



Extent of Knowledge and Adoption of System of Rice Intensification (SRI) Cultivation Practices among Rice Growers in Kohima District of Nagaland, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Rice is life for millions of people in the world, particularly in developing countries. Unfortunately in India, the productivity of rice is already very low and the area for growing rice cannot be increased further. The System of Rice Intensification (SRI), developed by Fr. Henri de Laulanie during eighties in Madagascar, offers opportunities for improving rice production in a variety of situations around the world. SRI was promoted under the "Integrated Cereal Development Programme-Rice". Rice is also the main staple food of people in the North Eastern Region of India. The demand for rice is growing with ever-increasing population. It is the most water intensive crops and requires about 3000-5000 liters of water to produce 1 kg of rice. Nagaland is also one of the states where SRI is cultivated by the rice farmers. It is one of the most important crops of the North Eastern states and SRI has been highly cultivated by farmers in Kohima district of Nagaland. It has the highest production and area. The present study is an effort to study the profile of farmers' already practicing SRI method of rice cultivation which would certainly help to develop suitable extension strategies to reach the slow adopters thus reducing the time gap and increasing the adoption rate. While worldwide SRI started three decades ago, its knowledge is still evolving and several issues with regard to various components that are involved in its implementation still need some investigation. The finding of the

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study can help to analyze the factors influencing it and the constraints faced by the farmers thus enlisting strategies to the rice farmers to overcome it.

The study was conducted in Jakhama, Kohima village and Kezocha block of Kohima district of Nagaland. A total number of 120 respondents from 4 villages were selected through random sampling based on maximum area under system of rice intensification production. Data was collected with the help of pre-structured interview schedule. The descriptive research design was used for the present research study. The socio-economic variables selected for the study were age, education, family size, family type, land holding, annual income, farm experience, extension contact, social participation, mass media exposure and sources of information utilization resources

The study revealed that majority of the system of rice intensification cultivators belonged to middle aged group, had medium level of annual income with medium size of land holding. Majority of them had medium year of farming experience, use of sources of information and medium level of extension contact. It was observed that the majority of the respondents had medium level of knowledge and adoption of recommended system of rice intensification practices among rice growers.

Keywords: Socio-economic characteristics; knowledge; adoption; System of Rice Intensification (SRI); rice growers; Nagaland.

1. INTRODUCTION

The System of Rice Intensification (SRI) methodology was synthesized in the early 1980s by Fr. Henri de Laulanie, S.J., who came to Madagascar from France in 1961 and spent the next (and last) 34 years of his life working with Malagasy farmers to improve their agricultural systems, and particularly their rice production, since rice is the staple food in Madagascar [1]. It is expected to enhance yield and substantially reduce water and other input requirements [2] by altering plant, soil, water and nutrient management practices [3]. The method completely deviates from the traditional way of cultivating paddy. Several innovations are taking place within the conceptual and practical framework of SRI [4,5].

Rice is life for millions of people in the world where more than 90 per cent of rice is grown and consumed. In India, rice is grown in about 44 million hectares (Mha) with a production of 90 million tons (Mt) annually. Annual rice production needs to be enhanced from the present 90 Mt to about 100 Mt by the end of eleventh plan period to meet the growing demand due to rapidly increasing population [6]. The United Nations General Assembly, in a resolution declared the year 2004 as the "International Year of Rice", which has tremendous significance to food security. It very eloquently upheld the need to heighten the awareness for the role of rice in alleviating poverty and malnutrition [7].

SRI concepts and practices have continued to evolve as they are being adapted to rain-fed

(unirrigated) environments and with transplanting being sometimes replaced by direct-seeding. The central principles of SRI according to Cornell researchers is that rice field soils should be kept moist rather than continuously saturated, minimizing anaerobic conditions, as this improves root growth and supports the growth and diversity of aerobic soil organisms [8,9]. Rice plants should be planted singly and widely spaced to permit root and canopy growth to keep all leaves photo synthetically active. Rice seedlings should be transplanted when young, less than 15 days old with just two leaves, quickly, shallowly, and carefully, to avoid trauma to roots and minimize transplant shock.

