



SMALLHOLDER FARMERS' ATTITUDE AND AWARENESS ON THE SYSTEM OF
RICE INTENSIFICATION INNOVATION PRACTICES IN NORTH-WEST, NIGERIA

^{1*}Abdulkarim, H. A., ¹Muhammad, M. B., ²Aliyu, A. and ¹Bello, O. G.

¹Department of Agricultural Extension and Rural Development, Federal University Dutse,
Jigawa State, Nigeria

²Department of Agricultural Economics and Agribusiness, Federal University Dutse, Jigawa
State, Nigeria

*Corresponding Email: hassanabdulkarim@yahoo.com GSM: +2348034575955

ABSTRACT

The study examined the smallholder farmers' awareness and attitude on the system of rice intensification innovation practices in North-west, Nigeria. Data were collected using structured questionnaire and interview schedule administered to randomly selected 315 rice farmers via a 3-stage sampling procedure. Data were analyzed using descriptive statistics. Majority are males (91.7%), married (75.0%), with secondary education (66.7%) and no extension contact (91.7%). Average age of 32 years, farming experience of 11 years, monthly income of N30, 637.51k, farm size of 7.0 hectares and household size of 5 persons. The respondents have favorable attitude towards SRI innovation practices ($\bar{x}=1.54\pm1.23$). The categorization of attitude shows that majority (58.7%) were with favorable attitude. Greater proportion indicated low awareness level (65.3%) on SRI innovation practices ($\bar{x}=2.37\pm1.54$). There are several severe constraints to implementation of SRI practices with constraint index of $\bar{x}=3.21\pm1.47$. The study recommends that awareness campaign on SRI practices be instituted using different information dissemination methods. Periodic advisory services be provided to increase the attitude, understanding and awareness of the clientele on the SRI components as well as boosting the adoption to strengthened food security.

Keywords: Attitude, Awareness, Farmers, Intensification and Smallholder

INTRODUCTION:

Rice (*Oryza sativa* L.) is one of the utmost significant food crops for over 50% of the global population (Ahmed *et al.*, 2019) and it meaningfully effects food security potentials of most countries (Ara *et al.*, 2017). Over 160 million hectares was estimated to be covered by rice production worldwide with an approximate annual production of around 500 million metric tons (Kirby *et al.*, 2017). Hence, the demand for irrigation water has exceeded the amount of available water for rice production in Nigeria (Salami and Shikuku, 2013). Therefore, alternative practices that reduce water use need to be put in place to enhance sustainable rice production for the nearest future (Denkyirah, 2015). Numerous procedures have been used to reduce input usage in production of rice previously (Ndiiri *et al.*, 2013). Among the various tried methods was the Green Revolution procedure, which involved sequences of technology transfer initiatives and research (Sudeep, 2011).

Rahman (2017), posited that the Green Revolution involves the improvement for high-yielding varieties of cereal grains and transformation of farmland management procedures. The novelty showed effectiveness and fruitfulness in many Asian countries (Nigeria inclusive) in



which many agriculturalists were able to adopt the technology massively (Ehiakpor *et al.*, 2017; Thakur *et al.*, 2015). The Green Revolution seemed to have its own defects.

However, by default the Green Revolution could not assist majority of African countries as a result of financial constraints and limited infrastructure (Ndiiri *et al.*, 2013). The System of Rice Intensification (SRI) evolved around 30 years back and has been seen to offer opportunity for reducing water usage while high yield tendency is maintained. Dobermann, (2004), opined that SRI is a conception based on the influence of some agronomic smart practices to achieve higher rice yields with the utilization of marginal resources like seeds, agrochemicals and water (no uninterrupted flooding in SRI compared to the common traditional methods). SRI is gaining popularity in all rice-growing areas of the world and agrarians can grow more rice with less water input usage (Sudeep, 2011).

The vital components of SRI comprise of water management which is done by keeping the soil well-drained rather than uninterrupted watering and soaking in the vegetative development period. The SRI adjusts farm practices for managing water use, nutrients, and soils. The two options recommended for water management in the SRI procedure involve the application of small quantity of water daily and leaving the fields dry for a short period (around 2 to 7 days) to the point of surface cracking. The additional one is flooding and drying the fields for alternating periods of 3 to 6 days each (Namara *et al.*, 2003). The succeeding component is the planting method involving spacing configurations and age of the seedlings. SRI seedlings are transplanted 8 to 15 days after germination (Thura, 2010). Some previous research suggested a line spacing of 0.3m × 0.3m. The spacing might be based on the local edaphic conditions but it has to allow for weeding (Uphoff *et al.*, 2005). The third component is weed control which is paramount about ten days after transplanting and then weeding every ten days until canopy closure (Thura, 2010). Soil fertility management is fourth component in SRI innovativeness. Many farmers use organic manure or compost but the quantity applied varies depending on availability and also no fixed recommended rate to be complied with (Thura, 2010).

