**Extent of Adoption of System of Rice Intensification (SRI) Technology for Sustainable Rice Production in Tripura**

**ABSTRACT**

The present study was conducted on 240 number of respondents randomly selected from ten villages under the Gomati and North district of Tripura. For finding out the extent of adoption of system of rice intensification (SRI) technology, 19 independent and one dependent variable were selected for the study. Data were collected through personal interviews during the Aman season of 2022–23. For data analysis, frequency; percentage; ranking and coefficient of correlation was carried out. It was revealed that around 60.00% of the paddy farmer fall under medium level of adoption and only 26.67 % of the paddy farmers had a high level of adoption. It was evident that age, education, annual income, income from paddy cultivation, land holding, innovation proneness, training exposure, Government subsidies and market orientation are found to be positively correlated and significant with adoption of SRI practices and major constraint faced by respondents was identified as labour constraints as priority constraints faced by most farmers followed by lack of technical knowledge.

**Introduction**

System of rice intensification (SRI) is a synergistic management strategy that involves four major components of rice cultivation, such as planting, weeding, irrigation, and nutrient management. SRI has been shown to help increase yield and substantially reduce water and other input requirements by altering crop, soil, water, and nutrient management practices (Dahiru, 2018). In 1980s it was first developed by a Jesus Priest Father Henry D Laulanae in Medagaskar as system of rice intensification. This new set of practices greatly improved the growing environment for rice plants, evoking more productive phenotypes from all rice genotypes with a host of improved practices under specific recommendations *viz*., minimum water use, and single transplantation of young seedling in a square pattern of spacing through efficient soil and nutrient management rather than use of new or purchased external inputs. It is been observed that system of rice intensification (SRI) practices results in a significant decrease of inputs such as seeds, chemical fertilizers and water supply which has a direct affect on production costs (Johnson and Vijayaragavan, 2011). Tripura is the third smallest state among the north-eastern states but second largest producer of rice after Assam. In Tripura, rice is the major cereal crop and food security strictly depends on rice production, as no other cereals are grown by the farmers of this state due to dietary habit and agro-climatic condition. Department of Agriculture has implemented strategic efforts to promote system of rice intensification (SRI) method of rice cultivation for enhancement of rice productivity and thereby to attain food self-sufficiency. Tripura was the first among North Eastern state to adopt, assess and promote system of rice intensification (SRI) technology since 1999. The adoption of the system of rice intensification (SRI) technology in paddy cultivation could increase productivity of rice from 2.5 t/ha to about 3.5 t/ha. The State Department of Agriculture has taken initiatives to promote SRI paddy cultivation techniques, but the expected result is yet to be achieved. Keeping these facts in view, a research study was conducted with the objective of evaluating the extent of adoption and factors influencing the adoption of SRI paddy cultivation technology.

**Materials and Methods**

The present study was carried out in Gomati and North district of Tripura during 2022-23. Ex-post facto research design was employed. From two district, 40 numbers of villages was selected randomly, from the selected villages 240 numbers of farmers were selected randomly and interviewed personally with the help of pretested survey schedule developed for the study. Frequency, percentage and rank were used as statistical measures to analyze the data. Mean percent score (MPS) was calculated for each of the constraint on the basis of their degree of magnitude and ranked in order of their significance as suggested by Tanwar( 2011).

**Results and Discussion:**

An investigation was carried out on the adoption of selected recommended SRI technology practices followed by the farmers. In total, fifteen selected cultivation practices of SRI technology were studied in terms of the number of adopters as well as the extent and nature of adoption of each individual practice (Table-1).

**Selection of irrigated land: Rice** can be cultivated in a various range of soil types, from sandy loams to clay soils. For cultivation of rice crops clay loams is best soil. Although rice crops can withstand various group of soil but mostly it prefers acidic soils with a pH between 5.5 to 6.5. It was found that majority (57.5 %) of respondent were reported to have good irrigated land followed by 42.5 % with semi and rainfed land.

