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Farm-centric based knowledge analysis on system of rice intensification for boosting paddy productivity

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Abstract

SRI (System of Rice Intensification) cultivation has gained significant traction in the agricultural landscape of Odisha. This innovative approach to rice cultivation emphasizes the optimization of resources while increasing yield. The present study, aimed to assess the farmers' knowledge of different practices under SRI in Ganjam district of Odisha were rice cultivated as major crop with purposive selection, then two developmental revenue blocks selected based on production potential and eighty farmers selected through probability proportionate simple random sampling method during 2022. The parametric and non-parametric statistical tools used for data analysis and meaningful interpretations were made. The findings suggest that most of SRI farmers had full knowledge on selection of land, land preparation, selection of seed, raising nursery, overall knowledge on SRI practices found as 80.71 per cent. Additionally, the study also indicates that about 66% to 68% respondents had full knowledge on maintaining water at soil saturation, providing drainage channel to avoid submergence and alternate drying and wetting; these practices are essential for successful SRI cultivation as they ensure the optimal growth conditions for rice plants. However, it is worth noting that more than 30% of respondents demonstrated only partial knowledge of these critical SRI practices. Among the 16 socio-economic attributes annual income had significance at 0.01% with knowledge of SRI farmers. There are rice farmers who need appropriate technological guidance and support from the extension functionaries to improve the knowledge level of recommended SRI practices.

Keywords: Extension functionaries, farm-centric, knowledge, practices, productivity, SRI

Introduction

India has the world's largest area devoted to rice cultivation, and it is the second largest producer of rice after China. Over half of its rice area is irrigated, contributing 75 per cent of the total production. Indian agriculture is dominated by small and marginal farmers (land holding of <2 ha) and constitute 82 per cent of the total farmers' population. The proportion of total population engaged in agriculture is 49 per cent. Due to unavailability of resources, there exists a gap between actual yield in farmers' field and potential yield of the crop (Aggarwal *et al.*, 1997) [1].

In Odisha, Rice is cultivated in an area of 4.17 million ha with a production of 8.29 million tonnes and productivity of about 2 t ha^{-1}. Odisha is the 8th largest state in India covering an area of 15.57 million ha, out of which the net sown area is 4.18 million ha. Rice is the principal food grain of the state. (Agricultural Statistics at a Glance 2015, Ministry of Agriculture, and Government of India) [8].

The System of Rice Intensification (SRI) represents an innovative approach to rice cultivation aimed at enhancing rice yield through a holistic set of techniques that require reduced quantities of seeds, water, chemical fertilizers, and pesticides (Rahangdale *et al* 2011) [5]. The SRI technology is a slow-moving innovation that merits ongoing repetition over the years, allowing beneficiaries to gradually continue with the practice as they become convinced of its tangible benefits (Johnson *et al.* 2012) [2]. About 78% of Indian farmers fall under the resource-poor category, characterized as small-scale and marginal growers. This classification limits their capacity to utilize optimal input quantities and embrace novel agricultural technologies that are crucial for enhancing crop output. In this context, the System of Rice Intensification (SRI) emerges as a viable solution for augmenting crop yield while reducing input requirements. (Varma, 2017) [10].

Over time, there has been a progressive decline in the rice cultivation area. This decline can be attributed to the sustained cultivation of crops without proper consideration for soil health and the depletion of natural resources, which has also led to disturbances in our ecosystem. In response to

this situation, individuals have begun to adopt the System of Rice Intensification (SRI) approach for cultivating rice. This method involves implementing appropriate management techniques for the cultivation of crops, nurturing soil quality, conserving water, and optimizing nutrient usage. (Thatchinamoorthy & Selvin, 2014) [9]. The new improved technologies will eventually lead the farmers to discontinue the old practice and to adopt new technology (Sharma *et al.*, 2011) [7]. Despite the considerable economic benefits associated with the System of Rice Intensification (SRI) methodology, its adoption has remained limited, influenced by diverse factors (Nath &Das, 2018) [3]. Despite the fact, State Department of Agriculture in Odisha making extensive efforts like awareness campaign, hands on training and offering various incentives from government agencies, there is a noticeable lack of enthusiasm among farmers (Ray & Raj 2014) [6]. On this backdrop, the present study was undertaken to assess the farmers' knowledge of different practices under System of Rice Intensification in Ganjam district of Odisha.

