System of Rice Intensification 2014 -16

MWRI-Egypt

EWRMP

Enhanced Water Resources Management Project - Egypt

INTRODUCTION

Rank	Country	Yield t/Ha
1	Australia	10.22
2	Egypt	9.59
3	United States of America	8.62
4	Turkey	8.14
5	Greece	8.03
6	Uruguay	7.88
7	Peru	7.71
8	Uzbekistan	7.65
9	Morocco	7.54
10	Spain	7.52

Variety	Beheira	Delta	Other	Total	%
Sakha 101	48,334	383,369	1,703	385,072	27.1
Sakha 102	13,198	35,418	-	35,418	2.5
Sakha 103	491	1,982	-	1,982	0.1
Sakha 104	22,126	200,044	1,382	201,426	14.2
Sakha 105	11,335	64,724	-	64,724	4.6
Sakha 106	12,826	40,570	-	40,570	2.9
Giza 170	-	220	-	220	0.0
Giza 171	-	2,424	-	2,424	0.2
Giza 177	57,329	256,991	-	256,991	18.1
Giza 178	16,124	420,355	2,759	423,114	29.8
Hybrid 1	8	163	-	163	0.0
Other	7,049	7,274	-	7,271	0.5
Total	188,820	1,413,534	5,841	1,419,375	100

Source: MARL (2014): Bulletin of Agricultural Statistics - Summer & Nile crops 2012/13

Rice areas per variety in 2013 in Beheira governorate, Delta and Egypt

Variety	Beheira	Delta	Beheira	Delta
	t/feddan		t/ha	
Sakha 101	4.0	4.1	9.5	9.8
Sakha 102	4.0	4.0	9.5	9.4
Sakha 103	4.0	3.6	9.5	8.5
Sakha 104	4.2	4.2	10.0	9.9
Sakha 105	4.1	4.1	9.8	9.8
Sakha 106	4.1	4.1	9.8	9.8
Giza 170	-	4.0	-	9.5
Giza 171	-	3.2	-	7.7
Giza 177	4.0	3.9	9.4	9.4
Giza 178	4.4	4.0	10.4	9.4
Hybrid 1	5.1	5.2	12.2	12.5
Other	4.0	4.0	9.5	9.5
Average	4.1	4.0	9.7	9.6

Source: MARL (2014): Bulletin of Agricultural Statistics - Summer & Nile crops 2012/13

Paddy rice yields (t/feddan and t/ha) per variety in 2013 in Beheira governorate and Delta

Objectives of the Demo Fields

- Introduce the concept of SRI to farmers;
- Experiment with SRI principles;
- Apply principles of SRI with farmers;
- Demonstrate (statistically) significant effects of SRI principles, both from an agronomic as from an economic perspective, and
- Raise awareness of farmers in general on the potentials of applying SRI.

The SRI concept consists of six main cultivation principles (Uphoff, 1999)

- Seedlings transplanted at a very young age, preferably 8 the third leaf appears), but certainly not older than 15 days
- The use of single seedlings per hill (or clump)
- Hills planted at sufficient distance (at least 25 x 25 cm)
- to allow for sufficient root development
- Water is applied only as necessary to keep the soil moist during the vegetative growth, and it is even allowed to dry out for periods of 3-6 days to improve aeration of the soil
- Rotary weeding to control weeds and to promote soil aeration.
- Use of organic fertilizer (dung or compost made from dung, rice straw and other organic material) for seed beds and final fields.

The Nekla/Menesi Pilot Scheme

Crop duration of rice varieties (days)

Stage	Sakha 104	Sakha 106	Giza 177
Initial	20-30	20-25	20-25
Development	60	60	50
Middle	20	15	20

SRI DEMO TRIALS IN 2014, 2015 AND 2016

Transplanting seedlings to the permanent field

Farm management in conventional rice growth and in the SRI trials in 2014, 2015 and 2016

	Conventional	SRI - 2014	SRI - 2015	SRI - 2016
Quantity of the variety used for a feddan	60 kg at least	50 kg at most	40 kg at most	30 kg at most
Nitrogen (kg/feddan)	200-250 kg Urea	100-150 kg Urea	100 kg Urea	kg Urea 100
Organic Matter				
Nursery	Not added	70%	100%	100%
Sustainable Field	Not added	Not added	Some fields	All the fields
Use of Pesticides	Random heavy use	Regulated (under the project supervision)	Only in case of infection	Only in case of infection
Use of Fungicides	Irregular	Regulated (under the project supervision)	In case of infection and protection	In case of infection and protection
Age of seedling at transplantation (days)	30-35	25-30	27 (21-33)	25 (20-30)
No. of seedlings per hill	Irregular (7 - 20)	1 or 2 - 4	2 - 3	1 - 3

