comparatively higher populations. Rynaxypyr 20 SC + EK-Boond was highly effective in suppressing yellow stem borer, recording lower dead hearts and white ears than the insecticide alone. Spider populations were not significantly affected by insecticidal treatments, while significant differences were observed in mirid bug abundance. Improved pest suppression resulted in increased grain yield, with dinotefuran + EK-Boond producing the highest grain yield (6004 kg ha⁻¹) during *Kharif*. The study demonstrates that incorporation of organosilicone adjuvant EK-Boond significantly enhances insecticide performance under field conditions and can be recommended as an effective spray adjuvant for improving rice pest management.

Keywords: Rice, *Nilaparvata lugens*, *Scirpophaga incertulas*, Organosilicone adjuvant, EK-Boond, Dinotefuran, Rynaxypyr, Acephate

Introduction

Rice (*Oryza sativa* L.) is one of the most important staple food crops for more than half of the world's population and occupies nearly 165 million hectares globally, producing over 770 million tonnes annually. In India, rice is cultivated on approximately 47 million hectares with an annual production exceeding 135 million tonnes, playing a pivotal role in national food security and rural livelihoods (FAO, 2024) [1]. However, the productivity of rice is constrained by several biotic stresses, among which insect pests constitute one of the most serious constraints to sustainable production (Heinrichs *et al.*, 2004) [2]. More than 100 insect species are associated with rice ecosystems, although only a few attain economic importance under field conditions (Heinrichs, 1994) [3]. Among these, planthoppers i.e. brown planthopper (BPH), *Nilaparvata lugens* Stål, white-backed planthopper (WBPH) *Sogatella furcifera* Horváth have emerged as one of the most destructive pests in Asian rice cultivation and are serious phloem-feeding insects capable of causing direct and indirect damage (Cabauatan *et al.*, 2009) [4]. The yellow stem borer (*Scirpophaga incertulas* Walker) is another economically important pest causing substantial yield reduction throughout South and Southeast Asia. Annual yield losses due to stem borers have been estimated at 5–30%, with outbreaks causing considerably higher damage under favourable conditions (Heinrichs *et al.*, 2004) [2].

Management of rice insect pests primarily depends on chemical insecticides because of their rapid action and reliable field performance. In recent years, several novel insecticide groups including diamides and neonicotinoids have demonstrated excellent activity against stem borers and sucking pests, while offering improved selectivity towards beneficial organisms (Sattelle *et al.*, 2008; Cordova *et al.*, 2006) [6, 5]. Those are rynaxypyr (chlorantraniliprole), belonging to the anthranilic diamide group, acts by activating insect ryanodine receptors leading to paralysis and death, and exhibits remarkable efficacy against lepidopteran borers (Cordova *et al.*, 2006) [5] and dinotefuran, a third-generation neonicotinoid insecticide, possesses sys

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temic and translaminar properties and has shown excellent activity against rice planthoppers (Tomizawa *et al.*, 2005) [7]. Acephate, an organophosphate insecticide, continues to be widely used owing to its broad-spectrum activity against several sucking and lepidopteran pests.

Despite the availability of highly effective insecticides, successful pest control frequently depends upon the efficiency of spray application. Poor wetting, inadequate retention, limited penetration through waxy leaf surfaces and spray runoff often reduces pesticide bioavailability and consequently diminish field performance (Knoche, 1994) [8]. These limitations become particularly important in rice ecosystems where the crop canopy is dense and insects often remain concealed within the lower portions of plants. Spray adjuvants have therefore become increasingly important components of modern crop protection programmes. Among various classes of adjuvants, organosilicone surfactants have attracted considerable attention because of their exceptional ability to reduce surface tension to very low levels, allowing rapid droplet spreading, improve rain fastness and enhanced foliar penetration, thereby enhancing biological efficacy (Stevens, 1993; Knoche, 1994) [9, 8].

