

Diversification of Establishment Techniques in Direct Seeded Rice

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ABSTRACT

Direct seeded rice involves sowing rice seeds straight into the main field rather than transplanting seedlings from a nursery. This cultivation method reduces labor needs by skipping nursery raising and transplanting steps. It allows faster crop establishment and uses less water compared to flooded transplanting. Seeds are evenly distributed through various techniques like broadcasting, drum seeding, seed drilling and line sowing. Though suitable for areas with labor or water scarcity, weed control is challenging initially without standing water. Ongoing research aims to develop improved seed varieties, herbicides, and agronomic practices to enhance weed management in direct seeded rice systems. With refinements, this technique has the potential to boost the sustainability and productivity of rice farming operations.

INTRODUCTION

Direct seeded rice (DSR) is a method of rice cultivation that involves sowing rice seeds directly into the main field, eliminating the need for nursery raising and transplanting. This approach offers several advantages over the traditional transplanting method, including reduced

labour requirements, earlier crop establishment, and higher water productivity.

The process of establishing crops through direct sowing can exhibit variability, ranging from manual or mechanical broadcasting (such as aeroplane or power sprayer) to line sowing,

accomplished either through a drill or a drum seeder. Alternatively, manual dibble method can also be employed in both puddled or unpuddled soil. In regions where labor shortage is pronounced but water resources are relatively abundant, farmers have transitioned to wet-direct seeding of rice (Wet-DSR) without altering their tillage practices (Kumar and Ladha, 2011). The seeds germinate and establish directly in the main field, eliminating the need for separate nursery preparation, seedling raising, and transplanting operations.

One of the key benefits of DSR is its potential to save water, as it requires less water than the traditional flooded transplanting method. Additionally, it allows for earlier crop establishment, leading to a shorter growing period and potentially higher yields. However, the success of DSR relies on effective weed management strategies, as the absence of standing water in the initial stages can lead to increased weed growth.

Wet direct seeded rice was reported to have a 10.8% increase in grain yield compared to transplanted rice, while also demonstrating a 60.4% reduction in global warming potential (Tao *et al.*, 2016). Direct seeded rice cultivation has gained popularity in various regions, particularly in areas facing labour shortages or water scarcity. With the continued development of improved seed varieties, weed management techniques, and proper agronomic practices, DSR offers a promising alternative to traditional rice cultivation methods, promoting sustainable and efficient rice production.

Types of direct seeding

1. **Wet direct seeded rice:** Direct wet seeding involves pre-germinating seeds, with a seed rate of 60 kg/ha, similar to the process for wet nursery preparation. Seeds are sown either by drum seeder or broadcast uniformly with a thin film of

water. Thinning and gap filling are essential tasks to be carried out 14-21 days after sowing to ensure proper spacing and optimal plant growth. Additionally, for an efficient nutrient budget and enhanced grain production, dual cropping of rice with green manure is recommended. To facilitate this method, the 'TNAU Rice-Green manure seeder' can be utilized. Incorporation of green manure is advised when it reaches a height of 40cm or 30 days after sowing, whichever comes earlier, using a cono-weeder. Following green manure incorporation, fields may benefit from another round of operation with a rotary weeder a week later, aiding soil aeration and exploiting any organic acids formed in the process (www.agritech.tnau.ac.in).

2. **Dry direct seeded rice:** Dry Direct Seeded Rice (DDSR) employs diverse sowing techniques, including broadcasting dry seeds after field preparation (conventional tillage or zero tillage) and mixing, dibbling sprouted seeds in hilly terrain, or line sowing with a seed-cum-fertilizer seed drill on various tillage systems. Unlike continuous submergence, DDSR in Asia relies on alternate wetting and drying in rain-fed upland ecosystems, with double DSR enhancing yields through cycling dry and wet tillage. With a seed rate of 75 kg/ha, seed hardening using 1% potassium chloride (KCl) and shade drying enhances seed resilience to early moisture stress. Treatment with *Pseudomonas fluorescens* and *Azophos* or *Azospirillum* and *Phosphobacteria* ensures microbial support. Precision drilling with a 20 cm inter-row spacing using a seed drill completes this approach to DDSR, ensuring optimal crop establishment and sustainable yields.