Mobilization of Farmers

- Trial in 2015

Cracking of soil surface

Getting supplies

Support provided by EWRMP to SRI cooperative farmers

	2014	2015	2016
Rice Seeds	X	X	X
Technical Assistance	X	X	X
Laser Levelling	X	X	
Fertilizers	X	X	
Agrochemicals	X		

- Trial in 2016

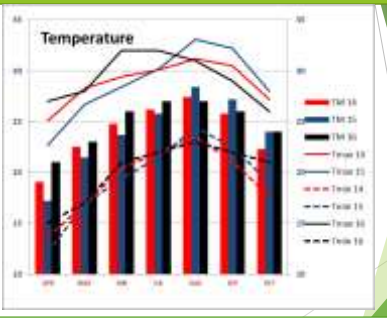
Village	2014		2015		2016			
	Farmers	Area (feddans)	Farmers	Area (feddans)	Farmers	Area (feddans)	Total by Village	Area (feddans)
Nekla	68	135	26	57	16	35.4	110	227.4
Kom El-Nasr	-	-	17	24.7	52	49.6	69	74.3
Kom El-bank	-	-	27	24.4	19	21.7	46	46.1
Total by year	68	135	70	106.1	87	106.7	225	347.8

Participation of farmers during the SRI 2016 demo trial

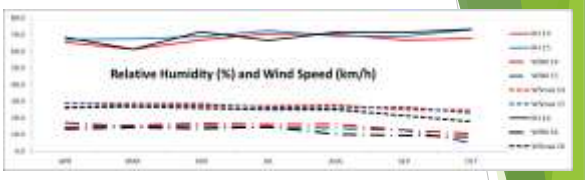
Recording of water level data

Results of the SRI Demo Trials

Weather conditions during SRI cultivation practices

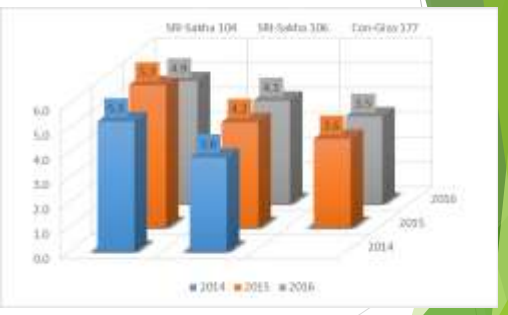


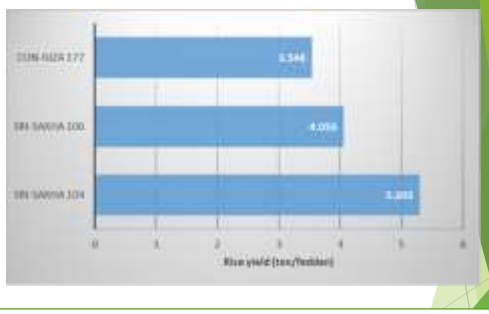
Monthly temperature (℃) during the growing season of rice for years 2014, 2015 and 2016 from Alexandria Borg El-Arab Weather Station



It is important to notice that no contribution to rainfall was reported by the Meteorological Station along the three years

Rice varieties yield (ton/feddan) during the growing seasons of 2014, 2015 and 2016





Average rice yields of Sakha 104 and Sakha 106 (with SRI) and Giza 177 (conventional) during the summer season of 2014, 2015 and 2016

Comparison of rice yields between SRI and conventional method

Water Use in SRI Demo Trials 2014

Approach	Average irrigated area (kirat)	Rice variety	Pumping time (h)	Water level after irrigation (cm)	Applied water (m³/ feddan)
Upstream:					
SRI plots (10)	14	Sakha 104 Sakha 106	44	3.1	4,620 (4,305 - 5,040)
Non-SRI plot (1)	32	Giza 177	102	3.9	6,195
Downstream:					
SRI plots (5)	28	Sakha 104, Sakha 106	85	3.1	5,711 (5,140 - 6,198)
Non SRI plot (1)	20	Sakha 104	65	3.1	5,709

