

Semi dry rice cultivation for dry land

—An opportunity for dry land agriculture

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In Asia, 90% of freshwater has been exploited by agriculture and more than 50% is utilized to irrigate rice. More than 75% of the rice supply comes from 80 M ha of irrigated rice. Therefore, food security is challenged and threatened by declining water availability. By the end of 2025, 2 M ha of dry season rice and 13 M ha of wet season rice would suffer from physical water scarcity in Asia. Therefore, agricultural scientists are looking for different approaches to reduce water use and increase the water use efficiency for rice production. An alternative approach to reduce water consumption and labour shortage in rice cultivation is of concern. Compared with the 1950s, the importance of direct seeding in irrigated and rainfed lowlands increased during the past three decades, mainly in India. Direct seeding helps maintaining crop residue on the soil surface and so builds soil organic matter that feeds soil microbial activity resulting in healthy soil and improved nutrient exchange capacity, direct seeding requires minimum manpower, fertilizers and minimum water requirement to get on par potential yield.

Keywords: Dry Direct seeding rice, Farm yard manure, Semi dry rice, Transplanted rice

DRY seeding is probably the oldest method of crop establishment. Transplanting, weeding, fertilization, and elaborate water management systems evolved over time. The increased labour supply resulting from population growth made the use of labour-intensive methods of rice production possible. By the 1950s, transplanting had become the dominant method of crop establishment in most of the Asia. Dry seeding was practiced only in those areas where low population density and/or severe climatic/hydrological constraints prevented intensification of rice systems. The direct-seeded area in Asia is about 29 million ha, which is approximately 21% of the total rice area in the region. This estimate also includes upland and submergence-prone environments where opportunities for transplanting are limited. If only the rainfed lowland and irrigated rice ecosystems are considered, the total

direct-seeded area is about 15 million ha. Compared with the 1950s, the importance of direct seeding in irrigated and rainfed lowlands increased during the past three decades, mainly in Malaysia, Thailand, and the India. Direct seeding helps maintaining crop residue on the soil surface and so builds soil organic matter that feeds soil microbial activity resulting in healthy soil and improved nutrient exchange capacity. The method has been gradually replaced with transplanting since the Green revolution, though direct seeding is better for soil health.

Direct-seeding methods

There are essentially two methods of direct seeding, dry and wet seeding, based on the physical condition of the seedbed and seed (dry or pre germinated). Dry seeding is practiced in rainfed lowland, upland, and flood-prone areas. Wet

seeding is commonly practiced in irrigated areas. It is further divided into aerobic wet seeding, anaerobic wet seeding, and water seeding, based on the oxygen level in the vicinity of germinating seed. Seeds are broadcast or sown in rows on dry/moist/puddled soil, whereas only broadcasting is used to seed on water.

Dry seeding

The broadcast sowing/row seeding/drilling/dibbling of dry rice seeds on dry (or moist) soil is called dry seeding. Dry direct-seeded rice (D-DSR) is a traditional practice developed by farmers to suit their agro ecological conditions. This is common in most of the rainfed upland or dryland ecosystem, some areas of the rainfed lowland and deep water ecosystems. In D-DSR, seeds can be sown before the start of the wet season, permitting the use of early rains for crop establishment or up to 30 days after the onset of rains

for upland rice. After emergence, rice plants grow in upland (aerobic) conditions until harvest (upland rice) or with accumulated standing water in the field for a significant part of the crop cycle in rainfed lowlands. Dry-sown rice converted to flooded paddy 30–40 d after sowing is called semidry rice in Tamil Nadu, India. The rice roots are short and fibrous with dense root hairs in dry soil and long and fibrous with long root hairs in wet soil. When dry-sown rice fields get flooded, rice plants undergo a dry-to-wet transition and leaves turn yellow temporarily, probably because of physiological shock and/or induced N deficiency. It is observed that stem rot is serious in dry-seeded rice in soils deficient in K.

