Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 03 (MAY-JUNE, 2024)
Available online at http://www.agriarticles.com

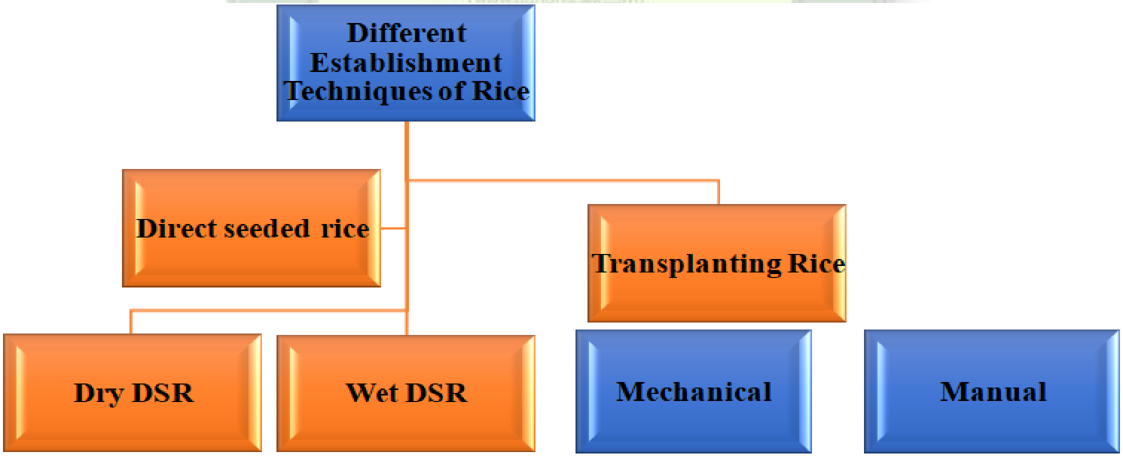
Direct Seeded Establishment Method of Rice (Dry -DSR)

(*B. Chakravarthi[1], K. Akhil[2] and B. Shreya[2])
[1]Young Professional -2 KVK, Kampasagar –Nalgonda PJTSAU, Telangana, India
[2]Teaching Associate, Agricultural College - Palem, PJTSAU, Telangana, India
*Corresponding Author's email: banothuchakri@gmail.com

Rice (*Oryza sativa* L.), a staple food for more than half the world's population, is sometimes grown by transplanting rice seedlings into puddles of soil, or wet tillage, which are known as India's "food bowl." Because it requires a lot of labour, water, and energy, the puddling method of growing rice is becoming less sustainable as these resources become increasingly scarce. Water is scarce for sustainable rice production due to fierce rivalry from several sectors (agricultural, industry, household needs in cities, etc.). Large volumes of water are needed for rice farming, especially in light-textured soils where groundwater is the primary source of supplemental irrigation in addition to rain and canal water. Since power is not charged when pumping water and there is no tax on using water,

The dry direct-seeded rice (DSR) production system is being taken into consideration by researchers and farmers due to the alarming rate of groundwater reduction and the water problem. Migrant labour is heavily utilized in rice transplanting. Farmers are being forced to switch from transplanting rice, which takes 25–50 person-days ha-1, to direct seeding, which only needs about 5 person-days ha-1 due to high labour demand at the time of transplantation, increasing labour shortages, and rising wage rates. Rajbir Singh et al. (2016).

A brand-new and developing system for producing rice is the DSR. In comparison to puddle-transplanted rice (PTR), our latest research has found that DSR produces higher crop, water, and labour productivity (Mahajan et al., 2011). Similar outcomes were also attained in the Philippines (Li, H., Guo et al., 2019) and China (Zhang et al., 2006). The inability to produce dry-DSR-compatible cultivars and the related production technology is a significant barrier to dry-DSR's full potential. The purpose of this bulletin is to assess overall crop performance, including resource-use efficiency in DSR, lessons learned, and management strategies currently being employed by farmers in the DSR. We provide research gaps based on the evidence that need to be filled in order to achieve optimal grain production.



