Rice seedbed during the dry season. (Christoph Kaufmann (Centre for Development and Environment CDE))

Adapted System of Rice Intensification (SRI) principles in Kampong Chhnang (Cambodia)

(Khmer)

DESCRIPTION

Some points of the System of Rice Intensification (SRI) technology, like the row transplanting of young seedlings and the use of compost are adapted and applied in Kampong Chhnang.

The System of Rice Intensification (SRI) was developed in the 1980s in Madagascar, where a French monk worked together with local farmers. The goals of the project were the improvement of the livelihoods of local farmers and the establishment of a farming system that is self-sufficient and thus needs no external inputs. SRI is not a recipe to be followed step by step, but general ideas that need to be adapted to the local conditions. These basic ideas are the following:
- Early transplanting of the seedlings, at the two-leaves-stage (less than 15 days after sowing). At this stage, the plant still has the potential to make a lot of tillers, and develop a strong root system. The seedlings are transplanted carefully, so the plant doesn't suffer a transplanting shock.
- Wide spacing of single seedlings, usually in squares. The recommended spacing goes from 25 to 50 cm, depending on the soil fertility. This transplanting technique reduces the concurrence between the rice plants and allows the land user easier weeding.
- Aerating the soil. Rice is produced in standing water, but grows better if the roots are aerated. This is usually done with weeding, and additionally either by alternately flooding and letting the soil dry out, or by draining the water regularly. - The soil is fed with compost or manure in order to enhance the fertility and improve the soil structure.
SRI induces changes in deeply rooted local habits with some counter-intuitive knowledge like that more seeds do not produce more yields. Thus the methods have to be adapted locally and yields monitored to fit to other areas.

In Kampong Chhnang, the rice is transplanted at the six-leaves-stage, which is still earlier than conventional transplanting, with spacing of about 15 to 20 cm.

In Kampong Chhnang, the labour availability is low, as many young people work abroad or in the garment industry. Thus the SRI principles, which were taught by an NGO in 2004, were not followed completely, but adapted to this major constraint. The use of very young seedlings requires careful transplanting, which takes time. Thus the seedlings are transplanted at the 6 leaves stage. Due to the low soil fertility in the area, the optimal spacing as tested by CARDI (Cambodian Agricultural Research and Development Institute), was about 20 by 20 cm.

The rice seeds are soaked in water for 24 hours, and then let to germinate in a hot and humid place for two days. Then they are sown on the seed bed, which is prepared with compost. As there is not enough compost available for all the fields, the seedbed is the only place where compost is applied. In the fields chemical fertilizer is used. The seedlings are transplanted after 20 to 25 days (5-6 leaves) single or two per hill, in rows 15 to 20 cm apart. They are transplanted in better levelled fields than conventional transplanting, to allow the use of less water, as the seedlings are smaller than conventional. Otherwise the water management is the same as conventional; due to the lack of labour availability, the fields are not drained as proposed by the NGO 10 years ago. The field is weeded with hoes. The rice is harvested after 85 % of the panicle turned yellow, thus obtaining the best quality.

The analysed area is flat (slope < 2%), with a tropical climate (dry season from November to May and wet season from June to October), and the soils are mostly sandy or loamy. The soil has a low fertility, contains little organic matter, and acidifies. The area has been deforested a long time ago, and the groundwater table is rather high (1-2 m during the dry season, on the surface during wet season).
Due to climate change, farmers notice more erratic rainfalls, temperature rises and more

LOCATION

Location: Cher Kroev, Kampong Chhnang, Cambodia

No. of Technology sites analysed:

Geo-reference of selected sites
- n.a.

Spread of the Technology: evenly spread over an area (approx. 10-100 km2)

In a permanently protected area?:

Date of implementation: 10-50 years ago

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☑ through projects/ external interventions

recurrent droughts. Rice is the predominant crop grown in the area, since it serves as staple food (mix subsistence and commercial activities).