Rice is also the main staple food of people in the North Eastern Region of India. The demand for rice is growing with ever-increasing population. It is the most water intensive crops and requires about 3000-5000 liters of water to produce 1kg of rice [8,10].

Nagaland, one of the potential states of the North-East India is basically an agrarian state having been endowed with favorable agro-climatic conditions and a rich bio-diversity of flora and fauna. Agriculture contributes heavily to the state's economy. It supports multiple crops. The success of SRI depends on participation of increased number of farmers in it (Wikipedia) Similarly, extension worker plays a more vital role to educate farmers to adopt System of Rice Intensification (SRI) cultivation on their farms.

SRI has been specifically very successful in Kohima district of Nagaland. The Sub-Divisional

Agriculture Officer (SDAO) Chiephobozou has implemented SRI with paddy MTU1010 under National Food Security Mission at various villages [11].

2. MATERIALS AND METHODS

2.1 Location of the Study Area

The study was conducted in Kohima District of Nagaland state in India. It is the home of the Angami Nagas. As of 2011, it is the second most populous district of Nagaland (out of 12), after Dimapur with a population of 267,988, 45% of which is urban. It is home to 13.55% of Nagaland's entire population. The district headquarters is at Kohima City. Kohima District is also the seventh-largest district in Nagaland with an area of 1,207 square kilometers (466 sq mi). Kohima District has a hilly landscape - Kohima urban area, typical of the area, is stretched along the top of a mountain. It is bounded by Tseminyü in the north, Zünheboto and Phek district in the east, Manipur in the south and Chümoukedima and Peren districts in the east. It is headquartered at Kohima, which is at an altitude of 1,444 metres (4,738 ft) above sea level Jakhama, Kohima village and Kezocha were the selected block through purposive sampling.

The study was taken under the following objectives:

- i. To find the socio-economic and personal characteristics of the respondents.
- ii. To examine the level of knowledge and extent of adoption of recommended system of rice intensification (SRI) practices among rice growers.

3. RESULTS AND DISCUSSION

3.1 Selection of Respondents

A total number of 120 respondents from 4 villages were selected through random sampling based on maximum area under system of rice intensification production. There are 118 villages in Kohima block out of which 4 villages namely (Kezoma village, Sakhabhama, Kigwema and Chedema) were selected through purposive sampling based on maximum area under system

of rice intensification production. Data was collected with the help of pre-structured interview schedule. The descriptive research design was used for the present research study at the month of May and June, 2022 where 30 number of farmers were interviewed from each selected (4) villages among rice growers.

The socio-economic variables selected for the study were age, education, family size, family type, land holding, annual income, farm experience, extension contact, social participation, mass media exposure and sources of information utilization resources.

3.2 Statistical Analysis of Data

The entire data was transformed into normal score for tabulation. The independent variables as well as dependent variable were categorized as low, medium and high or the term applicable so far on the basis of score obtained. Keeping in view the objectives of the study and to draw logical conclusion the statistical tests i.e. frequency, percentage, mean, standard deviation and correlation coefficient were used for analyzing and interpretation of the data.

1. Socio-economic and personal characteristics of the respondents.

Majority (61.67%) of the respondents were middle aged people, (42.5%) of the respondents had education up to primary school level (Table 1). Majority (90.83%) of the respondents were married, (91.67%) had nuclear family, (60%) had up to 5 members and (57.5%) of the respondents lived in hut house (Table 1). It was also found that majority of the respondents had farming experiences between (10 to 20 years) in cultivation (Table 1). A large number of the respondents had medium level of income. Most of the respondents also had social contacts with ATMA (Table 1). It was found that (61.67%) of respondents read newspaper on a daily basis, occasionally (49.17%) watch television and (20.83%) listen to radio (Table 1). Majority (77.5%) of the respondents were frequently interacting with progressive farmers, sometimes (43.83%) with neighbours, (65%) with relatives frequently (34.16%) interact with friends and (13.34%) often use mobile to stay updated (Table 1).

