

STUDY ON MAJOR DISEASE-INSECT INCIDENCE OF SCENTED GOBINDABHOG RICE IN NEW ALLUVIAL ZONE OF WEST BENGAL

Abstract:

A comprehensive study on “Improvement of production and storage system for Gobindabhog rice in West Bengal,” comprising two field and one laboratory experiment, was done at Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal, India, during the period of 2010–2012 to find out the optimum planting time, spacing, nutrients, disease, and pest management for scented Gobindabhog rice during the *kharif* season. Plant height, tiller production, and leaf area index increased consistently with the advancement of crop growth up to panicle exertion, panicle initiation (i.e., 56 DAT), and flowering (i.e., 84 DAT) stages, respectively. The planting date had a significant effect on the incidence of blast disease in Gobindabhog rice during both 2010 and 2011, except at 28 DAT. Delay in planting generally provided a favorable environment for the causal organism (*Pyricularia oryzae*) during the vegetative and reproductive stages of Gobindabhog rice, thereby leading to a greater incidence of delayed crops (25 July, 10 August, and 25 August) than the earlier one (10 July). The susceptibility of the Gobindabhog rice crop to brown spot disease caused by *Drechslera oryzae* increased progressively with the advancement of crop age from 28 DAT (i.e., active tillering stage) to 84 DAT (i.e., flowering stage). The population of gundhi bug (*Leptocorisa acuta*) increased steadily from 84 DAT (i.e., 50% flowering) to 112 DAT (maturity stage), irrespective of main and sub-plot treatments as well as years of investigation.

Keywords: Gobindabhog rice, planting date, spacing, disease, insect

1. INTRODUCTION

Rice (*Oryza sativa*) is one of the world's prominent staple foods in Asia and Africa. Gobindabhog, short-grain scented rice, is a native cultivar of lower gangetic plains in Bengal has been traditionally cultivated for about 400–500 years. The agro-morphological characterization of Gobindabhog rice is that it is a traditional non-Basmati-type aromatic rice of lower gangetic plains and *rahr* (red and laterite) regions of West Bengal [1]. Major quality features of Gobindabhog are: golden-yellow coloured grain, kernel length 3.97 mm, L / B ratio

2.04, short bold type kernel, amylose 17.9%, protein 7.2%, elongation ratio 1.77, alkali spreading value 3.7, and medium-strong aroma [2].

One of the major constraints in rice production is frequent occurrence of pests and diseases, and one of them is rice blast, which often causes yield losses ranging from 10 to 30%. [3]. The incidence of insects and diseases in rice fields varied depending on the season, weather, variety, etc. A survey-based study in Rewa district in Madhya Pradesh revealed the incidence of 12 insect-pests, of which 8 were either regular or sporadic in the following order: Gundhi bug > White backed plant hopper > Grass hopper > Stem borer > Rice hispa > Army worm > Horned caterpillar > Rice case worm [4]. The susceptibility of Gobindabhog rice to brown spot caused by *Drechslera oryzae* increased progressively with the advancement of growth or age, including severe infestation at flowering and maturity stages [5]. The population of gundhi bug (*Leptocorisa acuta*) in Gobindabhog rice field was revealed as 6.52 and 3.35 hill⁻¹ at 13 and 15 WAT, respectively. The minimum temperature (21.7 °C for 2008 and 22.5 °C for 2009) prevailing during the period from pre-flowering to soft dough stage had positive ($P < 0.05$) influence on gundhi bug population in West Bengal [5]. With the introduction of high-yielding varieties during 1970-80's, the area under cultivation of Gobindabhog decreased day by day. Thus, it is necessary to upgrade the production technology of Gobindabhog for higher yield and superior quality.

