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IMPACT OF VARIETIES, SPACING AND SEEDLING MANAGEMENT ON GROWTH AND YIELD OF MECHANICALY TRANSPLANTED RICE

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ABSTRACT

Mechanical transplanting (MT) of rice is considered as a feasible option to minimize huge labour use with timeliness cultivation in rice. Adoption to MT is still low due to socio-economic reasons and lack of technical information available. Three experiments were conducted to identify suitable (i). Rice varieties for MT compared with conventional transplanting (CT), (ii). Within row space (WRS) and per hill number of seedlings (PHSN) and (iii). Planting depths (PD) and seedling ages (SA) during *Yala* 2016 and *Maha* 2016/17. Eleven varieties (Bg 357, Bg 352, Bg 366, At 362, Bw 367, Bg 300 , Bg 403, Bg 379-2, Bg 406, Bg 450 Bg 454), 5 wrss (12 cm, 14 cm, 16 cm, 18 cm, 21 cm), 3 phsns (4, 6, 8), 5 pds (1.5 cm , 2 cm, 2.3 cm, 2.7 cm, 3 cm, 3.7 cm) and 3 sas (9, 12, 15 days) were tested. MT produced a comparatively lower ground cover %, but had higher tiller and panicle densities with 9-22 % yield advance compared to CT. Heading and maturity was delayed by 3-5 days in MT compared to the CT. All varieties except Bg 352 showed higher adaptability to MT. Use of higher WRS (18 cm or 21 cm) or lower number of PHSN (4) did not affect the yield. This study also proves the feasibility of using a wider range of pds (1.5-3.7 cm) in MT. The optimum SA was identified as 12 days, but seedlings from 9 to 15 days can be also used without any yield decline.

Keywords: Management options, Mechanical transplanting, Rice

INTRODUCTION

There is a need to explore establishment methods (EM) that require less labour but still allow the crop to be transplanted on time since labour scarcity has emerged as a serious problem in rice cultivation in Sri Lanka. Direct seeding (DS) is practiced as a solution but, apart from irregular stand establishment, the most disastrous constraint in DS is the invasion of weeds and weedy rice (Marambe 2009; Gunawardana *et al*., 2013). Use of herbicide in controlling weeds in DS is effective but excessive use is costly and causes problems such as ground water contamination, development of herbicide-resistant weed populations. Optimizing plant density and timeliness of operation is considered essential for optimizing yield in rice cultivation (Chaudhary *et al*., 2005). Hence, mechanical transplanting (MT) is one of the feasible alternatives in eliminating weed problem in DS and huge labour use in transplanting while facilitating the timeliness crop establishment.

MT of rice is the process of transplanting young seedlings, which have been grown in a mat nursery using a rice transplanter (Joseph *et al.,* 2015). In conventional manual transplanting (CT), 20-30 people are required to transplant 1 ha/day, but 3 people can transplant approximately 2 ha/day using the rice transplanter. The other advantages of MT include uniform spacing, optimum plant density, less transplanting shock and better employment opportunities for rural youth through the development of custom service business. It is also capable of adjusting desired within row space (WRS), per hill seedling number (PHSN) and planting depth (PD0 according to the seedling age (SA), soil type and the level of puddling done in the field.

Presently, MT is promoted in *Yaya* 2 program which is implemented by the Department of Agriculture (DOA), Sri Lanka. Further, the Food Production National Programme implemented by the Ministry of Agriculture is aiming to enhance the productivity of rice up to 5 t/ha in year 2018 where MT is identified as one of the main area to be exploited. Despite with many advantages, farmers are still reluctant to adopt MT because of some socio-economic reasons and lack of technical specifications available related to agronomic management options of the transplanter. Problems in nursery preparation, selecting suitable varieties and appropriate planting spaces have been reported and a trend in giving up the use of mechanical transplanter in rice cultivation has been observed. Studies on efficient use of mechanical transplanter to optimize the growth and yield of rice have not yet been properly investigated in Sri Lanka. This study was therefore planned to identify suitable varieties, WRS and seedling management options in MT to have an optimum growth and yield of rice.

