Implementation of System of Rice Intensification (SRI) in Najaf and Diwaniya Provinces of Iraq – Season 2009

Khidhir Abbas Hameed and Flayeh Abed Jaber
Al-Mishkhab Rice Research Station
Najaf - IRAQ

With support from the Iraq Ministry of Agriculture, the State Bureau of Agricultural Research (SBAR) and Al-Mishkhab Rice Research Station (MRRS) continued their SRI work in Najaf and Diwaniya Provinces, with cooperation from the State Board of Agriculture Extension and Cooperation (SBAEC) and the Directorates of Agriculture (DAs) in those provinces. One farmer was chosen from each district and sub-district with three donums of land for demonstrations fields for the SRI system.

SRI is a new concept to Iraqi rice farmers, requiring changes in rice-growing practices that they inherited from their parents. Therefore, we have done SRI demonstration fields before trying to expand SRI use, wanting to acquaint farmers with SRI principles and results, and also to know their feedback on SRI implementation in their locations and to hear their opinions, innovations and suggestions to contribute to wider application in the future.

SRI studies at MRRS were continued this year. In particular, in this season we conducted of a study on SRI water use efficiency (WUE) and compared the quantity of water used with SRI with that using prevalent conventional methods.

SRI training courses and lectures

With MRRS colleagues (Flayeh Abed Jaber, Aqel Yousif Hadi, Shaher F. Nwehi, Abdul Hussein Ahmed Rasheed, and Ahmed Shihab Ahmed), Khidhir Hameed delivered two training courses with lectures in Najaf and Diwaniya Provinces from 29April to 7 June 2009, attended more than 1,000 rice farmers and agricultural staff.

SRI Practice Evaluation at Field Level

Eight locations in Najaf and Diwaniya Provinces were chosen for SRI evaluation and demonstration, one farmer at each site in district and sub-district levels with with three donums for each farmer (one donum = 0.25 ha).

- **First donum:** 10 tons/ha of organic matter (OM) and half the usual amount of chemical fertilizer (CF), i.e., 140 kg/ha Urea + 200 kg/ha NP as compound 18×18); 1-2 young seedlings per hill (17 days old); spacing 20×20 cm between seedlings; and interval irrigation (alternate wetting and drying) during the vegetative phase.
- **Second donum:** 5 tons/ha of OM and half the usual amount of CF (140 kg/ha Urea + 200 kg/ha NP as compound 18×18); 1-2 young seedlings per hill (17 days old); 20×20 cm spacing between seedlings; and interval irrigation during the vegetative phase.
- **Third donum**: Conventional practice; no OM addition, only CF (280 kg/ha Urea + 400 kg/ha NP as compound 18×18); 4–5 seedlings per hill (30–40 days old); with spacing of 10×15 cm between hills; and continuous irrigation during cycle.

These treatments were compared with conventional methods used nearby on the farmer's own field.

Establishing of Seedlings and Nurseries

Farmers used less than 80 plastic plats per donum to produce rice seedlings, the plats being 3×28×58 cm and filled with sieved soil. Twenty (20) kg of Jasmine variety rice seeds were utilized per hectare. After seed germination, the seedling boxes were set into a puddled nursery to help the seedlings grow well. Transplanted was done for the SRI trials when seedlings were 7 days old.



Irrigation

After the rice seedlings were transplanted, intermittent irrigation was done for the SRI trials. After transplanting, the interval between successive irrigations was one day, and this continued up to one month. Then, 2-3 day intervals between successive irrigations were done up to panicle initiation phase. In the reproductive phase, the irrigation was continuous submergence, but with 1-2 cm depth of water on the surface of the soil until the maturing phase. A buffer zone was left between plots to prevent water seepage from one plot to another.




