FEATURES OF THE SYSTEM OF RICE INTENSIFICATION (SRI) APART FROM INCREASES IN YIELD

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The System of Rice Intensification (SRI) -- by changing the way that rice plants, soil, water and nutrients are managed – has its most obvious and dramatic effects on **yield**, generally raising yields by 50-100%, and sometimes even more. But there are many other considerations why farmers, governments and donor agencies should consider use or support of SRI practices that are now being increasingly documented in a number of countries.

1. SRI yield increases are not obtained only by farmers producing currently at low levels. Farmers using modern methods also get very good responses and greater returns with SRI.

- The Sichuan Academy of Agricultural Sciences in **China** conducted over 100 on-farm in 2004 comparing SRI methods with the yields obtained with modern, high-input methods. These gave an average of 7.5 tons/hectare, while SRI plots gave an average of 10.5 t/ha.[1]
- The extension service of the Andhra Pradesh state agricultural university (ANGRAU) in **India** conducted comparison trials in the past wet (kharif) and dry (rabi) seasons to evaluate SRI compared with the practices currently recommended.[2]

Season	*N*	*SRI*	*Comparison*	*Difference*
Rabi 2003-2004	94	9.67	7.13	2.54
Kharif 2004	476	7.92	5.58	2.44

- ***SRI methods can add 2 to 3 t/ha to already high levels of rice yield. Thus while SRI is accessible and beneficial for small and marginal farmers, it is not limited to them.***

2. SRI is not limited to small-scale, garden-style production of rice .

- In rabi 2003-2004 season in the Godavari delta of Andhra Pradesh state, the following yields were obtained by middle and large-scale farmers, measured by the staff of the AP department of extension and calculated from the harvest, not by sampling procedures.[3]

Name of farmer	*Location*	*Area (acres)*	*Harvested yield (t/ha)*
S. Lakshmana Reddy	Ramavaram	9	17.25
N.V.K.D. Raju	Kuruillagudam	100	11.15

- ***While highest SRI yields can be obtained on small, intensively-managed plots, large increases can be obtained with SRI methods when used appropriately on a field scale.***

3. SRI methods usually reduce costs of production, which is more important to farmers than their yield. Farmer profitability and income with SRI usually go up more than yield.
In seven evaluations, ***farmer costs of production were reduced on average by about 20% with SRI*** compared with standards methods. Here are some specifics on these evaluations.

- CHINA: 8% reduction in costs of production in Xinsheng village, Sichuan province, where SRI use went from 7 farmers in 2003 to 398 farmers in 2004. The net profit/ha with SRI was 22% higher in 2004.[4]
- INDIA: 17% reduction in costs of production for 110 farmers in Purulia district, West Bengal, where SRI use in upland production went from 4 farmers to 150 over 3 seasons. An IWMI evaluation team compared their costs of production for SRI vs. for standard upland rice production. Farmers' net returns/ha with SRI were 67% higher.[5]

- INDIA: 11% reduction in costs of production in Tamil Nadu state for 100 farmers doing on-farm comparison trials using SRI vs. standard methods, monitored and measured by staff of Tamil Nadu Agricultural University. With higher SRI yields, farmers' net returns/ha went up by 114% with SRI, from $242/ha to $519/ha.[6]
- CAMBODIA: 56% reduction in variable costs for 400 SRI farmers randomly sampled and surveyed in 20 villages randomly selected in five provinces, compared with 100 non-SRI farmers similarly selected, in an evaluation done for GTZ in that country. Even with few farmers using the full set of SRI practices as recommended, net returns/ha with SRI were calculated to have increased by 74%.[7]
- CAMBODIA: 51% reduction in costs of production for 120 farmers who had practiced SRI for three consecutive years, with a 76% increase in their net income/ha.[8]
- BANGLADESH: 7% reduction in costs of production for 487 farmers evaluated in four parallel studies that were funded by IRRI'Bangladesh's PETRRA project 2002-2004. These evaluations showed a 58% average increase in farmers' net return/ha with SRI.[9]
- SRI LANKA: An evaluation of SRI by the International Water Management Institute (IWMI) comparing 60 randomly selected SRI farmers (who were not all doing all the recommended practices) with 60 randomly selected 'non-SRI' farmers calculated that with SRI, net returns/ha averaged 103% more, with an average yield increase of 44%.[10]
- ***While we find a wide range in the reductions in cost of production with SRI, and under some conditions costs can increase, the associated increases in profitability have ranged from 22 to 114%, with an average increase of 73%. Few innovations have attained such gains across different countries and with large numbers of farmers.***

4. While the 'super-yields' reported to date with SRI are the exception rather than the rule, they are being confirmed elsewhere as SRI is being extended beyond Madagascar.

