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A Systemic Review of System of Rice Intensification Journey and System of Crop Intensification Development in the Rice Sector of Viet Nam

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Abstract

Started in Viet Nam in 2003 and was piloted in small areas via the demonstration fields in four provinces in northern Viet Nam, Systematic Rice Intensification (SRI) has proven its agronomic, economic, and environmental benefits and thus has been promoted widely in Viet Nam for almost two decades to almost 50 rice production landscapes that helped to improve livelihood for more than one million of smallholder farmers; reduced water irrigation by 40%; production cost of 32% and increased yield by 13-29% as compared to the conventional practices during the period of 2010- 2015. Viet Nam has been recognized as the world's third largest rice exporter (Department Crop Production of Vietnam, 2021), given almost 80% of agricultural land for rice cultivation (IRRI Online) and mobilization of advanced farming practices among other efforts. Overtime, key principles of SRI have been further developed and refined to be ecological-based suitable and enhance multi-dimensions efficacy. Mobilizing the combination of both literature review and primary data, this paper reviews the key milestones and results of SRI over the past two decades in VN; and makes a systematic review of the transition from SRI to System Crop Intensification (SCI) that are more relevant and pragmatic to the rice farming practices in different eco-systems and market needs in Viet Nam. A case study of the AgResults Vietnam Emissions Reduction Challenges Project (AVERP) showcases the sophisticated and innovative development of key principles of SRI to ecological and market-based SCI for sustainable and low carbon rice cultivation as well as the readiness of the roles of private sector in technology transferring and scaling those SCI to almost 48,000 smallholder rice farmers of 89 Co-ops over four (04) cropping season in Thai Binh province of Viet Nam.

Keywords: Systematic Rice Intensification (SRI); Systematic Crop Intensification (SCI); SRI in Viet Nam; AgResults low-carbon rice cultivation in Viet Nam.

Rice Production Context in Viet Nam

Rice production is central to Vietnamese culture, food security, poverty reduction and socio-economic development. Over the last 30 years, Viet Nam has made tremendous gains in increasing productivity to address food insecurity - average rice yields now trail only China, and it is now among the most food-available Middle-Income Countries (MIC) globally.[1] As the country has opened up to investment, trade and export markets, the country has become the third-largest global producer and exporter of rice.

Viet Nam is recognised as one of the country's most vulnerable to the impacts of climate change due to the large number of people living in low-lying coastal and delta regions, many of whom are directly dependent on land and agriculture as a primary livelihood strategy and source of income. Viet Nam's Mekong River Delta (MRD) is one of the world's most climate-vulnerable landscapes, already and expected to be increasingly impacted by water shortages, droughts, rising sea levels, and saline intrusion. Yet it is also Viet Nam's, and one of the world's most important rice baskets – where 90% of Viet Nam's rice for export is grown. There is an urgent need for a wide-scale transition to climate-resilient production in the MRD.

At the same time, Viet Nam is rapidly developing and, on the way, to becoming a Middle Income Country. As such, the country is expected to, and has made, ambitious climate mitigation commitments. Agriculture is now the third largest sector contributing to climate change, with around half of GHG emissions resulting from rice production. Therefore, reducing GHG emissions from rice production is a key priority for the agriculture sector.

Viet Nam's rice production is characterised by intensive production by millions of SHFs with high yields for low-value export markets. Very thin margins have meant that many rice farmers remain perilously positioned at just above the poverty line and vulnerable to commodity price shocks in global markets. The Covid-19 pandemic has severely impacted agricultural supply chains and demonstrated the vulnerability of SHFs to such global shocks. As Viet Nam rapidly develops to become a MIC, the costs of land and living rise, as do inequalities. Farmers need to increase their profit margins to remain above the poverty line. There is a need for the rice sector to shift to higher-value markets.

For all the above reasons, the Vietnamese rice sector urgently needs to transition towards low-carbon sustainable, and climate-resilient production practices. It started in Viet Nam in 2003 and was piloted in small areas via the demonstration fields in four provinces in northern Viet Nam; Systematic Rice Intensification (SRI) has proven its agronomic, economic, and environmental benefits and thus has been promoted widely in Viet Nam for almost two decades to almost 50 rice production landscapes that helped to improve livelihood for smallholder farmers; reduced water irrigation by 40%; production cost of 32% and increased yield by 13-29% as compared to the conventional practices during the period of 2010- 2015. Overtime, key principles of SRI have been further developed and refined to be ecological-based suitable and enhance multi-dimensions efficacy. Mobilizing the combination of both literature review and primary data, this paper reviews the key milestones and results of SRI over the past two decades in VN; and makes a systematic technical review of the transition from SRI to System Crop Intensification (SCI) that are more relevant and pragmatic to the rice farming practices in different eco-systems in Viet Nam. A case study of the AgResults Vietnam Emissions Reduction Challenges Project (AVERP) showcases the sophisticated and innovative development of the key principles of SRI to ecological and market-based SCI for low-carbon and sustainable rice cultivation as well as the readiness of the roles of the private sector in technology transferring and scaling those SCI to almost 48,000 smallholder rice farmers of 89 Co-ops over four (04) cropping season in Thai Binh province of Viet Nam.