Results

At harvest, the plants were sampled diagonally across 3 m^2 harvest areas per field to determine grain yield. Also, 10 randomly selected rice panicles were sampled from each field for determination of yield components. 10 randomly selected plants were sampled for each field to obtain a measure of average height plant. The results are reported in the following tables:

Table 1: Results of Aqel Abdullah Jaleel / Mishkhab Sub-District – Najaf

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**95**	**24**	**151.6**	**7**	**329.6**	**9,264**
OM 10 tons/ha + half amount of CF + SRI principles	**80**	**23**	**122.3**	**12**	**314.6**	**7,508**
Transplanting by farmer method + full CF; not SRI	**92**	**20**	**134.6**	**20**	**350.6**	**7,232**
Conventional methods; no SRI	**91**	**20**	**135.8**	**16**	**403.3**	**7,656**

Table 2: Results of Shakir Fahim Ksheil / Qadisiya Sub-District – Najaf

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**72**	**17**	**102.2**	**12**	**288.3**	**4,480**
OM 10 tons/ha + half amount of CF + SRI principles	**68**	**18**	**117**	**12**	**285**	**4,640**
Transplanting by farmer method + full CF; not SRI	**75**	**19**	**123.2**	**14**	**283.3**	**4,388**
Conventional methods; not SRI	**72**	**19**	**94.4**	**8**	**301.6**	**4,316**

Table 3: Results of Hasson Atiya Hameed / Abassiya Sub-District – Najaf

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**106**	**25**	**129**	**5.8**	**430**	**9,200**
OM 10 tons/ha + half amount of CF + SRI principles	**91**	**24**	**138**	**12.1**	**380**	**8,248**
Transplanting by farmer method + full CF; not SRI	**82**	**22**	**119**	**5.5**	**380**	**7,640**
Conventional methods; not SRI	**80**	**22**	**116**	**6.4**	**321**	**6,500**

Table 4: Results of Hadi Musa Lafta / Hurriya Sub-District – Najaf

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**80**	**21**	**149.6**	**5**	**405**	**7,648**
OM 10 tons/ha + half amount of CF + SRI principles	**78**	**21**	**129.2**	**9**	**388**	**7,000**
Transplanting by farmer method + full CF; not SRI	**78**	**18**	**98.7**	**16**	**354**	**6,000**
Conventional methods; not SRI	**71**	**17**	**92.6**	**20**	**272**	**5,120**

Table 5: Results of Ali Rasheed Swadi / Shamiya District – Diwaniya

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**93**	**24**	**197**	**7**	**283**	**7,428**
OM 10 tons/ha + half amount of CF + SRI principles	**90**	**22**	**166.4**	**14**	**275**	**7,248**
Transplanting by farmer method + full CF; not SRI	**93**	**22**	**187.3**	**8**	**266**	**6,900**
Conventional methods; not SRI	**104**	**24**	**136**	**6**	**295**	**7,348**

Table 6: Results of Karim Naji Fatlawi / Ghamas District – Diwaniya

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**80**	**23**	**169.2**	**7**	**282**	**6,840**
OM 10 tons/ha + half amount of CF + SRI principles	**82**	**21**	**138.7**	**7**	**266**	**6,368**
Transplanting by farmer method + full CF; not SRI	**81**	**20**	**125.9**	**9**	**258**	**6,140**
Conventional methods; not SRI	**84**	**20**	**108.5**	**7**	**461**	**7,120**

Table 7: Results of Basim M. Kshayish / Salahiya Sub-District – Diwaniya

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**85**	**22**	**140.5**	**13**	**260**	**6,580**
OM 10 tons/ha + half amount of CF + SRI principles	**86**	**21**	**143.5**	**13**	**254**	**6,120**
Transplanting by farmer method + full CF; not SRI	**86**	**22**	**143.3**	**9**	**214**	**5,068**
Conventional methods; not SRI	**82**	**21**	**101.2**	**24**	**267**	**4,388**

Table 8: Results of Ali Fakhri Abed / Mhanawiya Sub-District – Diwaniya

Treatment	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Sterility (%)	Tillers number per m^2	Yield (kg/ha)
OM 5 tons/ha + half amount of CF + SRI principles	**99**	**22**	**136.3**	**9**	**377**	**7,220**
OM 10 tons/ha + half amount of CF + SRI principles	**98**	**25**	**192.7**	**5**	**354**	**6,928**
Transplanting by farmer method + full CF; not SRI	**99**	**23**	**167**	**7**	**350**	**6,920**
Conventional methods; not SRI	**98**	**22**	**149.2**	**6**	**280**	**6,448**

These results indicate that the first SRI treatment -- using 5 tons/ha of OM combined with half the usual amount of chemical fertilizer -- gave the highest average grain yield (7,360 t ha^{-1}), 22% more than the lowest treatment (6,036 t ha^{-1}), which was farmers' current transplanting methods. These involve transplanting 40-day seedlings with full application of chemical fertilizer plus flooding, the third treatment.

