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RESEARCH NOTES

Technological Change in Paddy Production: A Comparative Analysis of Traditional and SRI Methods of Cultivation

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I

INTRODUCTION

The quantitative analysis of agricultural production systems has become an important step in the formulation of agricultural policy. A number of empirical studies have attempted to investigate producer responsiveness to product and input price changes, to estimate economies of scale, to assess the relative efficiency, and to measure the impact of technological change. In particular, there has been a considerable amount of theoretical and applied econometric research on the measurement of the impact of technological change. As knowledge of new and more efficient methods of production (cultivation in agriculture) becomes available, technology changes (Koutsoyiannis, 1983). The adoption of new or improved method of production/cultivation can shift the production function. In other words, production can be increased with new technology by using same quantities of resources that were used in old technology or alternatively, the production level in old technology can be attained with new technology by using fewer quantities of inputs. The recent breakthrough in rice cultivation known as System of Rice Intensification (SRI) method is one such case which may be considered as disembodied technology. The disembodied type of technical change is mainly due to improved management methods (Sankhayan, 1988). A few studies have treated SRI method as a new technology (Ratna Reddy *et al.*, 2005).

Father Henri de Laulanie developed SRI in Madagascar in the early 1980s. In 1990, Association Tefy Saina (ATS) was formed as a Malagassy NGO to promote SRI. Four years later, the Cornell International Institute for Food, Agriculture and Development (CIIFAD) began co-operating with Tefy Saina to introduce SRI around the Ranomafana National Park in eastern Madagascar supported by the US Agency for International Development (USAID). It has since been tested in China, India, Indonesia, Philippines, Sri Lanka and Bangladesh with promising results. In SRI method, synergic interaction increases land, labour and water use efficiency. SRI method deviates from the traditional method of cultivating irrigated paddy in a

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number of ways. For instance, five kgs/ha of seeds is sufficient in SRI as against the usual 50 to 60 kgs/ha in traditional method. The transplantation of the seedlings is carried out within two weeks as against four to five weeks with a wider spacing and one seedling per hill. The root development is more and healthier under SRI method; tillering is almost double, and the crop does not lodge, the grain weight is more (Aziz and Hasan, 2000) with fewer incidences of pests and diseases in the new method. Some of the unique features of SRI and the reasons for its low adoption are reported by Ratna Reddy *et al.*, 2005. Thus it involves the application of certain management practices, which together provide better growing conditions for rice plants, particularly in the root zone, than the traditional method. The reduced demand for water facilitates conservation of water and soil that is not kept saturated has greater biodiversity. The un-flooded paddy fields do not produce methane, one of the major greenhouse gases contributing towards global warming. This water saving and water use efficient method of rice cultivation is suitable for resource poor farmers and water scarce areas. The yield increase in SRI method over the traditional method was 41 per cent (Anthofer, 2004) in Cambodia and 37.4 per cent in Madagascar (Barrett *et al.*, 2004). Similarly, Rekha (2004) in Kerala, Rajendra (2005) in Nepal and Yang and Suon (2004) in Cambodia reported yield increase of more than 40 per cent in SRI method over the traditional method. However, it may be noted that most of these studies are mainly based on experimental station data and very few used data from cultivators' field. Ratna Reddy *et al.*, (2005) using field survey data from Anantapur district of Andhra Pradesh, reported yield increase of 29.80 per cent in SRI method over the traditional method. Even this study relied on small sample from only one district. The present study on the other hand, is based on fairly large sample covering four major rice growing districts of Andhra Pradesh and thus enables to draw more meaningful inferences.

Andhra Pradesh ranks fourth in rice area (30.86 lakh ha), and production (9.601 million tonnes) with the productivity of 3.11 tonnes per ha (Anonymous, 2006). Rice in the state is grown under varied agro-climatic conditions. Guntur, Prakasham, Srikakulam, Vizayanagaram, Vishakapatnam, East Godavari, West Godavari, Krishna, and Nellore districts account for nearly 65 per cent of rice area in the state. The Acharya N. G. Ranga Agricultural University (ANGRAU), Hyderabad promoted SRI cultivation in Andhra Pradesh state. The large scale on farm demonstrations on SRI method of paddy cultivation conducted during *kharif* 2003-04 in Andhra Pradesh showed increased yields of about 2.5 t/ha over traditional method, which induced farmers to adopt SRI method on their own during *rabi* season and obtained higher yields and income. In 2004-05, there was tremendous motivation for SRI method of cultivation by the farmers of the state. Andhra Pradesh state government has allocated Rs. 4 crores for popularising SRI method among farming communities. Despite these efforts, adoption rate of SRI is low. Hence there is a need to re-examine the issue of high yields and profitability. Keeping this in view the objectives of this study are to: (1) compare and contrast the cost and returns of paddy cultivation in traditional technology and the new technology of SRI method and (2) decompose the contribution of resources to the productivity differences between the two methods of paddy cultivation.