MATERIALS AND METHODS

These experiments were conducted at the Rice Research and Development Institute, Batalagoda situated in LCIZ (IL3) during 2016 *Yala* and 2016/17 *Maha* seasons. Three experiments were designed (i) to identify varieties suitable for MT compared with CT, (ii) to find out optimum WRS and PHSN and (iii) to identify optimum PD and SA to obtain a vigorous growth and maximum yield in mechanically transplanted rice using Kubota walk-behind type (Model NSP-4W) rice transplanter. The machine has the adjustment for changing WRS, PHSN and the PD. However, row width (between rows) of the transplanter is fixed as 30 cm since it was originated in Japan and was worked out for Japonica varieties having around 90 days of vegetative period during the growing season.

Experiment i: Identification of varieties suitable for MT compared with CT

Two separate trials for 3-3½ and 4-4½ months age varieties were established. Varieties selected under 3-3½ month age group were Bg 357, Bg 352, Bg 366, At 362, Bw 367 and Bg 300 while Bg 403, Bg 379-2, Bg 406, Bg 450 and Bg 454 were selected under 4-4½ months age group. They were selected based on their high tillering ability, yield potentials and popularity. Since transplanting is considered as more suitable for varieties having long vegetative period and high tillering ability, CT was used to compare the performance of MT, even though it is practiced <10% in Sri Lanka. The experiments were laid down in split plot designs with 3 replicates. Main plots were assigned to establishment methods (MT and CT) and the sub plots were assigned to varieties (sub plot size 7 m x 2.1 m). For MT, 12 day old seedlings raised in mat type nurseries (dapog) were used (seeding density used in nursery was 1kg/m^2). WRS of 30 x 14 cm (24 hills/m^2) and 30 x 16 cm (21 hills/m^2) were used for 3-3½ months and 4-4½ month's trails, respectively. For CT, same age seedlings (12 day old) raised in wet-bed nurseries (0.1 kg/m^2 of seeding density in nursery) was used. The planting density of 30-35 seedlings/m^2 was maintained with 3-4 PHSN for both trials. However, dapog seedlings (12 day old) were used for CT in 4-4½ months varieties during *Yala* 2016, where, planting density and PHSN were not changed.

Experiment ii: Identification of WRS and PHSN for MT

Two trials were established for Bg 357 (3½ months) and Bg 403 (4-4½ months) in a split plot design with 3 replicates where main plots and sub plots were assigned to WRS and PHSN, respectively (sub plot size 4m x 3.3m). Twelve days old seedlings raised in dapog nurseries were mechanically transplanted and WRS and PHSN used in the experiment were presented in Table 1. A higher PHSN were used in MT than that of the recommendation for CT (2-3 seedlings /hill) since the row width of MT was 30 cm which was also higher than the recommended width in CT (20 cm or 15 cm).

Experiment iii. Identification of suitable PD and SA for MT

During 2016 *Yala*, an experiment was conducted to identify a suitable PD for MT to optimize the growth and yield. The experiment was laid down as a RCBD with 3 replicates (plot size 6 m x 2.1 m). The 12 day old dapog seedlings of Bg 357 were transplanted with 5 different PDs *viz*. approximately 1.5 cm, 2 cm, 2.3 cm, 2.7 cm and 3 cm keeping 3-4 PHSN with a spacing of 30 x 16 cm using the adjustment available by the machine. During 2016/17 *Maha*, 3 PDs (3.7 cm, 2.3 cm and 1.5 cm) were tested with 3 different SAs (9, 12 and 15 days) in a split-plot design with 3 replicates where main plots and sub plots (6 m x 2.1 m) were assigned to PD and SA, respectively.

Table 1. WRS and PHSN used in Bg 357 and Bg 403.

Variety	WRS (cm)	Hills/m^2	PHSN
	30 x12	28	
Bg 357	30 x14	24	4, 6, 8
	30 x18	19	
	30 x14	24	
Bg 403	30 x16	21	4, 6, 8
	30 x21	16	

For all experiments, the experimental fields were ploughed twice and puddling and levelling were done 2 days before transplanting. Fertilizer application was done according to the recommendation for irrigated rice in

Dry/Intermediate zone (DOA, 2013). Pretilachlor (300 g/l EC) was applied for weed control at a rate of 1.6 l/ha on the 3rd day after establishment. The plots were maintained under irrigated condition and all other management practices were done as recommended by the DOA. In all trials, ground cover % of each plot at weekly interval during the vegetative phase was recorded using beaded sting method (Sarrantonio, 1991). A 0.5 x 0.5 m quadrant was placed randomly for each sub plot and 2 counts/plot for tillers and panicles were taken. Duration for 50 % heading, physiological maturity and plot yield were also recorded.

