The System of Rice Intensification (SRI) in Islamic Republic of Iran in 2008

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I. Operation of the System of Rice Intensification (SRI) in Iran

The Agronomy Group of HARAZ Development Technology and Extension Center, encouraged by the Deputy Minister for Extension in the Ministry of Agriculture started SRI practice in 2004 with guidance from the SRI internet home page (http://ciifad.cornell.edu/sri/), and it has continued since 2005 with e-mail contact with Prof. Norman Uphoff at Cornell University. The main reasons for interest in SRI practice in Iran are as follow:

1- The prevalence of small-scale farms with average rice field ownership about 0.7 ha.
2- Currently high costs of production and resulting low income from rice cultivation based on the labor of family members.
3- Water shortages are common during the rice cropping season.
4- Local varieties that have high consumer demand give low yield with present practices and are susceptible to blast disease and lodging.
5- Heavy application of agrochemical inputs is contributing to the contamination of water and soil resources.

From what has been experienced with SRI in other countries, its methods of rice cultivation should help deal with all of these problems.

The first SRI practice was done on two demonstration fields with 2 ha total paddy area (5000 m^2 in our center and 1.5 ha under farmer management) using a local variety. In that year we tested just a few principles of SRI practice, i.e., young seedlings, one seedling per hill, and intermittent irrigation in the farmer's field, and one seedling per hill and intermittent irrigation in our Center's paddy field (Table 1). In the next year, after introducing this method to farmers by demonstrations and FFS activities in our Center, we could provide five demonstration fields under farmers' management (3.3 ha) and a SRI paddy field of 6000 m^2 in our Center. For the latter, an experimental design was used with organic fertilizer treatments compared with chemical fertilization (Table 2), including different plant spacings at the farmer's field (Table 3).

This year's report (2008) covers three main items: (1) results of demonstration activities on SRI; (2) pictures of the first mechanized rotary weeder made by my colleague in our Center, and (3) economic analysis of SRI practice at farmer's field level.

II. Materials and methods:

Experimental treatments in different years at our Center and on farmers' fields as shown in Tables 1-3 as follow:

Table 1- Treatments of first SRI trials at our Center

Treatments	***Conventional methods in our center***	***SRI methods***
Raising of seedlings	Box seedlings	Box seedlings
Seed rate	40 kg/ha	6 kg/ha
Seedling age	3 to 3.5 leaf age	3 to 3.5 leaf age
Number of seedlings/hill	3 to 7 seedling/hill	1 seedling/hill
Transplanting method	Mechanical transplanting	By hand
Plant spacing	30x15 cm	25x25 cm
Irrigation method	Continuous submergence	Intermittent irrigation
Fertilization	Only NPK(46-46-50) kg/ha	Only NPK(46-46-50) kg/ha

Table 2- Treatments of second SRI trials at our Center

Treatments	***SRI methods without organic manure***	***SRI methods with organic manure***
Raising of seedlings	Box seedlings	Box seedlings
Seed rate	6 kg/ha	6 kg/ha
Seedling age	3 to 3.5 leaf age	3 to 3.5 leaf age
Number of seedlings/hill	1 seedling/hill	1 seedling/hill
Transplanting method	By hand	By hand
Plant spacing	25x25 cm	25x25 cm
Irrigation method	Intermittent irrigation	Intermittent irrigation
Fertilization	Only NPK(46-46-50) kg/ha	NPK+ Chicken manure; Chicken manure

Table 3- Treatments of SRI trials and demonstrations on farmers' fields under farmers' conditions, 2004-2008

Treatments	***Traditional methods***	***SRI methods***
Raising of seedlings	Traditional wet nursery bed	Box seedling
Seed rate	60 kg/ha	6-8 kg/ha
Seedling age	5 to 7 leaf age	3 to 3.5 leaf age
Number of seedlings/hill	5 to 8 seedlings/hill	1 seedling/hill
Transplanting method	Random transplanting by hand	Square transplanting by hand*
Transplanting depth	5 to 10 cm	3 cm
Plant spacing	Random plant spacing	25x30 cm
Irrigation method	Continuous submergence	Intermittent irrigation
Fertilization	Only NPK(46-46-50) kg/ha	NPK+ Chicken manure; Chicken manure*

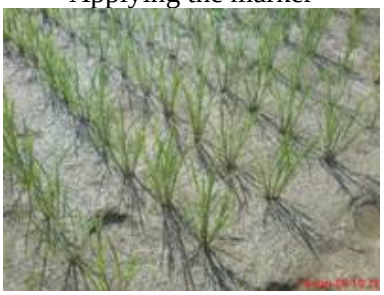
- Note: In first-year trial at farmer's field in 2004, we did not use chicken manure and square transplanting.

Land preparation

Applying the marker

Raising box seedlings

Transplanting single young seedlings



Early and middle tillering stage

Intermittent irrigation (less water) and drainage for soil aeration

Maturity time

III. Results

The results given in Table 4 show that SRI practices could increase rice yield about 60% due to higher tiller number and panicle number, increasing numbers of grains per panicle, percentage of ripened grains, root and plant health, resistance to lodging, and tolerance to pest damage.

The main reasons for high productivity appear to be transplanting of healthy young seedlings, singly and with optimum spacing, increased soil microbial activity supported by organic material, better root growth and soil aeration.

Based on our results, mixing of chicken manure with chemical NPK fertilizer, and 25x25 or 25x30 cm spacing can give highest yields in comparison with other treatments and also farmer's practice.

