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Assessment of promising rice hybrids against insect pests under western undulating zone of Odisha

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ABSTRACT

Eighteen rice hybrids were evaluated for their reaction against major insect pests at Bhawanipatna, Kalahandi, Odisha during wet season, 2013 and compared with two check hybrid rice i.e, *Ajaya and Rajalaxmi developed by Central Rice Research Institute, Cuttack and one high yielding variety MTU 1001. Results revealed that two rice hybrids* viz*., RH 10428 and RH 10422 exhibited lowest incidence of stem borer, gall midge, leaf folder, brown planthopper and whorl maggot incidence with highest grain yield. Rice hybrids RH 10428 and RH 10422 can be incorporated as a varietal component in the IPM programme for the vertical increase of rice production in this area.*

Key words: *hybrid rice, insect pests, yield*

Hybrid rice is one of the recent technologies that helps to increase rice yield. Malabanan (2007) reported about 32.6 per cent yield advantage of hybrids over the inbred varieties in the Philippines. In order to increase the productivity so as to meet the food requirement for the increasing human population, more areas are to be covered under hybrid rice.

Rice hybrid are more susceptible to insect pests attack compared to high yielding rice varieties. Investigation undertaken at Cuttack and in farmers field indicated that stem borer, gall midge, whorl maggot, leaf folder, brown plant hopper were the major insect pests in hybrid rice. It is desirable to develop rice hybrid having higher productivity with low insect pests problems. Keeping this point in view, the present study was under taken to evaluate some rice hybrids of private seed companies for their reaction against major insect pests under western undulating zone of Odisha.

A field experiment was conducted at the Regional Research and Technology Transfer Station, Bhawanipatna, Kalahandi, Odisha, during wet season, 2013 in randomized block design with three replications. Twenty rice hybrids (Table 1) and one high yielding variety MTU 1001 were evaluated for their reaction against the major insect pests, *i.e*, stem borer, gall midge, brown planthopper, leaf folder and whorl maggot. Thirty days old seedlings of respective hybrids were transplanted @ 2 seedlings hill^{-1} in 4 m x 4.6 m plots at a spacing of 20 cm x 15 cm on 27th July, 2013. The crop was raised in rainfed condition with a fertilizer dose of 120: 60: 60 kg of N, P_2O_5 and K_2O ha^{-1} respectively without any plant protection measures. The climate of western undulating zone is hot and moist sub humid with mean annual rainfall of 1614mm, mean maximum temperature of 40.0 ^{0}C and mean minimum temperature of 12.4 ^{0}C.

Data on per cent leaf damage due to leaf folder and whorl maggot were recorded by counting the total leaves and infested leaves on 10 randomly selected hills in each plot. The damage by stem borer and gall midge was assessed by counting total number of tillers and the infested ones *i.e*, dead heart (DH), white ear head (WEH) and silver shoot (SS), respectively on ten randomly selected hills in each plot. The population of brown planthoppers was recorded by sampling 10 randomly selected hills from each plot at weekly interval till harvest.

Table 1. Hybrid rice cultivars used in the study

Rice hybrid and duration	Name of the company with address
RH 664 plus (123), RH 1531 (122), RH 10422 (125), RH 10428 (129)	Devgen seeds and crop technology Pvt. Ltd. 7c, Surya Towers, 105, S.P.Road, Sardar Patel Road, Hyderabad - 500003, Secunderabad
BS 110G (124), BS 226 (129), BS 6444G (129)	Bayer Bio- Science Pvt. Ltd, Inorbit Mall Rd, HITEC City, Hyderabad, Telangana 500081
DRH 775 (124), SAVA 127 (113), SAVA 134 (119)	Dhanya seed Pvt. Ltd. Plot No-3, KIADB , 4th phase, Bommasandra, Bangalor, Karnataka-560099, India
US 312 (127), US 382 (130)	US Agri seed work International, 3424, Roberto Court, San Luis, Obispo, CA 93401, USA
NK 5251 (128), NK 6302 (129)	Syngenta Pvt. Ltd, Amar paragigam, Sr no. 110/11/3, Banner Road, Banner Near Sadanand Hotel, Pune-411045, Maharashtra, India
VNR 2355 plus (129)	VNR seeds, Village: Gomchi (Near Andanvan), PO- Tendua-492099, Dist-Raipur (C.G)
R 6301 (123), R 6451 (131), R 6606 (126)	Jaikisan Zauri Seeds, 5th Floor, Global Buines Park, Tower: A, M.G.Road, Sector 26, Gurgaon-122002, Haryana
Ajaya (129), Rajalaxmi (129)	Central Rice Research Institute (CRRI), Cuttack, Odisha

Figure in parenthesis is the duration in days of the variety

Major insect pests of hybrid rice recorded during the course of investigation were gall midge, leaf folder, stem borer, brown planthopper and whorl maggot (Table 2). There were significant differences in gall midge infestation among the rice hybrids. Maximum gall midge infestation was recorded at reproductive stage of the crop *i.e,* 60 DAT (14.34% SS) irrespective of its infestation in tested hybrids as compared to the infestation at vegetative growth period of crop *i.e,* 40 DAT (5.78% SS). Gall midge incidence was observed upto fag end of crop growth *i.e,* 80 DAT (11.9% SS), which was a peculiar observation. Rajamani *et.al*, (1979) reported that gall midge infestation which normally does not occur beyond the panicle initiation stage of the crop growth, it also attack the crop at flowering. Kalode and Viswanathan, (1976) reported that gall midge generally occur during tillering stage and occasionally during panicle initiation and flowering stage of the crop.