Data analysis

Data were statistically analyzed using SAS statistical software (9.1). Variation in tiller and panicle densities were analyzed using the categorical data analysis. ANOVA was performed to analyze the durations for 50 % heading, maturity and yield data and mean separations were made using LSD while interpretations were made at 95 % probability.

RESULTS AND DISCUSSION

Experiment i

A. Variation of ground cover % of varieties in MT and CT

Ground cover % measured in weekly interval during the vegetative phase of 3-3½ and 4-4½ month's varieties under MT and CT is illustrated in Figure 1. Ground cover increased above 50 % at the 4th week after planting (WAP) in both establishment methods, but was always higher in CT compared to MT (Figures 1A, 1B, 1C and 1D). It reached above 80 % at the end of vegetative stage in CT. It was also observed that a higher ground cover % was achieved by 4-4½ months age varieties compared with 3-3½ months age varieties since the former have longer vegetative periods. Thus, MT may be more adaptable for rice varieties having longer vegetative period. However, the exposure of comparatively higher proportion of ground space at early stages of establishment in MT emphasizes the need of proper weed management strategies such as impounding of standing water at earliest after planting, use of hand/ power weeder or herbicides to manage the weeds.

Increasing the plant population per unit area by reducing between row spaces is also suggested for the MT in order to maximize the utilization of available sunlight.

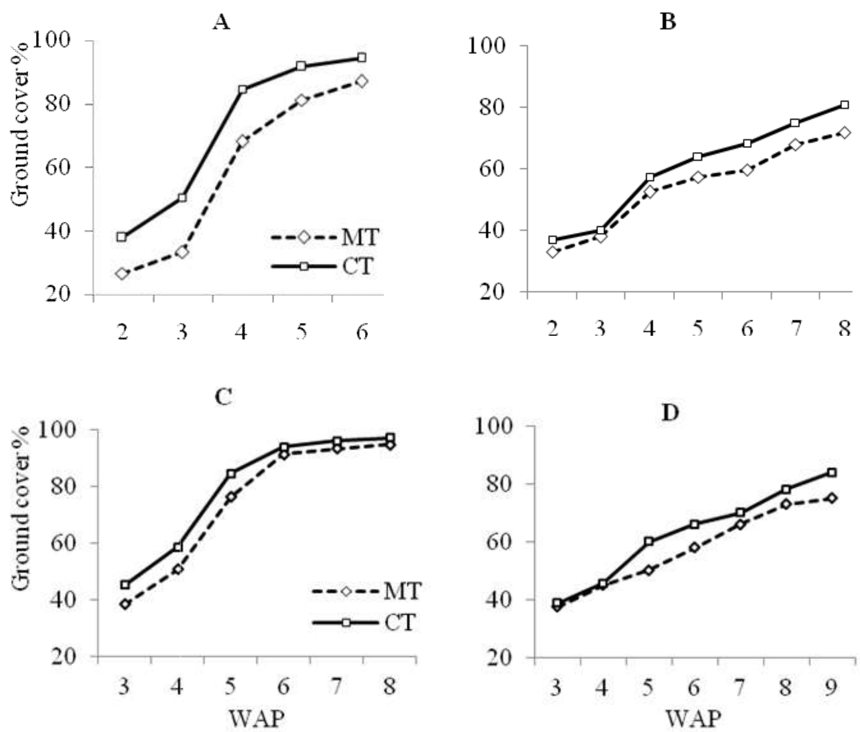

Figure 1. Pattern of increasing ground cover % during the vegetative stage of rice in MT and CT. A. 3-3½ months – 2016 *Yala*, B. 3-3½ months – 2016/17 *Maha*, C. 4-4½ months – 2016 *Yala*, D. 4-4½ months– 2016/17 *Maha*.

