Research article

Comparison of System of Rice Intensification (SRI) Practices in Irrigated and Rainfed Areas of Cambodia

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Abstract Based on principles of the System of Rice Intensification (SRI) practices, farmers need to manage properly the water level in the paddy fields to get higher yields. It is only in the irrigated area where farmers can control the water level. However, the practice of SRI has been disseminated to farmers also in rain-fed areas in Cambodia. Therefore, the study aimed to compare the SRI results done so far by farmers in irrigated and rain-fed areas and explain the SRI practices in both areas. Irrigated and rain-fed areas in Kampong Speu Province of Cambodia were selected as study areas. In irrigated areas, five farmers from upstream and downstream were selected. In rain-fed areas, five SRI farmers were also chosen. In-depth interview was conducted with field observation. The results showed that farmers at upstream can grow rice twice (late ripening variety-LRV and early ripening variety-ERV) per year. Farmers at downstream and in rain-fed areas can grow rice only one time (ERV) per year. There is an irrigation system at downstream area, but farmers cannot grow rice twice due to the lack of irrigation facilities, poor water distribution, and geographic condition. In rain-fed area, drought occurs in some years; so water availability is a big concern. In both areas, LRV conventionally provides the yield from 2.31 to 2.36t/ha. SRI way can improve the yield up to 3.30t/ha to 3.70t/ha. Besides same provided yields, farmers have applied almost same SRI principles such as reducing seeds for sowing (up to 50%) and chemical fertilizers (20% to 40%), raising nursery bed, and transplanting with fewer seedlings. So, the study concludes that SRI practices in rain-fed areas are similar with ones in irrigated area. Although irrigation system is a big advantage, controlling water in paddy fields in both areas is still a problem since irrigated facilities are poor.

Keywords system of rice intensification (SRI), irrigated area, rain-fed area, early ripening variety, late ripening variety

INTRODUCTION

In spite of the fact that several big NGOs such as Oxfam/GB and GTZ have played an important role in supporting local NGOs to implement and disseminate SRI in several provinces in Cambodia (CEDAC, 2004), most Cambodian farmers cannot practice SRI well due to inadequate irrigation systems and other inputs. Proper management of water level in paddy fields is one of the fundamental practices of SRI that produces higher yield. Today only 16% of total cultivated areas have been irrigated, revealing that Cambodia is using only 1% of its total water resources in Agriculture (Ngin, 2010). However, currently, SRI techniques are being promoted in rain-fed areas (Tsurui, 2010). This is surprising since it is hard for farmers in rain-fed areas to practice SRI without proper irrigation systems. Thus, it is worthwhile to know how much farmers in rain-fed areas earn after applying SRI techniques since only irrigated farmers can benefit from these

techniques before. Therefore, this study aimed to compare the SRI results produced by farmers in both irrigated and rain-fed areas, and to explain the SRI practices in both areas.

MEHODOLOGY

The study was conducted in Kampong Speu province in Cambodia. Two types of SRI farmers in Chbar Mon City were selected as key informants for irrigated areas. Five Farmers in Srae Thnal village (upstream) are represented as Farmers A1-A5, and five Romleang village farmers (downstream) are represented as Farmers B1-B5. The other five SRI farmers in Samraong Tong District were selected as key informants for rain-fed areas. They are represented as Farmers C1-C5. Qualitative and quantitative approaches were mainly used. Primary and secondary data collections were utilized to get needed information from various existing sources and field works.

Primary Data: The research employed the following data collection to get the needed data:

In-Depth-Interview: Fifteen classified farmers (A1-5, B1-5, and C1-5) were thoroughly questioned about SRI results, performances, perceptions and willingness to continue SRI.

Village observation: Village resources, farming land and the status of agricultural practices in the village can be noticed in order to create real images for the research.

Secondary data: Documents related to the concept of SRI are reviewed. Those documents can be reached by accessing the websites, libraries, reports, or research journals, etc.

Data analysis is done by using both descriptive and statistical analysis. Data are condensed and critically analyzed in order to respond to the above-mentioned objectives.

RESULTS AND DISCUSSION

Comparison of rice yield between SRI and Conventional ways

Before following the SRI techniques, farmers were told that SRI can provide higher yields. This established a reason for farmers in study areas to decide to apply these techniques. Based on the interviews with SRI selected farmers, some have made comparisons of SRI to conventional methods by applying these techniques in different plots. Without conducting experiments, a researcher simply asked farmers to compare the yields of conventional plots and SRI plots during 2009-2010.

