Inside Asia's Rice Revolution

An innovative rice-growing technique, known as the 'System of Rice Intensification' (SRI), is being steadily taken up by farmers across Asia because of its claims to significantly reduce water use, produce higher yields and endow farms with associated environmental benefits. But differing perceptions of the management, risk and verification of the technique are at the core of a widening international argument over whether SRI really has the radical advantages over the traditional flooded-field style of rice cultivation. **Richard Mogg** reports.

A rice farmer checks his SRI seedlings. Despite conjecture, there has been an appreciable increase in the numbers of rice farmers across Asia adopting the SRI method. Vicky Bennett

The Jesuit priest and agricultural engineer Father Henri de Laulanié de Sainte Croix is credited with developing the SRI technique in Madagascar during the 1980s. Originally from Poitou, France, de Laulanié spent the last 34 years of his energy on the improvement of farming technology and the alleviation of poverty across the small agrarian nation. Acceptance of his technique is now spreading throughout the poorer countries of Asia, Africa and South America, with wide endorsement from farmers in Cambodia and China.

A central element of SRI is that rice seedlings are not propagated in a continuously flooded field. Only one seedling is planted per 'hill', in a wide, square-grid pattern in good quality soil, which is kept moist but not wet, and with enough organic material to support increasing biological activity. Well-tended, rich soil is the basis of good SRI productivity, and the wide spacing avoids competition, encouraging larger root and canopy growth.

Seedlings are transplanted much younger than usual – before the start of their fourth growth phase (phyllochron), when the plant still has only two leaves. The exact timing normally varies between 14 and 18 days, according to climatic and other conditions, and the seedlings must be very delicately handled to avoid trauma when transplanted. This deft handling, important at all early stages, takes time to learn.

Careful weeding, too, is necessary several times in the SRI plant growth cycle, as the rice plants apparently grow faster in fields that are not kept flooded. This starts by the tenth or twelfth day subsequent to transplanting, and is preferred to take place three or four times before the canopy closes.

In contrast to the traditional flooded technique, only a little water is applied to the SRI plant during the vegetative growth period, and then only a thin layer is maintained on the field during the flowering and grain filling stage. As an alternative, to economise on labour, fields may be flooded and drained in a 3–5 day cycle. Best water management practice depends on soil type, labour availability and other factors. SRI farmers are encouraged to develop their own water management cycles to

maintain moist but well-drained soil – with the accent on economic use of the increasingly precious stuff.

For nutrients, chemical fertiliser is better than none at all; but natural compost is much preferred, according to the US-based Cornell International Institute for Food, Agriculture and Development (CIIFAD), and Cambodia's Centre d'Étude et de Développement Agricole Cambodgien (CEDAC), two of SRI's most authoritative proponents. CIIFAD reports that many farmers get the best results by spreading compost on the intermediate season crop of potatoes, beans or other vegetables. The subsequent rice crop benefits from the residual fertility.

Along with the cost advantages of this composting alternative, leading to reduced commercial fertiliser use, a particularly appealing feature of the SRI technique for the farmer is that the cultivation cycle is shorter than the traditional one, radically improving the cost-benefit financial pattern. General debate about the effectiveness of Father de Laulanié's technique, however, has now engaged wider authorities.

Take-up generates mainstream debate

Although interest is widening in diverse academic as well as business sectors, agricultural scientists did not take SRI seriously for a long time. Father de Laulanié only ever published one article on SRI in his lifetime[1], but argument about this new method of rice cultivation began with Asian agricultural scientists, and moved squarely into the international arena last year with the publication of countervailing arguments by two eminent agricultural academics.[2]

Dr Norman Uphoff, Director of CIIFAD, asserts that SRI responds to twenty-first century needs. But the University of Florida's Dr Thomas Sinclair, who is also a plant physiologist in the Agricultural Research Service of the US Department of Agriculture (USDA), is adamant that there are no shortcuts to increasing crop yields.

In his recent article in the industry journal, *Rice Today*, Dr Sinclair gives a jocular twist to the argument: 'Regrettably, SRI appears to be only the latest in a family of unconfirmed field observations (UFOs) that have several features in common with their space UFO cousins.' More seriously, Dr Sinclair contends that three components of current SRI strategy run directly counter to well-established principles for high crop growth. 'These principles were developed over many years of careful testing and scrutiny by scientists world-wide, and they have stood the test of time.'

The faulty SRI components are defined. 'SRI suffers from poor light interception because of low plant densities,' Dr Sinclair claims. 'High plant density enhances light interception, growth and yield.' Secondly, the USDA scientist explains, 'Ample water maximises rice yields, and flooded fields assure no water limitations develop.'

Dr Sinclair also believes that it is a mistake to emphasise organic nutrients to the exclusion of mineral fertiliser, particularly in terms of crucial nitrogen levels. 'Such a monumental demand for organic matter creates

1 de Laulanié, H. (1993). Le système de riziculture intensive malgache. *Tropicultura* (Brussels), 11:110-114. (In French. English translation available).
2 Uphoff, N. (2004) System of rice intensification responds to 21st century needs. *Rice Today*, July–September.

