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A REVIEW ON IMPACT OF SRI TECHNOLOGY IN INDIAN AGRICULTURE

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Abstract: *SRI technology is a miracle innovation in rice crop cultivation and management leading to reduced inputs and maximizing output. It was developed in 1983 by the Henri de Laulanié in Madagascar. It is a system that has evolved over the last few decades of the 20th century and offers a radical departure in the way of growing more rice with fewer inputs. The spread of SRI from Madagascar to around the globe has been credited to Norman Uphoff. Due to its efficacy, utility, production and productivity now the technology has spread out to all over world including India. In India this technology came in 1998 in Tamil Nadu state. Official record indicates that SRI diffused first to Tamil Nadu State, followed by Andhra Pradesh in India. Many researches had been conducted on SRI technology, methodology and impact to the society and environment. This paper is based on review of literature collected for this study entitled Study on SRI technology in Cauvery delta region of Tamil Nadu. The purpose of the paper is to create awareness among the general leaders about the impact of SRI technology on society and environment. In this manuscript various impacts has been explained by different authors. Its revealed that SRI technology has helped the farmers to reduce the input use such as seed, irrigation, fertilizer and their by maximizing water efficiency, soil health and environmental compatibility.*

Keywords: *Impact, SRI, Cauvery Delta Region.*

Introduction: Rice is life to a majority of people in Asia. The cultivation of rice represents both a way of life and a means to livelihood. Enormous progress has been made since World War II in improving the productivity and profitability of Indica rice. Such progress has been due to the development of semi dwarf, non-lodging and photo insensitive strains based on the DEE-GEE-WUN gene from China. Later, hybrid rice became a reality, thanks to the identification of cytoplasmic male sterile genes from Hainan Island in China. Higher yields also require higher inputs, particularly fertilizer and pesticides. Breeding for high yield should therefore be accompanied with methods of feeding the rice plant for high yield. This has to be done in a manner that minimizes the effect on climate change. Also, environmental problems associated with the excessive use of fertilizer and pesticides will have to be avoided**.**

Everything in most parts of India starts and ends with rice, from birth to death. It is an integral part of Indian culture. It is a lifeline that extendes into more than 540 of India's 604 districts. In India, rice cultivation probably began in the upper and middle Ganges between 2000 and 1500 B.C. It expanded quickly after irrigation works spread from Orissa State to the adjoining areas of Andhra Pradesh and Tamil Nadu in the Iron Age around 300 B.C. (http://www.cambridge.org/us/ books/kiple/ rice. htm). Rice is first mentioned in the Yajur Veda (1500-800 BC) and then is frequently referred to in many Sanskrit texts, which distinguished summer varieties grown in the rainy season from winter varieties. Shali or winter varieties were the most highly regarded in times past. The name of Annapurna, the Hindu god of rice, comes from the Sanskrit word for rice, anna. In peninsular India, there are numerous festivals connected with the sowing, planting and harvesting of rice. Major harvest festivals include Pongal in Tamil Nadu, Onam in Kerala, and Huthri in Coorg (Kodagu). Rice tinted with the auspicious yellow colour of turmeric is showered onto newly-married couples, and is part of numerous rites

and celebrations. It is offered to the deities and used as an oblation in the sacred fire of Hindu ritual.

India is one of the richest countries in the world for diversity in rice varieties. There are so many different varieties of rice depending on variations in the weather, soil structure, plant characteristics, and purposes of use. According to Dr. R.H. Richharia, one of the most eminent rice scientists of the world till date, 400,000 varieties of rice probably existed in India during the Vedic period. He estimated that even now, as many as 200,000 varieties of rice exist in India, which is an exceptionally high number. Even if a person eats a new rice variety every day of the year, he can live for over hundred years without eating the same variety again.

A new method of paddy cultivation introduced relatively recently is proved to increase the yield of paddy significantly with less water, less seed as well as with less chemical inputs than the conventional method of paddy cultivation. The new method of paddy cultivation is popularly known as the System of Rice Intensification (SRI). SRI is not a new variety or hybrid, but it is only a new method of cultivation, where a set of innovative principles are followed for cultivating paddy. It was first developed in the 1980s by Henri de Laulanie, a French priest and farming practitioner living in Madagascar, and furthered in the 1990s by passionate farmers, scientists and researchers.

