System of Rice Intensification in IRAQ during 2007

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Introduction

Rice is regarded as a very important food crop on which much of the Iraqi population depends. With the Iraq population still increasing and food requirements increasing day after day, feeding this large number of people becomes difficult when our land for rice production is decreasing, due to expansion of construction and reductions in soil fertility.

Rice cultivation in Iraq began several thousand years ago, particularly in the middle and southern areas of the country. The total available area for rice cultivation is approximately 250,000 hectares, but for various reasons, the total cultivated area utilized for rice 125,000 hectares, producing 400,000 metric tons of paddy at a yield rate of 3000 kg/ha for favored local varieties.

Iraqi rice farmers cultivate rice according to the cultural practices inherited from their parents, using a large amount of seed (about 160 kg/ha) and not usually using transplanting methods. When farmers do transplant, they transplant seedlings fairly close, at a distance of 15cm from each other. They do not utilize organic matter to improve soil fertility, but instead depend on chemical fertilizer. In addition, weeding is done by hand, with some farmers also using herbicides for weed control. Farmers generally grow a local variety (Amber 33) which has aromatic qualities because it is preferred by Iraqi consumers, having become popular particularly during the blockade post-1991. Cropping rice in alternation with wheat gives more food insurance for the people, but this cropping system has been exhausting the rice land.

The conventional method of rice irrigation in Iraq is continuous submergence which involves maintaining a layer of water 10cm in depth during the growing season. This requires a large quantity of water beside having a negative effect on the environment because of disposal of huge amount of drainage water which contains residual agrochemicals which cause pollution to environment. SRI methods can revive rice production and improve the soil, making rice production more skilled and creating better agronomic understanding among rice farmers, also reducing their costs.

SRI Committee activities during 2007

The SRI extension committee formed in Iraq in 2007 has been moving on a broad front for acquainting Iraqi scientists, decisions-makers and farmers about the SRI system. SRI trials and demonstration have started up this past season. SRI method have been tested, demonstrated and expanded under the direct supervision of the SRI committee. Its members managed all SRI activities to achieve good results from the very first season as follow:

1. Saleh M. Bader, Director-General of the State Board of Agriculture Research, agreed to made SRI methods a main part of MRRS activities.
2. The SRI Committee was carried out 4 trials of SRI methods and one demonstration/comparison field at the MRRS station.
3. At 14 sites, the SRI Committee was conducted demonstrations of cultivating a clover crop before rice for soil improvement as a green manure.
4. The SRI Committee was set up and managed two mechanical transplanting fields as demonstration fields outside of MRRS.
5. Conducting of three lectures for acquainting people on SRI system.
6. Arrangement of a bulletin on the SRI system.

Results and Discussion

SRI practice in most cases has indicated good results in comparison with conventional practice. This past year's results are as follow:

Trials of spacing between seedlings:

Trials have been conducted with two varieties including a local variety (Amber 33) and Jasmine rice. Seedlings 15 days old were planted singly per hill for all treatments. Different spacings were used: 15×15 cm, 20×20 cm, 25× 25 cm, and 30×30 cm for the two varieties, with three replications. Irrigation was managed according to SRI concepts, and organic matter was applied (10 ton/ha) combined with chemical fertilizer (140 kg/ha urea and 20 kg/ha P_2O_5).

Transplanting date was 1 July for all treatments. For adjusting the distance between seedlings, we used a stick of wood (10m×5cm×2cm) with nails hammered into it with each face of the stick having a particular distance between the nails (see picture). We think that this method is better than using a marked or knotted rope for transplanting in a square pattern, and it is quicker to use. Weed control was by hand, not with mechanical weeder as recommended for best SRI results. The results were as follow:

Variety	Spac-ing (cm)	Plant height (cm)	Pani-cles/ m^2	Panicle length (cm)	Spike-lets per panicle	Steri-lity (%)	Yield (t/ha)
Amber 33	15×15	150	205	29	192.6	21.5	5.080
	20×20	145	196	29	198.0	18	5.240
	25×25	145	230	27	177.8	16.5	6.682
	30×30	150	233	28	182.9	15.3	6.708
Jasmine	15×15	95	238	23	163.7	8	4.900
	20×20	95	210	23	170.9	6.6	5.960
	25×25	95	285	23	162.2	6.3	7.420
	30×30	95	328	23	177.8	6	7.450

These results indicated that the yield was increased more with spacing 30×30 cm between seedlings compared with narrower spacing for both varieties, by 25% and 23% compared with 15×15 cm spacing.