**Land preparation:** The main paddy field is prepared and land is levelled with little standing water a day before seedling transplanting. There should be 30 cm wide channels at every 2 meters interval. Perfect levelling is the pre-requisite for proper water management and good crop stand Kumar *et al.,* (2007). It was observed that majority (77.92%) of the respondents adopted the scientific way of land preparation of the main field followed by 53.00 % partial adoption.

**Use of HYV/hybrid seeds:** It has been observed that any variety, whether high yielding or land race, shows a higher response under SRI. The genetic potential of any variety or cultivar is expressed better in SRI because of the changed growing environment. Even though hybrids seem to fair well when compared to other cultivars Adhikari *et al.,* (2010). It was found that only 55.83 % of respondent were able to get good quality HYV/Hybrid seed from various Govt. source and other are growing local or pre owned seeds.

**Seed treatment:** Seed treatment with fungicides plays an important role in protecting the seeds and seedlings from different seed and soil borne diseases and insect pests affecting crop emergence and its growth. It was found that only 50 percent have adopted the practice followed by 33.33 % no adoption at all and for proper adoption of this practice by the farmers may requires effective extension strategies making the appropriate chemical pesticides/bio-pesticides and equipment’s available to the farmers and informing its important with the help of training and demonstration.

**Recommended seed rate per ha:** In SRI cultivation about 2 kg of seeds (5 kg / ha) is required to transplant in one acre of land. Paddy seeds should be evenly spread to avoid crowding of seedlings, when it’s germinated and care should be taken that no seeds should touch each other as much as possible. From the table-1, It is been observed that majority (48.55 %) of farmers followed recommended seed rate.

**Application of organic manure in nursery raising:** Nursery bed is prepared with application of farm yard manures (FYM) and soil in four alternating layers. The organic manure should be mixed properly that will help germinate the seeds and also minimize root damage during seedling pulling out from the bed. Majority of the respondents (42.92 %) showed no adoption of recommended practice in nursery management and only 31.25 % fully adopted the technology.

**Age of seedling (8-12 days old):** The reason for using the younger seedlings of 10-12 days age old is for profuse tillering and to have a potential for producing maximum number of tillers and roots simultaneously. It was observed that majority (40.00 %) of farmers used younger seedling followed by 32.50 % of farmers who use beyond recommended age of seedlings.

**Transplanting spacing (25x25 cm):** Result in the Table 1 also revealed that 38.33% of respondents were unable to adopt for maintaining of transplanting spacing in SRI technology, while only 36.25 % of respondent were able to adopt the recommended transplanting spacing (25x25 cm). Less adoption of transplanting spacing may be due to the fact it is labour intensive activity .The reason for using wider spacing is to obtaining the optimum number of tillers/ panicles for maximum yield.

**Number of seedlings/hill (1 Seedlings/hill):** In SRI technology, it is recommended to transplant only one seedling per hill to avoid minimum trauma to the roots and to avoid root competition and to obtaining the optimum number of tillers/ panicles for maximum yield. It was found that only 43.33 % of farmers were tried to adopt the practice partially followed by 32.92 % of farmers who fully full adopted the recommended number of seedling for transplanting.

**Application of recommended dose of NPK:** As much as 74.17 per cent of respondent fully adopted recommended NPK- fertilizer dose and while only 25.83 per cent of respondent partially adopted the recommended NPK- fertilizer dose. Partial adoption of recommended dose of NPK may be due to lack of awareness or misinformation. It may be concluded that majority of the farmers had used recommended dose fertilizer on their crops.

**Application of Organic manure:** It was revealed that majority (42.92%) of respondents applied organic manure for paddy cultivation. Organic manures are recommended in SRI cultivation, as they provide better response to crop growth and nutrient supply (Singh 2004).