However, alternative innovation practices such as SRI have not yet been fully investigated especially on awareness, attitude and adoption among rice farmers in Nigeria and more especially in the North-west zone where the pilot project was tested. Previous studies on SRI in the Nigeria is scanty like look into the constraints and the returns associated with SRI innovation compliance. The knowledge on SRI is still scanty especially on the application of econometric modeling too (Kaloï *et al.*, 2021). Therefore, this study provides a strong case of the argument of using SRI to generate information on awareness and attitude on SRI innovation practices with a view of driving policy recommendations and filling the information gap. The general objective of the study is to examine the smallholder farmers' awareness and attitude on the system of rice intensification innovation practices in North-west, Nigeria. The specific objectives are to:

- i. Describe the socio-economic characteristics of the rice farmers;
- ii. Examine the respondents' attitude towards the SRI innovation practices;
- iii. Examine the respondents' awareness of the SRI innovation; and
- iv. Identify the constraints to implementation of the SRI innovation practices;



MATERIALS AND METHODS

The Study Area

The study was conducted in Jigawa and Kano states in North-West Nigeria where the pilot SRI project was conducted. The study area is located between Latitude $11^{\circ} 00' 00''$ N and $13^{\circ} 00' 00''$ N with Longitude $8^{\circ} 00' 00''$ E and $10^{\circ} 15' 00''$ E. (National Geospatial-Intelligence Agency NGIA 2012). The area occupies a land mass of 216,065 Sq Km. According to National Population Census (2006), the study area has a population of 26,231,987 with a growth rate of 2.83% and 2.94% in Jigawa and Kano states respective (Worldometer, 2021). Jigawa State has a total of 27 Local Government Areas (LGAs) divided into Agricultural zones, which include Headquarters at Birnin-Kudu, Gumel, Hadeja and Kazaure.

The topography is characterized by high land areas which are almost 750metres above sea level. Soil tends to be fertile ranging from sandy-loamy with many pockets of Fadama and alluvial plains suitable for the cultivation of rice. The state shares a boundary with three (4) states and the Niger Republic (<http://hea-sahel.org>) and (Jigawa State Diary, 2015). There are usually two seasons in the state viz: the rainy season starting from June through October and the dry season spanning from November to May yearly. The mean temperature ranges from 35°C in October to about 50°C in May, while mean annual rainfall varies from 700mm to over 1000mm and last up to 200days in some lowland of the state. (Jigawa State Diary, 2015) The official language of the study area is Fulfulde and Hausa. The study was conducted in Agricultural zone three Jigawa state, Nigeria, the population for the study was mainly all the registered rice farmers in the state. Jigawa is situated between Latitude $11^{\circ} 00' 00''$ N and $13^{\circ} 00' 00''$ N and Longitude $8^{\circ} 00' 00''$ E and $10^{\circ} 15' 00''$ E. The state has a total land area of approximately 22,410 Square kilometers (National Population Commission, 2006).

Kano State has a total of 44 Local Government Areas (LGAs) about 13,076,900 people with an annual growth rate of 2.94%. Based on this growth rate projected present population of the state to about 19,296,109 (NPC, 2006). It lies between latitude $11^{\circ} 33'$ North and $12^{\circ} 37'$ North of the equator and Longitude $8^{\circ} 34'$ East and $9^{\circ} 29'$ East and covers a land area of about 20760km² square (Nigerian Postal Services, 2009). The state is bordered to the West and Northwest by Katsina State, to the East and Northeast by Jigawa State, to the South by Bauchi State, and to the Southwest by Kaduna State. The annual rainfall is between 420mm-1000mm and the temperature is averagely warm throughout the year. (Kano Agricultural and Rural Development Authority, 2007). It is characterized by two seasons which are the wet and dry seasons. The wet season occurs between May to September while the dry season occurs from October to April. Most of the people of Kano State depend on agriculture for their livelihood. In the pre-colonial period, Kano State was considered the garden of central Africa with the potential of feeding the whole region. The state has great potential for rice production, processing, and marketing (Inuwa, 2011). The major crops grown in the state includes rice, millet, groundnut, pepper, sorghum, and maize which are grown throughout the year because of the availability of irrigation facility made possible by the establishment of artificial water bodies like earth dams across the state. The state is administratively divided into three agricultural zones by Kano State agricultural rural development authority. These zones are zone 1, zone 2, and zone 3, with their different local government area of coverage with their headquarters: Rano, Danbatta, and Gaya