Numerous investigations have demonstrated that organosilicone surfactants significantly improve the performance of herbicides, fungicides and insecticides across diverse cropping systems (Stevens, 1993; Green *et al.*, 2000) [9, 10]. Nevertheless, information regarding the influence of organosilicone adjuvants on insecticide performance against major rice insect pests under Indian field conditions remains limited. Furthermore, increasing concerns regarding pesticide resistance, escalating production costs and environmental sustainability necessitate approaches that maximize insecticide efficiency without increasing pesticide load. Improving spray deposition through suitable adjuvants represents a practical strategy for enhancing pest control while potentially reducing pesticide inputs. Evaluation of insecticide–adjuvant combinations under field conditions is therefore essential for developing efficient and economically viable pest management strategies. In view of these considerations, the present investiga-

tion was undertaken to evaluate the effectiveness of selected insecticides applied with and without the organosilicone adjuvant EK-Boond against planthoppers and yellow stem borer under field conditions, and to assess their influence on natural enemy populations and grain yield.

Materials and methods

Field experiments were conducted during *Kharif* 2013 and *Rabi* 2013–14 at Regional Agricultural Research Station, Maruteru, Andhra Pradesh, India, to evaluate the influence of the organosilicone adjuvant, EK-Boond on the efficacy of selected insecticides against major insect pests of rice. The experiment was laid out in a Randomized Block Design (RBD) with eight treatments replicated three times. The rice crop was raised following the package of practices recommended for the area. Fertilizers, irrigation, and intercultural operations were carried out uniformly in all plots. The treatments consisted of three insecticides applied individually and in combination with the organosilicone adjuvant EK-Boond, along with adjuvant alone and an untreated control as mentioned below:

The insecticides were applied as foliar sprays using a knapsack sprayer fitted with a hollow-cone nozzle, ensuring uniform coverage of the crop canopy. Spraying was undertaken twice i.e. at 30 and 60 days after transplantation (DAT), when the pest population reached the economic threshold level. Care was taken to avoid spray drift between adjacent plots.

The population of planthoppers (BPH and WBPH) was recorded from 10 randomly selected hills in each plot before spraying (60 DAT) and at 70, 80 and 90 days after transplanting (DAT) during *Kharif*. During *Rabi*, observations were recorded before spraying (60 DAT) and after treatment (70 DAT). Both nymphs and adults present on each hill were counted. Incidence of yellow stem borer (*Scirpophaga incertulas* Walker) was assessed by recording number of dead hearts during the vegetative stage and white ears during the reproductive stage and the per cent infestation was calculated using the following formula:

$$\text{Per cent infestation} = \frac{\text{Number of dead hearts/white ears}}{\text{Total number of tillers/Panicle bearing tillers}} \times 100$$

The abundance of important predatory natural enemies, namely spiders and the green mirid bug (*Cyrtorhinus lividipennis* Reuter), was recorded from 10 randomly selected hills in each plot at the specified observation intervals. Grain yield from each net plot was recorded and converted into kg ha⁻¹. The data on planthopper, mirid bug populations were subjected to square-root transformation, while percentage observations were transformed using the angular (arcsine) transformation before statistical analysis. The experimental data were subjected to analysis of variance (Gomez *et al.*, 1984) [11]. Treatment means were compared using the Critical Difference (CD) at the 5% level of significance.

Results

Effect of insecticides during *Kharif* 2013

Planthoppers: The data presented in Table 1 revealed that the pre-treatment population of brown planthopper did not differ significantly among treatments, indicating uniform pest distribution before insecticide application. Significant differences among treatments were observed after spraying. At 70 DAT, dinotefuran 20 SG alone (53.00 insects/10 hills), dinotefuran 20 SG + EK-Boond (93.67 insects/10 hills) and acephate + EK-Boond (148.67 insects per 10 hills) recorded significantly lowest planthopper population. The highest population was observed in rynaxypyr 20 SC without adjuvant (913.67 insects/10 hills), reflecting its relatively lower efficacy against the sucking pest.

At 80 DAT, the superiority of dinotefuran 20 SG + EK-Boond became more evident, recording only 40.00 insects per 10 hills, which was statistically superior to most other treatments. The corresponding treatment without adjuvant recorded 45.67 insects per 10 hills, indicating a slight additional suppression due to EK-Boond. Acephate 95 SG combined with EK-Boond also performed better than acephate SG alone, demonstrating the beneficial effect of the adjuvant on spray efficacy. At 90 DAT, the residual effect of treatments became apparent. Dinotefuran 20 SG + EK-Boond maintained the lowest population (77.00 insects/10 hills), whereas dinotefuran 20 SG alone recorded 130.67 insects/10 hills. Similarly, acephate + EK-Boond resulted in substantially fewer planthoppers (1255.00 insects/10 hills) than acephate alone (2078.33 insects/10 hills). Rynaxypyr, irrespective of adjuvant addition, remained comparatively less effective against planthoppers because of its primary activity against lepidopteran insects.

