# Report on System of Rice Intensification Evaluations at RNRRC Bajo, Bhutan – 2008 Season

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**Abstract**
The System of Rice Intensification (SRI) has been tested and spread across the world since its development in early 1980s at Madagascar. It is now considered as an innovative and cost-effective system of rice cultivation, particularly in the field of seed and irrigation water saving and chemical inputs reduction. Asian countries like India, Nepal, Sri Lanka, Vietnam, etc. have also researched SRI with positive results. However SRI research in Bhutan has been of recent origin due to numerous circumstances like lack of technical capacity, literature review, and lack of confidence from researchers' side.

The success of SRI in other countries stimulated researchers in Bhutan to risk and try SRI. Thus, SRI trial was implemented on-station under researchers' management practices mainly to observe its performance with the given principles and guidelines. The results from the first and second years' trials were not that convincing, which may be attributed to lack of skill and improper research methodologies. However the response in the third year's trials was promising and encouraging, being 8.6 t/ha against 7 t/ha from the conventional method.

**KEY WORDS:** SRI, Bhutan, yield

## INTRODUCTION

There is a growing recognition and popularity of System of Rice Intensification around the world. As of 2007, the beneficial effects of SRI methods had been documented in 28 countries, most recently being Bhutan, Iraq, Iran and Zambia. ( *http://en.wikipedia.org/wiki/System_of_Rice_Intensification*). The main reasons for its spread and popularity are due to improvement in yield with less water, less seed and less chemical inputs compared to conventional methods of rice cultivation. Because plant populations are greatly reduced with SRI, **seed costs** are cut by 80-90%, and because paddy fields are not kept continuously flooded, there are **water savings** of 25 to 50%, a major benefit in many places. ( *http://ciifad.cornell.edu/sri/*)

SRI does not involve an entire change in the cultivation system of rice crop. It is just a modification of some agronomic practices of existing methods in rice cultivation that greatly enhance rice crop growth in terms of productivity. Six important basic principles have been outlined in SRI, namely: transplanting

young seedlings, single transplanting of one seedling per hill, wide spacing, moist but unflooded soil conditions, frequent weeding, and organic fertilization. Preparing high-quality land and developing nutrient-rich and unflooded nurseries are also considered as two more basic principles in addition to the above six principles. (Gujja et.al)

Rice is the most preferred and staple crop for Bhutanese. And rice has been cultivated from as low as 650 m to as high as 2500 masl. There have been several measures undertaken like introduction of high-yielding varieties and other technology development, but food sufficiency still remains a goal for the Ministry of Agriculture yet to be accomplished.

Current average productivity of rice in Bhutan is 1,101 kg/acre (RNR Statistics, 2006), or 2.6 tons/ha, which is much less than the global average of about 4 tons/ha (MoA). Moreover in the high and medium altitude zones, a particular weed *Potamogeton distinctus* (locally called Schochum) remains a problem and is estimated to reduce rice production by around 37% (Ghimiray 1999).

Therefore, an assessment of SRI as an emerging alternative methodology of rice production (http://www.wassan.org/sri/documents/SRI) was conducted to observe its performance under Bhutanese context and examine its associated benefits.

## MATERIALS AND METHODS

### Site selection

The trial was implemented on-station at an elevation of 1300 masl in 2008 cropping season.

### Experimental design

The trial was laid out in a large observation plot of 645 square meters. The trial was not conducted with randomized blocks as our previous experience showed that it is difficult to evaluate SRI practices, especially variations in water management, with blocks. Prof. Norman Uphoff, a SRI promoter, too recommended single-plot observation rather than randomization during his visit to the station (personal communication, October 2007). However to have a control for comparison, an adjacent plot subjected to normal conventional practices was used.

### Rice variety

An improved rice variety, IR 64, was tested under SRI management and in the control plot. This improved variety is quite popular in Wangdue-Punakha valleys.

**Single seedling transplanting**
Single seedlings were transplanted per hill rather than clumps in conventional method. Utmost care was taken during transplanting to prevent damage of the seed sac which provides nutrients to infant roots

**Transplanting of young seedling**
Nursery was established in a semi-dry bed method for easy uprooting. The bed was kept moist. The seedlings were 15 days old on the day of transplanting and were at 2 leaves stage and attained 8 cm of height.

**Wide spacing**
A wide spacing of 25 cm x 25 cm was maintained. In traditional method, farmers do maintain 10-15 cm. A nylon rope with demarcation was used to maintain the required spacing. Wide spacing expose plants to more sunlight, air and nutrients resulting in more root growth and more tillering.