Sampling Technique and Sample Size

A multi-stage sampling procedure was used in selecting respondents for the study. The first stage was a purposive selection of Jigawa and Kano states being the states where the pilot phase

of the SRI project was first conducted in North-west zone, Nigeria. The second stage was a judgmental selection of three Local Government Areas from each of the states where rice is mostly produced and where SRI farmers abound to obtained a total of six (6) local government areas. In the third stage, Taro Yamane's formula was used at 5% probability level as adopted as used by Kalpana (2011) to make a sample size of 315 respondents for the study. This implies that a total of 97 respondents were used in Jigawa State and 218 respondents were used in Kano State to give a total of 315 respondents for the study respectively.

RESULTS AND DISCUSSION:

Socio-economic Characteristics of the Rice Farmers

The result of the socio-economic characteristics of the respondents is shown in Table 1. From the Table, it shows that the mean age of the respondents is 32 years. Which implies that the respondents are in their active and productive age rang where maximum energy and contribution to the SRI innovation activities could be seen and adoption. This is in line with the work of Obisesan *et al.* (2013), who pointed out that the active age is regarded as agile with more energy to dissipate and concentrate on productive efforts. Majority were males (91.7%), married (75.0%), with secondary education (66.7%).

Table 1: Distribution of the respondents based on socio-economic characteristics

Variables	Frequency	Percentage	$\bar{x} \pm \delta$
Age (Years.)			
0-20	1	0.8	32.4±1.95
21-30	37	30.8	
31-40	80	66.7	
≥ 41	2	1.7	
Sex			
Male	110	91.7	
Female	10	8.3	
Marital Status			
Single	27	22.5	
Married	90	75.0	
Widowed	2	1.7	
Divorced	1	0.8	
Farming Experience (Years.)			
1-5	3	2.5	10.88±2.27
6-10	53	44.2	
11-15	57	47.5	
16-20	6	5.0	
≥ 21	1	0.8	

Source: Field Survey, 2022 $\bar{x} \pm \delta$ = Mean ± Standard Deviation

This implies that majority of the respondents were moderately literate and hence stands the chance of understanding the accruing benefits of improved innovations in rice farming practices and this would assist their information seeking habits as asserted by Ogunlade *et al.* (2010). The

marital status is in line with the findings of Ahien *et al.* (2017); Vogelstein (2013) and Unicef (2014a&b) that marriage confers responsibility.

Mean farming experience of 11 years, monthly income of ₦30,637.51k and farm size of 7.0 hectares respectively. This corroborates the ascertain of Bello *et al.* (2017) that, the higher the farming experience the more the farmers would have gained more knowledge and innovation in handling rice farming activities and the higher would be their output and income on the long run. It has been reported that farmers' experience in farming count more than educational attainment in order to increase productivity (Apantaku *et al.*, 2016).

Table 1: Distribution of the respondents based on socio-economic characteristics cont'd

Variables	Frequency	Percentage	$\bar{x} \pm \delta$
Educational Qualifications			
No Formal Education	1	0.8	
Primary Education	20	16.7	
Secondary Education	80	66.7	
Tertiary Education	6	5.0	
Islamic Education	13	10.8	
Average Monthly Income (N)			
1-10,000	2	1.7	30,637.51±3,689.84
11,000-20,000	1	0.8	
21,000-30,000	60	50.0	
31,000-40,000	48	40.0	
41,000-50,000	8	6.7	
≥ 51,000	1	0.8	
Farm Size (ha)			
1-5	40	33.3	7.0±1.2
6-10	66	55.0	
11-15	12	10.0	
≥ 16	2	1.7	
Household Size (No)			
1-5	89	74.2	4.5±1.5
6-10	27	22.5	
11-15	3	2.5	
≥ 16	1	0.8	
Presence of Extension Services			
Yes	10	8.3	
No	110	91.7	

Source: Field Survey, 2022 $\bar{x} \pm \delta$ = Mean ± Standard Deviation

Respondents' Attitude towards the SRI Innovation Practices

The respondents' attitude on the SRI innovation practices in the study area is presented in Table 2. The attitude of the respondents was measured on a 3-point Likert type scale of strongly agreed (SA)=2, undecided (U)=0 and strongly disagreed (SD)=1 respectively against some attitudinal statement obtained during pretesting of the data collection instrument. The class mid-point was determined and used for inference as follows $2+0+1=3/3=1.00$. This implies that at the

upper limit and with an interval of 0.50, values of $1.00+0.50=1.50$ implies strongly agreed variables (1.45-2.00), while values at the lower limit of 0.50 interval= $1.00-0.50=0.50$. Hence similarly values of 0.50 to ≥ 1.00 implies strongly disagreed variables.