Table 1 Comparison of average rice yield between SRI and Conventional ways

Area (t/ha)	Farmers	Seasons	Varieties	Methods	Average Yield
Irrigated Upstream	A1-A5	Dry (2009)	ERV	Conventional	**2.25**
				SRI	***3.51***
		Rainy (2009, 2010)	LRV	Conventional	**2.31**
				SRI	***3.70***
Irrigated Downstream	B1-B5	Rainy (2009, 2010)	LRV	Conventional	**2.36**
				SRI	***3.20***
Rain-fed	C1-C5	Rainy (2009, 2010)	LRV	Conventional	**2.31**
				SRI	***3.30***

As shown in Table 1, in the upstream portions of the irrigated areas, the average yield for Late Ripening Variety (LRV) conventionally is 2.31 t/ha; while SRI way can improve the yield up to 3.70 t/ha. For the downstream and rain-fed areas, the average yield of conventional methods is almost the same as upstream yields, approximately 2.31 to 2.36 t/ha. SRI method yields are slightly less compared to those of upstream, at roughly 3.20 to 3.30 t/ha. However, the difference was not as much as expected. It can therefore be concluded that SRI practices in both areas provide nearly

the same results because they have not applied all the SRI techniques. Moreover, irrigation systems in irrigated area do not greatly help improve the SRI results. Although there are irrigated facilities, good water distribution and the functions of facilities remain poor. It can be said that irrigation systems in Cambodia are not on big scale but of a small farming scale. Therefore, it is hard for farmers to use the irrigated facilities to full capacity because they have a limited knowledge in operating those facilities.

Rice cultivation practices in irrigated area and rain-fed area

In irrigated areas, most farmers are able to perform rice cultivation two times per year for the early ripening variety (ERV) and late ripening variety (LRV); especially in upstream villages because of the water availability through canals and rainfall. Some farmers still practice conventional farming; while some farmers have practiced SRI. In the case of the selected upstream farmers (A1-A5), some of them apply both conventional and SRI methods in different plots to be compared. The others have already applied SRI method for all of the plots. On the other hand, upstream farmers are likely to use water inefficiently. Although there are irrigation facilities, water is not distributed properly because farmers have limited knowledge on operation of these facilities. This makes downstream farmers suffer from water shortage. Then downstream farmers including selected farmers (B1-B5) do their farming one time per year for LRV only. As with upstream farmers, downstream farmers apply both conventional and SRI methods in separated plots or two-part divided plots.

In rain-fed areas, the majority of farmers are able to perform rice cultivation only once per year for LRV due to insufficient water or less rain. The main water storage for rain-fed area is a big reservoir. In case that there is no enough rain, farmers need to save water in the reservoir for other works such as daily life use, animal raising and vegetable watering. Under the support from NGOs on the SRI dissemination, farmers in the rain-fed areas have learnt what SRI is. According to the conducted interviews, some of the selected farmers (C1-C5) have applied both conventional and SRI methods in different plots for comparison. Nevertheless, some farmers have fully applied SRI to all the plots. Again the interviews with farmers reveal that in some years with little rain, rice plants are in tiller and panicle initiation stages. This significantly worsens the yield. However, if there is enough rain from early in the cultivation season, the rice plants will grow well and provide a high yield. But some farmers hesitate to drain water out when there is too much water in the paddy field because they are afraid of facing water shortages. This is one reason that SRI farmers in rain-fed areas face difficulty controlling water in the paddy field since the water availability is unpredictable.

Degree of Adoption of SRI principles by selected farmers in study areas

Under the past support from CEDAC (Cambodian Center for Study and Development in Agriculture), selected farmers started to practice SRI techniques since 2006. CEDAC introduced SRI with 12 principles and strongly recommended farmers to follow them (JICA, 2008). However, according to the interviews with the 15 selected farmers about their farming practices during 2009 and 2010, once CEDAC was removed, farmers became unable to follow all the principles. In irrigated areas as well as in rain-fed areas, farmers cannot apply all the 12 SRI principles (Table 2). In irrigated areas, roughly 76% of upstream farmers can adopt the SRI principles; compared with only 62% of downstream farmers. In addition, in rain-fed area, 68% of farmers can adopt SRI principles. Two principles stood out as being adopted by rain-fed and downstream farmers but not by upstream farmers. Those include the principle to "transplant seedlings younger than 15 days" adopted at level of 40%, 10% and 0%; and the principle to "transplant seedlings 25-40 cm apart" adopted at level of 60%, 80% and 0% by rain-fed farmers, downstream farmers and upstream farmers respectively. Nevertheless, there is one principle adopted only by upstream farmers. It is that which says to "weed at least 2-4 times a season" with adoption rate 40%. For the rest, the average rates of adoption are somehow the same. Therefore, it can be said that rain-fed farmers have stronger commitments towards following SRI principles. On the other hand, most farmers

generally have difficulty in keeping less water in their paddy fields. Even in the irrigated area, the act of keeping less water in paddy fields is still a big problem for farmers. This is because of insufficient irrigation facilities and geographic conditions. In rain-fed areas, water is not fully available all the time, so even though there is abundant water in the paddy fields, farmers do not dare to drain it out because they are afraid of future water shortage.

