SYSTEM RICE INTENSIFICATION (SRI) PILOTING AT MUKUNDAPUR, NAWALPARASI

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Organizational Say

It is the matter of pride for SAHAMATI to have a successful piloting of System Rice Intensification (SRI) technology that contributed doubling of rice productivity. It contributed the surplus income of women farmers and member of Yug Chetna Women Saving and Credit Cooperative Ltd. in Mukundapur.

This booklet is published to document the process of SRI. It also captures the learning made during the piloting. We hope farmer will continue with this technology for high yield.

Many thanks to OXFAM for their financial contribution and encouragement. We would like to thank Mr. Karuna Sagar Subedi Program Advisor SAHAMATI for his support to make it happen and media mobilization. We are grateful to SAHAMATI-SAMUNNATI program and Agriculture and Forestry University, Rampur for lunching SRI piloting process.

Heartfelt thanks goes to Yug Chetana Women Saving and Credit Cooperative Ltd., Kalika Women Farmer Group and Shreejana Women Farmer Groups.

Ratna Prasad Sapkota
President

Ashok Raj Pokharel
General Secretary

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SYSTEM RICE INENSIFICATION (SRI) PILOTING AT MUKUNADPUR, NAWALPARASI

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Abstract

System Rice Intensification (SRI) enhances rice productivity through manipulating Environment. A field demonstration was carried out at Mukundapur VDC, Nawalparasi during rainy season 2014 to verify the yield potential of SRI and advocate the technology in the district. Two rice varieties namely Gorakhnath (Hybrid rice) and Sabitri (High yielding rice) were planted through SRI methods of rice cultivation. Field visits of farmers group and focus group discussion was organized. The data on yield attributes and yield were collected from five randomly selected one square meter areas. The grain yields of Gorakhnath and Sabitri were 8. 43 t/ha and 7.5 t/ha respectively which was much higher than National average yield of 3.21 t/ha. The higher yield in SRI methods of rice cultivation was mainly due to higher number of effective tillers per unit area and higher number of filled grain per panicle. The farmer's perception regarding SRI methods of rice cultivation was good in terms of yield potential but they felt that labor requirement for transplanting young seedling and frequent weeding was higher.

1. Introduction

Rice is the most important crop of Nepal in terms of area (0.14 M ha) and production (0.45 Mt.) with an average yield of 3.21 t/ha (MoAD, 2012/13). Rice contributes nearly 20% to the agricultural gross domestic product (AGDP), more than 50% in food grains and total calories requirement of the Nepalese people (Basnet, 2014).

Mostly, the rice production in Nepal is monsoon dependent. Pathak, et al. (2011) reported that climate change may cause the variability of monsoon rainfall and also the risks of early season drought. There is change in monsoon pattern in Nepal with high intensity of rainfall and less numbers of rainy days (Malla, 2009 and Lamsal et al., 2013). Ladha *et al*., (2009) also reported that there may be delayed transplanting by 1 to 3 weeks due to waiting for water to be saturated in the field for puddling which ultimately reduces the crop yield. Methane is one of the most potential green house gases responsible for global warming produced from the anaerobic decomposition of soil organic matter (Gao *et al*., 2006). Kakumanu *et al*., (2011) reported that the Methane emission is higher in flooded rice fields than in the non flooded rice fields.

System of Rice Intensification (SRI) is based on some new insights into how rice can be grown best, translated into certain principles and practices, and was develop by Fr Henery de Laulanie along with his farmer in 1982, in Madagascar. Its main objective is by planting very young

seedlings which allows a greater realization of tillering potential of rice plants and wide spacing on a squire pattern which gives the root more space to grow and get more sunlight and air (Uphoof, 2002). System of rice Intensification (SRI) is defined by Uphoff et al., (2002) as a technique of agronomic manipulation. The practice is based on number of sound agronomic principles. They work synergistically with others in order to achieve higher grain yield. It improves physiological activities of the plants and provides better environmental condition. The key to success with SRI is the early transplanting of seedlings (8 to 12days seedlings), single planting with wider space 25 to 35 cm plant to plant and row to row (NARC 2007).

Two things were repeatedly reported by Morang District farmers (a) their SRI crops in addition to giving often double yield, are maturing 2-3 weeks earlier than normal transplanted methods, this also saves water, reduces the risk of crops loss and makes land available for other crops production. (b) once farmer has acquire the experience and skill with SRI methods, the new system of crop management is labor saving rather than labor intensive, saving labor as well as seeds. Water and cost of production makes SRI increasingly attractive to farmers (Uprety, 2006).