SRI practices used with 10 t/ha of OM, together with half the usual amount of chemical fertilizer, gave a yield of 6,785 t ha^{-1}, 12% more than the third treatment, current farmer transplanting practice. Both non-SRI treatments had similar results. Farmers' conventional rice cultivation methods with direct seeding, the fourth treatment evaluated, gave an average of only 6,112 t ha^{-1}.

Despite using a lot of seed, chemical fertilizer and water (due to continuous flooding), conventional direct-sowing methods produced only 1.2% more than conventional transplanting, and they yielded 17% and 10% less than SRI methods where half of the recommended chemical fertilizer was replaced by 5 or 10 t ha^{-1} of organic matter.

Mechanical Transplanting

SBAEC has undertaken a paddy mechanization project in cooperation with SBAR and MRRS at seven sites in three provinces (Najaf, Diwaniya , and Muthanna provinces). Demonstrations field areas totaled 10.5 ha. The trials used seedlings 17-20 days old of a popular Jasmine variety with spacing of 30×15 cm between seedlings. Seedlings were raised in the same way as with SRI, and the methods have been influenced by MRRS' SRI work. Expansion of this method is slow due to the need for more capital investment, and also it has not been determined who will be importing the machines.

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At harvest, plants were sampled diagonally across 3 m^2 harvest areas per field to determine grain yield, and also 10 randomly selected rice panicles were sampled from each field for determination of yield components. Ten randomly selected plants were sampled for each field for measurement of average height plant. Tables 9, 10, 11, 12, 13 and 14 below show the results of these trials. The average yield with MTP was 6,756 t ha^{-1} -- 16% more than the 5,966 t ha^{-1} average for traditional methods of crop establishment. Note that some part of the increase could be due to the use of younger seedlings and the wider spacing involved with the MTP process:

Table 9: Results of mechanical transplanting (MTP) / Abassiya Sub-District – Najaf

Farmer name	Culture method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m^2	Yield (kg/ha)
Hasson Atiya Hameed	MTP	**89**	**23**	**140.1**	**424.5**	**7,134**
	Traditional	**87**	**22**	**130.6**	**379**	**6,328**

Table 10: Results of mechanical transplanting / Hera Sub-District – Najaf

Farmer name	Culture method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m^2	Yield (kg/ha)
Dyab Ekab Alwan	MTP	**84**	**21**	**156.4**	**463**	**6,464**
	Traditional	**83**	**19**	**131.2**	**397**	**6,020**

Table 11: Results of mechanical transplanting / Mishkhab Sub-District – Najaf

Farmer name	Culture method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m^2	Yield (kg/ha)
Aqel Abdullah Jaleel	MTP	**92**	**23.5**	**166.25**	**242.6**	**6,383**
	Traditional	**85**	**22**	**132.5**	**182.3**	**5,883**

Table 12: Result of mechanical transplanting / Hurriya sub district – Najaf

Farmer name	Culture method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m^2	Yield (kg/ha)
Hadi Musa Lafta	MTP	**86**	**22**	**131.3**	**374**	**6,884**
	Traditional	**84**	**19**	**122**	**353**	**6,100**

Table 13: Results of mechanical transplanting / Ghamas District – Diwaniya

Farmer name	Culture method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m^2	Yield (kg/ha)
Salah Abdul Zahra Kyan	MTP	**95**	**23**	**172**	**421**	**7,100**
	Traditional	**85**	**20**	**143**	**320**	**5,600**

Table 14: Results of mechanical transplanting / Salahiya Sub-District– Diwaniya

Farmer name	Culture method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m^2	Yield (kg/ha)
Thaqip Mayea Shanshol	MTP	**81**	**20**	**127.9**	**367**	**6,574**
	Traditional	**75**	**19**	**127.5**	**350**	**5,800**

SRI Water Use Efficiency Study

A field study was conducted at MRRS during summer season of 2009 on 10×10 m size plots to evaluate irrigation water use efficiency (IWUE) with Amber 33 variety using SRI system of cultivation compared with traditional methods.

