Effectiveness of Behaviour of Rice Farmers in Propagating System of Rice Intensification (SRI) Technology in Andhra Pradesh

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ABSTRACT

SRI technology promises the much needed boost to productivity in rice with better water use efficiency. During the last decade, various agencies promoted this method of rice cultivation in Andhra Pradesh. However, the rate of adoption of SRI method by rice farmers is low. The purpose of the study was to understand the needs of the farmers in terms of knowledge and skills which can help improve the adoption rate of the technology. Data was collected using a questionnaire from a random sample of 150 SRI demonstration framers (N = 150) from the three North Coastal Districts of Andhra Pradesh. The study indicated that framers have developed positive attitude towards SRI technology. However, majority of the farmers feel that many of the operations of SRI method are labour intensive and time consuming. More than 80% of the farmers expressed the need for development of more efficient equipment for raising nursery, leveling and weeding. They felt the need for training agriculture labour in SRI techniques. Farmers expressed the need for season long contact and support of extension staff with information on irrigation technology and integrated crop management.

Key words: *SRI technology; Demonstrations; Behaviour; Knowledge; Skills; Attitudes;*

India has the largest area under paddy cultivation in the world with over 40 million ha each year. Andhra Pradesh is one of the leading states in terms of area and production contributing about 12 per cent of total rice production in the country. However, India lags behind in terms of productivity as compared to many other rice producing countries of the world. The world's population is increasing year after year building pressure on natural resources. The need of the hour is to produce more food grains efficiently in terms of increasing productivity and better input (land, water, agriculture chemicals etc.) use efficiency. System of Rice Intensification (SRI) technology in rice production promises to do the same. The return of investment of rice farmers can be increased by adopting SRI method. The economic status of small and marginal rice farmers can be substantially improved aiding in alleviation of poverty in the nation.

In Andhra Pradesh, SRI method of rice cultivation was promoted since 2002 by various nodal agencies and NGOs'. The agricultural officers of the Department of Andhra Pradesh were directed to conduct demonstrations on SRI method in all rice cultivating mandals of the state. Inputs like seed and conoweeder were provided on subsidy. During Kharif 2004, it was estimated that 10,000 farmers have tried SRI method. Over 800 demonstration trails and training covering all 23 distircts of Andhra Pradesh were organized (*Satyanarayana, 2004; Punna Rao & Satyanarayana, 2005*). The SRI method assessment project which was jointly undertaken by WWF-ANGRAU supported 250 farmers in 11 districts during Rabi 2004-05. Technology was disseminated through multiple sources that included WWF project staff, ANGRAU research team, NGOs', Department of Agriculture, Andhra Pradesh. The team reported that higher yields were recorded consistently in SRI method with 30 per cent less water (*Goud, 2005*).

SRI method of rice cultivation has been promoted by various nodal agencies, non-profit organizations, and

individuals for a decade. However, adoption levels of SRI method by rice farmers are still low in Andhra Pradesh. To assess the impact of SRI method and to formulate strategies to up-scale SRI method, a policy dialogue on "*Evolving strategies for increasing rice productivity through promotion of SRI*" was held at ANGRAU on May 4, 2009. Different stakeholders including Senior Officers of Planning Commission, ICAR scientists, Vice Chancellors of SAUs, Directors of Agriculture, Directors of Research from SAUs, Agriculture Commissioner, DAC, NGOs, Scientists from ICAR institutes/SAUs, Progressive farmers, WWF-ICRISAT representatives and others participated in the meeting (*Directorate of Rice Research, 2009*).

Progressive farmers opined that SRI method has increased the yields by 20-30 per cent, considerably reduced the cost of seed, improved soil health, and saved water up to 50 per cent. Lack of knowledge, awareness, and non-availability of good quality machinery are the main reasons for non-adoption of SRI on large scale. They expressed the need for training, cheaper disposable products for raising nursery, and efficient mechanized weeders (*Directorate of Rice Research, 2009*). The civil society groups and research community put forth the following suggestions: (1) demonstrations should be conducted at block level (rather than at individual level) for a continuous period of three years; (2) suitable varieties for SRI should be screened and new varieties should be developed; (3) proper land leveling and weeding equipment suitable under varied field situations should be made available; (4) integrated crop management package should be developed for SRI method; (5) extension personnel should be trained and updated with current research developments; (6) long term contact of extension personnel with SRI practicing farmers is needed (*Directorate of Rice Research, 2009*).