Table 1. Socio-economic and personal characteristics of SRI farmers among rice growers

S. no	Independent Variables	Category	Frequency	Percentage	
1.	Age	Young (21-35)	38	31.67	
		Middle Age (36-55)	74	61.67	
		Old (Above 55)	08	6.66	
2	Education	Illiterate	20	16.67	
		Primary	51	42.5	
		High School	40	33.33	
		Secondary School	03	2.5	
		Graduate and above	06	5	
3	Marital Status	Married	109	90.83	
		Unmarried	11	9.17	
4	Type of family	Nuclear	110	91.67	
		Joint	10	8.33	
5	Size of family	Upto 5 members	72	60.00	
		Above 5 members	48	40.00	
6	Type of house	Hut	69	57.5	
		Semi-cemented	38	31.67	
		Cemented	13	10.83	
7	Annual Income	Low (Less than 60,000)	52	43.33	
		Medium (60,000-1,00,000)	67	55.83	
		High (More than 1,00,0000)	01	0.84	
8	Total land holdings	Low (<2 acre)	25	45.33	
		Medium (2-6 acre)	83	55.83	
		High (>6 acre)	12	0.83	
9	Farming Experience	Below 10 years	43	10.00	
		10-20 years	65	81.67	
		Above 20 years	12	8.33	
10	Extension contact	Low	26	13.33	
		Medium	83	80.83	
		High	11	5.84	
11	Social Participation	Village Council Regularly	33	27.5	
		Farmer's club Occasionally	31	25.83	
		SHG Never	56	46.67	
12	Mass media exposure	Radio	Often	25	20.83
			Sometimes	46	38.33
			Never	49	40.83
		Television	Often	30	50.83
			Sometimes	46	38.33
			Never	29	40.83
		Newspaper	Often	30	25
			Sometimes	61	50.83
			Never	29	40.83
		Magazines	Often	5	4.17
			Sometimes	46	38.33
			Never	69	75.5
		Exhibition	Often	0	0
			Sometimes	21	17.5
			Never	99	82.5
		Printed Media (Poster, Folder, Leaflet)	Often	49	40.83
			Sometimes	48	40
			Never	23	19.16

S. no	Independent Variables	Category		Frequency	Percentage
13	Information sources utilization	Neighbor	Frequently	63	64.17
			Sometimes	57	43.75
			Rarely	00	00
	Friends		Frequently	65	54.17
			Sometimes	55	45.83
			Rarely	00	00
	Relatives		Frequently	78	65
			Sometimes	42	35
			Rarely	00	00
	Progressive Farmers		Frequently	93	77.5
			Sometimes	27	22.5
			Rarely	00	00
Mobile		Frequently	16	13.33	
		Sometimes	47	39.17	
		Rarely	60	50	

3.3 Knowledge Level of the Farmers

The above Table 2 shows that 100% of the respondents have precise knowledge on nursery preparation i.e. the land are thoroughly prepared when it is dry. Majority of the farmers about 84.16% had knowledge about application of FYM and raised beds whereas 15.83% of the respondents had not known about it. 100% of the respondents had known about the seeds being soaked (12 hrs) before sowing. 100% of the respondents had knowledge about soaked seeds (24 hrs) incubation. Majority of the respondents 71.67% of the respondents had known about the pre germinated seeds @2kg/40sqm area while 28.33% of the respondents had no knowledge about it. Majority of the respondents 74.16% had knowledge to cover the seeds by FYM whereas 25.83% of the respondents had not known about it.

About 76.67% of the respondents had knowledge of mulching of paddy straw till the emergence of seedlings whereas 23.33% of the respondents had not known about it. Majority of the respondents, 82.5% had knowledge about irrigating nursery bed every morning and evening while 17.5% of the respondents had not known about it. About 76.67% of the respondents had precise knowledge about the seed rate in SRI (2-5kg) per acre whereas 23.33% were not aware about it. About 71.67% of the respondents had known about the recommended varieties while 28.33% of the respondents had no knowledge of it. Majority of the respondents 62.5% had knowledge about the preparation of main field i.e. application of FYM during the final puddling while 37.5% of the respondents had not known about it. Majority of the respondents 62.5% of the respondents had known about field leveling and

