

Response of Exotic Drought Tolerant Rice Lines to Irrigated Conditions: Impact on Agronomic Traits

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INTRODUCTION

Climate change has become the biggest environmental challenge in the world and Sri Lanka too has been facing this challenge over the past few decades. An analysis of historical weather data in Sri Lanka revealed that annual mean rainfall has decreased throughout the country and incidence of droughts has increased over the years (Chithranayana and Punyawardena, 2014). Accordingly there has an urgent need to identify and develop drought tolerant short duration rice lines/cultivars to for rain-fed, water deficit and draught prone areas (Rajapakse *et al.*, 1999).

Farmers demand cultivars which provide higher yields under both favorable and water stress conditions and selection of rice varieties should be made on the basis of yield under both stress and non-stress conditions (Fischer *et al.*, 2003). This study was conducted to evaluate the yield potential, maturity duration, other agronomic traits, reactions to pest and diseases and grain quality characters of six exotic drought tolerant rice lines under irrigated conditions.

MATERIALS AND METHODS

Six exotic drought tolerant rice lines named 101, 102, 103, 104, 105, and 106 received from SAARC Agriculture Centre (SAC), Bangladesh were selected for the study and they were renamed as 15-SAC-DT-101, 15-SAC-DT-102-1, 15-SAC-DT-102-2, 15-SAC-DT-103, 15-SAC-DT-105 and 15-SAC-DT-106 respectively. Bg 251, Bg 300 and Bg 304 varieties were used as reference varieties representing 2.5 months and 3.0 months age groups.

Experiments were conducted at RRDI, Batalagoda (IL1, North Western province) during *Maha* 2016/17. The soil type of the experimental site was low humic clay and the trials were conducted under irrigated conditions. Pre germinated seeds were direct seeded and Urea, TSP and MOP fertilizer was applied as recommended by the Department of Agriculture (DOA, 2013). Weeds were controlled by applying

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weedicides and hand weeding was practiced where necessary. Days to 50% flowering, days to physiological maturity, plant height, panicle length, panicle weight, percentage of filled grain, grain yield, reactions to pest and diseases (GM, BPH, Blast, BLB) and grain quality characters (BR%, TMR %, HG%, S/S, pericarp color) at maturity were recorded. Differences between varieties were analyzed using Analysis of Variance using SAS.

RESULTS AND DISCUSSION

Agronomic Traits

Days to 50% flowering, days to maturity and grain yield of exotic rice lines are given in Table 1. The five exotic lines; namely 15-SAC-DT-101, 15-SAC-DT-102-1, 15-SAC-DT-102-2, 15-SAC-DT-105 and 15-SAC-DT-106, which matured 88-91 days after planting, could be categorized in to 3 months age group. The line 15-SAC-DT-103, which matured 99-100 days after planting, could be categorized in to 3½ months age group (Table 1).

Table 1. Days to 50% flowering, days to maturity and grain yield of exotic rice lines under irrigated condition at RRDI, Batalagoda during Maha 2016/17

Line /Variety	Days to 50% flowering	Days to maturity	Grain yield (t/ha)
15-SAC-DT-101	58.66 ^d	88.66 ^e	4.675 ^{ab}
15-SAC-DT-102-1	59.33 ^{dc}	90.00 ^d	3.858 ^{bcd}
15-SAC-DT-102-2	60.33 ^c	91.00 ^{cd}	4.527 ^{abc}
15-SAC-DT-103	67.00 ^a	99.66 ^a	2.957 ^d
15-SAC-DT-105	60.33 ^c	90.33 ^d	4.415 ^{abc}
15-SAC-DT-106	57.33 ^e	88.66 ^e	3.689 ^{cd}
Bg 300	67.00 ^a	97.66 ^b	4.179 ^{abc}
Bg 304	61.66 ^b	91.66 ^c	4.825 ^a
Bg 251	53.66 ^f	82.66 ^f	4.491 ^{abc}
CV%	0.9659	0.6421	12.6966
LSD	1.0131	1.0131	0.9186

Means followed by the same letters in each column are not significantly different at 5% significance level.

Among the exotic lines tested, 15-SAC-DT-101, 15-SAC-DT-102-2 and 15-SAC-DT-105 gave comparatively higher yield over 4.0 t/ha. The line 15-SAC-DT-103 which has taken a longer time to mature than the other tested lines, recorded the lowest yield (Table 1). The exotic rice lines 15-SAC-DT-102-1 and 15-SAC-DT-106 showed significantly lower plant height and there was no significant difference in plant height among all other tested entries (Table 2).

Table 2 . Plant height, panicle length, panicle weight, filled grain % and 1000 grain weight of exotic rice lines during *Maha* 2016/17 at RRDI, Batalagoda.

