

Evaluation of zero tillage in wheat (*Triticum aestivum*) under different methods of rice (*Oryza sativa*) transplanting

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Received: April 1997

ABSTRACT

A two-year study was carried out at Karnal to compare the performance of zero tillage in wheat [*Triticum aestivum* (L.) emend. Fiori & Paol.] under different methods of rice (*Oryza sativa* L.) transplanting viz. broadcast in puddled condition, transplanting, and dry seeding. Transplanting of rice (Pusa basmati-370) recorded 14% higher yield as compared to dry seeding of rice in *kharif* season. In wheat ('UP 2338'), zero and conventional tillage recorded comparable yield irrespective of different rice seeding/transplanting methods. Zero tillage under dry seeding of rice gave significantly higher yield (49.6 q/ha) than conventionally tilled plot of transplanted rice (43.3 q/ha). The study reveals that zero tillage in dry seeding of rice was similar to that of puddled rice but better than conventional tillage. Zero tillage saved more than 16% cost of cultivation. Even total tonnage of rice and wheat in dry seeded and transplanted condition was similar.

Key words: Zero tillage, Wheat, Rice, Methods of transplanting

Rice and wheat are important cereal crops in India and this cropping system occupies nearly 4.0 million-ha over north-west India. The cultural operations before transplanting or sowing of these crops are just opposite. Generally, rice crop grows by transplanting the seedlings manually in the puddled field. On the other hand, wheat is grown by repeated tillage operations, even up to eight times, and sometime to incorporate the rice crop residue. This is done with a perception that fine seed bed will provide good germination, weed control, proper aeration and moisture conservation. Therefore,

farmers and farm scientists used to advocate the need for multiple tillage operations as a part of successful crop husbandry. Wheat sowing after basmati rice generally gets delayed to mid December and this adversely affects the wheat productivity. Since, the field is irrigated after harvesting of rice and it takes 10 to 12 days waiting period for getting field in proper moisture condition and time and energy required for tillage operations, sowing of wheat is further delayed. So, this study was conducted with objective to reduce the turn-around time and establish good crop of wheat without loss in yield.

MATERIALS AND METHODS

A field trial was laid out at Karnal in a split-plot design with four replications during 1993-94 and 1994-95. There were 3 main plot treatments in rice crop, viz. transplanting, broadcast under puddled condition and dry seeding in lines. Nursery of rice cv 'Pusa basmati 370' was sown on 1 June for taking transplanted rice subsequently, and on the same day dry seeding of the same variety was taken up. On next day, as a third treatment, seeds of same variety soaked for 24 hours was broadcast in puddled field. Seedlings were transplanted between 26-29 June in both years. After harvesting of the rice, the field was irrigated for sowing of wheat. During *rabi* season, wheat cv 'UP 2338' was sown as sub-plot treatment under 3 tillage conditions, viz zero tillage (direct sown by seed drill), reduced tillage (discing, cultivator and planking operation, each one) and conventional tillage (3 discing, 4 cultivator and 2 planking) in a plot size of $8.0 \times 2.3 \text{ m}^2$. Fertilizer was applied @ 120 kg N, 60 kg P_2O_5 and 40 kg K_2O /ha. Half of the N and full of P and K were applied as basal. Remaining N was top dressed after first irrigation. The wheat sowing in zero tillage treatment, requiring higher moisture, was done 7 days after irrigation. On the other

hand, reduced and conventional tillage treatments were sown 14 days after irrigation. However, in dry seeded rice, which matured a week earlier than transplanted one, sowing of wheat was done at the same time. Before sowing of wheat in non tilled condition, one spray of paraquat @ 0.4 kg a.i./ha was done to control weeds left after harvest of paddy.

RESULTS AND DISCUSSION

The maximum yield was recorded by transplanting rice, being significantly higher than dry seeding in both the seasons and broadcast in 1994-95. Over the years, rice yield in transplanted condition was 14.7% more than in dry seeding of rice. This yield difference was mainly attributed to increase in panicles/ m^2 , grains/panicle and 1,000-grain weight and also showed significant in 1994-95 (Table 1).

Wheat yield in dry seeded plot was the maximum, being significantly higher than under puddled field of rice whether transplanted or broadcast. This was mainly attributed to more ears/ m^2 and 1,000 grain weight. Similar results were also reported by Dhiman and Sharma (1986). Wheat yield recorded in zero, reduced and conventional tillage condition, were similar during both the years (Table 2). This was in conformity with the findings of Singh and Brar (1994).