**Weed management:** It was found that majority of farmer (49.17 %) have effectively managed weed infestation. Alternate wetting and drying in SRI results in excessive weed growth leads to immense loss in yield if remain unchecked for longer time. In SRI, the weeds are incorporated by operating cono weeder between rows at the right time, which also supply nutrients to the crop as green manures. The foremost advantage of using a mechanical weeder is for minimizing time requirement and also adds organic matter to the soil. This gives the benefits of cultivating a green manure crop (Adhikari *et al.,* 2010).

**Plant protection:** Majority of the respondents 41.67 % were found in full adoption and 42.50 % were found in partial adoption in plant protection of transplanted crop in SRI cultivation by the farmers. The reason is that to reduce the critical crop weed competition (30-45days) after sowing otherwise yield get reduced to 15-40 %.

**Irrigation (alternative wetting and drying):** It is recommended that up to panicle initiation stage, to irrigate the field to 2.5 cm after the previously irrigated water disappears and hairline cracks develop and it is important point to remember that in SRI cultivation rice does not require flood water and it is enough to keep the soil moist (Adhikari *et al.,* 2010). It was observed that majority of farmers have adopted the practice followed by 33.33 percent who partially adopted.

**Table.1 Distribution of respondents based on extent of adoption of system of rice intensification (SRI) technology among the farmers (n=240)**

|  |  |
| --- | --- |
| **Package of practices** | **Extent of Adoption** |
| **Full adoption** | **Partial adoption** | **No adoption** |
| F | P | F | P | F | P |
| Selection of irrigated land | 138 | 57.50 | 102 | 42.50 | 0 | 0.00 |
| Land preparation  | 187 | 77.92 | 53 | 22.08 | 0 | 0.00 |
| Use of HYV/Hybrid seeds  | 134 | 55.83 | 50 | 20.83 | 56 | 23.33 |
| Seed treatment (2-3 gm/kg of seeds) | 120 | 50.00 | 40 | 16.67 | 80 | 33.33 |
| Seed rate/ha (5 kg per ha) | 117 | 48.55 | 80 | 33.20 | 44 | 18.26 |
| Application of organic manure in nursery raising  | 75 | 31.25 | 62 | 25.83 | 103 | 42.92 |
| Plant protection in nursery  | 60 | 25.00 | 108 | 45.00 | 72 | 30.00 |
| Age of seedling (8-12 days) | 96 | 40.00 | 66 | 27.50 | 78 | 32.50 |
| Transplanting spacing (25 x25 cm) | 87 | 36.25 | 61 | 25.42 | 92 | 38.33 |
| 1-2 number of seedlings/ hills | 79 | 32.92 | 104 | 43.33 | 57 | 23.75 |
| Application of recommended dose of NPK  | 178 | 74.17 | 62 | 25.83 | 0 | 0.00 |
| Application of organic manure (10-12 t/ha) | 103 | 42.92 | 87 | 36.25 | 50 | 20.83 |
| Weed management (Mechanical weeder) | 118 | 49.17 | 102 | 42.50 | 20 | 8.33 |
| Plant protection | 100 | 41.67 | 90 | 37.50 | 50 | 20.83 |
| Alternative wetting and drying | 97 | 40.42 | 80 | 33.33 | 63 | 26.25 |

**Extent of adoption of SRI technology**: It was revealed from Table 2 that 60 per cent of the paddy farmers had a medium level of adoption with respect to SRI paddy cultivation practices, while 26.67 per cent of the respondents had a high level of adoption. The same result was also reported by Debbarma *et al. (*2018) and Singh and Varshney (2010). Kumari and Prakash (2020).