II

METHODOLOGY

The study was based on the input-output data obtained from sample paddy growing farmers in Andhra Pradesh selected through multi-stage sampling design. At the first stage, four major paddy growing districts, namely, Prakasam, East Godavari, West Godavari and Guntur districts following both traditional and SRI methods of rice cultivation were purposively selected. From each district, three major paddy growing mandals following both the methods of rice cultivation were selected purposively at the second stage. Then at the third stage, four major paddy growing villages following both methods were purposively chosen from each mandal. In the final stage, ten farmers were randomly selected from each village such that they included five farmers in SRI method and five farmers in traditional method of rice cultivation. Thus, 480 farmers (240 farmers growing paddy by traditional method and 240 farmers growing it by SRI method) spread over four districts of Andhra Pradesh were interviewed during *kharif* season of 2005-06. The data on various inputs used in paddy cultivation like chemical fertilisers, plant protection chemicals, seed materials and human labour, and cultivation practices such as land preparation, transplanting, irrigation, inter-cultivation and harvesting along with labour requirement for these operations were collected from the sample farmers.

*Analytical Framework***:** The costs, returns and profits in traditional and SRI methods of paddy cultivation computed on per hectare basis were compared and contrasted. The cost of human labour was estimated in terms of 8 man hours. The women labour days were converted into man-days considering one women day as being equal to 0.60 man-day based on the prevailing wage rates in the study area (Rs. 50 for male and Rs. 30 per female labour). The costs of bullock and machine labour both, owned and hired, were calculated at the prevailing rates. The costs of farm produced seeds and farm yard manure (FYM) were imputed at the market price in the village including the cost of transportation and other incidental charges, if any. The costs of purchased seeds, fertilisers and plant protection chemicals were calculated based on the actual expenditure incurred. The amount fixed by the government for irrigation and land revenue was considered for computation of these costs. The rental value of land was imputed based on the prevailing rents in the study area. The short term (8 per cent) and long term (11 per cent) bank lending rates were used to work out the interest on working and fixed capital respectively. The depreciation was calculated by the straight line method. The charges on account of minor repairs of implements and machinery during the year were added to the depreciation charges. The interest on fixed capital and depreciation were apportioned on the basis of area of land under each crop grown during the year. The gross returns were computed by multiplying the quantity of main product and by-products with respective prices received.

The resource use efficiency was assessed by comparing marginal value product (MVP) with factor cost of the resources. The marginal product (MP) was estimated from the parameters of Cobb-Douglas production function and the geometric mean levels of the output and input. Solow (1957) developed Decomposition Analysis to evaluate the effects of technological change on output growth in US agriculture. Bisaliah (1977) extended the framework of decomposition analysis to examine technological change in Indian agriculture. In this paper, decomposition analysis was used to measure the contributions of technology and resource use differentials to the total productivity differences between traditional and SRI methods of paddy cultivation (Palanisami *et al.*, 2002). The Cobb-Douglas production function of the following type was specified.

$$Y=AX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}e^u$$

Where,

Y = Output in quintal/ha,
X_1 = Seeds in kgs/ha,
X_2 = Human labour in mandays/ha,
X_3 = Fertiliser in kgs/ha,
X_4 = Farm yard manure in t/ha,
X_5 = Plant protection chemicals and miscellaneous expenditure in Rs./ha,
u = Error term.

The miscellaneous expenditure in the model included the expenditure on bullock and machine labour, irrigation charges, land revenue and rent, interest on working and fixed capital and depreciation.

