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#### RK Kalyan

Agricultural Research Station-  
Banswara, Rajasthan-327 001  
(Maharana Pratap University of  
Agriculture & Technology-  
Udaipur), Rajasthan, India

#### DP Saini

Agricultural Research Station-  
Banswara, Rajasthan-327 001  
(Maharana Pratap University of  
Agriculture & Technology-  
Udaipur), Rajasthan, India

#### S Ramesh Babu

Agricultural Research Station-  
Banswara, Rajasthan-327 001  
(Maharana Pratap University of  
Agriculture & Technology-  
Udaipur), Rajasthan, India

## Evaluation of different doses of lancer gold (acephate 50% + imidacloprid 1.8% SP) against major insect pests of rice

RK Kalyan, DP Saini and S Ramesh Babu

#### Abstract

A field experiment was carried out to evaluate the efficacy of different doses of lancer gold (acephate 50% + imidacloprid 1.8% SP) *i.e.* 800, 1000 and 1200 g ha<sup>-1</sup> and 2000 g ha<sup>-1</sup> (only for phytotoxicity test) along with three checks against major insect pests of rice at Agricultural Research Station- Banswara, Rajasthan during *kharif*-2014 and 2015. Among the different doses of lancer gold, 1200 and 1000g ha<sup>-1</sup> were found effective over to acephate 75 SP, imidacloprid 17.8 SL and chlorpyrifos 50 + cypermethrin 5 EC in controlling population of brown plant hopper, green leaf hopper, stem borer and rice leaf folder and also gave significantly higher grain yield than other treatments. Highest grain yield of 3610 and 3471 kg ha<sup>-1</sup> was recorded in lancer gold (acephate 50% + imidacloprid 1.8% SP) @ 1200 g ha<sup>-1</sup> and it is statistically at par with lancer gold @ 1000 g ha<sup>-1</sup> in the year 2014 and 2015, respectively. However, the maximum cost: benefit ratio of 1:18.65 was obtained in lancer gold @ 1000 g ha<sup>-1</sup> due to low cost of treatment. Lancer gold (acephate 50% + imidacloprid 1.8% SP) @ 2000 g ha<sup>-1</sup> did not cause any visual phytotoxicity symptoms on the crop.

**Keywords:** Bioefficacy, brown plant hopper, green leaf hopper, lancer gold, leaf folder, rice and stem borer

#### 1. Introduction

Rice is the staple food of more than half of the world's population. Rice has molded the cultures, diets and economies of the thousands of millions of people. For, more than half of humanity rice is life. United Nations designated year 2004 as the International Year of Rice because of its importance [1]. The gap between the potential and actual yield across the Nation revealed that several factors act as yield constraints. Among these, insect pests are the major constraints in increasing rice productivity [2]. About 300 species of insect pests attack the rice crop at various stages of crop and only 23 species caused notable damage [3]. Among them, green leaf hopper (*Nephotettix* sp), brown plant hopper, *Nilaparvata lugens* (Stal.) and white backed plant hopper, *Sogatella furcifera* (Horvath) cause devastating damage. Rice leaf folder, *Cnaphalocrosis medinalis* (Guenée) earlier considered as a minor pest has gained the status of major pest with the wide spread of high yielding rice varieties [4] and damage caused by this pest ranged from 18.3 to 58.4 per cent [5] depending on the stage of the crop and time of infestation. Percentage of filled grains; 1000 grain weight and grain yield varied significantly due to rice leaf folder infestation levels [6]. Among stem borer, *Scirpophaga incertulas* (Walker) is the major pest and infests rice at the tillering and flowering stage. Yellow stem borer caused 1.0 to 19.0 per cent yield loss in early planted rice and 38.0 to 80.0 per cent in late planted rice [7]. Due to 1.0 per cent dead heart or white ear, or due to both phases stem borer damage would be 2.5, 4.0 and 6.4 per cent yield loss, respectively [8]. Yield losses due to insect pests of rice ranges from 25.0 to 51.0 per cent [9]. In general, yield loss due to insect pests of rice has been estimated about 25.0 per cent [10]. Farmers still considering application of insecticides as one of the most effective management tool besides tactics like cultural and biological means. The insecticides used to control insect pests of rice changed greatly due to development of insecticide resistance in target insects and innovation of newer chemicals [11]. These new molecules/chemicals provide opportunity to evaluate the efficacy of different doses of lancer gold (acephate 50% + imidacloprid 1.8% SP) *i.e.* 800, 1000 and 1200 g ha<sup>-1</sup> and 2000 g ha<sup>-1</sup> (only for phytotoxicity test) along with three checks against major insect pests of rice.

