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RESEARCH PAPER

Evaluation of system of rice intensification (SRI) in farmers fields of Anantapuram district of Andhra Pradesh

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Abstract : On-farm demonstrations were conducted to popularize the SRI method of paddy cultivation among the farmers under supervision of DAATT Centre (Extension unit of Acharya N.G. Ranga Agricultural University, Andhra Pradesh), Anantapuram for three years during *Kharif*, 2007-08 to 2009-10. The comparison was made between SRI method of paddy cultivation and farmers practice with an objective to obtain higher productivity, to reduce the cost of production of paddy and subsequently improve the returns from unit in farmers' fields. The results revealed that during three years of demonstration more number of tillers and panicles m^{-2} were recorded in SRI compared to farmers practice. SRI recorded higher grain yields compared to farmers practice which was 20.3 per cent higher over farmers practice. Higher gross returns, net returns and benefit cost ratio were also associated with SRI than conventional method of rice cultivation. The cost of cultivation was comparatively lesser in SRI which resulted in gaining an additional net profit of Rs. 15697 ha^{-1} as compared to farmers practice of rice cultivation. In SRI method grain and straw yields were enhanced by 20.3 and 21.0 per cent, respectively over farmers practice.

Key Words : SRI, Yield attributes, Grain yield, Economics

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INTRODUCTION

Rice is the most water consuming food crop of India and Andhra Pradesh. In Andhra Pradesh rice crop alone consumes about 80 per cent of the total water available in the state. The expenditure towards water alone accounts for 20-30 per cent of the total variable cost of rice production (Kumar *et al.*, 2007). Present management recommendations for rice in Andhra Pradesh include planting two 20 to 25 day-old seedlings per hill at 20×15cm spacing with hand weeding and continuous flooding (Vyavasaaya Panchangam, 2013). In the past over aged seedlings are planted due to delayed monsoon in Anantapuram district. Rice is being cultivated by raising nursery for about 30 days. Later seedlings were pulled and transplanted manually in zigzag manner without following any spacing in the main field after puddling. At present non-availability of labour, escalating of input cost coupled with water shortage leads to non-economic rice cultivation. The conventional rice production system of transplanted rice by farmers not only lead to wastage of water but also causes environmental degradation and reduces fertilizer use efficiency. The present water status demands for the scientific management of available water efficiently to achieve the two objectives of higher productivity and better water use efficiency.

The system of rice intensification (SRI) was conceptualized by Henri de Laulanie, a French missionary priest, in Madagascar during the early 1980s as a complementary suite of rice (*Oryza sativa* L.) management techniques. The main components of SRI include careful

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transplanting of single young seedlings at wider spacing, water management that keeps the soil moist but not continuously flooded, early and frequent (3 to 4 times) mechanical/manual weeding before canopy closure and ensuring adequate nutrient supplies (Laulanie, 1993).

Singh and Chinnusamy (2006) and Kumar *et al.* (2006) reported that system of rice intensification (SRI), a new method of rice establishment practice, has the potential to improve water and land productivity in irrigated rice. On farm demonstrations conducted during *Kharif* in Andhra Pradesh during 2003-04 using SRI method of paddy cultivation resulted in increased yields of about 2.5 t/ha over traditional method of paddy cultivation. Later, during *Rabi* season, farmers on their own cultivated paddy in large areas using SRI method and obtained higher yields and higher net income. In 2004-05, there was tremendous motivation for SRI cultivation method by the farmers of Andhra Pradesh.

Considering the above points, on-farm demonstrations were conducted to popularize the SRI method of paddy cultivation among the farmers under supervision of DAATT Centre (Extension unit of Acharya N.G. Ranga Agricultural University, Andhra Pradesh), Anantapuram for three years during *Kharif*, 2007-08 to 2009-10. The comparison was made between SRI method of paddy cultivation and farmers practice with an objective to obtain higher productivity, to reduce the cost of cultivation of paddy and subsequently improve the returns from unit area in farmers' fields.