making of wide channel of SRI cultivation whereas 37.5% of the respondents had no knowledge of it. Majority of the respondents 92.5% had known that there should be no standing water while transplanting in SRI whereas 7.5% had no knowledge about it. About 89.16% of the respondents had knowledge about transplanting 8-12 days old seedlings with just two leaves whereas 10.83% of the respondents had not known about it. 100% of the respondents had completely zero knowledge about iron sheet pushing through the nursery bed beneath the plants below the surface in SRI cultivation practices. About 77.5% of the respondents had known of the plant along with mud taken to the main field and how seedlings should be transplanted singly within 15 minutes whereas 22.5% of the respondents had no knowledge about it in SRI cultivation. About 72.5% of the respondents had knowledge about seedling thrusting downward while 27.5% of the respondents had not known about it in SRI cultivation practices. About 78.33% of the respondents had known about how the seedling is slipped in the soil very gently and its roots lie horizontally whereas 21.67% of the respondents had not known about it in SRI cultivation practices. About 85.83% of the respondents had known about the spacing in SRI (25 cm X 25 cm) whereas 14.67% of the respondents had not known about it. About 87.5% of the respondents had precise knowledge of using a wooden stick of length (25 cm) to use as a marker whereas 12.5% of the respondents had no knowledge about it in SRI cultivation practices. About 77.5% of the respondents had knowledge that the field should not be kept flooded under SRI whereas 22.5% of the respondents had not known about it in SRI cultivation practices. About 62.5% of the respondents had knowledge that the field should

Table 2. Distribution of knowledge level of the farmers about SRI cultivation practices among rice growers

Sl. No	Practices	Knowledge	
		Yes	No
A	Nursery preparation:	120 (100%)	--
	i) The land is thoroughly prepared when dry.		
	ii) FYM is applied and raised beds of 1m width with convenient length are prepared.	101 (84.16%)	19 (15.83%)
	iii) The seeds are soaked in water for 12 hours before sowing.	120 (100%)	--
	iv) The soaked seeds are left in a wet gunny bag for 24 hours for incubation.	120 (100%)	--
	v) The pre germinated seeds are broadcasted sparsely @2kg /40 sq m area	86 (71.67%)	34 (28.33%)
	vi) FYM is applied to cover the seeds.	89 (74.16%)	31 (25.83%)
	vii) The bed is mulched with paddy straw till the emergence of the seedlings.	92 (76.67%)	28 (23.33%)
	viii) The nursery bed is irrigated every morning and evening.	99 (82.5)	21 (17.5%)
B	Seed rate and recommended varieties.	92 (76.67%)	28 (23.33%)
	i) Seed rate - 2-5kg per acre.		
	ii) Recommended varieties:	86 (71.67%)	34 (28.33%)
	a) MTU-7029		
	b) IR-64		
	c) Mehourou (Local)		
C	Preparation of main field:	75 (62.5%)	45 (37.5%)
	i) FYM at 5t/ha is applied during the final puddling.		
	ii) Leveling of the field should be done properly and at every 2m interval, 30cm wide channel should be made.	75 (62.5%)	45 (37.5%)
	iii) There should be no standing water while transplanting.	111 (92.5%)	9 (7.5%)
D	Transplanting:	107 (89.16%)	13 (10.83%)
	i) 8-12 days old seedlings with just two leaves have to be transplanted.		
	ii) An iron sheet measuring 8"x15" is pushed through the nursery bed beneath the plants about 3" below the surface.	--	120 (100%)
	iii) The plant along with the mud is taken to the main field and seedlings should be transplanted 'singly' with the seed attached to the seedlings and transplanted within 15 minutes.	93 (77.5%)	27 (22.5%)
	iv) While transplanting, the root tip are not inverted and hence seedling is thrust downward.	87 (72.5%)	33 (27.5%)
	v) Seedling is slipped in the soil very gently and close to the surface, and its root lie horizontally in the moist soil.	94 (78.33%)	26 (21.67%)
E	Spacing:	103 (85.83%)	17 (14.17%)
	i) Seedling should be planted in square pattern at 25cmx25cm.		
	ii) To space the plant equally, a wooden stick of appropriate length (25cm) can be used as a marker.	105 (87.5%)	15 (12.5%)

