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Promotion of Sri and Drum Seeding Technology in Rice and Its Spread

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Abstract: Rice-Wheat cropping system pre-dominated in the Indo-Gangetic plains covering an area of about 13.5 million hectare. Ill effect of continuous puddling in rice field forced scientists to search for other methods of rice establishment like direct seeding, SRI method, dry seeding with ZT machine etc. The present studies were conducted to assess the SRI method and drum seeding technology in participatory mode on farmers' field through on farm trials and front line demonstrations. SRI techniques have yield potential upto 50% as compared to traditional transplanting rice. But various basic problems like availability of skilled laborers, use of 8-12 days old seedlings and non-practicability on problematic soils, prevented rapid spread of SRI technology amongst farming community. However, compared with SRI method, farmers much convinced with drum seeding technology, especially in terms of independency of agricultural labourers, tiller development, yield potential and benefit-cost ratio. KVK and State extension agencies distributed paddy drum seeder in each blocks under demonstration programmes, thus helps in proper spread of drum seeding technology in the district.

Keyword: *Drum Seeding Technology*, Rice and Its Spread.

Introduction

Rice and wheat are being grown sequentially in mainly irrigated, double cropping pattern in the Indo-Gangetic plains (IGP) of South Asia on about 13.5 million hectares of area. It is a major cropping system for sustaining food security in the region and millions of farmers and agricultural workers dependant on this system for employment and livelihoods. About 2.70 lakhs ha of land in eastern Uttar Pradesh is occupied under the sequence in prevailing three important agro-climatic zones viz. North Eastern Plain Zone (NEPZ), Eastern Plain Zone (EPZ) and Vindhyan Zone (VZ) which have varied eco-systems. Rice is the major crop of the monsoon season. More than 95% areas were sown under paddy in puddle condition where seedbeds are prepared in the month of May or June and the uprooted seedlings transplanted into flooded puddled field in June/July of 25-28 days old seedlings. Puddling affect the soil structures, reduced porosity and bulk density which causes a hard pan below the plough pan layer resulting in lower ground water recharge. The most ill effect of paddy was to deplete the carbon content from the soil. Thus, to reduce puddling and tillage operation in rice-wheat cropping system, emphasis will be given on other methods of rice establishment like direct seeding, SRI method, dry seeding with ZT machine, etc. to lowering the cost of production, is a pre-requisite now a days. According to Pandey and Velasco (2005) [2], low wages and adequate availability of water favours transplanting, whereas, high wages and low water

availability favours direct seeding of rice. The recent shifts from transplanting to direct seeding rice have been caused due to shortage of labour and hikes of wages charge. Keeping these things in view, present efforts were started with the objective to reduce puddling and tillage operations and emphasize resource conservation technologies in paddy cultivation.

Materials and Methods

The study was conducted by Krishi Vigyan Kendra, Faizabad in the district Faizabad of Eastern Plain Zone of Uttar Pradesh. The soils in this area are mainly alluvial in nature and few areas having recently reclaimed saline/sodic soils. The climate is a semi-humid, sub-tropical one with a distinct wet rainy season from June to September. Rainfall is mostly in the rainy season (85%) and averages about 1085 mm per year. The sources of irrigation in the district are mainly tube wells and canals. The main cropping system in the district for this case study is rice in the monsoon season followed with wheat in the cooler dry season. Both crops are grown in the one calendar year. The rice crop is usually planted into seedbeds in May/June and the uprooted seedlings transplanted into flooded, puddled soils in June/July. Long duration and short duration modern varieties are grown. The short duration varieties are harvested from late September to October. The longer duration varieties of rice are harvested later in November and can cause late planting of the next wheat crop. Farm Science Centre popularly known as Krishi Vigyan Kendra were introduced two rice establishment method of rice *viz* system of rice intensification (SRI) and drum seeding in the year 2005-06 through On-farm testing with farmers participation.

Results and Discussion

SRI techniques of rice establishment improve the yield potential of paddy cultivars in eastern plain zone. KVK Faizabad conducted on-farm trials at farmer's field and the pooled results of five OFTs are depicted in Table 1. The result reveals that the transplanting seedling with SRI method increases the yield (6.9 t/ha) as compared to Farmer's practice i.e. Transplanted rice with the tune of 43.75%. In terms of monetary gain the SRI method has Rs. 23,630/- more net return as compared to transplanted rice practice. The same is reflected in the B: C ratio also. The SRI has greatly introduced in the District Faizabad due to its yield advantage upto 50%, thanks to various publications of SRI promoters, scientists, State Government, which impressed many farmers in the District about SRI. Krishi Vigyan Kendra had also taken the lead to promote SRI methodology among rice farmers through various extension efforts including UPCAR project on SRI (2008 & 2010). Sensitization programmes covering all the 11 blocks of the District; demonstrations and guidance to farming community on about 20 hectares covering 11 blocks, exposure visits, field days, supply of conoweeders and markers free of cost to villagers were undertaken to promote SRI. The District Agriculture Department actively participated in promoting SRI technology in the District.

