ASSESSING THE SUITABILITY AND PROFITABILITY OF THE SYSTEM OF RICE INTENSIFICATION (SRI) METHODOLOGY UNDER FARMERS' CIRCUMSTANCES IN SIERRA LEONE

S. S. HARDING*, N. MAHMOOD, J. M. K., CHERRNOR SULLAY K., A. TOURE

Rokupr Agricultural Research Centre, Soil Crop Animal and Natural Resource Management Programme, P.M.B. 736, Freetown, Sierra Leone,

[1]* Corresponding author : Email: sokih2003@yahoo.co.uk.

ABSTRACT

In Sierra Leone, rice yields in farmers' fields are lowand estimated on average at 0.8 t/ha. The *System of Rice Intensification* (SRI) is an on-farm management approach that changes how rice plants grow and produce, regardless of what variety is used. Study in 2013 cropping season to assess the suitability and profitability of SRI was carried out on Farmers fields in the Associated Mangrove Swamp to determine its effectiveness in increasing rice productivity and assess the cost benefit of the system. Three production practices involving conventional method, basic SRI and enriched basic SRI were evaluated. The results were significantly different at p = 0.05 for practices and location effects. The enriched basic SRI gave an average yield that was actually 3 times greater than the average yield obtained with current farmer practices (6.2 and 2.0 t/ha). The basic SRI without any organic matter raised paddy yields by 60 % over conventional methods, (3.2 and 2.0 t/ha, respectively). The number of tillers and panicles per square meter, the number of panicle per tiller, the number of grain per panicle and thousand-grain weight was highest for the enriched basic SRI. The economic analysis shows that shifting from conventional practice and basic to the enriched basic SRI practices is economical and rewarding.

Key Words : Suitability, profitability, organic matter, SRI, economic analysis.

RESUME

EVALUATION DE L'ADAPTABILITE ET DE L'AVANTAGE DE LA METHODE DU SYSTEME DE RIZICULTURE INTENSIVE (SRI) SOUS CONDITIONS PAYSANNES EN SIERRA LEONE

En Sierra Leone, les rendements de riz bord champ obtenus par les agriculteurs sont faibles et ils sont estimés en moyenne à 0,8 t / ha. Le Système de Riziculture Intensive (SRI) est une approche de la gestion de l'exploitation qui, indépendamment de la variété qui est utilisée, change la façon dont les plants de riz se développent et produisent. Une étude a été conduite en milieu paysan au cours de la saison de culture 2013 afin d'évaluer la pertinence et la rentabilité du SRI dans l'écologie de Mangrove Associée. Le but de cette étude est de déterminer l'efficacité de SRI dans l'augmentation de la productivité du riz et d'évaluer les avantages-coûts du système. Trois pratiques de production ont été évaluées à savoir la méthode conventionnelle, le SRI de base et le SRI de base « enrichi ». Les résultats sont significativement différents au seuil de 5 % pour les pratiques et les effets liés à la localité. Le SRI de base « enrichi » a donné un rendement moyen trois fois plus élevé que le rendement moyen obtenu avec les pratiques paysannes actuelles (6,2 et 2,0 t / ha). Le SRI de base sans apport de matière organique a augmenté les rendements de riz de l'ordre de 60 % par rapport aux pratiques conventionnelles (3,2 et 2,0 t / ha, respectivement). Le nombre de talles et de panicules par mètre carré, le nombre de panicules par talle, le nombre de grains par panicule et le poids de mille grains sont les plus élevés pour le SRI de base enrichi. L'analyse économique montre que le passage de la pratique conventionnelle et de SRI de base vers les pratiques de SRI de base enrichi est économiquement rentable et permet de générer de gains financiers substantiels.

Mots clés : *Pertinence rentabilité, matière organique, SRI, analyse économique*

INTRODUCTION

Currently, the demand for water resources is becoming intense as a result of population pressure and the effect of climate change on the environment, competitions among different uses and users, and the inefficiencies of the developed water infrastructures. As agriculture currently consumes the bulk of the available water resources, the efficiency and productivity of water use in this sector may contribute to the relaxation of the demand for water. The *System of Rice Intensification* (SRI) is an example of an on-farm water productivity enhancing approach. The system is based largely on organic farming principles and additional requirements for the timing of transplanting and spacing of seedlings (Stoop *et al*., 2002).