**Moist but unflooded soil conditions**
As recommended, the soil was kept moist without flooding till vegetative stage. During heavy monsoon the excess water was drained out while irrigation was provided during field cracking. However optimum water level of 2-3 cm was maintained once the crop has reached reproductive stage. The irrigation water was drained out before 20 days of harvesting to enhance ripening.

**Weeding**
Two weedings were done during the entire crop period by the rotary weeder. The first weeding was done 20 days after transplanting to churn the soil and improve the soil aeration. The second weeding was carried out 30 days after the first weeding to remove the weeds that were grown after the first weeding. It is also intended to improve the soil aeration as aeration is considered to be important in SRI. It was found that there were not many weeds as Butachlor of 3 kgs was applied two days after transplanting.

**Organic fertilization**
SRI encourages more organic fertilization rather than inorganic. However some countries have modified the technology in terms of fertilization to suit their local conditions. In Bajo, the SRI was raised organically without any inorganic fertilization. Farm yard manure of 2 tonne was applied and incorporated during the last puddling. However it is fair to say that there must be some residual effects from the previous season's fertilization.

**Results and Discussions**
The crop cut results that were taken from three sites within the plot are presented in the Table 1.

**Plant height and days to maturity**

Not much difference was observed in plant height and days to maturity with that of conventional method. The average plant height was 88 cm which is also observed in normal method. The SRI crop came to maturity at 135 days where as in conventional method it usually takes 150 days.

**Tillering capacity**

There has been significant difference in terms of tillering capacity between SRI and normal method. In conventional method, IR 64 usually bears 15 – 20 tillers while under SRI it has borne an average of 47 tillers. The highest productive tiller number observed was 75 though not in the crop-cut area.

**Yield**

The yield was the most important parameter that has been looked with SRI. The trial at Bajo showed that SRI gave an average yield of 8.56 t/ha, an increase in yield by 15-20% from that of normal practice in Bajo on station (average 7 t/ha). The increased in yield has been mainly contributed from the increased number of tillers that were fertile and productive.

**Agronomic traits of SRI in 2008**

| Sl | Plant Ht | Tillers no | | Plot yield | Yield kg/acre | Yield t/ha |
|---|---|---|---|---|---|---|
| 1 | 86 cm | 31 | | 5.5 kg | 3440 | 8.6 |
| | 90 cm | 43 | | | | |
| | 89 cm | 40 | | | | |
| 2 | 93 cm | 37 | | 5 kg | 3164 | 7.91 |
| | 85 cm | 69 | | | | |
| | 90 cm | 55 | | | | |
| 3 | 87 cm | 52 | | 5.8 kg | 3672 | 9.18 |
| | 90 cm | 45 | | | | |
| | 85 cm | 51 | | | | |
| Av | 88.3 cm | 47 | | 5.43 | 3425.3 | 8.56 |

**Agronomic traits in normal method**

| Sl | Plant Ht | Tillers no | Plot yield | Yield kg/acre | Yield t/ha |
|---|---|---|---|---|---|
| 1 | 90 cm | 17 | 4.3 kg | 2809 | 7.00 |
| | 92 cm | 18 | | | |
| | 88 cm | 15 | | | |
| 2 | 91 cm | 19 | 4.1 kg | 2678 | 6.69 |
| | 90 cm | 18 | | | |
| | 92 cm | 16 | | | |
| 3 | 89 cm | 15 | 4.5 kg | 2940 | 7.35 |
| | 88 cm | 14 | | | |
| | 90 cm | 18 | | | |
| Av | 90 cm | 17 | 4.3 kg | 2809 | 7.00 |

## CONCLUSION

The results at Bajo on station gave some convincing results that there is some truth in SRI. The seed requirement was significantly reduced with 1.5 kilograms of seed for entire trial area, but the out put has been remarkable with total yield of 552 kg (0.55 t) from 645 sq.m.

It was physically observed that irrigation water requirement was less due to intermittent wetting and drying. However exact amount can not be quantified due to lack of technical capacity and materials. Apart from these benefits, there is a greater impact on Shochum management. The population of the weed was greatly reduced especially during vegetative stage as there has been no continuous flooding which discouraged growing and multiplication of this aquatic weed. However, the weed tends to grow after the reproductive stage due to maintenance of standing water, but the critical stage between the host weed competitions has been over, and there seems to be less or no effect on rice yield.

It is fair to justify that SRI under researcher's management condition has been successful and encouraging. Nonetheless there needs to be further studies in the farmer's fields to observe its suitability and farmers reaction. Moreover there is also a challenge how SRI can fit in the system of water rotation/sharing as usually prevalent in Bhutan and SRI needing assured irrigation.