#### Correspondence

#### RK Kalyan

Agricultural Research Station-  
Banswara, Rajasthan-327 001  
(Maharana Pratap University of  
Agriculture & Technology-  
Udaipur), Rajasthan, India

## 2. Material and Methods

Field experiments were conducted at Agricultural Research Station- Banswara (Rajasthan) during *kharif*-2014 and 2015 to evaluate the efficacy of different doses of lancer gold (acephate 50% + imidacloprid 1.8% SP) *i.e.* 800, 1000 and 1200 g ha<sup>-1</sup> and 2000 ha<sup>-1</sup> (only for phytotoxicity test) along with checks against major insect pests of rice namely brown plant hopper, green leaf hopper, stem borer and rice leaf folder. The trial was laid out in randomized block design (RBD) with 8 treatments and 3 replications. The rice variety (Pusa sugndha-5) was transplanted in the 2<sup>nd</sup> fortnight of July (in both the years) at 20 × 10 cm crop geometry. The plot size was kept 5.0 × 4.0 m. All recommended package and practices were followed to raise the crop, except plant protection measures. The knapsack sprayer and spray volume @ 500 litre ha<sup>-1</sup> was used with hollow cone nozzle to impose the spray treatments. All the treatments had two sprays except check. First spray was done at economic threshold level (ETL) and subsequent spray was given at fortnight interval. The observations on population of brown plant hopper (BPH) and green leaf hopper (GLH) were recorded from randomly selected 10 hills and averaged to per hill basis in each treatment before spray and 3, 5, 7 and 10 days after spray (DAS). The counts on white ears due to stem borer and leaf damage by rice leaf folder were recorded on randomly selected 10 hills and averaged to per hill basis. White ears due to stem borer were recorded at pre harvesting stage; whereas, per cent leaf damage due to leaf folder was recorded at 10 days after first spray (DAFS) and 10 days after second spray (DASS). The per cent of white ears and leaf damage was calculated by using the following formula<sup>[12]</sup>:

$$\text{Percent white ears} = \frac{\text{Number of white ears per hill}}{\text{Total number of tillers per hill}} \times 100$$

$$\text{Per cent leaf damage} = \frac{\text{Number of damaged leaves per hill}}{\text{Total number of leaves per hill}} \times 100$$

The per cent reduction in population of brown plant hopper and green leaf hopper *vis-a-vis* control was computed using the method described<sup>[13]</sup>:

$$\text{Per cent reduction in population} = 100 \times \left[ 1 - \frac{T_a \times C_b}{T_b \times C_a} \right]$$

Where,

T<sub>a</sub> = Number of insects after treatment

T<sub>b</sub> = Number of insects before treatment

C<sub>a</sub> = Number of insects in untreated check after treatment

C<sub>b</sub> = Number of insects in untreated check before treatment

The reduction percentage figures were transformed into arc sine values and subjected to analysis of variance. Grain yield/plot was recorded at harvest and it was converted into kg ha<sup>-1</sup> for analysis and comparison.