In the 1980s and 1990s, Sierra Leone suffered acute food shortages due to the poor productivity of its staple food-rice. During that period, the country was using the « conventional system of production intensification ». The « conventional system of production intensification » involves the introduction of short-stature, fertilizer-responsive, lodging-and disease-resistant and high-yielding varieties, investments in irrigation infrastructure, massive use of chemical fertilizers, herbicides, insecticides and fungicides, and government support through extension and micro-credit provisions. This system of production intensification had serious negative social and environmental externalities such as (1) depletion of water tables, (2) decline in soil fertility, (3) aggravation of air pollution, and (4) resistance of weeds to certain herbicides (Stoop *et al*., 2002). The massive increase in production and the increases in the relative prices of cash inputs that constitute core elements of the conventional intensification process have depressed the prices of outputs and hence the returns that the producers normally get. At the moment, buffer stocks of rice are held by private sector at high cost. Hence, methodologies or technologies that lower costs and which are favorable to the environment, save resources (such as water) and improve returns are currently in high demand.

The System of Rice Intensification (SRI) is a climate-smart rice production methodology that helps farmers to increase yields using less seed, water, and purchased inputs. SRI is a management approach that changes how rice plants grow and produce, regardless of what variety is used (Styger and Jenkins, 2014).

SRI originated from Madagascar and was developed by de Laulanié (1983). As of January, 2014 SRI has been validated in more than 50 countries in Africa, Asia, the Middle East, Central and South America, and the Caribbean, with more than 5 million farmers estimated to be practicing SRI.

SRI was introduced to Sierra Leone in 2001 to selected groups of farmers in the southern province of Sierra Leone as a production system that can give better utilization of land and water resources particularly the inland valley swamps and boliland ecologies, for rice production (Yamah, 2002). But the methodology was not sustainable and farmers could not continue with the practice because of improper training and the selected groups of farmers were from one chiefdom in one district.

In Sierra Leone the average lowland rice yields in farmers' fields are low and are reported to be in the range of 1 - 1.5 t/ha (RRS, 1991). A methodology for growing rice (Zotoglo, 2011) that can give increased production with little requirement for purchased inputs and little negative effect on the environment would thus be particularly beneficial to the country's food-insecure population, especially so when farmers want to increase their yields and become self-reliant and food secure. Therefore, the system of rice intensification (SRI) is a vital methodology in Sierra Leone that can be assessed since it has the potential to increase rice yields by 30 - 100 % (Yamah 2002 ; RRS, 2008).

Study was therefore carried out on farmers' fields in five locations (districts) to determine the effectiveness of SRI system in increasing rice productivity, assess the cost benefit of the SRI practices in Sierra Leone and to confirm the SRI Methodology in Sierra Leone for planners and farmers.

MATERIAL AND METHODS

LOCATION AND DESCRIPTION OF STUDY SITE

The study was carried out in the Mangrove Associated Swamps (MAS) in five districts (locations). The districts were Kambia, PortLoko,Western Area Rural, Bo and Kenema during the raining season of 2013 cropping season.

The rice ecology selected for the study was at the upper reaches of the main Mangrove Swampcatena and grade into the adjacent uplands. The Mangrove Associated Swamp has a saltfree period of at least six months. The ecology is influenced by seasonal flooding through seepage and/or runoff from the surrounding uplands ; as well as by tidal water during spring tides at the peak of the rainy season in August. The annual rainfall recorded was 2450 mm for 2013.

The soils are sufictropaquept (cat clays) with a massive structural consistence. Soil reaction is acidic with pH range of 4.5 - 5.5 ; and is characterized by toxic levels of iron and aluminium (RARC, 2011). The soil fertility status is low with nitrogen and phosphorus being the major nutrient deficiencies.

RICE VARIETY

The variety NERICA L19, developed at the West African Rice Development Association (WARDA, 2001) now called Africa Rice Centre (AfricaRice) was selected. It is short (85 - 100 cm) with a duration of 120 - 125 days and is a weed competitive variety (Harding and Jalloh, 2013). It was selected because it is the most widely preferred variety well adapted to this ecology.