By using the subscripts ‘s’ and ‘t’ respectively to represent production functions of SRI and Traditional methods of paddy cultivation, the difference in the natural logarithms of paddy output between the SRI and Traditional methods may be written as

$$[\ln Y_s - \ln Y_t] = [\ln A_s - \ln A_t] + \sum_{i=1}^{5} [b_{si}\ln X_{si} - b_{ti}\ln X_{ti}]$$

Adding and subtracting $\sum_{i=1}^{5} [b_{si}\ln X_{ti}]$ in the above equation and rearranging the terms yields the following decomposition model.

$$[\ln Y_s - \ln Y_t] = [\ln A_s - \ln A_t] + \sum_{i=1}^{5} [b_{si} - b_{ti}]\ln X_{ti} + \sum_{i=1}^{5} b_{si} [\ln X_{si} - \ln X_{ti}]$$

The above model involved decomposing the logarithm of ratio of per hectare productivity of SRI and traditional methods of rice cultivation (LHS). This is approximately a measure of percentage change in per hectare output between the SRI cultivation and traditional cultivation. The summation of the first term (neutral technology) and the second term (non-neutral technology) on the right hand side of the decomposition model represents the productivity difference between the SRI and traditional method, which is attributable to the difference in technology (the cultural practices). The third term provides the productivity difference between the two methods, which is attributable to the differences in the input use between the two methods.

To examine whether the parameters of the production functions defining the two methods of rice production were different, which was an essential component of decomposition analysis, intercept and slope dummies were introduced into the log linear production function, which was specified as follows.

$$\ln Y = \ln A + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + cD + d_1[D_1 \ln X_1] + d_2[D_2 \ln X_2] + d_3[D_3 \ln X_3] + d_4[D_4 \ln X_4] + d_5[D_5 \ln X_5] + u$$

Where, Y, X_1, X_2, X_3, X_4, X_5, and u are as defined earlier and

D = Intercept dummy which takes value ‘1’, if it is SRI method and value ‘0’ otherwise,

$D_1 \ln X_1$, $D_2 \ln X_2$, $D_3 \ln X_3$, $D_4 \ln X_4$, and $D_5 \ln X_5$ are slope dummies of X_1, X_2, X_3, X_4, and X_5 respectively taking value ‘1’ if it is SRI method and value ‘0’ otherwise.

The results of the study are presented and discussed in the following sections.

III

COST AND RETURNS IN TRADITIONAL AND SRI METHODS

The profitability of SRI method of paddy cultivation in the study area has been analysed by computing per hectare cost and returns and comparing them with those of the traditional method. The pattern of inputs used in both the methods of paddy cultivation for sample farmers is presented in Table 1. The quantities of seed, N, P, K and plant protection chemicals used in traditional method of paddy cultivation were 73.63 kg, 156.46 kg, 68.43 kg, 82.95 kg and 1939.8 ml respectively which were larger than the quantities of 5.51 kg, 141 kg, 62.68 kg, 80.19 kg and 798.21 ml correspondingly in SRI method. However, slightly higher amounts of all kinds of labour and farmyard manure were used in SRI method when compared to those in traditional method (185.66 man-days against 141.39 of human labour, 8.41 pair days against 4.29 pair days of bullock labour, 86.75 hours against 84.61 hours of machine labour and 9.24 tonnes against 4.33 tonnes of farmyard manure). Use of slightly higher quantities of all types of labour was the major contributor for higher per hectare cost in SRI method. It may be noted that SRI method involves careful transplanting of single seedlings and frequent inter cultivation and thus utilises more labour than traditional method. The higher expenditure on bullock labour in SRI method was on account of more number of land leveling operations required for transplanting and to avoid water stagnation on the fields.

TABLE 1. PER HECTARE INPUT AND OUTPUT IN TRADITIONAL AND SRI METHODS

			Traditional method		SRI method	
Sl. No. (1)	Particulars (2)	Units (3)	Quantity (4)	Value (5)	Quantity (5)	Value (6)
A.	Variable costs					
1.	Seeds	kg	73.63	921.63 (2.90)	5.51	69.48 (0.20)
2.	Fertilisers					
	N	kg	156.46	1712.20 (5.38)	141.00	1532.64 (4.62)
	P	kg	68.43	1365.47 (4.29)	62.68	1253.18 (3.78)
	K	kg	82.95	663.88 (2.08)	80.19	651.91 (1.96)
3.	Farmyard manure	tonnes	4.33	1078.19 (3.39)	9.24	2338.93 (7.06)
4.	Plant protection chemicals	ml	1939.80	2552.06 (8.03)	798.21	1052.75 (3.18)
5.	Human labour	Man-days	141.39	7069.50 (22.24)	185.66	9283.00 (28.04)
6.	Bullock labour	Pair-days	4.29	553.69 (1.74)	8.41	1080.15 (3.26)
7.	Machine labour	Machine hours	84.61	4426.15 (13.93)	86.75	4554.45 (13.75)
8.	Interest on working capital @ 8 per cent	Rs.		1667.62 (5.24)		1766.35 (5.33)
9.	Irrigation charges	Rs.		514.47 (1.61)		250.95 (0.75)
	Total variable cost	Rs.		22512.89 (70.85)		23845.77 (72.04)
B.	Fixed costs					
1.	Land revenue	Rs.		12.51 (0.04)		12.50 (0.03)
2.	Rental value of land	Rs.		8575.72 (26.99)		8401.62 (25.38)
3.	Depreciation	Rs.		290.41 (0.91)		468.59 (1.41)
4.	Interest on fixed capital @ 11 per cent	Rs.		381.75 (1.20)		374.02 (1.12)
	Total fixed cost	Rs.		9260.39 (29.14)		9256.73 (27.96)
C.	Total cost	Rs.		31773.28 (100.00)		33102.50 (100.00)
	Main product	tonnes	6.07		8.51	
	Byproduct	tonnes	4.96		5.82	
D.	Gross returns	Rs.		41493.58		56695.90
E.	Net returns	Rs.		9720.30		23593.40