Irrespective of the dates of observation, the high yielding variety, MTU 1001 recorded lowest silver shoot (0.00-4.25%) compared to rice hybrid (3.02-24.51%). Prasad (2011) and Behera *et.al.* (2013) reported that rice hybrid are highly susceptible to gall midge attack compared to high yielding rice varieties and was in agreement with the present findings. The check hybrid *viz*. Ajaya and Rajalaxmi, the silver shoots varied from 5.77 % (Rajalaxmi) to 15.83 % (Ajaya) compared to other hybrids US 312 (3.02%) to R 6606 (24.51%). Mean data revealed the silver shoots was lowest in the high yielding variety, MTU 1001(2.55%) followed by the hybrids *viz*. RH 1531(7.37%), RH 10428 (7.72%), DRH 775 (9.12%), RH 10422 (9.40%) and BS 110G (9.54%) compared to check Rajalaxmi (8.12%) and Ajaya (10.69%). Higher silver shoot was recorded in R 6606 (15.89%) followed by VNR 2355 plus (14.11%), R 6451 (13.14%) and R 6301 (13.06%).

Significant differences were observed among the rice hybrids for stem borer infestation (dead heart and white ear head). The dead hearts varied from (1.00-10.81%) in rice hybrid compared to check variety (0.00-7.87%). Mean data revealed that lowest dead hearts 2.34% was recorded in the hybrid RH 10428. Maximum dead heart was recorded in the hybrid SAVA 134 (8.25%). Lowest WEH was recorded in the hybrid RH 10428 (1.81%) while hybrid NK 6302 recorded the higher WEH (15.42%) followed by SAVA 127 (14.96%).

Significant difference was observed among the rice hybrids for leaf folder infestation. Leaf folder infestation was maximum at the fag end of the crop compared to early crop growth period. The leaf

Table 2. Incidence of stem borer, gall midge and grain yield of rice hybrid during wet season , 2013