FARMERS AND EXPERIMENTAL DESIGN

Since the methodology is new, ten farmers each belonging to community base organizations in each of the five districts (locations) were selected. Supervisors were trained on the principles and practices of SRI so as to supervise farmers during the implementation period on-farm. Such farmers will become early adopters as well as help in the dissemination of the methodology to other farmers in their different communities.

The experiment was a factorial involving 5 locations and 3 treatments using ten farmers in each location.

VARIABLES MEASURED

Variables measured were number of tillers and panicle per square meter, number of panicle per tiller, number of grains per panicle, thousand-grain weight and yield at 14 % moisture content. Two sample quadrats of 1m^2 each were used to collect data on yield components at harvest. Rice grain was hand-harvested at maturity and grain yield of rice in t/ha (tons per hectare) was calculated at 14 % moisture content (RRS, 1991). The count method was used to determine the number of tillers at six weeks after transplanting by the use of random number table and a quadrat measuring 1m x 1m (RRS, 1991). In each plot two sample quadrats were taken at random and average number of tillers per square meter determined. At harvest eight panicles were selected at random from two quadrat sample areas each for every plot and the average number of panicle per tiller and grains per panicle determined. The thousand-grain weight and yield at 14 % moisture content were obtained by weighing with a scale of sensitivity 1 kg x 0.1 g

The GenStat Discovery software package was used to carry out analysis of variance for grain yield and yield components. Gross returns and net profits for each practice were calculated using costs incurred during the production process.

PRACTICES

The practices (treatments) compared were three: (i) conventional methods (farmers usual cultivation practices of transplanting of at least thirty to forty-two-day-old seedling with three to four seedlings per stand and at random spacing); (ii) basic SRI, transplanting single 12 - day-old seedlings at spacing of 25 cm x 25 cm, with at least some minimal amount of water control by preventing standing water from rainfall through draining; and (iii) enriched basic SRI, the practices of (ii) plus the supplementary supply of organic material, in this case in the form of palm kernel cakes at 10 t/ha (PKC). A fourth practice, with the full recommended set of SRI practices as practice in Madagascar was not evaluated as it was thought that this is quite demanding, at least for now. It would include systematic weeding of the crop with a mechanical weeded to actively aerate the soil, stimulating plant root growth and the number and vigor of soil organisms. Sierra Leone Agriculture is rain-fed and all of the locations did not have irrigation facilities, so there could be no systematic water control or alternate wetting and drying.

Plot size measuring 10 m x 10 m (100 m^2), each was use for each practice. The PKC as organic manure was incorporated by plowing into the soil 100 kg of PKC on a plot size of 100 m^2 two weeks before transplanting of rice seedlings on well-leveled fields.

Three nurseries beds measuring 1 m x 1 m (1 m^2) each were prepared 5 days before sowing seeds. A seed rate of 10 Kg/ha was used. Seeds were first sorted out by soaking into water for five minutes allowing dense seeds (good seeds) to sink and lighter seeds (poor seeds) to float. The seeds were then drained out and sown directly into nurseries beds. 12 days later, young seedlings were transplanted on plots 100 m^2each. Minimal water control by frequent draining of rice plots to get rid of standing water and weeding were carried out when necessary.

ECONOMIC ANALYSIS

Farmers most often make decisions regarding the overall management of his farm activities and more specifically about changes they are considering to undertake or that have to be implemented. Many of the decisions are either incremental or the converse, but mostly the latter such as adding land, expanding or reducing an enterprise or changing some aspects of their farming practices. The SRI methodology involves changing some aspect of the farmer's farming practices thus involving changes in resource use and managerial know-how. A partial budget helps farm owners evaluate the financial effect of incremental changes. Hence in this study the partial budget was employed to assess the financial returns to the SRI Methodology.

