Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP4: 318-320

Dr. Devendra Kumar
Senior Scientist and Head KVK, Vaishali, DRPCAU, Pusa, Bihar, India

Dr. KM Singh
Director Extension Education, DRPCAU, Pusa, Bihar, India

Dr. Shobha Rani
Senior Scientist and Head KVK, Jehanabad, BAU, Sabour, Bihar, India

Correspondence
Dr. Devendra Kumar
Senior Scientist and Head KVK, Vaishali, DRPCAU, Pusa, Bihar, India

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

Effect of sowing of wheat with zero tillage and conventional methods on soil fertility in Vaishali district of Bihar

Dr. Devendra Kumar, Dr. KM Singh and Dr. Shobha Rani

Abstract
Water use efficiency in Vaishali is very poor and could be improved. Pollution of ground water through inefficient use of fertilizers, pesticides and other chemicals and poor disposal mechanism for waste is also on the rise and needs to be minimized. Therefore, a study was conducted in four blocks of Vaishali district namely Vaishali, Lalganj, Patepur and Jandaha by taking six farmers fields in each block. Thus altogether experiment was conducted on the fields of twenty four farmers regarding wheat sowing by RCT and Conventional methods. For the experiment in case of effect on soil fertility by zero tillage wheat as compared to conventional method of sowing mainly three methods were usedie first the sowing was done on surface seeding which is nothing but the simples of the zero tillage system in which soil is not disturbed and the wheat is placed on the soil surface. In the second method, wheat was sown by zero tillage machine in which wheat was placed in a narrow ground in the soil in V shape along with fertilizer and the third experiment was conducted by combining tillage done by a rotavator with seeding and planting was done in a single pass. Thus, the final results of the effect of soil fertility in case of zero tillage and conventional method was observed. Six farmers field sample from five points were collected for this and it has been observed that soil fertility significantly increased in both the methods except phosphorus. It was due to inadequate use of phosphorus fertilizer after harvesting of the rice crop stubbles were earlier decomposed in zero tillage technique and added adequate organic matter in depth by 43.6% and 66.7% as compared to 21.0% as compared to 21.0% and 36.0% in both depth by conventional method. Nitrogen was added about 10% more in upper soil layer and 21% more is 15-30 cm soil layer. Potassium was also 9% more in upper soil layer. Therefore zero tillage can improve the soil fertility.

Keywords: sowing of wheat, soil fertility, conventional methods

Introduction
The challenge of increasing food production to meet the needs of a growing population in India over the next 20 years is daunting. This challenge is made even more difficult since land area for agriculture is likely to stagnate or even decline as it is likely to be used more for domestic and industrial purposes and urbanization. Better quality land and water resources will be diverted to other sectors of the national economy. To grow more food from marginal and good quality lands, the quality of the natural resource base must be improved and sustained. Degradation processes must be minimized and cost of cultivation reduced to allow greater access to food by the population and to improve the ability of India farmers to compete globally. The means that productivity growth will have to rely more on vertical yield growth. More will have to be produced per unit area. Irrigation water, new varieties and fertilizers are already being used by farmers and have been the main traditional means of increasing yield growth over the past three decades. They will have less influence on yield growth in the future as response functions to these factors slow as input rates increase. Another major bottleneck in improving productivity of monsoon season rice, especially in the eastern regions, relates to the age-old tradition of delaying the establishment of the rice crop until after the onset of the monsoon rains. This wastes almost half of the total rainwater (1200 mm) for just preparatory tillage operations and delays planting and increases the chance of terminal droughts and reduces yields. The mindset of the farmers has to be changed in favor of growing rice nurseries

by developing and using groundwater to grow seedbeds before the monsoon rains. This would ensure enhanced productivity through an assured water supply to the rice crop (with rain-water and some supplemental irrigation, if needed) and timely establishment of next season crop.