The piloting of SRI was carried out as part of Samunnati program of Sahamati with support from Oxfam Hong Kong. This program was launched in Mukundapur VDC of Nawalparasi District. The program focuses on improvement

of livelihood of the community through proper management of local resources.

The field demonstration and piloting at Mukundpur VDC of Nawalparasi district in Nepal was carried out to verify and advocate the potential benefits SRI technology involving local farmers with following objectives.

2. Objectives

1. To verify the yield potential of SRI method of rice cultivation in Mukundapur VDC of Nawalparasi District.
2. To create awareness about SRI methods of rice cultivation among the farmers groups of Mukundapur VDC.

3. Materials and Methods

The details of methods adopted and materials used during the SRI demonstration at Mukundapur VDC have been described in this chapter under the following heading.

3.1 Description of the Demonstration of field

Demonstration of SRI was conducted with the support of Oxfam Hong Kong (an INGO), and SAMUNNATI program of SAHAMATI (a National Level NGO). SAHAMATI organized SRI methods of rice cultivation at

Mukundapur VDC by coordinating with Yug Chetana Women Saving and Credit Co-operative Ltd. and Department of Agronomy, Agriculture and Forestry University. Cooperative assigned two women groups namely, Kalika women farmer group and Shreejana women farmer group for conducting demonstration of SRI at two sites of Mukundapur VDC. The demonstration was conducted in area of 12 kattha (0.4 hectare) and 6 Kattha (0.2 hectare) of land on two sites respectively. Prior to SRI demonstration at Mukundapur different meeting and field visit was organized with line agencies, Agronomy Department of Agriculture and Forestry University(AFU), cooperative and farmer groups. Finally cooperative agreed to work and technical assistance was provided by SAHAMATI and AFU.

3.2 Climate of Demonstration site

The demonstration site is located in sub tropical climate belt of Nepal. The area enjoys with the sub humid types of weather conditions with cool winters, hot summers and distinct rainy season with annual rainfall of about 2000 mm. The meteorological data for the cropping season was recorded from the meteorological station of National Maize Research Program (NMRP) Rampur, Chitwan. The total rainfall from May 16th to the end of October was 2014.95 mm. The rainfall above 200 mm occurred only at the end July. Transplanting rice in early July was not possible without supplemental irrigation. SRI methods of cultivation do not require puddling of soil which consumes almost 30% of water required by

rice. The climatic data during crop growing season is depicted in Fig.1.

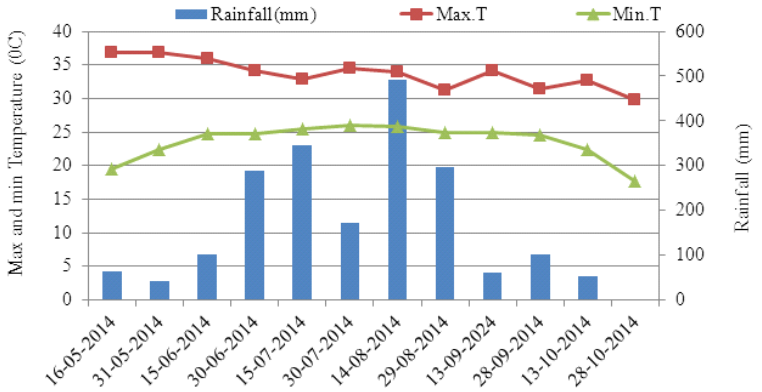

Figure 1 : Maximum, minimum temperature (^{0}C) and rainfall (mm) during crop growing season in 2014 at Mukundapur, Nawalparasi

3.3. Nursery bed preparation

Field was ploughed into two times using a disc harrow through tractor. The layout of the field was done by making 18 nursery beds manually by digging, weeding, and pulverizing the soils and preparing bund and water cannels. The area of single nursery bed was 15m Sq. with length of bed 10 m and width 1.5m. Total 18 seed beds were prepared, 12 nursery bed for kalika and 6 for Shreejana women group. Two verities of paddy

seed namely Sabitri (HYV) and Gorakhnath (Hybrid) were sown on nursery bed at the seed at rate of 1.5 kg per bed. The seed was pre soaked in water for 8 hours. Prior to sowing nursery bed was fertilized with well prepared compost at the rate of ten tons per hectare. Mulching with clean straw was done after seed sowing. After the seven days of seed sowing mulch has been removed from the seed bed. Seedlings were ready to transplant within 12 days at two leaves stage.