MATERIAL AND METHODS

On-farm demonstrations were conducted for three consecutive *Kharif* seasons (2007, 2008 and 2009) in eleven randomly selected farmers' fields of Anantapuram district, Andhra Pradesh to study the performance of system of rice intensification (SRI) over traditional rice cultivation (farmers practice). The details are given in Table 1. Test variety was Samba Masuri (BPT 5204) of 180 days duration in all the locations. The demonstrations comprised of two treatments *viz.*, T_1-Systems of rice intensification (SRI) T_2-Farmers practice (Transplanting). Plot size for each treatment of on-farm demonstration was 4000 m^2. In SRI method of rice cultivation nursery was prepared with raised bedduly applying FYM as a fine layer on the bed. Proper levelling was done before planting. Pre-sprouted seeds were sown @ 5.0 kg ha^{-1}. Eight to ten days old single seedlings were transplanted at aspacing of 25×25cm using 1-2 seedlings perhill (Table 2). Preventive measures were taken for the seedlings in the nursery as well as at the time transplanting. A metal sheet was inserted 4-5 inches below the seedbed and seedlings scooped along with soil without any disturbance to their roots. Transplanting of tender seedlings need care to minimize root trauma. Water management was done maintaining saturation up to panicle initiation (PI) stage and thereafter a thin layer (1 to 2 cm) of water was maintained and the field was completely drained 10 to 15 days before harvest. Weed control was done manually by using cono weeder for 4 times at 10 days interval starting from 10 days after transplanting (DAT) in both directions. Growth and yield attributes on 10 randomly selected hills were recorded. At harvest, grain yield and straw yields from the net plots (5×5 m) were recorded.

Farmer's practice of traditional rice cultivation (Table 2) was followed by planting 30-40 days old seedlings at random @ 30-35 hills m^{-2} using 4-6 seedlings per hill, maintaining 3 cm depth of water up to panicle initiation and 5-7 cm depth of water thereafter up to one week before harvest. The field was drained before application of fertilizers and one week before harvest. Manual weeding was done twice at tillering and panicle initiation to control weeds. A uniform dose of FYM @ 5.0 t ha^{-1} and 96-32- 32 kg ha^{-1} NPK were applied through urea, SSP, MOP in both SRI method and farmers practice. Entire P and K and 1/3 N was applied as basal, remaining N was applied in two equal splits at active tillering and panicle initiation for both SRI and farmers practice. The experiments received uniform plant protection and cultural management practices throughout the period of crop growth. Labour charges, cost of inputs were worked out to compute the cost of cultivation. Gross returns were calculated based on local market prices of paddy and straw and net returns by subtracting the total cost of cultivation from gross returns. Benefit : cost ratio was computed by dividing gross returns with cost of cultivation.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Growth and yield attributes :

Higher plant height of 72.6 cm was recorded with SRI method of rice cultivation compared to farmers practice (65.1cm) (Table 3). There were more number of tillers (461) and panicles (442) per metre square in SRI method of rice cultivation as compared to 406 tillers and 357 panicles per metre square in farmers practice which can be attributed to planting young seedlings at wider spacing (25x25 cm). Similar results were reported by Varghese *et al.* (2005). Higher number of grains $panicle^{-1}$ (193) and panicle length (18.1cm) was recorded in SRI method compared to farmers practice (15.3 cm panicle length and 120 grains per panicle). Tiller to panicle conversion ratiowas higher in SRI method which might be due to favourable growth and better translocation of assimilates to the sink as it was revealed by more number of grains $panicle^{-1}$. Naidu *et al.* (2009) reported similar results. Higher panicle length with more number of grains per panicle in SRI was also reported by Barla and Kumar (2011). In SRI method plant height, number of tillers per metre square, panicles per metre square, panicle length and number of grains

per panicle were increased by 11.5, 13.5, 23.8, 18.3 and 60.8 per cent, respectively over farmers practice. Whereas in farmers practice planting more seedlings per hill probably led to poor tillering which was also reflected in yield attributes such as number of panicles per metre square, panicle length and number of grain panicle^{-1}. Similar findings were observed by Sekhar *et al.* (2009).

