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# Direct-seeding and reduced-tillage options in the rice-wheat system of the Western Indo-Gangetic Plains

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## ABSTRACT

**With the introduction of new, improved shorter duration wheat and rice varieties in South Asia in the mid-1960s, double cropping of these two cereals became possible. Rice is grown in the wet, monsoon summer months and wheat follows in the dry, cool winter in one calendar year. More than 13 million ha are grown to rice and wheat in India, Bangladesh, Nepal, and Pakistan. Another 10 million ha are grown in China. This rice-wheat system is one of the most important cropping systems for cereal production and food security in the region. Most of the rice in this system is managed by transplanting rice seedlings into puddled soils. This age-old method of planting is used to reduce water percolation. It also helps control weeds ,but puddling also degrades the soil physical condition with resulting difficulties in establishing and growing succeeding upland crops such as wheat. Much of the research in the region looks at the possibility of establishing rice without puddling. Major perceived hurdles include the inability to economically control weeds and increased water use. However, there are situations when water tables are high or soils are fine-textured where puddling is not needed to slow water infiltration and where dry-seeding technology may work. Less research has been done on evaluating this technology on a systems basis. Experiment looked at the effects of various tillage and crop establishment practices on the productivity of both rice and wheat. Rice yield was not adversely affected by direct seeding without puddling. Direct seeding led to greater weed pressure.Rice yield attributes were altered by direct seeding, indicating a need to optimize plant density and spacing parameters for this practice.Soil bulk density was lowered and infiltration rates increased without puddling. This led to a different water management regime for direct-seeded rice and provided a better soil physical condition for the succeeding wheat crop. Wheat yields were affected by various tillage options whether applied in the rice season or in the wheat season. Wheat yields were significantly higher when rice soils were not puddled and zero tillage performed better as compared to conventional tillage but this may have been because of sufficient moisture for good root development in zero-till plots. The best wheat yield was obtained when soil was deep-tilled and unpuddled for rice and not tilled for wheat i.e. wide raised beds. Although rice yields were lower than wheat yields, differences in the latter were most important for overall system productivity. This paper suggests that direct-seeded rice on unpuddled soils is feasible and that zero-till wheat following unpuddled rice soils is cost-effective, conserves resources, and does not reduce yield.**

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**Key words :** IGP- Indo-Gangetic Plains, Profitability, Water productivity, Sustainability

## INTRODUCTION

"Green Revolution" technology introduced into South Asia in the mid-1960s has been the basis for sustained food security, rural development, conservation of natural resources, and poverty alleviation for the past 30 years. The technical change that resulted in the Green Revolution arose from the introduction of improved varieties, fertilizer, irrigation, and other plant protection chemicals. Investments from the public sector were crucial for making these inputs available to farmers. During the past 30 years, agricultural production has been able to keep pace with population demand for food. This came about through significant area and yield growth. Area growth was a result of new lands being farmed and through increases in cropping intensity, from a single crop to double or even triple crops per calendar year.

Post-Green Revolution or the present-day situation sees area growth slowing and it is expected that this will not play a major role in future production growth. Yield growth will have to be the mainstay for providing the means for meeting future food demand unless food imports start to play a major role in South Asia. Evidence from some long-term experiments, however, shows that problems of stagnating yields and even yield declines are

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