- This was seen, for example, in the yield of S. Lakshmana Reddy in India reported above (2.).
- In 2004, researchers for the China National Rice Research Institute, the Fujian College of Agriculture and Forestry, and Sichuan Agricultural University documented yields of 18 to 20.3 t/ha in Yunnan Province of China combining SRI methods with hybrid varieties.[11]
- In the IWMI evaluation of SRI use in Purulia district, West Bengal, India, the team leader personally measured the best SRI field and weighed the paddy harvested from it, calculating the yield to be 15 t/ha. This was rainfed, not irrigated rice production.[12]
- ***Such yields are not typical; however, they show the potential for higher rice production that exists, to be attained by plant, soil, water and nutrient practices are optimized to create an ideal soil environment for the growth of rice plants, capitalizing on the potential that exists in rice genomes. With SRI management, an average increase of 1-2 t/ha is easy to achieve. This is all that is needed to meet the food needs of most countries.***

5. SRI yields are highly variable -- both between countries and within countries. This is because four factors contribute to rice production, not just the first two usually cited.

- **Genetic potential,**
- **Resource inputs (quantitative),**
- **Management of inputs (qualitative), and**
- **The abundance and diversity of soil biota, and their response to SRI management.**

SRI focuses on the third in order to affect the fourth. This last can vary greatly in response to soil aeration and organic matter inputs as well as in response to root growth and exudation.

6. SRI will become more attractive as water scarcity becomes a more pervasive agricultural constraint. Droughts are becoming more frequent and serious. Weather fluctuations are becoming greater, e.g., El Niño effects and monsoon failures. SRI methods by inducing rice plants to grow much larger and deeper root systems give SRI plants more resistance to impact of drought. Better root systems also enable farmers to reduce their irrigation requirements.

- The **China** Agricultural University evaluation of SRI in a Sichuan village found that SRI reduced water requirements 45.8%, with increased yield (fn 4).
- The Tamil Nadu Agricultural University evaluation of SRI in Tamiraparani delta of **India** found that SRI reduced water requirements by 40-50% (fn 6).
- From the data in the IWMI evaluation of SRI in **Sri Lanka**, it can be calculated that the hours of irrigation were reduced by 21%. Given higher SRI yields, water productivity (kg of rice produced per irrigation hour) increased by 90% with SRI (fn 10).

7. SRI is more resistant to other biotic and abiotic stresses besides drought.

- The press in Andhra Pradesh, India, reported that when a typhoon hit the rice crop in that state in December 2003, it badly affected conventional rice crop, approaching harvest, but SRI rice was hardly affected, not lodging despite the heavy wind and rain. Resistance to lodging is often reported. In September 2002, a severe storm that hit Sichuan, China, knocked down much of conventional rice not yet harvested, but did not affect SRI plots.
- A cold spell in Andhra Pradesh in February 2004 had no effect on SRI plots, while it had an adverse impact on conventionally-grown rice (Dr. A. Satyanarayana, personal comm.).
- Farmers in many countries report that their SRI crops are more resistant to pests and diseases, perhaps because of the more robust root systems. The China National Rice Research Institute calculated that in its Zhejiang trials, SRI methods reduced the incidence of sheath blight, the main disease affecting rice in that province, by 70% (Dr. Zhu Defeng, personal comm.).
- Researchers at Tamil Nadu Agricultural University staff have documented significant decreases in rice pests both in nurseries and in the field: cutworm, thrips, green leaf hopper, brown plant hopper, whorl maggot, and gall midge, although more stem borers and leaf folders were observed in the field (fn 6).

8. SRI reduces farmers' risks, due to resistance to biotic and abiotic stresses (6 and 7) and due to reduced costs of production so there is less investment to be lost (3).

- The GTZ evaluation of SRI in Cambodia calculated the effect of farmers' switching to SRI methods on their risk of not attaining a target income from rice production. It found that farmers' risk was consistently and significantly reduced (fn 7).
- Similarly, data from the IWMI evaluation of SRI in Sri Lanka (like the GTZ evaluation, based on random samples) show that the incidence of net loss from rice production, with labor inputs valued at the prevailing agricultural wage, was about 35% on average with conventional production methods, and only 4% with SRI methods (fn 10).

