

Experience with the System of Rice Intensification in NEPAL

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SRI work has not progressed very far in Nepal; however there have been some small but interesting evaluations. In 1998, some initial work on SRI was begun by Chiranjivi Adhikari, an agronomist at the government's Khumaltar Research Farm near Kathmandu. The trials were sponsored by the Soil Management Collaborative Research Support Program funded from the U.S. Agency for International Development and managed through Cornell University. Though Adhikari has since been transferred to the Regional Agricultural Research Station (RARS) at Tarahara in eastern Nepal, his work on SRI continues.

In summer 2001, after some lengthy discussions between the first author and CIMMYT, two more sets of trials were begun, one at Sunrise Farm, an independent farm at Sitapaila near Kathmandu, owned and managed by the third author, and the other on the RARS at Bhairahawa in Rupandehi District. At that time, neither Evans nor CIMMYT knew about Adhikari's work.

About the time that the work on SRI began at Sitapaila and Bhairahawa, Scott Justice of CIMMYT learned from Prof. John Duxbury, Cornell's manager for the Soil Management CRSP about the previous work done on SRI. It was agreed then that there should be some coordination so as not to "reinvent the wheel" and waste resources. What follow are brief accounts of the evaluations to date.

Regional Agricultural Research Station Trials

In 1998, a small feasibility study on SRI was conducted as on-farm research at Sipaghat in Naldung, Kavre District. Three transplanting spacings (20x20, 30x30 and 40x40 cm), with three seedling ages (10, 20 and 30 days old), were transplanted on farmers' field. Very high tillering was observed at 40x40 cm spacing, but because the site was very far from Khumaltar, not all of the necessary data were collected. Also, it was not pos-

sible to maintain proper water control in the field as expected with SRI.

In 1999, evaluations were conducted both on-station at Khumaltar RARS and at two on-farm locations at Bhaktapur. At Khumaltar, two varieties that are popular in Kathmandu valley (Khumal-4 and Taichung-176) were used, while in Bhaktapur district, Khumal-4 was planted in Bageshori village and Taichung-176 in Nangkhel village. Three plant spacings (20x20, 30x30 and 40x40 cm) and three seedling ages (10, 20 and 30 days old) were used, and all detailed data were recorded.

Tillering was as high as 60 tillers per hill. However, the yield data showed the highest grain yield was achieved with 20-day-old seedlings using 20x20 spacing. The highest leaf area index (LAI) was also observed at 20x20 spacing. Thus, these first trials did not show the predicted SRI effect of better plant performance with younger seedlings and wider spacing. There were still difficulties during the trials in maintaining SRI water management.

In 2000, the study was continued with slightly modified SRI practices used again at Khumaltar and in farmers' fields at Bhaktapur. Three popularly grown varieties were used in this study (Khumal-4, Khumal-6 and Taichung-176). At Khumaltar, the trials were planted with three spacings (20x20, 20x15 and 15x15), while at Bhaktapur, only one spacing (20x20 cm) was used. Again the result showed that 20x20 spacing produced the highest grain yield, this time compared to narrower spacings, below what is recommended with SRI. Farmers preferred this 20x20 spacing for its higher tillering and good grain size.

In 2001, further evaluation was conducted at RARS Tarahara and on a farmer's field in its command area. Of the SRI practices, only single seedlings were used. They were not very young (20 days old) and with 20x20 cm spacing. The popularly grown variety Mansuli was planted. Very high tillering (as high as 65 tillers per hills) was observed in the farmer's field. Grain yield as

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high as 8 t/ha was observed. One important characteristic of the plants grown this way was that there was no lodging, because of stronger plants and greater root growth. The same variety of rice when planted with the usual practices lodged while the single-seedling plants did not.

Sunrise Farm, Sitapaila, Kathmandu

In 2001, the authors coordinated a small trial on this farm located on the edge of Kathmandu Valley. The seedlings used were 8 days old, planted at three spacings: 15x15, 30x30 and 50x50 cm. The yields were only average and the 15 cm spacing was best. Shrestha's wife found the planting easy, and the extra time spent planting individual plants carefully was saved by the low planting density.

