Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(5): 1802-1804
Received: 01-07-2019
Accepted: 03-08-2019

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Assessment of suitable salt resistant rice variety for saline soils of Theni district

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Abstract
The on farm testing (OFT) experiment was conducted at farmer field of Uppukottai Village of Theni District during Rabi 2018 -2019. The experiment trail was conducted to assess the suitable salt resistant rice variety for saline soils of Theni district. The experiment was laid out in a Randomized Block Design (RBD) and replicated thrice with following three treatments; T_1 - Farmers practice (Goraknath 509), T_2 - CSR 43, T_3 - TRY 3. There are two salt resistant varieties namely, CSR 43 and TRY 3 was used in this experiment trail. The recommended doses of fertilizer were applied at the time of field preparation as a basal dose. Each trail plot was conducted in 0.4 ha. The primary data collected from the farmers with help of the interview schedule and direct field measurement. All the yield components such as number of productive tillers, panicle length, panicle weight and test weight with values of 31, 21.4 cm, 2.6 g and 24.7 g were higher with the TRY 3 salt resistant rice variety (T_3) followed by, salt resistant rice variety CSR 43 (T_2) with number of productive tillers (26), panicle length (18.6 cm), panicle weight (2.1 g) and test weight (22.5 g). TRY 3 salt resistant rice variety (T_3) recorded higher grain yield (4828 kg ha^{-1}) and straw yield (5340 kg ha^{-1}) followed by, CSR 43 salt resistant rice variety (T_2) gave grain yield (4235 kg ha^{-1}) and straw yield (4860 kg ha^{-1}). The highest B: C ratio (2.13) was recorded with the TRY 3 salt resistant rice variety (T_3). The above study reveals that, salt tolerant variety TRY 3 could be considered as a better option for achieving higher production and profitability of rice under the saline soils of Theni District.

Keywords: Suitable salt resistant, rice variety, saline soils

Introduction
"Rice is life" for more than half of humanity in this world. The rice grain shaped the cultures, diets and economics of billions of people in Asia. In India the total area under the rice cultivation is 43 m ha, which comprises of all kinds of ecosystems *viz.*, irrigated (52.6%), rainfed (32.4%), upland (12%) and deep water (3%) (FAO, 2010). Yet all is not well in the world of rice. Growth in rice yields is slowing, and is already falling behind population growth. Most rice farmers are poor, but national policies often favors the consumer and export market (FAO, 2004). Further, Drought and high salinity affect more than 10 % of arable land, which results in more than a 50 % decline in the average yield of important crops worldwide (Bray *et al*., 2000) [3]. Salt stress is known to cause all other type of stresses like ionic, osmotic and oxidative. The Physiological effects of salt stress include the decrease in seed germination, seedling growth, and reduced leaf expansion which cause decrease in Photosynthetic rate and dry matter production (Ashraf M., 2010) [2]. Rice is one of the most suitable crops for saline soils although it is usually considered moderately sensitive to salinity (Mori *et al.*, 1987) [5]. Saline soils are usually under waterlogged condition; other crops could not grow in these areas except rice. The growth and yield of rice plants grown in saline soils besides being adversely affected by the direct osmotic effect of salts, is also affected due to nutritional imbalance caused by reduced availability of nutrients, which in turn affects the nutrition value and quality as a whole of rice grain. Although, salinity affects all stages of the growth and development of rice plant and the crop responses to salinity varies with growth stages, concentration and duration of exposure to salt. Several studies indicated that rice is tolerant during germination and vegetative stage but becomes very sensitive during seedling and reproductive stage (Ali *et al*., 2014) [1].

Salt- affected soils are an important ecological entity in the landscape of any arid and semi-arid region. In India nearly 9.38 million ha area is occupied by salt-affected soils out of which 5.5 million ha are saline soils (including coastal) and 3.88 million ha alkali soils (IAB 2000). These occur from Jammu & Kashmir (Ladakh region) in north to Kanyakumari in south and Andaman & Nicobar Islands in the east to Gujarat in the west. In the salt affected area, appropriate rice variety is required to get higher productivity and to get reasonable profit.

Varietal Screening is important in this way to find sufficient variation and to identify salt tolerant varieties which helps to devise appropriate screening techniques.