Materials and Methods

Under the concept of using different RCTs mainly three methods were used for the experiment such as sowing by zero tillage, use of laser leveler and transplanting of rice by transplanter. The most important need for promoting resource conservation technology was to change the mindset of the farmers. Conjunctive use of irrigation water was the common practice because canal supplies in the area are inadequate. On wheat fields under zero tillage, 3 to 4 irrigations were applied as compared to 5 irrigations on non-RCT wheat fields. Measured data on depth of irrigation for wheat crop were available for zero-tillage and conventional farms in the five blocks namely Bhagwanpur, Mahua, Jandaha, Bidupur & Goraul in Vaishali district. For this purpose one experiment was conducted in aforesaid five blocks just to see the behavior of change in soil fertility followed by soil salinity. The rice variety selected for the experiment was R. Bhagwati. Two fields surveys were conducted to evaluate the impact of RCTs on yields and net benefits of rice and wheat. Both surveys included information on parameters like use of seed rate, cultural practices, use of fertilizers and chemicals, plant and weed density, crop yields etc. However, for rice crop, parameters like cultural practices, seed rate, use of fertilizers, number of irrigations, labour charges for harvesting and threshing were constant both for transplanter planting and manual transplanting. The optimum time of planting of rice crop was first week to third week of July, 2016 both for mechanical and non-mechanical

Result & Discussion

After going through the experiment. It was observed that the value of water saved was Rs 900 ha^{-1}. On laser leveled farms, on an average 5 irrigations were applied with a depth of 2 to 3 inches per irrigation. On conventional farms, the same number of irrigations was applied but with a depth of 3 to 4 inches.

During the experiment it was observed that use of nitrogenous fertilizers was much more than the phosphate and potash fertilizers. Phosphate and potash fertilizers were applied invariably as basal, while nitrogen was applied generally in two to three split doses i.e., with 1st, 2nd and 3rd irrigation. On an average, NPK level used for RCTs farms was 190 kg ha^{-1} as compared to 200 kg ha^{-1} on conventional farms. In case of zero tillage, the farmers applied 10 to 35 kg ha^{-1} less NPK as compared to conventional method. The reason for this difference was stated to be the placing of fertilizer close to seed in zero tillage. This difference was 25 kg ha^{-1} and 30 kg ha^{-1} with laser leveling, and bed and furrow, respectively.

Weed density with bed and furrow was the minimum followed by zero tillage and laser leveling. Weed density was highest on conventional farms. However, weed density both on improved and conventional rice farms was negligible.

Two villages per block was randomly selected from where a composite sample was prepared for salinity and fertility appraisal for 0-15 and 15-30 cm soil depths. Data (Table 1) indicate that there was a slight increase in all the salinity components in each cropping technique except ECe in conventional method, which decreased by 4.2% in the upper layer to 35.0% in the lower layer. Increase in salinity was due to low water application after harvesting of high delta rice crop. By cultivation and mixing up the soil in conventional method, salts apparently leached to the lower soil layer. Overall, soil salinity was not seriously affected with both the techniques and remained within safe limits.

Soil fertility was significantly increased in both the techniques except phosphorous (Table 3) It was due to inadequate use of phosphoric fertilizers. After harvesting of rice crop, stubbles were earlier decomposed in zero-tillage technique and added adequate organic matter in both depths by 44.5% and 67.0% as compared to 20.0% and 35.0% in both depths by conventional method. Nitrogen was added about 12% more in upper soil layer and 20% more in 15-20 cm soil layer. Potassium was also 10% more in upper soil layer. Therefore, zero tillage can improve the soil fertility.

Table 1: Soil salinity as affected by sowing of wheat with two technologies (2015-2016)

Salinity components	Depth (cm)	Zero tillage			Conventional		
		Pre-sowing	After harvesting	Percent decrease/increase	Pre-sowing	After harvesting	Percent decrease/increase
pH	0-10	7.2	8.0	+ 11.11	8.0	8.2	+ 2.50
	10-20	7.2	8.5	+ 18.05	8.0	8.5	+ 6.25
ECe	0-10	2.0	3.0	+ 50.0	2.0	1.9	- 5.0
	10-20	1.9	2.0	+ 5.26	2.5	1.7	- 32.0

