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Evaluation of the Efficacy of Medium Maturing Coarse Rice Entries against Yellow Rice Stem Borer under Field Conditions

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Abstract:

The present study was carried out to evaluate six medium maturing coarse rice varieties against yellow rice stem borer at experimental area of Rice Research Institute, Dokri, Sindh-Pakistan. The study revealed that among tested medium maturing coarse rice entries, the lowest falling dead heart percentage against yellow rice stem borer was recorded in DR-48 rice cultivar. No significant difference was recorded between IR-6 and DR-82 during the study of dead hearts. The results revealed that lowest white head percentage was noted from DR-48 while; highest from DR-82. The study further revealed that average 2009 and 2010 maximum yield 31.36 among all tested varieties was recorded in DR-37, followed by IR-6, DR-46, DR-48, DR-45 and DR-82, respectively. Statistical analysis resulted that DR-46 and DR-48 entries were statistically co-related with each other during the yield study.

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Key words: Medium maturing coarse rice varieties, yellow rice stem borer, dead heart percentage, white head percentage.

Introduction

Rice, *Oryza sativa* Linn. is a basic food crop for a large proportion of the world's population. Consequently, it is receiving major attention in the current efforts to improve the world food situation. Rice cultivation extends from 8^0C to 35^0C N latitudes across diverse ecosystems such as irrigated (52.6%), upland (12%), rain fed low land (32.4%), semi deep water and deep water (3%) as well as coastal saline regions. Based on the water availability rice is taken up as a single crop or as high as three crops in a year (Krishnaiah and Varma, 2012). Rice is cultivated in 112 countries covering every continent and is consumed by 2500 million people in the developing countries. The most serious damage to rice crop observed over the globe is in the rice belt of Yangtze River Valley (China) where approximately two third of the damage is caused by the rice stem borers and one third by the rice leaf folder (Sheng *et al*., 2003). The average rice yield in Pakistan is considerably less when compared with other rice growing countries of the world.

Among other factors, low yields of rice in Pakistan due to damages by insect pests are the major constraints. About 128 species of insects have been reported attacking the rice crop. Of these 15 to 20 insect species are known to be the pests of paramount importance and are regularly noticed in tropical Asia (Majid *et al*., 2009). Insect pests damage rice crop at different stages of its growth. Besides other insect pests of rice, yellow rice Stem borer, *Scirpophaga incertulus* Wlk, Crambidae family, order Lepidoptera, is the most serious ones and responsible for significant losses (Shafique & Anwar, 1986). The onset of flooding and stem elongation provided a more favorable environment for *S. incertulas*. The larvae of the stem borers,

after hatching, bore into the rice plant and cut out the food supply to the upper part of affected stem, while the lower plant part remains green. The plant compensates low percentage of dead hearts but 1-3% loss of yield is expected for every per cent of white ear head (Pathak *et al*., 1971).

In modern agriculture, high yielding rice varieties are extensively grown with the use of fertilizers and manures. Insecticides are very effective for controlling agricultural pests, but are expensive, requiring repeated applications and having side effects on an environment and natural enemies. To gain best quality and quantity of the paddy yield, the research activities have been expanded in many countries, by introducing resistance varieties as Integrated Pest Management strategy having good results against insect pests. New introduced resistance rice varieties are highly yielding, better tolerant to kalar salts, have a shorter life cycle, better cooking qualities, better response to higher dose of fertilizers and are resistant to pests and diseases due to their stiff stemmed.

Keeping in view the importance of rice in our daily life, the present investigation was evaluated to test different medium maturing coarse rice varieties against yellow rice stem borer in field conditions.

Materials and Methods

The present study was evaluated for checking the status of rice varieties against yellow rice stem at experimental area of Rice Research Institute, Dokri, Sindh-Pakistan. Six medium maturing coarse rice cultivars viz. IR-6, DR-82, DR-37, DR-45, DR-46 and DR-48 were tested against yellow rice stem borer. IR-6 was used as a standard check. Experiment was conducted during 2009 and repeated during 2010. Experiment was Randomized Complete Block Design (RCBD) with three replications of six treatments. Nursery was grown on 5th July,

2009 and 8th July, 2010 and line transplanting was done in the field on 1ist August, 2009 and 4th August, 2010. The space between plant to plant and row to row was maintained at 20cm. The sub-plot size was maintained 63 m^2 (9x6). 10 hills per treatment and replication were selected at random to observe infestation percentage. After harvesting and threshing of the crop, paddy yield was recorded. No chemical was used in experimental area against yellow rice stem borers. The recommended dose of fertilizer application was made at the rate of 135-67: N-P kg/ ha. All P and half of the N was applied at the time of transplanting and rest of N was applied at the time of panicle initiation stage of crop.