Methodology: The reviews were collected for the doctoral research entitled as study on SRI technology in Cauvery delta region of Tamil Nadu. There were seven objectives in the study such as to study the Socio Economic Profile of the farmers adopting SRI Technology, to assess the Knowledge of the farmers on SRI Technology, to determine the Extent of Adoption of SRI Technology, to find out the relationship between selected independent and dependent variables, to assess the Impact of SRI Technology, to find out the constraints as perceived by the farmers for adoption of SRI technology, To elicit suggestion to obviate the constraints faced by the farmers in adopting SRI technology. As per the demand of the research national and international reviews from all sources were collected objective wise to give support to the objectives and research findings. Those reviews on various impacts have been below for the researchers and general readers.

Economic Impact of SRI: Economic Impact of SRI is defined as SRI Contribution to the economic growth; redistribution of resources at individual, local, regional national and global levels; development of human resources. In China, research by the National Hybrid Rice Research and Development Center using the Super-I hybrid, gave a record yield of 16 t/ha in trials at Meishan, 35.6 per cent higher than the 11.8 t ha^{1} achieved under conventional water-intensive methods. [1] The evaluation of SRI in Sri Lanka reports higher paddy yields compared to conventional method [2]. Followed by Lazaro (2004) found that the evaluation of SRI in 2003 by farmer field schools in three communities in Negros Occidental province of the Philippines estimated SRI yield of 7.33 t ha^{1}, which was almost triple the 2.65 t ha^{1} that was obtained from standard farmer practice. Revealed that the yield differentials for SRI and non-SRI cultivation strategies for Malagasy farmers and find SRI yield 84 per cent higher than alternative strategies practiced by farmers [3]. Field experiences from some Asian and African countries reports the average rice yield with SRI to be double the current average yield and also He said that the evaluation of SRI in Cambodia in 2004 showed that over 400 SRI farmers earned a 41 per cent higher yield from SRI farms [4-5]. Concluded that the average rice yield with SRI is 8 t ha^{-1}, whereas the yield is 3 t ha^{-1} under conventional paddy [6]. Rao and satyanarayana (2005) reported that in Srilanka an evaluation was done by the international water management institute (IWMI) by comparing 60 each of randomly selected SRI and non SRI farmers found that on average net returns were higher by 103 per cent for the SRI farmers with an average yield increase of 44 per cent. The SRI performance varied from country to country or even region to region within a country [2, 7]. There are report of yield increase in Nepal (5.6-50 per cent), Myanmar (up to 300 per cent), Srilanka (up to 200 per cent), Indonesia (40–78 per cent) compared to the conventional practice.

In West Bengal [8] found that the average yield increases of 32 per cent among farmers who partially adopted SRI. Found that the package of core components of SRI is reported to produce higher yields with less water and seeds [9-10]. Three mechanical weeding methods under SRI gave the best result with respect to the number of effective tillers/ sq. m, grain number, grain weight, yield/ha and benefit–cost (B : C) ratio [11]. Concluded that there is 66 per cent increase in yields in SRI relative to experimentally controlled plots using farming

methods similar to local rice farmers in Mali and 87% increases in SRI yields relative to surrounding farmer rice fields [12]. Concluded that the higher yields of around 50 per cent among those who adopt SRI [13]. Found that the Productivity of SRI farms is significantly higher than the conventional paddy farms [14]. The average productivity of SRI farms in all the three zones comes to 2.77 tonnes per acre, but the same is only about 1.61 tonnes for conventional paddy farms, indicating a difference of about 72 per cent over the conventional paddy farms.