Innovation for adjusting the distance between seedlings

Trials evaluating the effect of seedling age:

Two varieties of rice have been used with this trial (Amber 33 and Jasmine) since these are the cultivars most used by farmers. We used seedlings of different ages (8 days, 10 days, 15 days, and 30 days) for both varieties, following SRI principles such as transplanting one seedling per hill, wide spacing (30×25 cm), and intermittent irrigation. Chemical fertilizer has been applied but with a 50% reduction in quantity (140 kg urea/ha) accompanied by application of organic matter. Timely weeding was done by hand. The results were as follow:

Variety	Seed-ling age	Plant height (cm)	Pani-cles/ m^2	Panicle length (cm)	Spike-lets per panicle	Steri-lity (%)	Yield (t/ha)
Amber 33	8 days	15	237	27	190.1	16.8	6.254
	10 days	145	218	26	179.1	14	5.254
	12 days	145	268	28	195.3	17.6	6.640
	15 days	145	237	26	174.0	18.3	5.980
	30 days	115	137	23	114.8	22.3	3.954
Jasmine	8 days	95	292	22	162.9	9.3	6.402
	10 days	95	302	22	162.3	6.6	7.292
	12 days	90	294	22	195.5	6.5	7.680
	15 days	90	280	22	166.0	6.1	6.920
	30 days	85	272	20	150.1	11.3	5.542

The data in the above table indicated that the highest yield was found with 12-day-old seedlings for both varieties, 40% higher than 30-day-old seedlings of Amber 33, and 28% higher than 30-day-old seedlings with Jasmine variety. Age of seedling is a very important component of SRI method.

30-day-old vs. 15-day-old seedlings

Response of two varieties in chemical and organic fertilizer trials:

This trial was carried out with two varieties (Amber 33 and Jasmine). Rice seedlings 15 days old and single plants per hill were used for all the treatments. The treatments evaluated for both varieties were: chemical fertilizer (CF) only, organic matter (OM) only, a combination of CF+OM, and without fertilization. There were three replications of all treatments. Irrigation was done with SRI methods, as was hand weeding. Details are presented in the following table:

Variety	Treat-ment	Plant height (cm)	Pani-cles/ m^2	Pani-cle length (cm)	Spike-lets per panicle	Steri-lity (%)	Yield (t/ha)
Amber 33	CF	140	174	29	141.8	8	5.596
	OM	145	223	29	188.6	9.3	6.002
	CF+OM	145	226	29	226.2	5	6.662
	No fert.	135	156	28.5	121.0	11	4.356
Jasmine	CF	100	220	23	164.9	6.6	5.084
	OM	95	236	23	155.8	8	5.180
	CF+OM	100	246	23	151.3	6	6.076
	No fert.	90	186	21	143.1	10.3	4.076

Data indicated that the highest yield was with CF+OM treatment for both varieties. Without any fertilization, sterility increased with both varieties. Somewhat similar results with panicle length have been obtained.