Above: Baobab trees set an imposing backdrop to SRI rice fields in Madagascar. Muriel Lasure

Left: Dragon's Backbone rice terraces in Pingan, Longsheng County, China. Rice cultivation is environmentally intense. SRI proponents say it reduces farmers' effects on ecosystems and people. Tomasz Resiak

Rice planters in East Timor. SRI is gaining favour as the country moves to strengthen its economy.
Eric McGaw / ACIAR

huge challenges in sourcing, handling and managing these materials.'

Others, too, are joining the now-global debate. Some agricultural commentators argue that SRI is particularly suitable for Asia and could become the desired practice in areas where high-iron content soil is prevalent, as in much of Cambodia. Yet this factor alone could skew data on the favourable results achieved in SRI development by Dr Yang Saing Koma and his colleagues at CEDAC. Dr Koma is almost certainly the most eminent of SRI proponents in Asia, and he believes his practical experience bears him out.

SRI is now officially recognised by Cambodia's Ministry of Agriculture Fisheries and Food as suitable for rice production. On the questioning of labour and productivity benefits, Dr Koma states, 'No! There might be labour increases, but there are more management skills. But if there is an increase in labour, the productivity increase is much higher than the labour increase.'

Grahame Hunter, however, director of three Australian-funded (AusAID) agricultural development agencies in Cambodia, is not so sure: 'The jury is still out on this one,' he believes. 'Claims of large production differences are just not realistic.'

An Australian agronomist, Mr Hunter is director of the Phnom Penh-based Agricultural Quality Improvement Project (AQUIP).[3] He asserts, 'SRI is a high-risk technology; it is too high for Cambodia.' In his opinion, the conventional flooded-field system is more resilient to damage and loss than SRI, in terms of both agriculture and economy. Mr Hunter does not entirely dismiss SRI, but wants more verifiable scientific proof to support the claims made for it.

Currently, only about 10 per cent of Cambodia's rice farming has managed irrigation, although the government is giving high priority to increasing the managed area with a view to launching a second annual rice crop. Australian rice cultivation, in contrast, treats water management as a high art, according to Mr Hunter. In fact, he points out, Australian farms already perform a highly mechanised version of SRI: 'So much management goes into an Australian rice crop,' he says.

Rapid growth for farmers

Dr Koma explains how CEDAC development of SRI is expanding in Cambodia: 'There were around 17 000 farmers in 2004 and the area is about 5000 ha, which is very small if compared to the total rice cultivated area of the country (around two million ha). But it will grow very fast. In 2000 there were only 28 farmers. In 2006 we expect to have around 50 000 farmers. If there is good support for SRI extension, we expect SRI will reach millions of farmers in the next five to 10 years.'

For its 'Project on Global Marketing Partnership for SRI', CEDAC was jointly given the prestigious International SEED (Supporting Entrepreneur for Environment and Development) award, with the CIIFAD and farmers' organisations in Madagascar and Sri Lanka. The SEED competition, governed by IUCN, UNDP and UNEP (and working closely with the German Federal Ministry for Environment, the United States' government, and the UK and Norwegian environment ministries), aims to find the most promising, new, locally driven entrepreneurial partnerships in sustainable development. In 2005, five finalists were selected out of 260 submissions from 1200 organisations in 66 countries. This represents strong endorsement of CEDAC SRI work.

CEDAC is also at the forefront of the battle to control the widespread and health-threatening misuse of artificial pesticides, said to cost small Cambodian rice farmers over US$5 million annually. Since 1999, supported by Oxfam, Dr Koma and his staff have been educating farmers that SRI technology does not need pesticides. An important collateral benefit is that there will be less illness caused by over-use of commercial pesticides and other chemicals.

CEDAC's 2004 evaluation, tracking the experience of 120 farmers who have been using the SRI method for three years, is revealing. In that time, the average area under SRI, per farmer, has risen from 0.11 ha to 0.47 ha, while their rice area has remained constant, with conventional rice cultivation dwindling from 1.38 ha, prior to starting SRI, to 0.93 ha in 2003. Even with less than full adoption of SRI, gross household income has risen from 460 700 riels/ha (US$1 = 4000 riels approximately) to 869 800 riels/ha, with SRI yields averaging 2.75 t/ha, compared to 1.34 t/ha with conventional planting.

Compost use has burgeoned from 942 kg/ha to 2100 kg/ha, while chemical fertiliser usage fell dramatically to 67 kg/ha, from 116 kg/ha. The number of households using chemical pesticides fell from 35 to seven in 2003.

Meanwhile production costs fell to 113 140 riels/ha in 2003, from 231 300 riels/ha previously. With rising income and falling production costs, the gross margin per household rose from 499 900 riels to 879 800 riels, while farmers were still using only 40 per cent of their land for SRI production.