Sl. No	Practices	Knowledge	
		Yes	No
F	Water management:	93 (77.5%)	27 (22.5%)
	i) The field is not kept flooded under SRI.		
	ii) The field should be irrigated when the soil develops hairline cracks.	75 (62.5%)	45 (37.5%)
G	iii) Water may be applied before weeding to make the process easier otherwise water is best applied during evening by opening the water channels.	82 (68.33%)	38 (31.67%)
	Weeding:	120 (100%)	--
	i) The first weeding should be done at 10-12 days after transplanting.		
H	ii) Subsequent weeding is done at 10 days interval.	75 (62.5%)	45 (37.5%)
	iii) Instead of weeding manually and throwing the weeds outside the plot, rotary hoe/ cono-weeder/power weeder is used to aerate the soil which adds up the organic matter.	89 (74.17%)	31 (25.83%)
	Pest and disease management:	91 (75.83%)	29 (24.16%)
I	i) Wider spacing is maintained and organic manures are used to reduce the incidence of the pest and diseases.		
	ii) Organic concoction (Amrit Jalam) is applied which enhances the soil, making it stronger and protects against biotic stresses (pests, diseases) and abiotic stresses (drought, storm damage, extreme temperatures).	--	120 (100%)
	Harvesting:	120 (100%)	--
	i) The field is drained completely 25 days before harvesting.		
	Yield: 45 quintals/ hectare.	91 (75.83%)	29 (24.16%)

be irrigated when the soil develops hairline cracks whereas 37.5% of the respondents had not known of it in SRI cultivation practices. About 68.33% of the respondents had known about application of water before weeding or it is applied during evening by opening the water channels whereas 31.67% of the respondents had not known of it in SRI cultivation practices. 100% of the respondents had knowledge about the first weeding which should be done between 10-12 days after transplanting. About 65% of the respondents had known about the subsequent weeding while 35% of the respondents had no knowledge of it in SRI cultivation practices. About 74.17% had known about the use of cono-weeder/power weeder to aerate the soil whereas 25.83% of the respondents had no knowledge of it in SRI cultivation practices. About 75.83% of the respondents had knowledge about how wider spacing is maintained and organic manures are used to reduce pest and diseases whereas 24.16% had not known of it in SRI cultivation practices. 100% of the respondents had completely no knowledge about the application of organic concoction (Amrit Jalam) in SRI cultivation practices. 100% of the respondents had known about the draining of field 25 days

before harvesting in SRI cultivation practices .About 75.83% of the respondents had knowledge about yield (45 quintals per hectare whereas 24.16 % of the respondents had not known about it in SRI cultivation practices.

Table 3 reveals that the level of knowledge of respondents of system of rice intensification cultivation practices is medium 68.33% followed by high 19.17% and low 17.5 % respectively. Similar findings were found in Balakrishnan, T and Vasanthakumar J [12] and K. Nirmala et al. [13].

The result of correlation analysis in above table revealed the significance and non-significance of the socio-economic profile of the people and their level of knowledge of system of system of rice intensification among rice growers (Table 4).

Table 4 revealed that independent variables like age, type of house annual income, extension contact and social participation are significantly associated with knowledge of system of rice intensification. Further, the variables age, education, marital status, type of family, family size, farming experience, land holding, extension contact and information sources utilization was found to be non significant.

Table 3. Distribution of the respondents based on knowledge level towards system of rice intensification(SRI) cultivation practices

S.N	Category	Frequency	Percentage	Mean	SD
1	Low (<30)	21	17.5		
2	Medium (30-35)	76	68.33	37.4	3.2
3	High (>35)	23	19.17		
	Total	120	100.00		

Table 4. Association between selected independent variables with knowledge of respondents in system of rice intensification (SRI) practices among rice growers

Association between selected independent variables with knowledge of the farmers

S/no	Variables	Pearson's correlation coefficient
1	Age	0.126NS
2	Education	0.06NS
3	Marital Status	0.025NS
4	Type of family	0.05NS
5	Family size	0.16NS
6	Type of house	0.196*
7	Land holding	0.156NS
8	Annual income	0.200*
9	Farming experience	0.061NS
10	Extension contact	0.238*
11	Social Participation	0.318*
12	Mass media exposure	0.063NS
13	Source of information	0.319NS

