



P-ISSN: 2349-8528  
E-ISSN: 2321-4902  
IJCS 2018; SP4: 163-165

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(Special Issue -4)  
**International Conference on Food Security and  
Sustainable Agriculture**  
(Thailand on 21-24 December, 2018)

**Impact of resource conservation technologies in  
rice wheat system of Vaishali district (Bihar)**

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**Abstract**

Food prices must remain low so as to satisfy the needs of the urban population. On the other hand, farmers must be assured some profit so that they can support their families. The only way to achieve this is to increase the efficiency of agriculture. The use of resource conserving technologies is a key to achieving this goal. By resource technology we mean any practice that will result in more efficient use of resources or in other words will maximize the returns per unit of input. Efficient use of water, fertilizer, fuel and people in food production must be maximized. The experiment was conducted only due to the low productivity of wheat and rice in the Vaishali district. The main reason for low productivity is due to delay in wheat sowing, high cost of sowing and non availability of labour at the time of sowing. Since in the paddy field sufficient moisture is available after harvesting so direct wheat was sown through different RCTs. The concept was only to check the loss in yield due to late sowing of wheat (@1.5-1.8%/day) Due to non availability of labour also and energy shortages some farmers of the area leave their lands fallow. After the experiments it was observed the production cost with zero tillage ranges from Rs. 1766 to Rs. 1825/ha which was judged as most cost effective method of wheat sowing. Laser leveling or Precision Land Leveling (PLL) allows for uniform distribution of fertilizer and irrigation water. It has been observed through the survey that on a farm of laser leveled or PLL increased production of 30 to 40%/ha because of reduction of tillage in number of field channel. The laser leveling cost ranges from 2500 to 2700/ha. Thus the main cost difference between PLL and other sowing methods was the cost of leveling as the laser leveler was hired. Similarly the cost of land preparation and sowing cost in bed and furrow system was about Rs. 2200/ha and the land preparation and sowing cost under conventional method was around Rs. 2275 to 2390/ha. All of these methods are significantly higher as compared to zero tillage.

**Keywords:** rice wheat, agriculture, food production

**Introduction**

Impact of RCTs on water and crop productivity was evaluated for Rice-Wheat system of ten blocks of Vaishali district. This was for zero tillage, Laser leveling and bed & furrow cultivation of wheat followed by mechanical transplanting of rice during the yr. 2015-16. The experiment was conducted only due to the low productivity of wheat and rice in the Vaishali district. The main reason for low productivity is due to delay in wheat sowing, high cost of sowing and non availability of labour at the time of sowing. Since in the paddy field sufficient moisture is available after harvesting so direct wheat was sown through different RCTs. The concept was only to check the loss in yield due to late sowing of wheat (@1.5-1.8%/day) Due to non availability of labour also and energy shortages some farmers of the area leave their lands fallow. Nevertheless these fields be sown at proper time using RCTs (Zero Tillage) with the minimum resources available. The problem of Vaishali district is that nearly 50% of the total available irrigation water is lost in transit in tertiary level irrigation system and the farm during application to crops. A significant amount of irrigation water is wasted due to undulated fields and due to field ditches. Therefore levelled field help in reducing the amount of irrigation water and the labour requirement. Since surface irrigation is the most ancient method

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Since surface irrigation is the most ancient method of irrigation and has been practiced on the 90% of the irrigated area of land however application efficiency of surface irrigation is still below the available level.

### Materials & Methods

Seeing all the situation the impact study on RCTs were conducted to evaluate the variation on yields and net benefits of rice and wheat during the yr. 2015-16 in ten block of Vaishali district namely Hajipur, Jandaha, Rajapakar, Mahua, Patepur, Deshari, Bidupur, Lalganj, Vaishali & Shadai. Five villages/block were selected for the purpose. The study included information on parameters like use of seed rate, cultural practices, use of fertilizers and chemicals, plant and weed density, crop yield for wheat however for rice crop parameters like cultural practices, seed rate, use of fertilizer, number of irrigation, labour charges for harvesting and threshing were constant both for transplanted planting and manual transplanting. The main difference was in term of time spent for sowing (i.e. reduction in labour hrs) plant densities and yields. The RCTs included laser land leveling, zero tillage, bed and furrow for wheat and mechanical transplanting for rice. This all the methods were compared with conventional methods for both wheat and rice all together two farmers from each five villages per block were selected for study as sample size. In total 100 farmers were selected for experiment 50 farmers were selected for RCTs and 50 farmers for conventional methods. Among all 15 farmers were selected where wheat was sown with zero tillage, 10 farmers were used for precisely leveled with laser before wheat sowing and 25 farmers were selected where wheat was sown with bed and furrow method and the rest 50 farmers were selected where wheat was sown by conventional method without adopting any approve sowing method on an average one acre plot size was considered for the experiment

on RCTs wheat area 4 plowings and 2 plankings were done as compared to 5 to 6 plowings and 3 plankings on non RCTs wheat farm. On rice farm on an average 10 plowings and 5 plankings were done both on improves and conventional methods of sowing. On zero tillage farmers wheat was sown without any prior land preparation after harvesting of rice crop.