Performance of four rice varieties cultivated after clover crop:

Green manure can play a critical role in soil fertility and plant nutrition. The utilization of clover as a green manure can add to the store of organic matter in the soil and can enhance soil structure and functioning. After the green manure crop, in this case clover, is ploughed in, sowing time comes at a stage when the soil contains a mass of half-rotted material. Four varieties of rice were used with this trial. The treatments were:

a. Without fertilizer
b. 12.5% available N (70 kg/ha urea)
c. 25% available N (140 kg/ha urea)

For each variety, young seedlings (15 days old) were planted singly per hill with wide spacing (30×25 cm). Water management was according to SRI methods.

d. 50% available N (280 kg/ha urea)

For this treatment there were three seedlings per hill, 30-day-old seedlings with 15x15 hill spacing, and irrigation according to the farmer method, i.e., the plot was kept flooded throughout the growing cycle. Weed control has done by hand for all treatments. The results were as follow:

Variety	Treat-ment	Plant height (cm)	Pani-cles/ m^2	Panicle length (cm)	Spike-lets per panicle	Steri-lity (%)	Yield (t/ha)
T 85	No N/ SRI method	75	220	24	144.6	14	6.800
	12.5% available N/ SRI method	80	235	24	160.8	8	6.400
	25% Available N/ SRI method	85	300	23	162.7	14	6.868
	50% Available N/ farmer method	80	314	21	118.2	17	5.780
Furat 1	No N/ SRI method	75	200	21	97.4	17	4.160
	12.5% available N/ SRI method	80	263	21	148.4	12	6.880
	25% available N/SRI method	80	260	21	119.9	17	5.600
	50% available N/farmer method	80	227	21	103.8	21	5.280
Jasmine	No N/ SRI method	95	266	23	160.4	10	6.140
	12.5% available N SRI method	90	247	22	142.4	11	4.710
	25% available N/SRI method	85	230	21	145.3	9	5.140
	50% available N/farmer method	80	291	20	126.1	11	5.360

Amber 33	No N/ SRI method	125	159	24	151.7	18	4.160
	12.5% available N/ SRI method	135	168	25	159	16	4.282
	25% available N/ SRI method	135	168	25	171.3	18	4.322
	50% available N/ farmer method	125	146	24	132.3	22	4.050

Results showed considerable variation in varietal response to N supplementation. The highest production has harvested from SRI treatments (for T85, with 140 kg/ha N supplied; for Furat 1, with 70 kg/ha N supplied; for Jasmine, with no N supplied; and for Amber 33, with 140 kg/ha N supplied). The highest sterility percentage was with farmer method (with 280 kg/ha N supplied) for all varieties. We found that all varieties responded positively to SRI management methods.

Clover crop as a green manure

Ploughing clover crop before rice sowing

Comparison of SRI and Non-SRI methods in farmers' fields:

Comparison trials for SRI and non-SRI practices have been conducted in farmer fields to assess the potential benefits to farmers and gain adequate experience with SRI practices. IN a comparison field, we started SRI and non-SRI on small plots, just 100m^2 each plot) with a local variety (Amber 33). For the SRI plot, seedlings 15 days of age were transplanted, one seedling per hill, with wide spacing (30×25 cm). Organic material was added combined with 25% available N (140kg/ha urea) , and SRI irrigation methods were used. For the non-SRI

Culture method	Plant height (cm)	Pani-cles/ m^2	Panicle length (cm)	Spikelets per panicle	Steri-lity (%)	Yield (t/ha)
SRI	155	343	30	212.5	8	6.540
Non-SRI	125	200	23	156.1	12	4.520

Date	Culture method	Plant height (cm)	Leaf number/ plant	Tiller number/ hill	Leaf weight (gm/plant)	Stem weight (gm/plant)	Root weight (gm/plant)
25/7	SRI	54	19	9	1.5	2	1.5
	Non-SRI	40	7	2	0.5	0.5	0.25
10/8	SRI	71	145	34	11	24	5
	Non-SRI	56	47	20	3	3	1
25/8	SRI	96	207	40	29	42	14
	Non-SRI	87	68	23	7	9	3
10/9	SRI	125	180	50	38	74	15
	Non-SRI	100	60	20	9	15	4
25/9	SRI	140	178	50	52	95	18
	Non-SRI	120	51	20	10	21	4
10/10	SRI	145	160	50	46	110	15
	Non-SRI	130	45	20	8	35	4
25/10	SRI	155	125	50	41	123	15
	Non-SRI	135	36	20	6	54	2