Note: Figures in parentheses are percentage to the total cost.

The per hectare cost of cultivation in SRI method (Rs. 33,102.50) was more when compared to that in traditional method (Rs. 31,773.28). The share of human labour cost in total cost was 22.24 per cent in traditional method and 28.04 per cent in SRI method. Fertilisers was the next important item of expenditure in both the methods of paddy cultivation which worked out to be 11.75 per cent and 10.36 per cent of total cost, respectively in traditional and SRI methods. The amount spent on FYM (Rs.2,339) was higher in the case of SRI paddy compared to that in traditional paddy (Rs. 1,078) as more FYM is applied in SRI method. However, expenditure incurred on fertiliser in SRI method was less (Rs. 3,438) when compared to that in the traditional method (Rs. 3,742). There was a glaring difference in the costs incurred on seeds between the two methods mainly due to smaller quantity of seeds used in SRI method. The considerable difference in plant protection chemicals (PPC) between traditional method (Rs. 2,552) and SRI method (Rs. 1053) was due to the fact that the incidence of pests, especially brown plant hopper, which was the major pest in paddy in the study area during *kharif* season was less in SRI method. It may be noted that the irrigation charges in SRI method (Rs. 251) were less than that in the traditional method (Rs. 514) as the number of irrigations was lower and quantity of water required was less in SRI method. The rental value of land was also a major item of expenditure contributing to the fixed cost (27 per cent and 25.38 per cent, respectively in traditional and SRI methods). The share of variable cost in the total cost was 70.85 per cent (Rs. 22,513) in traditional method and 72.04 per cent (Rs.23,846) in SRI method. As such, variable cost was found to be less by about Rs.1,333 in traditional method, when compared to that in SRI method.

The yield realised in traditional method was 6.07 tonnes per hectare, while it was 8.51 tonnes per hectare in SRI method. The yield difference was mainly because of more number of productive tillers per m^2 in SRI. The straw yield in traditional and SRI methods was 4.96 tonnes and 5.82 tonnes per hectare. Though the cost of cultivation per hectare was higher in SRI method (Rs. 33,103) compared to that of traditional method (Rs. 31,773), the net returns realised was much higher in the former (Rs. 23,593) than in the latter (Rs. 9,720). This was mainly due to higher gross returns (Rs. 56,696) in SRI method, where paddy yield harvested was more. The returns per rupee spent in traditional method were Rs. 1.31 against Rs. 1.71 in SRI method. These findings clearly indicated that SRI is a better yielding technology though it involves slightly higher costs. The differences in the use of most of the inputs between the two methods are evident. SRI demands more inputs like FYM and labour. On the other hand, it required less seeds, fertilisers and expenditure on irrigation. Therefore promotion of SRI could result in substantial yield gain and efficient use of scarce water resource.