Grain yield :

SRI method of rice cultivation recorded higher grain yield (7948 kg ha^{-1}) which was 20.3 per cent higher over farmers practice (6607 kg ha^{-1}). Higher number of grains panicle^{-1} and panicle length (cm) might be the reason behind the yield increase in SRI method of paddy cultivation as reported by Murthy *et al.* (2006). Straw yield also followed similar trends to that of grain yield. In SRI method grain and straw yields were enhanced by 20.3 and 21.0 per cent, respectively over farmers practice. Lower paddy yields under farmers' practice might be due to planting 4 to 6 older seedlings (30-40 days old) with irregular spacing may lead to poor growth, poor tillering, lesser number of panicles per metre square and yield. Grain yield reduction following planting of older seedlings (Menete *et al.*, 2008) at high density (San-oh *et al.*, 2004) was reported earlier too.

Economics :

A saving of Rs. 1583/- (Rupees one thousand five hundred and eighty three only) on cost of cultivation per hectare was realized in SRI method of ricecultivation besides increasing grain yield. Gross returns (Rs. 84064/-) and net returns (Rs. 67814/-) per hectare were more with SRI method compared to farmers practice (Rs. 69650/- gross returns and Rs. 52117/- net returns). This was due to reduction in cost of cultivation and higher grain yield with SRI method. Higher gross returns of Rs. 14414/- per hectare was obtained with SRI method of paddy cultivation due tolowcost of cultivation and higher grain yield compared to farmers practice. The cost of cultivation was comparatively low in SRI which resulted in gaining an additional net profit of Rs.15697/- per hectare in SRI as compared to conventional method of rice cultivation. Similar results were reported by Ponni Priya *et al.* (2010). Simultaneously cost benefit ratio was higher with SRI method (1:5.2) compared to farmers practice (1:3.9) because of lower cost of cultivation and improved yield with SRI method of

Table 1 : Details of on-farm demonstrations

Sr. No.	Year	No. of villages	No. of locations	Area (ha)
1.	2007 – 08	4	4	1.6
2.	2008 – 09	4	4	1.6
3.	2009 – 10	3	3	1.2
Total		11	11	4.4

Table 2 : Specifications of SRI method in comparison with farmers practice

Sr. No.	Parameters	SRI	Farmers practice
1.	Seed rate (kg/ha)	5	63 -75
2.	Spacing	25 cm × 25cm	Zigzag
3.	Age of seedlings (days)	8-12	30-40
4.	Seedlings planted per hill	1-2	4-6
5.	No. hills m^{-2}	16	30-35

Table 3 : Growth and yield of paddy as influenced by SRI method of cultivation (Mean of 3 years)

Parameters	SRI	Farmers practice	% increase/decrease over farmers practice
Plant height (cm)	72.6	65.1	11.5
No. tillers m^{-2}	461	406	13.5
No. panicles m^{-2}	442	357	23.8
Panicle length (cm)	18.1	15.3	18.3
No. grains panicle^{-1}	193	120	60.8
Grain yield (kg ha^{-1})	7948	6607	20.3
Straw yield (kg ha^{-1})	9817	8111	21.0
Cost of cultivation (Rs. ha^{-1})	16250	17833	-8.9
Gross returns (Rs. ha^{-1})	84064	69650	20.7
Net returns (Rs. ha^{-1})	67814	52117	30.1
C:B ratio	1:5.2	1:3.9	–

paddy cultivation. Higher net returns and better B:C ratio were with SRI method due to reduced cost of labour requirement for weeding denoting lower cost of cultivation in SRI resulted in increased profitability compared to farmers' practice (Anitha and Chellappan, 2011). In SRI method cost of cultivation was reduced by 8.9 per cent whereas, gross returns and net returns were improved by 20.7 and 30.1 per cent, respectively over farmers practice.

From the results of these demonstrations it can be concluded that SRI method of paddy cultivation is good in terms of growth, yield and economic advantage. This technology can be advocated safely where water and labour are scarce for transplanting. The system of rice intensification has to be promoted in areas where water is scarce and also labour. However, actual adoption rate of SRI among paddy growers is very low as farmers opined that it is difficult to transplant one or two young seedlings $hill^{-1}$at specified spacing which requires skilled labour, drudgery and difficulty of using cono-weeders for weeding.

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