The data in the above table showed that the average rice yield with SRI practice was 6.54 ton/ha, while non-SRI methods yielded 4.52 ton/ha, an increase of 40% vs. the comparison field . Profuse increase in tillering was observed (343 vs. 200 tillers). The maximum tiller number in the SRI plot was 65 tillers per hill (per plant). Amber 33 variety has lodging problems under current farmer management, but with SRI methods , these lodging problems are solved . SRI is this well adapted to local conditions. We encourage farmers to do SRI practices in their fields if possible to see for themselves the possibilities of SRI.





Pictures from comparison field for SRI and non-SRI practices

Demonstration field for mechanical transplanting with wide spacing:

The State Board of Agricultural Extension in cooperation with MRRS and the Directorate of Agriculture in Najaf conducted three demonstration fields of mechanical transplanting done in three sites, first in MRRS (1.5 ha), second in farmer's field in Mishkhab sub-district (1 ha), and third at extension farm in Al-Abbasiya sub-district (1/4 ha). The machine for transplanting came from Korea as a gift. All the boxed seedlings were prepared in MRRS using plastic plots. Seedlings of age 16-18 days were used. Spacing was 30×15 cm. No organic matter was used, only chemical fertilizer. So there were only some similarities to SRI. Perhaps most important, irrigation was managed according to SRI principles. We compared this method with other cultivation methods. The results were as follow:

Site	Panicles/ m^2	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Steri-lity (%)	Yield (t/ha)	
						Mech. TP	Conv.
Farmer's field	273	150	27	189.9	13	4.400	3.600
Extension farm	281	140	27	202.3	12	5.600	4.000
MRRS	284	150	27	204.8	9	5.704	4.280

Culture method	Plant height (cm)	Pani-cles/ m^2	Panicle length (cm)	Spikelets per panicle	Steri-lity (%)	Yield (t/ha)
SRI	155	343	30	212.5	8	6.540
Mech. TP	150	284	27	204.8	9	5.704
Manual TP	130	250	27	173.0	5.1	5.332
Wet method	150	217	29	201.5	4.1	4.320
Dry method	130	199	25	167.0	12.1	4.140

These results indicate that SRI methods are at the top compared with other cultural methods. Mechanical transplanting has good prospects economically.






Application of clover crop as a green manure in farmer's field:

We conducted demonstrations at many sites of using clover crop as a green manure before sowing rice on large fields. Farmers have adopted clover as a green manure crop in their rice production system and have sought ecologically

appropriate practices to reduce their production costs, as part of a general strategy of soil improvement. The following table shows the results:

Farmer's name	location	Rice Variety	Yield(ton/ha)		Areas
			GMC	Conv.	
Hadi N. Hassan	Abbasiya Sub district	Amber33	4.480	3.700	½ ha
Abdul Rassaq M.O.	Abbasiya Sub district	Amber33	4.070	3.600	¾ ha
Hasson A. Hameed	Abbasiya Sub district	Amber33	4.680	3.600	¼ ha
Nory M. Cheyad	Abbasiya Sub district	Amber33	4.400	3.480	¼ ha
Mohamed M. Abed	Abbasiya Sub district	Amber33	4.800	3.620	2.5 ha
Abdul Ameer A. H.	Abbasiya Sub district	Amber33	4.600	3.400	¼ ha
Farhan A. Rahi	Abbasiya Sub district	Amber33	4.020	3.218	¼ ha
Abbas R. Abdul lah	Mishkhab Sub district	Amber33	4.800	3.490	¾ ha
Showan Taha	Mishkhab Sub district	Jasmine	7.206	6.000	¼ ha
Abdul Hassan D. T.	Mishkhab Sub district	Jasmine	7.004	6.010	¼ ha
Hassan A. Salman	Mishkhab Sub district	Jasmine	6.720	5.808	¼ ha
Salam J. Shaheed	Mishkhab Sub district	Jasmine	6.824	6.104	¼ ha
Annon Ghali	Mishkhab Sub district	Amber33	4.418	3.600	¼ ha
Shabbeb K. Hasson	Mishkhab Sub district	Amber33	4.812	3.664	1 ¼ ha
Total GMC areas					8 ha