During the growth phase, the numbers of leaves, stems and roots and plant height were measured every 15 days for both methods. At maturity, the depth and length of plant roots was assessed, along with leaf area index (LAI) of the flag leaf, and plant height. The amount of irrigation water applied was measured by water meters for both methods. SRI principles were implemented in the SRI plots.

The results indicated more vigorous growth of roots under SRI method, reaching 13,004 cm/plant compared with non-SRI results of 4,722 cm/plant (Table 15). There was 42% increase in grain yield when SRI methods were used. The value of IWUE under SRI method is shown in Table 16. Under SRI methods, the WUE reached 0.291 kg/m^2 compared with non-SRI WUE of 0.108 kg/m^2, almost three-fold difference. SRI reduced the need for irrigation water by about 38.5% (Table 17).

Table 15: Average of roots length per plant (cm) in SRI and non-SRI plants

Method	Divisions of roots length (cm)			Total
	First 10 cm	Second 10 cm	Third 10 cm	
SRI	**8,957**	**3,911**	**136**	**13,004**
Non-SRI	**3,567**	**1,112**	**43**	**4,722**

Table 16: Water use efficiency (kg of grain/m^3 of water) for SRI and non-SRI crop

Method	Irrigation Water Use Efficiency (IWUE)
SRI	**0.291**
Non-SRI	**0.108**

Table 17: Amount of water irrigation during rice cycle for SRI and non-SRI crop

Method	Amount of water (m3/ha)	Average water depth (cm)
SRI	**21,600**	**2**
Non-SRI	**34,500**	**3**

Honoring of Excellent Farmers

SRI practices have created better agronomic understanding among rice farmers in the region. One of them, Abdul Amir Owais from Muthanna province, went beyond the experimentation and evaluation stage. He decided to apply SRI practices on larger areas in the 2009 rice season, using two rice varieties on a half hectare and using MTP methods on 3.25 ha. He produced OM from the previous season's rice plant residues as we taught him in the SRI project in 2008. His SRI yields, averaged for the two varieties, were 45% higher than conventional methods on the same soils.

The Minister of Agriculture was requested by MRRS to honor this farmer and give him a transplanting machine and paddy harrow. The Minister agreed to do this, and he personally thanked Mr. Owais, whose results are reported in Tables 18 and 19 below. Pictures of Mr. Owais and his fields are also shown below:

Table 18: Results from Abdul Amir Owais's SRI fields

Variety	Cultivation method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m2	yield (kg/ha)
Jasmine	SRI	**95**	**23**	**182.6**	**422**	**7,600**
	Non-SRI	**82**	**21**	**134.4**	**277**	**4,840**
Furat 1	SRI	**76**	**22**	**179.4**	**383**	**7,200**
	Non-SRI	**72**	**19**	**112.7**	**254**	**5,420**

Table 19: Results of mechanical transplanting / Rumatha Sub-District – Muthanna

Farmer name	Crop establishment method	Plant height (cm)	Panicle length (cm)	Spikelets per panicle	Tillers number per m2	yield (kg/ha)
Abdul Amir Owais	MTP	**90**	**22**	**163.7**	**314**	**6,800**
	Traditional	**82**	**20**	**134.4**	**277**	**3,840**

Clover crop cultivation for soil improvement

More than 100 farmers have now cultivated a clover crop after rice to restore fertility of their rice-growing lands in three provinces (Najaf, Diwaniya, and Muthanna Provinces), although still in small areas since the government has not received clover seeds and farmers therefore abstain from planting this soil-restoring crop in large areas.

Farmers' opinions on SRI practices

We can get additional insights about the success of SRI, or not, from farmers' opinions about SRI operations. Accordingly below are reported some of the opinions about SRI voiced from different farmers:

- "It is good to hear about new concepts on rice cultivation introduced into Iraq like SRI." (Hasson E. Hameed).
- "It is difficult to do SRI [transplanting] by rope, but it is better by machine." (Basim M. Kshaish)

- "I saw the high yield attributed to organic matter and wider spacing with young seedlings, but there is need for good soil leveling." (Karim Naji)
- "It is very important to reduce pollution of the environment for our generations to come." (Ali Rasheed)
- "It is difficult to make large amounts of organic matter from plant and animal residues by hand to cover our large areas, but it is easy to make green manure from clover crop." (Hadi Mossa)
- "We need more acquainting on better use water for rice irrigation due to the negative effect of continued submergence on our fields." (Mohamed, comment made during lecture class)