The costs of cultivation of SRI Fields are substantially lower than that of the conventional paddy farms [14]. The average cost of cultivation Rs.7203 per acre for SRI farms and Rs. 10984 for conventional paddy farms, a difference of about 33 per cent. Convinced that the SRI with integrated nutrient management (50 per cent Farm Yard Manure (FYM) + 50 per cent RD of NPK) and SRI with 100 per cent organic manuring saved 28.63 per cent and 34.25 per cent input cost respectively, compared to conventional method of transplanting with recommended fertilizer and cultural practices [15]. According to SRI generates average yield gains of around 64 per cent relative to conventional methods in a study of Indonesian farmers [16]. Studied that there is about 14.8 per cent increase in production in treatment villages, and the expected revenue is 14.22 per cent higher [17]. The cost is significantly higher (10.9 per cent) for these farmers and also the yield gain is 17.75 per cent if we compare all the plots for a farmer who adopted SRI for at least one plot with the farmers in control villages. The difference is about 25.48 per cent when we consider only plots of land under SRI by farmers in treatment villages and then compare them with non-SRI plots in control villages. Thus we see the yield gains associated with SRI could be as high as 25 per cent.

SRI techniques are reported to give rise to three key benefits. First, grain yields are reported to increase, delivering a direct benefit to both subsistence and (semi-) commercial farming households. Second, SRI methods are widely believed to increase the productivity of two key inputs, namely water and seed. Consequently the system is thought to be more accessible and affordable to poor and marginal communities and farmers facing water scarcity. A more controversial claim holds that the productivity of the system as a whole increases through positive synergetic interactions among the SRI practices; in other words the positive impacts of individual components of the system are multiplied when they are applied in concert [18-19]. Third, SRI is said to represent a more ecologically sustainable method of rice cultivation, primarily through water conservation but also (organic) soil husbandry and lower methane emissions [20]. There are significant increases in yields among SRI farmers, the farmers face negative income effects upon adopting [21].

The SRI is economically attractive although the cost of cultivation was 3.2 per cent higher [22], the cost of production was almost 19 per cent less in SRI due to higher grain yield [23]. The implementation of SRI, the cost of production went down by around 20 percent compared with that achieved by standard methods of cultivation experienced that Tripura in India.

Environmental Impact of SRI: Environmental Impact of SRI is defined as SRI Contribution to improved environmental systems, sustainability. Found that rice under SRI to be more robust against extreme weather events, pests, and diseases due to improved plant vigor and root strength [18]. These practices improve the growth and functioning of rice plant's root systems and enhance the numbers and diversity of the soil biota that contribute to plant health and productivity [18, 24, 25]. The fertilizer input is significantly lower in case of paddy fields under SRI [26]. The SRI plants have less insect and disease problems [27].

Reported that it is quite widely accepted that SRI techniques promote visible changes in the growth patterns and morphology of individual rice plants, specifically a vigorous production of numerous tillers (shoots with the potential to produce grainbearing panicles) [28, 29, 30, 31]. Some Chinese and Indian studies have confirmed that SRI methods produce physiological and morphological changes in rice plants that can lead to improved yields and higher factor productivity. Concluded that the SRI represent a more ecologically sustainable method of rice cultivation, primarily through water conservation but also (organic) soil husbandry and lower methane emissions [20].

Social Impact of SRI: Social Impact of SRI is defined as SRI Contribution to individual, family, community well being. A tech (2004) said that the SRI practices help the farmers to improve their livelihood. He says that SRI performances have raised hope among policy makers, development activists and farmers to

solve the food deficit problem in remote areas where modern technologies are not feasible in terms of cost and accessibility. Found that the Yield of farmers SRI methods, in the locality were to be around 5.9-6.9 t/ha of land [32]. Major reasons for practicing SRI method by sample farmers were less water requirement and higher yield levels. Major constraints in practicing SRI method were high labour requirement and weed menace.

Conclusion: SRI generates significant estimated yield gains. Practicing SRI results in a greater abundance, activity and diversity of soil organisms, and thereby improves its quality. Increased use of organic fertilizers, as with advanced SRI application, should also contribute to improving water quality. Practicing SRI reduces adverse effects on water quality from rice farming. SRI works with all varieties of rice, it can contribute to maintaining a diversity of rice varieties. High yielding varieties are necessary to feed the growing world population. The application of SRI considerably reduced the use of natural resources. SRI contributes to saving water. Moreover, the production of chemical fertilizers relies on oil and other natural resources, in contrast to organic fertilizers promoted by SRI. Farmers are encouraged to experiment and to engage in participatory technology development. Avoiding the use of pesticides can help to reduce negative impacts on human health. SRI improves rural income; improve household welfare, and food security.

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