2. MATERIAL AND METHODS

2.1 Description of Experimental Site

The experiment was conducted during the wet (*khari*) seasons of 2010 and 2011 at 'C' Block Farm (22°58' N latitude, 88°26' E longitude and 15.9 m altitude) of Bidhan Chandra Krishi Viswavidyalaya (BCKV), Kalyani, Nadia, West Bengal. Monthly maximum and minimum temperatures throughout the crop season varied between 12.2 and 34.3°C and 13.4 and 33.2°C in 2010 and 2011, and the rainfall received for the seasons were 826.4 mm and 1720.3 mm, respectively. The bright sunshine ranged between 5.1 (June) and 7.5 hours (November) in 2010, and between 3.3 (August) and 8.2 hours (October) in 2011. It was lower in high-rainfall months, mainly due to cloudy days.

2.2 Treatment details and crop husbandry

The experiment was laid out in a split-plot design replicated thrice comprising four planting dates [10 July, 25 July, 10 August and 25 August] in main plots and three spacings [20 cm × 10 cm, 15 cm × 15 cm, and 20 cm × 15 cm] in sub plots. Gobindabhog paddy seeds were collected from RKVY Project on 'Bengal Aromatic Rice' of BCKV and sown at 18-20 kg/ha in wet nursery at three different times in a 15 days interval. 24- 25-days-old seedlings at 2-3 per hill were transplanted as per planting time and spacing schedule at a shallow depth (3-4 cm) in puddled field. A uniform fertilizer dose consisting of 2t FYM, 40kg N, 20kg P₂O₅ and 20kg

K₂O/ha was given to all experimental plots in the study. Manual weeding was done at 3 and 6 weeks after transplanting (WAT), and other crop management practices were adopted as per standard recommendations.

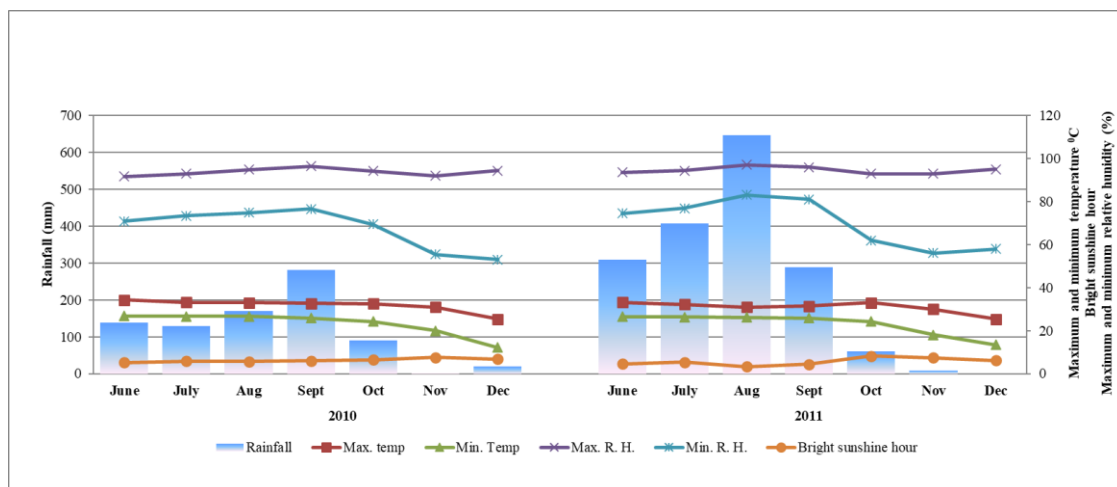


Fig. 1: Meteorological conditions pertaining to the periods of experimentation (2010 and 2011)
[Source: Department of Agricultural Meteorology and Physics, Faculty of Agriculture, BCKV, Mohanpur, W.B., India]

2.3 Methods of scoring pest-disease incidence

Five randomly selected hills were tagged in each plot for recording incidence of insect and disease at respective infestation stages during cropping season.

The infestation of brown spot and blast was estimated by the percentage of leaf area affected or disease symptoms (small, oval or circular and dark brown spots with light yellow halo around the outer edge for brown spot; while diamond-shaped with a grey or white center in blast) at 28, 56 and 84 DAT. Then, the leaf area affected values (%) were compared with the disease severity scale (IRRI, 1996) (Table 1).