Review of SRI application and results in Viet Nam and Transitions to System Crop Intensification: A Case Study of AgResults Viet Nam Emissions Challenges Project Body of paper

Introduction

Started in Viet Nam in 2003; SRI was piloted in small areas via the demonstration fields in four provinces in northern Viet Nam. With proven records of enhancing yield, reducing seed/fertilizer, water irrigation, and pesticide while increasing yield, since 2007, SRI has been promoted for wide-uptake in almost 50 rice production landscapes in Viet Nam; and received notable recognition for its efficacy and contributions to the realization of key development policy for sustainable agriculture development of Viet Nam. **Figure 1** below shows key milestones and a hallmark of the Government of Viet Nam's formal acknowledgement of SRI as an advanced rice farming tool for nationwide take in Viet Nam.

Methods

Mobilizing the combination of both literature review and primary data, this paper reviews the key milestones and results of SRI over the past two decades in VN; and makes a systematic review of the transition from SRI to System Crop Intensification (SCI) that are more relevant and pragmatic to the rice farming practices in different eco-systems and market needs in Viet Nam.

Results

Consolidated Results of Application of SRI in Viet Nam 2003-2015

Over decades, the application of SRI to rice production consistently delivers significant benefits in terms of agronomic, economic, social, and environment. These are critically important in the context of the proven thin margin for rice farmers, degradation of soil health, and adverse phenomena of climate change. **Table 1** below shows concrete records and a wide range of benefits that the application of SRI provided to millions of rice growers in Viet Nam.

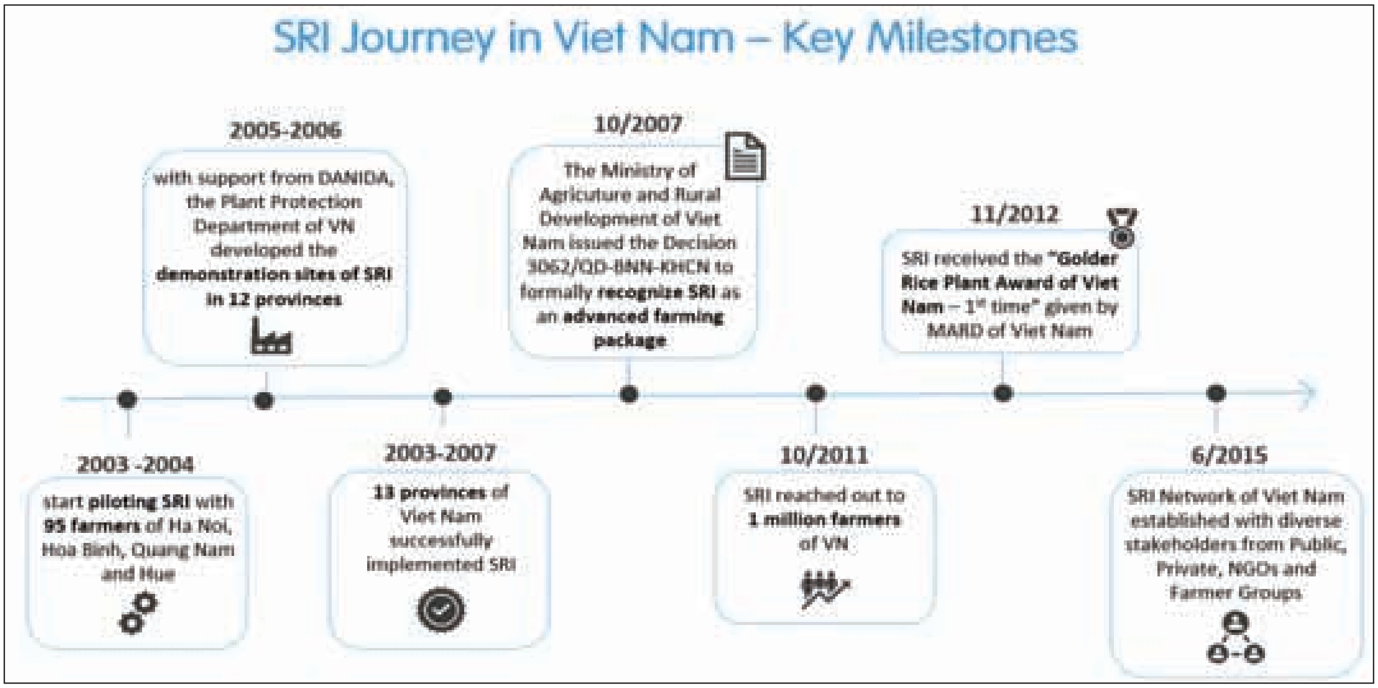

Figure 1: SRI Journey in Viet Nam 2003 – 2015

Table 1. Efficacy of SRI application to rice production in Viet Nam

Efficacies of SRI	Increase	Efficacies of SRI	Decrease
Yield	8-25%	Seed	90%
Production efficiency	19-31	Labour	50%
		Water	25-67%
		Pesticide	75%