Suitable conditions for raising semi dry rice

Soil: SDR can be grown on the same soils being used for transplanted rice, which typically ranges from sandy loam to heavy clay but clay soils are most suitable for SDR cultivation because this soil holds more amount of moisture than other soils and which will provide sufficient moisture later to the crop. In Tamil Nadu, SDR has been grown successfully on clay, coastal alluvium, sandy loam, alluvium, sandy and red soil clay, and black cotton soil.

Climate: Late samba season is most suitable for SDR during the late samba season the seeds are sown or broadcasted in a ploughed dry soil and the weather is prevailing like the maximum temperature up to 32.1 °C and minimum temperature 28.1 °C in coastal Tamil Nadu and the climate is sunny and dry and good for the establishment of SDR. The climate during the early Samba season is also often suitable for the establishment of SDR.

Topography: During late Samba seasons, all topographies are suitable for SDR as there is no rain during the sowing period. However, topography plays a major role during the late Samba/Thaladi season as sowing may



Fig. 1. Oorani

coincide with rainfall, and lower and poorly drained lands should be avoided.

Irrigation and water availability: Generally, SDR system has no irrigation connectivity to the canal, river and other reliable water sources and the tank or *oorani* is the one and only reliable sources for the supplemental irrigation (Fig. 1). The seeds are sown in dry climatic conditions and rainfall will be started after the seeds sown the excess rain water is stored in the tank (*kanmai*) that single tank is being connected with individual field through irrigation channel or bund. The crop is irrigated from 30-35 days onwards, utilizing water impounded in the tanks or canal. The rice field is submerged after tank is filled up

with water. Irrigation may be to a depth of 2.5-5.0 cm only. Follow the schedule of one day after disappearance of ponded water to save water and to bring additional this type of rice cultivation.

Field preparation

After harvesting the summer crops in April-May, the fields should be ploughed in deep. Summer plough/dry plough normally be given to eradicate the weed seeds from the field and get a fine tilth of soil as well as improvement of soil moisture availability for the crop during the entire cropping season.

Good land leveling ensure high yield and reliable production of SDR. This is best achieved using laser assisted land leveling. A level field allows planters/drills to place seed more precisely and enables more uniform irrigation, leading to a uniform crop stand and improved weed control and fertilizer use efficiency. Leveling also helps to reduce irrigation water input (Fig. 2).

Apply gypsum at 1.5-2.0 t/ha basally wherever soil crusting and soil hardening problem exist. Perfect land leveling for efficient weed and water management.

Provide shallow trenches (15 cm width) at an

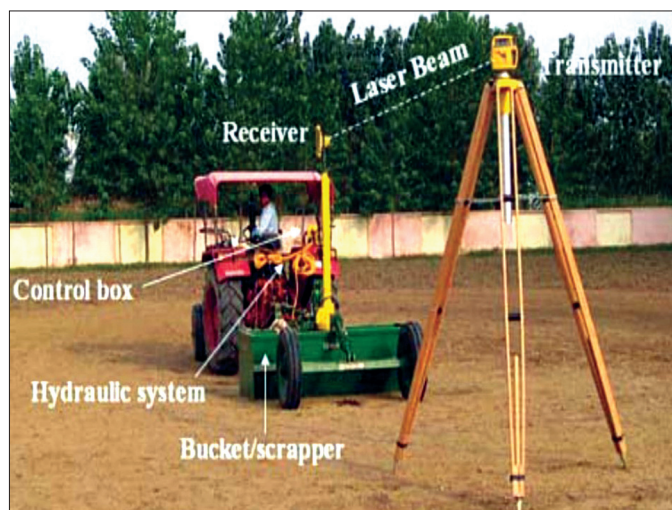


Fig. 2. Land levelling using laser beam



Fig. 3.a. Seed treatment



Fig. 3.b. Sowing of semi dry rice

Table 1. Varieties/hybrids suitable for late samba crop

Condition	Varieties/Hybrids
Saline/Alkaline	Co 43, TRY 1, CORH 2 and TRY (R) 2
Dry and semi-dry	TKM 9, TKM 10, TKM 11, TKM 12, MDU 5, PMK 1, PMK 2, PMK 3, Anna 4 (PMK 4) RMD1 and TPS 3

interval of 3m all along the field to facilitate draining excess water at the early growth stage.