Direct seeded rice (DSR)

Direct Seeded Rice (DSR) is a revolutionary method for growing high yielding rice that involves direct dry sowing on non-puddled soils with less irrigation and unsaturated (aerobic) soil without raising nursery, transplanting, or standing water. It is exactly like any other irrigated dryland crop, like maize or wheat. This approach allows efficient use of all available farm resources as well as effective use of rainfall on the farmer's field. Correct cultivars (seeds) generated employing technologies like aerobic rice, drought resistance, and marker-assisted selection are crucial for the efficient utilization of the DSR system. Changes in the procedures used to cultivate rice with much less water are also crucial. It should be emphasized that cultivars developed for wetlands could not perform as expected under DSR circumstances.

Instead of transplanting seedlings from a nursery, direct seeded rice (DSR) includes the development of a rice crop from seeds sown directly in the field using any suitable sowing technique. There are three recognized DSR techniques: dry seeding, wet seeding, and water seeding. Dry seeding, which is ideal for rainfed locations with severe water shortages, entails spreading seeds into a prepared seed bed under unpuddled and unsaturated soil conditions by disseminating, drilling, or dibbling. Upland rice is typically planted with dry direct seeding, which has a 22% increase in grain production, a 35–57% water savings over flooding, and a NUE of above 80%. For irrigated areas with reasonably decent amounts of rainfall, the wet seeding method of DSR is suitable.When a field is puddled and levelled, pre-germinated (sprouted) paddy seeds are directly sown there after the excess water has been drained. This process is known as drum seeding. A drum seeder is a piece of machinery that typically consists of four hyperbolic-shaped drums that can sow eight lines in one pass with a 20 cm row to row spacing. However, improper use of the machinery might cause the perforations in the drum to become clogged, which could result in uneven seed distribution. When seeds are sown in standing water in fields that have been prepared with ridges and furrows before being submerged, water seeding is appropriate for high rainfall areas. The depressions are made to keep the crop geometry favourable and stop the seeds from drifting.

DSR makes it easier to conserve resources, use them effectively, and plant successive crops on schedule. Although the yield of rice obtained using the transplanted method is higher than that of DSR, Kumar and Batra report that the net return and B-C ratio are higher in the case of DSR. (In the absence of water deficit stress, the

faster development of DSR than transplanted rice is consistent over many findings, according to Alam et al. Additionally, drum seeding, a form of direct seeding, is advantageous in the same way as demonstrated by who discovered that transplanting after puddling (1.54) resulted in a greater B:C ratio for dry seeded rice than drum seeding (1.70).

Advantages

- Rice with a Sustainable Design
- Direct seeding eliminates the need for a nursery and transplantation.
- Wetland activities such as wallowing are not necessary.
- No need for standing water means a water savings of almost 50%.
- Similar to maize, regular rainfall of about 700 mm throughout the Kharif (wet) season is sufficient.
- requires 20 kg/ha of seeds as opposed to 60–65 kg/ha in a rice habitat with wetlands.
- utilization of fertilizers and pesticides is decreased.
- lowers labour costs significantly.
- boosts net income by decreasing the entire cost of cultivation.
- Reduces the release of greenhouse gases including nitrous oxide and methane, making it environmentally friendly.
- With any type of pulse, intercropping, mixed cropping, and crop rotation are options.

Water is saved by using the direct wet sowing method. Since fewer workers are required, labour costs are decreased. Less soil disturbance and a shorter flooding period compared to transplanting rice plants cut methane emissions. The time-consuming, labour-intensive, and water-intensive traditional method of growing rice (Oryza sativa) includes transplantation after repeatedly puddling. To preserve rice productivity and natural resource availability, various concerns must be addressed, such as a lowering water table, a labour scarcity during peak seasons, and deteriorating soil quality. Direct seeded rice (DSR), the oldest method of crop establishment, is gaining popularity due to its minimal input needs. It has some advantages, such as labour savings, a decrease in water use, and labour savings. Comparable yields in DSR can be achieved by implementing a variety of cultural strategies, including choosing acceptable cultivars, choosing the right sowing period, choosing the right seed quantity, and managing weeds and water effectively. Additionally, direct sowing can be used to address soil issues with rice and subsequent crops. The transition from PTR to DSR is hampered by a number of factors, including a high weed infestation, the development of weedy rice, an increase in soil-borne diseases (nematodes), nutritional disorders, poor crop establishment, lodging, the prevalence of blast and brown leaf spot, among others. By overcoming these limitations, DSR may prove to be a very viable PTR substitute that is both technically and commercially viable. In this work, we address both the potential advantages and the potential drawbacks of DSR adoption.