3.4. Description of the demonstrated rice variety

3.4.1 Sabitri

It was released in 1972 and still becoming popular variety in central and western terai. It was derived from the cross of IR 1561-228-1/IR 1737//CR 94-13. It has slender and medium size grain. The milling and cooking qualities are acceptable. It is resistant to blast and bacterial blight. It is gradually replacing Mansuli because of higher yield, resistant to blast and earlier maturity (140-145 days) than munsali. It is semi-dwarf in nature and produce about 4-5 t/ha of the average grain yield.

3.4.2 Goraknath 509

It is the hybrid rice produced and marketed by Nath Biogens Ltd., Niath House, Aurangabad, India. It is one of the popular

hybrid rice in Chitwan and Nawalparasi. It has maturity period of 125 -130 days with average plant height of 105 cm. It has fine grain with thousand grain weight of 16 grams. It has average grain yield of 5- 6 t/ha.

3.5 Crop Management Practices

The following crop management practices were carried out during the Demonstration of SRI technology at Mukundapur VDC.

3.5.1 Land preparation for main field

The land was ploughed once using cultivator with tractor just after the first rain of the season on June 7th, 2014. Thereafter, field was left as such for a week for drying of weeds. The land was ploughed twice after one week and leveled with leveler. The soil contained enough moisture due to natural rainfall.

3.5.2 Transplantation

The seedling grown in the nursery bed was uprooted just after 12 days at 2 leaves stage. Seed bed was flooded before uprooting seedlings. Seedlings were carefully removed from the seed bed by using a small shovel and stick to avoid damage. Removed seedlings were transplanted in main field within a half an hour with two seedlings at sallow

depth of 2-3 cm in slightly standing position. Plant to plant and row to row space were maintained 25 cm by using a marked rope and pole to get uniform distance. After transplanting, field were left moist but without flooded for about a week.

3.5.3 Fertilizer management

National recommended doses of the fertilizer were used.. N: P: K used in SRI field were 100 : 30: 30 Kg/ha and 10 kg of zinc sulphate. The source of fertilizers were DAP ,Muriete of potash, and urea. Half of nitrogenous fertilizer was used in the day of transplantation and one third was used in the first weeding *i.e.* in 30 days and remaining fertilizer was applied after second weeding *ie* after 45 days.

3.5.4 Weed management

The first weeding of the SRI plot was done manually after 13 days of transplantation. Before a day of first weeding field was irrigated and water level was maintained 3-4 cm to make the soil loose and weeding easier. Second weeding was done after the 25 days after planting. After weeding, farmer flooded their field before

fertilizer application. Third weeding was done by rotary weeder after the 38 days of plantation.

3.5.5 Irrigation management

The first irrigation was applied 5 days after transplantation to moisten the field without ponding. The second irrigation was given to plot on the evening of the 12th days after transplanting at a ponding depth of 4-5 cm, and the next morning weeding was performed manually. Alternate wetting and drying method of irrigation was followed, and irrigation water was applied when cracks appeared in the field. After panicle initiation, all the plots were kept flooded with thin layers of water 1-2 cm on the paddles, and all were dried 15 days before harvest.

3.5.6 Pest management

It is found that some of the seedling had fungal attack and shunted growth and we suggested applying multiplex (vitamins) and fungicide to control it. In some of the plant rice ear head bug was observed problematic at milking stage and was manage by applying Endosalfan 35 EC @2 ml/liter of water.

3.5.7 Harvesting and threshing

The crops from the plot were harvested manually with the help of the sickle after physiological maturity. Harvested plants were left in- situ in field for three days for sun drying. Threshing was done manually.

3.6 Observation recorded in the rice

3.6.1 Numbers of tillers per square meter at 45 DAT

The numbers of tillers per square meter were counted at 45 days after planting from the five randomly selected areas from whole field. The data of five replicates was averaged and used for interpreting the result.

3.6. 2. Numbers of effective tillers per square meter

The numbers of panicle bearing tillers were counted at five randomly selected areas from one square meter of areas. The averages of the five replicates were used to interpret the result.

3.6 3. Number of filled grains per panicles

Twenty panicles were selected from replicates harvested from one square meter area from five randomly selected areas of field. The numbers of filled grains were counted and averaged to interpret the result.

3.6.4. 1000 grain weight

Thousand grains were counted from the harvested plot of one square meter. The weight was taken with electronic balance. The average of five represents the data of the SRI plots.

3.6.5 Grain yield

One square meter area was harvested from five randomly selected areas of the whole field. The harvested one square

meter from all five areas were threshed and cleaned manually. The grain moisture content during harvest was assumed as 20% and weight of each sample was taken. The averages of five were converted into yield in tones per hectare and moisture content was adjusted to 12%.