Line /Variety	Plant height (cm)	Panicle length (cm)	Panicle weight (g)	Filled grain %	1000 grain weight (g)
15-SAC-DT-101	91.20 ^a	22.06 ^a	2.08 ^c	81.49 ^{bc}	24.13 ^{de}
15-SAC-DT-102-1	74.10 ^b	19.06 ^b	1.27 ^d	70.74 ^{de}	19.50 ^f
15-SAC-DT-102-2	89.30 ^a	20.50 ^{ab}	2.05 ^c	89.90 ^a	30.56 ^a
15-SAC-DT-103	91.00 ^a	22.00 ^a	2.34 ^{bc}	70.90 ^{de}	23.38 ^e
15-SAC-DT-105	93.73 ^a	22.26 ^a	2.09 ^c	76.54 ^{de}	25.60 ^{cd}
15-SAC-DT-106	73.06 ^b	19.06 ^b	2.08 ^c	68.48 ^e	19.63 ^f
Bg 300	92.80 ^a	21.53 ^a	2.52 ^{ab}	67.12 ^e	28.09 ^b
Bg 304	91.00 ^a	21.93 ^a	2.57 ^{ab}	72.49 ^{de}	25.80 ^c
Bg 251	88.40 ^a	20.46 ^{ab}	2.64 ^a	87.96 ^{ab}	23.96 ^e
CV%	3.8419	6.4054	7.9682	5.0038	3.7846
LSD	5.7974	2.3271	0.3012	6.5984	1.6062

Means followed by the same letters in each column are not significantly different at 5% probability level.

The lowest panicle length was observed in rice lines 15-SAC-DT-102-1 and 15-SAC-DT-106. The highest panicle weight was observed in check variety Bg 251 followed by other two check varieties Bg 304 and Bg 300. The lowest panicle weight was recorded in the exotic rice line 15-SAC-DT-102-1 (Table 2).

The filled grain percentage was highest in exotic rice line 15-SAC-DT-102-2 and it was even higher than that of the check variety Bg 251. The check variety Bg 300 and exotic rice line 15-SAC-DT-106 recorded lower filled grain percentages. Among the tested exotic rice lines, the highest 1000 grain weight was observed in line 15-SAC-DT-102-2 and the lowest in line 15-SAC-DT-102-1 (Table 2).

Grain Quality Characters

Grain quality characters of tested exotic rice lines are given in Table 3. All the tested exotic rice lines had white pericarp. The lowest head grain percentage was in exotic line 15-SAC-DT-103 (50.9%). Line 15-SAC-DT-102-1 had the highest head grain %, although it has long slender grains (Table 3).

Table 3. Grain quality assessment of exotic rice lines during Maha 2016/17 at RRDI, Batalagoda

Line /Variety	BR%	TMR%	HG%	S/S	Pericarp Color
15-SAC-DT-101	79.7	74.2	66.0	LM	White
15-SAC-DT-102-1	82.6	77.5	70.5	LS	White
15-SAC-DT-102-2	79.5	73.2	56.9	LM	White
15-SAC-DT-103	78.0	70.3	50.9	LS	White
15-SAC-DT-105	79.7	74.4	71.4	IB	White
15-SAC-DT-106	82.5	76.6	67.6	LS	White
Bg 300	80.0	75.1	71.3	IB	White
Bg 304	81.6	75.9	55.1	LM	White
Bg 251	79.4	74.1	65.8	LM	White

Note: BR-Brown rice, TMR-Total milled rice, HG-Head grain, S/S-Size & shape, LM-Long medium, LS-Long slender, IB-Intermediate bold

Reactions to Biotic Stresses

None of the exotic lines or check varieties showed resistance or moderate resistance to bacterial leaf blight disease (Table 4). However, Exotic rice lines 15-SAC-DT-102-2, 15-SAC-DT-105 and 15-SAC-DT-106 showed acceptable resistance to rice gall midge, brown plant hopper and rice leaf blast disease.

Table 4. Reactions to biotic stresses of exotic rice lines during Maha 2016/17 at RRDI, Batalagoda

Line /Variety	Reaction to biotic stresses			
	RGM	BPH	Blast	BLB
15-SAC-DT-101	MR	MR/MS	MR	S
15-SAC-DT-102-1	MR	MR/MS	MR	S
15-SAC-DT-102-2	MR	MR	R	S
15-SAC-DT-103	R/MR	MR	S	MS
15-SAC-DT-105	MR	MR	MR	S
15-SAC-DT-106	R/MR	MR	MR	S
Bg 300	R/MR	MR	MR	S
Bg 304	R/MR	MR	MS	S
Bg 251	MR	MR	MR	S

Note: RGM-Rice gall midge, BPH-Brown plant hopper, BLB-Bacterial leaf blight, R-Resistant, MR-Moderately resistant, MS-Moderately susceptible, S-Susceptible

CONCLUSIONS

The exotic lines, 15-SAC-DT-101, 15-SAC-DT-102-2 and 15-SAC-DT-105 showed higher yield potential of over 4.0 t/ha. The exotic rice lines 15-SAC-DT-101, 15-SAC-DT-102-1, 15-SAC-DT-102-2, 15-SAC-DT-105 and 15-SAC-DT-106 which matured 88-91 days after planting, could be categorized in to 3 months age group and they could be used as breeding materials for developing drought escaping short age rice varieties. These exotic rice lines should be further screened under induced moisture stress conditions to identify the moisture stress tolerance ability.

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