Table 1. Disease severity scale for brown spot and blast

Scale	Severity (leaf area affected)
0	No incidence
1	Affected leaf area less than 1%
2	1-3% of the leaf area affected
3	4-5% of the leaf area affected
4	6-10% of the leaf area affected
5	11-15% of the leaf area affected

6	16-25% of the leaf area affected
7	26-50% of the leaf area affected
8	51-75% of the leaf area affected
9	Affected leaf area above 76%

In the context, it was also noted that there were some blast lesions (*Pyricularia oryzae*) intermingled with brown spot ones on rice leaves, which could not separately be identified or considered in the study.

The incidence of gundhi bug, i.e., the number of gundhi bug hill⁻¹ was recorded at 84 and 112 DAT.

2.4 Statistical analysis

The data recorded in the study were analysed using Fisher's 'Analysis of Variance' technique as per the procedures described by Gomez and Gomez [6], and the mean differences were compared at 5% level of significance.

3. RESULTS AND DISCUSSION

3.1 Disease incidence

Brown spot disease incidence

The variation in disease incidence (% of leaf area affected) at different growth stages noted in the study could generally be classified under scale 4 (6–10%) at 28 DAT, scale 5 (11–15%) at 56 DAT and scale 6 (16–25%) at 84 DAT in the investigation (Table 2). The incidence of brown spot disease increased rapidly with delay in planting from July 10 to August 25 during both 2010 and 2011.

The variation in brown spot disease incidence on Gobindabhog rice due to spacing was found non-significant at 56 and 84 DAT during both the years of experiment, except at 28 DAT during 2010 only. The greatest disease incidence in rice was observed in the earliest sown plants, and substantial control could be achieved by delay in planting from late May to mid-June. In an experiment where different proportions of infected plants were established (by inoculation or varying the sowing date), average yield losses were 0.8% for every 1% increase in disease incidence [7]. According to Rautaray planting geometry, skipping one row after every three rows with 15 cm × 15 cm spacing resulted in highest grain yield. Grain yields were similar with the next best planting geometry of 20 cm × 15 cm. The Incidence of sheath rot disease (34.4%) and also its severity in terms of chaff number per

panicle (41.4) were lower under the skip row arrangement [8].

Table 2. Effect of planting date and spacing on brown spot disease incidence of Gobindabhog rice during *kharif* season

Treatment	Brown spot disease incidence (%)		
	28 DAT	56 DAT	84 DAT
<i>Planting time</i>			
10 July	7.46 (15.8)	12.0 (20.2)	18.7 (25.6)
25 July	7.46 (15.8)	13.8 (21.7)	20.6 (26.9)
10 August	8.82 (17.3)	13.2 (21.2)	22.3 (28.0)
25 August	8.82 (17.2)	13.9 (21.9)	23.3 (28.8)
SEm±	0.26	0.30	0.57
CD (P=0.05)	0.79	0.94	1.75
<i>Spacing</i>			
20 cm × 10 cm	8.42 (16.8)	12.9 (21.0)	21.3 (27.4)
15 cm × 15 cm	8.09 (16.5)	13.4 (21.4)	21.3 (27.4)
20 cm × 15 cm	7.91 (16.3)	13.4 (21.4)	21.1 (27.3)
SEm±	0.21	0.27	0.31
CD (P=0.05)	NS	NS	NS

Figures in parentheses are angular transformed values; DAT = Days after transplanting; NS = Not significant

Blast disease incidence

Rice blast development is intimately related to meteorological factors that include air temperature, accumulated rainfall, and amount of sunshine kang [9–12]. The blast lesions observed on Gobindabhog rice plants were found to increase from 28 DAT to 84 DAT during both years of investigation (Table 3). Based on the percentage of leaf area affected, the incidence could be grouped under scale 2 (1–3%) and 3 (4–5%) at 28 DAT, scale 4 (6–10%) and 5 (11–15%) at 56 DAT, and scale 5 (11–15%) and 6 (16–25%) at 84 DAT.

