Performance of System of Rice Intensification in Morang District, 2004

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Nepal as an agricultural country still has more than 65% of its population is engaged in agriculture for their livelihood. Agriculture contributes 39% of GDP. Among agricultural crops, rice is the main crop, cultivated on nearly 1.54 Million hectares of land. Total production of rice in 2002/2003 was 4.13 million tons, with average productivity of 2,675 kg/ha (APSD/MOAC 2004). The productivity of rice in Nepal is not high since the world average is about 4,000 kg/ha, 50% more, so there is lot of possibility for making increments in productivity and total production.

Morang is one of the important rice-growing districts in eastern Nepal. Total rice-growing area of this district is more then 94,000 hectares, out of which, early rice is grown on 10,000 hectares, and boro (winter) on nearly 100 hectares. Average rice productivity in the district is 3,173 Kg/Hectare.

Behind the low production of rice there are various factors such as use of older-generation seeds (most farmers have used their own seed for decades), low doses of chemical fertilizer application, little use of improved cultivation practices, less care for plant protection, etc. Generally farmers use more then 60 kg of seeds/ha, transplant very old seedlings (30-45 days old), and plant many seedlings, 6-10/hill. These all factors are contribute to low productivity of rice in Nepal.

After reading an article on SRI in the *LEISA* magazine on low external-input sustainable agriculture, published by a Dutch NGO, I found many things in it that might be useful in Nepalese context, so I contacted Dr. Norman Uphoff for more information about SRI. After collecting some good information, last year I started evaluations of SRI in Morang district of eastern Nepal. Last year two small plots of less then 100 square meters were planted with some SRI practices (young seedlings, widely spaced planting, less water, and some weeding, but no compost). We got more then 7 metric tons/ha yield with healthy plants having less diseases and pests. That result encouraged us, so we disseminated knowledge to farmers about SRI through training activities, a monthly newsletter, and personal and group contact.

This information created a sensation among the farmers, and we found many farmers wanting to try this technology. But still farmers didn't fully believe in this technology. Most farmers wanted to visualize these results on another's field to gain

confidence. However, some innovative farmers were willing to try the methods with their early rice, and 3 farmers planted early rice using SRI methodology. Two of them got nearly 6 metric tons/ha with such practices.

One farmer, Mr. Udaya Narayan Nepal, planted 3 plots, with three different ages of seedling (8 days, 12 days, and 17 days). His land is upland with no irrigation facility, very low content of organic matter, and without compost. Despite these conditions, vegetative growth of his crop was very good. Tiller number reached up to 130/hill. All his neighbors who had teased him initially became astonished to see his crop. Mr. Nepal was excited, expecting to harvest a bumper crop according to his tiller numbers. However, when the tillers reached panicle initiation stage, he was unable to provide any irrigation to his rice crop, and wilting symptoms appeared. I too was very sad to see his crop in that condition. Yet even after the evident water stress, his crop produced a nice crop with up to 63 panicles/hill and up to 362 grains/panicle. We were all very happy with the nice results after the crop harvest. Details of production results are as follows:

Table 1. Performance of SRI for Chaite (early) rice in Morang district, Nepal, 2004

S N.	Particulars	Plot no.1 Sundarpur-7	Plot no.2 Sundarpur-7	Plot no.3 Ithari-1
1	Rice variety	Bansdhan	Bansdhan	Bansdhan
2	Land type	Upland	Upland	Upland
3	Plot size (sq. meters)	400	350	400
4	Date of seed sowing	April 13, 2004	April 13, 2004	April 13, 2004
5	Date of transplanting	April 21	April 25	April 30
6	Seedling age	8 days	12 days	17 days
7	Planting spacing (cm)	40 x 25	40 x 25	40 x 35
8	Number of weedings	3	3	2
9	Average tiller number (130 maximum)	107	98	78
10	Insect attack situation	Normal	Normal	Normal
11	Disease situation	No disease	No disease	No disease
12	Average of fertile tillers/hill Maximum Minimum	37.8 59 18	37.4 63 11	31.9 50 10
13	Average number of grains/panicle Maximum Minimum	201.5 295 77	167.9 362 69	265.3 407 85
14	Fertilizer application	25:22:11 kg/ha NPK	25:22:11 kg/ha NPK	22.5 kg/ha N only
15	Compost use	No compost	No compost	No compost
16	Date of crop cutting	August 31	August 31	September 5
17	Productivity (Mt/ha)	8.75	7.50	9.25
18	Average productivity of same variety with improved practices	4 Mt/ha		
19	Average productivity of same variety with farmers' practices	2.5 Mt/ha		

