Evaluation of the Crop Establishment methods for Submerge Tolerant Rice Variety: Bg455 under Waterlogged Conditions

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Abstract
A major portion of Sri Lanka low lying lands lies in a belt along the Western coast from Wennappuwa to Dondra. Approximately 28,000ha of low lying lands are situated in the Low Country Wet Zone of Sri Lanka. These lands are often under water logged condition due to their low lying nature. Sowing of seeds, the most popular method of establishment is limited by the water logging nature of these lands. Transplanting though possible, is limited by the scarcity of labor. Objective of this study was to identify an appropriate method of establishment of submergence tolerant Bg 455 rice variety under water logged condition. Treatments were transplanting, seedling broadcasting (parachute method), broadcasting of untreated seeds, broadcasting of pre germinated seeds (48h soaked and 24h incubated), broadcasting of pre germinated seeds (24h soaked and 72h incubated), and the control treatment. The treatments were laid out in randomized complete block design with three replicates. Experiment unit was a 6m x 3m plot. 10cm of water level was maintained for ten days. Number of plants/unit area, days to 50% flowering and plot yield were measured. Number of plants per unit area and the plot yield (t/ha) was significantly different among the treatment. The significantly higher yield (3 t/ha) was recorded in the both transplanting and parachute method. The second best method was the broadcasting of 48h soaked and 24 h incubated seeds. Therefore, broadcasting of 48h soaked and 24 h incubated seeds are recommended as the best method of establishment for Bg 455 under water logged condition.

Keywords: Establishment methods, Pre-germinated seeds, Water logged condition

Introduction

A major portion of Sri Lanka low lying lands lies in a belt along the Western coast from Wennappuwa to Dondra. Approximately 28,000ha of low lying lands are situated in the Low Country Wet Zone of Sri Lanka. This coastal flood plain remains unproductive because of impeded drainage. Submergence reduces the number of rice plants per unit area. To achieve self sufficiency in rice productivity of paddy lands in LCWZ has be enhanced by maintaining the standard number of rice plant per unit area.

The most popular cultivation ways in rice are direct seeding and transplanting methods. (Naresh *et al.*, 2013). Although transplanting is common it is more laborious, cumbersome, time consuming and entails a lot of expenditure. (Awan *et al.*, 2007).In direct seeded rice systems, poor seedling establishment is a major constraint since seed germination is subjected to submergence stress.

Notwithstanding its tolerance for waterlogged and shallow floods during the vegetative stage, rice is extremely sensitive to anaerobic conditions during germination. (Balasubramanian and Hill, 2002). Hence, direct seeding of rice is not appropriate for crop establishment in waterlogged low lying areas in LCWZ of Sri Lanka. Therefore it is needed to identify an appropriate method for crop establishment under waterlogged condition.

Bg 455 which is popular among the farmers of flood prone areas in Sri Lanka is the first rice variety released for the flood prone areas by the Department of Agriculture in 2014. The seedlings of Bg 455 can withstand submerged conditions. The aim of this study was to identify a suitable crop establishment method for Bg 455 under waterlogged conditions.

Materials and Methods

Field experiment was conducted at the rice Research Station, Bentota for five consecutive seasons from 2012/2013. Maha seasons from 2014/15 Maha season. The submergence tolerant rice variety Bg455 was tested in six different establishment methods as follows.

1. Broadcasting of un-treated seeds.
2. Broadcasting pre-germinated seeds which were kept in the water (soaked) for 48 h and incubated for 24 h
3. Seedling broadcasting (parachute method); Parachute trays were maintained to raise the seedling for broadcasting of seedlings. 14 day old seedlings were broadcasted in to the experiment plots.
4. Transplanting: Fourteen-day old seedlings were used for transplanting.

5. Control treatment (Broadcasting pre germinated seeds soaked for 24 h and incubated for 48 h)
6. Broadcasting pre-germinated seeds soaked for 24 h and incubated for 72 h

Seedlings were transplanted with the spacing of 15cm x 20cm and seeds were sown at the rate of 2bu/ac. This experiment was laid out in randomized complete block design with three replicates and each replicate was a 6 m x3 m plot. Control treatment is the currently practiced seed broadcasting method. A 10 cm deep water level was maintained for ten days. Other agronomic practices were done according to the recommendations. After one month, number of plants per unit area (number of plants per square feet), days to 50% flowering and yield (t/ha) were measured.