Yellow stem borer: The influence of insecticides and EK-Boond on yellow stem borer incidence is presented in Table 2. Significant differences were observed among treatments for both dead hearts and white ears. The data on % dead hearts indicated that all the insecticides alone and in combination with non-ionic organosilicone wetting agent EK-boond recorded significantly lowest % of dead hearts (0.42 to 1.67) than untreated control (4.39) and EK boond alone (2.91). Rynaxypyr 20 SC @ 30 g a.i./ha + EK boond @ 200 ml/ha recorded significantly lowest % of white ears (3.89) and on par with other insecticide treatments.

S. No.	Details of the treatment
1	Rynaxypyr 20 SC @ 30 g a.i. ha ⁻¹ + EK-Boond @ 200 ml ha ⁻¹
2	Acephate 95 SG @ 500 g a.i. ha ⁻¹ + EK-Boond @ 200 ml ha ⁻¹
3	Dinotefuran 20 SG @ 40 g a.i. ha ⁻¹ + EK-Boond @ 200 ml ha ⁻¹
4	Rynaxypyr 20 SC @ 30 g a.i. ha ⁻¹
5	Acephate 95 SG @ 500 g a.i. ha ⁻¹
6	Dinotefuran 20 SG @ 40 g a.i. ha ⁻¹
7	Water spray + EK-Boond @ 200 ml ha ⁻¹
8	Untreated control

Natural enemies: The abundance of spiders and mirid bugs following insecticide application is presented in Table 3. Spider populations did not differ significantly among treatments throughout the observation period, indicating that none of the insecticidal treatments caused substantial adverse effects on these generalist predators. In contrast, significant differences were observed in mirid bug populations. Treatments receiving dinotefuran recorded comparatively lower numbers of green mirid bugs, whereas rynaxypyr-treated plots generally maintained relatively higher populations of this predator. Since green mirid bugs feeds primarily on planthopper eggs and early instar nymphs, lower predator abundance in highly effective treatments may also reflect reduced prey availability rather than direct insecticidal toxicity.

Grain yield: Grain yield differed significantly among treatments. All insecticide treatments produced significantly higher yields than the untreated control (4371 kg ha⁻¹). Among the treatments, significantly highest grain yield was obtained with dinotefuran + EK-Boond (6004 kg ha⁻¹) and on par with rynaxypyr + EK-Boond (5594 kg ha⁻¹) and were followed by acephate + EK-Boond (5299 kg ha⁻¹).

Effect of insecticides during Rabi 2013–14

Planthoppers: Similar trends were observed during the *Rabi* season (Table 4). Pre-treatment data at 60 DAT indicated that there was not significant difference among the treatments. At 70 DAT, dinotefuran combined with EK-Boond (67.33 insects per 10 hills) and dinotefuran alone (109.33 insects per 10 hills) again recorded the significantly lowest planthopper population than other treatments, confirming the consistency of the adjuvant effect across seasons. Rynaxypyr 20 SC recorded highest numbers than untreated control.

Natural enemies: Significant differences among the treatments were observed in spider and mirid bug populations (Table 4). Treatments receiving dinotefuran 20 SC and acephate 95 SG recorded comparatively lower numbers of spiders and mirid bugs, whereas rynaxypyr-treated plots generally maintained relatively higher populations of this predator.

Yellow stem borer: All the insecticide treatments recorded significantly lowest % dead hearts than EK boond alone and untreated control (Table 5). Among the treatments, rynaxypyr 20 SC @ 30 g a.i./ha + EK boond @ 200 ml/ha and rynaxypyr 20 SC alone recorded significantly lowest % of dead hearts and white ears.