Methods of establishment in direct seeded rice

- 1. Broadcasting:** The broadcasting method involves evenly distributing dry or pre-germinated rice seeds over the entire field surface by manually scattering or using mechanical seed broadcasters. Careful calibration is necessary to ensure the optimum seed rate per unit area. After broadcasting, the seeds are lightly incorporated into the soil using a rake or harrow to achieve proper seed-soil contact for germination. This method is relatively simple and requires less equipment but demands skilled labor for uniform seed distribution across the field.
- 2. Drum seeding:** The drum seeding method utilizes a specialized equipment called a drum seeder. It consists of perforated cylindrical drums that are filled with pre-germinated rice seeds. As the drum seeder moves across the field, the drums precisely meter and drop the seeds into the soil at predetermined spacing. This method ensures accurate seed rate and uniform plant distribution. Drum seeding requires less labour but involves higher capital investment in the seeding equipment.
- 3. Seed drilling:** The seed drilling method employs a tractor-mounted or manual seed drill machine for direct rice seeding. The seed drill has furrow openers that create shallow trenches into which the rice seeds are precisely placed at the desired depth and row spacing. Trailing covering devices then close the furrows, ensuring proper seed-soil contact for germination. Seed rate and depth can be accurately controlled using calibrated seed metering mechanisms. This method enables precise seed placement, reducing seed wastage and facilitating easier crop

management practices like inter-row cultivation. However, it requires substantial capital investment in seed drill equipment.

- 4. Line Sowing:** The line sowing method involves stretching a rope across the field at the desired row spacing. Pre-germinated rice seeds are then manually placed along the rope at appropriate seed-to-seed distances. Once seeding is completed for one line, the rope is lifted and relocated to mark the next row. This manual method ensures precise seed placement and plant geometry, enabling easier inter-row cultivation. However, it is highly labor-intensive and may not be suitable for large areas. Skilled labors are required for uniform seed distribution along the ropes.

Advantages of direct seeded rice over transplanted rice

Under optimal conditions, direct seeded rice (DSR) demonstrates no significant yield reduction, while efficient water management practices lead to water savings of 12-35%. This method also diminishes labor and drudgery by eliminating seedling uprooting and transplanting, resulting in reduced cultivation time, energy expenditure, and costs. Additionally, there is no plant stress from transplanting, ensuring faster crop maturation and lower greenhouse gas (GHG) emissions. Mechanized DSR not only provides employment opportunities for youth through a service provision business model but also increases total income by reducing the overall cost of cultivation (DSRC, IRRI)

Constraints

Challenges associated with direct seeded rice (DSR) include higher seed rates, leading to increased costs, and the risk of seeds being

exposed to birds and pests, potentially impacting crop establishment. Effective weed management becomes crucial to mitigate competition for resources and ensure optimal crop growth. Additionally, there is a higher risk of lodging due to the absence of water support for plant roots, which can lead to yield losses. Moreover, there is a risk of poor or non-uniform crop establishment, necessitating careful monitoring and management practices to achieve desired yields

Future prospects

With continued research and innovation, direct seeded rice establishment methods are poised to become more efficient, precise, and cost-effective. Integration of precision agriculture technologies, such as seed mapping, variable rate seeding, seed coating, brown manuring, fertigation, sensor-based irrigation etc. could further optimize seed utilization and crop performance.

CONCLUSION

Direct seeded rice presents a viable alternative to traditional methods, offering labour, energy, and water savings. Challenges such as higher seed rates and weed management require

attention, but with proper techniques, risks can be minimized. Through efficient management practices, DSR has the potential to revolutionize rice cultivation, promoting sustainability and profitability for farmers. Embracing DSR could lead to significant advancements in agricultural practices, benefiting both farming community and the environment.

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