Results and Discussion

Number of plants per unit area (number of plants per square feet) was significantly different with the treatment. 30 plants per square feet resulted in the highest number of plants in transplanting as well as seedling broadcasting treatments in 12/13 Maha season. In all other seasons as well, the higher number of plants was reported in transplanting and seedling broadcasting treatments. Since rice is a semi-aquatic plant, rice seedlings can be grown with the ill drained conditions. 48 h soaked and 24 h incubated seeds recorded as the second best number of plants per square feet in all the seasons.

2014 Yala and 2014/15 Maha results explain that Bg 455 can be established by sowing the pre-germinated seeds of 48 h soaked and 24 h incubated to get a better number of plants per unit area under water logging condition. The lowest plant count was observed in the broadcasting of untreated seeds treatment. It varied from 1 to 6 plants/feet^2 in the five seasons. It ensured that seed pretreatment is essential for crop establishment. Plot yield (t/ha) was significantly different among the treatment. The significantly higher yield (3 t/ha) was recorded in the both transplanting and parachute method treatments. The lowest yield was observed in the untreated seed treatment in which plant count was also the lowest. The control treatment resulted in significantly lower yield in all the tested seasons and it was 1.48 t/ha in 2014 Yala season. Days to 50% flowering were not significantly different with the six treatments in all the five seasons.

Conclusion

Transplanting and seedling transplanting are the two possible method of establishment of Bg 455 in submerged condition though these two treatments are labour intensive and time consuming. Sowing of pre-germinated seeds to the water is possible with Bg 455. Therefore it can be concluded that the enhancement of land productivity in water logged areas can be done successfully by sowing of Bg 455 pre-germinated seeds which were 48h soaked and 24 h. Incubated rather than adopting labour intensive establishment methods like transplanting and parachute method.

Table 1: Effect of different establishment methods on yield, plants/feetand days for 50% flowering

Treatments	2012/13 Maha*		2013 Yala			2013/14 Maha*		2014 Yala			2014/15 Maha*	
	Plants / Feet^2	Days to 50% flowering	Plants/ Feet^2	Yield/ (t/ha)	Days to 50% flowering	Plants/Feet^2	Days to 50% flowering	Plants / Feet^2	Yield/ (t/ha)	Days to 50% flowering	Plants / Feet^2	Days to 50% flowering
T1	1^{d}	102^{a}	13e	0.7^{d}	100^{a}	4e	102^{a}	1 e	0.79c	99^{a}	6d	104^{a}
T2	24^{b}	100^{a}	24bc	2.7^{b}	99^{a}	25b	103^{a}	20a	2.63a	100^{a}	24ab	100^{a}
T3	30^{a}	102^{a}	30a	3.2a	102^{a}	28a	102^{a}	29a	2.69a	100^{a}	26a	102^{a}
T4	30^{a}	103^{a}	28ab	3^{b}	102^{a}	28a	102^{a}	29a	2.69a	100^{a}	27a	103^{a}
T5	16^{c}	99^{a}	16de	2.8c	98^{a}	23c	101^{a}	17b	1.48b	101^{a}	21b	104^{a}
T6	23^{b}	100^{a}	13cd	2.3^{b}	101^{a}	21d	100^{a}	14b	82bc	103^{a}	15c	102^{a}
CV%	9.8	10.6	13	4.5	11.8	14.3	8.2	15.6	19	9.6	9.6	10.4

(Means of same letters are not significantly different)

* Yield was not recorded

T1- Broadcasting of un-treated seeds, T2 Broadcasting pre-germinated seeds soaked for 48h and incubated for 24 h, T3- parachute method,T4 Transplanting, T5- control treatment - T6Broadcasting pre-germinated seeds soaked for 24 h and incubated for 72 h

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