The purpose of this paper was to study about the effectiveness of behavior (knowledge, attitude and skill) in propagating SRI technology among rice farmers in Andhra Pradesh. The objectives of the study were to: (1) understand the demographics characteristics of SRI technology demonstration plot farmers; (2) assess demonstration plot farmers' knowledge on SRI technology; (3) assess demonstration plot farmers' skills developed in SRI technology; and (4) understand the demonstration plot farmers' attitude towards SRI technology (5) to assess the farmers' needs on SRI technology.

Extension education is concerned with dissemination of useful and practical information, application of knowledge acquired, and assisting the trainees to use the knowledge to better solve their own problems (*Okunade, 2007*). The purpose of agriculture extension is to bring about desirable changes (knowledge, skills, attitude, understanding, goals, action, and confidence) in human behavior by means of education (*Ray, 2012*). Training programs should be designed to change the knowledge, skill, and attitude of the trainees (*Norman, 1986*). For the purpose of this study, the three major dimensions of knowledge, skill, and attitude (KSA) of the SRI technology demonstration farmers were accessed to reflect the training effectiveness of the extension staff. The following statements provide a brief explanation about the KSA dimensions in agriculture extension education.

Knowledge includes information, facts and description of someone or something acquired through education or experience (cognitive abilities). It can be explicit (theoretical understanding of information) or implicit (practical skill or expertise) (*Bandura, 1977*).

Skills are the proficient manual, verbal or mental manipulation of data or things that allow for the execution of well-specified tasks (psycho-motor abilities). To be skilled, one must undertake the task competently and completely (*Bandura, 1977*).

Attitudes represent a state of mind, feelings, or beliefs about a particular matter (affective abilities). They are evaluative and are usually positive or negative. Attitudes have consequences on human behavior (*Bergevoet et al., 2004*).

METHODOLOGY

For the purpose of the study, three north coastal districts of Andhra Pradesh i.e., Visakhapatnam, Vizianagaram, and Srikakulam were selected purposively as the investigator is familiar with these districts. The population consists of 1053 rice farmers on whose farms demonstration plots were organized by the extension staff of the department of agriculture, Andhra Pradesh during past five years. From each district 10 paddy growing mandals were selected randomly. Five

demonstration plot farmers from each mandal were selected randomly and included in the sample (N = 150).

Data was collected using a structured questionnaire. The questionnaire consisted of five parts. The first three parts of the questionnaire were designed to assess the knowledge, skills and attitude of the demonstration rice farmers on SRI method of cultivation. Part IV was designed to understand the needs of the farmers on SRI. Part V was designed to understand the demographic characteristics of the SRI demonstration farmers. The participants had three choices for an answer; Disagree (D), Not Sure (NS), and Agree (A). Face and content validity of the questionnaire was established by a panel of experts consisting of extension specialists in the Department of Agriculture (Andhra Pradesh) and faculty of Acharya N. G. Ranga Agricultural University (ANGRAU). A pilot test (n = 30) was conducted to establish the reliability of the questionnaire (Cronbach's alpha = 0.85). These farmers were removed from the sample frame and were never contacted again. The data collected was analyzed using Statistical Package for Social Sciences (SPSS 19.0).

RESULTS AND DISCUSSION

Table 1 shows the personal characteristics of SRI technology demonstration plot farmers'.

Age: the respondents were asked to indicate their age using five categories. Majority (37.3%) of the respondents were in the 25 – 35 years age group while 26 per cent of the participants were in the age group of 36 – 45 years. Ten per cent of the participants were aged below 25 years, 14 per cent were aged between 46 – 55 years, and 12.7 per cent were aged above 55 years (see Table 1).

Education: majority (50.7%) of the respondents graduated middle school while 32.7% of the participants graduate high school. Six of the respondents (4.0%) were graduates while one (0.7%) was post-graduate (see Table 1).