IV

DECOMPOSITION OF FACTORS CONTRIBUTING TO PRODUCTIVITY DIFFERENCE BETWEEN TRADITIONAL AND SRI METHODS

In order to test the difference in the structural relationship in the parameters defining the production functions for the two methods, the log-linear production function with both intercept and slope dummies was estimated. The estimated production parameters are presented in Table 2. The estimated production function explained 89.10 per cent variation in paddy output due to variation in all the resources put together showing a good fit of the model. The coefficients of the intercept dummy and slope dummies were significantly different from zero. This result facilitated the rejection of the hypothesis that production parameters defining the SRI method and traditional method are same. The positive estimates of intercept and slope dummy coefficients for all resources implied that the output in SRI method

TABLE 2. ESTIMATED PRODUCTION FUNCTIONS WITH INTERCEPT AND SLOPE DUMMIES

		Production elasticity		
Sr. No. (1)	Particulars (2)	Pooled (3)	Traditional (4)	SRI (5)
1.	Intercept	0.2053 (0.1129)	0.2578	0.3224
2.	Seeds	0.0680* (0.0353)	0.0680* (0.0380)	0.3440** (0.0905)
3.	Human labour	0.2827** (0.0617)	0.2827** (0.0654)	0.1548** (0.0365)
4.	Fertiliser	0.1200* (0.0583)	0.1210* (0.0597)	0.2273** (0.0696)
5.	Farmyard manure	0.2028** (0.0517)	0.2028** (0.0548)	0.0306* (0.0115)
6.	PPC + misc. expenditure	0.1857** (0.0457)	0.1857** (0.0484)	0.0723* (0.0329)
7.	Dummy			
	(a)Intercept	0.2653** (0.0795)		
	(b) Seeds	0.237** (0.0508)		
	(c) Human labour	0.1147* (0.0512)		
	(d) Fertiliser	0.0347** (0.0110)		
	(e) FYM	0.1304** (0.0483)		
	(f) PPC+ misc. expenditure	0.0359** (0.0124)		
	R^2	0.891	0.775	0.743
	F-value	71.84**	37.22**	29.44**

Note: Figures in parentheses are standard errors.
* and ** Significant at 5 and 1 per cent level, respectively.

is significantly higher than that in the traditional method for a given level of resources. They also implied larger elasticity coefficients of production with respect to each input under SRI method compared to traditional method. This result as such offered the required justification for decomposing the factors contributing to productivity difference between SRI and traditional methods of paddy cultivation.

For decomposing the productivity difference between SRI and traditional methods of paddy cultivation, the parameters of the per hectare production functions and the mean levels of input use for the two methods were essential. Hence, the production functions for SRI and traditional methods were also estimated separately. The estimates are provided in Table 2. As much as 77.5 per cent and 74.30 per cent of variation in paddy output, respectively, in traditional and SRI methods was explained by the independent variables. The constant term (intercept) in the case of SRI method was higher than that for the traditional method. This virtually signified that there was an upward shift in production function due to technological change associated with SRI. The production elasticity coefficients of seeds, labour, fertiliser, FYM and expenditure made on plant protection chemicals (PPC) and miscellaneous expenditure were positive and significant in traditional and SRI methods. The output elasticity coefficients of labour, FYM and expenditure made on PPC and miscellaneous items in the case of traditional method were relatively greater as compared to those for SRI method. The paddy output in traditional method would increase by 0.2827 per cent and 0.2028 per cent for every one per cent increase in the use of labour and FYM. Thus, the major contribution to output in traditional method came from labour and FYM. In the case of SRI method, the paddy output would increase by 0.344 per cent and 0.2273 per cent for every one per cent increase in the use of seeds and fertilisers. Thus, the major contribution to output in SRI method came from seeds and fertilisers.

To analyse the scope for intensification of resources in both methods, the marginal value product (MVP) of the resources was compared with the respective marginal factor costs (MFC). The MVP and MFC ratios for different resources for both the methods are given in Table 3. The MVP-MFC ratios in traditional methods indicated that there was a scope for increased use of seeds in the short-run keeping the use of other resources at a constant level. This was also true for fertiliser and FYM as MVP-MFC ratio for these resources was also more than one. Nevertheless, MVP-MFC ratio for labour and expenditure made on PPC and miscellaneous items were less than one and positive indicating that profit could be maximised in the short run by using less quantity of these resources. On the other hand, the farmers under the SRI method could maximise their profit by using more quantities of seeds, labour, fertiliser, FYM and PPC including miscellaneous items as the MVP-MFC ratio for all these resources was more than one.

