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Increasing Rice Production through System of Rice Intensification

Aanandi Lal Jat[1]*, S. L. Sirvi[1], H. R. Choudhary[1], Ekta Joshi[2], Manoj Kumar[2], B. Lal[3] and Roshan Choudhary[4]

[1]Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P.)- 221005, India
[2]Indian Agricultural Research Institute, New Delhi-110012, India
[3]Central Rice Research Institute, Cuttack, Odisha-753006, India
[4]Rajasthan College of Agriculture, Maharana Pratap University of Agriculture & Technology, Udaipur- 313001, Rajasthan, India
***Corresponding author email: aanandiagro508@gmail.com**

Rice is the second most important cereal crop in the world covering 155 mha with the annual production of 596 mt. Rice is one of the most important cereals that hold the key for food security. Increasing water scarcity is becoming a real threat for rice cultivation. About 80 per cent of fresh water is being used for agriculture and out of this more than 50 per cent is consumed by the rice crop alone. The system of rice intensification originated in Madagascar and developed by the late father Henry de Laulanie in 1983. SRI is not a new variety or a hybrid. It is only a method of cultivation. SRI has proved to be a promising system under all kinds of rice varieties whether local or improved. SRI has showed great promise of saving water, seed, pesticides, fertilizers, etc producing yields more than or equal to that of traditional cultivation.

Introduction

Rice is the second most important cereal crop in the world covering 155 mha with the annual production of 596 mt. Rice is one of the most important cereals that hold the key for food security. It is a staple food for more than 70 per cent of the people living in Asia where more than 90 per cent of it is produced and consumed. In India, rice presently grown in an area of 42.5 m ha with the production of 91.8 mt (Economic Survey, 2009). At the current rate of population growth, the country has to produce about 130 mt of rice by 2025 to feed the ever growing population. Meeting the targeted demand of rice is a challenging task.

Water scarcity is becoming a real threat for rice cultivation. About 80 per cent of fresh water is being used for agriculture and out of this more than 50 per cent is consumed by the rice crop alone. Rice is labour intensive crop but due to modernization labour availability for agriculture is decreasing and labour wage is increasing. Consequently cost of cultivation is also increasing day-by-day. Another challenge is deterioration of soil health due to imbalance use of fertilizers. Farmers use huge

amount of nitrogen as compare to phosphorus and potassium. Input use efficiency for higher production is also a major concern. In direct seeding system, less germination and more weeds is limiting factor for higher yield. Although transplanted rice gives higher yield but it requires huge amount of water. The existing system of rice establishment are seems to be fail in achieving our challenges. To overcome problems associated to establishment some advancement has been made in transplanting as well as direct seeding rice cultivation.

The System of Rice Intensification (SRI), is one of advanced rice establishment system for meeting through the challenges.

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SRI method is emerging as a potential alternative to traditional way of flooded rice cultivation. SRI has showed great promise of saving water, seed, pesticides, fertilizers, etc producing yields more than or equal to that of traditional cultivation.

Rice Cultivation with SRI

Suitable soils: Unlike in the conventional transplanting system, saline or alkaline soils are not suitable for SRI cultivation. As water needs to be drained frequently in SRI, the salts come to surface, damaging young seedlings. It is therefore advisable to go for soil test before opting for SRI cultivation.

Raising nursery for SRI: Make a raised bed. A bed with a width of 1.25 m is ideal and length of the bed can be decided by the farmer depending on the ground situation. The ideal size of bed is 1.25 m × 8 m. The nursery bed is prepared with application of farmyard manure (FYM) and soil alternately in 4 layers. 1st layer: 2.50 cm thick well decomposed FYM, 2nd layer: 3.70 cm soil. 3rd layer: 2.50 cm with well decomposed FYM, 4th layer: 6.3 cm soil. The FYM helps in easy prostration of roots. To drain excess water appropriate channels should be provided on all sides. The 5 kg seed is required to transplant in one ha of land. For 1 kg seed two beds are required having sizes 1.25 m × 8 m.

Tillering habit of rice in SRI

Sprouted seeds should be sparsely spread to avoid crowding of seedling. Care should be taken that no two seeds should touch each other. It is better to broadcast/spread seeds in the evening. Spread well decomposed FYM or paddy straw over the sown seed thinly. The seeds are not to be directly exposed to sun. This would ensure protection from birds and ants. Straw can be removed once seeds have germinated. Depending on the requirement, watering should be done twice a day (morning and evening). Watering can be done slowly with sprayer by controlling the flow with hand. Care should be taken that the seeds do not come out while watering. The seed bed should be preferably in the centre or corner of the plot and it should not be away from the main field for quick transplantation. If the area is large, separate nursery bed for each acre is recommended.