B. Tiller and panicle densities between ems and among varieties

Tiller density (expressed as number/m^2) under MT was significantly higher than in CT for both age groups and for the 2 seasons (Table 2). An average of 369 and 423 tillers/m^2 were recorded in MT compared with 323 and 353tillers/m^2 produced in CT for 3-3½ and 4-4½ months age varieties, respectively. An average panicle density (number/m^2) of 278 and 296 were produced in MT compared with 233 and 256 in CT for 3½ and 4-4½ months age varieties, respectively. Irrespective with the lesser number of hills/m^2 established in MT than that of in CT, high densities of tillers and panicles of

MT were attributed by the production of higher number of tillers and panicles/hill compared to CT. MT produced an average of 18 tillers/hill compared to 13 tillers/hill in CT, while an average of 13 panicles/hill were produced in MT compared to 8 panicles /hill in CT. The production of higher tiller and panicle/hill in MT may be due to the maintenance of uniform planting density during the establishment compared with irregular random planting in CT.

Table 2. Tiller and panicle densities under MT and CT and probability vales for the EM in 2016 *Yala* and 2016/17 *Maha*.

Factor	Tiller density (number/m^2)		Panicle density (number/m^2)	
	2016 *Yala*	**2016/17 *Maha***	**2016 *Yala***	**2016/17 *Maha***
3-3½ months varieties				
MT	440	297	290	265
CT	387	258	248	218
Pr>Chi-square for EM	0.0001	0.0003	0.0084	0.0087
4-4½ months varieties				
MT	488	358	302	290
CT	423	283	280	232
Pr>Chi-square for EM	0.0001	0.0060	0.0014	0.0045

Note: Pr=probability

The tiller and panicle densities were highly varied among varieties but the interaction effect between EM and variety (EM) was non- significant except for 3-3½ month varieties in 2016 *Yala* (Table 3). Even though, the tiller production under CT was low, Bg 367 and Bg 357 produced higher tiller numbers in CT during the season indicating their suitability for both EMs. Figure 2 (A and B) illustrates tiller and panicle densities (averages of the 2 seasons) recorded in different rice varieties in MT. Accordingly, all varieties produced > 300 tillers/m^2 while Bw 367, Bg 357 and all 4-4½ month age varieties (except Bg 454) produced above 400 tillers/m^2. Shaobing *et al*. (2008) suggested that 270-30/m^2 of heavy droopy panicle (>5 g) is needed to obtain a higher productivity in rice while Bw 367, Bg 357, Bg 379-2, Bg 405 and Bg 450 recorded higher panicle numbers (>300/m^2) indicating their potential for using in MT to obtain a higher yield. In contrary, the inability of other varieties to achieve panicle density >300/m^2 may be due to higher and fixed between row space that would be one of the drawback for optimizing the yield in MT.

Table 3. Probability values for variety and interaction for EM*Variety (EM) for tiller and panicle numbers in 2016 *Yala* and 2016/17 *Maha*.

Factor	Pr>Chi-square			
	Tiller number/m^2		Panicle number/m^2	
	2016 *Yala*	2016/17 *Maha*	2016 *Yala*	2016/17 *Maha*
3-3½ months varieties				
Variety (EM)	*(0.0119)	*(0.0001)	*(0.0001)	*(0.0060)
EM*Variety (EM)	*(0.0023)	ns	ns	ns
3-3½ months varieties				
Variety (EM)	*(0.0001)	*(0.0001)	*(0.0001)	*(0.0031)
EM*Variety (EM)	ns	ns	ns	ns

Note: * significant at given p level, ns= non significant at p=0.05.

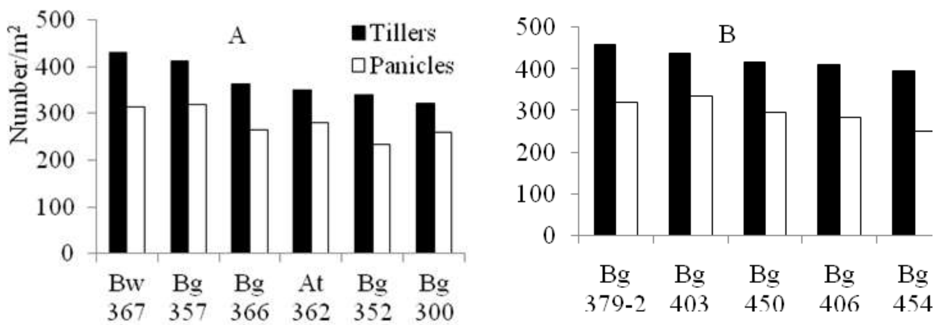

Figure 2. Tiller and panicle densities among varieties under MT.
Note: Values represents the average of 2016 *Yala* and 2016/17 *Maha*. A. 3-3½ months and, B. 4-4½ months age varieties