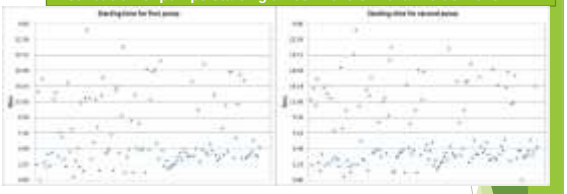
Tentative applied irrigation water in up- and down-stream SRI plots and conventional plots in 2014

Trial in 2015

Summary (Daily Operation Hours)			
Date	Pump		Daily Average
	1	2	
7 - 30 June	236.11	264.72	10.89
1 - 31 July	281.83	369.02	10.50
1 - 23 August	255.00	296.50	11.99
Total	772.94	930.24	
Daily average			11.12

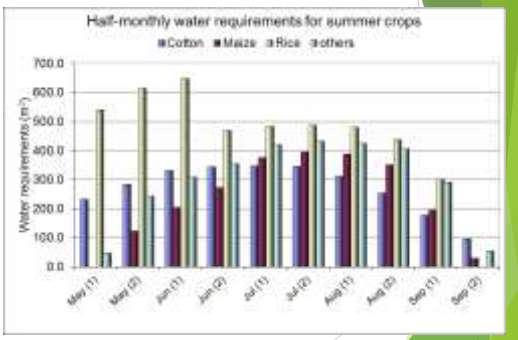
Summary of operation hours for two pumps in Mesqa Abu-Shabana. 2015

Distribution of pumps starting times in the SRI-trial fields. 2015



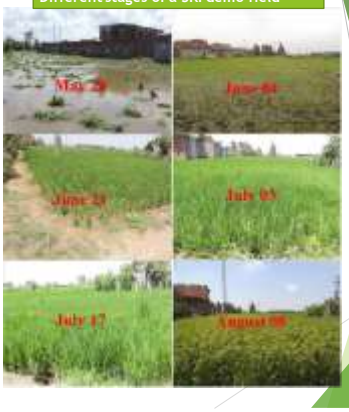
Operation hours for two pumps in the SRI-trial fields. 2015

Half-monthly water requirements based on WMRI. 2015



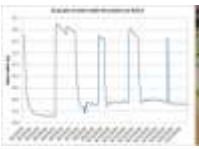
Trial in 2016

Different stages of a SRI demo field



Water depth

Water table changes during an irrigation event



Water table changes of a SRI field and location of the sensor

Rice water requirements

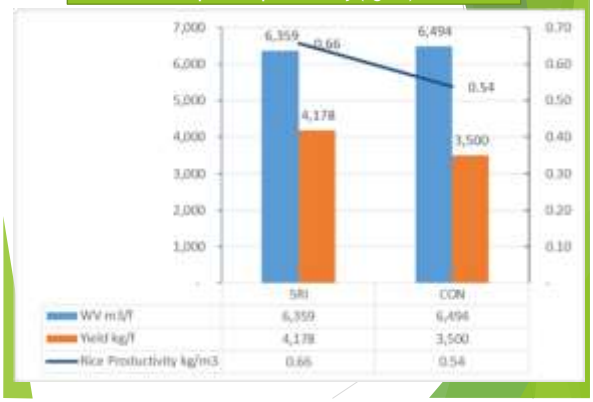
Volume of water applied, number of irrigations and total length of time for the SRI demos fields

	Volume of Water Applied (m³/feddan)		No. of Irrigations		Total Irrigation Time (h/feddan)		Average Irrigation Time (h/feddan)		Range of Irrigation Time (h/feddan)	
	Measured	Collected	Measured	Collected	Measured	Collected	Measured	Collected	Measured	Collected
SRI-F-1	6,592	5,949	30	30	74.3	68.2	2.47	2.27	0.14 - 4.8	0.4 - 4.9
SRI-F2	5,549	7,347	38	35	129.3	85.1	3.40	2.43	0.33 - 13.3	0.4 - 7.7

Irrigation efficiency of SRI and Conventional Technologies

Technology	Water applied m³/feddan	Rice water consumption m³/feddan	Irrigation efficiency (%)
SRI	6,359	3,517	55
Conventional	6,494	3,517	54

Crop water productivity (kg/m³)