Partial budgets are based on the principle that small business changes have effects in one or more of the following areas (Tigner, 2006); increase in income, reduction or elimination of cost, increase in costs and reduction or elimination of income

The net impact of the above effects will be the positive financial changes minus the negative financial changes. A positive net impact indicates that farm income will increase due to the change, while a negative net impact indicates the change will reduce farm income. A partial budget consists of two columns, a subtotal for each column and a grand total. The left hand column has the items that increase income while the right hand column notes those that reduce income for a farm business. The budget can be divided into four parts as in the Table 1 below.

Table 1 : Partial budgeting showing benefit and cost items

Budget partiel montrant les éléments de couts et bénéfices

Items	Benefits	Costs
1	Added income due to enriched SRI	Added cost due to enriched SRI
2	Reduced cost due to enriched SRI	Reduced income due to enriched SRI
3	Total of Benefit	Total of Cost
4	Net Benefit = Total Benefit – Total Cost	

MARGINAL RATE OF RETURN (MRR)

In order to avoid basing our recommendations solely on increasing yields as such premise assume producers are only interested in net returns. Once the net benefit has been determined for each of the three practices used in this study, the next step is to perform a dominance analysis. We employed a more robust financial analysis tool « MRR » to help us make objective recommendations for dissemination and adoption of SRI methodology based on financial returns.

Marginal analysis as used within this context is a procedure for calculating marginal rates of return between methodologies/technologies, proceeding in a stepwise manner from a lower-cost methodology/technology to the next higher-cost, and comparing marginal rates of return to acceptable minimum rates of return (Perrin *et al.*, 1988). The procedure is useful for making recommendations to producers and for selecting alternative technologies. The economic principle underlying the analysis is that it is worthwhile for a producer to continue investing up to the point where the return from each extra unit invested equals the cost of the extra unit. As applied to a situation in which the producer is confronted with a set of discrete alternative methodologies/technologies, the producer should invest in the costlier as long as the marginal rate of return (in switching from a lower-cost methodology/technology to a higher-cost methodology/technology) is greater than the minimum acceptable rate of return. Hence, recommending to producers is not based solely on the premise that it must be profitable (i.e., added returns are greater than added costs), but that it must also satisfy the added criterion that the marginal rate of return must be above a given minimum acceptable rate of return. Methodologies/Technologies satisfying these criteria stand the greatest chance of being adopted.

Marginal rate of return is computed by expressing the difference between the net benefit of the pair as a percentage of the difference of the total cost. The computed marginal rate of return gives an indication of what a producer can expect to receive, on average, by switching technologies.

$$MRR = \frac{Difference\ in\ Net\ Benefit\ of\ Enriched\ basic\ SRI\ and\ Conventional\ Practice}{difference\ in\ total\ variablet\ Cost\ Of\ Enriched\ basic\ SRI\ and\ Conventional\ Practice} \times 100$$

Hence, a 150 % marginal rate of return in switching from Conventional practice to SRI Methodology implies that for each Le1 invested in SRI, the producer can expect to recover the Le1 invested plus an additional return of Le1.50.

To incorporate risk factor, a minimum acceptable rate of returns (MARR) needed to be determined. Perrin *et al.* (1988) provide some general guidelines for determining minimum acceptable rate of return. Without asking producers what they considered to be a reasonable rate of return, researchers noted that experience and empirical evidence suggest that a rate between 50 % and 100 % seems adequate. If the methodology/ technology is new and requires learning new skills, then the upper-bound should be used. In cases where switching technologies simply represents an adjustment, such as a different fertilizer rate, then the lower-bound may be acceptable.

BENEFIT COST RATIO (BCR)

Benefit cost ratio is a ratio of benefit accrued to cost incurred in a given economic activity. A positive BCR indicates a profitable venture and a negative BCR indicate otherwise, the higher the BCR the better the investment. General rule of thumb is that if the benefit is higher than the cost the project is a good investment (BCR = Benefit/Cost) implying that BCR is greater than 1. If BCR is less than 1, the costs outweigh the benefits of the project. If BCR equals to 1, the benefits equal the costs.

RESULTS

The results presented in Figures 1 - 4 and in Tables 1 - 5 are summaries of data from analysis of variance of the different practices in randomized complete block, across locations during the year 2013 main cropping season. The results show that application of organic manure (palm kernel cake) at 10 t/ha two weeks before transplan-ting of a single seedling of 12 day-old seedling at spacing of 25 cm x 25 cm « enriched basic SRI » significantly increased number of tillers, number of panicles per tiller and number of grains per panicle ($P \leq 0.05$).