c. Duration for heading and maturity in MT and CT

EM had a significant effect on duration for heading and maturity (*p=0.0001*) where the durations extended approximately 3-5 days in MT compared to CT in both age groups when dapog seedlings were used in MT and seedlings raised in wet bed nursery were used for CT (Table 4). However, when dapog seedlings were used in both MT and CT (as 4-4½ month age varieties during 2016 *Yala*), no difference on heading or maturity durations was observed between the EMs. The height of 12 days old dapog seedlings were 9-11 cm with 2 leaves while the height of the seedlings raised in wet bed nurseries were 14-16 cm with 3 fully expanded leaves. This suggested that the delay in heading and maturity durations in MT is due to slow growth of dapog seedlings which is attributed by high seeding density used for mat nursery. Therefore, the present seeding density used (1 kg/m^2) is suggested to reduce to obtain a vigorous seedling growth during the nursery period. Significant differences (*p=0.0001*) among rice varieties were recorded for durations for heading and maturity, but the interaction EM*variety (EM) was not significant (*p=0.05*) for none of the age group.

Table 4. Durations for 50 % heading and maturity in MT and RT.

	3-3½ months		4-4½ months	
	2016 *Yala*	**2016/17 *Maha***	**2016 *Yala***	**2016/17 *Maha***
Duration for 50 % heading				
MT	83.0±1.3 a	83.4±1.2 a	95.8±0.0 a	96.1±1.8
CT	78.2±1.4 b	80.1±1.8 b	95.8±0.0 a	90.8±1.5 b
CV %	0.73	0.56	0	0.83
LSD	0.41	0.26	0	0.56
Duration for maturity				
MT	114.8±2.4 a	116±2.6 a	129.8±0.0 a	130±1.9 a
CT	110.7±2.2 b	113±2.8 b	129.8±0.0 a	126±1.4 b
CV %	0.33	0.44	0	1.4
LSD	0.29	0.34	0	0.63

d. Variation in yield between MT and CT and among varieties

The yield recorded in MT and CT for different age groups is illustrated in Figure 3 (A, B, C and D). Except in 4-4½ month age varieties grown in 2016 *Yala*, the yield recorded in MT was significantly higher (*p=0.05*) than CT and the increase was 0.4-0.8 t/ha (9-22 %). Higher tiller and panicles densities in MT may be attributed to this high yield. Farooq *et al.* (2001) reported that mechanically transplanted fields yielded 200-240 kg/ha higher as compared with the manually transplanted fields at similar inputs level use. The 4-4½ months varieties produced higher yields in MT than 3-3½ months age varieties revealing a higher adaptability of 4-4½ months varieties to MT.

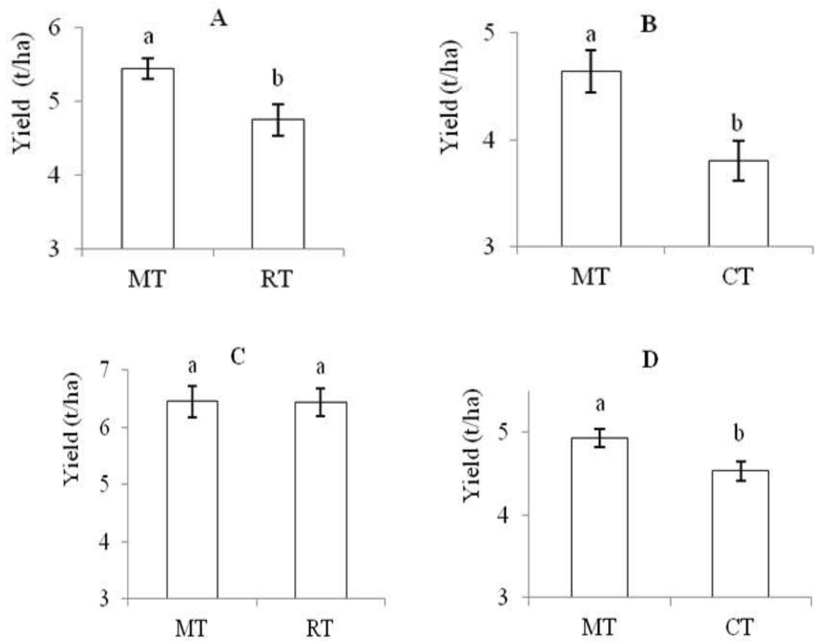

Figure 3. Variation in mean yield (t/ha)