Table 2 Degree of SRI principles adoption by selected farmers (2009-2010)

SRI Principles	Farmer A1-A5		Farmer B1-B5		Farmer C1-C5	
	No.	%	No.	%	No.	%
Level the paddy field and provide drainage	4	80	4	80	5	100
Keep less water in the paddy field	3	60	2	40	3	60
Raise nursery beds or use dry nursery beds	5	100	3	60	5	100
Select purified and dense seedlings for sowing	5	100	4	80	5	100
Transplant seedlings younger than 15 days	0	0	1	10	2	40
Transplant big seedlings immediately	4	80	4	80	4	80
Transplant one plant per hill	3	60	3	60	2	40
Transplant seedlings shallowly with horizontal roots	5	100	5	100	5	100
Transplant seedlings with square pattern or in line	4	80	2	40	2	40
Transplant seedlings 25-40cm apart	0	0	4	80	3	60
Apply natural fertilizer as much as possible	5	100	5	100	5	100
Weed at least 2-4 times a season	2	40	1	10	0	0
Average of adoption		**67**		**62**		**68**

Change in using seeds

Revealed in the interviews with selected farmers, it seems that all farmers do feel positive about the decrease of seeds used for sowing and transplanting. They said that applying SRI in their fields can help reduce a large amount of seeds per year. Saving seeds can help them use the remaining seeds for food and for storage in the following year (save space for storing seeds).

Table 3 Change in use of seed on average during 2009-2010

Seed (kg/ha)	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
Before SRI	100	250	80	50	230	65	60	162	108	114	90	80	200	175	75
After SRI	36	83	50	25	110	35	30	50	50	71	30	40	80	50	38
Ratio (%)	***64***	***67***	***38***	***50***	***52***	***46***	***50***	***69***	***54***	***38***	***67***	***50***	***60***	***71***	***49***

A decreased weight of seeds is what farmers can notice quickly when they start to apply SRI. It is also another reason why they decide to apply SRI. Table 3 shows that farmers can reduce the weight of seeds from 38% up to 71%. The majority of farmers can also decrease the weight of seeds up to 50%. This is because most farmers know how to select full-inside seeds, to raise nursery beds for sowing and to select big healthy seedlings for transplanting.

Change in application of chemical and natural fertilizers

The effect on environmental understanding is noticeable since farmers have changed their habits, started to reduce the weight of chemical fertilizers and increase the use of natural fertilizers. During

interviews with selected farmers, they were asked to reveal the weight of the chemical and natural fertilizers they used before and after practicing SRI. These changes are shown below:

