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Comparative Study on the Performance of Rice Seedlings Raised by Single Seedling Nursery Tray Method and Conventional System

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Abstract: Rising of rice seedlings is among the important factors responsible for better growth and development of rice plants as well as increasing the grain yield. Conventional method of raising rice seedlings requires larger space, time (24 hours seed soaking and 34 hours in jute bag up to sprouting) and labour intensive procedure, which limits the production capacity of rice seedlings. Transplanted seedlings raised by newly developed single seedling nursery tray have not been compared with the conventional system in the field so far. The objective of this study was to evaluate the average number of tillers per hill at 60-days after transplanting (DAT). The experimental design was one treatment [newly developed single seedling nursery tray (T1)] and three replications. The age of the seedlings raised by the newly developed single seedling nursery tray at the time of transplantation was 8 days. Plants were randomly selected and number of tillers were counted and recorded at 60 DAT from each treatment plot for further analysis. Average number of tillers (32.27 tillers/hill) in the case of the conventional system at 60 DAT using 8 days old seedlings was collected from previously published data. One sample T test was used to analyse the data using SPSS statistical analysis software (version 21) at 95% Confidence Levelof the Difference. The result of the analysis showed significant difference between them, with larger average number of tillers in T1 (68.56 tillers/hill) than the existing average number of tillers. The study depicted that using the newly developed single seedling nursery tray is one of the options to increase the number of tillers in SRI farming in order to increase the number of effective tillers, number of panicles, straw yield and grain yield of rice plants.

Keywords: Nursery Tray, Planting Media, Mechanization

1. Introduction

System of rice intensification, known as SRI is an innovation in rice farming cultural practice for increasing the productivity of water, capital, labour and land. SRI is all about altering the management of soil, water, rice plants and nutrients. It is environment friendly and makes the yield of rice to significantly increase, in addition to water productivity using less external inputs, which in turn will give a positive advantage to the farmers, as well as, the country at large. Also, SRI plays important roles in term of water, land, labour and capital productivity in irrigated rice production[1]. SRI comprises of various components to be followed. The components are transplanting of young and single seedlings per hill at wider spacing, applying organic inputs (e.g. pesticide, fertilizer, herbicide and insecticide) and less use of water through alternate wetting and drying (AWD) to provide moist environments [2], but it can be modified if the key components are adopted. System of rice intensification has many variations with conventional system

of farming:

- Conventional practice of rice farming uses larger amount of rice seeds [3,4] than SRI practice which uses lower quantity of seeds per hectare [4].
- SRI practice transplants young seedling ≤15 days old, while conventional practice transplants ≥3weeks old seedlings [5].
- SRI practice transplants one seedling rapidly and prudently [5] while conventional practice transplants more than one seedling.
- SRI practice transplants using at least 25 cm×25 cm planting geometry, leading to reduction of plant density ranging from 80 to 90% while the conventional practice uses close spacing [5].
- Repeated weeding is being practiced in SRI compared to conventional practice which suppresses weed infestation under permanent flooded situation [4].
- Due to intermittent irrigation and repeated mechanical weeding in SRI, soil aeration gets improved [5] while conventional practice uses flooded field [4].
- SRI practice has robust root growth than the conventional practice [6].
- Rice crop from SRI farm absorbs higher amount of macronutrients through their roots than the conventional system of rice farming [5].

Generally, uprooting of single seedling for transplanting causes stress to the seedling, which could be reduced when the endosperm stays attached [7,8]. In conventional practice, it has been reported that around a range of 40 to 60% of the roots stay in the soil during removing or pulling up from the nursery bed. Cutting up to 60% of the rice roots during transplanting significantly reduces subsequent rice root and shoot dry matter build up [9]. Therefore, there is a need to use the newly developed single seedling tray for SRI in order to increase shoot and root dry matter accumulation by protecting root system during transplanting. This will also lead to increase of growth and development of rice plants. The main objective of this study was to evaluate the average number of tillers per hill at 60 days after transplanting (DAT).

2. Methodology

MR219 rice variety was used in the experiment. The treatment test (T1) consists of one treatment with three replications. Newly developed single seedling tray with a seedling capacity of 924 seedlings was used for raising the seedlings (T1) up to 8 days [10]. The seed rate was 4.3 kg/ha. Best rice seeds were selected by soaking the seeds in water and salt solution for six hours, after that drained and kept for 24 hrs for sprouting to initiate. The sprouted seeds were sown in the seedling tray containing a mixture of soil to compost ratio of 1:1. The sown seeds were irrigated twice daily using hand watering jar to prevent drought and to sustain moist soil condition up to one day before transplanting. The study area was 8 m^2. The size of each plot was 1 m^2. The planting geometry was 30 cm×30 cm. Single seedling per hill was transplanted. Hence, every plot contained a total number of nine seedlings. One block containing 3 subplots were manually made by means of hand hoe in order to design the field layout. The preparation of the experimental site was done using manual digging followed by weed removal after field layout design. Single seedlings per hill were transplanted using the 8 days old seedlings. A total of 27 seedlings for all the three plots were thus maintained. Nitrogen fertilizer applied was 68 kg/ha in four splits times, 1.77 g/m^2(26%) at 15 DAT, 2.52 g/m^2(37%)at 35 DAT, 1.84 g/m^2 (27%) at 55 DAT as practiced by farmers in Malaysia and also, recommended by Department of Agriculture, Malaysia. Irrigation water was applied using alternate wetting and drying (AWD), in order to maintain moist soil or aerated condition. During the vegetative growth of the rice plants, the plots were left unirrigated for at least 2 to 4 days, until the appearance of hairline cracks as a result of drying of the soil. Weeds of each treatment plot were controlled by means of mulching material known as "SRImat" [11]for reducing the competition against rice plants in term of nutrients, water, carbon dioxide and solar radiation. Numbers of tillers per hill were randomly recorded from 3 hills of each treatment plot at 60 DAT. The tillers were counted and mean values calculated and recorded.