As depicted in Table 2, the respondents agreed with all the attitudinal statement on SRI innovation practices except the following; SRI practices is easy to apply on any rice farm ($\bar{x}=1.29\pm 1.11$), SRI innovation styles can only for educated farmers ($\bar{x}=0.89\pm 0.91$), there is ease of land preparation & transplanting ($\bar{x}=1.44\pm 1.20$) and it does not requires too much high cost in application ($\bar{x}=1.34\pm 1.14$). They may be unconnected to the fact that they were not aware of the innovation practices and as well no full understanding of the content of the innovation. This is in congruent with the submission of Aromolaran *et al.* (2017) who agreed that farmers have favorable attitude improved practices except if they are not aware of the complete benefits of same hence, they are ready to adopt its usage in southwest area of Ogun State, Nigeria. From the attitudinal index value ($\sum \bar{x}=1.54\pm 1.23$), it shows that the respondents have favorable attitude to the SRI innovation practices only that they have low awareness of its benefits. Hence, it implies that with the low awareness adoption would be hindered. Therefore, adequate institutional and local measures should be put in place to increase the awareness of SRI innovation practices among respondents in order to increase rice production output for food security. This was also posited in the findings of STOA (2008), that farmers have favorable attitude to the SRI innovation practices in any environment where introduced except if the principle and operational procedures are not understood as well as the awareness.

Table 2: Distribution of the respondents based on their attitude towards the SRI innovation practices

Variables	SA(%)	U(%)	SD(%)	$\bar{x}\pm\delta$
SRI Practices can improve your livelihood in rice production	193(61.3)	7(2.2)	115(36.5)	1.59 \pm 1.21
SRI practices are easy to apply on any rice farm	100(31.7)	10(3.2)	205(65.1)	1.29 \pm 1.11
SRI practices are not only good for mechanize farmers alone	229(72.7)	16(5.1)	70(22.2)	1.68 \pm 1.27
SRI innovation styles can only for educated farmers	67(21.2)	102(32.3)	146(46.3)	0.89 \pm 0.91
SRI increases yield and output of rice	271(86.0)	14(4.4)	30(9.5)	1.82 \pm 1.33
There is ease of land preparation & transplanting	159(50.5)	21(6.7)	135(42.9)	1.44 \pm 1.20
SRI practices are compatible with my cultural belief/values	216(68.6)	41(13.0)	58(18.4)	1.56 \pm 1.24
SRI innovation is a climate smart friendly practice	197(62.5)	33(10.5)	85(27.0)	1.52 \pm 1.22
With SRI pest and diseases pathogens are put on check	221(70.2)	37(11.7)	57(18.1)	1.58 \pm 1.25
SRI innovation reduces water usage/wastage	244(77.5)	29(9.2)	42(13.3)	1.68 \pm 1.27
With SRI innovation early maturation period is possible	277(87.9)	15(4.8)	23(7.3)	1.83 \pm 1.34
It is compatible with any kind of manuring type	291(92.3)	21(6.7)	3(0.9)	1.86 \pm 1.36
There is reduced seed usage in SRI practices	202(64.1)	59(18.7)	54(17.1)	1.45 \pm 1.21
It does not require too much high cost in application	117(37.1)	10(3.2)	188(59.7)	1.34 \pm 1.14
Attitudinal Index	1.54\pm1.23			

Source: Field Survey, 2022

Strongly Agreed (SA)=2, Undecided (U) and Strongly Disagreed (SD), R=Remarks $\bar{x}\pm\delta$ =Mean \pm SD

Categorization of the Attitude of the Rice Farmers on the SRI Innovation Practices

The result of the categorization of the attitudinal level of respondents on SRI innovation practices is shown in Table 3. From the table it can be deduced that majority of the respondents at pooled level (58.7%) shows favorable attitude towards the SRI innovation practices in the study

area while smaller proportion of about 1/3 (32.1%) shows low attitudinal disposition to the SRI innovation practices. This is because of their low awareness level of the SRI innovation practices. This followed similar trend across Kano and Jigawa States of the study area. This is in agreement the work of Singh *et al.* (2018) on the attitude of farmers to the SRI technology in the study area.

