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Effect of direct seeded rice on yield, water productivity and saving of farm energy in reclaimed sodic soil

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ABSTRACT

A field experiment was conducted on conventional rice transplanting (TPR) and direct seeded rice (DSR) in different sets of crop establishment technique with the objective to examine water productivity and save the natural resources. The basmati rice (CSR30) produced maximum grain yield in TPR with and without residue incorporation (3.72 and 3.68 t ha^{-1}, respectively) followed by DSR without residue (3.67 t ha^{-1}). DSR with sesbania co-culture yielded 3.50 t ha^{-1}. High yielding Pusa 44 produced maximum grain yield in TPR with residue incorporation (7.66 t ha^{-1}) followed by TPR without residue (7.40 t ha^{-1}). There was no significant difference in yield of puddled and un-puddled transplanted rice. DSR in wheat stubbles resulted minimum yield (4.54 t ha^{-1}). DSR with sesbania brown manuring yielded 5.79 t ha^{-1}. Water productivity was more in DSR compared to TPR. The maximum water saving (39.4%) was recorded in DSR with sesbania co-culture. Water productivity of rice Pusa 44 was 0.45 kg m^{-3} when grown in DSR without crop residue while it was 0.43 kg m^{-3} with sesbania co-culture. The maximum water saving was 32.3% in DSR with sesbania. In case of permanent raised bed, rice transplanting saved 23.3% irrigation water. DSR in different combinations saved irrigation water 30.2%, reduced diesel consumption by 42% in reduced tillage method and by 86% in zero tillage in comparison to transplanted rice. DSR technology reduced labour requirement by 24% in reduced tillage and 30% in zero tillage, whereas power saving in DSR was more than 29%.

1. INTRODUCTION

The Indo-Gangetic plain (IGP) is of great importance for food security of India as well for South Asia. It is spreading from the arid and semi-arid environment of Rajasthan and Punjab to humid and per-humid deltaic plain of West Bengal (Shankaranarayana, 1982). It is estimated that the demand of milled rice will increase at the rate of 25% per decade at global level. The major challenge is to achieve this goal with less water, labour and chemicals; thereby ensuring long term sustainability. It owed due to the indiscriminate use, or rather misuses of natural resources, especially irrigation water and has led to the pollution and depletion of groundwater resources (Nayar and Gill, 1994). Intensive tillage and residue burning has led to depletion of soil organic carbon resulting in decreased soil fertility and reduced factor productivity (Yadav, 1998). Continued intensification of input-use since the green revolution, has provided lower marginal returns (Ladha *et al.*, 2000). In addition, inappropriate use of applied inputs and over exploitation of natural resources, like land and water leading to degradation in the form of salinization, water-table depletion, physical and chemical deterioration of the soil, *etc.* (Byerlee, 1992 and Murgai *et al.*, 2001). A decline in land productivity has been observed over the past few years in the Northern and North Western IGP despite the application of optimum levels of inputs under assured irrigation (Paroda, 1997). Although tillage has been considered an integral part of traditional production system (Reicosky, 2008), but it is also a principal practice resulting into soil perturbation and subsequent modification of the soil structure and soil organic carbon dynamics. Improved agricultural practices such as direct seeding or conservation tillage have the potential to sequester more carbon (C) in soil than conventional practices. In recent years, due to continuous energy crisis and increasing fertilizer prices, green manuring has been considered as a sound practice