Note: MT and CT; A. 3-3½ months – 2016 *Yala*, B. 3-3½ months – 2016/17 *Maha*, C. 4-4½ months – 2016 *Yala*, D. 4-4½ months –2016/17 *Maha*. Vertical bars indicate ±SE. Columns with same letters are not significantly different at *p=0.05*.

Among the rice varieties tested under 3-3½ months age group, all varieties recorded above 5 t/ha in 2016 *Yala* while Bw 367, Bg 366, Bg 357 Bg 357 and Bg 300 had significantly higher yields (Table 5). Bg 357 followed by At 362 recorded the highest yield (5.6 and 5.3 t/ha, respectively) in 2016/17 *Maha*. In contrast, Bg 352 had significantly lower yields in both seasons revealing its poor adaptability to MT. Among the rice varieties evaluated under 4-4½ months age group, all varieties except Bg 454 recorded higher yields in 2016 *Yala* while there was no differences in yields among varieties in 2016/17 *Maha* (Table 6). Therefore, all rice varieties tested under 4-4½ month age group are considered as suitable for MT.

Experiment ii

a. Ground cover % among different WRS and PHSN

The pattern of increasing ground cover from 2-7 WAP did not differ among different WRS for Bg 357 and Bg 403 in 2016 *Yala* (Figure 4) while the same trend was observed in 2016/17 *Maha*. There was no difference in increasing ground cover among different PHSNs also. These results emphasize the ability of mechanically transplanted rice to increase their leaf biomass during the vegetative period irrespective with WRS or PHSN used during the establishment and therefore use of higher WRS (30 x 18 cm for 3-3½ month age varieties and 30 x 21 cm 4-4½ month age varieties) combined with lower PHSN (4) seems to be possible.

Table 5. Mean yields (t/ha) recorded by 3-3½ month's age rice varieties in MT.

Variety	2016 *Yala*	2016/17 *Maha*
Bg 366	5.8± 0.1a	4.8±0.2 bc
Bg 357	5.7±0.4 a	5.6±0.4 a
Bw 367	5.6± 0.2 a	4.4±0.4 cd
Bg 300	5.5±0.5 a	3.8±0.2 e
At 362	5.1±0.2 b	5.3±0.5 ab
Bg 352	5.0±0.6 b	4.0±0.4 de
CV %	9.6	7.2

Table 6. Mean yields (t/ha) recorded by 4-4½ months age rice varieties in MT.

Variety	2016 *Yala*	2016/17 *Maha*
Bg 379-2	7.2±0.2 a	4.9± 0.2 a
Bg 403	7.0±0.4 a	5.3± 0.5 a
Bg 406	7.0±0.6 a	4.7± 0.1 a
Bg 450	6.0±0.1 ab	4.8± 0.3 a
Bg 454	5.1±0.7 b	5.0±0.1 a
CV %	9.8	9.3

