System of Rice Intensification

Success Stories of Farmers

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Out of 3240³ million km globally available fresh water, 69% is used in agriculture, 8% in domestic purpose and 23% for industry and other sectors. In India, 88 percent water is used in agriculture which covers 80 mha under irrigation. About 70% of irrigation water is used in rice alone. Rice contributed more than 42% of total foodgrain produced in the country during 2008-09. The lion's share of the rice production comes from 24 million ha irrigated rice areas. As the demand for industry and the domestic use would increase considerably in the years to come, the availability of water for irrigation is expected to reduce. This calls for the adoption of alterative methods of rice culture which demands less water. System of Rice Intensification (SRI) and aerobic system of rice need only about 50% of water needed by the traditional method of rice culture. This paper narrates the different facets of SRI and also the experiences of some farmers with these alternatives methods of rice culture.

Rice, the king crop of Asia and the second most important crop of the world, has the unique capacity to grow in standing water. Therefore, this crop is abundantly grown in the low lying areas of the globe. In irrigated rice, a tradition of keeping standing water in rice field is an age old practice. This might be mainly because i) the availability of water was abundant, ii) it was easy to control weeds iii) water logging improves the availability of certain important plant nutrients. But in years to come, water availability would be a serious problem because of the higher demand of water for agriculture, industry, and drinking purposes. Climate change is expected to affect water availability. In such a situation, an innovative technique of rice culture which would reduce the need of water for rice cultivation without reducing the productivity is the need of the hour.

To overcome the challenges, agriculture research worldwide has been looking forward for alternative approach. The System of Rice Intensification (SRI) is one such emerging alternatives. SRI package of agronomic approaches which exploit the genetic potential of rice plants, create a better growing environment, enhance soil health and reduce needs of the inputs (seeds, water and labour). It uses all the usual agronomic practices for transplanted rice such as raising a nursery, transplanting, irrigating, weed control measures etc. However, the difference lies in the implementation of the practices (1).

SRI is a rice cultivation technique developed in Madagascar. It is popularly known as SRI. It was developed by Mr John Henri Loulane in 1980s.

Special Features of SRI

The special features of SRI are mentioned below :

1) In SRI, a single seedling is transplanted per hill at a wider spacing and the hills are also spaced more widely than usual, thus reducing the density of seedlings needed for planting (from about 200per sq.m to 16/sq.m) Thus only 5-7.5 kg seeds/ha are required, instead of about 50 kg/ha in the traditional method of rice cultivation. This is more important in case of hybrid rice where seed cost is very high. And the farmers have to purchase seed every year

2) The nursery preparation costs are also considerably reduced because the area needed is reduced from 800 m^2 to 100 m^2 and the nursery is needed for 7- 14 days only.

3) SRI system uses the much younger seedlings (8-14 days old) compared to 3 to 4 weeks old seedlings in the traditional system Transplantation of young seedlings at shallow depth of water results in quick recovery and establishment and production of more effective tillers (1)

4) Square plantin

Planting is generally done in square which makes it convenient to use the weeder of a particular width

5) Less water nee

Water requirement in the SRI method is considerably low, since the crop is not kept flooded during the entire crop cycle. Water is much reduced during the vegetative growth phase, and only a minimum of water is kept on the field during the reproductive phase, reducing water requirement by about 50% compared to the traditional method of rice cultivation. This results in substantial reduction in irrigation cost.

Weed Control

Special aspect of the SRI method is to use a hand operated weeder to disturb and churn the soil between the rows. This operation simultaneously incorporates weeds replenishing nutrients in form of green manure and also aerates the soil. Since weeder operation starts after 10-12 days and are performed every 10 days weed growth is much controlled resulting in over 50 % reduction in the cost of weed control compared to traditional rice culture(1).

Nutrient Management

Integrated nutrient management system is recommended.. However, the use of organic manure is emphasized as they are found to give better response.

Advantages of SRI

Increased Tillering

On an average 30-50 tillers per plant, 80-100 is also possible, and sometimes even more than100 tillers are obtained from a single plant

Greater Root Growth

Around 5-6 times more force is needed to uproot an SRI plant than to pull up one traditionally grown plant

Increased Grain Growth

Panicle are larger having greater number of filled grain per panicle.

Higher Grain Quality and Greater Grain Weight

In SRI method, the grain is heavier, denser, still smaller. Plant can withstand shattering and keep their shape better after cooking.

Less Lodging

Because of stronger tillers and larger root systems, SRI plots can withstand adverse weather conditions such as strong winds, cyclones and heavy rains.