The ICAR introduced on farm testing (OFT) for evaluation of suitable salt resistant rice variety for saline soils of Theni district to enhance the yield and income of the famers. The main objective of the trail is evaluating the salt resistant rice variety under the real farming situation. The present study has been undertaken to assess the suitable salt resistant rice variety for saline soils of Theni district.

Materials and methods

The on farm testing (OFT) experiment was conducted at farmer field of Uppukottai village of Theni District during Rabi 2018 -2019. The experiment trail was conducted to assess the suitable salt resistant rice variety for saline soils of Theni district. The soil type of the trail plots is sandy clay loam in texture with low organic carbon (0.29 - 0.34 %), available nitrogen (278 - 289 kg ha^{-1}), available phosphorous (8.65 - 12.01 kg ha^{-1}) and available potassium (163 - 181 kg ha^{-1}). The soil pH (1:2 soil water suspension) (Jackson, 1973) [4] and EC (1:2 soil water suspension) (Jackson, 1973) [4] of the trail plot is 8.6 and 2.3 dS m^{-1} The experiment was laid out in a randomized block design and replicated thrice with following three treatments; T_1 - Farmers practice (Goraknath 509), T_2 - CSR 43, T_3 - TRY 3. There are two salt resistant varieties namely, CSR 43 and TRY 3 was used in this experiment trail. The recommended doses of fertilizer were applied at the time of field preparation as a basal dose. Each trail plot was conducted in 0.4 ha. The primary data collected from the farmers with help of the interview schedule and direct field measurement.

Under the OFT, the testing salt resistant varieties *viz*.., CSR 43 and TRY 3 at the rate of 5 kg ha^{-1} was taken. Appropriate need based plant protection measures were taken up to control the pest and diseases following the recommended package of practices as per the Crop Production Guide (Anonymous, 2012).

Table 1: Difference between testing salt resistant rice variety and farmers practices

S. No	Particulars	Parentage	Duration	Characters
1	T_1 - Farmers practice (Goraknath 509)	-	120	Goraknath 509 with yield of 700 kg ha^{-1}
2	T_2 - CSR 43	KDML105/IR4630-22-2-5-1-3/ IR 20925-33-3-1-28	110	Plant height (cm) : 95, Grain type : Short Bold, Salinity tolerance (dS m-1) : 7.0, Sodicity tolerance (pH) : 10.0, Grain yield in Normal soils (q ha^{-1}) : 60, Grain yield in Salt affected soils (q ha^{-1}) : 35, Recommended States / Areas : Salt affected soils including sodic soils of UP
3	T_3 - TRY 3	ADT 43 / Jeeraga Samba	135	Season - Samba / Late Samba / Thaladi, Yield (Kg/ha) - 5833 / ha, Grain type - Medium bold grain, Rice color - white rice Special features - Resistant to leaf folder, stem borer, brown plant hopper, blast, brown spot, sheath rot and sheath blight

Results and discussion

Yield attributes

The findings of this study revealed that the yield attributes, yield and economics were significantly influenced by different salt rice varieties.

Yield components of plant decreased significantly in response to salinity in all rice genotypes. When plants are grown under saline conditions, as soon as the new cell starts its elongation process, the excess of salts modifies the metabolic activities of the cell wall causing the deposition of various materials which limit the cell wall elasticity. The reduction in leaf area, yield and yield components under saline conditions were also due to reduced growth as a result of decreased water uptake, toxicity of sodium and chloride in the shoot cell as well as reduced photosynthesis. Further, the shrinkage of the cell contents, reduced development and differentiation of tissues, unbalanced nutrition, damage of membrane and disturbed avoidance mechanism could be the causes for reduction in yield per plant, leaf area and yield components in rice. Therefore a genotype exhibiting relative salt tolerance for all the plant attributes may be ideal one (Ali *et al.*, 2004) [1].

All the yield components such as number of productive tillers, panicle length, panicle weight and test weight with values of 31, 21.4 cm, 2.6 g and 24.7 g were higher with the TRY 3 salt resistant rice variety (T_3) followed by, salt resistant rice variety CSR 43 with number of productive tillers (26), panicle length (18.6 cm), panicle weight (2.1 g) and test weight (22.5 g) (Table 1) (Fig 1).

