

Impact of Direct Seeded Rice (DSR) For Resource Conservation

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ABSTRACT

Puddling doesn't have much influence on rice yields. Many changes and innovations have contributed to the expanding use of resource conserving technologies in the country. One of the most important has been the development, testing and marketing of a low cost seed-cum-fertilizer drill which can establish crops with a minimum of soil disturbance, can take best advantage of residual soil moisture and thereby reduce irrigation requirements, can help improve the timeliness of sowing, can place seed and fertilizer nutrients at suitable soil depths, and can foster the development of innovative inter-cropping systems that are particularly suitable for flood-prone and drought-prone environments. During 2008-10 efforts has been made for resource conservation in paddy by introducing DSR and short duration rice varieties (Krishna Hansa, NDR-97, PRH-10 etc) at the farmers' fields of Kushinagar district in U.P. The results revealed that in DSR, Krishna Hansa has performed significantly well fetching grain yield of 56.57 q/ha whereas, Rajshree variety of paddy is successful under low land condition fetching an average yield of 46.71 q/ha compare to traditional variety which fetched only 30.87 q/ha.

Key words: Direct seeded rice; High yielding varieties; Yield; Economics;

The process of change has begun to transform the paradigm of agricultural research and development. A transformation represented by an on-going shift from conventional to conservation agriculture i.e., from an earlier set of principles based on massive soil inversion with a plough towards a new set of principles based on minimal soil disturbance, management of crop residues and innovative cropping systems is the best option of farming under rice-wheat cropping system. Recent studies indicate a slowdown in the productivity of growth in the rice-wheat systems of India (Kumar *et al.* 2002). Evidence from long-term experiments shows that crop yields are stagnating and sometimes declining (Duxbury *et al.* 2000; Ladha *et al.* 2003). Current crop cultivation practices in rice-wheat systems degrade the soil and water resources thereby threatening the sustainability of the system (Ali and Byerlee 2000; Duxbury *et al.* 2000; Gupta *et al.* 2003; Kumar and Yadav 2001; Ladha *et al.* 2003).

At the same time, rapid urbanization decreases the land available for agriculture. As a result, food security in the country remains a challenge for the future. If the supply of food is to keep pace with the rapidly growing demand, rice-wheat farmers will have to produce more food from fewer resources while sustaining the

environmental quality. This will require rapid changes towards technologies that are more productive but less resource-degrading. Many changes and innovations have contributed to the expanding use of resource conserving technologies in the country. In this regard, one of the most important technology has been the developed and tested is low cost seed-cum-fertilizer drill which can establish crops with a minimum of soil disturbance. This seed-cum-fertilizer drill can take best advantage of residual soil moisture and thereby reduce irrigation requirements, can help in improving the timeliness of sowing, can place seed and fertilizer nutrients at suitable soil depths, and can foster the development of innovative inter-cropping systems that are particularly suitable for flood-prone and drought-prone environments.

Paddy is generally transplanted in the first fortnight of July in puddled (wet tillage) soil, which leads to destruction of macropores and reduction in permeability. With direct seeding, rice seed is sown and sprouted directly into the field, eliminating the laborious process of planting seedlings by hand and greatly reducing the crop's water requirements (Polycarpou 2010). Traditional paddy cultivation requires 200-250 man-hours per hectare, which are about 25 percent of the total

labour requirement for the crop production. Resource conservation by adopting direct seeded rice (DSR) with the help of seed-cum-fertilizer drill have the potential to reduce the production costs by consuming less time, labour, fuel, energy and machinery inputs. Puddling breaks capillary pores, reduces void ratio, destroys soil aggregates, disperses fine clay particles, and lowers soil strength in the puddle layer. The destruction of soil aggregates by puddling leads to the formation of surface crusts and cracks on drying thereby delaying preparation of a seedbed for ensuing crops.

Keeping the above facts in view, the present study was done for resource conservation in paddy by introducing DSR and short duration rice varieties (Krishna Hansa, NDR-97, PRH-10 etc) at the farmers' fields of Kushinagar district in U.P. during 2008-10 with an objective to study the impact of direct seeded rice over traditional method of transplanting.