SRI expert during a consultation meeting with cooperative farmers

Before and after SRI

No.	Conventional (traditional method)	SRI (new method)
1.	One type of seed is used. Seeds are usually collected from the previous growing season which leads to less productivity and more diseases.	Use of new rice varieties opens the possibility to increase productivity and improve crop sanitation (diseases). Seeds are purchased at the local agricultural market.
2.	Farmers are exclusively concentrated on cropping their own lands regardless of what is happening on neighboring farms. For example, adding fertilizers and organic matter without exchanging experiences.	After the SRI consultation meetings, farmers know about demonstration fields and are used to participate together around it and exchange their expertise during or at the end of the growing season.
3.	Farmers are not motivated for dealing with new technology and methods of rice cultivation.	Farmers are now cooperating together in using the new technology. For example, supply the tractor and equipment required for the laser levelling device.
4.	Farmers used to be harvesting of rice without their neighbors participation.	Farmers participate and share with neighbors and other farmers when harvesting. Sharing the amount of rice yielded at the same moment of harvesting is now part of a rice activity for farmers gathering.
5.	Preserving part of the grain yielded to be used as seeds during the next season.	Quality seeds are purchased at the local agricultural market and are used for one growing season only.

Farmers behaviour and positive attitudes when applying SRI

Meetings with farmers

Event	2014	2015	2016
Introductory and consultation meeting	✔	✔	✔
Field day on Nursery Preparation	✔	✔	✔
Field day on Transplanting	✔	✔	✔
Field day Middle of the growing season	✔	✔	✔
SRI Harvesting		✔	✔
Rice Festival	✔	✔	

Media events to promote SRI results

No.	Participants	Link	Date
1	SRI cooperative farmers, Dr. Eman Sayed	https://www.youtube.com/watch?v=nId8CLxII6s	19-Apr-2016
2	Dr. Eman Sayed	https://www.youtube.com/watch?v=k82ZhoWHiNQ&feature=youtube&app=desktop	12-May-2016
3	Dr. Saeed Soliman	https://www.youtube.com/watch?v=I1QmgzdLkuE	04-Jun-2016
4	Dr. Saeed Soliman	https://www.youtube.com/watch?v=Kf45EGybDYM	21-Aug-/2016
5	SRI cooperative farmers	https://www.youtube.com/watch?v=56s0G2o91_0	24-Aug-/2016
6	SRI Harvesting	www.youtube.com/watch?v=UZ_fJVSZXzA	6-Sep-2016
7	SRI Harvesting	https://www.youtube.com/watch?v=fYrtLHfbX_g	6-Sep-2016
8	Cooperative farmers	https://www.youtube.com/watch?v=FTmerkZZcwc	7-Sep-2016

TV programs with coverage of SRI activities

Media programs with coverage of SRI activities

SRI publications

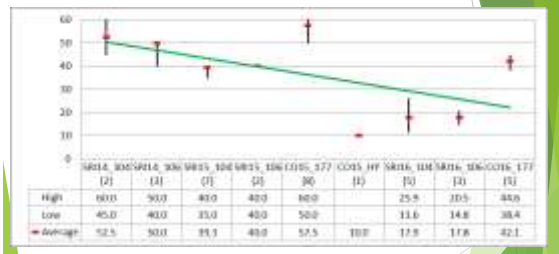
No.	Name	Description
1	SRI Flyer: Nursery Stage	Technical recommendations about the nursery site preparation and the treatment for the seeds before planting
2	SRI Flyer: Transplanting	Focuses on recommendations in how to develop the transplanting of the seedlings from nursery to final place of cultivation
3	SRI Flyer : Diseases	It contains information about the diseases that could attack rice fields and its control
4	Poster 1	Shows the results of the 2014 season of SRI
5	Poster 2	Sows the steps of SRI activity implementation
6	Technical Guide	It documents the steps for SRI cultivation
7	Concept Note	Main results and outputs of SRI during the 2014, 2015 and 2016 growing seasons are discussed

SRI cooperative farmers group discussions

Village	Trial farms	Nominal area		Measured	%
		Feddan	m^2	m^2	
Kafer Nekla	9	57	239,400	201,809	84
Kafer Kom El-Nasser	4	24.4	102,550	95,924	94
Kafer El-Bank	5	22.8	95,900	85,300	89
Total	18	104.3	437,850	383,033	87