Source: System of Rice Intensification in Viet Nam: A Decade of Journey

Ecological and market-based Transitions from System of Rice Intensification to System of Crop Intensification for Rice Production in Viet Nam

The origination of contemporary System of Crop Intensification (SCI) for Rice cultivation in Viet Nam such as 3 Reductions – 3 Gains (3Rs-3Gs) and 1 Must Do – 5 Reductions (1M5Rs), had been deeply rooted in the key principles of System of Rice Intensification (SRI). In 2006, the Crop Production of Viet Nam approved and promoted rice farmers to apply the three reductions of i. Seed; ii. Fertilizer, and iii. Pesticide. The results of these three reductions are three Gains: i. Yield; ii. Rice quality, and iii. Production Efficiency. In 2009, to be more sufficiently addressing the large-scale rice production for export, the 3Rs3Gs was improved to be 1M5Rs which one must do, and that is, rice growers must use the certified quality seed; five reductions mean that rice growers are encouraged to reduce i. Seed density; ii. Fertilizer application; iii. Pesticide; iv. Water irrigation and v. post-harvest loss (**Table 2**). The application of 3Rs3Gs and 1M5Rs delivers similar results in reducing input cost and water consumption, thus reducing lodging and fertilizer in SRI; but more suitable to the ecosystem and large-scale rice production for export in the Mekong Delta of Viet Nam. From 2010, thanks to experiments from the internationally funded project from the Environmental Defense Fund via the Vietnam Low Carbon Rice Project (2011-2015) and Sowing the Seed of Changes (2012-2014); both SRI and SCI such as 1M5Rs in which the alternate wet dry irrigation was identified and concluded as the technology for reducing the methane emissions from rice cultivation.

Table 2. Technical review of the transition from SRI to SCI for Rice Cultivation in Viet Nam for period 2003-present

SRI	3 Reductions - 3 Gains	1 Must Do - 5 Reductions	Ecological and Market-based SCIs (via AVERP)
Started in 2003	Started in 2006	Started in 2009	Started in 2017
Key Principles	**3 Reductions:**	**5 Reductions**	**Improvised 5 key components**
Low seed density young seedlings	- Seed	- Seed	- Smart & crop-based Variety, low Seed density
Promotion of organic and microbial fertilizer	- Fertilizer	- Fertilizer	- Smart fertilizer application
Manual grass removal	- Pesticide	- Pesticide	-Bio-fungi treatment of stubble and rice straw
Irrigation: Alternate wet dry		- Water via AWD	- Eco-based AWD water irrigation
		- Post-harvest loss	- Mechanized transplanting and harvesting
	Resulted in 3 Gains: Yield; Quality, Efficiency	Resulted in reduction of input cost and GHG emissions	Resulted in reduction of input cost and GHG emissions

Source: Literature review and consolidation by the Author

Discussion

A case study from AgResults Viet Nam Emissions Reduction Challenge Project

The AgResults Vietnam Emissions Reduction Challenges Project – abbreviated as AVERP – is an initiative of the AgResults program that aims to promote the development, testing, and scaling up of innovative technologies, tools, and approaches to reduce greenhouse gas (GHG) emissions in the land cultivation and production stages for Rice, while also supporting provincial and national poverty reduction, environmental protection and climate change goals. The AVERP utilizes a "pull" mechanism to spur a diverse pool of actors to achieve significant GHG emissions reductions from large-scale rice production while also strengthening market linkages. AVERP has been implemented in the Thai Binh province in the Red River Delta for the period of 2016 – 2021.

Upon reviewing the results and impact of SRI on rice production in Viet Nam; and the ecological and market-based transitions to the System of Crop Intensification for Rice production in the main rice bowl of Viet Nam; this paper continues to review and analyse the advanced refinements of key principles of SRI and innovations made to formulate the diverse and optimized sustainable rice farming technology package that target five main components of rice productions:

1. Rice Variety
2. Planting/Sowing density and spacing
3. Fertilizer application
4. Water irrigation
5. Crop residues management

Competitors who participated in AVERP were allowed to experiment with their SCI for rice cultivation in Phase I of AVERP. With proven efficacy for increasing yield and economic gain and reduction of CO2 equivalent, four (04) out of eleven (11) Competitors with top results were allowed to participate in Phase II for scaling their tested SCI technologies in intensive rice production communities in Thai Binh province. Key features of the four winning SCI are shown in **Table 3**.