Land holding: seventy-seven (51.3%) of the participants have land holding between 5.1 – 10 acres (see Table 1). Fifteen (10%) of the respondents hold less than 1.0 acres while 21 (14%) have a land holding between 2.5 – 5.0 acres. Twenty-four (16.0%) participants indicated that their land holding is between 11.0 – 20.0 acres while 13 (8.7%) had more than 20.0 acres (Table 1).

Table 1. Personal characteristics of SRI technology demonstration plot farmers' (N= 150)

Characteristic	Category	No.	%
Age	Below 25 years	15	10.0
	25 – 35 years	56	37.3
	36 – 45 years	39	26.0
	46 – 55 years	21	14.0
	Above 55 years	19	12.7
Education	Primary school	18	12.0
	Middle school	76	50.7
	High school	49	32.7
	Graduate	6	4.0
	Post-graduate	1	0.7
Land size (in Ac)	Less than 2.5	15	10.0
	2.5 – 5.0	21	14.0
	5.1 – 10.0	77	51.3
	11.0 – 20.0	24	16.0
	Above 20.0	13	8.7
Farming Experience	Less than 5 years	13	8.7
	5 – 10 years	24	16.0
	11 – 15 years	51	34.0
	16 – 20 years	35	23.3
	Above 20 years	27	18.0

Farming experience: the participants of the survey were asked to indicate their farming experience by using five categories. Thirteen (8.7%) have less than five years of farming experience while 24 (16%) have farming experience between 5 – 10 years. Majority (57.3%) of the respondents indicated their farming experience in the 11 – 20 years categories while 27 (18%) indicate to be farming for over 20 years (Table 1).

The knowledge of the participants was assessed using a series of questions on SRI method of rice cultivation. Sixty-two (41.4%) of the respondents agreed that rice is an aquatic plant, 39.3 per cent of participants were not sure while 19.3 per cent disagreed. Majority (76%) of the participants agreed to the statement, "Land should be leveled perfectly in SRI method." All (100%) of the respondents agreed that nursery should be grown on raised beds, SRI method requires less seed than traditional method, and marking should be done for transplantation. Ninety-four (62.7%) participants agreed, 44 (29.3%) were not sure while 12 (8.0%) disagreed to the statement. "Transplanting shock is minimized in SRI method." Seventy-four (49.3%) of the participants

Table 2. Farmers' behaviors on SRI technology (*N* = 150)

