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Direct Seeded Rice: Saving Water, Labour and Energy for Sustainable Rice Production

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In South Asia, the traditional production system is based on seedling raising, puddling and transplanting. It is an effective system but demands a great deal of water, labour and energy. Direct-seeded rice (DSR) is an alternative to transplanted rice that is established directly in the main field. It can reduce the need for labour and water and lower the cost of cultivation but challenges such as weed infestation, poor crop establishment and yield instability remain. Hence, DSR should not be considered as an alternative sowing method but as an integrated agronomic system with appropriate varieties and management of nutrients, water and weeds.

Keywords: Direct seeded rice, water use efficiency, weed management, labour conservation

Introduction

Rice is one of the most important food crops in South Asia. Conventional transplanted rice is grown through nursery raising, puddling and transplanting of seedlings. Rising labour costs, diminishing water availability and increasing energy requirements have stimulated interest in alternative methods of establishment. Direct-seeded rice (DSR) is a method of sowing rice seed directly in the main field, bypassing the transplanting stage. Depending on field conditions DSR can be dry seeding, wet seeding or water seeding. DSR involves direct establishment of crop under field condition as against transplanted rice. Hence early establishment and weed management are particularly important.

Why is DSR gaining importance?

- **Water conservation:** One of the major advantages of DSR is the potential for reduced water use. DSR has the potential to improve water-use efficiency as puddling and water requirement of transplanting can be reduced. But actual saving depends on the soil, rainfall, irrigation and management conditions.
- **Reduction in labour and cultivation costs:** The transplanting involves the nursery preparation, uprooting, transportation and planting of the seedling. The elimination of these operations allows DSR to reduce labour requirements and cultivation costs.

This is especially important where there is labour shortage during the small period of rice-establishment.

- **Energy efficiency:** Reduced puddling and fewer field operations can lower the energy use. Hence DSR has the potential to improve overall resource-use efficiency compared to conventional transplanted rice.

Weed management: the major challenge

Weed infestation is one of the major constraints of DSR. Transplanted rice has an initial competitive advantage over weeds. In DSR, weeds and rice emerge together, making the weeds compete at the initial stages. Therefore, DSR requires timely and integrated weed management involving appropriate land preparation, timely sowing, suitable herbicides and mechanical or cultural means wherever feasible.

Nutrient and water management

DSR alters the soil environment and crop establishment pattern, and hence, nutrient and irrigation management may not always be in line with recommendations made for transplanted rice. Proper balanced fertilization, nitrogen management and irrigation as per the crop requirements are important for maintaining vigorous crop growth. Recent studies emphasize that DSR performs best when integrated with variety selection, nutrient management, weed control and other agronomic practices.

What about the yield

DSR is not necessarily better than transplanted rice in terms of grain yield. An analysis showed that DSR yielded on average 12% less than transplanted rice, but the response was highly variable with environment and management. Recent evidence from India also indicates to a yield trade off. An analysis in 2025 showed DSR reduced yield by approximately 9%, but lowered water use and cultivation costs and improved several ecosystem services. Therefore DSR needs to be evaluated not only for grain yield but also for water productivity, labour requirement, production cost, profitability and environmental benefits.

Making DSR successful

- Selection of varieties suitable for direct seeding
- Proper plant population and timely sowing
- Effective weed control
- Balanced application of nutrients
- Proper of scheduling irrigation
- Proper field preparation and good quality of seeds
- Proper mechanization

No single practice can overcome all the limitations of DSR.

Future prospects

Future research should focus on the development of varieties suitable for DSR, better technologies for weed management, precision seeding, efficient irrigation and site-specific nutrient management. More attention should be paid to evaluating DSR at the whole-cropping system level than just judging it by rice field.

Conclusion

Direct-seeded rice has a huge potential to increase the water, labour and energy efficiency of rice production. But the benefits are not automatic. Productivity can be reduced by poor crop establishment, weeds and poor management. In this context, the future of DSR lies in

developing location specific integrated agronomic packages which can sustain yield and profitability while reducing resource in rice reproduction.

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