



Analysis of Adoption Practices of SRI in Tribal Region of Sundargarh District in Odisha

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HIGHLIGHTS

- Extra care had to be taken in main field preparation in SRI than the conventional method.
- Poor adoption was noted for green manuring, vermicomposting, and applying the recommended dose of compost or farmyard manure.
- Further exposure is needed to understand the benefits, enabling respondents to adopt and continue the SRI rice cultivation method.

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ABSTRACT

The study was conducted in 2020 and data was collected randomly from ten Gram panchayats spread across five blocks of Sundargarh district of Odisha, the total farmers being 96 in the tribal area who had stopped using System of Rice Intensification (SRI) in paddy cultivation. It was found that in spite of all efforts and incentives the farmers were not developing enthusiasm to continue the method. Therefore, the goal of the present study was to assess the causes of discontinuance in SRI method of rice cultivars. It revealed that poor adoption of raising nursery beds at 80-100 cm height, putting seedlings in a thin metal sheet for transplanting, applying recommended dose of manure or vermicompost and green manuring, applying nitrogen in three splits, alternate drying and wetting of the main field, light irrigation during hair line cracks and applying minimum of four weeding at 10 days interval. Path analysis revealed that the socio-economic attribute education through housing pattern, annual income, extension contact, social participation, agricultural implements use significantly influenced adoption practices.

INTRODUCTION

Adopting a demand-driven strategy is crucial for the effectiveness of agricultural extension services, particularly in the ever-changing agricultural sector (Godara et al., 2024). The System of Rice Intensification (SRI) involves a package of practices aimed at increasing yield without relying on additional seeds, chemical

fertilizers, or other external inputs (Agarwal et al., 2019). Key practices for nursery raising include using raised seedbeds (80-100 cm), well-decomposed manure, good drainage, seed treatment, and uniform seed broadcasting. Transplanting 8–12 day-old seedlings (1 per hill) at 25 x 25 cm spacing, maintaining field saturation, weeding with a conoweeder, and emphasizing organic nutrient management are essential steps (Kiran & Shenoy, 2010).

However, SRI practices are labor-intensive and time-consuming. Challenges like inadequate labor skills and the lack of proper equipment for tasks such as leveling, weeding, and nursery management can impede the adoption of these practices (Krishna, 2016). Farmers often struggle with issues like increased weeds, labor shortages, unsuitability for heavy or saline soils, difficulties with markers, improper field leveling, lack of manure, and the need for timely and intensive weed management in nurseries (Biswas & Nath, 2013; Kiran & Shenoy, 2010; Singh & Varshney, 2010). Cono-weeders (58.21%) and nursery management (56.61%) are the primary obstacles to SRI cultivation. In Ranchi, Jharkhand, key challenges include lack of awareness, skilled labor shortages, and the difficulty of using cono-weeders (Agarwal & Kumar, 2017). Farmers often identify challenges such as maintaining water levels in fields, difficulties in mechanical weeding, unreliable irrigation sources, large area coverage with mechanical weeders, unpredictable rainfall, and insufficient organic fertilizers as major barriers to SRI adoption (Pal et al., 2019).

In Imphal, Manipur, a significant issue hindering SRI adoption is the lack of suitable row marker for transplanting (Salam et al., 2022). Farmers are motivated to adopt SRI due to lower cultivation costs, higher yields of grains and straw, access to subsidies, and reduced seed rates (Johnson et al., 2012). A Tobit study highlights that the number of training sessions attended and the availability of extension services significantly affect SRI adoption. A primary barrier to implementation is the lack of competent workers (Handral et al., 2017). To improve adoption nationwide, farmers need to adopt best practices and receive technical support through community-based nursery cultivation (Shanmugasundaram, 2015). Factors such as perceived behavioral control, training participation, and family assets are major determinants of adoption, according to a study using the Theory of Planned Behavior and the Technology Acceptance Model (Moore et al., 2024).

In Balaghat, Madhya Pradesh, research found that paddy production levels among SRI farmers were strongly correlated with landholding, social participation, media exposure, extension involvement, knowledge of SRI technology, and economic motivation (Rahangdale et al., 2011). The present study found that while farmers participated in demonstrations, they did not continue SRI practices despite positive harvest outcomes. This suggests that there are underlying constraints preventing long-term adoption, which was the focus of the research—understanding the deficiencies causing the discontinuance of SRI cultivation in the study area.

METHODOLOGY

In 2020, the research was conducted in the tribal district of Sundargarh. Among the list of blocks, Sundargarh Sadar, Subdega, Balisankara, Bargaon and Nuagaon were randomly selected for the study. A sample of 96 rice growers by using SRI technology from 10 Gram Panchayats of 5 these selected blocks was selected by simple random sampling as the respondents for the study. Nursery raising, main field preparation, transplanting, nutrient, water, and weed management practices were chosen as the statements of adoption scale. The data collected on a scale point of fully, partially, and not adopted over the framed statement were analyzed with a score of 3, 2, and 1 respectively. So 3-point scale was adopted.