9. Although SRI requires more labor/ha initially, while the methods are being learned, there is evidence now accumulating that SRI can eventually become labor-saving.

- The Chinese farmers in Xinsheng village interviewed by China Agricultural University staff about SRI ranked SRI's being labor-saving as its most attractive feature, ahead of both higher yield, greater profitability, and water-saving (fn 4).

- Farmers surveyed in the IWMI evaluation of SRI impact in Purulia district, India were found to be able to reduce their labor input/ha by 8.7% with SRI, while farmers' labor productivity (kg of rice produced per day of labor) went up by 43.5% (fn 5).
- The GTZ evaluation of SRI use in Cambodia found that SRI was essentially labor-neutral for the 400 farmers studied; SRI practices took 305 hours/ha compared to 302 hours/ha with conventional production. Because SRI reduced labor for transplanting by 10 days/ha at a time when the demand for labor was highest, farmers much preferred the SRI pattern of labor distribution; so they judged SRI 'easier' in terms of labor (fn7).
- ***Once farmers understand that with SRI methods, they can save labor as well as seed, water and costs of production, its acceptability and popularity will surely increase.***

10. Because it has practically no capital requirements, being a matter mostly of learning new methods, SRI is especially accessible to and appropriate for the poor. The simple hand weeder recommended is really low-cost; it can be shared, and it is not necessary for better yield.

- An evaluation of SRI adoption and disadoption in **Madagascar** suggested that SRI's labor requirements made it less accessible to the poor (Moser and Barrett, 2003).[13] However, this does not appear to be the general case as more experience is gained in other countries.
- The IWMI evaluation of SRI in **Sri Lanka** found that poorer households were as likely as richer ones to adopt SRI, and once they had tried SRI, they were less likely to disadopt (see fn 10).
- The CAU evaluation in Sichuan, **China**, found no significant difference in wealth status among the 398 SRI adopters compared to the whole village (N=612) (fn 4).
- The IWMI evaluation of SRI as practiced in very poor, marginal tribal communities in West Bengal, **India**, found they were able to reduce labor/ha by 9%. As labor is their main asset, they could put this to other productive purposes when not needing it to grow their staple food. Their increases in yield and income, reported above, gave them more relative benefit from SRI methods than would accrue to richer farmers. Moreover, using a lower seed rate and younger seedlings enabled them to adjust their planting dates to match the unreliable onset of the monsoon. This is not possible with conventional methods, so SRI gave them more assurance of being able to produce a crop to harvest.
- ***By getting much higher yields from small parcels of land, SRI can enhance food security. Drought-resistance is of special relevance to poor farmers, who usually are more vulnerable to this catastrophe. SRI should be able to help many rural households who live in perpetual debt because of their food deficits to get out from under this debt burden.***

These are the major findings that have emerged from various evaluations done of SRI impacts, some with large enough samples so that results have strong statistical reliability. That similar results are frequently coming from a number of countries adds to their validity. More studies and evaluations should be done to monitor and assess the impacts of SRI. ***Surely some negative or disappointing features will emerge at least in some places***. But so far, the picture that emerges from evaluations is usually quite positive. Here are some other positive considerations.

A. Rainfed Rice Possibilities: As seen from from the IWMI evaluation of SRI in Purulia, India, SRI methods can be adapted productively to rainfed conditions. The use of mulch is the main innovation to be introduced, instead of transplanting young seedlings. Wider spacing of single plants, with enhanced soil organic matter and increased soil aeration, are SRI-like practices.

- In the **Philippines**, the NGO Broader Initiatives for Negros Development (BIND) did trials with five spacings (15x40 cm to 35x40 cm) and four replications on an area of 4,000 m^2 in 2002.The trials gave an average yield of 7.2 t/ha, and as high as 7.7 t/ha, relying only on rainfall. *Gliricidia* mulch was used. This conserved soil moisture, suppressed weeds, and lowered soil temperature. With the latter change, earthworms became more abundant, aerating the soil in place of the use of the rotating hoe.
- In **Madagascar**, a similar version of upland SRI was tried in 1999. A yield of 4 t/ha was obtained, 2.5-5 times more than normally produced with upland rice in the area.