Net profit and cost benefit ratio was calculated by using following formula:

Net profit = Cost of increased yield over control - Cost of respective treatment

$$\text{B: C ratio} = \frac{\text{Net profit (Rs. ha}^{-1}\text{)}}{\text{Cost of respective treatment (Rs. ha}^{-1}\text{)}}$$

The visual observations on the phytotoxicity to the crop was rated using the criteria developed by<sup>[14]</sup> on a scale of 0 – 10 where; 0 represents no injury and 10 represents dead plants. The observations on the phytotoxicity on crop health due to application of lancer gold (acephate 50% + imidacloprid 1.8% SP @ 2000 g ha<sup>-1</sup>) were recorded at 1, 3, 5, 7 and 10 days after spray in terms of leaf injury on tips/surface, wilting, yellowing, vein clearing, necrosis, chlorosis, epinasty and hyponasty using the scale/scores shown in Table-1.

**Table 1:** Phytotoxicity visual rating scale

Scale/Score	Per cent phytotoxicity symptom
0	No phytotoxicity
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

## 3. Results and Discussion

### 3.1 Bio-efficacy of lancer gold on insect pests of rice

#### 3.1.1 Brown Plant hopper (BPH)

There was no significant difference in brown plant hopper population among the plots before the application of treatments during both the seasons (*kharif* 2014 & 2015). The significant maximum reduction in the brown plant hopper population with a mean of 65.09; 70.05; 76.26 and 66.68; 71.5; 75.00 per cent was recorded in lancer gold (acephate 50% + imidacloprid 1.8% SP) @ 1200g ha<sup>-1</sup> at 3, 5 and 7 days after first spray during the year 2014 and 2015, respectively and it is statistically at par with lower dose of lancer gold @ 1000 g ha<sup>-1</sup> during both the seasons. It was followed by lancer gold @ 1000 g ha<sup>-1</sup> and imidacloprid 17.8 SL@ 125 ml ha<sup>-1</sup>. Whereas, minimum per cent reduction in BPH population 23.27; 26.66; 29.57 and 26.85; 28.20; 30.43 were recorded in chlorpyrifos 50% + cypermethrin 5% EC at 3, 5 and 7 days after first spray during both the seasons, respectively. At 10 days after spray, decreasing trend was recorded in reduction of the BPH population. The similar trend was also observed in second spray at 3, 5 and 7 and 10 days after spray during the year 2014 and 2015 (Table 2 and 3).

**Table 2:** Bio efficacy of lancer gold (acephate 50% + imidacloprid 1.8% SP) against brown plant hopper on paddy during *kharif*-2014

Treatments	Doses (g or ml ha <sup>-1</sup> )	PTP*	Per cent mean reduction in population of brown plant hopper days after treatment							
			1 <sup>st</sup> spray				2 <sup>nd</sup> spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T <sub>1</sub> = Acephate 50% + Imidacloprid 1.8% SP	800	22.00 (4.69)	49.66 (58.09)	52.10 (62.26)	53.40 (64.46)	52.65 (63.19)	50.06 (58.78)	51.97 (62.05)	53.16 (64.05)	52.54 (63.01)
T <sub>2</sub> = Acephate 50% + Imidacloprid 1.8% SP	1000	23.00 (4.80)	52.79 (63.43)	54.40 (66.11)	58.03 (71.96)	57.70 (71.44)	52.92 (63.64)	54.30 (65.94)	58.11 (72.09)	57.77 (71.56)
T <sub>3</sub> = Acephate 50% + Imidacloprid 1.8% SP	1200	23.00 (4.79)	53.78 (65.09)	56.82 (70.05)	60.84 (76.26)	59.98 (74.97)	55.02 (67.13)	57.49 (71.11)	61.80 (77.67)	61.12 (76.68)
T <sub>4</sub> = Acephate 75 SP	1000	24.00 (4.90)	49.44 (57.72)	50.49 (59.52)	52.47 (62.89)	51.69 (61.57)	49.89 (58.50)	51.51 (61.26)	52.59 (63.10)	51.70 (61.58)
T <sub>5</sub> = Imidacloprid 17.8 SL	125	22.00 (4.69)	49.15 (57.22)	51.69 (61.57)	51.85 (61.85)	51.04 (60.46)	49.15 (57.22)	50.94 (60.29)	52.37 (62.72)	51.64 (61.49)
T <sub>6</sub> = Chlorpyrifos 50% + Cypermethrin 5% EC	750	24.00 (4.90)	28.84 (23.27)	31.09 (26.66)	32.94 (29.57)	32.14 (28.29)	31.24 (26.89)	33.22 (30.02)	34.37 (31.86)	33.40 (30.30)
T <sub>7</sub> = Untreated control	-	23.00 (4.79)	-	-	-	-	-	-	-	-
S. Em. ±		-	0.89	0.83	1.06	0.71	1.40	1.27	1.45	1.60
CD at 5%		NS	2.67	2.49	3.17	2.32	4.19	3.79	4.33	4.78