### Results & Discussion

After the experiments it was observed the production cost with zero tillage ranges from Rs. 1566 to Rs. 1625/ha which was Judged as most cost effective method of wheat sowing. Laser leveling or Precision Land Leveling (PLL) allows for uniform distribution of fertilizer and irrigation water. It has been observed through the survey that on a farm of laser leveled or PLL increased production of 30 to 40%/ha because of reduction of tillage in number of field channel. The laser leveling cost ranges from 2500 to 2700/ha. Thus the main cost difference between PLL and other sowing methods was the cost of leveling as the laser leveler was hired. Similarly the cost of land preparation and sowing cost in bed and furrow system was about Rs. 2200/ha and the land preparation and sowing cost under conventional method was around Rs. 2275 to 2390/ha. All of these methods are significantly higher as compared to zero tillage.

Sowing cost of rice by mechanical methods was much higher than conventional method this was only due to high hiring cost of machine as very few farmers have the facility of machine and they are charging hiring cost as per their choice. However time and labours hours spent by mechanical method were much less compared to conventional method of rice transplanting. The most important benefit of mechanical transplanting observed by the farmers was in term of higher plant density/ha and reduction in labour hours required for sowing of rice. The results are placed in table 2

**Table 1:** Time and Labour Saving (Per Ha) On Rice Farms

Block →	Hajipur	Jandaha	Rajapakar	Mahua	Patepur	Deshari	Bidupur	Lalganj	Vaishali	Shadai
Technology ↓	Man-hr	Man-hr	Man-hr	Man-hr	Man-hr	Man-hr	Man-hr	Man-hr	Man-hr	Man-hr
Mechanical	4-6=24	4-8=32	4-7=28	5-7=35	4-7=28	5-7=35	5-6=30	4-6=24	4-7=28	4-8=32
Manual	5-11=55	5-12=60	6-10=60	5-11=55	5-12=60	5-12=60	6-10=60	5-12=60	5-11=55	6-10=60
Average time and labour saving - Mechanical -30, Manual - 59										

**Table 2:** Average Wheat Plant Densities, Cos under Different Methods of Sowing

Methods of sowing	Plants m <sup>-2</sup>	Tiller/ plant	Tillers m <sup>-2</sup>	Cost of Cultivation (COS) Rs.
Zero tillage	258	4.2	1084	1766-1825
Laser leveling	254	4.4	1118	2500-2700
Bed and Furrow	218	4.3	937	2000-2200
Conventional tillage	230	4.2	966	2275-2390

**Table 3:** Depth of Irrigation and Water Saved Of Wheat in Different Blocks

Name of Block	Discharge (Q) (cusecs)	Zero tillage			Conventional		
		No. of irrigations	Time taken (hr-mnt)	Depth of irrigation (inches)	No. of irrigations	Time taken (hr-mnt)	Depth of irrigation (inches)
Hajipur	1.70	2	1-45	3.5	3	2-10	4.5
Jandaha	1.70	2	1-35	3.5	3	2-0	4.2
Rajapakar	1.90	2	1-45	4.0	3	2-4	5.3
Mahua	1.80	2	1-35	4.0	3	2-3	6.2
Patepur	1.70	2	2-40	4.0	3	2-9	4.5
Deshari	1.90	2	1-40	3.5	3	2-5	7.5
Bidupur	1.70	2	1-40	3.5	3	2-4	7.3
Lalganj	1.90	2	1-35	4.0	3	2-3	5.3
Vaishali	1.70	2	1-40	3.5	3	2-5	4.5
Shadai	1.80	2	1-45	4.0	3	2-4	4.2

The time of sowing of wheat was 1 to 15 November, 2016 however farmers continue planting up to last December, 2016 as per the soil condition and yield was reduced as the date of sowing was moving after November, 2015. But wheat sown by zero tillage in these area saves sowing time and also reduced the cost of cultivation. It was also observed that No presoaking irrigation was required when wheat was planted in rice crop field as there was sufficient moisture for wheat sowing by zero tillage machine. After collection of result it was observed that as the sowing time (date) was increased the seed rate was also increased. Rice planting time was kept between 10<sup>th</sup> July to 25 July both in mechanical and non mechanical methods.

The seed rate of wheat on RCTs was 100kg/ha as compare to 115-120kg/ha for non RCTs. The seed varieties of wheat was HD-2967 and for rice it was R. Bhagwati. The seed rate for rice was kept as 20kg/ha for both RCTs and non RCTs method.

In RCTs method the irrigation used was 3 to 4 times for wheat as compared to 5 to 6 irrigation in non RCTs method. The depth of irrigation was also measured at different levels in all the villages. The discharge was measured with a cut through throat type flume.

The weed density with bed and furrow was minimum followed by zero tillage and laser leveling weed density was highest on conventional method of wheat sowing however in rice cultivation the weed density was negligible in both RCTs and non RCTs method.

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