Seed varieties for SDR: Shorter duration varieties/hybrids are preferred for the late samba crop to reduce the irrigation requirement and to enable early harvest, thus reducing the risk of rain at harvest (Table 1).

Seed treatments and sowing

- Seed hardening with 1% KCl or 3% NaCl for 16 hr and shade drying is required.
- On the day of sowing treat the hardened seeds first with *Pseudomonas fluorescens* 10 g/kg of

seed and then with *Azophos* 2,000 g or *Azospirillum and Phosphobacteria* @ 600 g each per ha seed, whichever is available and recommended for SDR (Fig. 3a).

- When the field is in the right condition, broadcast the seeds in the soil with the help of local plough or disk harrow with the application of FYM enriched (750 kg) recommended phosphorous application (25 kg P) before sowing is taken (Fig. 3b).
- Seed rate: 75-80 kg ha⁻¹

Fertilizer recommendations

Blanket recommendation: 80:30:35 kg N:P₂O₅:K₂O/ha

- Apply a basal dose of 750 kg of FYM enriched with fertilizer phosphorus (P at 25 kg/ha).
- Apply N and K in three splits at 20-25, 40-45 and 60-65 days after germination. Each split may follow 25-27 kg N and 11.5 kg K₂O.
- Basal application of ZnSO₄ at

25kg/ha and FeSO₄ at 50 kg/ha and CuSO₄ is desirable wherever Zinc, Copper and iron deficiency were noted.

Weed management: In SDR rice cultivation, weeds are a major problem. Hence effective weed control is very important from the very beginning

- First weeding should be done between 15 and 21 days after germination.
- Second weeding may be done 30 - 45 days after first weeding.
- Apply pendimethalin 1 kg/ha on 5 days after sowing or Pretilachlor + safener (Sofit) 0.45 kg/ha on the day of receipt of soaking rain followed by one hand weeding on 30 to 35 days after sowing.

Pests and diseases: The common insects and pests of SDR rice in the region, and chemicals for controlling them, are listed in Table 2.

Since the yield of direct seeded rice (SDR) is comparable with transplanted rice, this is an alternative option to overcome the problem of labor and water shortage. Methane emissions are substantially reduced in SDR. Therefore, it is gaining momentum among rice farmers as it is more economical than transplanting. However, the poorly managed field may cause partial to complete failure of SDR crop by weeds and dynamics of soil mineral nutrient. The development of early maturing varieties with early seeding vigor and efficient nutrient management techniques along with integrated weed management would encourage farmers to switch over from TPR to SDR culture.

Table 2. Common insects, pests and diseases in SDR

Pest	Stage/period of attack	Chemical name and product dose (kg/ha, g/ha, or mL/ha)
Insect		
Yellow stem borer	July to October	Cartap hydrochloride 4 G (15 kg), monocrotophos 36 SL (1,000 mL), chlorpyrifos 20 EC (2,000 mL)
Leaf folder	Aug to October	Monocrotophos 36 SL (500 mL), chlorpyrifos 20 EC (1,000 mL)
Diseases		
Brown leaf spot	Tillering to flowering	Zineb (1-1.5 kg)
Bacterial leaf blight	Just after transplanting	Copper oxychloride (1,250g)
Blast	Maximum tillering	Carbendazim 50 WP (500 g), tricyclazole 75 WP (300 g)
Sheath rot	Boot leaf stage	Carbendazim 50 WP (250 g), metomino-strobin (500 MI), mancozeb (1,000g)
False smut	Flowering stage, heavy dew situation, January	Proplconazole 25 EC (500 mL), copper oxychloride 50 WP (1,250 g)

Dissolve this in 5 L of water and then mix it with 50 kg of sand and broadcast uniformly in saturated to flooded condition.

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