More evaluation of rainfed versions of SRI should be done. ***Many of the world's poorest households have no access to irrigated land and rely on upland rice production***, often employing slash-and-burn methods that are environmentally destructive. So this adaptation of lowland SRI could have great benefits both for the poor and for the environment.

B. Higher Milling Outturn: In addition to getting higher paddy production (all the figures above are for paddy, not milled rice), SRI paddy has been giving a higher rate of milled rice.

- Already in 2002, millers in parts of **Sri Lanka** were offering SRI farmers a premium of 10% for their SRI paddy, even before it was harvested, while standing in the field. (W. M. Abey-gunawardena, personal comm.). Since millers are not known for their altruism, they must have been getting >10% outturn or they could not afford to pay higher prices.
- In Andhra Pradesh, **India**, the rice millers' associations has been supporting SRI spread since 2003-2004. They found that SRI paddy gives less chaff (fewer unfilled grains) and there was less shattering (fewer broken grains). AP millers have produced calendars, magazines and other materials to promote SRI.
- In **Cuba**, the cooperative CPA Camilo Cienfuegos, the first to use SRI in that country, reported in 2004 that its milling rate had gone from 60% with conventional paddy to 68-71% with SRI paddy -- an increase of 13-17%.
- Prof. Ma Jun of Sichuan Agricultural University in China did detailed evaluations of this question. In a paper presented to a national rice meeting in August, 2004, he reported that milled rice outturn with SRI rice (grown with three different spacings) ranged from 53.58-54.41% while the rate for conventionally grown rice was 41.54-51.46%, a difference of 16.1% on average.

SRI thus offers ***a 'bonus' of 10-15% or more in terms of final food production.*** This is over and above the increase in on-farm paddy yields that are being obtained from SRI methods.

C. Quicker Maturation: Reports are showing that the currently expected periods for maturation of various varieties, calculated when they have been grown with conventional practices, can be ***reduced by 7-15 days with SRI methods*** as a result of the more favorable growing conditions.

- The most clear-cut data are from **Nepal**, where in 2004, 22 farmers who got average yields of 3.37 t/ha with their conventional methods, produced 7.85 t/ha from the same varieties using SRI practices. Records of planting and harvesting dates showed that the SRI crops matured in 15.1 days less time than the conventionally-grown ones (Rajendra Uprety, District Agricultural Development Officer, Morang District, personal comm.).
- In Andhra Pradesh, **India**, data from the rabi season 2003-2004 showed that SRI rice matured 7-10 days sooner (Dr. A. Satyanarayana, Director of Extension, ANGRAU).
- In **Cambodia**, SRI farmers report that their SRI crops are maturing about 7 days sooner (Dr. Koma Yaing Sang, Executive Director, CEDAC, personal comm.).

This phenomenon should be studied more closely, to understand how SRI rice plants not only produce more photosynthate and ultimately more grain, but do this ***in a shorter period of time***. This offers farmers the opportunity to harvest earlier, so they can plant other crops or can plant them sooner. Harvesting earlier reduces the frequency of losses due to bad weather, pests or disease which often come at the end of the normal growing season.

D. SRI Works with Hybrid Varieties and HYVs: Some might regard the System of Rice Intensification as competing with the introduction and use of hybrid varieties or high-yielding varieties (HYVs). However, hybrids and HYVs are very compatible with SRI. All of the highest yields with SRI methods have come with improved rice germplasm.

- This was seen from the report above on super-yields in Yunnan province, **China**, in 2004. SRI methods can add 1-3 t/ha to the yields that are obtained from hybrids and HYVs compared to using standard cultural practices.
- Because ***SRI reduces seed requirements by 80-90%***, it can reduce the higher costs of production when adopting hybrids or HYVs which have more expensive seed. SRI not only gives higher yield from these seeds but very few seeds are needed to plant the crop.
- The China National Hybrid Rice Research and Development Center, under its director Prof. Yuan Longping, widely known as 'the father of hybrid rice,' now uses mostly SRI methods and recommends there when introducing its hybrid varieties in Africa. Part of the yield premium associated with hybrid varieties is attributable to SRI methods.

SRI gives farmers more options. They can aim for higher yields without investing in new seeds. But if they want certain advantages from using hybrids or HYVs, these modern varieties can be planted more cheaply and with better results when farmers adopt SRI methods.

E. SRI Works Well with Traditional Varieties: Since SRI does not rely on large applications of nitrogen fertilizer, various traditional varieties(otherwise susceptible to lodging when heavily fertlized) have no problem when they are planted with SRI methods. That do not lodge, and their panicles are held upright by strong tillers and big root systems.