The increasing migration rate (the young generation leaves the villages to work in the cities, garment industry or abroad) results in a decrease of available labour force in the area which has detrimental effects on the agricultural activities. Furthermore, the civil war in the 1970s (Khmer Rouge) led to the loss of agricultural knowledge which different NGOs try to re-establish.

Compost House. (Christoph Kaufmann (Centre for Development and Environment))

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [ ] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [ ] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Cropland

- Annual cropping

Number of growing seasons per year: 1

Water supply

- [ ] rainfed
- [x] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [x] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion), Ca: acidification

SLM group

- integrated soil fertility management

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility

TECHNICAL DRAWING

Technical specifications

Cambodia
Date: 25.10.2011

Technical knowledge required for field staff / advisors: high
Technical knowledge required for land users: moderate
Main technical functions: increase in nutrient availability (supply, recycling,...)
Secondary technical functions: increase in organic matter

Better crop cover
Material/ species: Rice
Remarks: Single or 2 young rice seedlings per hill, in rows, space 15-20 cm

Manure / compost / residues
Material/ species: 2 – 3 t of compost for the seed bed (0.25 ha, transplanted on 1 ha), 75 kg/ha after transplanting.
Quantity/ density: 2-3 t

Author: Luy Pisey Rith, Oxfam America, #94, Russian Boulevard, Sangkat Teuk Laak I, Khan Toul Kork, Phnom Penh, Cambodia

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **n.a.**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: 4.50

Most important factors affecting the costs

The factor affecting the costs the most is the labour. SRI is labour intensive; the farmer needs twice as much time for a SRI field than for a conventional field. This is the reason he makes only a few of the steps he was taught 10 years ago by SOFDEC.

Establishment activities

n.a.

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (n.a.)	Total costs per input (n.a.)	% of costs borne by land users
Equipment					
Compost house		1.0	15.0	15.0	33.0
Total costs for establishment of the Technology				**15.0**	
Total costs for establishment of the Technology in USD				*15.0*	

Maintenance activities

1. Ploughing the seed bed (either part of the paddy fields or different field) (Timing/ frequency: 1 / year)
2. Put seeds 24 hours in water (Timing/ frequency: 1 / year)
3. Cover the seeds in a warm place for incubation until they sprout (approximately 2 days, temperatures between 37-40 °C), plant the seedlings in seed bed and let them grow for about 20 - 25 days (Timing/ frequency: 1 / year)
4. Ploughing of rice paddy field (Timing/ frequency: 2 / year)
5. Pull the seedling from seed bed, row transplanting of young rice seedlings (20-25 days): 1-2 seedlings per hill, not too deep into the soil, in 1-2 cm of water. (Timing/ frequency: 1 / year)
6. Add chemical fertilizer to the paddy fields (20 days after transplanting) (Timing/ frequency: 1 / year)
7. Weed control (easier because of row transplanting), done manually (Timing/ frequency: 2 / year)
8. Harvest rice manually when plant is 85% mature. (Timing/ frequency: 1 / year)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (n.a.)	Total costs per input (n.a.)	% of costs borne by land users
Labour					
labour	ha	1.0	228.0	228.0	100.0
Equipment					
animal traction	ha	1.0	56.0	56.0	100.0
Plant material					
seeds	ha	1.0	15.0	15.0	100.0
Fertilizers and biocides					
fertilizer	ha	1.0	55.0	55.0	100.0
compost/manure	ha	1.0	10.0	10.0	100.0
Total costs for maintenance of the Technology				**364.0**	
Total costs for maintenance of the Technology in USD				*364.0*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [x] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
1486.45 mm 2013 in Kampong Chhnang
Thermal climate class: tropics. 27-35°C

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth
- [x] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [ ] medium
- [x] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Ja
- [ ] Nee

Occurrence of flooding
- [ ] Ja
- [ ] Nee

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [x] manual work
- [x] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [x] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [x] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [x] individual