TRY 3 salt resistant rice variety (T_3) recorded higher grain yield (4828 kg ha^{-1}) and straw yield (5340 kg ha^{-1}) followed by, CSR 43 salt resistant rice variety (T_2) gave grain yield (4235 kg ha^{-1}) and straw yield (4860 kg ha^{-1}) (Table 2).

Economics of raising a particular crop plays a vital role in making recommendations for adoption of a technology to the farmers. The data pertaining to gross returns, net returns and B: C ratios are presented in Table 3. The highest gross return (Rs. 72420 ha^{-1}) and net return (Rs. 38480 ha^{-1}) were recorded with the TRY 3 salt resistant rice variety (T_3). The highest B:C ratio (2.13) was recorded with the TRY 3 salt resistant rice variety (T_3).

Table 2: Yield and yield parameters of different salt resistant rice variety

Treatments	No. of productive tillers	Panicle Length (cm)	Panicle weight (g)	Test grain Weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1 - Farmers practice (Goraknath 509)	19	16.3	1.6	19.4	3852	4170
T_2 - CSR 43	26	18.6	2.1	22.5	4235	4860
T_3 - TRY 3	31	21.4	2.6	24.7	4828	5340
S Ed	0.58	0.34	0.05	0.76	157.4	130.0
CD (0.05 %)	1.62	0.93	0.15	2.12	436.9	361.2

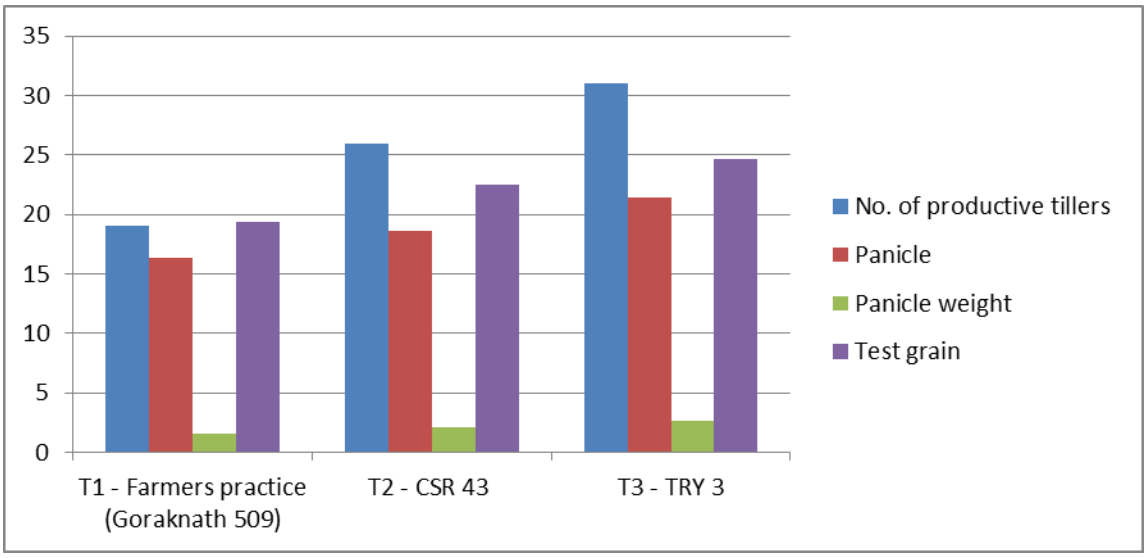

Fig 1: Yield and yield parameters of different salt resistant rice variety

Table 3: Economic parameters of different salt resistant rice variety

Treatments	Cost of cultivation (Rs ha^{-1})	Gross income (Rs ha^{-1})	Net income (Rs ha^{-1})	B:C ratio
T_1 - Farmers practice (Goraknath 509)	31506	53928	22422	1.71
T_2 - CSR 43	35650	63525	27875	1.78
T_3 - TRY 3	33940	72420	38480	2.13

Data statistically not analysed

Conclusion

The above study reveals that, salt tolerant variety TRY 3 could be considered as a better option for achieving higher production and profitability of rice under the saline soils of Theni District.

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