Minimum tillage non-puddled transplanting of rice: An overview

Richard W. Bell[1]* and M.E. Haque[2]

[1] School of Veterinary and Life Sciences, Murdoch University, Murdoch WA 6150 *Corresponding Author: R.Bell@murdoch.edu.au; [2] Project Implementation Office-Murdoch University, Uttara, Bangladesh. Email: E.Haque@murdoch.edu.au

Introduction

Labour-intensive and water-demanding practices for rice cultivation such as soil puddling and transplanting of rice seedlings are no longer feasible in many parts of Asia due to declining labour and irrigation water availability. Non-puddled transplanting into soils with minimum soil disturbance (NPT) is a possible approach for rice seedling establishment that could decrease the labour and water requirements and cost of establishment of rice while maintaining some of the advantages that transplanting and flooding of soils bring, namely weed control and increased nutrient availability. The present paper reviews earlier work on the NPT technology in the Indo-Gangetic plain and then examines the findings for minimum tillage NPT of rice seedlings in Bangladesh.

Results and Discussion

Zero tillage and strip tillage are the most common methods of NPT. Generally, experiments examined a single crop of NPT of rice and showed that the first rice crop established by NPT produced similar yield to the conventional rice seedling establishment by transplanting on puddled soils (Ladha et al. 2009; Saharawat et al. 2010; Haque et al. 2014, 2016). In the monsoon season, 38 on-farm paired comparisons in northwest Bangladesh produced no grain yield difference between NPT and puddled transplanted rice. However, in the dry-season irrigated season of 2012 (boro) the NPT increased average yield over 29 paired comparisons by 0.26 t ha^{-1}. From a further 66 rainfed monsoon (aman) and 84 boro crops during 2013 to 2015 in north and north-west Bangladesh, NPT of rice seedlings in strips produced similar or significantly greater grain (boro season of 2015) and straw yield (Haque et al. 2017).

In three long-term experiments with up to 15 consecutive crops since commencing strip tillage, NPT gave the same grain yield of rice as conventional puddling and transplanting (Haque et al. unpublished data). By contrast, at another three long term experiments, rice grain yield increased by 0.7 to 1.7 t ha^{-1} in all crops under NPT following strip tillage. Collectively, the replicated experiments and on-farms assessments of NPT demonstrate that it is reliably able to produce as much grain yield in the first crop as the conventional puddling of soils. Moreover, with continuation of minimum tillage by strip tillage the yield of both aman and boro rice crops equal or exceed those of the conventional puddling and transplanting of rice. With mechanised transplanting, the grain yield was similar between NPT and conventional soil puddling for rice establishment (Hossen et al. 2017). We conclude that changing to NPT represents minimal minimal risk of yield loss for rice producers while providing labour, fuel and water savings (Haque et al. 2016).

First impressions of the performance of NPT are important for acceptance by farmers. Generally, results shown no yield change with NPT in the first crop compared to the conventional puddling of soil and transplanting. However, there are immediate savings in labour and water although for transplanting itself the labour requirement may increase (Haque et al. 2016). With continuous minimum soil disturbance and residue retention about 50 % of cases report increased grain yield with NPT rice and the remainder report no yield difference

(Haque et al. 2017). Increased profitability is consistently reported from experiments and on-farm experiments and demonstrations.

Farmers' practice of NPT will provide a pathway for the adoption of conservation agriculture in rice-based systems. The knowledge base for NPT is still limited compared to puddling and transplanting. Hence many questions still remain about this practice. Further research is needed to define the domain of soil types, hydrology and farmer typology within the lowland rice-growing areas where this technology is suitable. The main consideration is whether enough of the key questions about its feasibility and profitability have been answered so that it can now be recommended to farmers. If not, what are the remaining research and practical questions that remain? There is also a need to demonstrate NPT in long term trials to establish confidence among target farmers in the technology and to identify emergent trends that need to be studied in detail before they become limiting factors for widespread adoption or practice.

References

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