Less Pest and Disease Infestation

The incidences of pest and diseases are low in the SRI method as the plants are widely spaced and use of IPNS results in healthier plant in SRI

Seed Saving

Since less plant are grown, seed rates are only 7-10 kg/ha This results greater benefits particularly for hybrid rice where seeds cost is very high. SRI method gives better yield in both traditional and HYV of rice. Therefore, farmers may not purchase seed every year.

Lower Production Cost

Since the seed cost, irrigation cost etc are reduced, the total cost of rice cultivation is reduced to a great extent.

Reduced Risk

The more intensive and extensive root growth, in addition to better withstanding of weather aberration, less pest and disease infestation results in lower risk in SRI. (1)

Higher Factor Productivity

The returns per ha, per unit of water, per unit of labour and capital etc is increased considerably. Theses enable the plants to get better supplies of carbon, nitrogen and oxygen And the result is higher productivity **(Table 1)**.

Limitations

There are certainly some limitation on the adoption of SRI. This is universally true for all new technology. So is the case of SRI.

SRI needs greater and newer skilled. It needs certain time for the farmers to shift from the traditional method to the new method which is little tedious and delicate. Nursery preparation and handling of smaller and young seedling demands more care and concentration.

Necessity is the mother of invention. Therefore as the time will demand because of scarcity of water and other inputs, the farmers will rise to the occasion and they will excell in this system too.

Labour requirement in initial years may be little more, but with gaining the needed experiences, this also would get reduced. This is more suited in more water scarcity areas. Canal irrigation system may not go well with this system.

Table 1 – Relative performances of rice yields in SRI and traditional method

Parameters	SRI	Traditional method
Grain yield (minimum) Tonnes/ha	4.2	3.9
Grainyield (maximum) Tonnes/ha	12.1	8.7
Mean grain yield (t/ha)	7.3	5.6

Source : (1,4)

Future Prospects

SRI is currently being practised in over 40 countries of the world. Bangladesh, China, Indonesia, Cambodia, Cuba, Nepal, Sri Lanka, Vietnam, West Africa, Myanmar, India are some of the major rice growing countries where SRI is being practised.. The farmers of AP, Tamil Nadu, West Bengal and Tripura are are ahead of other states in this respect In India about one million ha areas is under SRI. The relative performances of SRI are mentioned in **Table 1**.

Impact

SRI, a resources saving and labour intensive method is well suited for small and marginal farmers who constitute more than 80 % of Indian farmers. In addition, in India, where more than 88 percent available water is used in agriculture, ground water account for 75 %, of water used, the demand for water will exceed all supplies by 2020. India should therefore, improve its agricultural practices which is also essential to meet the food security. The data presented in **Table 2** indicate the

Table 2 – Impact of system of rice intensification (SRI) in India

	Level		Total estimate		Impact of SRI over TL system
	Traditional(TL) system	SRI	Traditional(TL)	SRI system	
Seed	50	7.5	0.85mt	0.15mt	0.70mt
Irrigation (24 mha)	149m^3	97m^3	3576m^3	2328m^3	1248m^3 saved
Rice yield (unhusked)	3.17t/ha	4.17t/ha	76.08mt	100mt	22mt extra

Source (1,4)

rice cultivation

Advantages observed

1) Higher yield is obtained with less water

2) Seed requirement is less, so is the cost of production

3) Less land is needed for nursery preparation

4) It is environment friendly too.

Limitation

The following limitations were observed

1)It is better suited to well drained condition, where water scarcity exists

2) Where the energy cost is higher for lifting tube well water

3) In areas where it was promoted by the organised sector namely Tripura, Tamil Nadu and Warangal and Mehaboobnagar districts of AP, the results were encouraging.

In Warangal district of AP, the Center for Rural Operation Programme Society tried to promote SRI during both *Kharif* and *Rabi* seasons in 2007-2008

Some important features of the project are

1) Total 1063 farmers adopted SRI in 754 ha of land areas

2) Irrigation was provided through open well or bore well.

3) Yields obtained were 9 tonnes to 12.2/ ha compared to 6.5tonnes to 7.5 tonnes/ ha by traditional method.

4) Cost of production was only 60-70 percent of the cost incurred in traditional method of rice cultivation

5) Profits were higher by 60-100 percent in SRI

6) The interesting points to be observed are that the farmers have overcome the initial difficulties of SRI

Shripunnu Swami of Sarareddy district of AP, developed some innovative modifications of the system which are mentioned

!) Preparation of nursery on poly bed spread over organic manure

2) For separation of seedling the roots are dipped in water

3) Laterals of drips are fixed at 2.5 ft apart in the land to be used for transplantation

5) Seedlings of 10-12 days duration are transplanted at a spacing of 15 inches distance from row to row and 9 inches from plant to plant

6) Paddling was not done, only the land was made wet through running drip. This saved a lot of water.