After observing the early rice result, many farmers went ahead to plant their regular rice crop with SRI methods. Immediately after the early rice, the normal season rice planting started, and farmers from 14 Village Development Committees and one Sub-Metropolitan City, planted rice with SRI on plots from 500 square meters up to 2 hectares (Mr. Kalayan Rai). The VDCs where SRI was introduced are Sundarpur, Dulari, Mirgauliya, Indrapur, Harincha, Kashani, Bahuni, Bairban, Jhorahat, Hatimuda, Hasandaha, Janthe, Dangraha, Katahari, and Biratnagar.

Most of these innovative farmers faced pessimistic comments from their neighbors, initially all of them laughing and teasing the SRI farmers because initially the SRI plot looks pitiful, with so few tiny plants and no standing water. But after one month, most of the farmers became surprised to seen the 'magical' growth of SRI crops. After this they started regular visits to SRI plots. Almost all SRI plots' were started with very few inputs, less water, and very few seeds (only 3-5 Kg/ha). Many plots' rice plants started (resumed) tillering 2-3 days after transplanting, and single seedlings produced up to 135 tillers per hill. One isolated rice plant in the vegetable field of Mr. Haricharan Biswas produced even 182 panicles in a single hill. This shows the potentiality of single rice seedlings.

We need to manage the environment differently and better for bumper production of rice. In better conditions, local cultivars can produce more rice with SRI methods than any HYV can with conventional methods. We observed that if we keep the soil only moist (and sometimes dry), even older seedlings also produce more tillers. In one plot of Mr. Dhirendra Tharu (Kashani-9) using Masuli variety, 21-day seedling also produced more then 40 tillers/hill with very good panicles (350-400 grains/panicle). It is necessary to verify this fact with more replication in the next season.

The normal season SRI rice crop acquainted us with many facts of rice crops and with limitations in our current cultivation practices. Most of the SRI plots were planted with wider spacing (40-45 cm in both directions). Because our early crop produced more than 100 tillers in each hill, we thought our spacing needed to increase. In the early crop., there was water stress (which enhanced vegetative growth) in early crop, but the fertile panicle number was about 50%. In the normal season when there was no scarcity of water and sometimes flooded condition due to heavy rainfall during September-October, our tillering rate decreased but the number of fertile tillers increased. Our normal crop yield was good but we can probably produce more if we could manage the crop with somewhat closer spacing (30x30 cm).

Table 2. Fertile tillers/hill and grains/panicle with SRI practice

	Farmer name	Location	Rice variety	Fertile tillers/hill	Grains/ panicle	Maximum no. grains/panicle
1.	Udaya N. Nepal	Sundarpur 7	Bansdhan Radha 12 Suganda	36 28 18	220 265 278	407 358 328
2.	Dhirendra Tharu	Kashani 9	Bansdhan Mansuli	36.8 20	239 308	348 395
3.	Ms. Aloean Chapagain	Sundarpur 4	Bansdhan	41	172	234
4.	Kishor Luintel	Jhorahat 2	Bansdhan	49	192	286
5.	Krishna K.C.	Hatimuda 6	Radha 12	23.6	213	307
6.	Mrs. Bhagiratha Bhattrai	Dangraha	Radha 12	21	253	298
7.	Lila Karki	Bairban 4	Bansdhan	18	315	396
8.	Mrs. Manuka Dahal	Bairban 4	Bansdhan	18	302	386
9.	Bhupendra Bhattrai	Bairban 4	Bansdhan	16	300	391
10.	Shiba Prasad Niraula	Janta 9	Barshe 3004	36	284	358
11.	Kalayan Rai	Kashani 4	Mansuli Radha 12 Bansdhan	12 13 16	280 200 186	378 287 193
12.	Durga Timsina	Biratnagar 4	Barshe 3004	34	259	348

Most of our fields contain very low organic matter (less than 1%). In better organic soil we found better SRI yield with more fertile tiller percentage and longer panicle size. In the next season we intend to verify the effect of organic matter content on tiller number, fertile tiller percentage, number of grain/panicle, disease pest effect, and yield.