Statements	Disagree		Not sure		Agreed	
	No.	%	No.	%	No.	%
Farmers' knowledge on SRI technology						
Rice is an aquatic plant	29	19.3	59	39.3	62	41.4
Land should be leveled perfectly in SRI method	4	2.7	32	21.3	114	76.0
Nursery should be grown on raised beds	0	0.0	0	0.0	150	100.0
SRI requires less seed than traditional method	0	0.0	0	0.0	150	100.0
Marking for transplantation should be done	0	0.0	0	0.0	150	100.0
Transplanting shock is minimized in SRI method	12	8.0	44	29.3	94	62.7
Transplanting of seeding must be done up to 3-leaf stage	18	12.0	58	38.7	74	49.3
Spacing in SRI is wider than traditional method	0	0.0	0	0.0	150	100.0
Seedlings are planted at a younger age in SRI	0	0.0	0	0.0	150	100.0
Only one seedling is transplanted per hill in SRI	0	0.0	0	0.0	150	100.0
Number of seedling planted/acre are fewer in SRI	0	0.0	0	0.0	150	100.0
More number of tillers/hill are produced in SRI	3	2.0	9	6.0	138	92.0
First weeding should be done 10-12 days after transplantation in SRI	16	10.7	44	29.3	90	60.0
Subsequent weeding should be done at 10 day intervals	0	0.0	41	27.3	109	72.7
Use of conoweeder adds organic matter to the soil	5	3.3	24	16.0	121	80.7
Unflooded irrigation should be done in SRI	0	0.0	21	14.0	129	86.0
SRI method requires less water than traditional method	0	0.0	8	5.3	142	94.7
SRI method produces better root system	12	8.0	59	39.3	79	52.7
Chemical fertilizers can be reduced in SRI method	29	19.3	54	36.0	67	44.7
Farmers' skills developed in SRI technology						
I acquired the skill of raising nursery in SRI method	26	17.3	35	23.3	89	59.4
I acquired land leveling skills required in SRI method	15	10.0	32	21.3	103	68.7
I acquired the skill for marking hills in SRI method	22	14.7	41	27.3	87	58.0
I acquired the skills for separating seedling in SRI	19	12.7	34	22.7	97	64.6
I acquired the skill for transplanting single seedling	16	10.7	46	30.7	88	58.6
I acquired the skill needed for weeding in SRI method	18	12.0	29	19.3	103	68.7
I acquired the skill for irrigating plots in SRI method	12	8.0	19	12.7	119	79.3
Farmers' attitudes towards SRI technology						
Farmers can improve rice productivity by adopting SRI	14	9.3	42	28.0	94	62.7
Adopting SRI will improve farmers' economic status	12	8.0	34	22.7	104	69.3
Adopting SRI method will conserve water	9	6.0	23	15.3	118	78.7
Raising nursery in SRI method is easy	25	16.7	39	26.0	86	57.3
Leveling land perfectly for SRI method is possible	38	25.3	49	32.7	63	42.0
Leveling land for SRI method is labour intensive	5	3.3	19	12.7	126	84.0
It is easy to mark hills for transplantation in SRI	43	28.7	38	25.3	69	46.0
Marking hills for transplanting is labour intensive	8	5.3	21	14.0	121	80.7
Separating seedling for transplanting is possible	19	12.7	39	26.0	92	61.3
Separating seedling for transplanting is time consuming	4	2.7	17	11.3	129	86.0
Transplanting single seedling can be done easily	43	28.7	29	19.3	78	52.0
Transplanting single seedling is labour intensive	10	6.7	21	14.0	119	79.3
Transplanting single seedling is time consuming	10	6.7	19	12.7	121	80.6
Weeding in SRI method is easy	51	34.0	41	27.3	58	38.7
Weeding in SRI method is labour intensive	5	3.3	21	14.0	124	82.7
Weeding in SRI method is time consuming	4	2.7	19	12.7	127	84.6
Unflooded irrigation in SRI method can be done	19	12.7	32	21.3	99	66.0

Table 3. Farmers' needs on SRI technology (N = 150)

Statements	Disagree		Not sure		Agreed	
	No.	%	No.	%	No.	%
Better nursery raising techniques should be developed	4	2.7	7	4.7	139	92.7
Better equipment for raising nursery are needed	0	0.0	0	0.0	150	100.0
Precision land leveling equipment is needed	2	1.3	12	8.0	136	90.7
Better marking system should be developed	0	0.0	17	11.3	133	88.7
Efficient marking equipment are needed	0	0.0	0	0.0	150	100.0
Efficient manual weeding equipment are needed	0	0.0	0	0.0	150	100.0
Mechanized weeding equipment are needed	2	1.3	7	4.7	141	94.0
Season long contact of extension personnel is needed	8	5.3	21	14.0	121	80.7
Agriculture labour should be trained in SRI techniques	0	0.0	7	4.7	143	95.3
Information on irrigation technology is needed	0	0.0	11	7.3	139	92.7
Information on integrated crop management is needed	0	0.0	0	0.0	150	100.0

agreed that seedling should be transplanted up to 3-leaf stage and less than 14 days old. Fifty-eight (38.7%) respondents were not sure while 18 (12%) disagreed. All (100%) of the respondents agreed to the following statements: "Spacing in SRI is wider than traditional method", "Seedlings are planted at a younger age in SRI", "Only one seedling is transplanted per hill in SRI," and "Number of seedling planted/acre are fewer in SRI." Majority (92%) of the participants agreed that more number of tillers/hill are produced in SRI method. Ninety (60%) respondents agreed to the statement, "First weeding should be done 10-12 days after transplantation in SRI." Forty-four (29.3%) participants were not sure while 16 (10.7%) disagreed. One hundred and nine (72.7%) respondents agreed that subsequent weeding should be done at 10 day interval while 41 (27.3%) were not sure. Majority (80.7%) participants agreed to the statement, "Use of conoweeder adds organic matter to the soil." One hundred and twenty-nine (86.0%) respondents agreed that unflooded irrigation should be done in SRI while 21 (14.0%) were not sure. Majority of the participants agreed that SRI method requires less water than traditional method of rice cultivation (Table 2).