3.7 Advocacy of SRI methods of rice cultivation

Farmers groups were called time to time at the meeting hall of village and knowledge about SRI was given through talk and discussion. The farmers, NGO people and students from AFU and outside the countries visited the SRI plots. A group meeting was organized which included News paper editors, FM radio, TV journalist, farmers and leaders of local bodies to discuss about the technology regarding SRI. They also visited SRI plots and question – answer session was organized in the field. The SRI technology was broadcasted on TV and published in National newspaper.

4 Result and discussion

Table 1. Numbers of tillers at 45 DAT, effective tillers, Numbers of filled grains, 100 grain weight, and yield of rice varieties at Mukundpur in SRI demonstration plot during 2014

varieties	No. of tillers/m^2 at 45 DAT	Effective tillers/m^2	No. filled grains	1000 grain weight (g)	Grain yield t/ha
Gorakhnath (Hybrid)	392	255	271	16	8.43
Sabitri (HYV)	350	242	179	23	7.50

4.1 Number of tillers and effective tillers/ m^2

The number of tillers per square meter at 45 DAT were 392 in hybrid rice and 350 in Sabitri planted in SRI methods. Similarly number of panicle bearing tillers per square meter were 255 and 242 in Gorakhnath (hybrid rice) and Sabitri (high yielding rice) respectively. Devkota (2007) reported number of tillers at 45 DAT were 310 in Gorakhnath and 277 in Sabitri respectively from transplanted rice. Similarly number of effective tillers in both varieties were also higher as compared to Devkota (2007). In SRI, number of tillers is generally higher than transplanted rice because crops get more number of phyllochron developments because seedlings are planted in younger stage.

4.2 Number of filled grain and thousand grain weight(g)

The number of filled grain per panicle in Gorakhnath and Sabitri were 271 and 179 respectively under SRI methods of rice cultivation. Devkota (2007) reported the number of filled grain per panicle in Gorakhnath and Sabitri were 258.9 and 171.7 respectively in transplanted methods of rice cultivation. The higher number of filled grain per panicle in SRI methods of rice cultivation may be due to better root system of the crop. Thakur et al. (2010) also reported higher number of grain per panicle in SRI methods of rice cultivation. Thousand grain weights of Gorakhnath and Sabitri were 16 and 23 gram respectively in SRI methods of rice cultivation. Devkota (2007) also reported similar thousand grain weight in both

varieties under transplanted rice. The thousand grain weight is mostly determined by genetic makeup of the variety and does not differ more with methods of crop establishments.

4.3 Grain Yield (t/ha)

The grain yields of Gorakhnath and Sabitri were 8.43 and 7.5 t/ha respectively in SRI methods of rice cultivation in Mukundpur. The higher grain yield was because of higher number of effective tiller per unit area and higher number of filled grain per panicle. Tripathi et al. (2004) also reported higher yield of rice in SRI plots. In general the yield was much higher than the national average yielding of 2.907 t/ha of Nepal.

5. Conclusion

SRI methods of rice cultivation improved the productivity of rice by manipulating crop environmental complex. It can be grown with less water and suitable for condition of delayed monsoon. The major problem with SRI perceived by the farmers was more labor requirement for transplanting young seedling and frequent weeding. In context with climate change, the rainfall pattern is being delayed in Nepal, SRI method of rice cultivation is useful because no puddling is required which consume about 30% of total water used by the rice crop. Besides that, the productivity of rice was more than double as compared with transplanted rice and methane gas emission is also lowers due to frequent aerobic condition in SRI method of rice cultivation.

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Community Voice

We got surprised with new technology of rice production (SRI). We used to produce rice in traditional method that requires more cost in seed and more water for irrigation. We are happy with this method and from onwards we will apply this method and increase 50% more productivity.

- Mina Chaudhary
Manager of cooperative and group member

Rice is the main source of food in Tharu community. We live in the joint family with increase in the family member we compelled to convert our productive land into residential. Hence the productive land is decreasing. In the meantime, erratic rainfall, effect of climate change also impacted adversely on production. But SRI technology yielded double quantity that is enabling us to feed the whole family. I thank to the project.