Figure 1 shows the interaction effect of the practices (treatments) x locations of the number of tillers per square meter. The interaction effect was significant at $P \leq 0.05$. The incorporation of organic matter produced significantly more tillers four weeks after transplanting followed by basic SRI transplanting of a 12 day-old single seedling at the same spacing but without organic matter incorporated. The conventional method of transplanting at random and using more seedlings per stand produced the least number of tillers (Figure 1). A similar trend was also observed across locations (districts). The number of tillers per square meter was higher for the enriched basic SRI in Bo, Western Area and Kenema district in that order and the least with the conventional method.

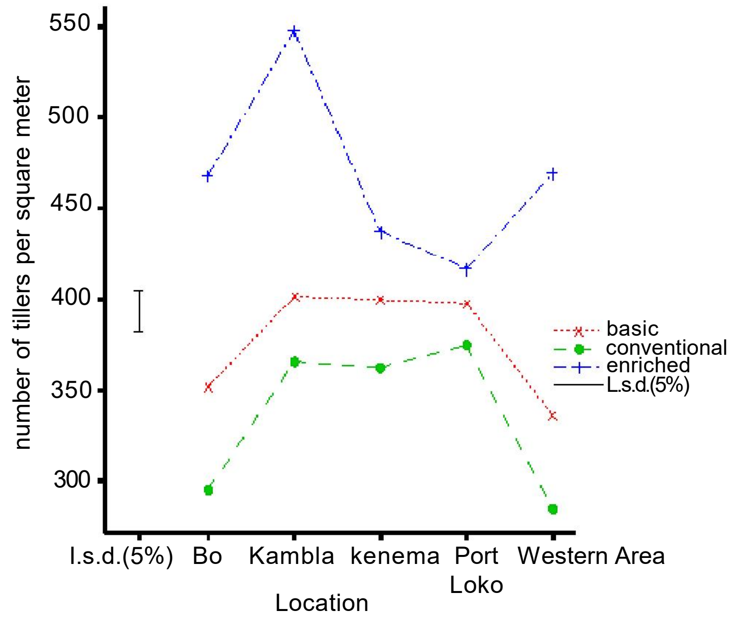

Figure 1 : Average number of tillers produced across locations for different practices.

Nombre moyen de talles produites par type de pratique et par localité

Figure 2 shows the number of panicles per tiller for the interaction effect of practices (treatments) across locations. The effect shows significant difference in panicle production per tiller at $P \leq 0.05$. More panicles were produced for the enrich basic SRI followed by the basic SRI and the conventional method. Similarly the number of panicles per tiller was higher in Bo and Western Area followed by Kenema district for the enriched basic SRI followed by basic SRI and the least for the conventional method.

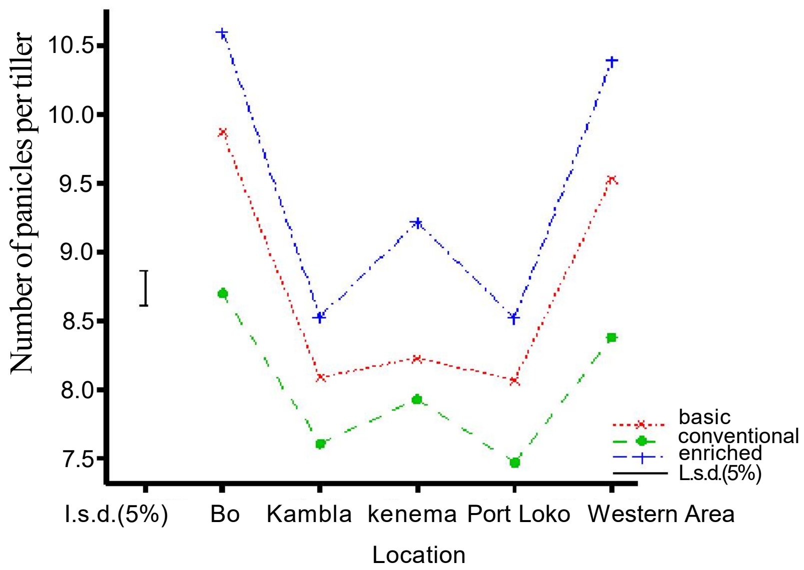

Figure 2 : Average number of panicles produced per tiller across locations for different practices