The skills developed by SRI demonstration farmers were assessed. Eighty-nine (59.5%) respondents acquired skill necessary for raising nursery in SRI method while 35 (23.3%) were not sure, and 26 (17.3%) disagreed. One hundred and three (68.7%) participants agreed that they acquired the required land leveling skills for SRI method while 32 (21.3%) were not sure, and 15 (10%) disagreed. Eight-seven (58.0%) respondents agreed that they acquired skills for marking hills for transplantation in SRI. Forty-one (27.3%) participants were not sure while 22 (14.7%) disagreed. Ninety-seven (64.6%) respondents agreed that they acquired skills needed to separate the seeding, while 34 (22.7%) were not sure, and 19 (12.7%) disagreed. Eighty-eight (58.6%) respondents agreed that they acquired the skill of transplanting single seedling, while 46 (30.7%) were not sure, and 16 (10.7%) disagreed. One hundred and three (68.7%) participants agreed that they acquired weeding skills in SRI method, while 29 (19.3%) were not sure, and 18 (12.0%) disagreed. One hundred and nineteen (79.3%) respondents agreed that they acquired the necessary skills for irrigating SRI plots, while 19 (12.7%) were not sure, and 12 (8.0%) disagreed (Table 2).

Ninety-four (62.7%) participants agreed that SRI can improve rice productivity while 42 (28%) were not sure, and 14 (9.3%) disagreed. One hundred and four (69.3%) respondents agreed that SRI will improve the economic status of the rice farmer while 34 (22.7%) were not sure, and 14 (9.3%) disagreed. One hundred and eighteen (78.7%) participants agreed that water is conserver in SRI method while 23 (15.3%) were not sure and nine (6.0%) disagreed. Eighty-six (57.3%) of the respondents felt that raising nursery in SRI method was easy while 39 (26%) were not sure, 25 (16.7%) disagreed. Sixty-three (42.0%) participants agreed that land can be leveled perfectly for SRI method while 49 (32.7%) were not sure, 38 (25.3%) disagreed. One hundred and twenty-six (84.0%) participants felt that land leveling for SRI method is labour intensive while 19 (12.7%) were not sure, five (3.3%) disagreed. Sixty-nine (46.0%) participants agreed that it is easy to mark

hills for transplantation in SRI method while 38 (25.3%) were not sure, 43 (28.7%) disagreed. Over 80% (121) of the participants agreed that marking hills for transplanting is labour intensive while 14 % were not sure, eight disagreed. Ninety-two (61.3%) respondents agreed to the statement, "Separating seedling for transplanting is possible," while 39 (26.0%) were not sure, 19 (12.7%) disagreed. One hundred and twenty-nine (86.0%) participants felt that separating seedling for transplanting is time consuming while 17 (11.3%) were not sure, four (2.7%) disagreed. Seventy-eight (52.0%) respondents agreed that transplanting single seedling can be done easily while 29 (19.3%) were not sure, 43 (28.7%) disagreed. One hundred and nineteen (79.3%) participants agreed that transplanting single seedling is labour intensive while 21 (14.0%) were not sure, 10 (6.7%) disagreed. One hundred and twenty-one (80.6%) respondents agreed that transplanting single seedling is time consuming while 19 (12.7%) were not sure, 10 (6.7%) disagreed. Fifty-eight (38.7%) participants agreed that weeding in SRI method was easy while 41 (27.3%) were not sure, 51 (34.0%) disagreed. One hundred and twenty-four (82.7%) respondents agreed that weeding in SRI method is labour intensive while 21 (14.0%) were not sure, five (3.3%) disagreed. One hundred and twenty-seven (84.6%) respondents agreed that weeding in SRI method is time consuming while 19 (12.7%) were not sure, four (2.7%) disagreed. Ninety-nine (66.0%) participants agreed that unflooded irrigation in SRI method can be done while 32 (21.3%) were not sure, 19 (12.7%) disagreed (Table 2).

