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Effects of cultivation methods and cultivars on the incidence of major insect pest of rice

■ VIJAY KUMAR SONI* AND S.N. TIWARI[1]

S.K. College of Agriculture and Research Station (IGKV), KAWARDHA (KABIRDHAM) (C.G.) INDIA
[1]Department of Entomology, G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. NAGAR, (UTTARAKHAND) INDIA

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ABSTRACT

The field experiment were conducted on effects of cultivation methods and cultivars on the incidence of major insect pest of rice at Norman E. Borloug Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India during *Kharif* 2012. Normal transplanted and direct seeded cultivation systems of rice hybrids (KRH-2) and high yielding variety (HKR-47) were sown. Sprouted seeds of KRH-2 and HKR-47 was dibbled in lines for direct seeding and the same sprouted seed was sown on the same day in nursery for transplanting in field. Date of sowing was same under both the systems. Results revealed that infestation of rice stem borer was significantly higher in transplanted rice as compared to direct seeded rice. In direct seeded rice the infestation was significantly higher in hybrid KRH-2 as compared to high yielding variety HKR-47.The population of brown plant hopper (BPH) was higher in direct seeded rice as compared to transplanted rice, however, such differences appeared due to delayed incidence of BPH in higher number after 70 days after transplanting (DAT). The mean population of white backed plant hopper (WBPH) was higher in transplanted rice as compared to direct seeded rice and more hoppers were seen in KRH-2 as compared to HKR-47. Significantly higher gundhi bug damage (5.8%) to the grains was found in transplanting (KRH-2).

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***Corresponding author:**
Email: vijay.soniji@gmail.com

INTRODUCTION

Rice (*Oryza sativa* L.) is an ancient and the most genetically diversified cereal crop. Approximately half of the people on earth obtain the majority of their caloric intake from rice. Changing pattern of monsoon and uncertain release of water in irrigation canals is compelling farmers to schedule planting of rice as per prevailing conditions. Under such condition also the knowledge of insect pest incidence and population dynamics of pests in relation to crop phenology and

calendar is very important to devise efficient location specific pest management strategies (Anonymous, 2012). Direct seeded and transplanting methods of rice cultivation are widely adopted by the farmers. Among these methods, direct seeded rice is being widely adopted as alternative methods of rice cultivation due to the limitation of water resources, labour shortage and other inputs. The agronomic or cultural practices followed and the micro-environment in direct seeded rice is quite different from that of the transplanted method of rice cultivation which might affect the insect pest incidence (Anonymous, 2011). Rice harbour more than 100 insect pest species. Among these, stem borer, *Scirpophaga incertulas* (walker), brown planthopper (BPH), *Nilaparvata lugens* (Stål) and white backed plant hopper, *Sogatella furcifera* are the most important pest of rice in Asia and India. Collectively the losses in grain yield ranges from 10 per cent in moderately affected fields to 70 per cent in those severely affected (Kulshreshtha, 1974) due to attack of these insect pests in rice. Thus, the present studies were conducted to know the effects of cultivation methods and cultivars on major insect pest incidence of rice under field condition.

MATERIAL AND METHODS

The field experiments were conducted at Norman E. Borloug Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar during *Kharif* 2012. The crop was raised under irrigated conditions in silty clay loam soil. High yielding rice hybrids (KRH-2) and high yielding variety (HKR-47) were sown with standard cultivation systems as Normal transplanted and direct seeded using standard agronomical practices. Good quality seeds of KRH-2 and HKR-47 were soaked for 24 hours in water and incubated for 24 hours for getting desirable sprouts. Sprouted seed was dibbled in lines for direct seeding with the spacing of 20 × 10 cm and the sprouted seed was sown on the same day in nursery for further transplanting in field. Twenty one day old seedlings of each variety were transplanted with a spacing of 20 × 10 cm. Date of sowing was same under both the systems. The experimental area was divided into seven equal blocks each representing a replication. The experimental area had 28 plots.

Observations on insect pest incidence were recorded on randomly selected ten marked hills at ten day interval in each plot. For rice stem borer (*Scirpophaga incertulas*) total number of tillers and dead hearts while for brown plant hopper (*Nilaparvata lugens*) and white backed plant hopper (*Sogatella furcifera*) total number of both nymph and adults were counted on marked hills. At harvest, number of panicle bearing tillers, white ear heads, total number of grains, number of gundhi bug damaged grains and grain yields were also recorded. Plot-wise yields were also recorded after removing the two border rows and marked hills from each plot.