Nombre moyen de panicules produites par talle par type de pratiques et par localité

The Figures 3 and 4 show the interaction effect of the practices on panicle production and the number of grains per panicle, respectively. Treatments (practices) effects were significantly different at $P \leq 0.05$ with more panicles and number of grains produced with the enriched basic SRI and basic SRI when 12 day-old seedlings were transplanted at a spacing of 25 cm x 25 cm.

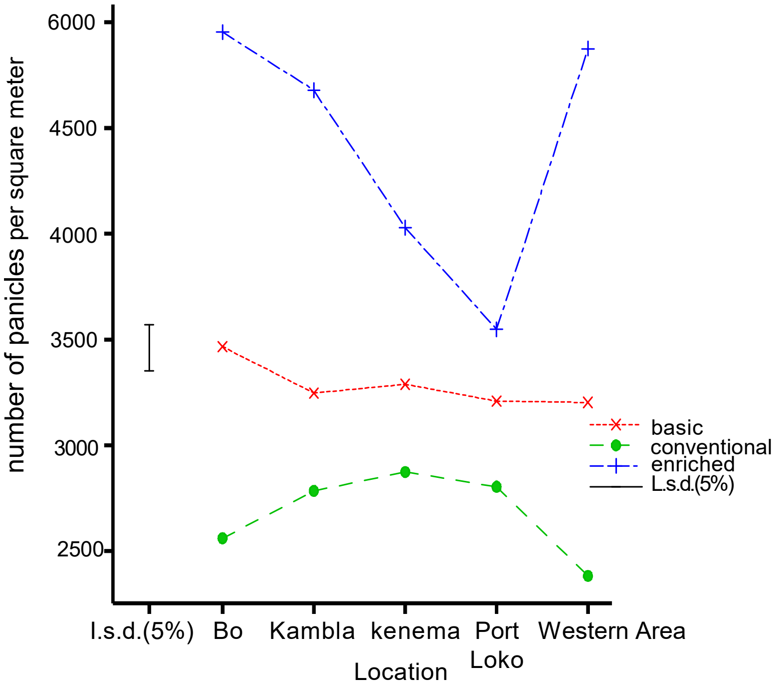

Figure 3 : Average number of panicles produced per square meter across locations for different practices.

Nombre moyen de panicules produites par mètre-carré par type de pratiques et par localité.

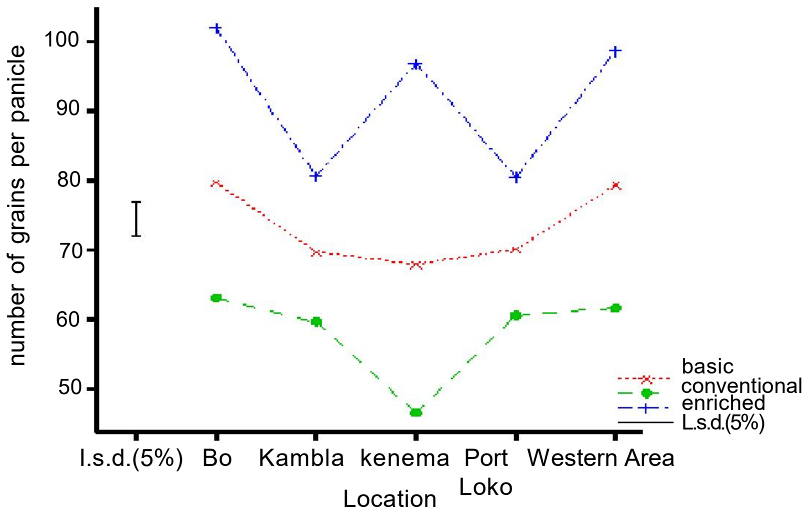

Figure 4 : Average number of grains produced per panicle across locations for the different.