\* Pre-treatment population/3leaves \*\*Figures in parenthesis are retransformed per cent values DAS= Day/days after spray NS=Non significant

**Table 3:** Bio efficacy of lancer gold (acephate 50% + imidacloprid 1.8% SP) against brown plant hopper on paddy during *kharif*-2015

Treatments	Doses (g or ml ha <sup>-1</sup> )	PTP*	Per cent mean reduction in population of brown plant hopper days after treatment							
			1 <sup>st</sup> spray				2 <sup>nd</sup> spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T <sub>1</sub> = Acephate 50% + Imidacloprid 1.8% SP	800	25.00 (4.98)	49.89 (58.50)	51.01 (60.42)	52.24 (62.51)	51.58 (61.39)	49.20 (57.31)	51.42 (61.11)	52.18 (62.40)	51.93 (61.97)
T <sub>2</sub> = Acephate 50% + Imidacloprid 1.8% SP	1000	24.00 (4.90)	52.10 (62.26)	54.23 (65.83)	55.00 (67.10)	54.49 (66.26)	51.80 (61.76)	54.22 (65.81)	55.03 (67.15)	54.49 (66.26)
T <sub>3</sub> = Acephate 50% + Imidacloprid 1.8% SP	1200	26.00 (5.10)	54.74 (66.68)	57.64 (71.35)	60.00 (75.00)	59.28 (73.90)	54.79 (66.76)	58.55 (72.78)	59.82 (74.72)	59.00 (73.48)
T <sub>4</sub> = Acephate 75 SP	1000	24.00 (4.90)	48.84 (56.68)	49.79 (58.32)	51.95 (62.02)	51.51 (61.27)	46.93 (53.36)	48.45 (56.01)	49.20 (57.30)	48.58 (56.24)
T <sub>5</sub> = Imidacloprid 17.8 SL	125	25.00 (5.00)	48.12 (55.43)	49.39 (57.64)	50.82 (60.08)	49.99 (58.67)	46.68 (52.94)	47.93 (55.10)	49.00 (56.96)	48.35 (55.83)
T <sub>6</sub> = Chlorpyrifos 50% + Cypermethrin 5% EC	750	24.00 (4.90)	31.21 (26.85)	32.08 (28.20)	33.48 (30.43)	32.90 (29.51)	31.80 (27.77)	33.49 (30.45)	34.68 (32.37)	33.74 (30.85)
T <sub>7</sub> = Untreated control	-	26.00 (5.10)	-	-	-	-	-	-	-	-
S. Em. ±		-	1.59	1.79	1.80	1.86	1.78	1.60	1.65	1.52
CD at 5%		NS	4.75	5.35	5.36	5.56	5.30	4.78	4.93	4.55

\* Pre-treatment population/3leaves \*\*Figures in parenthesis are retransformed per cent values DAS= Day/days after spray NS=Non significant