Table 3: Categorization of the attitude of the respondents on SRI innovation practices

Attitudinal Level	Kano		Jigawa		Pooled	
	Freq	%	Freq	%	Freq	%
Low	70	32.1	31	31.9	101	32.1
Moderate	20	9.2	9	9.3	29	9.2
High	128	58.7	57	58.8	185	58.7
Total	218	100	97	100	315	100

Source: Field Survey, 2022

Respondents' Awareness of the SRI Innovation Practices

From the analysis shown in the Table 4, the respondents did not show high awareness to all the examined variables. They showed low awareness to the fact that; Sri use gives high yielding quality/variety ($\bar{x}=2.46\pm1.79$), Sri use gives high resistant disease variety ($\bar{x}=2.32\pm1.52$), Sri use gives early maturing potentials ($\bar{x}=2.01\pm1.42$), Sri use gives resistant to bacterial diseases ($\bar{x}=2.19\pm1.48$), Gives good mechanical weed control ability ($\bar{x}=1.77\pm1.31$) and Provides for early weed hand picking possibility ($\bar{x}=1.67\pm1.29$). They exhibited very low awareness to; Ease of usage of modern harvesters, Ease of usage of manual harvester, Better association with compost combination and the practice is one of the best for increased livelihood ($\bar{x}=1.42\pm1.19$). They were indifferent with regards to; Sri use gives resistant to fungus diseases ($\bar{x}=2.67\pm1.63$), Sri use gives resistant to viral diseases ($\bar{x}=2.57\pm1.60$), Sri use give good broadcasting technology ($\bar{x}=3.21\pm1.79$), Compactible with transplanting technology ($\bar{x}=3.05\pm1.75$), Provides for effective water management ($\bar{x}=2.67\pm1.63$), Has good moisture water maintenance ability ($\bar{x}=2.67\pm1.63$), Compactible of SRI with inorganic fertilizer usage ($\bar{x}=3.21\pm1.79$), Compactible with both compost & inorganic fertilizer used together ($\bar{x}=2.67\pm1.63$), There is easy cost of land preparation, There is easy cost of transplanting and There is easy cost of harvesting ($\bar{x}=2.81\pm1.68$). The awareness index value $\bar{x}=2.37\pm1.54$ indicates a low awareness of the SRI practices among the respondents. It implies that a low awareness will definitely lead to a low adoption of the SRI practices among rice farmers. This is in line with Njeru *et al.* (2021) that rice farmers have low awareness level on the SRI practices.

Table 4: Distribution of the respondents according to their awareness of SRI innovation practices

Variables	VH	H	U	L	VL	$\bar{x}\pm\delta$	R
Sri use gives high yielding quality/variety	30	45	15	175	50	2.46±1.79	L
Sri use gives high resistant disease variety	27	28	20	185	55	2.32±1.52	L
Sri use gives early maturing potentials	9	11	10	230	55	2.01±1.42	L
Sri use gives resistant to bacterial diseases	17	19	71	108	100	2.19±1.48	L
Sri use gives resistant to fungus diseases	33	16	89	169	8	2.67±1.63	N
Sri use gives resistant to viral diseases	28	39	34	198	16	2.57±1.60	N
Sri use give good broadcasting technology	42	31	89	86	67	3.21±1.79	N
It gives good mechanical planting technology	51	40	72	102	50	2.81±1.68	N
Compactible with transplanting technology	71	36	57	140	11	3.05±1.75	N
Gives good mechanical weed control ability	11	17	27	100	155	1.77±1.31	L

Provides for early weed hand picking possibility	18	09	21	69	198	1.67±1.29	L
Ease of usage of modern harvesters	12	11	10	31	251	1.42±1.19	VL
Ease of usage of manual harvester	12	11	10	31	251	1.42±1.19	VL
Provides for effective water management	33	16	89	169	8	2.67±1.63	N
Has good moisture water maintenance ability	33	16	89	169	8	2.67±1.63	N
Better association with compost combination	12	11	10	31	251	1.42±1.19	VL
Compactible of SRI with inorganic fertilizer usage	42	31	89	86	67	3.21±1.79	N
Compactible with both compost & inorganic fertilizer used together	33	16	89	169	8	2.67±1.63	N
There is easy cost of land preparation	51	40	72	102	50	2.81±1.68	N
There is easy cost of transplanting	51	40	72	102	50	2.81±1.68	N
There is easy cost of harvesting	51	40	72	102	50	2.81±1.68	N
The practice is one of the best for increased livelihood	12	11	10	31	251	1.42±1.19	VL
						2.37±1.54	L

Awareness Index

Source: Field Survey, 2022 Very High (VH), High (H), Undecided (U), Low (L) and Very Low (VL). $\bar{x} \pm \delta$ = Mean \pm SD