TABLE 3. MVP AND MFC OF RESOURCES IN TRADITIONAL AND SRI METHODS

Inputs (1)	Traditional MVP (2)	Traditional MFC (3)	Traditional Ratio (4)	SRI MVP (5)	SRI MFC (6)	SRI Ratio (7)
Seeds (kg)	168.69	12.50	13.49	1073.66	13.08	82.08
Labour (man-days)	34.54	50.00	0.69	77.69	50.00	1.55
Fertiliser (kg)	34.20	12.11	2.82	42.68	12.1	3.52
FYM (tonnes)	272.75	248.43	1.10	1183.90	253.13	4.67
PPC+ misc. expenditure (Rs.)	0.749	1.00	0.749	1.65	1.00	1.65

Using the decomposition model, the productivity difference between the SRI and traditional method was decomposed into its constituent sources and the results are presented in Table 4. A perusal of the results of decomposition analysis revealed that there was not much discrepancy between the observed difference (33.72 per cent) and the estimated difference (33.71 per cent) in the productivity of SRI method and traditional method. It can further be inferred that between technological and input use differentials, which together contributed to the total productivity difference of the order of 33.72 per cent, the former alone accounted for 31.61per cent. This implied that paddy productivity could be increased by about 31.61 per cent if the farmers could switch over from traditional method to SRI method with the same level of resource use as in traditional method. An increase in productivity exclusively from technological improvement is brought about through a shift in the scale and/or slope parameters of the production function.

TABLE 4. DECOMPOSITION OF OUTPUT DIFFERENCE BETWEEN THE SRI AND THE TRADITIONAL METHODS

Sr. No. (1)	Source of output difference (2)	Per cent contribution (3)
I.	Observed difference in output $[\ln Y_s - \ln Y_t]$	33.72
II.	Source of contribution	
1.	Due to difference in technology $[\ln A_s - \ln A_t] + \sum_{i=1}^{5} [b_{si} - b_{ti}] \ln X_{ti}$	31.61
2.	Due to difference in input use $\sum_{i=1}^{5} b_{si} [\ln X_{si} - \ln X_{ti}]$	
a.	Seeds	-17.83
b.	Human labour	7.65
c.	Fertiliser	-0.90
d.	FYM	15.19
e.	Expenditure on PPC and miscellaneous items	2.01
	Due to all inputs	2.10
3.	Estimated difference in output	33.71

The contribution of differences in input use between the SRI method and traditional method of paddy cultivation to the productivity difference was meager at 2.10 per cent. The larger quantity of seeds used in traditional method of cultivation has helped to increase yield of paddy by 17.83 per cent in that method. Similarly, larger quantity of resources like FYM and human labour used in SRI method caused yield increase of 15.19 per cent and 7.65 per cent respectively. This implied that farmers practicing SRI method obtained higher output by spending slightly more on these two inputs compared to those practicing traditional method.

V

CONCLUSION

The average net returns were Rs. 9,720/ha and Rs. 23,593/ha in traditional and SRI methods of paddy cultivation. The yield realised in traditional method was 6.07 tonnes per hectare and it was 8.51 tonnes per hectare in SRI method. The expenditure on human and machine labour accounted for the highest share (22.24 per cent and 13.93 per cent, respectively) in the total cost of cultivation of Rs. 31,773/ha in traditional method. The cost of cultivation in SRI method worked out to be Rs.33,103/ha in which the share of human and machine labour was 28 per cent and 14 per cent respectively. The estimated production functions were significant with high R^2 for both the SRI method and traditional methods. The output elasticity coefficients for seeds, labour, fertiliser and FYM were positive and statistically significant in both the methods. There was a structural break up between the two production functions. The MVP-MFC ratio analysis indicated that in the short run there was a scope for intensification of use of resources like seeds, fertilisers in traditional method and for seeds, fertilisers and farmyard manure in SRI method. The technological change in paddy production has brought about 33.72 per cent productivity difference between the two methods. The major component of this productivity difference was due to the difference in method of cultivation, which contributed to 31.61 per cent. The remaining two per cent difference in output was due to difference in quantities of inputs used.

The findings of this study demonstrate the superiority of SRI in terms of yield and returns advantage. However it is worth mentioning here that the actual adoption rate of SRI among paddy growers is very low, which appears to be a puzzle given the encouraging performance of the new technology. There are several reasons for this kind of poor response of farmers to SRI method. First, the farmers, particularly in the head reaches of command areas, where paddy is grown extensively, have not fully realised the importance of water in view of market and policy failure in pricing the resource appropriately; second, intensive care particularly during transplanting of seedlings and higher weed infestation demands more labour and hence farmers in labour scarce areas are hesitant to adopt SRI; third, only soils with good drainage facility and low clay content are suitable for SRI cultivation and finally, there is not enough awareness among farmers about its superiority. These observations call for enhanced extension services for popularising the SRI method. The timely guidance to the farmers from the extension agencies and to the persons involved in the transfer of technology to the farmers' fields would be of immense help in this direction.

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