Water use rights
- [x] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓	good
education	poor	✓	good
technical assistance	poor	✓	good

employment (e.g. off-farm)	poor ✓ good	
markets	poor ✓ good	
energy	poor ✓ good	
roads and transport	poor ✓ good	
drinking water and sanitation	poor ✓ good	
financial services	poor ✓ good	

IMPACTS

Socio-economic impacts

Crop production	decreased ✓ increased	Around 20% more yields
risk of production failure	increased ✓ decreased	Seedbed can be irrigated
demand for irrigation water	increased ✓ decreased	The seedbed is smaller, so less irrigation is needed in the beginning of the rainy season/dry spell
expenses on agricultural inputs	increased ✓ decreased	Used half the amount of seeds
farm income	decreased ✓ increased	
workload	increased ✓ decreased	

Socio-cultural impacts

food security/ self-sufficiency	reduced ✓ improved	Crop is more tolerant to droughts. He uses less chemical fertilizer since he uses compost
SLM/ land degradation knowledge	reduced ✓ improved	Knowledge about composting
conflict mitigation	worsened ✓ improved	
contribution to human well-being	decreased ✓ increased	SRI increased the rice yields and reduces the use of seeds.

Ecological impacts

soil organic matter/ below ground C	decreased ✓ increased	Compost only used in seedbed

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative ✓ very positive	
Long-term returns	very negative ✓ very positive	

Benefits compared with maintenance costs

Short-term returns	very negative ✓ very positive	
Long-term returns	very negative ✓ very positive	

The building of the compost house (only establishment cost) was subsidized, so he had to pay only 5 $ to build it. On the long term the addition of compost is very positive for the soil fertility.

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all very well	Answer: not known

Climate-related extremes (disasters)

local rainstorm	not well at all ✓ very well	
local windstorm	not well at all very well	Answer: not known
drought	not well at all ✓ very well	
general (river) flood	not well at all ✓ very well	

Other climate-related consequences

reduced growing period	not well at all very well	Answer: not known

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ☐ single cases/ experimental
- ☐ 1-10%
- ☐ 11-50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- ☐ 0-10%
- ☑ 11-50%
- ☐ 51-90%

- [ ] > 50%
- [ ] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Ja
- [ ] Nee

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Improved soil structure and fertility due to the compost addition.

Strengths: compiler's or other key resource person's view

- Improved yields (ca. 20%)
- Better price possible if he applied SRI without chemical fertilizer and if he sold the yield on the organic market.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- The seedlings have to be treated with care. More yields, less dependent on off-farm income.
- Increases the workload. Change the local agriculture to more perennials and animals to produce more organic matter (shift toward integrated farming).
- SRI needs more compost than is available.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- The fields are always flooded, thus there are anaerobic conditions in the root area. Either, the water can be drained before the rain, or the fields can alternatively be dried out and flooded.
- The seedlings are much older at the 6 leaves stage than recommended by SRI. Experiment with transplanting of younger seedlings.

REFERENCES

Compiler
Christoph Kaufmann

Editors

Reviewer
Deborah Niggli
Alexandra Gavilano

Date of documentation: Okt. 16, 2014

Last update: Maart 11, 2019

Resource persons
Stefan Graf - SLM specialist
Lean Hak Khun - SLM specialist
Christoph Kaufmann - SLM specialist
Mesa Say - SLM specialist
Sreytouch Bin - SLM specialist
Khonhel Pith - SLM specialist

Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1224/

Linked SLM data
Approaches: Model farmer https://qcat.wocat.net/af/wocat/approaches/view/approaches_2498/

Documentation was faciliated by

Institution
- Local Agricultural Research and Extension Centre (LAREC) - Cambodia
- Society for Community Development in Cambodia (SOFDEC) - Cambodia

Project
- n.a.

Key references
- List of documentation about SRI in English: http://sri.ciifad.cornell.edu/extmats/index.html#english (free)