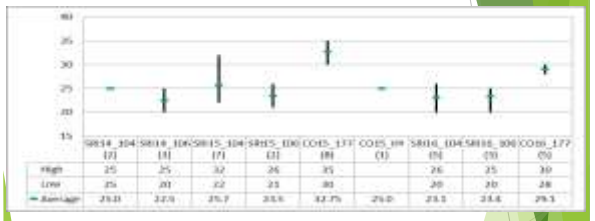
Nominal area sizes mentioned by the farmers and sizes measured on the basis of GPS coordinates at the farms in the villages of the SRI-trials

Economic Analysis

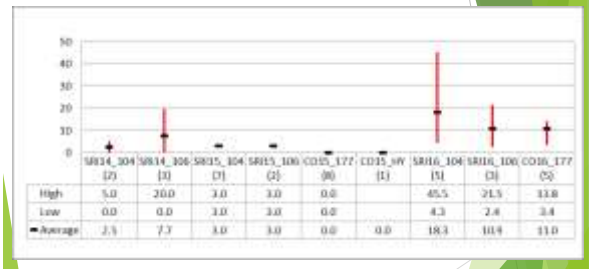


SRI = System of Rice Intensification; CO = Conventional; HY = high yielding variety; 14 = 2014, 15 = 2015, 16 = 2016; 104 = Sakha 104; 106 = Sakha 106; 177 = Giza 177; number in brackets = sample size

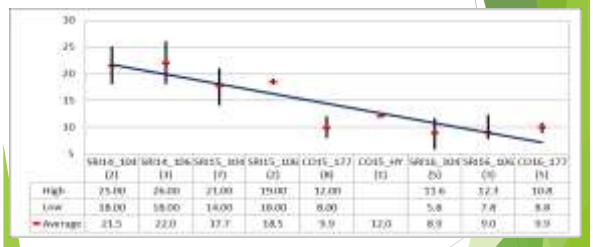
Seedling age at transplanting



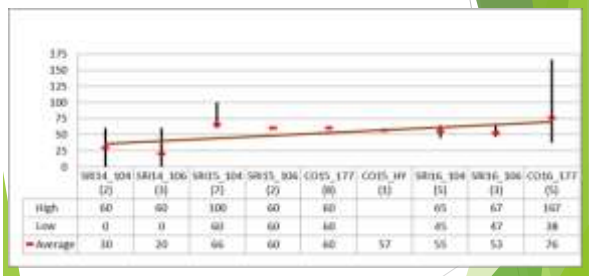
Organic fertilizer (m^3/feddan)



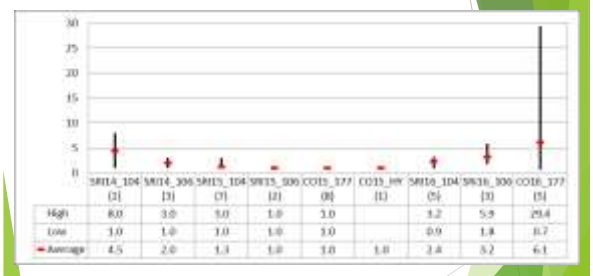
Transplanting (days/feddan)



Herbicide costs (LE/feddan)



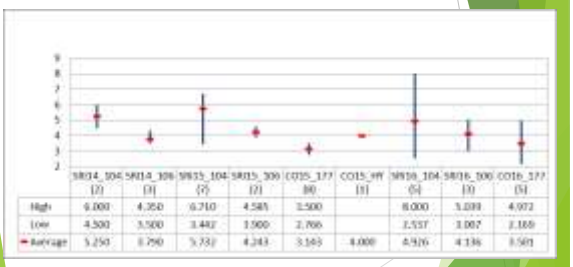
Weed control labour (hours/feddan)

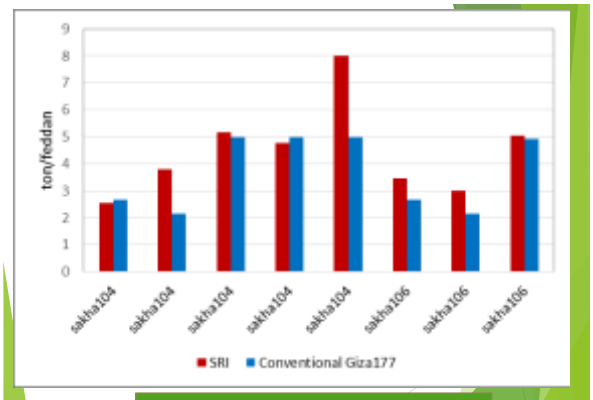


Irrigation costs

Production costs (LE/feddan)