- Rajmati Khajuwar
President, Kalika Women Farmer Group

Publication

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कृषक

१६ | कार्तिक १९-२५ गते, २०७१

उन्नत प्रविधिले धान दोब्बर उत्पादन

■ नारायण शर्मा

नवलपरासी- यहाँको मुकुन्दपुरका महिलाले उन्नत एसआरआई (सिस्टम राइस इन्टेन्सिफिकेसन) प्रविधि प्रयोग गरेर धान खेती गर्दा उत्पादन दोब्बर भएको छ। मुकुन्दपुरस्थित कालिका र सिर्जना महिला कृषक समूहले १८ कठ्ठा जग्गा भाडामा लिएर सघन धान खेती गर्दा परम्परागतभन्दा दोब्बर उत्पादन भएको हो।

उनीहरूले गोरखनाथ र सावित्री जातको धान रोपेका थिए। युग चेतना महिला समूहकी अध्यक्ष मायाबापा आलेका अनुसार उनीहरूले फरक फरक स्थानमा क्रमशः ५, ६ र ७ कठ्ठामा मिलेर सामूहिक धान खेती गरेका हुन्। उनीहरूले प्रतिकठ्ठा वार्षिक १ हजार ५ सय तिरेर जग्गा भाडामा लिएका थिए। चितवनको रामपुरस्थित कृषि तथा वन विश्वविद्यालयको प्राविधिक सहयोगमा खेती गरिएको थियो।

धान बिकीबाट आएको नगद मिलेर बनाएको क्रोषमा राखेर समूहमा ऋण लगानी गर्ने गरेका छन्। सहमति गैडाकोट र अक्सफाम नेपालले समूह बनाउने र उन्नत जातका धान खेतीमार्फत आय आर्जन बढाउने काममा सहयोग गरेका हुन्। थोरै पानी र सामान्य गोडमेलमा २५ सेन्टिमिटरमा धान लगाइएको छ। ८/१० दिनको बीउ रोपिएको स्थानमा बाक्लो र झाँगिएको धान फलेको हो।

त्यसले परम्परागत धान खेतमा भन्दा दोब्बर उत्पादन हुने रामपुर कृषि क्याम्पसका प्राध्यापक श्रवणकुमार शाहले कान्तिपुरलाई बताए। प्रविधि अपनाउँदा प्रतिकठ्ठा साढे ४ मुरीदेखि ६ मुरीसम्म उत्पादन हुने शाहले जानकारी दिए। १ क्विन्टलको ३ हजारदेखि ३ हजार २ सयसम्म बिक्री हुन्छ। परम्परागत धान खेतीबाट मुस्किलले २/३ मुरीसम्म उत्पादन हुने गरेको छ। सँसारका २७ वटा मुलुकले यस प्रविधिबाट खेती सुरु गरेको उनले जानकारी दिए।

प्रविधिबाट रोपेको १५ दिनमा गोडमेल गरेर मल छर्ने गरेको स्थानीय कृषक राजमणि खोजारले बताइन्। डोरी टरिर २५ सेन्टिमिटरको दूरीमा रोप्न झन्झटिलो भए पनि लटरम्म गाँज हालेको देख्दा आफूहरूले गरेको दुख बिर्सेको उनले सुनाइन्। अर्को वर्ष आफ्नो सबै जग्गामा यसै प्रविधिबाट धान खेती गर्ने योजना रहेको उनले सुनाइन्। बीउ रोप्दा एउटा मात्र बेर्ना रोप्ने यस प्रविधि धेरै लगानीमा धेरै उत्पादन दिन सकिने भएकाले स्थानीय महिलाहरू उत्साहित भएको उनीहरूको भनाइ छ।

धान रोप्ने पुरानी चलनभन्दा एसआरआई (सघन धान खेती) पद्धतिको प्रयोगले उत्पादन दोब्बर दिने भएकाले धेरैको आकर्षण देखिएको सहयोगी संस्था 'सहमति गैडाकोट' का सल्लाहकार करुणासागर सुवेदीले जानकारी दिए। सुवेदीले मुकुन्दपुरको सयौं बिघामा वर्षौंदेखि लगाउँदै आएको धान खेतीभन्दा यो वर्ष त्यहाँ परीक्षणका रूपमा सुरु गरिएको झाँगिएको धानखेतीका गाँज र लटरम्म झुलेको धानका बाला देखेर धेरै किसानबाट यो प्रविधिको माग गर्दै आफूहरूकहाँ आउने गरेको उनले सुनाए।

अन्य धान बालीमा भन्दा निकै कम पानीमा उत्पादन हुने भएकाले धेरै मेहेनत र समय बचत हुने गरेको छ।

News published in National Daily News Paper Kantipur about SRI piloting at Mukundapur, Nawalparasi on 12th Oct. 2014

Glimpse of SRI piloting plots

Orientation with farmer groups for SRI

Seed Bed Preparation

Seedlings rased after 7 days of sowing

After transplanting of 7 days

Weeding of SRI plant by using weeder.

Manually weeding of SRI plot

Field description of SRI plot

SRI plant after 45 days

SRI plant during 2nd weeding

SRI piloting field observation

Description of SRI at press conference

SRI field during maturity stage of rice