Grain yield: Grain yield differed significantly among treatments (Table 5). All insecticide treatments produced significantly higher yields than the untreated control (4351 kg ha⁻¹). Among the treatments, Rynaxypyr 20 SC alone produced the significantly highest grain yield (5656 kg ha⁻¹) and was on par with rynaxypyr combined with EK Boond (5461 kg ha⁻¹). These were followed by dinotefuran 20 SG + EK boond (5121 kg ha⁻¹).

Discussion

The present investigation demonstrated that incorporation of the organosilicone adjuvant EK-Boond significantly improved the field performance of selected insecticides against major insect pests of rice.

The enhancement was particularly evident with dinotefuran against planthoppers and with rynaxypyr against yellow stem borer. Improved pest suppression resulted in increased grain yield without causing significant reduction in spider populations.

Planthoppers remains one of the most destructive insect pests of irrigated rice ecosystems because of its rapid reproductive potential, ability to develop insecticide resistance, and efficient transmission of viral diseases (Heinrichs *et al.*, 2004) [2]. Consequently, maximizing insecticide efficiency has become an important component of integrated pest management. The present investigation clearly demonstrated that addition of EK-Boond improved the efficacy of dinotefuran and acephate against planthoppers. Dinotefuran combined with EK-Boond consistently recorded lower planthopper populations during both *Kharif* and *Rabi* seasons compared with the insecticide applied alone. The improvement was most evident during later observations, indicating that the adjuvant enhanced both initial deposition and residual effectiveness. Organosilicone surfactants possess exceptional spreading characteristics because they reduce the surface tension of spray solutions thereby producing uniform spray deposits and increasing pesticide retention (Stevens, 1993; Knoche, 1994) [9, 8]. These surfactants also facilitate stomatal infiltration and improve penetration through the cuticular wax layer, thereby increasing the availability of systemic insecticides within plant tissues (Stevens, 1993) [9]. Several workers have also demonstrated superior efficacy of dinotefuran against planthoppers (Matsuda *et al.*, 2020) [12].

In the present investigation, rynaxypyr with EK-Boond recorded lower dead heart and white ear incidence than rynaxypyr alone, indicating that the organosilicone adjuvant enhanced insecticidal performance. Lahm *et al.* (2005) [13] reported that chlorantraniliprole possesses excellent residual activity against lepidopteran pests because of its novel mode of action and high affinity for insect ryanodine receptors. Sarao *et al.* (2014) [14] further demonstrated prolonged protection of rice against stem borers following chlorantraniliprole application.

The present investigation indicated that spider populations remained statistically unaffected following insecticide application, whereas significant variation was observed in mirid bug abundance. This indicates that the tested insecticides, particularly the newer molecules, exhibited relatively low toxicity to spiders under field conditions. Similar observations have been reported for chlorantraniliprole, which is generally regarded as comparatively safe to many predatory arthropods because of its selective mode of action (Cordova *et al.*, 2006) [5]. Mirid bug populations, however, were comparatively lower in dinotefuran-treated plots. This reduction may not necessarily indicate direct toxicity, because *Cyrtorhinus lividipennis* primarily feeds on planthopper eggs and young nymphs. Effective suppression of prey populations often leads to reduced predator abundance because of limited food availability (Heinrichs *et al.*, 2004) [2].

Grain yield ultimately reflects the cumulative effect of pest suppression throughout crop growth. In the present study, insecticide treatments i.e. dinotefuran 20 SC and rynaxypyr 20 SC combined with EK-Boond generally produced higher yields than their corresponding insecticides applied alone, with dinotefuran + EK-Boond recording the highest grain yield during *Kharif* rynaxypyr 20 SC + EK-Boond during *rabi*. Higher yields were primarily associated with effective reduction of planthopper populations during reproductive stages, thereby preventing hopper burn and maintaining photosynthetically active foliage. Similarly, suppression of stem borer damage reduced dead hearts and white ears, allowing greater panicle development and grain filling. Green *et al.* (2007) [15] emphasized that improved spray application technology frequently translates into greater economic returns because enhanced pesticide utilization improves crop protection without increasing pesticide dose. The present investigation supports this observation by demonstrating that the organosilicone adjuvant improved insecticide performance sufficiently to increase grain productivity.