* = Significant at p = 0.05%, NS= Non Significant

3.4 Extent of Adoption of Recommended SRI Technology

The above table revealed that 100% of the respondents were adopting the nursery preparation i.e. the land is thoroughly prepared when it is dry. Majority of the farmers about 79.16% had fully adopted about application of FYM and raised beds whereas 20.83% of the respondents had not adopted it in SRI cultivation practices. About 85.83% of the respondents had fully adopted about the seeds being soaked (12 hrs) before sowing while 14.17% had partially adopted in SRI cultivation practices. 100% of the respondents had fully adopted the practice soaked seeds (24 hrs) incubation. About 54.17% of the respondents had fully adopted about the pre germinated seeds @2 kg/40 sqm area while 45.83% of the respondents had partially adopted in SRI cultivation practices. Majority of the respondents 78.33% had fully adopted to cover the seeds by FYM whereas 21.67% of the respondents had partially adopted in SRI cultivation practices. About 83.33% of the respondents had fully adopted of mulching of paddy straw till the emergence of seedlings whereas 16.67% of the respondents had partially adopted it in SRI cultivation practices. About 50% of the respondents had fully adopted irrigating nursery bed every morning and evening while 50% of the respondents had partially adopted it. Majority of the respondents 86.67% had fully adopted of the seed rate in SRI (2-5kg) per acre whereas 13.33% of the respondents had partially adopted in SRI cultivation. 100% of the respondents had fully adopted the recommended varieties in SRI cultivation practices. The SRI practice has been reported to result in higher yields ranging from 6 to 8 ton/ha with subsequent water saving of up to 25% [14]. Majority of the respondents 74.17% had fully adopted about the preparation of main field i.e. application of FYM during the final puddling while 25.83% of the respondents had partially adopted in SRI cultivation practices. Majority of the respondents 76.67% had fully adopted the leveling of field and making wide channel of SRI cultivation whereas 5.83% of the respondents had partially adopted it and 17.5 % of the respondents had not adopted in SRI cultivation practices. Majority of the respondents 83.33% had fully adopted the practice of no standing water while transplanting in SRI whereas 16.67 % had partially adopted in SRI cultivation practices. About 90 % of the respondents had fully adopted t transplanting 8-12 days old seedlings with just two leaves whereas 10% of

the respondents had partially adopted in SRI cultivation practices. These are also the fundamental recommended package of practices explained by extension officers hence more respondents had knowledge on these items. [13] 100% of the respondents had completely not adopted the use of iron sheet pushing through the nursery bed beneath the plants below the surface in SRI cultivation practices. About 83.33% of the respondents had fully adopted transplanting of the plant along with mud to the main field and transplanting seedlings singly within 15 minutes whereas 10 per cent of the respondents partially adopted and 6.67% of the respondents had not adopted in SRI cultivation practices. About 83.33 % of the respondents had fully adopted about seedling thrust downward while 16.67% of the respondents had partially adopted it in SRI cultivation practices. About 66.67% of the respondents had fully adopted the practice of the seedling slipped in the soil very gently and its roots lying horizontally whereas 33.33% of the respondents had partially adopted it in SRI cultivation practices. About 93.33% of the respondents had fully adopted the spacing in SRI (25 cm X 25 cm) whereas 6.67% of the respondents had partially adopted it in SRI cultivation practices. About 87.5% of the respondents had fully adopted the use of a wooden stick of length (25 cm) which is used as a marker whereas 12.5% of the respondents had partially adopted it in SRI cultivation practices. 100% of the respondents had fully adopted that the field is not to be kept flooded under SRI cultivation practices. About 47.5 % of the respondents had fully adopted the practice of field irrigation when the soil develops hairline cracks whereas 44.17% of the respondents had partially adopted and 8.33% of the respondents had not adopted in SRI cultivation practices. 100% of the respondents had fully adopted the application of water by opening the water channels in SRI cultivation practices About 87.83% of the respondents had fully adopted about the first weeding which should be done between 10-12 days after transplanting while 14.17 % of the respondents had partially adopted it in SRI cultivation practices. About 43.33% of the respondents had fully adopted the subsequent weeding while 56.67% of the respondents had partially adopted it in SRI cultivation practices. About 89.17% of the respondent's had fully adopted the use of cono-weeder/power weeder to aerate the soil whereas 10.83% of the respondents partially adopted of it in SRI cultivation practices. About 74.17% of the respondents had fully adopted the practice of

