

On-farm non-puddled rice yield response to crop residue retention

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Introduction

In Asia, rice (*Oryza sativa* L.) is established generally by seedling transplanting in puddled soil. Generally, lands are prepared by 3-4 ploughing and cross ploughing operations followed by levelling in standing water. This traditional method is costly in terms of labour, fuel, time and irrigation water, and is detrimental to soil health (Islam *et al.*, 2014). Adoption of non-puddled transplanting may be a good alternative to soil puddling which has potential to achieve savings in labour, energy, water and time during rice establishment (Islam *et al.*, 2012). Retaining previous crop residues maintains soil microbial activity which can also lead to weed suppression by the biological agents leading to increases in crop yield (Kennedy, 1999). Considerable research work has been done on puddled transplanting, but there is a limited information on the effect of crop residue retention level on the performance of non-puddled transplanting of rice.

Materials and Methods

The experiment was conducted at a farmer's field located at Durbacakra village of Bangladesh (between 24.75° N and 90.50° E) during summer rice season (July-November, 2013) and winter rice season (December-June, 2014). The summer and winter rice were 10th and 12th crop of a long-term trial using the rice-mustard-rice pattern. The treatments (four replicates) were: in puddled condition (i) Conventional tillage (CT) and in non-puddled condition (ii) Strip tillage (ST) with two levels of crop residue *viz.*, No residue (R₀) and 50% residue retention (R₅₀). CT was completed by 2-wheel tractor (2WT) and ST by Versatile Multi-crop Planter (VMP). Three days before ST, glyphosate (Roundup) was applied @ 75 mL/10 L water. After ST, the land was inundated with 3-5 cm standing water one day before the transplanting operation to allow the land to soft enough to transplant seedlings. For aman rice, 25 day-old seedlings of summer rice (*Hybrid Krishan2*) and 40 day-old seedlings of winter rice (*BRR/dhan28*) were transplanted. Recommended cultural operations were performed. The crops were harvested at maturity from three 3 × 3m quadrats per plot. Grain yield was adjusted to 14% moisture content. Data were subjected to ANOVA using *STATISTIX* and means were separated by Duncan's Multiple Range Test.

Results and discussions

ST and 50% residue retention yielded the highest grain yield of both summer rice (5.97 t ha⁻¹) and winter rice (4.81 t ha⁻¹) which could be attributed from the highest number of effective tillers m⁻², the highest and lowest number of fertile and sterile grains panicle⁻¹, respectively. The highest grain yield generated the highest BCR both in summer rice (3.08) and winter rice (2.78). CT without residue yielded the least grain both of summer rice (5.17 t ha⁻¹) and winter rice (4.12 t ha⁻¹), and consequently earned the lowest BCR 1.63 and 2.08, respectively.

The higher rice yields in ST obtained in this study are in the conformity with results of Mahajan *et al.* (2002) who concluded, crop yield in minimum tillage are greater than conventional practice when crops are managed successfully. Residue is mineralized during crop growth and releases nutrients which promote crop growth and facilitates higher yield over no residue.

Similarly, Devasinghe *et al.* (2011) concluded that residues prevents weed growth and supplies organic matter for heterotrophic N fixing microorganisms, which could be utilized by succeeding crops and lead to higher yield.

Conclusion

Considering the rice grain yield and BCR, it may be concluded that, non-puddled rice transplanting might a very good alternative to the conventional practice without sacrificing yield or profit. Farmers are likely to be benefited from the adoption of non-puddled rice establishment with the retention of crop residues in the field

Acknowledgement

The research was conducted under the LWR-2010-080 project funded by Australian Centre for International Agricultural Research (ACIAR).

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