The data were statistically analyzed and LSD range test was applied to compare mean infestation differences. Steel and Torrie (1984) data were subjected for analysis of variance using Fisher's analysis of variance technique and treatment means were compared with standard (control) by Least Significant Difference (LSD) test. Dead heart and white head percentage were calculated by Abbott's formula (1925).

Results

Dead Heart Study:

At the vegetative stage of crop (45 days after transplanting), dead heart percent results showed that during 2009 and 2010 were recorded as (7.72, 7.93, 7.33, 7.05, 7.48 and 6.89%) and (8.31, 8.16, 8.89, 8.15, 8.25 and 7.43%) from the medium maturing coarse rice entries IR-6, DR-82, DR-37, DR-45, DR-46 and DR-48. However, the maximum average dead heart percent of during both 2009 and 2010 years were recorded as 8.11 in DR-37 followed by 8.05, 8.02, 7.87, 7.60, and 7.16 in DR-82, IR-6, DR-46, DR-45 and DR-48, respectively (Table 1).

Table 1. Dead heart percentage from the medium maturing coarse rice entries during 2009 and 2010.

Name of entries	Dead heart% 2009	Dead heart% 2010	Average
IR-6	7.72 A	8.31 B	8.02
DR-82	7.93 A	8.16 B	8.05
DR-37	7.33 AB	8.89 A	8.11
DR-45	7.05 B	8.15 B	7.60
DR-46	7.48 AB	8.25 B	7.87
DR-48	6.89 C	7.43 C	7.16

The same letters denotes that means are not statistically significant different.

Statistical analysis

During the study of dead hearts from the medium maturing coarse rice entries, the analysis of variance showed non-significant effect among all treatments (P>0.317) and (P>0.462) during 2009 and 2010, respectively. Coefficient of variation, Grand Mean and Grand Sum during 2009 were 7.91%, 7.400 and 133.200 (Table 2); and during 2010 were 9.82%, 8.198 and 147.570 (Table 3), respectively.

Table 2. Analysis of variance of dead heart percentage from the medium Maturing coarse rice entries during 2009

Source	DF	SS	MS	F Value	Prob.
Replication	2	0.20	0.110	0.320	
Factor A	5	2.332	0.466	1.359	>0.317 ns
Error	10	3.430	0.343		
Total	17	5.981			
Coefficient of variation	7.91%				
Grand Mean	7.400				
Grand Sum	133.200				
Total Count	18				

Table 3. Analysis of variance of dead heart percentage from the medium maturing coarse rice entries during 2010

Source	DF	SS	MS	F Value	Prob.
Replication	2	0.143	0.072	0.110	
Factor A	5	3.263	0.653	1.006	>0.462 ns
Error	10	6.486	0.649		

Total	17	9.893			
Coefficient of variation	9.82%				
Grand Mean	8.198				
Grand Sum	147.570				
Total Count	18				

White Heads Study

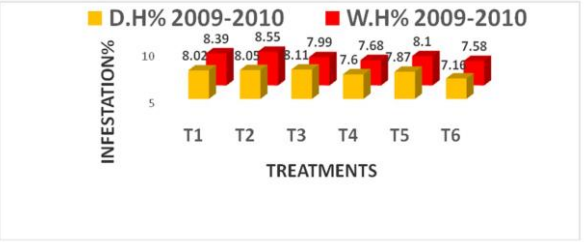
From the medium maturing coarse rice entries, white heads were recorded 70 days after transplanting (reproductive stage of the crop). During 2009, white head percentage was recorded as 8.13, 8.33, 7.72, 7.45, 7.87 and 7.16; and during 2010 it was recorded as 8.65, 8.77, 8.26, 7.90, 8.32 and 7.99; however, average for both years was 8.39, 8.55, 7.99, 7.68, 8.10 and 7.58 recorded from IR-6, DR-82, DR-37, DR-45, DR-46 and DR-48, respectively (Table 4). Comparison between the averages of dead heart percentage and white head percentage of both years are included in (Fig. 1).

Table 4. White head percentage from the medium maturing coarse rice entries during 2009 and 2010

Name of entries	White head% 2009	White head% 2010	Average
IR-6	8.13 A	8.65 A	8.39
DR-82	8.33 A	8.77 A	8.55
DR-37	7.72 B	8.26 B	7.99
DR-45	7.45 BC	7.90 BC	7.68
DR-46	7.87 B	8.32 B	8.10
DR-48	7.16 C	7.99 C	7.58

The same letters shows that means are not significantly different.

