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Study of sodicity tolerance at critical sensitive stages in short duration rice genotypes

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ABSTRACT

The present experiment was conducted to screen the already adapted high yielding short duration rice varieties and pre release cultures for two critical sodicity sensitive phases of rice crop, viz., early seedling phase and reproductive stage. It was concluded that the rice genotypes, TRY2, ASD 16, MDU 5, CO 47 , IR 64, TR 2000-3, TR 2003-25 and TR 2004-08 were more suitable for sodic soils.

Key words: *rice, sodicity tolerance, varieties, screening*

Rice is moderately sensitive to sodicity and it is grown as a desalinization and reclamation crop because of its ability to grow well under flooded conditions. Sensitivity to sodicity in rice crop varies with the stage of crop growth. It is considered tolerant during germination, active tillering and maturity while sensitive during early seedling stage, panicle initiation, pollination and fertilization. When breeding is aimed for developing a sodicity tolerant rice variety it is obligatory to identify a donor or variety with tolerance to sodicity and the rice varieties should be screened at different stages of crop growth. The rice variety IR 64 even though not bred for drought tolerance, it has been found to be performing well under drought conditions also. Hence, it may be possible to find sodicity tolerance in already released high yielding rice varieties, which were not originally bred for salinity tolerance. Further, it has been observed that usually the semi-dwarf rice varieties are having more tissue tolerance when exposed to sodicity than the traditional salt tolerant land races. Richards (1983) has noted that highly yielding wheat cultivars generally out yield the salt tolerant or more environmentally stable lines in situations in which salinity is spatially variable across the field. Hence the present study was taken up to study the influence of sodicity at critical stages of crop growth of selected short duration rice varieties.

A set of 20 short duration (100–115 days maturity) rice genotypes comprising of seventeen released cultivars and three pre released cultures, was raised in a randomized block design with three replications in the dry season in the 'hot spot' of the AD Agricultural College, Trichy. The 'hot spot' sodic fields were having the ESP more than 15, pH > 9.0. The irrigation water was also of poor quality *i.e.*, with pH >9.0, SAR>10 and RSC>10meq/l. Ten plants from each replication were used for taking observations. Scoring at early seedling stage was done based on modified Standard Evaluation Score (SES) of visual salt injury as suggested by Gregario *et al*. (1997). The sodicity tolerance at reproductive phase was done based on spikelet fertility percent (Table 1).

The results revealed that the salinity tolerance behaviour was different at early seedling stage and reproductive phase for different rice genotypes which envisages the importance of screening rice varieties critically at different crop stages. This is due to the

Table 1. Basis of scoring for sodicity tolerance at reproductive phase

Spikelet fertility (%)	Score	Tolerance
>90	1	Highly tolerant
81-90	2	tolerant
71-80	3	Moderately tolerant
61-70	4	Moderately sensitive
51-60	5	sensitive
< 50	6	Highly snesitive

Table 2. Scoring for sodicity tolerance during critical stages

Genotypes	Grade for salinity tolerance during vegetative phase	Grade for salinity tolerance during reproductive phase based on spikelet fertility percent	Average score
ASD 20	3 (T)	5 (S)	4
ASD 18	5 (MT)	5 (S)	5
ADT 37	7(S)	5(S)	6
MDU 5	3(T)	4(MS)	3.5
TRY2	3(T)	3(MT)	3
ASD 16	3(T)	4(MS)	3.5
ADT 43	5(MT)	5(MS)	5
TKM 11	7(S)	5(MS)	6
IR 72	5(MT)	5(MS)	5
ADT 42	5(MT)	5(MS)	5
ADT 41	5(MT)	6(S)	5.5
IR 64	3(T)	3(MT)	3
TKM 9	3(T)	5(MS)	4
TKM 10	3(T)	5(MS)	4
IR 50	7(S)	6(S)	6.5
Co 47	3(T)	3(MT)	3
ADT 36	3(T)	4(MS)	3.5
TR 2000-3	3(T)	3(MT)	3
TR 2003-25	3(T)	3(MT)	3
TR 2004-08	1 (HT)	1(T)	1

(HT- highly tolerant; T: tolerant, MT- moderately tolerant; MS- moderately sensitive; S- sensitive; HS- highly sensitive)

differential pattern of salt accumulation and duration of salinity and also due to the weather factors like temperature and rainfall. In sensitive varieties, drying of leaves was seen conspicuously with discoloration of leaves starting from the tip of leaves during early seedling stage while during reproductive phase the spikelets turned pale, very thin and even malformed which caused poor grain filling and grain density.

The culture TR 2004-08 was found to be the most tolerant both at vegetative and reproductive stage. The genotypes, TRY 2, ASD 16, MDU5, CO 47, IR 64, TR 2000-03, TR 2003-25, ASD 20, TKM 9 and TKM 10 were the most tolerant types during early seedling stage. During reproductive phase, the genotypes viz., TRY2, IR 64, CO 47, TR 2000-03 and TR 2003-25 were found to be tolerant. While considering the overall tolerance the genotype TR 2004-08 topped all the genotypes followed by TRY2, ASD 16 Co 47, MDU 5, IR 64 and the prereleased cultures, TR 2004-08, TR2000-03 and TR 2003-25 were adjudged to be the most tolerant varieties with early seedling tolerance and reproductive phase tolerance and could be recommended for sodic soils (pH~ 9.5, ESP~ 35) of Tamil Nadu and also effectively be used in hybridization programme as donors since more possibility to realise sodicity tolerant segregants with acceptable phenotype as compared to that of using the traditional tall photosensitive donors. Rajagopalan *et al.* (2004) have also reported that TRY 2 is highly suitable for cultivation in the salt affected soils of Tamil Nadu.

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