Categorization of the Respondents' Awareness of SRI Innovation Practices

The result of the categorization of the awareness level of the respondent on SRI innovation practices among the respondents in the study area is shown in Table 5. At pooled level majority (65.3%) of the respondents shows low awareness to the SRI innovation practices. About 1/3 (34.0%) of the respondents doubtful of their awareness of the SRI innovation practices, while negligible proportion (0.7%) claimed higher awareness of the SRI innovation practices in the study area. At each state level, Jigawa shows greater proportion (64.9%) with low awareness and 1.1% with high awareness while Kano to shows significant percentage (65.6%) with low awareness and negligible proportion (0.5%) with high awareness of SRI innovation practices respectively. This shows that the trend across the surveyed state and the pooled values indicated similar phenomena. Based on the findings of the study, the implications are that with the low awareness of sustainable rice intensification (SRI) practices there is a need for increased education and awareness programs for farmers to increase their knowledge of the improved innovative rice farming practices. With these outcomes there would be low adoption of the SRI practices in the study area. The study found that a need for more support and incentives to encourage farmers to adopt the sustainable farming practices based on the benefits accrued to it. Hence, there is need to target education and extension services pro-activeness, to increase awareness and help adoption of SRI practices among farmers. Njeru *et al.* (2021) posited that awareness is need for adoption to be possible in any agricultural innovation dissemination.

Table 5: Categorization of the respondents' awareness on SRI innovation practices

Level of Awareness	Kano		Jigawa		Pooled	
	Freq	%	Freq	%	Freq	%
Low	143	65.6	63	64.9	206	65.3
Undecided	74	33.9	33	34.0	107	34.0
High	1	0.5	1	1.1	2	0.7
Total	218	100	97	100	315	100

Source: Field Survey, 2022

Constraints to Implementation of the SRI Innovation Practices

The result of the constraints to implementation of the SRI innovation practices among the rice farmers is shown in Table 6. The rice farmers in the study area perceive several constraints to the adoption of SRI practices. Most of the constraints examined were severe constraints except for none availability of organic manure for usage ($\bar{x}=3.70\pm1.50$), farm input requirement are expensive ($\bar{x}=3.45\pm1.60$), inadequate funds to practice the SRI method ($\bar{x}=3.56\pm1.58$) and the equipment are not available or too expensive to practice SRI innovation into practice ($\bar{x}=3.53\pm1.58$) that are very severe. Arifin and Hambali's (2020) discovered that expensive input requirement, limited access to inputs and finance, and adherence to traditional farming practices among others are main barriers to adoption of SRI innovation practices. Bhattacharyya and Bhattacharyya's (2018) identified lack of access to inputs and finance, and inadequate support from government agencies as key constraints to SRI adoption. Boulakia *et al.* (2019) found that low education levels and limited access to finance and information were among the main barriers to SRI adoption in the study area. The mean index value of the constraints shows that SRI innovation practices has a severe constraint ($\bar{x}=3.21\pm1.47$) militating against its adoption/implementation among the rice farmers in the study area.

Table 6: Distribution of the respondents based on constraints to implementation of SRI innovation practices

Variables	Mean (\bar{x})	SD (δ)	R
Problem of weed control	3.19	1.45	Severe
Transplanting difficulties	3.19	1.45	Severe
SRI requires skill labour for management	3.21	1.45	Severe
SRI transplanting demands more labour	3.44	1.45	Severe
SRI need more concerted effort	3.21	1.53	Severe
None availability of organic manure for usage	3.70	1.50	Very Severe
Transplanting organic matter is a problem	3.44	1.37	Severe
There is rodents attack due to unclean bunds	3.19	1.32	Severe
SRI practices require well drained soils	2.69	1.35	Severe
SRI practices do not work on flooded fields	2.89	1.41	Severe
SRI management activities are difficult	2.96	1.43	Severe
SRI nursery management is difficult to handle	2.77	1.54	Severe
SRI seed selection is again another difficulty	2.71	1.55	Severe
SRI awareness and its benefits against the traditional methods	2.79	1.57	Severe
The Farm inputs requirements are expensive	3.45	1.60	Very Severe
Inadequate funds to practice the SRI method	3.56	1.58	Very Severe
Farmers are not aware of the SRI innovation	3.30	1.43	Severe
Inadequate education to comprehend the innovation	3.44	1.52	Severe
Equipment are not available/expensive to practice SRI innovation into practice	3.53	1.58	Very Severe
No government support to practice SRI technology	3.43	1.34	Severe
Mean Index Value of Constraints	3.21	1.47	Severe



Source: Field Survey, 2022

CONCLUSION AND RECOMMENDATIONS

The examine the smallholder farmers' awareness and attitude on the SRI innovation practices in North-west, Nigeria. It was carried out to understand the awareness and attitude of rice farmers on SRI smart practices. The results showed that majority are males (91.7%), married (75.0%), with secondary education (66.7%). Average age of 32 years, farming experience of 11 years, monthly income of ₦30, 637.51k, farm size of 7.0 hectares and household size of 5 persons. The respondents have favorable attitude towards SRI practices ($\bar{x}=1.54\pm1.23$). Awareness level on SRI practices is low ($\bar{x}=2.37\pm1.54$). there are several severe constraints to implementation of SRI practices ($\bar{x}=3.21\pm1.47$). The study recommends that awareness campaign on SRI practices be instituted using different information dissemination methods. Periodic advisory services be provided to increase the attitude and awareness of the clientele and increase adoption to strengthened food security.