Methodology

The present study was carried out purposively in Ganjam district of Odisha, because Ganjam is one of the major agricultural districts in Odisha, where many farmers practicing SRI. Thus, it provided ample opportunity to generate the relevant data from the farmers regarding SRI cultivation practices and adoption behaviour of farmers with respect to scientific practices of SRI cultivation practices. Two blocks from Ganjam districts were selected randomly for the study, which were Digapahandi and Sanakhemundi. From each block, two villages, thus a total of four villages namely, Bhismagiri and Phasibanda from Digapahandi block and Pudamari and Pattapur from Sanakhemundi block were selected randomly for the present study. As the farmers are the primary respondents, a list of farm families practising SRI on a regular basis was prepared from each selected village. Thereafter, a probability proportionate sample of farmers from each village was selected randomly to choose a total of 80 respondents for primary data collection through personal interview. Ex- post facto research design was adopted for the study as the investigator has no scope to manipulate the independent variables, because these have already occurred.

A 5-point continuum scale was used to record the farmers' responses on each intervention that was ranging from Very highly effective (5) to very low effective (1). The data were collected with the help of aforesaid personal interview schedule constructed for the study. Data were collected in four villages of Ganjam district covering 80 farmers cultivating rice following SRI. The main statistical techniques and tools used were frequency and percentage, mean, standard deviation, range, co-efficient of variation, correlation coefficient, and multiple regression and interpretations were made.

Results and Discussion

Farmers Knowledge of Different Practices under SRI

Knowledge is an important tool which facilitates in decision making to make farming more profitable and sustainable. In the present study, knowledge of the respondent-farmers was measured on SRI practices on 3-point continuum scale and score assigned: Full Knowledge- 2, Partial Knowledge- 1, and No-Knowledge- 0, respectively. The collected data were analysed and results are presented in following tables.

Table 1: Distribution of respondents based on their overall knowledge level regarding different practices of SRI

Sl. No.	SRI Practices	Mean score (SD)
		Knowledge
1	**Selection of land**	
	Medium upland/ medium lowland/ lowlands, where water doesn't stand, are suitable	2.00 (0.00)
	Irrigation facility is needed for medium uplands	1.98 (0.16)
	Overall (%)	100 (0.00)
2	**Land preparation**	
	4-5 ploughing is required for preparing land	1.93 (0.27)
	6-inch depth of ploughing is to be ensured in the last ploughing	1.9 (0.30)
	Preparing well levelled fields with good drainage	1.85 (0.36)
	Require Good puddling and levelling	1.86 (0.35)
	Making channels after 2 m distance	1.86 (0.35)
	Marking at 25x25 cm Distance	1.71 (0.46)
	Not keeping standing water during transplanting	1.69 (0.47)
	Overall (%)	91.43 (11.94)
3	**Selection of seed**	
	Improved variety of seed	1.81 (0.39)
	Medium lowlands and lowlands require varieties of 150 days duration	1.39 (0.67)
	Medium uplands require varieties of 120 days duration	1.4 (0.49)
	Overall (%)	76.67 (20.98)
4	**Preparation of nursery bed**	
	Selecting 40 sq m area for one acre crop	1.74 (0.47)
	Bed size 1x10 meter	1.63 (0.49)
	Preparing raised bed of 8-10 cm height	1.65 (0.48)
	Putting well mixed soil and FYM of equal amount on the bed	1.63 (0.49)
	Provide drainage channels on all sides	1.65 (0.51)
	Overall (%)	82.88 (18.77)