### 3.1.2 Green leaf hopper (GLH)

The pre-treatment population of green leaf hopper (GLH) did not vary significantly in all the plots before first spray during both the years 2014 & 2015. The highest reduction in population of green leaf hopper with mean of 64.76; 70.03; 76.48 and 67.09; 69.20; 74.45 per cent was recorded in lancer gold @1200 g ha<sup>-1</sup> at 3, 5 and 7 days after first spray during both the seasons, respectively and statistically at par with

lancer gold @1000 g ha<sup>-1</sup>. It was followed by lancer gold @ 800 g and acephate 75 SP @ 1000 g ha<sup>-1</sup>. Whereas, minimum per cent reduction in GLH population 43.83; 46.36; 50.44 and 51.03; 52.30; 53.54 were recorded in chlorpyrifos 50% + cypermethrin 5% EC at 3, 5 and 7 days after first spray during both the seasons, respectively. The similar trend was also observed in second spray at 3, 5, 7 and 10 days after spray during the year 2014 and 2015 (Table 4 and 5).

**Table 4:** Bio efficacy of lancer gold (acephate 50% + imidacloprid 1.8% SP) against green plant hopper on paddy during *kharif*-2014

Treatments	Doses (g or ml ha <sup>-1</sup> )	PTP*	Per cent mean reduction in population of green plant hopper days after treatment							
			1 <sup>st</sup> spray				2 <sup>nd</sup> spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T <sub>1</sub> = Acephate 50% + Imidacloprid 1.8% SP	800	16.00 (4.00)	48.90 (56.79)	51.31 (60.93)	53.30 (64.29)	51.93 (61.97)	49.75 (58.25)	51.09 (60.55)	53.12 (63.98)	52.28 (62.57)
T <sub>2</sub> = Acephate 50% + Imidacloprid 1.8% SP	1000	17.00 (4.12)	50.95 (60.31)	54.48 (66.24)	56.28 (69.19)	55.87 (68.53)	51.84 (61.83)	54.50 (66.27)	57.34 (70.88)	55.87 (68.52)
T <sub>3</sub> = Acephate 50% + Imidacloprid 1.8% SP	1200	17.00 (4.12)	53.59 (64.76)	56.81 (70.03)	60.99 (76.48)	60.20 (75.30)	55.49 (67.90)	58.40 (72.54)	60.95 (76.42)	60.57 (75.86)
T <sub>4</sub> = Acephate 75 SP	1000	15.00 (3.87)	48.64 (56.34)	51.39 (61.06)	52.24 (62.51)	51.87 (61.87)	49.70 (58.16)	51.08 (60.53)	52.79 (63.43)	51.87 (61.88)
T <sub>5</sub> = Imidacloprid 17.8 SL	125	16.00 (4.00)	48.23 (55.62)	51.14 (60.64)	52.18 (62.40)	51.01 (60.41)	49.10 (57.13)	50.76 (59.99)	51.43 (61.14)	50.76 (59.99)
T <sub>6</sub> = Chlorpyrifos 50% + Cypermethrin 5% EC	750	15.00 (3.87)	41.45 (43.83)	42.91 (46.36)	45.25 (50.44)	44.21 (48.62)	44.43 (49.00)	45.89 (51.55)	46.44 (52.51)	45.51 (50.90)
T <sub>7</sub> = Untreated control	-	-	-	-	-	-	-	-	-	-
S. Em. ±	-	-	1.56	1.67	1.65	1.86	1.70	1.93	1.96	2.13
CD at 5%	-	NS	4.65	4.99	4.94	5.54	5.06	5.75	5.86	6.36

\* Pre-treatment population/3leaves \*\*Figures in parenthesis are retransformed per cent values DAS= Day/days after spray NS=Non

**Table 5:** Bio efficacy of lancer gold (acephate 50% + imidacloprid 1.8% SP) against green plant hopper on paddy during *kharif*-2015

