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Short Communication

MOPHOMETRIC EVALUATION OF EXOTIC AND LOCAL RICE HYBRID

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INTRODUCTION

Rice (*Oryza sativa* L.) is one of the world's most important crops and is the staple food for near half the global population (FAO, 2004). Enhancement of rice production is important requirement to meet increasing demand for rice in future. Development of high yielding varieties with having multiple resistant to biotic and abiotic stress are important to cater the present and future changing environment. Hybrid rice technology is one of the options to enhance the productivity of rice. Hybrid rice technology assures the rice farmers with increased yield over improved conventional varieties by 15 to 20 % (Tran, 2002). In Sri Lanka, the research and development(R&D) programme on hybrid rice began in late 1994 at the Rice Research & Development Institute and have been able to identify several hybrids 1.0-1.5 t/h yield advantage over the best inbred grown under similar environments (Iqbal, 2009). However, limited genetic resources of parental lines (the Male sterile lines (CMS), Maintainers (B) and Restorers (R)) of hybrid rice programme was one of constrains at present and it directly affect the development of high heterotic hybrid combinations. Therefore, expansion of genetic diversity is important to develop better hybrid in future. In addition, testing of exotic hybrid combinations to identify their adaptability for local condition is one of options to expand the genetic materials of hybrid. Therefore, objective of this experiment was to study the performance and adaptability of exotic hybrid combinations for local conditions and compare their performance with locally developed hybrid combinations.

MATERIALS AND METHODS

The experiment was conducted to test four hybrid combinations for their yield performance and yield related components in *Maha* 2015/2016 at Rice Research & Development Institute (RRDI), Batalagoda. Two exotic hybrid combination (CH-1 and CH-2) from China were included along with 2 locally developed hybrid combinations (BgCMS4A/R147 and Bg407H). One high yielding restorer line (R16) and three inbred varieties under 3, 3anda ½ and 4 months (Bg304, Bg357and Bg403) age group were included respectively as the stranded check. Experiment was established in a well prepared paddy field following randomized complete block design with four replicates. Eighteen days old seedlings were transplanted at 20 × 20 cm spacing. Seedling were placed one plant per one hill basis. Plot sizes were maintained 3× 6 m. Other agronomical practices were applied according to the Department of Agriculture (DOA) recommendations. Rainfall and average temperature of experimental field was recorded within the period of experiment was conducted.

RESULTS AND DISCUSSION

In this experiment, nine parameters were measured and presented Table 1 (yield,1000 grain weight (1000GW),fill grain (FG), unfiled grain(UFG), plant height (PH), productive tillers (PT), unproductive tillers (UPT), panicle length (PL), flag leaf length (FLL), flag leaf with (FLW) and days to 50 % flowering). Exotic two hybrid lines compared with 3 and a 3½ months variety (Bg357). According to the yield data Bg407H obtained comparatively higher yield (4.09 t/h) but it was not significantly higher than its stranded check variety Bg 403. The highest 1000 GW (33.07 g) was shown by the CH-1 and it was significantly higher than all local inbred verities and local hybrid variety Bg407H. However, 1000 GW of CH-1 was similar to that of BgCMS4A/R147. Significantly higher FG obtained by R16 (247.8). But there was no significant difference of FG among CH-1, CH-2, BgCMS4A/R147 compared with their standard check variety Bg357. In addition, Bg407H, Bg304 and Bg 403 did not show significant FG number irrespective of their age. The lowest UFG was obtained (16.8) by Bg 403 and the highest by Bg407H. CH-1, CH-2, Bg CMS4A/R147 had shown significantly higher PH than their check variety Bg357. Meanwhile, the highest PH (111.7 cm) was shown by R16. CH-1 and CH-2 obtained significantly higher (3.95 and 2.44) UPT than the inbred variety, irrespective of their age. CH-1 and CH-2 obtained significantly high PL (24.8 cm and 25.15 cm) compared to stranded check Bg357 (22.1 cm). Meanwhile Bg 407H showed the highest PL (27.95 cm) but was not significantly higher than its stranded check variety Bg403 (26 cm). There was no significant difference of FLW of all the entries except Bg357, which showed the lowest FLL. There was no significant difference in FLL among all the tested entries. This experiment indicated that, tested exotic hybrid combinations (CH-1 and CH-2) did not obtain significantly higher performance on grain yield, FG, UFG, and FLW than the local hybrid and stranded check variety in same age group under local conditions in *Maha* 2015/2016. Meanwhile, these two hybrids showed significant higher performance of some traits (1000 GW, PH, PT, UPT, PL, and FLL) than stranded check Bg357. But out of these higher performing traits, yield component traits such as 1000 GW, FG, PT and PL, did not show much contribution to obtain higher yield than the stranded check (Bg357) and local hybrid combination (BgCMS4A/R147) in same age group in tested season (Table 1).

$$SH = \frac{(F1-SC)}{SC} \times 100$$

Where SH=Stranded Heterosis, F1 = Value of tested traits of hybrid, SC = Value of stranded check.