Table 5. Distribution of extent of adoption level of recommended system of rice intensification (SRI) cultivation practices among rice growers (FA-Fully Adopted, PA-Partially Adopted, NA-Not Adopted)

Sl. No Practices	Adoption		
	FA	PA	NA
A Nursery preparation:	120 (100%)	--	--
i) The land is thoroughly prepared when dry.			
ii) FYM is applied and raised beds of 1m width with convenient length are prepared.	95 (79.16%)	25 (20.83%)	--
iii) The seeds are soaked in water for 12 hours before sowing.	103 (85.83%)	17 (14.17%)	--
iv) The soaked seeds are left in a wet gunny bag for 24 hours for incubation.	120 (100%)	--	--
v) The pre germinated seeds are broadcasted sparsely @2kg /40 sq m area	65 (54.17%)	55 (45.83%)	--
vi) FYM is applied to cover the seeds.	94 (78.33%)	26 (21.67%)	--
vii) The bed is mulched with paddy straw till the emergence of the seedlings.	100 (83.33%)	20 (16.67%)	--
viii) The nursery bed is irrigated every morning and evening.	60 (50%)	60 (50%)	--
B Seed rate and recommended varieties.	104 (86.67%)	16 (18.33%)	--
i) Seed rate - 2-5kg per acre.			
ii) Recommended varieties:	120 (100%)	--	--
a) MTU-7029			
b) IR-64			
c) Mehourou (Local)			
C Preparation of main field:	89 (74.17%)	31 (25.83%)	--
i) FYM at 5t/ha is applied during the final puddling.			
ii) Levelling of the field should be done properly and at every 2m interval, 30cm wide channel should be made.	92 (76.67%)	7 (5.83%)	21 (17.5%)
iii) There should be no standing water while transplanting.	100 (83.33%)	20 (16.67%)	--
D Transplanting:	108 (90%)	12 (10%)	--
i) 8-12 days old seedlings with just two leaves have to be transplanted.			
ii) An iron sheet measuring 8"x15" is pushed through the nursery bed beneath the plants about 3" below the surface.	--	--	120 (100%)
iii) The plant along with the mud is taken to the main field and seedlings should be transplanted 'singly' with the seed attached to the seedlings and transplanted within 15 minutes.	100 (83.33%)	12 (10%)	8 (6.67%)
iv) While transplanting, the root tip are not inverted and hence seedling is thrust downward.	100 (83.33%)	20 (16.67%)	--
v) Seedling is slipped in the soil very gently and close to the surface and its root lie horizontally in the moist soil.	80 (66.67%)	40 (33.33%)	--

Sl. No	Practices	Adoption		
		FA	PA	NA
E	Spacing:			
	i) Seedling should be planted in square pattern at 25cmx25cm.	112 (93.33%)	8 (6.67%)	--
	ii) To space the plant equally, a wooden stick of appropriate length (25cm) can be used as a marker.	105 (87.5%)	15 (12.5%)	--
F	Water management:	120 (100%)	--	--
	i) The field is not kept flooded under SRI.			
	ii) The field should be irrigated when the soil develops hairline cracks.	57 (47.5%)	53 (44.17%)	10 (8.33%)
	iii) Water may be applied before weeding to make the process easier otherwise water is best applied during evening by opening the water channels.	120 (100%)	--	--
G	Weeding:	103 (85.83%)	17 (14.17%)	--
	i) The first weeding should be done at 10-12 days after transplanting.			
	ii) Subsequent weeding is done at 10 days interval.	52 (43.33%)	68 (56.67%)	--
	iii) Instead of weeding manually and throwing the weeds outside the plot, rotary hoe/ cono-weeder/power weeder is used to aerate the soil which adds up the organic matter.	107 (89.17%)	13 (10.83%)	--
H	Pest and disease management:	89 (74.17%)	17 (14.17%)	14 (11.67%)
	i) Wider spacing is maintained and organic manures are used to reduce the incidence of the pest and diseases.			
	ii) Organic concoction (Amrit Jalam) is applied which enhances the soil, making it stronger and protects against biotic stresses (pests, diseases) and abiotic stresses (drought, storm damage, extreme temperatures).	--	--	120 (100%)
I	Harvesting:	120 (100%)	--	--
	i) The field is drained completely 25 days before harvesting.			
	Yield: 45 quintals/ hectare.	99 (82.5%)	21 (17.5%)	--