Package of Practices

Habitat: Soil preparation for Aerobic Rice is similar to that for any other desert crop, such as millets, sorghum, corn, or pulses. It is advised to examine every component of soil health and deal with any deficiencies or illnesses. It is preferable to have a high soil carbon content, however it is undesirable to continuously plant aerobic rice throughout the year.

Terrain: Aerobic rice should not be grown in coastal regions or locations with heavy rainfall or unmanageable water.

Land preparation: Slightly sloping areas are suitable for land preparation. Having perfectly level grounds is not necessary. Rows can be prepared for direct planting by plowing behind bullock teams, tractors, or tillers. It's not necessary to keep the soil at "field capacity" during planting or at any other point throughout crop growth. Green manuring is advised in addition to applying and incorporating well-decomposed FYM (25 tons/ha) into the field.

Seed rate in Dry DSR: It is advised to use certified seeds because seed quality significantly affects germination rate. With a 20 cm row spacing and multicrop planter, a seed rate of 20–30 kg/ha is ideal for DSR. This rate should be used with good-quality seeds that have a germination rate of at least 95%.Aerobic rice can be cultivated in both hybrid and variety forms. Use should be made of specifically created or currently available Aerobic Rice varieties for that area.

Seeding: Germination begins when it rains or when irrigation is applied, and it is possible to seed in dry soil. In contrast to the 62.50 kilograms advised for areas with irrigation, just 15 kilograms of seeds are needed for a hectare. Both Kharif and the summer months are suitable for sowing.

Spacing: The inter-row and intra-row distances are 30 cm and 10 cm, respectively. Per hill, only one seed is planted. If at all possible, seeding should be done across the slope to avoid obstructing water flow, which would improve percolation. Crop Management: Intercropping, mixed cropping, relay cropping, and crop rotation with pulses like pigeon pea is recommended.

Earthing-Up: To strengthen the roots of the plants and to promote tillering, earthing-up must be done about 35 to 40 days after sowing. Bullock-drawn inter-cultivator, Kono-weeder, Rotary weeder at the beginning of the crop cycle, furrows can be utilized to both manage weeds and loosen the soil.

Weed Management: In this technique, after pre-sowing irrigation, fields are left as such and weeds are allowed to germinate and thereafter are killed through cultivation or with the use of non-selective herbicide (e.g., paraquat or glyphosate) application or shallow tillage. The aerobic soil condition in DDSR conserves water, but because there isn't any standing water and rice seedlings don't have a "head start" on weed seedlings, the weed problem in DSR is exacerbated. Although the essential weed competition phase in DDSR continues to be up to 41 days after sowing (DAS), weed-free conditions up to 70 DAS are still preferred for improved productivity. Weeds can reduce yields by 15% to 100% if they are not controlled during this time. Weeds compete fiercely with crops for sunlight, nutrients, and water, which lowers production and grain quality. ineffective weed control is the second significant yield barrier in DDSR following a lack of water, however the range of maximum and minimum yield losses varies under different ecologies, as shown in Figure 1. Under DDSR versus TPR, yield losses are still greater. In TPR, a yield loss of about 35% has been documented, however with DDSR, it could increase to 100%. Weeds account for almost 10% of the 40% yield loss in rice caused by different pests, which under DSR might increase to 32%. Thus, among the various agronomic management choices for greater productivity in DDSR, weed management ranks quite highly in terms of relative importance. Shekhawat et al., (2020).

Water Management: It has been demonstrated that dry direct-seeded rice reduces labour and irrigation costs. At any point of the crop cycle, the field has no requirement for standing water. If rains are evenly distributed and plentiful, most open areas would have enough water. Controlling weeds requires either physical labour, a blade harrow pulled by a pair of bullocks, or a tractor or tiller. There are weedicides for pre-emergent and post-emergent combinations. At any point of the agricultural cycle, there is simply no need for standing water in the field. If rains are evenly distributed and plentiful, most open areas would have enough water. Irrigation is required when there is no rain or when the crop exhibits water problems. Any available technique, including flooding, sprinklers, surface or subsurface drips, can be used for irrigation. Priority to rainwater is desired and advised. However, it is advised to avoid any standing water.

