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YELLOWING SYNDROME IN F_4 GENERATION OF RICE (Oryza sativa L.)

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ABSTRACT

An unusual epidemic form of leaf yellowing associated with stunted growth in rice varieties was observed in some parts of Tamil Nadu during 1984-85. An experiment was carried out to know whether varietal factors has got any influence on yellowing syndrome or not. The incidence of yellowing syndrome was less in IR 50, Co 41 and in the F_4 cross derivaties involving IR 50 and CO 41 as parents. Since the syndrome being genetically controlled developing resistant lines for this stress condition could be possible through recombination breeding utilizing IR 50 and CO 41 rice varieties.

Rice crop in various districts of Tamil Nadu was affected by varying degrees of a strange yellowing disease and affected the yield considerably during 1984-85. The leaves turned to palegreen and then to yellow and reduced tillering and plant height (Anon, 1985 a). More than one factor either singly or incombination were reported to be the cause for the sudden occurrence of the wide spread yellowing (Jayaraj and Subramanian, 1985). The present study was therefore undertaken to investigate the influence of rice genotypes on yellowing syndrome and the results discussed.

MATERIALS AND METHODS

The investigation was carried out at the wetland Farm, Agricultural College and Research Institute, Madurai. F_4 generations involving seven intervarietal cross combinations were formed the materials for this study. Out of twenty five F_3 families studied in each cross combination, six families were selected in each group of high, medium and low family mean yield to serve as bulk selections. The seeds from the entire family row from all the replications were bulked in each group of selection and random sample of seeds was drawn for

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advancement to F_4 generation as family bulks. Similarly, selection was exercised on the basis of single plant yield and six plants in each category of high, medium and low yield group were selected irrespective of the family mean for comparison of the single plant selections against bulk selections. The eighteen single plant selections and the eighteen bulk selections in each cross were raised in a compact family block (Split-split) design with two replications, where the method of selections, crosses and yield groups were allotted to the main, sub-plots and sub plots respectively during the summer season (December, 1984). Each singleplant selection and the bulk selection was raised in a three metre row in each replication with 10 cm space between plants and there were six rows in each selection group with 20 cm space between the rows.

The severity of the yellowing infection exhibited by the individual plants was scored on 70th day by examining the amount of plant area infected on the whole by assigning the appropriate grade values. The following were the different grades adopted for scoring.

Grades	Description
0	No infection. Plants completely green.
1	More than 50 percent of total leaves in a hill were yellow. Plant height reduced. No grain formation.
2	Completely infected. All the leaves were yellow. Plant height and tiller reduced. Plants almost dead.

The percentage of disease index (PDI) was calculated for yellowing syndrome on the basis of their reaction using Mc Kinney's (1928) formula.

$$PDI = \frac{\text{Sum of all grades}}{\text{Total number of plants assessed} \times \text{Maximum disease category}} \times 100$$

RESULTS AND DISCUSSION

The intensity of yellowing syndrome scored in F_4 generation of seven crosses for single plant selections and bulk selections were given in Table. Among the parents, the yellowing index score was low in IR 50 (20.63) and CO 41 (24.18) and high in CUL 1753 (81.33), CO 33 (73.88), ADT 31 (70.68), IET 7281 (60.40) and CO 37 (57.33). The mean differences in yellowing index scores between the cross combinations were significant. The progenies of crosses CO 33 x CO 41, CO 37 x IR-50, and CO 37 x CO 41, CO 41 x CO 37 showed moderate resistance while the progenies of crosses CO 33 x CUL 1753, CO 37 x IET 7281 and ADT 31 x IET 7281 showed high level of susceptibility to yellowing syndrome. The resistance of the lines in the crosses in F_4 generation could have been inherited from the resistant donars IR 50 and CO 41 involved as parents in these crosses. These results indicated that the cause for yellowing syndrome might be either

partly or fully genetic in nature and thus, offers scope for developing breeding lines with built in resistance to the yellowing syndrome. Subramanian et al. (1986) reported that rice varieties ADT 31, CO 33, CO 37 and IET 4786 were badly affected by yellowing diseases while IR 50, ACM 9 and IR 56 were least affected.

The differences CO 41, in yellowing index score in F_4 generation were not statistically significant between the single plant selections and the bulk selections made in F_3 based on mean values. There was significant interaction between crosses and the yield group selections. The incidence of yellowing was high in higher yielding selections in the crosses CO 37 x IR 50, CO 37 x IET 7281, CO 41 x CO 37 and ADT 31 x IET 7281. This indicated that the resistance genes might be the polygenic and the resistance might be horizontal (Vander Plank, 1963).

The results of present study did not show complete resistance in the F_4 generation of the cross derivaties, and suggested that other factors might also be involved for the cause of yellowing syndrome. It was estimated that yellowing due to other causes (other than RTV) was high in Madurai district (Anon 1985 b). Followup research with IR 50 and CO 41 might result in developing resistant lines for this yellowing syndrome.

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TABLE : Mean Percentage Yellowing Index in F_4 generation of the seven crosses for the different single plant and bulk selections.

	Single plant selections			Bulk selections			Mean
	Low yield group	Medium yield Group	High Yield Group	Low mield group	Medium yield Group	High Yield Group	
Cross 1 CO 33/CUL 1753	71.12 (57.48)	67.36 (55.18)	64.03 (53.13)	58.06 (49.66)	61.95 (51.94)	60.17 (50.89)	63.78 (53.01)
Cross 2 CO 33/CO 41	43.87 (41.50)	42.27 (40.57)	40.38 (39.47)	37.51 (37.76)	38.67 (38.47)	37.17 (37.58)	39.98 (39.23)
Cross 3 CO 37/IR 50	23.19 28.79)	29.59 (33.21)	39.86 (39.23)	47.36 (43.51)	40.60 (39.58)	45.00 (42.13)	37.59 (38.06)
Cross 4 CO 37/IET 7281	70.78 (57.29)	65.42 (53.97)	71.39 (57.67)	60.84 (51.24)	69.45 (56.48)	66.12 (54.39)	67.36 (55.18)
Cross 5 CO 37/CO 41	38.06 (38.12)	38.06 (38.12)	36.81 (37.35)	40.70 (39.64)	44.86 (42.07)	33.06 (35.12)	38.59 (38.59)
Cross 6 CO 41/CO 37	30.42 (33.46)	32.09 (34.51)	34.73 (36.09)	28.92 (32.52)	18.88 (25.77)	38.61 (38.41)	30.61 (33.58)
Cross 7 ADT 31/IET 7281	62.50 (52.24)	70.84 (57.29)	73.61 (59.08)	71.25 (57.61)	74.31 (59.54)	82.37 (65.40)	72.49 (58.37)
Mean	48.56 (44.20)	49.38 (44.66)	51.54 (45.86)	49.23 (44.54)	49.82 (44.94)	51.79 (44.03)	

Figures in parenthesis indicated ercsine transformed values

	SE_D	CD (P = 0.05)
Selection	0.1768	NS
Cross	4.0847	8.90
Group	0.7551	NS
Selection x cross	5.7760	NS
Selection x Group	1.0679	NS
Cross x Group	1.9978	4.09
Selection x cross x group	2.8250	5.79