Treatments	Doses (g or ml ha <sup>-1</sup> )	PTP*	Per cent mean reduction in population of green plant hopper days after treatment							
			1 <sup>st</sup> spray				2 <sup>nd</sup> spray			
			3 DAS	5 DAS	7 DAS	10 DAS	3 DAS	5 DAS	7 DAS	10 DAS
T <sub>1</sub> = Acephate 50% + Imidacloprid 1.8% SP	800	17.00 (4.12)	48.52 (56.13)	49.79 (58.32)	51.36 (61.00)	50.15 (58.94)	48.63 (56.31)	51.04 (60.47)	52.15 (62.35)	51.76 (61.70)
T <sub>2</sub> = Acephate 50% + Imidacloprid 1.8% SP	1000	16.00 (3.99)	50.37 (59.31)	52.95 (63.70)	55.71 (68.27)	54.51 (66.30)	50.92 (60.25)	53.45 (64.54)	56.45 (69.46)	54.91 (66.95)
T <sub>3</sub> = Acephate 50% + Imidacloprid 1.8% SP	1200	18.00 (4.24)	55.00 (67.09)	56.29 (69.20)	59.64 (74.45)	59.02 (73.50)	54.21 (65.79)	56.93 (70.22)	59.66 (74.49)	58.61 (72.87)
T <sub>4</sub> = Acephate 75 SP	1000	16.00 (3.99)	48.41 (55.94)	49.45 (57.73)	51.23 (60.80)	47.73 (54.76)	44.78 (49.61)	46.74 (53.04)	48.73 (56.49)	48.09 (55.38)
T <sub>5</sub> = Imidacloprid 17.8 SL	125	18.00 (4.24)	47.79 (54.87)	49.04 (57.03)	50.87 (60.18)	46.33 (52.33)	44.72 (49.51)	46.34 (52.34)	48.50 (56.10)	48.01 (55.25)
T <sub>6</sub> = Chlorpyrifos 50% + Cypermethrin 5% EC	750	17.00 (4.12)	45.59 (51.03)	46.32 (52.30)	47.03 (53.54)	44.96 (49.94)	41.90 (44.60)	44.05 (48.34)	45.93 (51.62)	45.31 (50.54)
T <sub>7</sub> = Untreated control	-	16.00 (4.00)	-	-	-	-	--	-	-	-
S. Em. ±	-	-	1.57	1.63	1.52	1.88	1.64	1.21	1.56	1.36
CD at 5%	-	NS	4.69	4.87	4.55	5.60	4.86	3.60	4.66	4.04

\* Pre-treatment population/3leaves \*\*Figures in parenthesis are retransformed per cent values DAS= Day/days after spray NS=Non

### 3.1.3 Stem borer

The per cent stem borer infestation was recorded on the basis of white ears at pre harvesting stage. All the insecticides significantly reduce the white ears as compared to control. The minimum 1.90 and 2.30 per cent white ears was recorded in lancer gold @ 1200 g ha<sup>-1</sup> during the year 2014 and 2015,

respectively and it is statistically at par with lower dose of lancer gold @ 1000 g ha<sup>-1</sup> during the year 2014 and 2014 as compared to untreated check (9.10 and 8.70 per cent during the year 2014 and 2015, respectively). It was followed by chlorpyrifos 50% + cypermethrin 5% EC, acephate 75 SP, imidacloprid 17.8 SL during both the seasons (Table 6).

**Table 6:** Bioefficacy of lancer gold (acephate 50% + imidacloprid 1.8% SP) against stem borer on paddy during *kharif*- 2014 and 2015