Statistical tools such as mean score, gap percentage, and path analysis were employed to reveal the results.

Mean is the average which is calculated by using the following formula.

$$\text{Mean } (\bar{X}) = \frac{\sum fx_i}{N}$$

Where, $\bar{X}$ = The symbol used for mean, Σ = Summation, X_i = Values of i^{th} item, N = Total number of respondents

$$\text{Gap } (\%) = \frac{\text{Total Score-Obtained Score}}{\text{Total Score}} \times 100$$

RESULTS

Proper care should be taken in the preparation of a good nursery bed. The seedling must be healthy as 8-10 days old seedlings are to be transplanted. Well-pulverized seed beds, application of well decomposed manure, seed germination, and showing at shallow depths are some of the important practices in raising nursery beds. However, the raised beds help improve water drainage, prevent soil compaction, and allow for better root growth by ensuring the seedlings have access to well-drained soil but poor adoption was observed (Table 1) on raising seed beds at 80-100 cm height. Poor adoption rates were observed on alternate drying and wetting of the main field and light irrigation during hairline cracks. This practice is crucial in SRI because it helps in regulating water usage and prevents the field from becoming either too dry or too waterlogged, both of which could hinder plant growth. It is also recommended to keep 2-3 cm of standing water after flowering as well as draining water after 20 days of flowering to harvest well-matured and bold grains. However, the adoption of these practices was not satisfactory. The respondents therefore need to be further exposed to extension approaches for a clear understanding about the benefits of all these practices. Special management practices are to be adopted in the SRI method. Young seedlings of 8-12 days are advised in transplanting. The seedlings should not be damaged either during uprooting or transplanting in the main field alongwith keeping the seeds intact. Only one seedling need to be transplanted at shallow depth and erect per hill at a spacing of 25 x 25 cms. Only organic manure is recommended in the SRI method of rice cultivation. However, the State Department of Agriculture has advised applying half dose of recommended fertilizers in rice along with organic manure due to unavailability. Green manuring and vermicomposting are also recommended to supplement farm yard manure. Poor adoption was observed on the adoption of green manuring and vermi compost application and 4 weeding at 10 days interval. 4 weeding at 10 days interval practice of conducting a minimum of four weeding at 10-day intervals ensure that the paddy plants are not deprived of these essential resources. Transplanting seedlings using a thin metal sheet serves as a technique to avoid root damage during the transplantation process but poor adoption rate was observed in putting seedlings in a thin meta sheet for transplanting The metal sheet holds the seedlings in place, ensuring they are planted in a straight line at the correct spacing and depth. This practice helps in maintaining uniformity in seedling placement,

Table 1. Analysis of Adoption of practices

Sl.No	Practice	Mean score	Poor/High
i.	Raising seed bed at 80-100 cms height	1.51	Poor
ii.	Light irrigation during hairline cracks	1.52	Poor
iii.	Putting seedlings in a thin meta sheet for transplanting	1.68	Poor
iv.	Adopting green manuring practices	1.69	Poor
v.	Producing and applying vermicompost	1.78	Poor
vi.	Minimum of 4 weeding at 10 days interval	1.97	Poor
vii.	Alternate drying and wetting of the main field	1.98	Poor
viii.	Maintaining water soil saturation	3.00	High
ix.	Keeping drainage channel around sub-plotting	3.00	High
x.	Not keeping standing water during transplanting	2.94	High
xi.	Irrigating one day before weeding	2.91	High
xii.	Using cono/mandvaweeder for weeding	2.88	High
xiii.	Applying potash in two splits	2.86	High
xiv.	Planting seedlings erect at shallow depth	2.95	High
xv.	Not keeping standing water during transplanting	2.94	High
xvi.	Irrigating one day before weeding	2.91	High
xvii.	Using cono/mandvaweeder for weeding	2.88	High
xviii.	Raising seedling in 100 sq meter area for transplanting 1.0 ha land	2.52	High