**Table.2 Distribution of respondents based on their extent of overall adoption scores on recommended package of practices of SRI technology (n=240)**

|  |  |  |
| --- | --- | --- |
| **Category**  | **Frequency**  | **Percentage**  |
| Low | 20 | 13.33 |
| Medium | 90 | 60.00 |
| High | 40 | 26.67 |
| **Total** | **150** | **100** |

**Table.3 Correlation of personal, socio-psychological and communication characteristics with the extent of adoption of SRI technology (n=240)**

|  |  |
| --- | --- |
| Characteristics  | Correlation coefficient (r)  |
| Age | 0.427\*\* |
| Sex | -0.17 |
| Family type | 0.154 |
| Family size | 0.146 |
| Education | 0.352\*\* |
| Annual income | 0.243\* |
| Income from paddy cultivation | 0.258\* |
| Total operational land holding (acre) | 0.228\*\* |
| Total operational land under SRI | -0.148 |
| Cropping intensity | 0.197 |
| Risk orientation | 0.241 |
| Mass media exposure | 0.199 |
| Social participation | 0.101 |
| Source of information | 0.124 |
| Innovation proneness | 0.292\* |
| Economic motivation | 0.147 |
| Training exposure | 0.510\*\* |
| Attitude | 0.178 |
| Govt. subsidies | 0.484\*\* |
| Market orientation | 0.254\*\* |

\*significant at 0.05 level of significance

\*\* Significant at 0.01 level of significance

Table: 3. Indicates that age, education, annual income, income from paddy cultivation, land holding, innovation proneness, training exposure, Government subsidies and market orientation are found to be positively correlated and significant with adoption of SRI practices and the result was also supported by (Kumar et al., 2014), (Meshram, 2012), (Devi and Ponnarasi 2009), (Karki 2010), (Thatchinamoorthy and Rexlin, 2014), (Ray and Raj, 2014), (Kacharo, 2007), (Singha and Baruah 2011) and (Singha et al., 2012).

**Table 4. Constraints in adoption of SRI technology faced by farmers**

|  |  |  |
| --- | --- | --- |
| Constraints | Mean score | Ranking  |
| Labour constraints | 0.67 | I |
| Technical knowledge | 0.62 | II |
| Extension and information | 0.59 | III |
| Govt. policy and support | 0.54 | IV |
| Financial | 0.51 | V |
| Marketing and renumeration | 0.49 | VI |

**Major constraints faced by farmers in the adoption of SRI technology**:

It was evident from table 4 that the major constraint faced by respondents was identified as labour constraints as priority constraints faced by most of the farmers, as labour availability is less and high wage cost, therefore to overcome this problem, farmers need to use farm machinery starting from transplanting to harvesting of the crop. Lack of technical knowledge ranked second. Therefore, to overcome this problem, seminars, workshops, and training programmes should be conducted. Extension constraints ranked third. Therefore, extension personnel should address the information relating to farms, pay regular visits to the villages and provide training according to their present needs. The farmers should be made aware to avail the benefits from different government schemes by organizing periodic village meetings. The 4th constraint was the policy level constraints. Govt. policy and support constraints can be address by providing incentives or subsidies, setting up storage facilities, and encouraging the farmers to go for large-scale cultivation can have a huge impact on the extent of SRI cultivation technology and the productivity of paddy. Financial constraints ranked fifth. Farmers faced problems in obtaining loans from the banks. This problem can be avoided by creating awareness of the procedure of availing loans from various financial institutions. Marketing and renumeration is the 6th constraint faced by farmers. Marketing constraint can be overcome by creating proper marketing infrastructures and educating the farmers about the proper system of market functions. And also the government should take the initiative to procure the produce from the farmers so as to provide a sense of guarantee of minimum crop loss.

**Conclusion:**

SRI is a very beneficial for rice production that may be helpful in increasing the productivity and income of farmers in comparison to conventional farming. Variables like formal information sources, extension contact, scientific orientation, training exposure, attitude, age, mass media, and market orientation were found important in influencing the SRI technology adoption by the farmers. As most of the farmers had a moderate level of SRI technology adoption, they should be motivated and encouraged through training and demonstrations by the government agencies to increase the extent of SRI technology adoption thereby reducing the technological gap. Farmers should be provided with quality inputs increased avenues of marketing and storage and required logistics for enhancing productivity and profitability at the farm level.

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