Table 2: Soil fertility as affected by sowing of wheat with zero tillage and conventional methods in the Vaishali district

Fertility components	Depth (cm)	Zero tillage			Conventional		
		Pre-sowing	After harvesting	Percent decrease/increase	Pre-sowing	After harvesting	Percent decrease/increase
N	0-10	0.05	0.07	+ 40.0	0.05	0.06	+ 20.0
	10-20	0.03	0.04	+ 33.33	0.03	0.04	+ 33.33
P	0-10	7.5	5.5	- 26.66	7.0	5.0	- 28.57
	10-20	5.5	3.5	- 36.36	5.5	3.5	- 36.36
K	0-10	130	160	+ 23.07	135	160	+ 18.51
	10-20	120	155	+ 29.16	115	155	+ 34.78

After going through the different types of observation it has been noticed that the concept of RCTs is quite beneficial for the farming community but the other factor is excessive tillage after rice harvest before wheat planting. It has been in the belief of extension workers and farmers that the more tillage is done the better is the yield. In some cases farmers plough their fields ten times or more before they obtain a satisfactory tilth. Up to 100 liters of fuel per ha are needed for this operation, which alone accounts for about 30% of the total costs of production for wheat. Data from research

conducted in many regions of the IGP now suggests that excessive tillage is not needed and in fact is a major inefficiency in the system. Zero-tillage and one-pass reduced tillage systems not only allow early, timely planting and hence higher yields, but also significantly reduce costs of production and fossil fuel use. Additional benefits noted by farmers are:

1. Water savings. Farmers report savings due to less need for pre-irrigation and faster and less water (20% at least) for the first irrigation. This also results in no yellowing of the wheat crop after the first irrigation.
2. Efficient fertilizer use because the drill places the fertilizer, whereas much of the wheat planted after rice is broadcast sown including the fertilizer.
3. Savings in fuel by as much as 100 liters per ha, a significant savings when fuel prices are rising.
4. Savings in time since the fields can be planted quicker in a single pass. Farmers need less number of tractors to get the work done.
5. Less wear on the tractors and implements,
6. Fewer weeds, especially Phalaris minor, because the soil is not disturbed much in the zero-till systems.
7. The ability of zero-till systems to keep the residues on the surface (as long as planting equipment is available) and so provide an option for not burning residues and reducing air pollution.
8. The residue left standing in zero-till provides a friendly habitat for beneficial insects and spiders that are predators to common rice and wheat pests.
9. Significant increases in profit since the cost of production is reduced. This is probably the most important factor as far as farmers are concerned.
10. The technology is scale neutral since farmers of varying farm sizes can utilize this technology through contract hiring.

References

1. Terry RE, Tate RL. (III) And Duxburained cultivatery, J.M. Nitrous oxide emissions from drained cultivate organic soils of India. Amer. Pollut. Contr. Assoc. J. 1981; 31:1173-1176.
2. Wang B, Adachi K. Differences among rice cultivars in root exudation, methane oxidation of methanogenic and methanotrophic bacteria are relation to methane emission. Nutr. Cycl. Agroecosyst. 2000; 58:349-356.
3. Wang B, Neue HU, Samonte HP. Effect of cultivar difference (‘IR72’, ‘IR65598’ and ‘Dular’) on methane emission. Agric. Ecosys. Environ. 1997; 62:31-40.
4. Wassmann R, Neue HU, Lantin RS, Buendia LV, Rennenberg H. Characterization of methane emissions from rice fields in Asia. I. Comparison among field sites in five countries. Nutr. Cycl. Agroecosyst. 2000a; 58:1-12
5. Wassmann R, Neue HU, Lantin RS, Makarim K, Chareonslip N, Buendia LV *et al.* Characterization of methane emissions from rice fields in Asia. II. Differences among irrigated, rainfed, and deepwater rice. Nutr. Cycl. Agroecosyst. 2000b; 58:13-22.
6. Youngdahl LJ, Lupin MS, Crasswell ET. New developments in nitrogen fertilizers for rice. Fert. Res. 1986; 9:149-160.