The significant variation in blast infestation on Gobindabhog rice due to spacing was usually found at 84 DAT (i.e. flowering stage), along with a few cases at 28 and 56 DAT in the investigation. Close spacing (20 cm × 10 cm) resulted in greater blast incidence than other two wider spacings (15 cm × 15 cm and 20 cm × 15 cm) (Table 3).

Table 3. Effect of planting date and spacing on blast disease incidence of Gobindabhog rice during *kharif* season

Treatment	Brown spot disease incidence (%)		
	28 DAT	56 DAT	84 DAT
<i>Planting time</i>			
10 July	3.21 (10.1)	8.02 (16.3)	13.2 (21.2)
25 July	3.64 (10.7)	10.11 (18.4)	14.6 (22.4)
10 August	4.32 (11.8)	13.32 (21.3)	15.7 (23.3)
25 August	5.00 (12.7)	14.06 (22.0)	19.4 (25.9)
SEm±	0.56	0.37	0.54
CD (P=0.05)	1.73	1.14	1.66
<i>Spacing</i>			
20 cm × 10 cm	4.30 (11.7)	12.16 (20.2)	17.9 (24.8)
15 cm × 15 cm	3.38 (10.3)	11.15 (19.3)	15.2 (22.9)
20 cm × 15 cm	4.44 (11.9)	10.82 (19.0)	14.1 (21.9)
SEm±	0.48	0.39	0.42

CD (P=0.05)	1.38	NS	1.22
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Figures in parentheses are angular transformed values; DAT = Days after transplanting; NS = Not significant

3.2 Insect incidence

Gundhi bug incidence

The population of gundhi bug per hill of gobindavhog paddy was increased from early (10 July) to mid-planting (25 July) in July and then declined gradually due to delayed planting upto August 25 in the experiment (Table 4), but the differences were mostly non-significant, excluding at 112 DAT, pooled over two year. The mean number of gundhi bug per hill of four planting dates pooled over two years was 3.10 and 4.96 during 2010 and 2011 respectively, which indicated greater incidence of gundhi bug in second year than first year. Plant density could not show any definite effect or trend on incidence of gunghi bug during both grain development and ripening stage of Gobindabhog rice in 2010 and 2011 (Table 4).

Table 4. Effect of planting date and spacing on gundhibug incidence of Gobindabhog rice during *kharif* season

Treatment	Number of gundhibug hill ¹	
	84 DAT	112 DAT
<i>Planting time</i>		
10 July	2.78 (1.64)	4.67 (2.12)
25 July	3.39 (1.79)	5.56 (2.34)
10 August	3.28 (1.77)	5.17 (2.25)
25 August	2.94 (1.67)	4.44 (2.08)
SEm±	0.19	0.21
CD (P=0.05)	NS	0.65
<i>Spacing</i>		
20 cm × 10 cm	3.08 (1.72)	5.29 (2.29)
15 cm × 15 cm	3.04 (1.70)	4.79 (2.15)
20 cm × 15 cm	3.17 (1.74)	4.79 (2.15)
SEm±	0.23	0.32
CD (P=0.05)	NS	NS

Figures in parentheses are square root transformed values; DAT = Days after transplanting; NS = Not significant

4. CONCLUSION

This research work was conducted to find out the major diseases and insects of indigenous Gobindabhog rice in the new alluvial zone of West Bengal. Based on the findings of the present study, the highest brown spot disease intensity was recorded with a delay planting time (25 August), whereas the lowest was observed with an earlier planting time (10 July). The blast intensity was also recorded at its highest (19.4%) with a delay in planting time and at its lowest (3.2%) with an earlier planting time. In the case of the gundhi bug population, the highest number (5.56 per hill) was counted on 25 July at planting time and also with a closer spacing (20 cm x 10 cm) (5.29 / hill).

Abbreviations: DAT-Days after transplanting; WAT-Week after transplanting; NS-Not significant

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