7) Thus he was able to cultivate 20 ha of land with 5 bore wells and one open well.

8) The yield obtained was 12.35t/ha This was the results of his innovation in *Kharif*. He planned to increase the area in *Rabi* season.

Experiences of the Karnataka Farmers

Aerobic Rice Culture

The University of Agriculture sciences , Bangalore had developed a very interesting alterative method of rice cultivation in the farmers fields of Tumkur, Raichur and Bangalore Rural districts of Karnataka

The data presented in **Table 3** show that the yield obtained by the farmers were higher than the yield obtained in the traditional method of rice cultivation. It is imperative to make a mention here that the water requirement in the alternative method was about 60 percent less than the traditional method.

Among the farmers,Sri Lingaraj of Raichur district is a B Sc(Ag) who used the bullock driven ferti-seedrill.

It is beyond doubt that in water scarcity areas this system of rice cultivation has great scope.

Similar system has been adopted by Sri Ranga Rao of Medak district of AP in 16 ha areas. Interesting, he did not use the AP University recommended variety, but used commercial Hybrid. Planting was done at row to row spacing of 10 inches and 6 inches spacing of seed to seed. The yield obtained was 11.25t/ha. Highlights of the system were that I) no puddling was done, direct seeding was practised, seed requirement was less and water requirement was only 50 % compared to the traditional method. Encouraged by the success, he plans to increase the area under this system of rice culture. He also plans to use ferti-seed drill and bullock driven weeder(4).

This method has also been successfully used by the farmers of canal irrigated area of Krishna district of AP. The name of the innovative farmer is Sri Prasad. Unfortunately his land is situated at the tail end of the canal. Water may or may not reach at the tail end . Frustrated Sri Prasad started aerobic rice culture . The variety used was long duration BPT 5204.

The Special features of his rice culture is mentioned below :

1) He used tractor driven seed drill to cultivate 28 ha area during last three *Kharif* seasons

2) The spacing used was 9 inches between row to row and 2 inches between seed to seed

3) For weed control he used post emergence weedicide

4) Yield obtained was 5-6 q/ha more than

Table 3 – Experiences of Karnataka Farmers in Aerobic Rice culture

Serial number	Narration	Sri Anand Vill Uttanali Bangalore Rural	Sri Lingaraj, Vill Gajalagatta Raichurr	Sri Lakkappa Kunigal, Tumkur	Sri PappanaVill: Chintamoni, Chickballapur
1	Variety	MAS-946-1	MAS-946-1	MAS-26	Thella Hamsa
2	Farm size	0.5 acre	1.0 acre	0.5acre	0.5acre
3	Soil type	Sandy loam	Medium Black	Lateritic	Sandy loam
4	Seeding	Mid, August	Mid August	Last week, July	03/08/2009
5	Transplanting	1seedling/hill	Bullock drawn Seedrill	2-3slig/hill	1sdling/hill
6	Thinning	No	No	1sdling/hill	No
7	Weed Control	HW-twice	HW-twice	HW-twice	Hw-once & Weeder used twice
8	Irrigation	22, once in a week	10(good rain)	26, once in 5days	20, once in a week
9	Irrigation method	Check basin(CB)	sprinkler	CB	CB
11	Traditional method yield(t/ha)	6.2	5.2	5.9	5.2
12	Yield obtained(t/ha) in alternative method		6.3	5.8	6.3 5.2

Source (4)

the traditional method with only 50 percent water used in traditional method.

CONCLUSION

The results being obtained in the farmers' fields in the different parts of the world by the SRI system and also by the aerobic system of rice culture are very encouraging. It is now clear from the results that standing water is not essential for rice cultivation. Rice has the capacity to withstand water stagnation. By traditional method of rice culture, 2500-5000 liters of water are needed to produce 1 kg rice grain. By adopting SRI and aerobic system, water need can be reduced to a great extent. Alternative method as mentioned here can be of immense importance to save water. In addition to water saving which could be gainfully used to cultivate double the present area, soil health and environmental quality could also be maintained successfully.

FUTURE LINES OF WORK

1) SRI has shown great potential in higher rice production with less water in some states like AP, Karnataka, Tamil Nadu, Tripura and West Bengal. Its potential needs to be tested in other states where similar situation exists

2) In Karnataka and AP, aerobic rice culture has also shown great potential. This has also to be tested in larger areas of the country.

3) Both Central and State Governments need to encourage these alternative systems of rice cultivation in the suitable areas.

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