Nombre moyen de grains produits par panicule par type de pratiques et par localité.

Similar trend was observed for panicles per square meter and the number of grains per panicle across locations with Bo, Western Area and Kenema giving the highest for organic matter incorporated followed by no incorporation of organic matter.

Table 2 shows the interaction effect of treatments on 1000-grain weight across locations. Significant differences were observed in 1000-grain weight at $P \leq 0.05$. 1000-gain weight was higher for enriched basic SRI followed by basic SRI and conventional method in that order, however, the enriched basic SRI gave the same 1000-grain weight across locations.

Tabe 2 : 1000-grain weight of different treatments across location

Poids de 1000 grains de différents traitements par localité

Treatment	Location					
	Bo	Kambia	Kenema	Port Loko	Western Area	Mean
Conventional (farmer's practice)	21.4	22.1	18.0	20.0	18.8	20.0
Basic SRI	21.4	22.0	20.8	22.4	22.1	21.7
Enriched basic SRI	23. 6	23. 6	24.3	23. 6	22.7	23.5
CV (%)						5.4
LSD (0.05) Treatment						0.5
Location						0.6
Treatment x Location						1.0

The yields (t/ha) in Table 3 for the different treatments or practices across locations were significantly different at $P \leq 0.05$. The enriched basic SRI which involves the incorporation of organic matter and transplanting of a single 12 day-old seedling at a spacing of 25 cm x 25 cm gave higher yields than the basic SRI and the conventional method, respectively. Similarly across locations, yields were significantly different. Yields were higher in Bo followed by Western Area and Kenema in that order. The lowest yields of 5.3 and 5.5 t/ha were obtained in Port Loko and Kambia, respectively. However, the yields obtained with the enriched basic SRI practices in Kambia and Port Loko are above the national targeted yield in Sierra Leone, which is expected to be at 4 t/ha by the year 2016 by using the current recommended researchers practices of transplanting twenty eight (28) day-old seedlings at a spacing of 20 cm x 20 cm with fertilizer application at the rate of 60 - 30 - 30 of N, P_2O_5 and K_2O per hectare, respectively with weeding done once at six (6) weeks after transplanting in the lowlands.

Table 3 : Yield (t/ha) of different treatments across location.

Rendement (t/ha) de différents traitements par localité

Treatment	Location					
	Bo	Kambia	Kenema	Port Loko	Western Area	Mean
Conventional (farmer's practice)	2.2	2.3	1.5	2.2	1.7	2.0
Basic SRI	3.7	3.1	2.8	3.2	3.0	3.2
Enriched basic SRI	7.5	5.5	5.9	5.3	6.8	6.2
CV (%)						12.1
LSD (0.05) Treatment						0.18
Location						0.24
Treatment x Location						0.41

Table 4 shows partial budget analysis and marginal rate of returns from the SRI practices across locations. From the Table 4 it is economically profitable to change from the conventional farming practice to enriched basic SRI as higher profits were obtained when compared with the basic SRI and the conventional method. Profits of Le 20,860,000.00, Le 19,900,000.00, Le 16,540,000.00, Le 10,300,000.00 and Le 10,780,000.00 were obtained in Bo, Western Area, Kenema, Port Loko and Kambia, respectively. The results in Table 5 show the benefit-cost ratios of the different alternative scenarios to be positive for the different alternative shifts.

Table 4 : Partial budget and Marginal Rate of Returns from SRI methodology across locations.

Budget partiel et taux de rentabilité marginal de la méthodologie SRI par localité

Alternative Scenario	Location					
	Bo	Kambia	Kenema	Port Loko	Western Area	Mean
Enriched basic SRI vs Conventional	2.2	2.3	1.5	2.2	1.7	2.0
Enriched basic SRI vs Basic SRI	3.7	3.1	2.8	3.2	3.0	3.2
Basic SRI vs Conventional	7.5	5.5	5.9	5.3	6.8	6.2
MRR : Shifting from Basic SRI to Enriched Basic SRI						12.1
MRR : Shifting from Conventional to Basic SRI						0.18

Table 5 : Partial budget and Marginal Rate of Returns from SRI methodology across locations.

