Evaluation of Growth and Yield Parameters of Exotic and Local Rice Hybrid Varietiesin Low Country Intermediate Zone

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Exotic hybrid rice varieties were evaluated to identify the adaptable rice hybrids for local environment. An experiment was conducted adopting Randomized Complete Block Design with 03 replicates in Yala2016 and Maha2016/17 at Rice Research and Development Institute. Eleven treatments were included six exotic rice hybrids, two local rice hybrid and three inbred standard check varieties. Yield and yield components were recorded and data analysis was done using SAS software package. Standard hetorosis(SH) of all hybrids was calculated compared with standard check varieties which come under the same age group. In Yala season three months aged two exotic and local hybrids (CH3, CH5, HR10) showed SH of-39.08%, -34.07%, 22.66% respectively. Three and a half (3 ½) months four exotic hybrids CH4, CH6, CH7, CH8 showed SH of -11.19%, -11.22%, -0.86% and 14.44% and 4-month local hybrid showed standard heterosis of 1.90%. Exotic hybrid CH8 showed positive standard heterosis (14.44%) but did not show potential level of SH (>15%). HR10 local rice hybrid variety is having positive SH of 22.6% when compared to the exotic rice hybrid varieties. In Maha season grain yield of six exotic hybrids were 4.88, 4.86, 4.33, 4.28, 4.82, 4.82 t ha^{-1} and grain yield of two local hybrids were 4.27, 5.67 t ha^{-1}. Three months two exotic and local hybrids (CH3, CH5, HR10) showed SH of 7.62%, -4.14%, 33.81%. 3 ½ months four exotic hybrids CH4, CH6, CH7, CH8 showed SH of 6.93%, -6.25%, 5.86%, 5.28% and 4-month local hybrid 407H showed SH of 0.75%. In Yala season exotic hybrid rice varieties (CH3, CH4, CH5, CH6.CH7 and CH8) not performed potential level of SH. But in the Maha season exotic hybrid varieties such as CH3, CH4, CH7 and CH8 showed the positive SH and but not exceed the potential level SH. Result concluded that exotic rice hybrid varieties did not perform better in the low country intermediate conditions compared to the local rice hybrid varieties.

Keywords: *Rice hybrid, Standard heterosis, seasons*

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Introduction

Rice (*Oryza sativa L.)* is one of the staple food crops for near half the global population (FAO, 2004). Enhancement of rice production is an important requirement to meet increasing demand for rice in future. Development of high yielding varieties with having multiple resistant to biotic and a-biotic stress are important to cater the present and future changing environments. Hybrid rice is one of the options to enhance the productivity of rice. Hybrid rice production assures the rice farmers with increased yield over improved conventional varieties by 15 to 20% (Tran, 2002). Hybrid rice cultivation area is now rapidly increasing outside China ever since the release of the first set of hybrids in china in 1976 (Yaun, 1998). Presently, many countries other than China like Vietnam, India, Indonesia, Iran, Philippines, United States of America, Bangladesh, Sri Lanka, Myanmar and Egypt are currently engaged in developing hybrid rice production to suit their local condition (Dorosti, 2014). In Sri Lanka, initiated research for hybrid rice production at the Central Rice Breeding Station, Batalagoda and at the Agriculture Research Station, Bombuwela in 1983 (Pathinayake,1985). However, limited availability of better hybrid varieties was one of the major constrains. Therefore, development of own hybrids and testing of exotic hybrid combinations to identify their adaptability for local condition is one of options to enhance the hybrid rice production in the Island. Therefore, objective of this experiment was to study the performance and adaptability of exotic hybrid combinations for local conditions.

Materials and Methods

The field experiment was conducted at Rice Research and Development Institute(RRDI), Bathalagoda, Ibbagamuwa comes under Low Country Intermediate zone (IL_{1a}). The study was carried out in 2016 *Yala* and 2016/2017 *Maha* seasons. Experimental design was Randomized complete block design (RCBD) with three replicates. Eleven treatments were included for this experiment such as six exotic rice hybrids (CH3, CH4, CH5, CH6, CH7 andCH8), two locally developed rice hybrid varieties (HR-10 and Bg407H), come under 3½ and 4-month age, respectively. Bg304, Bg357, Bg403 were included as inbred varieties (standard checks) to represent the 3, 3½ and 4-month age groups respectively. Grain yield (GY) and yield components such as thousand grain weight(TGW), filled grain percentage (FG%), productive tillers per hill (PT/H), panicle length (PL), spikelet per panicle(SPP) and growth parameters such as unproductive tillers (UPT), plant height (PH), flag leaf length (FLL) and flag leaf width (FLW) were measured. Eighteen days old seedlings were transplanted in the plot (plot size 3 x 6m) one plant per hill basis and spacing within two plants was 20 x 20 cm. All the other agronomic practices were carried out according to the Department of Agriculture (DOA) recommendations. Data recording was initiated in fifty percent flowering stage

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and important yield related and growth parameters were recorded. Mean separation was done by Duncan Multiple Range Test (DMT) by using SAS statistical software package 9.1. Standard hetorosis of all hybrids was calculated compared with standard check varieties which come under the same age group.

Results and Discussion

Yield and yield components presented (table 1). All the exotic hybrids matured at 3½ (105 Days) month and their flowering synchronized with Bg357 inbred and HR-10 hybrid variety. Not all six exotic hybrid varieties have showed significant yield advantage compared to local hybrid or inbred varieties. They showed poor yield in *Yala* season. However, in *Maha* season showed some yield improvement but it not enough to exploit the grain yield of same age local inbred or hybrid varieties such as Bg357 and HR-10.