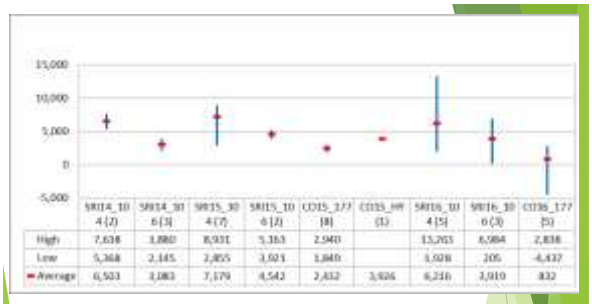
Rice yields (Tons/feddan)





SRI and conventional yields 2016 per plot

SRI profits



Conclusions

1. Rice yields with SRI are already high.

2. The overall high yields in the demo trials were related to the rice varieties Sakha 104 and Sakha 106 and the land levelling as they were uniform across the demo site.

3. The use of fewer seedlings per hill potentially allows considerable savings in seed and nursery costs and in water use during the nursery stage.

4. Water application was monitored in 2014 qualitatively, while it has been monitored much more accurate (i.e. quantitatively) in 2015 and 2016, providing more accurate data for water use and water productivity of the crops.

5. Reduction of water use in SRI can only be achieved in combination with continuous flow in the mesqa.

6. The socioeconomic and agronomic issues involved in water-saving irrigation in rice systems are still challenged.

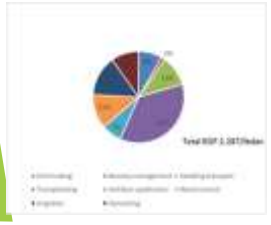
7. The economic survey of the 23 plots presented in this analysis suggests that paddy production with Sakha 104 and Sakha 106 according to SRI principles results in lower overall production costs, higher yields and better profits as compared to conventional paddy production with Giza 177.

8. General Successes that can be concluded from the SRI experience are:

- The adoption of SRI by some farmers who come from areas outside of the Project's geographical coverage area.
- Greater yields of rice led to more income and improved the standard of living. For example: a farmer from Kom El-Nasr mentioned that after getting the revenue from the extra yield, he was able to enter water pipes into his home. Another farmer said that before using SRI, his land was not fertile enough for cultivation.
- Some farmers emerged as SRI leaders to whom other farmers can go to for advice/guidance.

Recommendations

Labor cost rice cultivation (average SRI and Conventional Technology)



Labour use rice cultivation (average SRI and Conventional Technology)

Transplanting machine used in Korea

Rice straw baler

Hand tool for weed control of rice

1. SRI was not expected to be the main activity within the EWRMP pilots, however three consecutive years (2014 -2016) of good results showed SRI to be the most successful story for local farmers.
2. SRI technology showed consistently increasing rice yields in an average of 15-24% in comparison to traditional rice cultivation. Management of nursery, increase distance among hills, reduce the number of seedlings per hill, use of local available organic matter, identification of promising rice varieties were the main factors detected in making the difference.
3. Increasing rice yields with SRI open the possibility to increase profits and improve social economic conditions for farmers and their families.
4. It seems the potential for saving water with SRI cultivation exists, however this means more efforts in terms of coordination between farmers and irrigation district that allows proper operation of pumps and irrigation scheduling based on crop water needs criteria.
5. SRI success with rice yields and productivity opened the possibility for the promotion of the technology with a good media coverage with different written articles, alive TV and radio interviews and others

Policy Implications from EWRMP

1. SRI efforts should be shared at high, medium and local level conjointly between the MWRI and Ministry of Agriculture and also with official national and international (and private if any) research institutions regarding rice cultivation.

2. Looking for alternatives for making less heavy the hard work with rice cultivation, focus could be in the use of transplanting commercial machines already available in the international rice markets. The above possibility may present the opportunity to decrease transplanting cost.

3. It is clear that burning rice crop residues contributes to CO_2 emissions. At this point improved machinery such as the rice straw baler machine could help to reduce emissions.

Suggestions for the future based on the EWRMP work

- **SRI needs a special focus on saving water as a priority for coming season if any.**
- SRI requires additional support to realise full potential of its benefits, and this may imply integrating the continuous flow and controlled drainage practices to look for water savings, thus increasing crop per drop.
- **SRI results so far support the preparation of the coming agriculture plans specifically regarding identification of rice productive varieties and modifying some conventional rice practices.**


Many thanks
for your attention