Stranded heterosis was estimated comparing CH-1, CH-2 and BgCMS4A/R147 with Bg 357(31/2 months) and Bg407H was compared with Bg403 (4 months). According to the estimated heteritic levels of all traits, CH-1 and CH-2 obtained 14.67 %, 3.66 % heterosis levels for yield respectively, not significantly higher than the heterosis level of local hybrid combination Bg CMS4A/R147 (15.8 %). Heterosis value of other yield components not positively affected to obtain the high heterosis such as filled grain, productive tillers and panicle length. Therefore, it indicated that tested exotic hybrid combinations did not perform well under local conditions in *Maha* 2015/2016 season. But comparison data of CH-1 and CH-2 in their native environment in China, showed highest yield 10.5 t/h and 9.95 t/h, respectively. Those yields are significantly different from that obtained in Sri Lanka (3.54 t/h, 3.27 t/h, respectively). In addition, those two hybrids took significantly longer duration for maturity; 142 days and 155 days, respectively. However, crop duration reduced under Sri Lankan condition (Table 3). Moreover, plant height and days to maturity also reduced in Sri Lankan condition. It indicated that, tested two hybrids showed poor performance out of their native environment and environmental effects highly affect to their performances. However, CH-1 and Bg CMS4A/R147 showed some potential level of heterosis 14.67 %, 15.83 %, respectively than CH-2 and Bg407H. Hence, this experiment should be repeated in next *Yala* (2016) to further study of these tested lines.

CONCLUSION

This experiment showed that tested two exotic hybrid combinations (CH-1, CH-2) and local hybrid combinations (BgCMS4A/R147 and Bg407H) did not obtain the significant higher yield than their stranded check varieties (Bg357 and Bg403), respectively. These two exotic hybrid showed poor performance out of their native environment and did not obtain satisfactory level of heterosis (>15-20 %) in *Maha* 2015/2016 to select them for hybrid production in local conditions. But this experiment should be done to next *Yala* (2016) to further study and conformation of performance of these hybrid.

Table 1: Means comparisons of tested traits of treatments:

Treatment	Y(t/h)	1000 GW(g)	FG	UFG	PH(cm)	PT	UPT	PL(cm)	FLL(cm)	FLW(cm)	50% F
CH-1	3.5abc	29.3ab	126.4d	27.5abc	96.2d	5.9d	4a	24.8bc	29.3a	1.7ab	74f
CH-2	3.3bc	33.1a	176.7b	17.3bc	108.4ab	5.9d	2.4ab	25.2bc	32a	1.6abc	76.8de
BgCMS4A/R147	3.6abc	29.8ab	145.7cd	28.3ab	98.9cd	8.5b	1.9bc	24.1bcd	29.4a	1.4bc	77.8d
Bg407H	4.1a	28.2b	166bc	32.8a	103.6bc	9ab	1.8bc	28a	30.3a	1.5abc	90.0a
R16	3.9ab	23.1c	247.8a	25.1abc	111.7a	6.9cd	0.6c	25.4bc	30.1a	1.8a	80.0c
Bg357	3.2c	22.3c	156.7bcd	18.1bc	82.2e	8.0bc	0.4c	22.1d	24.8b	1.5abc	77.5d
Bg304	2.9c	22.9c	170.3bc	27.1abc	98.3cd	7.6bc	0.6c	23.4cd	30.7a	1.3c	76.0e
Bg403	4.1a	25.6bc	164.5bc	16.8c	99.2cd	10.3a	1.2bc	26.0ab	29.4a	1.5abc	85.0b
CV%	13.907	10.635	12.448	31.153	3.954	12.626	70.559	6.310	9.532	13.566	1.210
LSD	0.730	4.189	30.980	11.030	5.802	1.439	1.655	2.307	4.132	0.308	1.417

Y- Yield(t/ha), 1000GW- 1000 Grain weight, FG- Filled grain number, UFG- Unfilled grain, PH- Plant height, PT-Productive tillers, UPT- Unproductive tillers, PL-Panicle length, FLL-Flag leaf length, FLW-Fag leaf width, 50%F-days to50% flowering

Table 2: Standard Heterosis (%)of tested hybrid combinations in *Maha* 2015/2016.

Combinations	Y	FG	UFG	PH	PT	UPT	PL	FLL	FLW
CH-I	14.67a	-16.30b	-16.3b	16.98b	-25.18b	1362.5a	12.15a	18.99ab	13.38a
CH-2	3.66a	15.85a	15.84a	32.30a	-25.55b	659.4a	14.55a	30.55a	4.81a
BgCMS4A/R147	15.83a	-5.82ab	-5.82ab	20.64b	7.36a	479.2a	9.37a	19.39ab	-5.15a
Bg407H	1.49a	0.56ab	0.56ab	4.49c	-12.36ab	80.5a	7.57a	3.59b	3.20a
LSD	29.65	25.17	25.17	9.76	22.05	1300.7	13.63	25.87	19.60

Y- Yield, FG-Filled grain, UFG- Unfilled grain, PH- Plant height, PT-Productive tillers,.UPT- Unproductive tillers, PL-Panicle length, FLL-Flag leaf length, FLW-Fag leaf width.

Table 3: Comparison of some plant characters of CH-1 and CH-2 in China & Sri Lanka.

Plant characters	In China CH 1	In Sri Lanka CH 1	In China CH 2	In Sri Lanka CH 2
Age	142	104*	155	107*
Y(t/h)	10.5	3.54*	9.95	3.27*
DM	30-35	30*	38-42	30*
SH (cm)	124	96.15*	120	108.35*
TT	12	9.8ns	12 to 13	8.3*
FLL (cm)	27	29.3ns	26	31.98*
FLW (cm)	1.5	1.67ns	1.5	1.57ns
PL(cm)	27	24.8ns	26.3	25.15ns
1000GW(g)	32	29.3*	30.2	33.07ns

DM-Date to maturity, Y-Yield, SH-Stem height, TT-Total tillers, FLL-Flag leaf length, FLW- Flag leaf width, PL-Panicle length, 1000 grain weight; *- significant in 5% probability level; ns- not significant difference.

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