CH6 showed significantly higher TGW in both *Yala* and *Maha* seasons (33.5g and 31g) compared to all local varieties but it did not significantly contribute to enhance the yield of such variety.

There was not significant different for the PL of exotic hybrid and local hybrid in same age(HR-10) in *Yala* season but CH6 showed significantly high PL (24.57cm) compare to the HR-10 in *Maha* season.

All exotic hybrids were not significant in FGP compared to local check varieties in *Yala* season. In *Maha* season showed the same results but CH4 showed high FGP (93.15%) and it significantly higher than all local varieties.

Table1. Means age and age differences of tested hybrid combinations in local condition

Varieties	Age (days) in China	Age (days)in local condition	Age(months) in local condition	Age difference in local condition (days)
CH3	145	97	3	-48
CH 4	148	105	3 and ½	-43
CH 5	142	97	3	-45
CH 6	140	102	3 and ½	-38
CH 7	149	105	3 and ½	-44
CH 8	150	105	3 and ½	-45

All exotic hybrids showed less maturity days under local condition than their native environment in China. It is more than 35 days and it becomes the major reason to obtain low yield under local condition as reduced crop duration limiting the per day yield maximizations.

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Table 2. Means comparison of yield and yield components of tested rice varieties

Parameter	GY(t/h)		TGW(g)		PL(cm)		FGP	
Variety	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha
CH3	2.25d	4.88b	29.83b	30.23abc	25.37abc	24.93b	87.09a	84.14cdc
CH4	2.24d	4.86b	30.6ab	28.47cd	23.37bc	21.15f	79.95ab	93.15a
CH5	2.4cd	4.33b	32.37ab	30.8ab	24.12abc	23.4cd	81.59ab	87.68abcde
CH6	2.25d	4.28b	33.5a	31a	23.73abc	24.57a	86.20ab	89.56abc
CH7	2.57cd	4.82b	29.57b	30.63ab	24.73abc	25.09b	81.16ab	89.34abcd
CH8	2.91c	4.82b	29.67b	29.8abc	23.07bc	21.5ef	83.89ab	90.94ab
HR-10	4.48a	4.27b	25.27c	26.87d	26.43ab	22.87d	83.32ab	83.56ed
Bg 407 H	3.93ab	5.67a	30.13b	28.93bc	23.37bc	27.53a	78.19ab	73.47f
Bg 357	2.55cd	4.57b	20.43d	21.9e	23.07bc	20.87f	79.15ab	85.78bcde
Bg 304	3.65b	3.17c	19.83d	23.37e	27a	22.53de	87.03ab	82.33e
Bg 403	4.02ab	5.65a	24.17c	26.43d	22.83c	26.57a	75.33b	85.51bcde
CV	11.16	8.25	6.46	4.32	8.67	3.16	4.12	2.03

***GY**-Total Grain Yield, **TGW**-Thousand Grain weight, **PL**-Panicle length, **FGP**-Filled grain percentage*

$\mathbf{SH} = \frac{(\mathbf{F1-SC})}{(\mathbf{SC})} \times (\mathbf{100})$*Note: Within a column, means followed by same letters are not significantly different at 5% probability level*

***SH**= Standard Heterosis, **F1** = Value of tested traits of hybrid, **SC** = Value of stranded check*

Standard heterosis was calculated for all local and exotic hybrid varieties which come under different age groups (Table 3.).

Standard heterosis was calculated for GY, TGW, FGP and PT. Result showed the local rice hybrid HR 10 had the highest Standard heterosis for GY in both *Yala* and *Maha* season. It is the most stable variety over the season for Standard heterosis for GY. The Exotic rice hybrid CH5 recorded higher Standard hetorosis during *Yala* season over local rice hybrids. However, during *Maha* season standard heterosis was not significant over local rice hybrids. Best FGP was recorded for the rice hybrid CH7 in *Yala* season and rice hybrid CH5 for *Maha* season. Although Bg 407H showed comparatively stable standard heterosis over seasons. All the rice hybrids showed a negative hetorosis over the PT/H in *Yala* season, however, significant higher standard heterosis in CH3 for PT/H in *Maha* season.

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Table 3. Standard heterosis of yield related parameters

Standard heterosis	GY		TGW		FG		PT/H	
Variety	Yala	Maha	Yala	Maha	Yala	Maha	Yala	Maha
CH3	-39.08e	7.62b	53.47abc	-285.6ab	5a	-6.6ab	-43.71b	1211.8a
CH4	-11.u19cd	6.93b	49.94abc	242.3ab	-191.23a	-110ab	-31.49b	-813.9b
CH5	-34.07de	-4.14b	66.96a	-471.4b	-25.9a	27.8a	-39.78b	-254.6b
CH6	-11.22cd	-6.25b	64.43ab	474.5a	-3.69a	-122.4ab	-28.01b	-158.8ab
CH7	-0.86bc	5.86b	44.85abc	-328ab	11.09a	-70.5ab	-17.89ab	-206.1b
CH8	14.44ab	5.28b	45.29abc	-74.4ab	3.8a	-195.5b	-18.74a	-55.7ab
HR-10	22.66a	33.81a	31.05bc	-84ab	-7.94a	-55.1ab	-34.1b	-44.9ab
Bg 407 H	-1.9bc	0.75b	24.71c	-154.6ab	8.8a	8ab	-39.45b	-53.2ab

***GY**-Grain yield, **TGW**-Thousand grain weight, **FGP**-Filled grain percentage, **PT/H**-Productive tillersper hill*

Note: Within a column, means followed by same letters are not significantly different at 5% probability level

Conclusion

The result concluded that exotic rice hybrid varieties from China did not perform better in the low country intermediate condition in Sri Lanka compared to the local rice hybrid varieties.

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