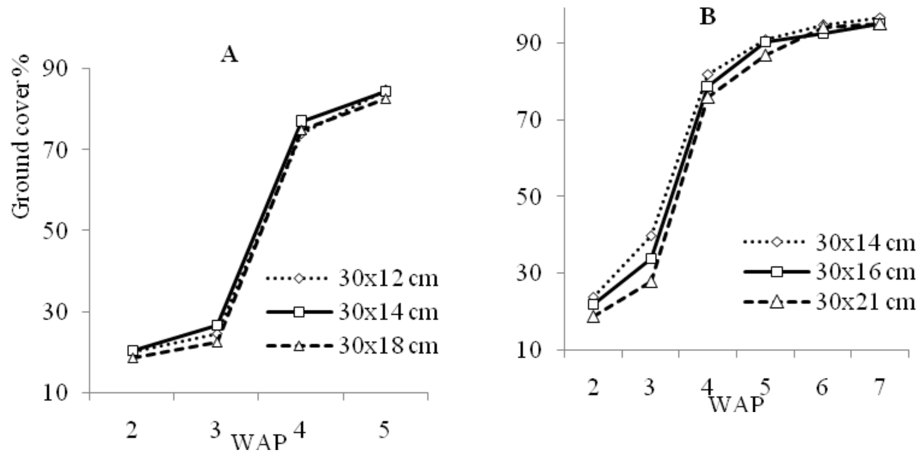

Figure 4. Pattern of increasing ground cover % during the vegetative stage among different WRS in 2016 *Yala*; A. Bg 357, B. Bg 403.

b.Tiller and panicle densities among different WRS and PHSN

Probability values for tiller and panicle densities in WRS, PHSN (WRS) and the interaction recorded for Bg 357 and Bg 403 are presented in Table 7. Accordingly, tiller density of Bg 357 varied significantly among the WRS and among PHSN in both seasons but there was significant interaction effect. None of the factors had significant effect on tiller density of Bg 403 while the panicle densities of both varieties were not affected by WRS or PHSN.

A negative correlation was observed between WRS and the tillers/m^2 in Bg 357 where the number of tillers produced/m^2 was decreased with increasing WRS (Figure 5). Accordingly, above 500 tillers/m^2 were produced by the spacing of 30 cm x 12 or 30 cm x 14 but it was about 475 tillers/m^2 at the spacing of 30 cm x 18 cm in 2016 *Yala*. However, the number of tillers produced/hill increased with increasing WRS where, 26 tillers/hill were recorded in 30 cm x18 cm compared with 19 tillers/hill by the spacing of 30 cm x 12 cm in 2016 *Yala* and the same trend was observed in 2016/17 *Maha*. Since the WRS or PHSN selected in this experiment did not affect the final panicle density, it again confirmed the possibility of using higher WRS with lower PHSN in MT.

Table 4. Probability values for different WRS and PHSN and their interactions for tiller and panicle densities in 2016 *Yala* and 2016/17 *Maha*.

Factor	Pr>Chi-square			
	Bg 357		Bg 403	
	2016 *Yala*	**2016/17 *Maha***	**2016 *Yala***	**2016/17 *Maha***
Tiller density (number/m^2)				
WRS	*(0.0042)	Ns	* (0.0001)	Ns
PHSN(WRS)	*(0.0306)	Ns	*(0.0065)	Ns
WRS*PHSN(WRS)	ns	Ns	ns	Ns
Panicle density (number/m^2)				
WRS	ns	Ns	ns	Ns
PHSN(WRS)	ns	Ns	ns	Ns
WRS*PHSN(WRS)	ns	Ns	ns	Ns

Note:'*'indicates the significant at given p level, ns-non significance at p=0.05

b. Maturity duration and yield

The duration for heading and maturity did not vary with different WRS or PHSN (*p=0.05*) for both varieties. Bg 357 recorded an average of 84±0.2 and 120±0.4 days and Bg 403 recorded 92±0.3 and 127±0.7 days for heading and maturity, respectively. Yield also did not vary among WRS or PHSN for both varieties and the average yield recorded by Bg 357 and Bg 403 is presented in Table 8. These results confirm the possibility of using higher spacing (30 cm x18 cm and 30 cm x21 cm for Bg 357 and Bg 403, respectively) together with lower number of seedlings/hill (4) in MT to have a comparable yield which is an advantage to minimize the seed paddy requirement. Sanjeev *et al.* (2012) reported that 20-25 kg of good quality seed paddy is required in MT to plant 1 ha with 2-3 seedlings/hill at 20x20 cm spacing while Joseph *et al.* (2015) stated that 10-15 kg of seed paddy is needed to plant 1ac with 26-28 hills/m^2 and 2-3 seedlings/hill. However, the seed paddy requirements for Sri Lankan rice varieties to optimize obtain a higher yield in MT yet to be studied.