During the first four years after the initiation of trials, KVK identified many farmers interested to adopt SRI, but only 25% of them have repeatedly practiced it for more than five seasons. Inspite having good potential in SRI over traditional practice in terms of water saving and yield, common problems like higher labour requirement for transplanting and weeding have become one of the cause for lower adoptability of SRI method of planting The transplanting of rice seedlings of 8-12 days old is also a labour-intensive and expensive operation can be replaced by direct seeding that can reduce labour needs (Santhi *et al*. 1998 and PDCSR, 2005) [4, 3].

Table 1: Performance of SRI technology in terms of yield and economics

Technology Option	No. of trials	Yield (t/ha)	Increase in Yield (%)	Gross Cost (Rs)	Gross Return (Rs)	Net Return (Rs)	B: C ratio
Transplanted rice (Farmer's practice)	5	4.8	-	28500	60000	31500	2.10
SRI technology		6.9	43.75	31120	86250	55130	2.77

The basic problems that prevented rapid spread of SRI technology amongst farming community as identified by the KVK are:

- SRI needs continuous guidance, technically and operationally
- Greater constraints in the availability of agricultural labour
- Every seasons new labourers trained for SRI by the Extension workers
- Using of 8-12 days old seedlings for transplanting reluctant farmers to adopt
- SRI demands more organic inputs, which are not available at field level
- Farmers, especially big farmers, depends on hired labour, and the requirement of more labour inputs make them reluctant to take SRI on large areas
- No much progress on the researchable issues in SRI even after 10 years of its acceptance by the Indian farmers
- Non-practicability on problematic soils, low-lands, canal irrigated areas etc. also limits the wide spread of SRI practices

Identifying the problem, Krishi Vigyan Kendra now searches for other options under resource conservation. During the same period (2005-06) KVK endeavored to get Paddy Drum Seeder of 12 rows from the Vietnam under the IRRI project and the first on-farm trial were conducted in Madhupur village, Masodha block with the help of a drum seeder in *kharif* 2006. Three treatments were laid down under on-farm testing viz. traditional practice (*ie*. transplanted rice, TPR), SRI and direct seeding through drum seeder; to assess the pros and cons of the alternative technology.

Result of On-farm trials with comparison of SRI and drum seeder

OFT were conducted in village Madhupur, Block Masodha at five farmers' field with three treatments. The trials were conducted in the Kharif 2006 and 2007 and the pooled data is presented in Table 2 to assess the technology. The yield performance and economic indicators are presented in the Table 2. The data reveal that the performance of both technologies i.e. SRI and Drum seeding in terms of yield and economics were found to be substantially higher than that of farmers practice *i.e.* transplanted rice. The yield of rice under SRI method was 7.03 t/ha which was higher when compared with drum seeding (5.60 t/ha) and the transplanted rice (4.70 t/ha). The yield enhancement due to technological intervention was to the tune of 49.6% and 19.1% respectively over the farmers' practice. Economic indicators i.e. gross expenditure, gross returns, net returns and B: C ratio of on-farm trials clearly revealed that the net returns from the SRI method were substantially higher than the transplanted plot as well as drum seeding technology during both the years. However, the lowest cost of cultivation was observed under direct seeding technology. An average net return from direct seeding through drum seeder were observed to be Rs. 26,269/- in comparison to SRI method i.e. Rs. 28,505/- and TPR i.e. Rs. 12,409/-. On an average Rs. 13,860/- as additional income is attributed to the technology intervention provided in drum seeding technology.

Economic analysis of the yield performance revealed that cost benefit ratio of trial plots were observed significantly higher than farmers' practice. The cost benefit ratio of technology assesses i.e. drum seeding method, SRI method and transplanted plots were 2.23, 1.91 and 1.45, respectively. Hence, favourable cost benefit ratios proved the economic viability of the intervention

made under technology trials and convinced the farmers on the utility of intervention.

The farmers who conducted the trial and the rest of the farmers, who closely observed it, were very much convinced about the drum seeding technology, especially in terms of independency of agricultural labourer, tiller development, yield potential and benefit-cost ratio. Shekhar and Singh (1991) [5] and Hobbs (2003) [1] have stated that direct seeding of sprouted seeds under puddled condition results in significant improvement in yield attributes like number of effective tillers and grain yield.