Nutrient management: The crop can be completely organic if the soil fertility is excellent; if not, chemical fertilizers may be used to fertilize the crop. The recommended N:P:K basal dosage is 50:50:50. The remaining 50 N can be multiplied by two splits. The second split happens during the tillering stage, the third split happens at the peak vegetative stage. Application of growth stimulators, such as silicon, can increase drought and disease tolerance while boosting productivity.

Pests and Disease Management: Aerobic rice varieties are less prone to infestation. Pest and disease management. Sprays of the appropriate insecticides and fungicides should be used for minor pests and illnesses.

Grain Yield: Experimental yields of 7 tons per hectare of grain have been attained. Farmers that used effective crop management techniques were able to harvest 5–6 tons from their crops. There have been reports of 1.9 to 4 tons per acre under extreme stress situations.

Conclusion

In conclusion, alternative management techniques based on conservation agriculture are effective and environmentally beneficial ways to raise rice cultivation's water productivity. Water is unquestionably one of the most valuable natural resources, yet it is getting harder to find internationally. The irrigated lowland rice system, which is crucial to rice production and food security, is threatened by freshwater scarcity, water pollution, and competition for water use. It is clear from the review that aerobic rice is a potentially viablea substitute for lowland rice where water availability is a concern. Above all, switching to aerobic rice will increase productivity without reducing greenhouse gas emission rates from rice fields. Direct seeded rice (DSR) is an alternative aerobic rice establishment technique that maintains both rice output and resource sustainability. A sustainable rice production method called aerobic rice has the potential to increase rice yields while using less water. Under an aerobic rice production system, it provides benefits such as less labour, less water usage, less drudgery, early crop maturity, low production costs, proper seed and fertilizer placement, increased fertilizer use efficiency, improved soil health for crops, and decreased greenhouse gas (GHG) emissions.However, in order to make aerobic rice a potentially viable substitute for direct seeded rice (DSR), we must first overcome the obstacles to obtaining potential yield under an aerobic system. Adopting various packages and methods with scientific intervention helps to boost rice's production and profitability. Direct seeded rice can be obtained in this way.

References

1. Husain, M. & Haque, Mohammad & Khan, Mohammad & Rashid, Md & Islam, M. (2003). Direct wet-seeded method of establishment of rice under irrigated condition. The Agriculturists. 1. 111-118.
2. Kumar, R., & Batra, S. C. (2017). A comparative analysis of DSR technology Vs. transplanted method in Haryana. *Economic affairs*, *62*(1), 169.
3. Li, H., Guo, H. Q., Helbig, M., Dai, S. Q., Zhang, M. S., Zhao, M., ... & Zhao, B. (2019). Does direct-seeded rice decrease ecosystem-scale methane emissions? —A case study from a rice paddy in southeast China. *Agricultural and Forest Meteorology*, *272*, 118-127.
4. Liu, H., Hussain, S., Zheng, M., Peng, S., Huang, J., Cui, K., & Nie, L. (2015). Dry direct-seeded rice as an alternative to transplanted-flooded rice in Central China. *Agronomy for Sustainable Development*, *35*, 285-294.

5. Mahajan, G., & Chauhan, B. (2011). Effects of Planting Pattern and Cultivar on Weed and Crop Growth in Aerobic Rice System. Weed Technology, 25(4), 521-525. doi:10.1614/WT-D-11-00025.1
6. Rajbir Singh, Gulshan Mahajan and M.S. Bhullar. 2016. Direct Seeded Rice in North West India – Opportunities, Scope and Research Gaps. ICAR-Agricultural Technology Application Research Institute, Ludhiana. Pages:52
7. Shekhawat, K., Rathore, S. S., & Chauhan, B. S. (2020). Weed management in dry direct-seeded rice: A review on challenges and opportunities for sustainable rice production. *Agronomy*, *10*(9), 1264.
8. Zhang M, Jin ZQ, Zhao J, Zhang GP, Wu FB (2015) Physiological and biochemical responses to drought stress in cultivated and Tibetant wild barley. Plant Growth Regul 75:567–574
9. Zhang Y, Wang Y, Zhang C, Dong G, Yang L, Huang J, Chen P, Gong K (2006) Differences of Nitrogen Absorption and Utilization and Their Influences on Grain Yield of Conventional Indica Rice Cultivars. Jiangsu J Agr Sci 22:318-324. doi: 1000-4440(2006)04-0318-07. (In Chinese with English abstract)