Grain number and Grain weight per marked hill from ten hills were recorded by using the following formula:

$$\text{Grain wqt. per hill} = \frac{100 - MC}{86} \times W$$

where,

MC: moisture content (%) of the grains

W: weight of all harvested grains from one hill.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Effects of rice cultivation methods and cultivars on the incidence of rice stem borer (*S. incertulas*) :

The dead heart/white head caused by rice stem borer (*S.incertulas*) in different cultivation system and cultivars are given Table 1 which indicated that infestation of stem borer was significantly higher in transplanted rice as compared to direct seeded rice. In direct seeded rice the infestation was significantly higher in hybrid KRH-2 as compared to high yielding variety HKR-47. No infestation of stem borer was recorded at 10 DAT in any of the plots, however, in the next observation recorded at 20 DAT the infestation of this insect was evident in transplanted rice. At 30 and 40 DAT also very high infestation was recorded in transplanted rice while it was not seen in direct seeded rice. At 50 DAT infestation of stem borer was recorded in all the plots, however, it was significantly low in direct seeded rice as compared to transplanted rice. The infestation of stem borer was recorded up to 90 DAT in transplanted rice while direct seeded rice showed the infestation of this insect up to 100 DAT. The present findings indicated that damage of rice stem borer was significantly low in direct seeded rice as compared to normal transplanted rice and among the cultivars the infestation was significantly high in hybrid

KRH-2 than the high yielding variety HKR-47. Similar results were also reported in multi-location trial of AICRIP at Ranchi location where, the incidence of dead heart was significantly higher in normal transplanting method (6.0% DH) as compared to direct seeded rice (2.62% DH) (Anonymous, 2012). However, at Pusa, the infestation of stem borer was high in direct seeded rice as compared to normal method. On the other hand, direct seeded rice recorded significantly more damage of stem borer as compared to normal method at Raipur while at Rajendranagar there were no significant differences among the cultivation methods and cultivars with respect to dead hearts (Anonymous, 2012).

Table 1: Effects of rice cultivation methods and cultivars on the incidence of *S. incertulas*

DAT	Per cent dead heart /white head				Mean
	Transplanting		Direct seeding		
	KRH-2	HKR-47	KRH-2	HKR-47	
10DAT	0.0	0.0	0.0	0.0	0.0
20 DAT	3.5	0.8	0.0	0.0	1.1
30 DAT	7.6	10.0	0.0	0.0	4.4
40 DAT	13.1	16.1	0.0	0.0	7.3
50 DAT	13.7	16.0	3.2	0.8	8.5
60 DAT	1.0	5.4	8.5	5.4	5.1
70 DAT	4.7	1.9	5.1	2.1	3.5
80 DAT	14.7	8.4	8.8	7.2	9.8
90 DAT	17.2	10.6	4.7	1.0	8.4
100 DAT	0.0	0.0	7.5	4.9	3.1
110 DAT	0.0	0.0	0.0	0.0	0.0
Mean	6.9	6.3	3.5	2.0	4.7
	A		B		AXB
S.E.±	0.3		0.5		1.1
C.D. (P=0.05)	0.9		1.5		3.1

A= Treatment, B= Days after transplanting (DAT)

Table 2 : Effects of rice cultivation methods and cultivars on the number of *N. lugens*

DAT	Number of BPH /10hill				Mean
	Transplanting		Direct seeding		
	KRH-2	HKR-47	KRH-2	HKR-47	
10DAT	0.0	0.0	0.0	0.0	0.0
20 DAT	0.0	0.0	0.0	0.0	0.0
30 DAT	0.0	0.0	0.0	0.0	0.0
40 DAT	1.7	1.1	0.0	0.0	0.7
50 DAT	36.1	33.5	0.0	0.0	17.4
60 DAT	55.2	51.2	1.0	0.0	26.9
70 DAT	54.0	48.8	32.1	21.4	39.1
80 DAT	33.1	29.8	83.1	53.7	50.0
90 DAT	6.4	4.4	62.0	56.0	32.2
100 DAT	0.0	0.0	71.5	73.4	36.3
110 DAT	0.0	0.0	0.0	0.0	0.0
Mean	17.0	15.4	22.7	18.6	18.4
	A		B		AXB
S.E.±	1.1		1.9		3.9
C.D. (P=0.05)	3.2		5.4		10.8

A= Treatment, B= Days after transplanting (DAT)

Effects of rice cultivation methods and cultivars on the infestation of *N. lugens* :

The influence of different cultivation methods and cultivars on the number of BPH (*N. lugens*) population is presented in Table 2. The study revealed that overall population of BPH was higher in direct seeded rice as compared to transplanted rice, however, such differences appeared due to delayed incidence of BPH in higher number after 70 DAT. The incidence of BPH was noticed at 40 DAT in transplanted rice while it invaded the direct seeded rice after 60 DAT. In the transplanted rice the population was high from 50 to 80 DAT while in direct seeded rice higher population was recorded from 70 to 100 DAT. Comparison of cultivars revealed that overall population of BPH was comparatively higher in hybrid KRH-2 as compared to high yielding variety HKR-47 in both the system of cultivation and such difference was recorded in most of the observations.