- In **Sri Lanka**, yields of 6-12 t/ha have been obtained with a number of traditional varieties. Because these have more desirable eating qualities, they command a higher price in the market, which makes them more profitable than conventional HYVs given that the lateter also has ongoing higher operational costs.
- CIIFAD has started working with partners in **Cambodia, Madagascar** and **Sri Lanka**, through the SEED Initiative of UNEP, UNDP and IUCN, on the trademarking and marketing of organically-grown indigenous rice varieties using SRI techniques. It should be possible to sell these nationally and eventually to export them, giving farmers better remuneration.

The resurrection of traditional varieties can help ***preserve rice biodiversity***, by making growing traditional varieties that are more profitable than modern ones, and are often more nutritious and more palatable. So, SRI can meet health and aesthetic values for consumers as well as provide more income for farmers.

F. SRI Ideas Are Working with Other Crops: One of the most exciting developments of the past year is to see SRI concepts and practices being applied or extended by farmers to other crops.

- An India SRI farmer, Sudarkhar Reddy, has extrapolated SRI thinking to his **sugar cane** crop. He has reduced his seed (sett) rate from 10 t/ha to 1.5 t/ha, growing initially small setts

in plastic bags with compost to obtain good root growth and tillering before transplanting. His first use of these adapted methods gave a yield of 100 t/acre compared with his more usual 30 t/acre. ANGRAU faculty are following this experiment carefully, and other farmers are also applying SRI concepts to sugar cane, also a gramineae species like rice.

- The Green Foundation in Bangalore, an NGO working with tribal and other marginalized women in Karnataka state of India, is promoting the Guli Vidhana system for producing **finger millet** (*ragi)*. This system is similar to SRI, with 45x45 cm spacing of single plants, and a low seeding rate of 1.25 kg/ha only, plus active soil aeration as well as addition of organic matter. Yields of 18-20 quintals/acre are being obtained, compared with 4-5 quintals/acre using usual methods. ANGRAU researchers have documented the advantages of transplanting very young ragi seedlings (10 or 15 days) compared to older ones. Another NGO is working to apply these methods to **pearl millet** (*bajra*).
- A farmer in Tamil Nadu, Gopal Swaminathan, who has made some important innovations to SRI in the Cauvery Delta, such as the Kadiramangalam system of double-transplanting that strengthens young seedlings against intense heat and breeze, has recently reported getting good results with SRI ideas applied to **cotton**, though we have no data on results.
- In Cambodia, some villagers whom I visited insisted that they have been able to improve their **chicken** flocks by concentrating on their management efforts on smaller numbers, reducing mortality, and getting more productivity from their poultry this way.

SRI is alerting farmers to: (a) the importance of better management, not thinking just of varieties and quantities of inputs, and (b) the possibilities that reducing plant (and even animal) populations can give greater total production, more economically. If SRI can improve the production of crops like ragi and bajra, as well as upland rice, this will be of great benefit to many poor households.

G. <u>Environmental Quality and Human Health</u>: SRI is having some desirable externalities that go beyond the agricultural sector. It may also have more benefits yet to be determined.

- By reducing the demands that rice farmers make on surface irrigation and groundwater supplies, SRI should ***take pressure off scarce freshwater and aquifer supplies. Aquatic ecosystems*** in particular should benefit from reductions in the need for and use of agrochemicals. This is recognized by WWF's Living Waters Program, which is currently funding a systematic evaluation of SRI in Andhra Pradesh, India.
- By increasing output from irrigated rice production in Madagascar and other countries, pressures for the expansion of shifting upland cultivation at the expense of ***remaining forest ecosystems*** are being reduced. Progress in extending <u>upland SRI</u> production could reduce the need/incentive for shifting cultivation once labor can be more productively employed in this new system compared to continuing to practice slash-and-burn.
- Reduced use of agrochemicals should enhance the ***health of cultivators*** and will also by diminishing chemical residues on rice and other food, SRI should contribute to ***better health for consumers*** as well. Further, if applications of nitrogen fertilizer can be reduced, this should ***enhance groundwater quality*** by diminishing nitrate concentrations.
- No real evaluations have been done yet on the ***nutritional quality of SRI rice***, but we know that it has greater grain weight without having larger grains, so that these grains are more dense. They may well be richer in micronutrients and vitamins as a result of having larger, better functioning root systems that access larger volumes of soil. It is evident that SRI plants

are healthier and more vigorous. It seems quite possible that SRI rice will be more nutritious than rice grown with standard methods, but this remains to be assessed.