Table 6. Distribution of the respondents based on the adoption towards system of rice intensification cultivation practices

Sl. No	Category	Frequency	Percentage	Mean	SD
1	Low (<30)	16	13.33		
2	Medium (30-35)	82	68.33	39.6	3.06
3	High (>35)	22	18.33		
	Total	120	100.00%		

Table 7. Association between selected independent variables with adoption of SRI by the farmers

S. No	Variables	Pearson's correlation coefficient
1	Age	0.07NS
2	Education	0.029NS
3	Marital status	0.052NS
4	Type of family	0.007NS
5	Family size	0.082NS
6	Type of house	0.190*
7	Farming experience	0.016NS
8	Land holding	0.044NS
9	Annual income	0.197*
11	Social participation	0.069NS
12	Mass media exposure	0.064NS
13	Source of information	0.319*
14	Extension contact	0.174 NS

* = Significant at $p = 0.05\%$, NS= Non Significant

wider spacing maintained and organic manures which are used to reduce pest and diseases whereas 14.17% of the respondents had partially adopted and 11.67% had not adopted it in SRI cultivation practices. 100% of the respondents had completely not adopted about the application of organic concoction (Amrit Jalam) in SRI cultivation practices. 100% of the respondents had fully adopted the practice of draining the field 25 days before harvesting in SRI cultivation practices. About 82.5% of the respondents had fully adopted the yield (45 quintals per hectare whereas 17.5% of the respondents had partially adopted it in SRI cultivation practices among rice growers.

Table 6 revealed that 68.33% of respondents were having medium level of adoption followed by 18.33% of respondents having high level of adoption whereas 13.33% of respondents were having low level of system of rice intensification (SRI) cultivation practices. Similar findings were also reported by B. Debberma et al., [15].

Association between selected independent variables with adoption of farmers towards system of rice intensification cultivation practices.

Table 7 revealed that independent variables like annual income, type of house, information

sources utilization are significantly associated with adoption of SRI among rice growers. Further, the variables education, marital status, type of family, family size, land holding, farming experience, social participation, mass media exposure and extension contact was found to be non significant.

4. CONCLUSION

It is concluded from the present study that majority of the respondents were middle aged people, had education up to high school level, majority are married, had nuclear family up to 5 members and most of them lived in hut house. Majority of the respondents had farming experiences between 10 to 20 years. A large number of the respondents had medium level of income. Most of the respondents also had social contacts with ATMA. It was found that large number of respondents had medium level of knowledge and medium level of adoption.

Variables like age, type of house annual income, extension contact and social participation are significantly associated with knowledge of system of rice intensification. Further, the variables age, education, marital status, type of family, family size, farming experience, land holding, extension contact and information

sources utilization was found to be non significant whereas for adoption by the respondents, variables like annual income, type of house, information sources utilization are significantly associated with adoption of SRI among rice. Further, the variables education, marital status, type of family, family size, land holding, farming experience, social participation, mass media exposure and extension contact was found to be non significant.

The main constraints faced by the respondents were dependence on monsoon, unavailability of electricity, shortage of water, poor transportation and high rent charges over borrowed agricultural machinery. The farmers have suggested that more cono weeders and other agricultural machineries should be made available, regular supply of electricity as it hinders their daily work, proper information should be given by the department as they are in a state of confusion most of the time, more interaction with extension workers which can help them broaden their knowledge and seek their suggestions with agricultural problems as well as various schemes which they are able to apply so as to assist them in balancing their earning and the subsidiaries provided by the government and more trainings provided by the department can help breach the gap, hence making more farmers to adopt system of rice intensification(SRI) among rice growers.

The researcher hopes that this research study would come in use to understand the socio-economic and personal characteristics of system of rice intensification (SRI) among rice growers with their level of knowledge and adoption of recommended cultivation practices of SRI technology.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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