

52.05 per cent.  $E_5$  recorded the highest seed yield of 7.02 g per plant. The results obtained for seed set per fruit (i.e. number of seeds per fruit) was not significant. Seed set per fruit was in the range of 47.77 to 50.55 per cent. On an average all the ecotypes produced 2 to 4 seeds per plant. The reasons for low fruit set in  $E_1$  may be due to the production of more number of flowers per umbel, resulting in the competition among the flowers for nutrients. Besides it produced less number of leaves per plant ultimately resulting in reduced photosynthetic area. The low seed yield of  $E_1$  may be due to the lesser number of seed heads per plant. The results obtained for seed size was greatest in  $E_5$  (2.99 x 2.33 mm, length and breadth wise) and the smallest was recorded in  $E_2$  (2.78 x 2.11 mm). Weight of 1000 seeds was the highest in  $E_4$  (3.30 g) and the lowest was in  $E_2$  (3.12 g). The greatest seed size and 1000 seed weight in  $E_4$  may be attributed to the low fruit set percentage (Table 2).

Initial seed germinability was 98.60 per cent and it decreased with the storage of seeds. Under ambient conditions of storage, all the ecotypes retained 50 per cent germinability up to 6 months. During 7th month of storage, seeds of  $E_2$  completely lost their viability while other ecotypes could retain it (Table 3). The reason for reduction of viability in  $E_2$  may be leakage of solutes from the seeds. Seeds of other ecotypes showed 30-40 per cent viability up to 8 months of storage due to their boldness.

### Acknowledgments

The authors are thankful to Dr. P. Baskaran, Dean, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu for the support rendered during the study.

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(Received : July 1999; Revised : November 2000)

Madras Agric. J., 87(7-9): 372 - 375 July - September 2000

<https://doi.org/10.29321/MAJ.10.A00474>

## Management of brown spot disease of rice by *Drechslera oryzae*

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**Abstract** : Date of sowing has profound effect on the development of brown spot disease and yield of rice. Crop sown on 15th May recorded maximum yield 5050 kg ha<sup>-1</sup> with minimum build up of disease severity 4.5 per cent. Contrary to this, late sown crop yielded the least (2896 kg ha<sup>-1</sup>) with maximum disease severity of 21.1 per cent. Out of 157 varieties/entries screened against brown spot disease of rice, only 2 entries IET 13818 (OR 165-97-15) and IET 13830 (Rewa 14-174) showed highly resistant reaction and others were categorised as resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible. (Key words : Brown spot, Rice, *Drechslera oryzae*).

Brown spot caused by *Drechslera oryzae* is a devastating disease of rice especially in calcareous belt of North Bihar and generally called a disease of poor management. Padmanabhan (1973) accounted it for the Great Bengal famine of 1942-43 during

which 52-90 per cent yield losses was recorded. Keeping in view the economic importance of the crop, widespread occurrence and heavy losses inflicted by the disease, the present investigations aim at the manipulation of agronomical practices and

varietal improvement to keep down the disease pressure below the economic threshold level.

#### Materials and Methods

Date of sowing experiments were conducted with rice varieties Pankaj, TN 1 and IR 64 earlier categorised as susceptible, moderately susceptible and resistant, respectively sown in seed beds at 15 days interval commencing from 15<sup>th</sup> May to 15<sup>th</sup> July. Twenty five day old seedlings were transplanted at 15 x 15 cm spacing using 3 seedlings / hill. The treatments were replicated twice. The test varieties were flanked on all sides of two rows of NC 1626 which served as infector rows. Infector rows were inoculated by spraying with the spore suspension having spore load  $1.24 \times 10^5$  spores ml<sup>-1</sup> of *Drechslera oryzae* in the evening at growth stage 5. The yield was computed in kg ha<sup>-1</sup> and disease severity was recorded and subjected to statistical analysis with angular transformed values.

One hundred fifty seven entries of rice were screened for their reaction to brown spot disease for two consecutive years 1996 and 1997 as per the standard method of National Screening Nursery. Twenty five days old seedlings of each entry/variety were transplanted in two rows of 5 meters length with 15 x 15 cm spacing maintaining two test entries 30 cm apart. Each block was flanked on all sides with NC 1626 (susceptible check). Soil was supplemented with NPK @ 100 : 40 : 40 kg ha<sup>-1</sup> in both the experiments. Nitrogenous fertilizer was split thrice whereas phosphatic and potassic fertilizers were incorporated in soil before transplanting. Disease severity was recorded as per scale mentioned in Standard Evaluation System (IRRI, 1996) for this disease.

#### Results and Discussion

Pooled analysis of data of two years (Table 1) revealed that date of sowing has profound effect on the development of brown spot disease and corresponding yield, irrespective of varieties of rice. Highest mean yield of three varieties was recorded to the tune of 5050 kg ha<sup>-1</sup> with least dates produced less yield with corresponding high disease severity. Highest mean disease severity upto 21.1 per cent was observed when transplanted on 15<sup>th</sup> July and this date yielded the least (2896 kg ha<sup>-1</sup>). Critical analysis of the data also indicate that the sowing on 15<sup>th</sup> June yielded 4462 kg ha<sup>-1</sup> with disease severity 11.3 per cent. Based on yield potentiality and corresponding disease severity, three distinct phases have emerged which are termed as 'Very safe' (15<sup>th</sup> May to 1<sup>st</sup> June), 'Safe' (15<sup>th</sup> June) and 'Unsafe' (1<sup>st</sup>

to 15<sup>th</sup> July). During these periods maximum, moderate and minimum yields could be obtained with mild, moderate and severe disease development. Based on the principle to reduce to a minimum level over which an ineffective agent (propagule) meet the susceptible stage of the host (Singh, 1984). Chattopadhyay (1976) suggested to avoid late planting of rice to prevent incidence of brown spot. Srinivasan (1981) also had the same view that the disease was more severe with late plantings. Similar findings in respect of brown spot development under different dates of sowing could be postulated by several workers (Gangopadhyay, 1978 and Rao and Hasanuddin, 1993).