5	**Raising nursery**	
	Using 2 kg seeds per acre	1.79 (0.41)
	Selecting good quality seed with salt solution	1.65 (0.51)
	Sowing only sprouting seeds	1.78 (0.42)
	Broadcasting the sprouted seeds on the seed bed	1.71 (0.46)
	Covering seeds with well decomposed FYM	1.66 (0.53)
Overall (%)		85.88 (17.48)
6	**Transplanting**	
	Transplanting 8-12 days old seedlings	1.44 (0.50)
	Putting seedlings with a thin metal sheet of 30x30 cm	1.46 (0.50)
	Transplanting one seedling per hill	1.6 (0.52)
	Transplanting immediately after uprooting from nursery	1.66 (0.50)
	Not removing seeds from the plant while transplanting	1.64 (0.51)
	Not washing the seedlings after uprooting	1.54 (0.57)
Overall (%)		77.81 (19.12)
7	**Fertilizer management**	
	Applying 4-5 tonnes FYM/compost per acre	1.59 (0.50)
	Applying before ploughing and incorporating	1.65 (0.48)
	Applying green manuring/brown manuring, vermi-compost	1.53 (0.62)
	Applying 60:30:20 kg NPK	1.66 (0.48)
	Applying nitrogen in three doses	1.66 (0.48)
	Applying potash in two doses	1.66 (0.48)
	Applying panchagavya	1.04 (0.75)
Overall (%)		77.05 (20.45)
8	**Water management**	
	Maintaining water at soil saturation	1.66 (0.48)
	Provide drainage channel to avoid submergence	1.66 (0.50)
	Alternate drying and wetting	1.68 (0.47)
	Light irrigation during hairline cracks	1.51 (0.55)
	Keeping 2-3 cm standing water during flowering to maturity	1.51 (0.55)
	Draining water 20 days after flowering	1.5 (0.53)
Overall (%)		79.38 (19.26)
9	**Weed management**	
	Irrigating field before one day of weeding	1.39 (0.58)
	Using cono/mandwa weeder for weeding	0.83 (0.82)
	Incorporating weeds into the soil	1.34 (0.48)
	Four weeding at 10 days interval	1.44 (0.50)
	Uprooting weeds manually near to the plants	1.36 (0.51)
Overall (%)		63.56 (23.92)
Grand total of SRI practices (%)		80.71 (13.26)

It is evident from Table 1 that in case of selection of land, the overall level of knowledge 100%; however, regarding land preparation knowledge level is 91.43%. Knowledge index values with respect to selection of seed and preparation of nursery bed are 76.67% and 82.88% respectively. Knowledge under raising nursery and transplanting practices in SRI are found 85.88% and 77.81% respectively. The practices like fertilizer management, water management and weed management with knowledge index values of 77.05%, 79.38% and 63.56%, respectively. Overall knowledge of SRI practices are observed as 80.71%. This research study findings on knowledge level of farmers practicing SRI are similar to some of the results of the study undertaken by Nirmala *et al.* (2015) [4] in Karnataka and it was evident that, majority of the respondents (67.50%) had medium level of knowledge followed by low (21.67%) and high (10.83%); motivational factors for knowledge upgradation towards SRI method are also reported.

The correlation analysis indicates that farmer's attributes like years of education, land holding, annual income, economic status, domestic asset, farm implements and machinery, total irrigated land, personal localite information sources use, personal cosmopolite information sources use, mass media exposure, social participation are significantly and positively correlated with knowledge level on SRI practices (Table-2).

Correlation analyses have indicated the significant association of SRI farmers' selected attributes with their knowledge; However, it does not indicate the functional relationship among those variables. To reveal functional relationship, multiple regression analyses were done considering the selected attributes of the SRI farmers as independent variables and knowledge level as dependent variables, respectively.