REFERENCES

- Ahmed, H. and Anang, B. (2019). Impact of improved variety adoption on farm income in Tolon district of Ghana. *Agricultural Social Economic Journal*, **19**(2):105–115.
- Apantaku, S. O., Aromolaran, A. K., Shobowale, A. A. and Sijuwola, K. O. (2016). Farmers and extension personnel view of constraints to effective agricultural extension services delivery in Oyo State, Nigeria. *Journal of Agricultural Extension*, **20**(2):202-214.
- Ara, I., Lewis, M. and Ostendorf, B. (2017). Understanding the spatially variable effects of climate change on rice yield for three ecotypes in Bangladesh, 1981–2010, *Advances in Agriculture*, **6**(2):11-20.
- Arifin, M. Z. and Hambali, E. (2020). Factors affecting the adoption of System of Rice Intensification (SRI) technology in Indonesia: A meta-analysis. *Journal of Agricultural Extension*, **24**(3):32-44. <https://doi.org/10.4314/jae.v24i3.4>
- Aromolaran, A. K., Akerele, D., Oyekunle, O., Sotola E. A. and Taiwo L. K. (2017). Attitudes of Farmers to Extension Trainings in Nigeria: Implications For Adoption of Improved Agricultural Technologies in Ogun State Southwest Region. *Journal of Agricultural Sciences*, **62**(4):423-443 <https://doi.org/10.2298/JAS1704423K>
- Asare-Bediako, E. A., Addo-Quaye, A. B., Boakye, B., Sarbah, J. M., Asante, P. and Dorm, E. (2015). Incidence and severity of viral and fungal diseases of chilli pepper (*Capsicum frutescens*) in some districts in Ghana. *International Journal of Plant and soil science*, **7**(3):147-159.
- Bello, O. G., Abdurahaman, O. L., Makinta, U., Yakubu, H. and Adeleke, E. A. (2017). Farmers' Preference and Constraints in the Production of Striga Resistant Maize Varieties (sammaz 15 & 16) in Jigawa State, Nigeria. *FUOYE Journal of Agriculture and Human Ecology*, **1**(4):1-14.
- Bhattacharyya, R. and Bhattacharyya, P. (2018). System of Rice Intensification (SRI): Constraints and opportunities for its widespread adoption in Eastern India. *Journal of Crop Improvement*, **32**(1):121-135. <https://doi.org/10.1080/15427528.2017.1364269>.
- Boulakia, S., Mzoughi, N. and Ben-Youssef, S. (2019). Adoption of System of Rice Intensification (SRI) practices in Tunisia: An empirical analysis. *Journal of Agricultural Economics*, **4**(2):12-19.