METHODOLOGY

Kushinagar district is a major rice growing pockets of Eastern Uttar Pradesh, selected for the present study since direct seeded rice is a new technique for this region. Further, three major rice growing blocks viz., Dudhahi, Padrauna and Seorahi and 20 villages from each block were randomly selected for the present study. Under rice-wheat cropping system, farmers of these villages mostly take long duration traditional paddy varieties which not only give them low yield but also require more number of irrigation and agronomic practices. This also results in delay sowing of wheat after harvesting of rice crops. Therefore, short duration high yielding varieties of paddy like NDR-97, Krishna Hansa etc and along with some other improved varieties suited for different field conditions like Rajshree & Pusa-

44 etc were demonstrated at 312 farmers' field in an area of 109.82 hectares through direct seeded method of sowing (Table-1), in which, after proper ploughing of field, paddy seeds were directly sown in the field using seed cum fertilizer drill (zero tillage machine). Desired data were collected through field observations and focus group discussions with the farmers. Collected data were further analyzed by using appropriate statistical tools.

RESULTS AND DISCUSSION

Direct seeded rice (DSR) was demonstrated in the selected farmers' field for two years along with recommended IPM and IPNM techniques in an area of 109.82 hectare area with different varieties like Saryu-52, Krishna Hansa, PRH-10 etc (Table-2). In DSR, the major hurdle has been paucity of knowledge for weed management. Most of the rice herbicides available have been developed for transplanted rice and these are not as effective in dry seeded rice. It has been observed that application of pre emergence herbicides and keeping fields submerged early in the season helps in controlling chlorosis and weeds. It has also been observed that puddling doesn't have much influence on rice yields. In general, a total of 1382 mm to 1838 mm water is required for the rice-wheat system accounting more than 80% for the rice growing season (Gupta et. al., 2003). Direct seeded rice avoids repeated puddling, preventing soil degradation and plough-pan formation. It facilitates timely establishment of rice and succeeding crops as crop matures 10-15 days earlier. It saves water by 35-40% and reduces production cost by Rs 3000/ha with an increase in yields by 10%. It saves energy, labor, fuel and seed besides solving labor scarcity problem and reduces drudgery of labours (www.knowledgebank.irri.org).

Table 2. Performance of demonstrated Paddy technologies under DSR in Kushinagar district

Variety	Average grain yield (q/ha)		Increase in yield (%)	Average cost of cultivation (Rs/ha)		Net profit (Rs.)		Profit ratio
	Demo.	Local Check		Demo.	Local Check	Demo.	Local Check	
Krishna Hans	56.57	38.71	46.14	13570.78	13673.22	35941.72	22642.1	1.59
Sarju-52	52.53	41.97	25.20	12958.81	13842.67	33743.19	21874.3	1.54
PRH-10	62.35	41.97	48.56	16842.6	13842.67	38444.90	21874.3	1.76
PB-1	30.41	30.51	-0.33	21,867.1	21,779.5	34,288.9	20,415.5	1.68
Rajendra Mansoori	41.52	38.83	6.93	17663.4	23722.9	27770.3	18805.7	1.48
Pusa-44	42.53	36.21	17.45	18665.5	21692.5	27392.0	17817.5	1.54
Rajshree	46.71	30.87	51.31	18791.6	15625.5	32397.3	17746.1	1.83

The performance of frontline demonstration of paddy in Kushinagar district is presented in Table-2. It has been observed that Krishna Hansa has performed

significantly well in the district. The data presented in Table-2 revealed that in DSR farmers fetched highest yield of 56.57 q/ha with Benefit-Cost ratio of 1.59 in

case of Krishna Hansa variety of paddy. Though, hybrid paddy, PRH-10 is the most successful among all demonstrated varieties (62.35 q/ha) but, the farmers showed their unwillingness towards this hybrid as seeds of this cannot be stored for next cropping year. In Kushinagar district, Rajshree variety of paddy is most successful under low land condition fetching an average yield of 46.71 q/ha compare to traditional variety which fetched only 30.87 q/ha. Rajendra Mansoori and Pusa-44 were other new varieties introduced in Kushinagar district that show a significant increase in yield with less irrigation requirement. Basmati rice was also introduced in the selected villages but was not much successful due to low yield and more water requirement compared to other varieties but, fetched a better return with benefit-cost ratio of 1.68.