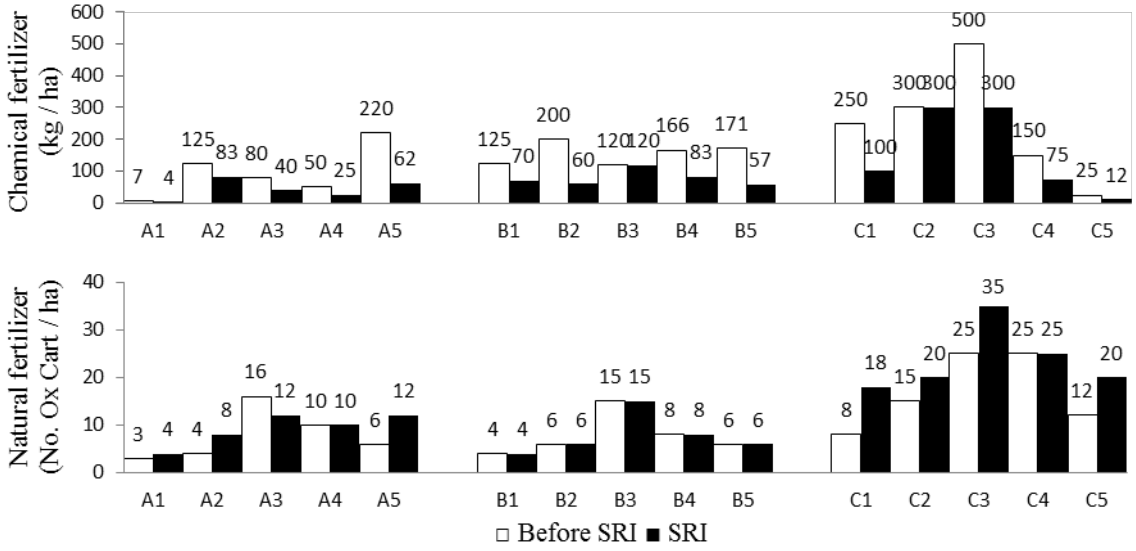

Fig. 1 Change in application of chemical and natural fertilizers

According to Fig.1, the weight of chemical fertilizers decreased remarkably. Previously, farmers had used chemical fertilizers from 7 kg/ha up to 500 kg/ha for conventional farming, but afterwards farmers reduced this amount to 4 kg/ha to 120 kg/ha for SRI practice. This results in almost 20% to 40% decrease from previously used conventional practices. This shows that farmers have understood the impact of chemical fertilizers on soil fertility, health, expenditure and environment.

In contrast, there is also a noticeable increase in the weight of natural fertilizers as shown in Fig. 1 as well. On average, conventionally farmers used 3 ox carts of natural fertilizers per ha up to 25 ox carts. However, for SRI practices, farmers can increase from 4 ox carts of natural fertilizers to 35 ox carts. Although there is not much improvement in the use of natural fertilizers, it is evident that some farmers are still making attempts to increase the use of natural fertilizers. Moreover, it can be said that farmers have used the resources available near their living areas on the fields in order to reduce the expenses of chemical fertilizers. Therefore, farmers have gained a better understanding since SRI techniques require farmers to use natural fertilizers in order to sustain and enrich the soil quality over a long period.

Benefits and difficulties in Practicing SRI

According to interviews with selected farmers, there are various key benefits from practicing SRI. These include increased yields, saving of seeds, decreased amount of chemical fertilizer, reduction of labors, and time saving. Among these benefits, saving seeds is the most popular answers from SRI farmers. 15 farmers out of 15 (100%) said that they can save a lot of seeds after applying SRI. 14 farmers of 15 farmers (93%) also said that their yields increased after practicing SRI compared to previous practices. The other three popular answers about the benefits of practicing SRI are the reduction of labors, decreased amount of chemical fertilizer, and time saving with the percentage of answers 66%, 46% and 20% respectively. Nevertheless, some difficulties arise while practicing SRI. 53% of the responses from 15 SRI farmers complained about transplantation in a line. They faced difficulties in making a line, or did not have the equipment to make a line in their paddy fields. In addition, other reported difficulties included water management (53%), weeding (26%), preparation of nursery beds (6%), and plowing (6%). The percentage of weeding is very low because farmers do not have weeding tools and they need to do it by hand. That is why farmers do not care much about weeding, which requires intensive labor.

CONCLUSION

Although SRI techniques are believed to provide higher yields than conventional methods, most farmers still cannot apply all 12 SRI principles due to insufficient irrigation systems, labor shortages, and time consuming activities. It can be said that farmers` behaviors toward SRI technique are somehow positive and that they will be able to apply all principles if all those inconvenient things mentioned above can be resolved.

Upstream farmers can grow rice twice per year for LRV and ERV; while downstream and rain-fed farmers can grow only once per year for LRV. In comparison with conventional methods, all selected farmers can get the average LRV yield of 2.31 to 2.36 t/ha. The SRI method for LRV is around 3.30 to 3.70 t/ha. The differences of yield between the SRI method and the conventional method are roughly the same for irrigated and rain-fed areas. This means that in both irrigated and rain-fed areas, SRI results are higher than the conventional method by around 1 to 1.5t/ha. In addition to the SRI method providing the same yields in irrigated and rain-fed areas, farmers also applied nearly identical SRI principles such as reducing seeds for sowing (up to 50%) and chemical fertilizers (20% to 40%), raising nursery bed, and transplanting with fewer seedlings. Therefore, this study concludes that SRI practices in rain-fed areas are similar with those in irrigated areas. Although irrigation systems provide big advantages, controlling water in paddy fields in both areas is still a problem since irrigation facilities are poor. Nevertheless, all selected farmers have also faced the same problems in practicing SRI such as transplanting in line, doing weeding, and managing water. Finally, some farmers still have strong intentions to continue SRI, and also have willingness to share these techniques with other farmers. However, others have given up due to a lack of external supports.

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