Fig. 1. Comparison between the averages of dead heart percentage and white head percentage from the medium maturing coarse rice entries during 2009 and 2010



Statistical analysis

Analysis of variance showed a non-significant difference of white heads from the medium maturing coarse rice entries during 2009 (P>0.115) and during 2010 (P>0.352). Coefficient of variation, Grand Mean and Grand Sum during 2009 were 6.257%, 7.777 and 139.980 (Table 5); while during 2010 were 6.43%, 8.315 and 149.670 (Table 6), respectively.

Table 5. Analysis of variance of white head percentage from the medium maturing coarse rice entries during 2009

Source	DF	SS	MS	F Value	Prob.
Replication	2	1.853	0.926	3.923	
Factor A	5	2.790	0.558	2.363	>0.115 ns
Error	10	2.361	0.236		
Total	17	7.004			
Coefficient of variation	6.25%				
Grand Mean	7.777				
Grand Sum	139.980				
Total Count	18				

Table 6. Analysis of variance of white head percentage from the medium maturing coarse rice entries during 2010

Source	DF	SS	MS	F Value	Prob.
Replication	2	0.404	0.202	0.708	
Factor A	5	1.800	0.360	1.261	>0.352 ns
Error	10	2.854	0.285		
Total	17	5.059			
Coefficient of variation	6.43%				

Grand Mean	8.315				
Grand Sum	149.670				
Total Count	18				

Yield Study

Yield in kg was also recorded from the medium maturing coarse rice varieties during 2009 and 2010. The maximum yield 32.13 in 2009, while in 2010 it was 30.59 was recorded from DR-37 variety. The average 2009 and 2010 maximum yield 31.36 among all tested varieties was recorded in DR-37, followed by IR-6, DR-46, DR-48, DR-45 and DR-82, respectively (Table 7).

Table 7. Yield (kg/plot) from the medium maturing coarse rice entries during 2009 and 2010

Name of entries	Yield 2009	Yield 2010	Average
IR-6	31.15 A	30.41 A	30.78
DR-82	27.84 C	27.28 C	27. 56
DR-37	32.13 A	30.59 A	31.36
DR-45	28.82 BC	27.46 BC	28.14
DR-46	30.25 B	29.10 AB	29.67
DR-48	30.17 B	28.04 B	29.10

The same letters shows that means are not significantly different.

Discussion

efficacy of medium maturing coarse rice entries against yellow rice stem borer medium was tested during the year 2009 and 2010 at the experimental area of Rice Research Institute, Dokri, Sindh-Pakistan. The results of the present study revealed that the maximum average dead heart percent of during both 2009 and 2010 years were recorded in DR-37 variety. However, the maximum white head percentage was recorded in DR-82 among six tested varieties around 2009 and 2010. The study further revealed that average 2009 and 2010 maximum yield 31.36 among all tested varieties was recorded

in DR-37, followed by IR-6, DR-46, DR-48, DR-45 and DR-82, respectively.

The insect resistance cultivars have been widely used by Sonatakke *et al*., (1997) in the field for control of agricultural pests. Sarwar *et al*., (2005) suggested the agricultural scientists to produce insect resistant plants. The present study also agrees to Abro *et al*., (2003) who used insect resistant varieties as environmentally friendly and an ideal strategy for controlling rice pests. Further present study also agrees to Chandramani *et al*., (2010) who carried out experiments in field conditions to analyze the effects of induced resistance on certain major pests of rice. Moreover, Shafique M. *et al*., (2000) who defined that use of resistance varieties has received much attention during recent years.

Further, Roberts *et al*., (2013) calculated that semi-dwarf cultivars produced higher yields than that of tall cultivars. Suwansri *et al., (*2002); Jana *et al.,* (2011) reviewed that non aromatic rice varieties are widely consumed in most Asian countries. Baisakh (2000) transferred genes against various pests to introduce resistant varieties. Breitler *et al*., (2000), Cohen *et al*., (2000), Marfa *et al*., (2002), Maqbool *et al*., (2001), Tabashnik *et al*., (2000), Tu *et al*., (2000), Wu *et al*., (2002) and Ye *et al*., 2001b) studied on resistance varieties against rice pests for increasing the yield. Gurdev Khush (2004) produced modern semi dwarf rice varieties at large number of unproductive tillers and excessive leaf area which cause mutual shading and reduce canopy photosynthesis and sink size. Javito Bandong and James Litsinger (2005) noted that deposition of lignin, cellulose and silica takes place in cell wall of resistance varieties.

Conclusion

The present study concluded that medium maturing coarse rice entries are more susceptible than the early maturing coarse

rice entries and less susceptible than the aromatic rice entries against yellow rice stem borer.

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