With SRI methods, very interestingly, we found reduced crop duration on all plots and with all varieties. It appears that with SRI we can harvest our crops 7-30 days earlier then with conventional methods. Reduction of crop duration varied with different variety, soil type, water availability, and seedling age. In water-scarcity conditions with young seedlings, the crop maturity was found to be 15 days earlier then with traditional methods. We saw SRI rice plants starting their vegetative phase (tillering) 20-35 days earlier then with traditional methods (using 30-45 day-old seedlings). So they pass through all stages earlier and reach maturity earlier than traditionally. It is necessary to verify in the next season with replications and the same varieties of rice.

Table 3. Effect on crop duration with SRI methods (time from seed to seed)

	Farmer name	Location	Rice variety	Crop duration with traditional methods	Crop duration with SRI methods	Difference -- earlier harvest (days)
1.	Udaya N. Nepal	Sundarpur 7	Bansdhan Radha 12 Suganda	145 155 123-127	130 145 109	15 10 16
2.	Dhirendra Tharu	Kashani 9	Bansdhan Mansuli	145 165	133 141	12 24
3.	Ms. Aloean Chapagain	Sundarpur 4	Bansdhan	145	129	16
4.	Kishor Luintel	Jhorahat 2	Bansdhan	145	130	15
5.	Krishna K.C.	Hatimuda 6	Radha 12	155	144	11
6.	Mrs. Bhagiratha Bhattrai	Dangraha	Radha 12	155	147	8
7.	Lila Karki	Bairban 4	Bansdhan	145	127	18
8.	Mrs. Manuka Dahal	Bairban 4	Bansdhan	145	128	17
9.	Bhupendra Bhattrai	Bairban 4	Bansdhan	145	127	18
10.	Shiba Prasad Niraula	Janta 9	Barshe 3004	145-150	140	7
11.	Kalayan Rai	Kashani 4	Mansuli Radha 12 Bansdhan	165 155 145	135 138 129	30 17 16
12.	Durga Timsina	Biratnagar 4	Barshe 3004	145-150	138	9
13.	Fata Ba. Shrestha	Harincha 3	Bansdhan	145	121	24
14.	Bhim Niraula	Mirgauliya 3	Barshe 3004	145-150	137	10
15.	Ashok Singh	Katahari 9	Barshe 3004	145-150	135	12
16.	Narayan Shrestha	Dulari 1	Barshe 3004	145-150	135	12
	Average					15.1

Table 3. Yield performance of traditional and SRI methods in normal season rice, 2004 (Mt/ha)