Table 4- The comparison of yield and yield components of Tarom variety under SRI and conventional cultivation systems

	1st Trial		2nd Trial		3rd Trial	
	Conven-tional	SRI	SRI + chemical fertilizer	SRI + chemical fertilizer + chicken manure	Conven-tional	SRI
No. of hills/m^2	19	16	16	16	16	13
Tillers/hill	21	27	28.3	31.8	21	35
Panicles/hill	13	17	19.1	23	14	27
Panicle length (cm)	------	-------	---------	----------	20.4	26.5
Grains/panicle	92	103	107	113.5	80	117.4
% ripening	85	83.3	81.2	84	84	85.1
1000-grain weight	24	24.3	24	24.8	24	24.3
Paddy yield (kg /ha)	**3,800**	**4,780**	**6,399**	**6,995**	**3,650**	**6,080.4**
			Conv.	**SRI**	**Increase**	
Average paddy yield (kg/ha)			**3,725**	**5,951.8**	**59.7 %**	

This increased production is achieved with about one-third reduction in water requirements. In Mazandaran Province, with conventional management, 1 ha of rice needs 12,500 m^3 water, while with SRI practice, the requirement is about 8,000 m^3, a reduction of 4,500 m^3 in irrigation water with the wetting/drying method, with 3,000-4,000 m^3 needed for puddling and land preparation. The water management regime followed is:

1- From transplanting until the start of leaf emergence and tillering: shallow standing water
2- During tillering stage: intermittent irrigation, with alternate wetting and drying
3- From panicle initiation to flowering: shallow standing water to avoid soil cracking
4- From flowering to early milky stage: increase water level up to 5 cm
5- During frain-filling period: wetting and drying again
6- At 2 weeks before harvest: drainage of field

IV. Extension activities and pilot demonstrations of SRI

After the first year trial, we extended and described our observations to agricultural organizations and the Ministry of Jihad-e-Agriculture. In addition, we established a training program on SRI at our training center for farmers and governmental rice staff. SRI practice was of interest for Mazandaran and Gilan provinces as the biggest rice cultivation area in Iran near the Caspian Sea.

Mature rice seedling, ready for conventional transplanting

High number of seedlings per hill and deep transplanting in traditional rice cultivation system at farmer's field



SRI training program at rice training center and farmer's field (lecturer: Bahman Amiri Larijani)



Pilot demonstration on SRI for head of agricultural organization
at Mazandaran Province and farmers


Square and random transplanting by farmer under SRI practice*


Farmer's field at tillering stage under SRI practice

Farmer visiting his SRI field

2 weeks before harvesting

Harvesting time

* Note: In the first-year trial under SRI methods, farmers were afraid to transplant small seedlings, so they just used one seedling per hill; but in the second year, they used SRI practices at transplanting time.

VI. Economic analysis and comparison of SRI practice with conventional method

Generally, we found that the greatest effect from SRI practices on the pilot farm based on farmer's condition was reducing nursery costs by 41% as follows:

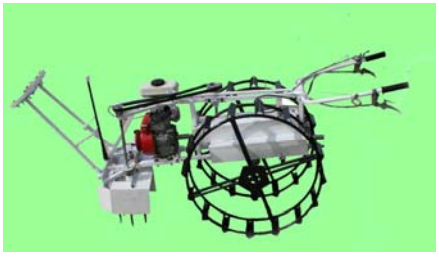
Preparation of seedlings for 1 ha	Conventional	SRI
Nursery area (m^2)*	400 to 500	60
Bed nursery preparation (Rials)	350,000**	7,000
Metal arcs for nursery (no.)	125	25
Cost of arcs (Rials)	1,875,000	375,000
Plastic sheets (kg)	30	6
Cost of plastic sheets (Rials)	600,000	120,000
Seed rate (kg/ha)	60	7
Cost of seed (Rials)	900,000 Rls	105,000 Rls
Fertilizer (N-P-K) for nursery (kg)	15-10-15	3-2-3
Cost of fertilizer (Rials)	45,000	11,000
Nursery preparation (Rials)	400,000 (2 persons)	80,000 (0.5 persons)
Nursery management (Rials)	1,200,000 (80 hrs)	150,000 (10 hrs)
Pulling seedlings (Rials)	750,000 (4 persons)	200,000 (1 person)
Transplanting (Rials)	2,250,000 (15 persons)	3,000,000 (20 persons)***
Total cost (Rials)	**10,370,000**	**6,111,000**
	Total SRI reduction in cost	**41%**

*Conventional rice nursery in Iran is a wet bed; with SRI, a box nursery is used, 3x30x60 cm.
** Each Rial is $0.0001
*** All items are lower with SRI than with conventional practice except for transplanting; SRI transplanting needs 5 persons more than conventional methods.

VII. Making of First Rotary Weeder in Iran

One of my colleagues in our center, Mr. Aghagolzadeh, who is rice machinery specialist, has made two models of mechanized rotary weeders shown below:

Mr. H. Aghagolzadeh



VIII. Problems and Suggestions:

The following problems or constraints have been identified, and solutions are being sought or worked out for these.

1- Sometimes due to their poor land preparation and leveling, farmers could not use or were afraid to transplant small, single seedlings as recommended.
2- In some rice cultivation areas in the southern and southwestern paddy areas in Iran, small single seedlings could not be used due to the high temperatures, sun radiation, or very high evapo-transpiration rates at transplanting time.
3- Difficulty of square transplanting by hand using ropes, markers, etc., especially on big plots
4- Problems of water management caused by traditional field layout not having separate irrigation and drainage channels for the respective fields.
5- Shortages of water and farmers' fear that water supply will not be reliable, also difficulties in some places with drainage of water, making soil conditions more saturated than desirable with SRI. Especially in warmer paddy areas in Iran, there is very high evapo-transpiration rate, and some places farmers could not drain their fields.
6- Weed control sometimes is difficult under aerobic soil conditions, but this is not a main problem. The new weeders will help with control.
7- Compost and organic manure preparation is difficult and is not popular with farmers. This constraint is being addressed.

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