Table 1. Effect of methods of rice seeding/transplanting on productivity of rice

Treatment	Plant height (cm)		Panicle/ m^2		Grains/panicle		1000 grain weight (g)		Grain yield (q/ha)	
	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95
Transplanting	123.0	139.0	463	259	149	101	20.6	24.1	54.0	40.5
Broadcast	106.7	134.3	305	327	126	91	21.5	21.3	51.2	31.0
Dry seeding	98.5	117.0	438	368	137	94	19.8	22.8	49.6	32.8
CD (P = 0.05)	8.7	12.4	54	81	NS	6	NS	1.93	4.2	4.3

The observation of Singh and Singh (1992) years, it was observed that wheat yield with that non tilled wheat produced lower yield zero tillage was as good as with than fine tilth condition could not be conventional tillage. The cost of cultivation validated in the present study. In both the in conventional tillage was around Rs 7,200/

Table 2. Effect of methods of rice seeding/transplanting on productivity of wheat under different tillage conditions

Treatment	Grain yield (q/ha)		Straw yield (q/ha)		Ears/m ²		Grains/ear		1,000 grain weight (g)	
	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95
<i>Seeding method</i>										
Transplanting	41.17	44.4	65.14	72.3	304	328	68.4	51.2	37.94	42.6
Dry seeding	45.94	52.8	63.38	83.9	314	351	68.1	53.2	40.83	42.5
Broadcast	42.88	45.7	63.77	77.6	308	332	63.4	50.5	39.31	38.3
CD (P = 0.05)	3.56	5.14	NS	NS	NS	19.42	NS	NS	2.87	3.12
<i>Tillage</i>										
Zero tillage	43.25	46.8	60.33	71.0	300	332	67.3	46.2	40.61	42.4
Reduced tillage	45.15	47.6	66.69	84.6	271	345	63.6	49.9	38.62	40.3
Conventional tillage	43.75	48.4	68.13	78.2	320	334	67.9	46.4	39.53	40.3
CD (P = 0.05)	NS	NS	6.5	NS	34.85	12.36	3.05	NS	2.20	2.13

Table 3. Effect of methods of rice seeding/transplanting on productivity of wheat under various tillage conditions (mean of 2 seasons)

Wheat	Grain yield (q/ha)			
	Zero tillage	Reduced tillage	Conventional tillage	Mean
<i>Rice seeding</i>				
Transplanting	40.3	45.6	43.3	43.1
Broadcast	45.1	44.6	44.7	44.8
Dry seeding	49.6	48.8	50.3	49.6
Mean	45.0	46.3	46.1	
<i>CD (P = 0.05)</i>				
Rice seeding method (A)		2.15		
Tillage in wheat (B)		2.89		
Interaction (A × B)		5.05		

Table 4. Response of methods of rice seeding/transplanting on productivity of rice-wheat under different tillage practices in wheat

Treatment	Yield (q/ha)				
	Rice	Wheat		Total	
		ZT	CT	R + WZT	R + WCT
Transplanting	47.3	40.3	43.3	87.6	90.6
Broadcast	41.1	45.1	44.7	86.2	85.8
Dry seeding	41.2	49.5	50.4	90.7	91.6

ZT = Zero tillage, CT = Conventional tillage, R = Rice, W = Wheat

ha whereas in zero tillage it was only Rs 6,050/ha. This shows that zero tillage is cost wise effective, since the amount of fuel used for field preparation is less. As there is no compromise on yield due to tillage, the reduced cost of cultivation increases the profit margin to the farmers substantially.

The pooled data indicate that the maximum wheat yield was recorded in dry seeding condition (49.6 q/ha), being significantly higher than transplanting condition (43.1 q/ha) irrespective of tillage practices. The yield of wheat in zero tillage was on par with reduced tillage or conventional tillage practices irrespective of method of rice seeding. There was a yield gain of 9.3, 3.2 and 7.0 q/ha of wheat under zero tillage, reduced tillage and conventional tillage, respectively when earlier crop of rice was dry seeded as compared with transplanted one (Table 3). Wheat yield in non-tilled condition under

dry seeded plot of rice recorded 14.3% higher yield as compared with yield in conventional tillage of transplanted rice. The total productivity of rice and wheat system was similar irrespective of whether rice was dry seeded or transplanted (Table 4). However, the yield of wheat was higher in dry seeding followed by zero tillage in wheat.

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