Effects of rice cultivation methods and cultivars on the number of *S. furcifera* :

The influence of cultivation methods and cultivars on the number of WBPH (*S. furcifera*) population is presented in Table 3 which indicated that a different picture emerged in case of this insect. The population of WBPH was very low as compared to BPH in all the treatments. The mean population of WBPH was higher in transplanted rice as compared to direct seeded rice and more hoppers were seen in KRH-2 as compared to HKR-47. The incidence of WBPH was noticed at 50 DAT in transplanted rice while these insects were recorded on 60 DAT in direct seeded rice. The population of WBPH was high on 70 and 80 DAT in transplanted rice while direct seeded rice showed more population of

Table 3 : Effects of rice cultivation methods and cultivars on the number of *S. furcifera*

DAT	Number of WBPH /10hill				Mean
	Transplanting		Direct seeding		
	KRH-2	HKR-47	KRH-2	HKR-47	
10DAT	0.0	0.0	0.0	0.0	0.0
20 DAT	0.0	0.0	0.0	0.0	0.0
30 DAT	0.0	0.0	0.0	0.0	0.0
40 DAT	0.0	0.0	0.0	0.0	0.0
50 DAT	0.7	1.1	0.0	0.0	0.5
60 DAT	7.0	3.8	0.1	0.0	2.8
70 DAT	19.4	16.2	0.0	0.1	9.0
80 DAT	26.7	15.1	0.0	0.1	10.5
90 DAT	2.2	1.5	12.0	13.7	7.4
100 DAT	0.0	0.0	14.5	10.0	6.1
110 DAT	0.0	0.0	0.0	0.0	0.0
Mean	5.1	3.5	2.4	2.2	3.3
	A		B	AXB	
S.E..±	0.4		0.7	1.4	
C.D. (P=0.05)	1.1		1.9	3.9	

A= Treatment, B= Days after transplanting (DAT)

Table 4 : Effects of rice cultivation methods and cultivars on the per cent white ears, total no. of grains, grain wt, Gundhi bug damage grains, and yield

Treatments	White ears (%)	Number of grains /hill	Grain wt/hill (g)	Gundhi bug damage grains (%)	Yield (kg/ha)
Transplanting (KRH-2)	18.9	710.8	17.1	5.8	2769.1
Transplanting (HKR-47)	14.1	641.5	16.3	5.1	2562.3
Direct seeding (KRH-2)	12.8	664.3	17.3	4.7	2572.5
Direct seeding (HKR-47)	4.7	759.6	20.0	4.7	2758.9
S.E.±	2.7	NS	NS	0.1	NS
C.D. (P=0.05)	8.0	-	-	0.4	-

NS=Non-significant

WBPH on 90 and 100 DAT.

Effects of rice cultivation methods and cultivars on the per cent white ears, total number of grain, Gundhi bug damage grain, grain weight and yield :

The data presented in Table 4 indicates that percentage of white ears varied from 4.7 to 18.9 among the different cultivation methods and cultivars before harvesting of the crop. Maximum white ears were recorded in the transplanting KRH-2 (18.97%) followed by HKR-47 (14.11%), however, no significant difference was recorded in these treatments. As compared to these treatments less white ears were recorded in direct seeded rice which varied from 4.7 to 12.8 per cent. Lowest white ears were recorded in direct seeded HKR-47 which was significantly less as compared to transplanted KRH-2 and HKR-47 and direct seeded KRH-2.

Total number of grains on the marked hills varied non-significantly from 641.5 to 759.6 (Table 4). Maximum grains (759.6) was recorded in cultivar direct seeded HKR-47 while transplanted HKR-47 showed minimum (641.5) grain.

No significant difference was recorded in the weight of grain per hill which varied from 16.3 to 20.0 g (Table 4).The highest grain weight was observed in direct seeded HKR-47 (20.0 g) which was lowest in transplanted HKR-47(16.3 g).

The incidence of Gundhi bug recorded on marked hills is given in Table 4 which indicated that significantly more damage (5.8%) to the grains was found in transplanting (KRH-2). No significant difference was recorded in the infestation of this insect in other treatment which varied from 4.7 to 5.1 per cent.

No significant difference was recorded in the yield of different treatments which varied from 2562.3 to 2769.1 kg/ha. However, the yield of transplanted KRH-2 and direct seeded HKR-47 was higher as compared to transplanted HKR-47 and direct seeded KRH-2 (Table 4).

Significantly higher white ears damage in transplanted KRH-2 was also recorded at Rajendranagar and grain yield was significantly superior in direct seeded rice over transplanted at Raipur, Rajendranagar and Ranchi (Anonymous, 2012).

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