- Denkyirah, E. K. (2015). *Profitability of rice production: A comparative analysis of system of rice intensification and conventional method in the Kassena-Nankana east district of Ghana*. University of Ghana, Accra, Ghana, 2015, Doctoral dissertation.
- Dobermann, A. (2004). A critical assessment of the system of rice intensification (SRI), *Agricultural Systems*, **79**(3):261–281.
- Ehiakpor, D. S., Apumbora, J., Danso-abbeam, G. and Adzawla, W. (2017). Households' preference for local rice in the upper east region, Ghana. *Advances in Agriculture*, **20**(2):10-19.
- Ehien, A. E., Orifah, M. O. and Oloruntoba, A. (2017). Information needs of cassava farmers in peri-urban area of ogun state, Nigeria. *Dutse Journal of Agriculture and Food Security (DUJAFS)*, **4**(2):201-212.
- Inuwa, I. M., Kyiogwom, S. U. B., Ala, A. L., Maikasuwa, M. A. and Ibrahim, N. D. (2011). *Profitability Analysis of Rice Processing and Marketing in Kano State, Nigeria. Nigerian Journal of Basic and Applied Science*, **19**(2): 293-298.
- Kalpana, C. (2011). *How Many People Do I Need To Take My Survey*, Survey Monkey Blog. blog.surveymonkey.com/blog/2011/09/15/how-many-people-do-i-n-75k
- Kirby, M., Ahmad, M. U. D., Mainuddin, M. and Khaliq, T. (2017). Agricultural production, water use and food availability in Pakistan: historical trends, and projections to 2050. *Agricultural Water Management*, **17**(9):34–46.
- KNARDA (2007). Kano State Agricultural and Rural Development Authority. Annual Report for 2007 Kano, Nigeria.
- Kaloi, F. K., Isaboke, H. N., Onyari, C. N. and Njeru, L. K. (2021). Determinants Influencing the Adoption of Rice Intensification System among Smallholders in Mwea Irrigation Scheme, Kenya. *Hindawi Advance Agriculture*.
<https://www.hindawi.com/journals/aag/2021/1624334/>
- Namara, R. E., Weligamage, P. and Barker, R. (2003). Prospects for adopting the system of rice intensification in Sri Lanka: A socioeconomic assessment. International Water Management Institute, Battaramulla, Sri Lanka, 2003.
- NATIONAL POPULATION COMMISSION" (NPC) (2006). *PHC Priority Tables – population.gov.ng*. 184(3):28–35.
- Ndiiri, J. A., Mati, B. M., Home, P. G., Odongo, B. and Uphoff, N. (2013). Adoption, constraints and economic returns of paddy rice under the system of rice intensification in Mwea, Kenya. *Agricultural Water Management*, **129**(3):44–55.
- Njeru, L. K., Kaloi, F. K., Isaboke, H. N. and Onyari, C. N. (2021). Determinants Influencing the Adoption of Rice Intensification System among Smallholders in Mwea Irrigation Scheme, Kenya.
- Obisesan, A. A., Omonona, B. T., Yusuf, S. A. and Oni, O. A. (2013). Adoption of RTEP Production Technology among Cassava based Farming Household in Southwest Nigeria. *New York Science Journal*, **6**(2): 62-65.
- Ogunlade, M. O., Agbeniyi, S. O. and Oluyole, K. A. (2010). An Assessment of the Perception of farmers on cocoa Pod Husk Fertilizer in Cross River State, Nigeria. Asian Research Publishing Network (ARPN). *Journal of Agricultural and Biological Science*, **5**(4): 117-129.
- Rahman, S. (2017). Climate, agroecology and socio-economic determinants of food availability from agriculture in Bangladesh, (1948–2008). *Sustainability*, **9**(3):354-364.



- Salami, S. O. and Shikuku, K. M. (2013). An analysis of technical efficiency of rice farmers in ahero irrigation scheme, Kenya. *Journal of Economics and Sustainable Development*, **4**(10):9–16.
- Science and Technology Option Assessment-STOA (2008). European Parliament. Agricultural Technology for Developing Countries. Annex 3. Case Study of the System Rice Intensification. **(IP/A/STOA/FWC/2005-28/SC42)**. IPOL/A/STOA/2008-02 PE 424.734.
- Singh, R., Thakur, A. K., Mohanty, R. K. and Patil, D. U. (2018). Enhancing water and cropping productivity through Integrated System of Rice Intensification (ISRI) with aquaculture and horticulture under rainfed conditions. *Agricultural Water Management*, **16**(1):65–76.
- Sudeep, K. (2011). System of rice intensification: an analysis of adoption and potential environmental benefits, Norwegian University of Life Sciences, Ås, Norway, 2011, Master's thesis.
- Thakur, A. K., Mohanty, R. K., Singh, R. and Patil, D. U. (2015). Enhancing water and cropping productivity through Integrated System of Rice Intensification (ISRI) with aquaculture and horticulture under rainfed conditions. *Agricultural Water Management*, **161**(3):65–76.
- Thura, S. (2010). Evaluation of weed management practices in the system of rice intensification (SRI), Yezin Agricultural University, Naypyidaw, Myanmar, 2010, M. Sc. Thesis.
- UNICEF (United Nations Children's Fund) (2014a). Ending Child Marriage: Progress and Prospects. New York: UNICEF.
- UNICEF (United Nations Children's Fund) (2014b). Hidden in Plain Sight: A Statistical Analysis of Violence Against Children. New York: UNICEF.
- Uphoff, N., Saryanarayana, A. and Thiyagarajan, T. M. (2005). Prospects for rice sector improvement with the system of rice intensification, considering evidence from India, in *Proceedings of the The International Rice Conference Held in Bali*, pp. 10–14, Bali, Indonesia,
- Vogelstein, R. (2013). Ending Child Marriage: How Elevating the Status of Girls Advances U.S. Foreign Policy Objectives. New York: Council on Foreign Relations.