Table 3. Yield attributes of rice crops under two methods of crop establishment at Kushinagar

Treatment	Panicles/m ² (No.)	Grain weight/panicle (g)	1,000-grain weight (g)
Transplanted	243	2.7	30.3
Direct-seeded	361	2.1	30.1
CD(5%)	21	0.2	NS

NS = Not significant

The yield attributes of the rice crop at Kushinagar show that panicle number per unit area was almost 150% higher in the DSR crop than in the transplanted crop, but grain weight per panicle was higher in the transplanted crop (Table 3). The 1,000-grain weight was the same for the two treatments. This compensation of various yield components resulted in statistically similar grain yields. However, the average yield of paddy was more in DSR due to more number of panicles per unit area.

Table 4. Yield of rice and wheat across three locations in Kushinagar, with and without puddling

Location	Treatment	Yield (qt/ ha)		
		Rice	Wheat	Total
Dudhahi	Puddled	47.49	45.93	93.42
	Unpuddled	37.01	37.54	74.55
Padrauna	Puddled	46.81	45.61	92.42
	Unpuddled	37.23	37.82	75.05
Seorahi	Puddled	47.66	46.00	93.66
	Unpuddled	37.23	37.55	74.78

In general, DSR results in earlier harvests and allows timely planting of the next wheat crop. The results of farmer participatory field trials showed that the strategy of timely sown of rice improves wheat yields.

In present study, rice-wheat system productivity was more than 90 quintal per ha (table-4) when rice was sown upto 28th June. This was reduced by more than 30% when fields were transplanted after 25th July (75 quintal/ha). The key issue is if higher system productivity is desired, the rice crop must be sown/planted early with the onset of monsoons by raising rice nurseries with ground water and vacating the main fields early in the season for the succeeding wheat or other crop (*Gupta et.al. 2003*). It has also been observed that in case of timely sown rice by DSR average number of tillers was 16-17 per plant with plant height of 108-116 cm. Major pest problem in paddy in encountered were stem borer and Gundhi bug which were managed by application of Carbofuron 3G @ 1 kg a.i./ha, bioagents *Trichogramma* @ 1-1.5 lakh parasitized eggs per hectare and NSKE 4% spray.

Results of Focus Group Discussions on DSR

- Direct seeded rice (DSR) save time, labour, critical inputs and conserve the natural resources like, soil, water etc.
- DSR increases the yield due to timely sowing of paddy.
- DSR also save 30-40 per cent water due to unpuddled field and not raising nursery in advance.
- Short duration and improved varieties of paddy reduces the number of irrigation required for paddy and also giving higher yield compared to conventional technologies/varieties.
- Krishna Hansa, Rajshree, Pusa-44 and Pusa-1460 varieties of paddy proves boon for this region due to high yielding and less water requirements.
- Pusa Basmati gave 21 % less yield than check (BPT-5204) but net income was more with BC ratio 1,68 due to high value of fine & scented grain.
- Paddy var. Rajendra Mansoori found slightly better than check MTU-7029 in respect of increased yield (6.9%) in water logged condition.
- Paddy var. Rajshree gave better performance in water logged areas with higher yield over check MTU-7029.
- In case of demonstrated technologies, weed population is also less due to proper use of herbicides and recommended agronomic practices.

CONCLUSION

During 2008-10, efforts have been made for resource conservation in paddy by introducing DSR and short duration rice varieties (Krishna Hansa, NDR-97,

PRH-10 etc) at the farmers' fields of Kushinagar district in U.P. The results of Krishna Hansa variety in paddy revealed that in DSR farmers fetched an average yield of 56.57 q/ha with B-C ratio of 1.59, whereas, Rajshree variety of paddy was successful under low land condition fetching an average yield of 46.71 q/ha compared to traditional variety which fetched only 30.87 q/ha. Farmers showed a great response in adopting the techniques of DSR as well as short duration high yielding varieties of paddy along with other recommended technologies of IPM, balanced use of fertilizers, use of herbicides and irrigation management in paddy field.

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