Preparation of main field: Preparation of main field in SRI is the same as in conventional transplanting. Field should be evenly leveled and there should not be standing water in the field during transplanting. In SRI, method, seedlings are widely spaced (25 × 25 cm) and only one seedling per hill is transplanted. SRI method can accommodate only 16 hills m^{-2}. Uniform spacing is also required for easy weeding by cono weeder. To maintain uniform spacing, different types of 'Markers' are being developed. These markers need to be run over the propagated field lengthwise and widthwise. Transplanting of the marked intersection gives the 25 × 25 cm spacing. Some of the newly developed markers draw 8 rows and column simultaneously. These markers need to be pulled at an even space for proper marking. To have the lines straight, it is advisable to tie a rope and pull the marker along side the rope. The care should be taken that no water stagnation is there in field during marking to obtain clear marks for smooth transplanting, field operations like bunding, leveling and marking with maker should be completed a day before the transplanting.

Transplanting: In SRI, 8-12 days old seedlings are used for transplanting. Uproot the seedlings very carefully. The uprooted seedlings should have seed, soil and roots. Care should be taken to prevent any harm to seedlings while pulling them from nursery or at the time of transplanting. In SRI, young seedlings (8-12 days) are transplanted shallow. Single seedling with seed and soil are transplanted by using index finger and thumb and gently planting them at the intersection of markings. Light irrigation should be given on the next day of transplanting.

Water management: The soil is kept moist but not flooded during the vegetative growth phase. A thin layer of water may be maintained during panicle initiation and grain filling stage. The irrigation is given to wet the soil, just enough to saturate the soil with moisture, subsequent irrigation is suggested when the soil develops fine cracks. Irrigation interval depends on soil type and weather conditions. This method helps in better growth and spread at roots. Regular wetting and drying of soil results in increased microbial activity in the soil and easy availability of nutrient to plants.

Weed management: Absence of standing water provides a congenial environment for weed to proliferate in SRI. If these weeds are incorporated into the soil, they serve as green manure. The weeds in the vicinity of hills which could not be reached by the weeder have to be removed by hand. The 2-4 weeding should be done mechanically with the cono weeder. The cono weeder churns the soil thereby more root growth, reduced weed competition, increased soil biological activity, increased soil aeration, prevent cracking and better nutrient availability. The 1st weeding should be done at 10-12 DAT and subsequent weeding depending on the need, weeding can be done once every 10 days.

Nutrient management: In SRI, instead of chemical fertilizer alone, FYM or compost also applied as source of nutrients. Apply compost 10 t/ha in addition to chemical fertilizers. Regarding chemical fertilizers, only basal dose of NPK (25: 50: 40 kg) is advised. If the quantity of organic matter increased, in future, the dose of NPK chemical fertilizers can still be reduced.

Management of pest and diseases: The incidence of pests and disease is naturally low in SRI because of wider spacing and the usage of organic manures. Natural pest management methods and use of natural bio-pesticides are

recommended whenever necessary to keep pests under control.

Advantages of SRI

i) Water saving

During the vegetative growth period, rice field maintained moist instead of flooding. Therefore, it reduce water requirement by 35-45 per cent.

ii) Greater root growth

This is key to SRI performance though it is unseen. Root pulling resistance was about 5 times greater per plant than for rice plant growth under conventional conditions (Singh, *et. al.,* 2006).

iii) Increased tillering

Transplantation of young seedlings at shallow depth results in quick recovery and establishment and production of more tillers.

iv) More grain filling

With SRI practices, a positive correlation is found between the number of tillers per plant and the number of grain per panicle (Kumari and Kumar, 2006). The inverse relationship that has been observed between tillering and grain tilling occurs in conventionally grown rice plants because they have became practically closed system because of their root degeneration and this causes diminishing return to tillering.

v) Less lodging

The plants have less lodging in SRI compared to the rice plants grown in conventional way because it has stronger tillers and larger root system.

vi) Seed saving

Since a single seedling is transplanted per hill at wider spacing, seed requirement is drastically reduced. This is a benefit particularly for hybrid rice where seed cost can be barrier for adoption.

vii) Increased factor productivity and profitability

Increased factor productivity i.e. yield/hectare, labour (income/hour), water productivity (output/m^3) and monetary returns (profitability) all increase at the same time in SRI practice as compared to normal transplanting.

Constraints in Adoption of SRI

i) Require good water control

The practices are beneficial even without good water management, but the best results depend on maintaining aerobic soil during at least the phase of vegetative growth.

ii) Labour requirement

Farmers using both SRI and conventional practices, labour inputs were 26 per cent higher with the SRI. However, some farmers who have mastered the techniques in Madagascar and Sri Lanka now report that their labour input per hectare is lower with SRI, so the SRI can become labour saving over time.

iii) Motivation and skill

SRI is a skill intensive practice; we think an ambiguous disadvantage of the methodology. Increasing farmer's decision making and management capacities should be seed as an asset rather than as a liability.

Conclusion

The new advances in rice establishment like SRI have greater promises to meet challenges in agriculture by saving water, seed, pesticides, fertilizers, etc producing yields more than or equal to that of traditional system. However it needs to be studied more precisely before recommending for wider adoption and commercial cultivation.

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