Perusal of weather elements (Table 3) with the development of brown spot disease revealed that temperatures of 22-31° C coupled with minimum of 70% and maximum above 90% relative humidity were congenial. Early sown crop escaped such weather factors resulting in less disease severity. Contrary to this late planted rice succumbed to high disease severity due to the fact that congenial weather factors prevailed during susceptible stage of the crop.

Out of 157 only 2 entries viz., IET 13818 (OR 165-94-15) and IET 13830 (Rewa 14-174) showed highly resistant based on the observations taken in respect of size and number of spots on plant parts inclusive of grains which scored whereas 12 entries had resistant reaction and 31 entries exhibited moderately resistant reaction (Table 2).

The highly resistant varieties/entries may be utilized as resistant donors in breeding programme. The highly resistant and resistant varieties/entries can safely be recommended in endemic as well as epiphytotic areas as this is only the most effective and economical tool to manage rice disease (Ou, 1988). Variations in disease reaction of varieties/entries may be explained by the fact that they have different genetic make - up. Varietal differences in susceptibility of rice plants to brown spot were well demonstrated in the past by several works (Ganguly, 1946; Padmanabhan *et al.* 1974 ; Singh and Prasad, 1985 DRR, 1997).

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**Table 1.** Effect of date of sowing on the development of brown spot disease and grain yield of rice.

Date of sowing	Brown spot (%)			Mean	Grain yield (kg ha <sup>-1</sup> )			Mean
	Variety				Variety			
	V <sub>1</sub> = Pankaj	V <sub>2</sub> = T (N) 1	V <sub>3</sub> = IR 64	V <sub>1</sub> = Pankaj	V <sub>2</sub> = T (N) 1	V <sub>3</sub> = IR 64		
D1 (15th May)	9.0 (17.4)	2.4 (8.9)	2.1 (11.5)	4.5	5800	4850	4500	5050
D2 (1st June)	14.1 (21.9)	4.9 (12.5)	3.7 (10.7)	7.5 (15.1)	5275	4800	4425	4833
D3 (15th June)	21.5 (27.6)	17.7 (15.9)	4.7 (12.0)	11.3 (18.5)	5000	4300	4088	4462
D4 (1st July)	26.6 (31.0)	12.2 (20.4)	8.4 (16.8)	15.7 (22.8)	4225	3963	3588	3925
D5 (15th July)	37.8 (36.7)	16.9 (24.3)	10.7 (19.0)	21.1 (26.7)	3000	2675	3103	2896
Mean	21.8 (26.9)	8.8 (16.4)	5.9 (13.4)	12.0 (18.9)	4660	4116	3923	4233

Figures in parentheses are angular transformed values

	CD at 5%	CV%		CD at 5%	CV%
Treatment	3.12 (3.58)	11.76 (5.68)	Treatment	43.12	7.89
Date of sowing (D)	1.21 (2.87)		Date of sowing (D)	24.88	
Variety (V)	0.95 (2.86)		Variety (V)	19.29	
D x V	3.75 (-)		D x V	43.11	

**Table 2.** Varieties / entries graded as highly resistant, resistant and moderately resistant against brown spot of rice.

Group / grade	Variety / entry
1. Highly resistant (HR) Score-1	IET 13818 (OR 165-97-15) and IET 13830 (Rewa 14-174) = (2)
2. Resistant (R) Score-2	IET 13817 (OR 165-86-12), IET 13827 (Rewa 6-85-3), IET 13837 (RP 2479-18715-1197), IET 13983 (KAUM 59-29-7-1-2), IET 13985 (UPRI 201-1-5-3), IET 14031 (OR 764-39), IET 14040 (TTB 151-91-3), IET 14041 (TTB 151-51-3-5) IET 13994 (OR 930-1-1-2), IET 13650 (ACM 60P), IET 13652 (RP 2526-14767-1143), IET 14769 (RNRM 70) = (12).
3. Moderately resistant (MR) Score-3	IET 13832 (JR 201), IET 14086 (RP 1579-23057-1319), IET 14087 (RP 1579-23071-1320), IET 13570 (HKR 91-113), IET 13932 (NLR 33358), IET 14032 (OR 809-39), IET 14034 (OR 1204-11), IET 14037 (R 744-1-107-2), IET 14038 (R 55-74-11), IET 13968 (WGL 3824), IET 14775 (RR 272-18-832), IET 14790 (RP 3791-35-1669), IET 14999 (OR 776-5P-48), IET 15001 (OR 1144-144), IET 15006 (RR 272-17-829), IET 14313 (P 1120-3102), IET 14850 (Rewa 311-56), IET 14851 (Rewa 302-20), IET 14852 (CR 807-17), IET 14859 (Pusa B10-304/94), IET 14860 (RJB 95001), Bandana, IR 36, IR 64, RAU 1344, Prabhat, Prasanna, Rajshree, PSR 1119-13-3, Turanta Dhan and Vaidehi = (31).

Moderately susceptible = 73, Susceptible = 29, Highly susceptible = 10.