	Farmer name	Location	Rice variety	Ave. yield with tradl. methods	Ave. yield with SRI methods
1.	Udaya N. Nepal	Sundarpur 7	Bansdhan Radha 12 Suganda	3.0 5.0 3.0.	8.5 8.0 6.0
2.	Dhirendra Tharu	Kashani 9	Bansdhan Mansuli	4.0 4.0	10.2 10.5
3.	Ms. Aloean Chapagain	Sundarpur 4	Bansdhan	3.0	6.0
4.	Kishor Luintel	Jhorahat 2	Bansdhan	3.5	8.0
5.	Krishna K.C.	Hatimuda 6	Radha 12	3.0	7.5
6.	Mrs. Bhagiratha Bhattrai	Dangraha	Radha 12	3.5	7.5
7.	Lila Karki	Bairban 4	Bansdhan	3.0	
8.	Mrs. Manuka Dahal	Bairban 4	Bansdhan	3.0	
9.	Bhupendra Bhattrai	Bairban 4	Bansdhan	3.0	
10	Shiba Prasad Niraula	Janta 9	Barshe 3004	4.0	10.75
11	Kalayan Rai	Kashani 4	Mansuli Radha 12 Bansdhan	3.0 3.5 3.0	7.5 6.0 6.5
12	Durga Timsina	Biratnagar 4	Barshe 3004	4.0	12.12
13	Fata Ba. Shrestha	Harincha 3	Bansdhan	4.5	13.5
14	Bhim Niraula	Mirgauliya 3	Barshe 3004	3.0	6.0
15	Ashok Singh	Katahari 9	Barshe 3004	3.0	7.0
16	Sagar Kamet	Katahari 4	Suganda	3.0	6.2
17	Sovit Shrestha	Indrapur 6	Suganda	3.0	6.0
18	Mohanlal Shrestha	Indrapur 6	Bansdhan	3.0	7.3
19	Tikaram Shrestha	Indrapur 6	Bansdhan	3.0	6.4
20	Bhola Thapa	Indrapur 6	Bansdhan	3.0	8.3
21	Subash Karki	Hasandaha 5	Suganda	3.0	7.5
22	Narayan Shrestha	Dulari 1	Barshe 3004	4.0	5.0
				3.37	7.85

According to our crop cutting records, most of the SRI crop produced at least more then double production except for Mr. Narayan Shrestha's plots in Dulari 1. Low production of his plots was due to very wide space planting (50x45 cm), lack of water management, and limited weeding. Due to the standing water in his field, tillering capacity was reduced, and the wide spacing reduced his panicle number per unit area. Otherwise his crop also produced good numbers of fertile tillers and handsome panicles with large numbers of grains/panicle. The highest grain yield was produced in a farmers' field school (13.5 Mt/ha), although the SRI plot was small, just 20 square meters, followed by a yield of 12.2 Mt/ha for a 600 square meter area at Biratnagar with Barshe 3004 with water-scarcity condition at flowering stage.

Overall, the average SRI yield was 133% higher than the average obtained with traditional methods. The farmers in this evaluation had average yields with conventional methods only about 6% higher than the district mean, so this indicates that their soils were reasonably representative of district soils generally.

Besides higher production and earliness of the crop, another important advantage of SRI methods was the reduced need for and use of pesticides. Generally, local farmers use Phorat, Thimate and other pesticides to control stemborer, leafhopper, case worm and other insects. These pesticides have long residual toxicity and probably have some adverse effects on biological life (earthworms and other microorganisms) in the soils. These pesticides also pollute water and affect water biology and almost all useful insects found in rice field (spiders, tiger beetles, dragon flies, honey bees, and ladybird beetles). With SRI, our farmers did not use any insecticide to control stemborer and other insects because there were a lot of tillers in every hill so some damage to plants by insects had little effect on production. Some farmers did use fungicide (for leaf spots and neck blast) at the flowering stage. By using seed treatment methods before seed sowing next time we can minimize use of fungicide too.

Above all, these facts show that SRI will become very useful for our resource-poor, marginalized, small landholding farmers, who are a majority of our farmers and use their own labor to cultivate their crops. We should do more to popularize and familiarize these SRI eco-friendly methods to our farmers. To achieve this, we need to do following work:

1. Conduct verification trials with replications using standardized SRI methods for particular climatic zones, because Nepal has diverse climatic zones within short distances.
2. Provide massive demonstrations in farmers' fields with farmer collaboration to create awareness and develop confidence about this methods among farmers.
3. Produce sufficient printed and A-V aids about SRI to distribute and demonstrate within rice farming communities and to extension worker.
4. Conduct training session on SRI for extension workers as well as leader farmers.
5. Study further potentialities of rice plants with different water, manure, climatic and other condition.
6. Use this method strategically within the Department of Agriculture/Nepal and its district offices and also with different NGOs which are involved in agriculture development to give new momentum to agriculture in the country, promoting food security and agricultural improvement as well as diversification of the sector.