The data collected were analysed by SPSS statistical analytical package (version 21). Means were compared using one sample T-test, to determine the significant difference between the seedling performance raised by the newly developed single seedling tray method and the conventional practice.

3. Results and Discussion

3.1. Raising of Seedlings

The rice seedlings were prepared using the newly developed single seedling tray method using the medium with a soil to compost ratio of 1:1 as shown in Fig. 1. The age of seedlings used was 8 days(Fig. 2).

Fig. 1. *Soil to compost ratio (1:1) used in this study.*

Fig. 2. *MR219 8 days old seedlings raised in the tray.*

3.2. Number of Tillers

The transplanted seedlings raised from the newly developed single seedling tray (T1) were able to grow and develop in good health. The conventional practice of raising nursery seed beds requires larger area than the area occupied by the newly developed single seedling tray for raising the seedlings. It consumes more time because seed soaking is done up to 14 hrs and kept for 34 hrs in jute bag for rapid germination of seeds [12]. The roots are hard to separate during pulling for transplanting due to interconnection among the roots and compete with one another in terms of nutrients, aeration, water and sunlight. The mean value of the number of tillers (68.56) for the seedlings raised by the newly developed single seedling tray (Table 1) is higher than the mean value of the number of tillers in conventional planting (32.27) (Table 2). The effectiveness of the newly developed single seedling tray as shown by the one-sample t-test result, made the number of tillers per hill to be significantly higher than the conventional practice. This may be due to the absence of root interconnection which leads to the transplanting of seedlings with healthier roots and shoots than in the conventional practice.

Table 1. *One-sample statistics of the test result.*

Age of plot	N	Mean	Std. Deviation	Std. Error Mean
60 DAT	3	68.56	7.95	4.59

Fig. 3. *Seedling performance at 60 DAT.*

Table 2. *One-sample test between the SRI and conventional method.*

Age of plot	Test Value = 32.27					
	t	df	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
60 DAT	7.90	2	0.016	36.29	16.53	56.04

4. Conclusion

The number of tillers per plant varied significantly due to different methods of raising the seedlings for transplanting. The increment in the average number of tillers per plant was remarkably higher in the newly developed single seedling tray treatment than the conventional practice. Under the present day constraints of lower production of rice crops, this study depicted that using the newly developed single seedling nursery tray is one of the options to increase the number of tillers in SRI farming in order to increase the number of effective tillers, number of panicles, straw yield and grain yield of rice plants. The results from the experiment clearly revealed that younger seedlings raised by the newly developed single seedling tray method resulted to significantly higher number of tillers than in the conventional practice. Thus, the above SRI technique can be extended to the farmers to maximize total production of rice, ultimately contributing to food security.

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References

[1] Kassam, A., Stoop, W. & Uphoff, N. (2011). Reviewof SRI modifications in rice crop and water management and research issues for making further improvements in agricultural and water productivity. *Paddy and Water Environment, 9*(1), 163-180.

[2] CIIFAD(2014). Guideline on SRI practice for tropical countries.http://sri.ciifad.cornell.edu/countries/japan/extmats/JSRI_Guideline0312.pdf.

[3] Mishra, A., & Uphoff, N. (2011). System of rice intensification: 'less can be more' with climate-friendly technology. *SATSA Mukhaptra Annual Technical Issue, 15*, 28-39.

[4] Miyazato, T., Mohammed, R. A. & Lazaro, R. (2010). Irrigation management transfer (IMT) and system of rice intensification (SRI) practice in the philippines. *Paddy and Water Environment, 8*(1), 91-97.

[5] Barison, J. & Uphoff, N. (2011). Rice yield and its relation to root growth and nutrient-use efficiency under SRI and conventional cultivation: An evaluation in Madagascar. *Paddy and Water Environment, 9*(1), 65-78.

[6] Hameed, K. A., Mosa, A. J.& Jaber, F. A. (2011). Irrigation water reduction using system of rice intensification compared with conventional cultivation methods in iraq. *Paddy and Water Environment, 9*(1), 121-127.

[7] Ota, Y. (1975). Site condition and rice crop ecology. *Nogyo Gijutsu Taikei, Field Crop, 1*, 259-275.

[8] Sakai, H., & Yoshida, T. (1957). Studies on the conditions affecting the outbreak of physical damping of rice seedliqgs, so-called" murenae," in frame nursery.part 1. observation on the oxidation of roots by means of a-naphtylamine oxidation. *Hokkaido, Japan Natl.Agric.Exp.Std., 72*, 82-91.

[9] Ros, C., White, P. & Bell, R. (1998). Field survey on nursery and main field fertilizer management. *Cambodian Journal of Agriculture, 1*, 22-33.

[10] Usman Z. B. (2013). *Design and development of seedling tray in system of rice intensification (SRI).*(Unpublished Master of science). UniversitiPutara Malaysia.

[11] Mohammed, U., Aimrun, W., Amin, M., Khalina, A. & Zubairu, U. (2016). Influence of soil cover on moisture content and weed suppression under system of rice intensification (SRI). *Paddy and Water Environment,* 14(1), 159-167.

[12] Karki, K. (2009). Productivity and economic viability of rice under different planting pattern and age of seedlings through system of rice intensification (SRI). (Unpublished Master of Science thesis). Institute of Agriculture and Animal Science Rampur, Chitwan.