S. No.	Treatments	Dosage (g or ml ha <sup>-1</sup> )	Per cent white ear due to stem borer	
			2014	2015
1.	Acephate 50% + Imidacloprid 1.8% SP	800	4.60 (12.38)	3.57 (10.87)
2.	Acephate 50% + Imidacloprid 1.8% SP	1000	2.10 (8.32)	2.40 (8.91)
3.	Acephate 50% + Imidacloprid 1.8% SP	1200	1.90 (7.92)	2.30 (8.72)
4.	Acephate 75 SP	1000	4.50 (12.13)	3.30 (10.46)
5.	Imidacloprid 17.8 SL	125	7.10 (15.45)	6.00 (14.17)
6.	Chlorpyrifos 50% + Cypermethrin 5% EC	750	3.20 (10.30)	2.70 (9.45)
7.	Untreated control	-	9.10 (17.55)	8.70 (17.13)
	S. Em. ±		0.54	0.41
	CD at 5%		1.67	1.28

Figures in the parenthesis are arc sine value

### 3.1.4 Rice leaf folder

The data (Table 7) on per cent damaged leaves due to leaf folder recorded 10 days after each application revealed that all the insecticidal treatments recorded significantly lower per cent damaged leaves than control. The minimum 4.80; 2.00 and 1.30; 0.70 per cent leaf damage was recorded in lancer gold @ 1200 g ha<sup>-1</sup> after each spray in both the study years, respectively. It was statistically at par with lancer gold @ 1000 g ha<sup>-1</sup> during the year 2014 and 2015. It was followed by chlorpyrifos 50% + cypermethrin 5% EC, acephate 75 SP, imidacloprid 17.8 SL during both the seasons.

In the present investigation, lancer gold (acephate 50% + imidacloprid 1.8% SP) is ready mix new molecule; hence, specific information regarding to efficacy of this molecule against insect pest of rice is not available. However, efficacy of insecticides of different groups viz. organochlorines,

organophosphates, carbamates and synthetic pyrethroids have been tried and recommended [15-23] against major insect pests of rice and significantly increased the yield of rice. After that, the insecticides used to control insect pests of rice changed greatly due to advent of new chemicals and found very effective like fipronil [24-30], imidacloprid 17.8 SL, thiamethoxam 25 WG [31-33], buprofezin 25 SC, ethiprole, flubendiamide 480 SC, emamectin benzoate 5 SG [34-36, 32, 37, 38]. Presently, pesticide companies emphasis on ready mixed insecticides of different groups and mode of action. Pre-mix combinations of some insecticides like flubendiamide + buprofezin and buprofezin + acephate were found effective against insect pest of rice [39, 40]. The present findings corroborated the findings of above authors who reported that most of the new insecticides were effective in controlling major insect pests of rice and gave significantly higher yield.

**Table 7:** Bioefficacy of lancer gold (acephate 50% + imidacloprid 1.8% SP) against rice leaf folder on paddy during *kharif*- 2014 & 2015

S. No.	Treatments	Dosage (g or ml ha <sup>-1</sup> )	Per cent leaf damage due to rice leaf folder			
			2014		2015	
			10 DAFS	10 DASS	10 DAFS	10 DASS
1.	Acephate 50% + Imidacloprid 1.8% SP	800	7.00 (15.32)	3.50 (10.76)	2.70 (9.45)	1.90 (7.91)
2.	Acephate 50% + Imidacloprid 1.8% SP	1000	5.10 (13.05)	2.10 (8.31)	1.70 (7.47)	1.30 (6.53)
3.	Acephate 50% + Imidacloprid 1.8% SP	1200	4.80 (12.65)	2.00 (8.09)	1.30 (6.52)	0.70 (4.79)
4.	Acephate 75 SP	1000	6.80 (15.11)	3.20 (10.30)	2.60 (9.27)	2.70 (9.45)
5.	Imidacloprid 17.8 SL	125	11.20 (19.54)	6.70 (15.00)	8.30 (16.74)	3.30 (10.46)
6.	Chlorpyrifos 50% + Cypermethrin 5% EC	750	6.70 (15.00)	2.30 (8.72)	2.00 (8.12)	1.70 (7.48)
7.	Untreated control	-	12.70 (20.81)	8.30 (16.71)	11.20 (19.54)	5.00 (12.90)
	S. Em. ±		0.51	0.48	0.39	0.341
	CD at 5%		1.59	1.50	1.21	1.051