Weeding was, as expected, labor-intensive but it was reduced by sowing a green manure crop of mustard at transplanting time. This kept weeds down for 2-3 weeks. The first author has produced a brochure for farmers on SRI in Nepali which the NARC scientists have remarked was very helpful for them in formulating their trials. (Copies were made available at the conference.)

Regional Agricultural Research Center/ Bhairahawa and CIMMYT

Here there had been numerous participatory technology development (PTD) investigations undertaken and new advances in tillage and crop establishment (TC&E) technologies, such as surface seeding and reduced and zero tillage in wheat, in connection with the Rice-Wheat Systems consortium program. This work has been supported by CIMMYT.

The need to identify new TC&E technologies for rice had been noted for some time. Prior to summer 2001, RARS/Bhairahawa scientists J. Tripathi and M. R. Bhatta had been discussing recent SRI papers with Scott Justice (CIMMYT). They found the claims interesting and worth taking a closer look. It was decided that the work should not only evaluate SRI but should attempt to find germplasm that might have high tillering tendency.¹

¹ This is an offshoot of work done earlier, on bed-planted wheat, where wheat on raised beds of up to 70 cm in height, with 50 cm separation between outer rows, can give higher yields with lower seeding rates, due to the higher number of tillers and longer panicles

At the Bhairahawa research farm, two preliminary experiments on SRI, funded by CIMMYT, were conducted in the rice season of 2001-2002 to study the feasibility of these techniques for the local environment and also to examine their economics. The experiment was simply laid out in RCBD with three methods of rice transplanting (two SRI and one conventional) and two rice varieties (Rampur Masuli & Radha 4) (See Table 1).

After transplanting, severe weed infestation appeared to be a serious problem, so two weeding practices (rotary weeder and manual weeding) were adopted in the experiment. Thus, all together three factors were included in the experiment but replicated only twice. Thirty centimeter spacing was used in SRI 1, and 40 cm spacing in SRI 2, while 10-day-old seedlings were transplanted with both SRI methods; for the conventional practice (CP), 20-day-old seedlings were transplanted at a distance of 20 cm apart.

The overall results of the experiment did not show any significant SRI yield increase over the conventional practice. However, data analysis revealed that the longer-duration variety produced a higher yield with SRI 1, whereas the shorter-duration variety did better with conventional practice. It was noticed that the SRI experiment suffered from heavy rains just a few days after transplanting and from severe weed problems, which contributed to poor crop growth.

Overall crop performance was poor for some weeks with SRI, but later it recovered surprisingly well and gave very good impressions. From the field observations, it was seen that growth performance was not uniform with SRI methods. In some patches the crop was so good that it produced up to 70 tillers /hill.

Future Plans

An SRI workshop was held mid-April in Kathmandu at the National Agricultural Research Council (NARC) headquarters to share data and experiences between scientists and farmers. At RARS/Bhairahawa, scientists have decided, based on their observations during the last crop season, to continue this experiment. In fact, they wish to formalize the experiment by developing and submitting a new proposal for NARC funding.

At Sunrise Farm, Shrestha and his wife consider that the method certainly has promise and plan to expand their area under SRI as well as continue evaluating its use with green manures and mulch to try to reduce weeding costs. Shrestha also plans to combine SRI with the Fukuoka no-till system (a rice-wheat-clover rotation) which is already working well on his farm.