The fifth objective of the study was to understand the needs of the farmers on SRI technology. One hundred and thirty-nine (92.7%) respondents agreed that better nursery raising techniques should be developed while seven (4.7%) were not sure, four (2.7%) disagreed. All (100%) participant agreed that they needed better equipment for raising nursery. One hundred and thirty-six (90.7%) participants agreed that they needed precision land leveling equipment while 12 (8.0%) were not sure, two (1.3%) disagreed. One hundred and thirty-three (88.7%) respondents agreed that a better marking system should be developed while 17 (11.3%) were not sure. All (100%) survey participants agreed than efficient marking and manual weeding equipment are needed. Ninety-four per cent of the participants agreed that they needed mechanized weeding equipment. One hundred and twenty-one (80.7%) respondents agreed to the statement, "Season long contact of extension personnel is needed," while 21 (14.0%) were not sure, eight (5.3%) disagreed. Over 95 per cent of the participants agreed to the statement, "Agriculture labour should be trained in SRI techniques." One hundred and thirty-nine (92.7%) participants agreed that information on irrigation technology in SRI method is needed while 11 (7.3%) were not sure. All (100%) respondents needed information on integrated crop management in SRI method (Table 3).

CONCLUSION

The results of the study indicated that there is a substantial gain of knowledge on SRI technology among the demonstration farmers. Farmers understood the key concepts of raising nursery, land leveling, marking, spacing, transplanting, and irrigation technology in SRI method. However, about one half of the respondents are unsure about the following: correct stage/age of the nursery to be transplanted; timing of the first weeding; and integrated nutrient management in SRI method. More than one half of the participants were confident that they have acquired the skills needed to cultivate rice in SRI method. Based on the results of the study, it can be concluded that framers have developed positive attitude towards SRI method. However, majority of the farmers feel that many of the operations of SRI method are labour intensive and time consuming. Majority (80 – 100%) of the farmers expressed the need for; development of better techniques for operations in SRI method; better and efficient equipment for raising nursery, leveling and weeding; training agriculture labour; season long contact of extension staff; and information on irrigation technology and integrated crop management.

Implications for scaling-UP :

i. Training is the most effective way of developing knowledge, skills, and attitude in agriculture extension. However, training should be designed to teach the necessary skills, motivate, and create a positive attitude towards the technology besides disseminating knowledge.

ii. For widespread adoption of SRI, cheaper disposable

products for nursery raising, efficient mechanized weeders, supply of organics especially the vermicompost and laser levelers on custom hiring (*Directorate of Rice Research, 2009*). Knowledge and equipment should be readily available to the farmer as required.

iii. Training rural youth, *Adarsha Rythus* (contact farmers), and farm labour on SRI method of rice cultivation will help in better adoption of the technology.

iv. Block level approach rather than individual demonstrations will help to spread SRI faster (*Directorate of Rice Research, 2009*). More number of farmers and demonstrations on larger extents should be taken up.

v. Long term contact of the extension staff with SRI demonstration and practicing farmer must be maintained. Regular and continuous trainings should be done to field level and supervisory level extension personnel in order to improve the adoption rate.

vi. Existing varieties should be screened for suitability. New varieties that are better suitable to SRI technology should be developed ((*Directorate of Rice Research, 2009*).

vii. Integrated crop management schedule suitable to the local agro-climatic conditions should be developed and recommended.

viii. Best practices suitable to the local conditions should be developed by multi-location trails instead of recommending common set of practices in the entire state.

ix. Exposure visits should be conducted to states like Tripura and Tamil Nadu where SRI method is popular. This will help in creating a positive attitude in the farmers to SRI method of rice cultivation.

x. A nodal agency at the district level should be established coordinate different partners (University, Department of Agriculture, Non-profit organizations, individual etc.) promoting SRI technology.

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