Table 2: Yield performance and economic indicators as influenced by various establishment method in rice (two years pooled data)

Technology assessed	Effective tillers (per m^2)	Yield (t/ha)	Cost of cultivation (Rs)	Gross return (Rs)	Net return (Rs)	B:C ratio
Traditional (TPR)	450	4.70	27541	39950	12409	1.45
SRI method	694	7.03	31250	59755	28505	1.91
Direct seeding through drum Seeder	570	5.60	21331	47600	26269	2.23

Spread of Technology

The KVK introduced an 8-row paddy row seeder (also called drum seeder) made of fibre during *kharif* season 2009 through front line demonstrations. Though KVK worked out on various type of paddy row seeder through OFTs and demonstrations like 12-row plastic drum seeder, 4-row iron make paddy row seeder and 8-row paddy row seeder from *kharif*, 2008 to 2010. Various front line demonstrations were organized in different blocks of district to demonstrate the drum seeding technologies among the farming community. Training programmes, field days, crop seminars and kisan melas were also organized for the wide spread dissemination of technology.

After the success of the trial conducted in the District, the KVK introduced five more 8-row paddy drum seeder. Till *kharif* 2010, 10 drum seeders were placed in different villages so that practicing farmers in that area could use the machine free of cost under front line demonstration programme. With financial support from the Bringing Green Revolution of East India (BGREI), State Dept. of Agriculture, Faizabad purchased 22 drum seeders and has placed two machines at each Bocks of the District area. In total, there are 22 drum seeders in 11 blocks in the year 2011. During the year (2011), ATMA project conducted demonstration on drum seeder with an area of 61 ha in the District and under BGREI programme more than 80 ha area in the district were covered under drum seeding technology with more than 50 drum seeders in the district. All the drum seeders are used by the farmers on community basis free of cost.

The summarized result of front line demonstration of drum seeding is depicted in Table 3. The comparison between technology assessed with farmer's practice i.e. transplanted rice is also depicted in Table 3. The result indicated that cost saving in terms of labourer, nursery preparation and water requirement was with the drum seeding technology help its wide spread among farming community. Scarcity of labourers is another factor which forced farmers to search for another option of rice establishment method. It was also revealed that there was significant increase recorded in grain yield of paddy (52.1 q/ha) sown with drum seeding method as compared to transplanted rice (41.8 q/ha) and the per cent increase was 24.64. The comparative profitability of the demonstrated technology has been studied by estimating total cost, gross returns, net returns and benefit cost ratio and depicted in Table 3. The cultivation of improved technology gave higher net return of Rs. 29718/ha as compared to farmers practices (Rs.12925). Similarly, benefit cost (B: C) ratio was 2.08 under demonstrations which was far less in case of local check (1.39). This may be due to

higher yields obtained under improved practice). technologies compared to local check (farmers

Table 3: Summary of front line demonstrations of direct seeded rice conducted on 20 ha area in Faizabad District during 2012 alongwith comparison with Traditional (transplanted rice)

Particulars	Traditional (TPR)	Direct Seeding
Seed rate	25-35 kg	35-40 kg
Days to transplant	21-30 days old nursery	0 days
Cost of nursery (Rs)	4500	0
Labour required for transplanting/seeding	50	5
Spacing	Zig-zag method	20 X 5-8 cm
Water management during establishment	5 cm or more standing water	No standing water after seeding
Yield (q/ha)	41.8	52.1
Cost of cultivation (Rs.)	33,055	27,592
Gross return (Rs.)	45,980	57,310
Net return (Rs.)	12,925	29,718
B:C ratio	1.39	2.08

The Critical Factors Influences to Adopt the Technology among Farmers are:

- Direct seeding method avoids any raising of seedling and transplanting them, thus reducing the cost of nursery raising and lowering labour requirement for crop establishment.
- Farmers can sow paddy crop any time during the season when the conditions favourable for growing crops.
- Labour requirement reduced to minimum under this technology, even family labourer can manage to establish crop upto 2.0 ha area.
- Direct seeding needs weed management, thanks to availability of latest technology for post emergence rice herbicide for selective weed control.
- Farmers opined with the reduction of expenditure incurred in producing paddy crop rather for yield maximization. Drum seeding reduced the expenditure upto Rs. 9,000/- per hectare in costs incurred for raising nursery and transplanting.
- Line sowing May influences other agronomical practices well in time like site specific nutrient placement, mechanical weeding, pesticide application, etc.
- Most critical factor that brings confidence among farmers was the lowering of duration of paddy crop. It is found that duration of crop under this technology was reduced by 15-20 days compared to traditional practice i.e. transplanted rice. Wang and Sun (1990) also noticed that duration can be shortened by 7-15 days in direct-seeded rice compared to transplanted rice.

Thus, it can be concluded that various extension tools viz. OFTs, FLDs, training programmes conducted by KVK with the apparent objective for popularization of technologies in the district have proved to be the most effective tools in the result oriented speedy dissemination of knowledge and technical skills to the farmers. Assessed technologies *ie.* drum seeding resulted in the increase in area of the district through agricultural extension activities. Further efforts are being made by way of organizing different extension activities for the motivating the farmers for further popularization and adoption of this technology.

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