Table 1. Experiments at Regional Agricultural Research Station, Bhairahawa

| Treatments | Plant height (cm) | Panicle length (cm) | Maximum tillers/m ² | Effective tillers/m ² | Filled grains | Unfilled grains | Total grain weight (g) | Yield (kg/ha) |
|---|-------------------|---------------------|--------------------------------|----------------------------------|---------------|-----------------|------------------------|---------------|
| Effect of variety: | | | | | | | | |
| R. Masuli | 115 | 23 | 300 | 211 | 172 | 20 | 19 | 5665 |
| Radha-4 | 112 | 23 | 244 | 185 | 136 | 24 | 25 | 5192 |
| Effect of SRI methods: | | | | | | | | |
| S1 | 111 | 23 | 259 | 196 | 155 | 21 | 22 | 5368 |
| S2 | 115 | 24 | 268 | 193 | 162 | 23 | 22 | 5204 |
| CP | 115 | 22 | 288 | 205 | 146 | 22 | 23 | 5713 |
| Effect of weeding practices: | | | | | | | | |
| WP1 | 113 | 23 | 273 | 199 | 154 | 22 | 22 | 5453 |
| WP2 | 113 | 23 | 270 | 197 | 154 | 22 | 22 | 5404 |
| Variety x SRI methods: | | | | | | | | |
| RMxS1 | 115 | 24 | 297 | 219 | 180 | 26 | 19 | 5905 |
| RMxS2 | 115 | 24 | 295 | 207 | 184 | 23 | 19 | 5465 |
| RMxCP | 115 | 22 | 308 | 206 | 153 | 11 | 19 | 5624 |
| R-4xS1 | 106 | 23 | 222 | 174 | 130 | 15 | 25 | 4832 |
| R-4xS2 | 114 | 24 | 241 | 179 | 140 | 24 | 25 | 4942 |
| R-4xCP | 115 | 22 | 269 | 203 | 138 | 32 | 26 | 5802 |
| Variety x weeding practices: | | | | | | | | |
| RMxW1 | 115 | 23 | 305 | 214 | 172 | 20 | 19 | 5739 |
| RMxW2 | 115 | 23 | 295 | 208 | 172 | 20 | 19 | 5590 |
| R-4xW1 | 112 | 23 | 241 | 185 | 136 | 24 | 25 | 5166 |
| R-4xW2 | 112 | 23 | 246 | 186 | 136 | 24 | 25 | 5218 |
| SRI methods x weeding: | | | | | | | | |
| S1xW1 | 111 | 23 | 260 | 200 | 155 | 21 | 22 | 5494 |
| S1xW2 | 111 | 23 | 259 | 193 | 155 | 21 | 22 | 5243 |
| S2xW1 | 115 | 24 | 272 | 193 | 162 | 23 | 22 | 5152 |
| S2xW2 | 115 | 24 | 264 | 193 | 162 | 23 | 22 | 5256 |
| CPxW1 | 115 | 22 | 288 | 205 | 146 | 22 | 23 | 5713 |
| CPxW2 | 115 | 22 | 288 | 205 | 146 | 22 | 23 | 5713 |
| Variety x SRI methods x weeding practices: | | | | | | | | |
| RMxS1xWP1 | 115 | 24 | 301 | 227 | 180 | 26 | 18.5 | 6193 |
| RMxS1xWP2 | 115 | 24 | 306 | 208 | 184 | 23 | 19 | 5402 |
| RMxS2xWP1 | 115 | 22 | 308 | 206 | 153 | 11 | 19 | 5624 |
| RMxS2xWP2 | 115 | 24 | 293 | 212 | 180 | 26 | 18.5 | 5618 |
| RMxCPxWP1 | 115 | 24 | 285 | 205 | 184 | 23 | 19 | 5529 |
| RMxCPxWP2 | 115 | 22 | 308 | 206 | 153 | 11 | 19 | 5624 |
| R-4xS1xWP1 | 106 | 23 | 218 | 173 | 130 | 15 | 25 | 4795 |
| R-4xS1xWP2 | 114 | 24 | 238 | 178 | 140 | 24 | 25 | 4902 |
| R-4xS2xWP1 | 115 | 22 | 269 | 203 | 138 | 32 | 26 | 5802 |
| R-4xS2xWP2 | 106 | 23 | 226 | 174 | 130 | 15 | 25 | 4869 |
| R-4xCPxWP1 | 114 | 24 | 244 | 180 | 140 | 24 | 25 | 4983 |
| R-4xCPxWP2 | 115 | 22 | 269 | 203 | 138 | 32 | 26 | 5802 |