Conclusion

The present study demonstrates that the organosilicone adjuvant EK-Boond substantially enhances the biological efficacy of insecticides under field conditions. Among the evaluated combinations, Dinotefuran + EK-Boond proved most effective against brown planthopper, whereas Rynaxypyr + EK-Boond provided superior suppression of yellow stem borer. The adjuvant improved insecticide performance primarily through enhanced spray deposition and penetration while maintaining acceptable compatibility with major predatory arthropods. These findings support the inclusion of organosilicone ad-

juvants as useful components of integrated rice pest management programmes.

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Conflict of interest

The author declares that there are no competing interests related to this study

Table 1. Effect of insecticides with and without adjuvant on occurrence of planthoppers

S. No.	Treatment	Dose (g a.i.+ ml/ha)	Planthoppers/10 hills**			
			60 DAT (BS)	70 DAT	80 DAT	90 DAT
1	Rynaxypyr 20 SC + EK boond	30 +200	69.00 (7.92)	695.00 (26.36)	131.67 (11.29)	1699.67 (40.56)
2	Acephate 95 SG+ EK boond	500 +200	119.33 (10.20)	148.67 (12.19)	78.00 (8.66)	1255.00 (35.34)
3	Dinotefuran 20 SG + EK boond	40 +200	101.67 (10.03)	93.67 (9.65)	40.00 (6.13)	77.00 (8.42)
4	Rynaxypyr 20 SC	30	203.33 (13.08)	913.67 (30.21)	161.00 (12.29)	2740.00 (52.27)
5	Acephate 95 SG	500	155.67 (12.11)	281.00 (16.33)	112.67 (10.30)	2078.33 (45.38)
6	Dinotefuran 20 SG	40	115.00 (10.68)	53.00 (7.11)	45.67 (6.61)	130.67 (11.34)
7	Water + EK boond	200	157.33 (12.04)	591.33 (22.58)	96.67 (9.66)	1318.33 (36.18)
8	Untreated control		126.67 (11.04)	828.00 (28.46)	133.33 (11.21)	2280.67 (47.74)
	<i>F</i> test		NS	Sig	Sig	Sig
	CD (0.05)		---	8.31	2.62	7.80
	CV (%)		35.97	24.83	15.72	12.86

Table 2. Effect of insecticides with and without adjuvant on incidence of yellow stem borer and grain yield

S. No.	Treatment	Dose (g a.i.+ ml/ha)	Yellow stem borer*		Grain yield (Kg/ha)
			% DH	%WE	
1	Rynaxypyr 20 SC+ EK boond	30 +200	1.04 (5.40)	3.89 (11.34)	5594
2	Acephate 95 SG+ EK boond	500 +200	1.06 (5.73)	6.05 (14.15)	5299
3	Dinotefuran 20 SG+ EK boond	40 +200	0.85 (3.64)	8.31 (16.73)	6004
4	Rynaxypyr 20 SC	30	1.21 (5.44)	5.30 (13.28)	5036
5	Acephate 95 SG	500	0.42 (3.25)	6.28 (14.24)	4495
6	Dinotefuran 20 SG	40	1.67 (7.30)	6.56 (14.79)	5176
7	Water + EK boond	200	2.91 (9.81)	7.80 (16.19)	5164
8	Untreated control		4.39 (12.07)	10.07 (18.49)	4371
	<i>F</i> test		Sig	Sig	Sig
	CD (0.05)		4.91	3.37	525
	CV (%)		44.05	12.94	5.83

(continued on next page)

Table 5. Effect of insecticides with and without adjuvant on incidence of yellow stem borer and grain yield**Table 3.** Effect of insecticides with and without adjuvant on occurrences of natural enemies during *Kharif* 2013