DAFS= Days after first spray, DASS= Days after second spray, Figures in the parenthesis are arc sine value

### 3.2 Impact on grain yield and cost benefit ratio

The data recorded on the grain yield in different treatments during the year 2014 and 2015 revealed that all the insecticidal treatments were found significantly superior over control. Among the insecticidal treatments highest grain yield of 3610 and 3471 kg ha<sup>-1</sup> was recorded in lancer gold (acephate 50% + imidacloprid 1.8% SP) @ 1200 g ha<sup>-1</sup> and it is statistically at par with lancer gold @ 1000 g ha<sup>-1</sup> in both

the years, respectively as compared to untreated check (2305 and 2027 kg ha<sup>-1</sup>, respectively).

The maximum net profit of Rs. 28,428 ha<sup>-1</sup> was obtained in lancer gold @ 1200 g ha<sup>-1</sup> and followed by its lower dose @ 1000 g ha<sup>-1</sup> (Rs. 27,980 ha<sup>-1</sup>). However, the maximum cost: benefit ratio of 1:18.65 was obtained in lancer gold @ 1000 g ha<sup>-1</sup> due low cost of treatment (Table 8).

**Table 8:** Mean grain yield (kg ha<sup>-1</sup>) and C: B ratio in different treatments

S. No.	Treatments	Dosage (g or ml ha <sup>-1</sup> )	Grain yield (kg ha <sup>-1</sup> )		Mean grain yield (kg ha <sup>-1</sup> )	Increase in yield over control (kg ha <sup>-1</sup> )	Cost of increased yield over control (Rs. ha <sup>-1</sup> )	Cost of treatment (Rs. ha <sup>-1</sup> )	Net profit (Rs.)	B:C ratio
			2014	2015						
1.	Acephate 50% + Imidacloprid 1.8% SP	800	3138	2666	2902	736	16192	1200	14992	12.49
2.	Acephate 50% + Imidacloprid 1.8% SP	1000	3596	3415	3506	1340	29480	1500	27980	18.65
3.	Acephate 50% + Imidacloprid 1.8% SP	1200	3610	3471	3540	1374	30228	1800	28428	15.79
4.	Acephate 75 SP	1000	3027	2610	2818	652	14344	1240	13104	10.56
5.	Imidacloprid 17.8 SL	125	2804	2346	2575	409	8998	500	8498	16.99
6.	Chlorpyrifos 50%+Cypermethrin5%EC	750	2471	2249	2360	194	4268	1050	3218	3.06
7.	Untreated control	-	2305	2027	2166	-	-	-	-	-
	S. Em. ±		160.44	145.80						
	CD at 5%		412.00	374.00						

A) Rate of insecticides applied: Lancer gold (Acephate 50% + Imidacloprid 1.8% SP) @ Rs. 750 /kg, Acephate Rs. 620/kg, Imidacloprid Rs. 2000/lit.

and Chlorpyrifos 50 % + Cypermethrin 5% EC @ Rs. 700 /lit.

(B) Sale price of paddy - Rs. 2200/q

### 3.3 Phytotoxicity

Lancer gold (acephate 50% + imidacloprid 1.8% SP) did not cause phytotoxicity on rice upto 10 days in any form (injury to leaf tips and leaf surface, wilting of plants, vein clearing,

necrosis, epinasty and hyponasty) even spray @ 2000 g ha<sup>-1</sup>.

### 4. Conclusion

Two sprays of lancer gold (acephate 50% + imidacloprid

1.8% SP) @1000g ha<sup>-1</sup> was found cost effective dose in controlling insect pests of rice viz., brown plant hopper, green leaf hopper, stem borer and leaf folder. It did not cause phytotoxicity on rice spray @ 2000 g ha<sup>-1</sup>. This is one of the obvious methods to delay resistance built up for any class of insecticides.

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