Table 2. Path analysis of socio-economic attributes influencing adoption

S.No.	Attribute	Total effect	Total direct effect	Total indirect reflect	Substantial effect		
					I	II	III
X ₁	Age	0.128	0.087	0.041	0.173x ₉	-0.123x ₁₁	-0.034x ₁₀
X ₂	Education	0.143	-0.184	0.327	-0.156x ₁₂	0.086x ₁	-0.042x ₄
X ₃	Caste	0.346	0.136	0.210	-0.144x ₁₃	0.105x ₆	-0.042x ₁₁
X ₄	Housing Pattern	0.421	0.197	0.224	-0.206x ₂	0.167x ₉	0.088x ₁₃
X ₅	Holding size	0.251	0.084	0.167	-0.223x ₅	0.172x ₈	0.074x ₁
X ₆	Social participation	0.213	-0.061	0.274	-0.051x ₄	0.017x ₇	-0.012x ₂
X ₇	Cosmopoliteness	0.225	0.000	0.225	0.203x ₁₂	0.194x ₁₀	-0.023x ₂
X ₈	Extension contest	0.254	0.167	0.087	-0.276x ₁₀	-0.150x ₂	-0.045x ₄
X ₉	Agricultural implements use	0.608	0.475	0.133	-0.172x ₁	0.089x ₆	0.035x ₂
X ₁₀	Annual income	0.371	0.116	0.255	0.062x ₂	0.052x ₉	-0.008x ₅
X ₁₁	Family type	0.049	0.053	-0.004	-0.234x ₇	0.074x ₄	0.003x ₁
X ₁₂	Family size	0.061	-0.066	0.127	0.184x ₁₁	0.169x ₁₃	-0.124x ₃
X ₁₃	Occupation	-0.161	-0.070	-0.091	0.143x ₆	-0.106x ₇	-0.008x ₁₁

(Highest indirect effect – Education, Residual effect –0.022)

which is important for ensuring that plants have adequate space to grow and access nutrients, thus enhancing their productivity. Poor adoption rate was observed on alternate drying and wetting of the main field. So the farmers should be adopting these practices to get more yield because it reduces methane emissions from rice fields, improving environmental sustainability. The technique mimics natural drying and wetting cycles, which are beneficial for rice plants and promotes healthy root development. Good rates of adoption were observed in maintaining soil water saturation, keeping drainage channel around sub-plotting, not keeping standing water during transplanting, irrigating one day before weeding, using cono/mandvaweeder for weeding, applying potash in two splits, planting seedlings erect at shallow depth, not keeping standing water during transplanting and irrigating one day before weeding.

Simple correlations are divided into direct and indirect effects in linear structural analysis, also known as path analysis, which is a cause-and-effect relationship. As a result, path analysis was used

to break down the impact of socioeconomic characteristics into direct, indirect, and residual impacts. Table 2 shows that the use of agricultural tools has the greatest direct impact on faster adoption of techniques. Similarly, the characteristic education had the strongest indirect influence, showing correlations with the use of agricultural implements, social participation, cosmopoliteness, annual income, housing patterns, and extension contact.

DISCUSSION

The SRI method's success is contingent on optimal water management, which may not be feasible in areas with irregular rainfall or water scarcity. Better adoption were observed on seedling raising of 100 sq meter area transplanting in 1.0 ha land, drainage channel in all sides of seed bed, proper levelling and sowing sprouted seeds in line at shallow depth. Transplanting has to be done at a spacing of 25 x 25 cm being marked with marker to maintain the plant density of 16 hills per meter square. Poor adoption observed on

this practice requires further sensitization to maintain optimum spacing for more effective tillers resulting better production. Keeping seedlings in a thin metal sheet make easy to separate single seedlings from the bunch in transplanting which were not being adopted by majority of the respondents. Further sensitization through effective extension approaches have to be organized for clear understanding about the benefits that may motivate rice growers to adopt SRI. Organic manure improves soil structure as well as multiplication of micro-organisms in soil enhancing more nutrient availability to the plant, the growers have to be sufficiently exposed to realise the benefits which further motivate the growers to adopt green manuring and vermicompost use to supplement organic manure along with nitrogen use in three splits to achieve the desired production. As SRI method of rice cultivation is an organic way, herbicide application is usually avoided. It is therefore suggested to incorporate the weeds into the soil with at least four weeding at 10 days interval. The growers have to be well equipped with detail knowledge and understanding for adoption of the practices. Path analysis illustrates that the attribute education channelized through housing pattern, annual income, extension contact, social participation cosmopolitaness, and use of agricultural implements could exhibit significant influence in increasing the adoption of practices in the SRI method of rice cultivation. As the residual effect is 0.022, it was found that 2.20% of the variation in this relation could not be explained.

CONCLUSION

The System of Rice Intensification (SRI) aims to boost rice production by altering plant, soil, water, and nutrient management. Despite the efforts of Odisha State Department of Agriculture to promote SRI, farmers are discontinuing the practices. Reasons for poor adoption include inadequate nursery bed height (80-100 cm), improper levelling, small bed size (1 x 10 meters), and uneven application of well-decomposed manure. Additionally, transplanting deficiencies include insufficient organic manure, improper spacing (25 x 25 cm), and using thin metal sheets for seedlings. In rice cultivation using the SRI, poor adoption was observed in water management practices, including alternate drying and wetting, irrigating during hairline cracks, and maintaining 2-3 cm of standing water after flowering. Deficiencies in weed management included inadequate weeding (only four at 10-day intervals) and insufficient incorporation of weeds into the soil. To boost yield and encourage SRI adoption, further education on its benefits is essential.

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