- SRI has been promoted in Madagascar as part of projects for integrated environmental conservation and economic development. Association Tefy Saina, the NGO in that country most responsible for developing and spreading SRI, was given in 1993 the Environmental Conservation Award bestowed annually by Europe's Slow Food Movement.

The links of SRI with environmental protection and improvement and human health are just beginning to be explored and forged and could be an added benefit.

H. <u>SRI Is Not Finished</u>: Any current assessments of SRI should take into account that the system is evolving and changing as more and more farmers become involved with it and as more researchers take an interest. There is considerable farmer innovation already in redesigning and improving weeders and planting aids to save labor and reduce cost further. Thus, we expect that SRI will become even more beneficial in the future as such innovations improve SRI in economic terms. Also, productivity should increase as farmer skills improve and as the quality of soils used with SRI is enhanced by biological abundance and activity (through the addition of organic matter and root exudation).

- It is possible that some ***negative features***, currently not noticed or maybe yet to emerge, will surface. We need to be alert for possible problems and pitfalls, especially since so far, the negatives with SRI have been so few. Even the earlier disadvantage of labor-intensity is now receding as a problem as farmers find ways to make SRI labor-saving.
- It is possible that with high crop offtakes, ***soil nutrient supplies*** will become reduced and constraining. SRI experience to date has indicated that so long as decomposed biomass is added to the soil, yields go up rather than down even with very high yields. How long this can continue is unknown, but it is known that there are large stores of 'unavailable' nutrients (e.g., P) that can become 'available' through biological processes. There is no limit on the amount of N that can be acquired and fixed by soil organisms. SRI may lead to some rewriting of soil science textbooks, at least to emphasize soil biological processes more than usually done now. But many detailed and rigorous studies should be done within the domain of SRI, and the sooner the better.
- It is also possible that by changing the ***hydrological dynamics of paddy soils***, there could be some pest or disease problems under aerobic conditions. It appears, for example, that ***root-feeding nematodes*** are constraining SRI performance in Thailand, and possibly Laos. Water management recommendations will need to be modified to be able to deal with such problems if they appear.
- There can be ***a 'dark side' to soil biology***, and this should be monitored and evaluated along with soil chemical analyses. Attention should be given to increasing biomass supplies from non-arable areas to enrich cultivated soils. This may require the design and dissemination of labor-saving tools and implements to be able to acquire, process and apply biomass more efficiently.

I. <u>Human Development</u>: One of the most interesting but most difficult-to-quantify aspects of SRI is its social and psychological dimensions. Farmers who have grown rice for many years with conventional methods can become quite excited and inspired when they see how many benefits can come from changing management practices. The name of Association Tefy Saina which promotes SRI in Madagascar means, in Malagasy, 'to improve the mind/mentality.'

- SRI was intended by its creator, Fr. Henri de Laulanié, to be disseminated in a very participatory manner. Farmers are encouraged to experiment with and adapt SRI methods, rather than just to adopt them. This philosophy is very practical and has many benefits beyond improving rice production as farmers become more comfortable with and skillful at ***planning, evaluating and innovating***. The 'labor-intensive' training on which SRI dissemination has been based is possibly slower and more costly, but it has long-term effects of ***'capacitating' the rural community.***
- One of the remarkable features of SRI is how many farmers it has inspired to spend their own time and resources in spreading knowledge of the new system to other farmers. The ***altruism*** that it has elicited in country after country is unusual. We have no data on this, only anecdotal evidence, but this is abundant. One can hope that this will be something lasting and have continuing positive influence on social relations within rural communities.
- CEDAC in **Cambodia** has found that its community development efforts and its program to get farmers to diversify their farming systems (from monocropped rice) for greater food security as well as economic returns have more favorable reception in communities and from individuals who have gotten involved with SRI. CEDAC uses SRI as an 'entry point' for initiating a range of local improvements.[14]
- As SRI gains momentum and as governments and donor agencies begin backing its spread, it is hoped that the human and social aspects of SRI will not be lost in 'top-down' efforts to get the new system widely adopted. There are many non-agronomic benefits to be obtained from SRI that go beyond rice production. Once there is an appreciation of the broad potentials of SRI to uplift rural communities (with the urban poor benefiting by having lower prices for their staple food), SRI dissemination should become part of a ***strategy for integrated rural development and poverty alleviation*** that does more than narrowly address food security and agricultural productivity.
- ***SRI raises the productivity of land, labor, capital and water concurrently, at the same time.*** Once farmers understand and appreciate this, many can reduce the area that they devote to rice production and can redeploy the resources freed up from rice cultivation to increase their output of fruits, vegetables, pulses, fish and other products that are more remunerative. This will contribute to ***human health through diversified diets***. SRI should not simply increase rice output but should speed agricultural diversification and modernization.