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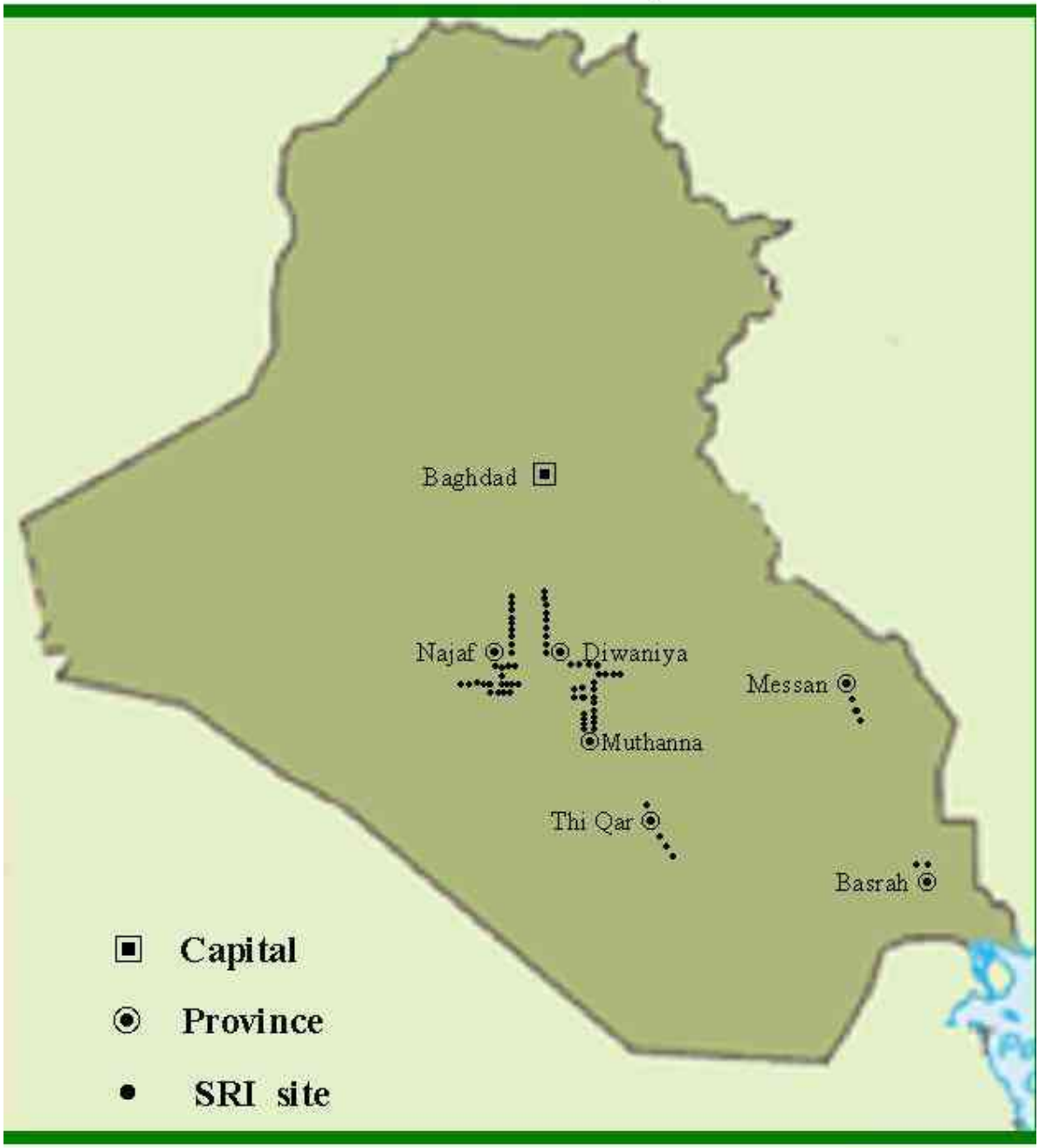
- All the staff in the Agricultural Sections at Najaf, Diwaniya, and Muthanna Provinces

SRI map in Iraq

SRI locations are shown on the follow map :-



SRI sites distribution in Iraq