Treatments	Stem borer				Silver shoot (%)				Grain yield (t ha^{-1})
	DH (%) (40 DAT)	DH (%) (60 DAT)	Mean (%)	WEH (%) (80 DAT)	40 DAT	60 DAT	80 DAT	Mean	
BS 110G	6.54 (14.81)	3.50 (10.71)	5.02 (12.76)	2.04 (15.74)	7.17 (12.37)	8.84 (23.44)	12.62 (22.01)	9.54 (19.27)	6.47
BS 226 (Arize Prima)	4.06 (11.58)	3.65 (10.81)	3.86 (11.19)	7.37 (8.18)	5.08 (12.58)	11.73 (20.12)	16.38 (23.85)	11.06 (18.85)	6.14
BS 6444 G	3.41 (10.62)	2.00 (8.13)	2.71 (9.37)	1.84 (19.21)	7.68 (16.06)	17.04 (24.33)	6.00 (14.04)	10.24 (18.14)	6.41
RH 664 Plus	5.88 (14.00)	4.34 (12.01)	5.11 (13.00)	12.06 (20.30)	9.68 (18.09)	12.01 (20.33)	19.82 (26.41)	13.84 (21.61)	6.05
RH 1531	1.00 (5.74)	4.86 (12.73)	2.93 (9.23)	7.00 (15.33)	4.16 (11.76)	5.52 (13.52)	12.43 (20.63)	7.37 (15.30)	6.10
RH 10422	5.36 (15.98)	2.65 (8.82)	4.00 (12.40)	3.13 (22.70)	4.86 (16.58)	12.87 (22.00)	10.46 (19.28)	9.40 (19.29)	6.68
RH 10428	3.69 (19.18)	1.00 (6.95)	2.34 (13.06)	1.81 (13.97)	5.76 (16.18)	9.22 (24.71)	8.17 (19.33)	7.72 (20.07)	6.86
DRH 775	3.75 (11.16)	2.22 (8.57)	2.98 (9.86)	8.67 (17.12)	6.06 (14.23)	14.07 (21.84)	7.22 (15.55)	9.12 (17.21)	6.22
SAVA 127	7.59 (13.37)	2.36 (9.35)	4.98 (11.36)	14.96 (7.73)	8.36 (12.69)	14.05 (21.01)	10.96 (18.85)	11.12 (17.52)	5.01
SAVA 134	8.89 (17.30)	7.61 (15.99)	8.25 (16.64)	5.83 (10.17)	4.69 (14.66)	15.90 (17.22)	14.06 (20.74)	11.55 (17.54)	5.52
US 312	5.50 (13.50)	3.50 (10.51)	4.50 (12.01)	9.50 (17.93)	3.02 (10.61)	18.23 (26.66)	11.26 (25.61)	10.84 (20.96)	6.43
US 382	10.81 (11.06)	1.49 (4.62)	6.15 (7.84)	8.41 (16.84)	8.32 (16.75)	15.40 (23.04)	13.09 (21.19)	12.27 (20.32)	5.53
NK 5251	4.25 (11.89)	1.97 (8.01)	3.11 (9.95)	5.60 (13.67)	4.45 (12.15)	15.77 (23.36)	10.71 (19.01)	10.31 (18.17)	6.40
NK 6302	8.40 (16.82)	6.47 (14.70)	7.44 (15.76)	15.42 (23.10)	7.78 (13.80)	17.77 (17.65)	11.01 (16.59)	12.19 (16.01)	5.55
VNR 2355 Plus	6.84 (15.13)	2.51 (9.08)	4.68 (12.11)	11.70 (19.99)	3.47 (9.91)	20.15 (25.24)	18.71 (19.59)	14.11 (18.25)	5.90
R 6301	6.91 (15.20)	2.25 (8.62)	4.58 (11.91)	4.05 (11.60)	5.32 (13.32)	21.20 (27.33)	12.65 (20.81)	13.06 (20.49)	5.96
R 6451	8.25 (16.68)	1.43 (6.81)	4.84 (11.74)	10.84 (7.74)	3.95 (11.45)	19.76 (26.38)	15.71 (23.30)	13.14 (20.38)	5.63
R 6606	6.29 (14.49)	6.34 (14.56)	6.32 (14.52)	7.15 (15.50)	6.60 (14.88)	24.51 (29.66)	16.56 (24.00)	15.89 (22.85)	5.70
Ajaya(Check)	7.87 (16.21)	0.00 (0.00)	3.94 (8.11)	11.20 (19.53)	9.10 (17.52)	15.83 (23.42)	7.13 (15.46)	10.69 (18.8)	6.20
Rajalaxmi(Check)	4.52 (12.25)	2.91 (9.74)	3.72 (10.99)	10.72 (19.10)	5.77 13.58)	6.95 (15.28)	11.64 (19.94)	8.12 (16.27)	6.21
MTU 1001	4.40 (12.03)	3.20 (10.29)	3.80 (11.16)	9.46 (17.89)	0.0 (0.00)	4.25 (11.72)	3.41 (10.48)	2.55 (7.40)	5.60
Mean	5.91 (13.76)	3.15 (9.57)		8.03 (15.87)	5.78 (13.29)	14.34 (21.82)	11.90 (19.84)		
CD (P<0.05)	1.732	2.523		1.205	3.874	3.278	2.311		4.656

Figure in parentheses are angular transformed values

infestation varied from 0.33%-8.86% in rice hybrid compared to check *i.e,* Ajaya and Rajalaxmi (0.56-4.9%) and in high yielding variety MTU 1001 (0.41-5.97%). Leaf infestation was lowest in RH 10428 (0.60%) followed by RH 10422 (1.09%). Highest leaf infestation was recorded in RH 664 plus (3.97%).

Perusal of data on incidence of *N. lugens* in different rice hybrids revealed a significant difference of hopper population among the test hybrids. The population of BPH varied from 1.70-6.35 nos/hill in rice hybrid as compared to check varieties *i.e,* Ajaya and Rajalaxmi (3.0- 3.1 nos/hill). Lowest population of BPH (1.70 nos/hill) was recorded in RH 10428 and was at par with RH 10422 (1.80 nos/hill) and BS 110 G (1.95 nos/hill). Maximum population of BPH was recorded in the hybrid US 382 (6.35 nos/hill).

Whorl maggot infestations differed .significantly among the test hybrids. The leaf infestation by whorl maggot varied from (0.84- 3.38%) in the test hybrids compared to check (1.59- 1.63%) *i.e,* Ajaya and Rajalaxmi. The whorl maggot infestation was lowest in the hybrid RH 10428 (0.84%) followed by RH 10422(0.87%) and BS 6444G (0.88%). Maximum infestation was recorded in hybrid SAVA 134 (3.38%).

Significant differences in grains yield was observed among the hybrids. The grain yield of the tested hybrid varied from (5.01- 6.86 t ha^{-1}) compared to check Ajaya (6.20 t ha^{-1}) and Rajalaxmi (6.21 t ha^{-1}). Highest yield was recorded in RH 10428 (6.86 t ha^{-1}) and was at par with RH 10422 (6.68 t ha^{-1}), BS 110G (6.47 t ha^{-1}), US 312 (6.43 t ha^{-1}), BS 6444G (6.41 t ha^{-1}) and NK 5251 (6.40 t ha^{-1}). The rice hybrid SAVA 127 recorded lowest grain yield (5.01t ha^{-1}) followed by SAVA 134 (5.52 t ha^{-1}), US 382 (5.53 t ha^{-1}), NK 6302 (5.55 t ha^{-1}) and even lower than the high yielding variety MTU 1001 (5.60 t ha^{-1}).

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