J. SRI Has Unprecedented Capacity to Spread Farmer-to-Farmer: Few innovations have sparked as much enthusiasm among farmers as has SRI. In most countries, farmers are helping to disseminate knowledge about SRI.

- The most experience with this to date has been in Cambodia, where the number of SRI users has grown from 28 farmers in 2000 to at least 16,884 in 2004, and probably many more have untaken SRI through informal dissemination mechanisms. An evaluation in Cambodia of 120 farmers who have used SRI methods for at least 3 years found that, all together, they had informed 969 households within their respective villages, and 967 households outside. This is a potential multiplication ratio 16:1 (fn 8).
- The NGO leading this effort in Cambodia, CEDAC, reports that from using SRI methods, farmers gain increases self-confidence having seen what improvements they can achieve just by using their own skills and locally-available resources. This is making them more willing to work on other agricultural innovations (Koma Yang Saing, pers. comm.)

[1]Data provided by Dr. Zhang Jiaguo, Director, Crop and Soil Management Institute, Sichuan Academy of Agricultural Sciences, Chengdu, China, September, 2004 (zhjguo@mail.sc.cninfo.net)
[2]Data provided by Dr. Alapati Satyanarayana, Director of Extension, Acharya N. G. Ranga Agricultural University, Hyderabad, India, February, 2005 (alipatisatyam@yahoo.com).
[3]Same as note 2.
[4] "A Socio-Economic Assessment of the System of Rice Intensification (SRI): A Case Study of Xinsheng Village, Jianyang County, Sichuan Province," by Li Xiaoyun et al., College of Humanities and Development, China Agricultural University, Beijing, February, 2005.
[5] "Impact of the System of Rice Intensification (SRI) on Rice Yields: Results of a New Sample Study in Purulia District, India," by Shekhar Kumar Singh and Jayesh Talati, International Water Management Program-India, for 4th Annual IWMI-Tata Meeting, Anand, Gujarat, India, February 2005.
[6] "Tamiraparani Command Area, Tamil Nadu, India," power point presentation to World Rice Research Conference, Tsukuba, Japan, by Dr. T. M. Thiyagarajan, Dean, Tamil Nadu Agricultural University Agricultural College and Research Institute, Killikulam, November 2004.
[7]"Evaluation of the System of Rice Production (SRI) in Cambodia, February-April 2004," report of a study by Dr. Jürgen Anthofer and team for Cambodia mission of GTZ, Phnom Penh, June 2004.
[8]"Ecological System of Rice Intensification (SRI) Impact Assessment (2001-2003)," report by Chey Tech, Center for Study and Development of Cambodian Agriculture, CEDAC field document, Phnom Penh, May 2004.
[9]"Final Evaluation Report on Verification and Refinement of the System of Rice Intensification (SRI) Project in Selected Areas of Bangladesh (SP 36 02)," presented to IRRI/BD by A. M. Muazzam Husain, et al., June 2004.
[10]*The Prospects for Adopting the System of Rice Intensification in Sri Lanka: A Socioeconomic Assessment*, by R. E. Namara et al., Research Report 75, International Water Management Institute, Colombo, 2004.
[11]Personal communication from Dr. Zhu Defeng, China National Rice Research Institute, Hangzhou, August, 2004 (zhudf@mail.hz.zj.cn); also information from Dr. Yang Ren Cui, Dean, Fujian College of Agriculture and Forestry, and Prof. Tian Yan Hua, Sichuan Agricultural University, Chengdu.
[12]Personal communication, Shekhar Kumar Singh, February, 2005.
[13] C.M. Moser and C. B. Barrett, "The disappointing adoption dynamics of a yield-increasing, low external input technology: The case of SRI in Madagascar," *Agricultural Systems*, 2003.
[14]Personal communication, Dr. Koma Yang Saing, March, 2005 (yskoma@online.com.kh)