3 Grahame Hunter is also director of the Cambodia-Australia Agricultural Extension Project (CAAEP), and the Cambodia Agricultural Research and Development Institute (CARDI).

Constraints on SRI adoption, CEDAC points out, are similar to those affecting traditional rice farming and production everywhere. The Cambodian farmer still has to deal with flood, drought, insects, diseases and weeds. Distances of rice fields from home and lack of biomass for composting are just some of the problems. Another limiting factor is the lack of coordinated water management. Nevertheless, 80 per cent of the farmers in the CEDAC sample group said that they expected to expand their area under SRI, and 70 per cent stated that they intended to adopt an increasing level of SRI practice.

In terms of efficiency and economy, around 55 per cent of farmers sampled by CEDAC considered the SRI technology easier to practice than the traditional method. Some 75 per cent agreed to intensify and broaden their farming system to grow more trees, raise animals and increase the use of compost. The aim is to utilise land, labour, water and capital freed from rice production to increase efficiency and productivity. The CEDAC evaluation indicates a crucial need for a comprehensive relaunch and revitalisation of the Cambodian national agricultural sector.

An important factor in SRI acceptance is its adaptability; practices may be selected for implementation, then new practices brought into play as the farmer's confidence increases with experience. A continuous dialogue between CEDAC and participating farmers enhances feedback. Through a gradual, practical learning process, it takes several years for a farmer to become fully skilled in SRI practices, especially in handling young seedlings and careful, quick transplanting.

Dr Koma is optimistic that, within five to 10 years, the majority of rice farmers in Cambodia (around 1.7 million households are engaged in rice farming) will participate in the SRI movement.

Benefits asserted by trial and training

CEDAC's success in winning the SEED award is encouraging other countries in South-east Asia, and beyond, to take a close look at SRI. Cambodia and Sri Lanka, as well as Madagascar, are way ahead with introduction of the new technology. The Peoples Republic of China (PRC) has become a powerful promoter since evaluating it in 1999 and 2000, even developing a variant called 3-S that grows well in the cold climate of northern provinces, such as Heilungliong.

China's Ministry of Agriculture supports ongoing evaluation of SRI by the China National Rice Research Institute, the China National Hybrid Rice Research and Development Centre, and the Sichuan Academy of Agricultural Sciences, in association with CIIFAD. Nanjing Agricultural University, too, has been conducting an SRI evaluation program since 1999. Another version of SRI was independently developed at China's Northeastern Agricultural University between 1994 and 1999.

Mr Hunter and a quorum of his agricultural colleagues in Phnom Penh are considering the coordination of an informal group to scientifically collate the pros and cons of SRI. He defines the core difficulty: 'SRI is good practice, but it puts the farmer at risk.' The risk, in Mr Hunter's view, comes from the higher level of technology and management required by SRI farming.

Dr Koma is more confident: 'I am not sure about other countries, but for Cambodia I am sure that it will be dominant, at least for shallow and medium fields, which is more than 50 per cent of the country's area of rice cultivation.'

The results of various performance trials of SRI seem to have given different results. Regional soil and technique differences appear to affect yield success. CSIRO

According to Dr Sinclair, meanwhile, an international team has already shown, from both theoretical evaluations and a number of experimental tests using a classical scientific approach, that SRI offers no yield advantage. These results were published in *Field Crop Research* (2004), an international journal that requires anonymous reviews. Dr Uphoff from CIIFAD, on the other hand, contends that field tests of SRI across 22 districts in Andhra Pradesh, India, were highly successful, except in soils afflicted by salinity.

Strong interest, therefore, persists today in the SRI debate one year following the appearance of opposing arguments in *Rice Today*. Comparative academic research, based on formal observation and independent peer review, to test the claims made for SRI today, is still too sparse. One essential aspect must not be overlooked: in poor, lesser developed countries, such as Cambodia, the growing of rice is elemental to both society and economy, and age-old practices tend to endure unless there are no worthy alternatives.

Traditional agriculture today, moreover, has become acutely sensitive to unrealistic commercial distortion. Poor as they are, the Cambodian farmers and their brethren in the other developing Asian countries are aware of the heavy pressure they are under to embrace the use of modern products such as chemical fertilisers and insecticides. Might the holistic style of management inherent in SRI be just the right sort of simple, but revolutionary technology to cause the launch of badly needed, and environmentally sustainable agricultural reform?

● **Richard Mogg** is a Bangkok correspondent.

More information:
About SRI: http://ciifad.cornell.edu/sri
CIIFAD: http://ciifad.cornell.edu
The SEED Awards: www.seedawards.org

Contacts:
Dr Yang Saing Koma, Director, CEDAC, yskoma@online.com.kh
Dr Norman Uphoff, Director, CIIFAD, ntu1@cornell.edu