Budget partiel et taux de rentabilité marginal de la méthodologie SRI par localité

Alternative Scenario	Location					
	Bo	Kambia	Kenema	Port Loko	Western Area	Mean
	Net benefit (Le)	Net benefit (Le)	Net benefit (Le)	Net benefit (Le)	Net benefit (Le)	Net benefit (Le)
Enriched basic SRI vs Conventional	20,860,000.00	10,780,000.00	16,540,000.00	10,300,000.00	19,900,000.00	15,676,000.00
Enriched basic SRI vs Basic SRI	13,990,000.00	7,270,000.00	10,630,000.00	5,830,000.00	13,990,000.00	10,342,000.00
Basic SRI vs Conventional	6,870,000.00	3,510,000.00	5,910,000.00	4,470,000.00	5,910,000.00	5,334,000.00
MRR : Shifting from Basic SRI to Enriched Basic SRI	172	91	114	33	196	121
MRR : Shifting from Conventional to Basic SRI	2082	1064	1791	1355	1791	1617

Table 6 : Benefit Cost Ratio: SRI methodology across locations for 2013.

Ratio Bénéfice-Cout: méthodologie SRI par localité en 2013.

Alternative Scenario	Location					
	Bo	Kambia	Kenema	Port Loko	Western Area	Mean
	Benefit Cost ratio	Benefit Cost ratio	Benefit Cost ratio	Benefit Cost ratio	Benefit Cost ratio	Benefit Cost ratio
Enriched basic SRI vs Conventional	527	508	439	311	321	427
Enriched basic SRI vs Basic SRI	426	429	350	237	271	343
Basic SRI vs Conventional	1190	1038	1038	810	657	994

DISCUSSION

The high number of tillers produced in the enriched basic SRI was as a result of early transplanting of young seedlings at 12 days old and at a wider spacing. Similar findings by Makaim *et al.* (2002) reported age of seedling at transplanting as a factor responsible for the number of tillers and panicles produced. Early transplanting results in early establishment and maximizes plant potential for shoot and root growth. Mishra *et al.* (2006) also considered young seedling and wider spacing with soil rich in organic matter and well aerated as practices that improve the growth and functioning of rice the plants' root system and enhance the numbers and diversity of the soil biota that contribute to plant health and productivity. Similar results have been reported by Zhu *et al.* (2002) that incorporation of organic matter into the soil enables young rice plants transplanted at wider spacing to establish more quickly and vigorously and to initiate early tillering.

Application of organic matter enriched the soil and wider spacing minimizes competition for resources-such as nutrients, water, sunlight and soil volume helps the plants grow quickly and healthy, and become more productive with better panicle and grain development. This was demonstrated by the increase number of tillers produced and number of grains per panicle and grain observed for the enriched basic SRI practices. Furthermore single transplanted plants were able to grow quickly and healthy and became more productive with better panicle and grain development per panicle with the enriched basic SRI practices.

Farmer most often make decisions which are either about incremental or the converse, but mostly the latter such as adding land, expanding or reducing an enterprise or changing some aspects of their farming practices. The SRI methodology involves changing some aspect of the farmer's farming practices. Since partial budget helps farm owners evaluate the financial effect of incremental changes (CIMMYT, 1988) it was employed in this study to assess the financial returns to the SRI Methodology. From the analyses it was evident that a shift from basic SRI to enriched basic SRI gave higher net benefits than from conventional to basic SRI (Table 4). The high benefit cost ratios observed for a shift from conventional to basic SRI in this study was due to 'reduced cost' of organic matter since no organic matter was purchased for incorporated (Table 5). From the results obtained and according to CIMMYT (1993) the enriched basic SRI could be considered as a better economic venture for farmers to adopt in Sierra Leone.

CONCLUSION

The enriched basic SRI which involves the incorporation of organic matter and transplanting of a single 12 day-old seedling at a spacing of 25 cm x 25 cm gave higher net benefits compared with basic and conventional farmers' practices. With the enriched basic SRI, higher yields that are above the national targeted yield of 4 t/ha were obtained in all locations. From the result obtained the enriched basic SRI, seemed a better economic and rewarding venture for farmers in Sierra Leone.

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