Sowing clover crop after rice in farmer's field

Comparison plots in Al-Mishkhab Agriculture Department:

Staff of the Department (MAD) with cooperation from MRRS conducted comparison plots near their office for acquainting farmers with SRI methods. The first plot used chemical fertilizer(CF) , the second plot used organic manure (OM), the third plot used CF+OM. Plot sizes were 5×5m each with the same variety (Amber 33). Practices used were: one seedling per hill, young seedlings (17 days old), wide spacing (30×25cm), and SRI water management. The results were as follow:

Plot	Plant height (cm)	Pani-cles/ m^2	Panicle length (cm)	Spikelets per panicle	Steri-lity (%)	Yield (t/ha)
CF	160	260	26	166.2	26.6	4.6
OM	150	250	25	181.5	22.3	4.8
CF+OM	160	308	28	212.7	15.8	5.2

CF+OM Plot

With staff of MAD

SRI development in Iraq

SRI area is continuing to expand, to cover many sites during 3 years, as seen in the following table:

Year	SRI trials	SRI demonstration fields	SRI comparison fields	Farmers	Area	SRI methods tested/evaluated
2005	-	1	-	1	¼ ha	Parachute method, wide spacing, one seedling per hill
2006	1	8	-	8	2 ha	*Trial using cattle manure, wide spacing, one seedling/hill *Demonstration field using parachute method .
2007	5	16	2	16	11 ha	*Trials using organic matter, different spacing, seedling age, composted compound with N, clover as a green manure *Demonstration field: mechanical transplanting with wide spacing, clover as green manure. *Comparison fields: SRI plot compared with non-SRI

SRI map in Iraq

SRI locations are shown on the follow map :-

{ **SRI sites distribution in Iraq** }

Concerns of farmers regarding SRI practices

1. Farmers are skeptical about using young (10-15 day old) seedlings, but a few farmers have accepted the principle of single plants per hill.
2. Farmers perceive that transplanting 3-4 plants per hill is easier to handle seedlings.
3. Not all farmers are capable of understanding new ideas. Only those who are committed to exploring new ways for growing a healthy crop more sustainably and more profitably have taking a lead with SRI.
4. Farmers have said that weed infestation is more severe in the SRI plot due to intermittent irrigation.

Opinion of farmers on SRI practices

1. Farmers are impressed with plant growth and cost-saving opportunities.
2. Farmers have shown the capacity of assess the impact on weed problems of planting younger seedlings, more widely spaced, and with less root damage.
3. Many farmers have assessed and adapted good ideas contained within the SRI methodology.
4. Farmers have shown that transplanting younger seedlings more quickly with less root disturbance, and with greater spacing, leads to greater tiller production and more yield.
5. Water management was a problem, but farmers have felt this is a transitional problem.
6. In general, farmers have been impressed by SRI practices.

Future schemes for thrust areas and research on SRI

1. Studies on the relative efficacy of organic manure on rice productivity.
2. Studies on using watery fermentation extracts of well-composted organic material for rice.
3. Expanding clover cultivation before rice crop (as green manure).
4. Expanding use of mechanical transplanting to many rice-growing provinces with wide spacing and use of organic matter in soil in 2008.
5. Using parachute method in Basrah province (south of Iraq) at three sites in 2008 .
6. Demonstration fields in Al-Muthanna province using SRI methods at 16 sites in 2008 and training 2,000 farmers on using SRI methods.
7. Evaluating and improving water use efficiency for rice production under SRI irrigation.

Gratitude

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▲
SRI trial ►

Non-SRI continuous flooding

Box seedlings nursery

Clover crop before rice

RDD Director in SRI field

Training

Farmer's demonstration field

SRI plant

Clover crop

Trials in MRRS

SRI plant