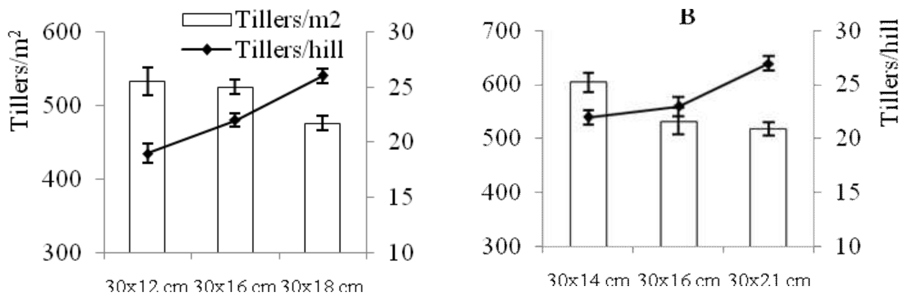

Figure 5. Tillers /m² and tillers/hill among different spacing levels in 2016 *Yala*; A. Bg 357, B. Bg 403.

Table 8. Average yields of 3 WRS of Bg 357 and Bg 403 in 2016 *Yala* and 2016/17 *Maha*.

Variety	2016 *Yala*	2016/17 *Maha*
Bg 357	6.1±0.10	3.4±0.07
Bg 403	6.7±0.08	4.2±0.08

Experiment iii

a. Ground Cover % among different PDs

There was no difference in pattern of increasing ground cover with time among different PDs in the 2 seasons. However, ground cover increase during 2-5 WAP in 9 day old seedlings was comparatively lower, but seedlings of all ages had approximately similar level of ground cover at latter stages (Figure 6). Therefore, a higher weed competition at early stages of establishment may arise if very young seedlings (9 days old) are use in MT.

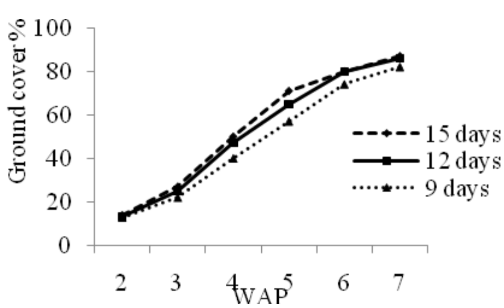

Figure 6. Pattern of increasing ground cover % with time in different SAs in 2016/17 *Maha*.

b.Tiller, panicle densities, durations for maturity and yield

Tiller or panicle densities did not vary among different PDs or SAs and the interaction was also not significant at *p=0.05*. There was no difference (p=0.05) for duration taken to 50 % heading and maturity or grain yield among PDs or SAs. No significant interaction was observed between PD* SD (PD) for these traits in 2016/17 Maha and the pooled values of agronomic traits are given in Table 9. However, it was observed that few numbers of 9 day old seedlings died when water was impounded to the field 6 DAP. Also, practical difficulties were come across during the cutting off the mat nursery and operating the machine due to excessive root growth of 15 day old seedlings. Therefore, 12 days was identified as the optimum age for seedlings, but 9-15 day old seedlings can be used in MT without affect on yield. These results reveal the feasibility of using different planting depths and seedling ages in MT depending on soil type, level of puddling and the time taken to land preparation without any effect to the yield.

Table 9. Pooled values oh tiller and panicle densities, durations for heading and maturity and yield irrespective with planting depth and seedling age.

Agronomic trait	2016 *Yala*	2016/17 *Maha*
Tiller density (number/m^2)	555±20	393±8
Panicle density (number/m^2)	345±7	305±7
Duration for 50 % heading (days)	83±0.5	86±0.5
Duration for maturity (days)	119±0	119±0.3
Yield (t/ha)	5.9±0.1	5.1±0.1

CONCLUSIONS

MT produces a comparatively lower ground cover, but having higher tiller and panicle densities and 9-22 % higher yield than CT. The duration taken to heading and maturity delays 3-5 days in MT compared to CT. Except Bg 352, all varieties tested show better adaptability to MT but Bg 357 and Bg 403 are the most promising ones. Use of higher WRS or lower PHSN does not affect the yield. This study also proves the possibility of using a wider range of PDs (1.5-3.7 cm) and SAs (9-12 days) in MT. Though MT looks a feasible option in rice cultivation, the yield advances and cost effectiveness compared with DS and seedling broadcasting method should be studied to popularize this technique among farming community. In addition, nursery management is the base for higher yield in MT and therefore research to identify proper seeding density and fertilizer management in dapog nursery should be needed.

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