Table 3: Key characteristics of the modifications and advancement

Variety Characteristics	Stubble and Rice Straw Treatment	Transplanting/ Sowing Density (kg seed/ha)	Fertilizer Application (N-P2O5-K2O) kg/ha	Organic Fertilizer (kg/ha)	Irrigation Management
Advanced Aromatic + yield improvement + pest resistant	Bio-fungi treatment	35	83-83-62	830 kg microbial/ha	2 intermittent irrigation/crop
Advanced Aromatic + yield improvement + pest resistant	Bio-fungi treatment	35	85-73-43		4 intermittent irrigation/crop
Advanced Japonica + high yielding +pest resistant	Bio-fungi treatment	35	91-112-97		6 intermittent irrigation/crop
Advanced high yielding + pest resistant	Bio-fungi treatment	33	66-20-41	200 kg microbial/ha	3 intermittent irrigation/crop
Advanced Aromatic + yield improvement + pest resistant	Bio-fungi treatment	42	80-83-68	15% organic fertilizer	2 intermittent irrigation/crop

Source: Evaluation of Technological Methodology, AVERP, Tran Thu Ha et al 2021

Yield increase, return on investment, and reduction of CO2 as a result of applying the four improvised SCI for rice cultivation by almost 48,000 smallholder rice farmers over almost 5,000 hectares of land area are shown in **Table 4**.

Table 4: Key outcomes and efficacy on yield, economic and CO2 equivalent reduction

Com-petitor	Vari-ety	Dry yield (kg/ha)		Total investment cost (000 VND/ha)		Net profit (000 VND/ha)		Average yield increase (tons/ha)		Average GHG reduction (tons/ha)		Return on Invest-ment (ROI)
		Spring	Summer	Spring	Summer	Spring	Summer	Spring	Summer	Spring	Summer	
I4	DS1	5,016	4,790	27,209	28,472	15,640	17,122	0.2	0.1	1.0	1.9	30%
I5	BC15	6,330	5,696	30,542	28,506	30,084	32,190	0.5	1.8	0.3	1.3	79%
I18	LTH31	5,750	5,545	28,908	31,096	20,178	16,138	0.1	0.6	0.3	0.8	36%
I23	BT7	4,571	4,757	27,809	33,325	13,841	21,956	0.0	0.1	0.1	1.1	26%

Source: Evaluation of Economic Efficacy of four SCI Technological Packages, AVERP, Tran Thu Ha *et al.,* 2021

Conclusion

Rice production has long been central to the society and culture of Vietnam. It has also been one critical pillar in Vietnam's remarkable socio-economic success story over the three decades since the 'Doi Moi' (Policy Reforms) was launched in 1989. Continuous improvements and progress in rice production through policy enhancement and the application of advanced farming technologies include SRI and contemporary SCI have helped lift millions of smallholder farmers out of poverty and lifted Vietnam from food insecurity in the 1980s to the world's 3rd largest rice exporter today. The adoption of SRI/SCI approaches and technologies in rice production presents a range of other climate, environmental and socio-economic co-benefits, including: i) Increased climate resilience: The development of stronger plants which are more resilient to the floods and storms which negatively affect rice production areas with increasing frequency and severity as a result of climate change; ii) Socio-economic stability and poverty reduction in rural areas: SRI/SCI rice production methods lead to lower input cost while maintaining equal or higher yields and hence increased incomes for vulnerable smallholders; iii) Environmental co-benefits: SRI/SCI rice production methods have a range of other positive environmental impacts, including reduced water consumption and thus reduced methane emissions, reduced application of agro-chemicals and reduced air pollution as stubble is not burned.

Acknowledgments

This paper is developed from the literature review of official records documented by the Department of Plant Protection, Ministry of Agriculture and Rural Development of Viet Nam for the period of 2003-2015; and the outputs of the AgResults Viet Nam Emissions Reduction Challenge Project implemented in Thai Binh, Viet Nam during the period of 2016-2021.

References

Department of Crop Production of Viet Nam. 2021. Crop Production of Viet Nam: Consolidated Report 2021.

International Rice Research Institute. Overview of Rice Production in Viet Nam. [Online] Available:

https://www.irri.org/where-we-work/countries/southeast-asia#vietnam

The World Bank. Viet Nam Overview. [Offline]. Available: https://www.worldbank.org/en/country/vietnam/overview

Ngo D and Hoang P. 2016. System of Rice Intensification in Viet Nam: A Decade of Journey. https://vietnamsri.wordpress.com/2017/04/25/the-10-years-journey-of-sri-in-vietnam/