S. No.	Treatment	Spiders/10 hills				Mirid bugs/10 hills		
		60 DAT (BS)	70 DAT	80 DAT	90 DAT	70 DAT	80 DAT	90 DAT**
1	Rynaxypyr 20 SC+ EK boond	11.67	23.33	22.00	36.33	21.00	16.67	194.33 (13.84)
2	Acephate 95 SG+ EK boond	13.67	18.67	19.00	30.67	3.67	14.00	146.00 (11.84)
3	Dinotefuran 20 SG+ EK boond	12.67	16.00	14.67	28.00	3.67	5.33	66.00 (7.98)
4	Rynaxypyr 20 SC	13.67	24.33	20.33	29.67	16.33	17.00	249.33 (15.69)
5	Acephate 95 SG	13.00	20.00	20.33	33.33	9.33	17.33	175.00 (13.15)
6	Dinotefuran 20 SG	14.67	12.00	19.00	31.00	4.67	5.67	87.33 (9.23)
7	Water + EK boond	15.00	24.00	19.00	37.00	10.00	18.00	182.33 (13.49)
8	Untreated control	12.67	25.33	19.33	34.67	22.67	14.00	197.00 (14.01)
<i>F</i> test		NS	NS	NS	NS	Sig	Sig	Sig
CD (0.05)		--	--	--	--	10.43	2.66	3.55
CV (%)		36.13	24.28	18.99	31.40	52.18	11.27	16.33

Table 4. Effect of insecticides with and without adjuvant on occurrence of planthoppers and natural enemies during *Rabi* 2013-14

S. No.	Treatment	Dose (g a.i.+ ml/ha)	Planthopper no. s/ 10 hills**		Natural enemies	
			60 DAT (BS)	70 DAT	spiders	Mirid bugs**
1	Rynaxypyr 20 SC + EK boond	30 +200	66.33 (8.12)	1129.67 (33.57)	30.33	183.00 (13.52)
2	Acephate 95 SG+ EK boond	500 +200	60.67 (7.78)	329.33 (17.97)	18.33	85.67 (9.22)
3	Dinotefuran 20 SG+ EK boond	40 +200	62.33 (7.84)	67.33 (7.67)	15.00	25.33 (4.96)
4	Rynaxypyr 20 SC	30	98.67 (9.83)	932.00 (30.16)	24.33	165.33 (12.83)
5	Acephate 95 SG	500	59.67 (7.67)	625.33 (23.11)	24.00	116.00 (10.76)
6	Dinotefuran 20 SG	40	49.33 (6.99)	109.33 (10.45)	17.33	38.67 (5.98)
7	Water +EK boond	200	49.00 (6.94)	557.33 (23.59)	25.67	124.67 (11.12)
8	Untreated control	---	46.67 (6.83)	567.33 (23.82)	22.67	116.33 (10.77)
<i>F</i> test			NS	Sig	Sig	Sig
CD (0.05)			---	8.65	9.24	2.12
CV (%)			13.76	23.19	23.75	12.22

S. No.	Treatment	Dose (g a.i.+ ml/ha)	% Dead hearts*		%White ears*	Grain yield (kg/ha)
			40 DAT	50 DAT		
1	Rynaxypyr 20 SC+ EK boond	30 +200	0.92 (5.34)	0.70 (4.81)	3.31 (10.21)	5461
2	Acephate 95 SG+ EK boond	500 +200	2.78 (9.53)	1.58 (7.13)	14.16 (22.09)	4528
3	Dinotefuran 20 SG+ EK boond	40 +200	1.34 (6.56)	1.18 (6.00)	17.55 (24.52)	5121
4	Rynaxypyr 20 SC	30	0.71 (3.37)	0.81 (4.98)	3.61 (10.85)	5656
5	Acephate 95 SG	500	3.33 (10.48)	0.96 (5.39)	14.96 (22.70)	4855
6	Dinotefuran 20 SG	40	3.90 (11.37)	2.75 (9.55)	16.32 (23.82)	4843
7	Water+ EK boond	200	2.37 (8.86)	2.98 (9.91)	18.21 (25.17)	4736
8	Untreated control	---	5.30 (13.30)	2.44 (8.86)	23.09 (28.61)	4351
	<i>F</i> test		Sig	Sig	Sig	Sig
	CD (0.05)		3.14	2.79	4.75	531
	CV (%)		20.81	22.54	12.91	6.14

*Arc-sine transformation, DAT: Days after transplantation

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- during Kharif 2013.
- Square root transformation; DAT: Days after transplantation; BS: Before spray. during Kharif 2013.
- Arc-sine transformation.
- Square root transformation; DAT: Days after transplantation; BS: Before spray.
- Square root transformation; DAT: Days after transplantation; BS: Before spray. during Rabi 2013–14.

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