Table 2: Correlation between the Socio-economic attributes of farmers and their knowledge on SRI practices

Sl. No.	Socio-economic Attributes	Correlation Coefficient (r)
		Knowledge
1	Age (year)	-0.151
2	Years of education	0.311**
3	Size of family	-0.064
4	Earning members	-0.030
5	Land holding (ha)	0.365**
6	Annual income	0.450**
7	Economic status	0.258*
8	Farming experience (years)	-0.199
9	Domestic asset	0.336**
10	Livestock	0.133
11	Farm implement & machinery	0.314**
12	Total irrigated land	0.379**
13	Personal localite information sources use	0.368**
14	Personal cosmopolite information sources use	0.317**
15	Mass media exposure	0.370**
16	Social participation	0.329**

**Significant at the 0.01 level; *Significant at the 0.05 level

Table 3: Multiple regression (enter method) between the attributes of farmers and their knowledge level on SRI practices

Sl. No.	Attributes	Std. Error	Beta	t-value	Sig.
1	Age(year)	0.298	0.176	0.634	0.528
2	Years of education	0.392	-0.005	-0.034	0.973
3	Size of family	0.690	0.113	0.877	0.384
4	Earning members	2.611	-0.186	-1.458	0.150
5	Land holding (ha)	2.746	-0.186	-0.559	0.578
6	Annual income	0	0.202	1.306	0.196
7	Economic status	5.401	-0.007	-0.056	0.955
8	Farming experience (years)	0.312	-0.382	-1.362	0.178
9	Domestic asset	0.991	0.063	0.469	0.641
10	Livestock	0.773	0.024	0.205	0.838
11	Farm implement & machinery	1.070	0.024	0.164	0.870
12	Total irrigated land	1.127	0.396	1.263	0.212
13	Personal localite information sources use	0.126	0.160	1.311	0.195
14	Personal cosmopolite information sources use	0.119	0.140	1.156	0.252
15	Mass media exposure	0.126	0.094	0.655	0.515
16	Social participation	0.203	0.166	1.458	0.150
R=0.668, R^2=0.446, F value=3.020**					

Table 4: Multiple regression (backward method) between the attributes of farmers and their knowledge of SRI practices

Sl. No.	Attributes	Std. Error	Beta	t	Sig.
Constant (56.281)		7.807		7.209	0
1	Annual income	0	0.285	2.552	0.013
2	Farming experience (years)	0.105	-0.265	-2.825	0.006
3	Total irrigated land	0.363	0.216	2.135	0.036
4	Personal cosmopolite	0.096	0.197	2.024	0.047
5	Social participation	0.173	0.194	2.002	0.049
R=0.628, R square=0.395, F value=9.257**					

The result of multiple regression (Enter method) between attributes of farmers as independent variables and their knowledge level on SRI Practices as dependent variable is presented in Table 3. It is revealed that all of the selected attributes together have determined 44.6% (R square=0.446) of knowledge level of SRI Farmers.

Thereafter, multiple regression analyses were conducted following backward elimination method (Table 4) The analysis reveals that annual income, farming experience, total irrigated land, personal cosmopolite information sources use and social participation explain 39.5 percent (R^2=0.395) of variation in the farmers' knowledge on SRI practices. The regression coefficient (-0.265) of the farming experience is negative, implying the less knowledge of younger farmers on SRI practices.

Conclusion

Rice covers about 69% of the cultivated area and is the major crop, covering about 63% of the total area under food grains often as a single crop though with tremendous diversity of rice varieties. The SRI (System of Rice Intensification) method represents a creative approach to rice cultivation that has garnered significant attention in the agricultural world. The knowledge levels of farmers about SRI practices are assessed. The correlation analysis demonstrated that socio economic attributes of farmers, such as education, landholding, and information source usage, are significantly and positively associated with their knowledge of SRI practices. However, multiple regression analysis identified that only specific factors like annual income, farming experience, irrigated land, personal cosmopolite information use, and social participation explain the knowledge variation, with younger farmers

showing less knowledge. There are certain groups of farmers who need appropriate technological guidance and support from the extension functionaries to improve the knowledge level of recommended SRI practices. Present study is precursor of future research as well as policy advocacies in revamping Paddy cultivation through SRI method in Ganjam district of Odisha and also in other region of the country.

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