Journal of Pharmacognosy and Phytochemistry 2020; 9(1): 1417-1422

Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 1417-1422
Received: 15-11-2019
Accepted: 18-12-2019

Prem Chand Yadav
Research Scholar, Bhagwant University, Ajmer, Rajasthan, India

Dharmendra Dubey
Supervisor, Bhagwant University, Ajmer, Rajasthan, India

Mohammad Gufran
Co-Supervisor, B.S.B.R.A. College Agricultural Engg. & Tech. Etawah, Uttar Pradesh, India

Rudra Pratap Singh
Faculty of Agriculture Sciences, Bhagwant University, Ajmer, Rajasthan, India

Corresponding Author:
Prem Chand Yadav
Research Scholar, Bhagwant University, Ajmer, Rajasthan, India

Impact of zero till ferti seed drill for paddy wheat system in Etawah district of Uttar Pradesh

Prem Chand Yadav, Dharmendra Dubey, Mohammad Gufran and Rudra Pratap Singh

Abstract
The present study focused on impact of zero till ferti seed dril for paddy wheat in Etawah district of Uttar Pradesh. In the selected district, the sample size consisted of farmers with an equal number of adaptors and non-adaptors and the inverse sampling technique was employed to select the households. The data was collected in collaboration with the Krishi Vigyan Kendra, scientists & district agriculture department functionaries. The results shows that total income in ZT was Rs. 60040 per hectare and net profit was Rs. 24561 per hectare which was Rs. 23171 more than CT. It has been observed that in CT the net profit was Rs. 1389.

Keywords: paddy wheat and zero till ferti seed drill

Introduction
Zero-tillage is the direct seeding of wheat into unploughed paddy fields following rice harvest-offers a more sustainable alternative: it involves a single tractor pass, thereby saving fuel, cutting gas emissions, and allowing the earlier planting of wheat. The International Maize and Wheat Improvement Centre (CIMMYT) began to introduce this practice throughout the IGP in the 1980s, with efforts increasing with the involvement after 1994 of the Rice-Wheat Consortium (RWC). DFID (The Department for International Development-U.K. Government) has supported the work of RWC both directly and through on-going core assistance to CIMMYT.

Rapid adoption of zero-tillage in the region, especially in India, began in the late-1990s. During 1997-2004, around 620,000 farmers adopted the system and zero-tillage wheat cultivation now covers as estimated 1.76 million of the 14 million hectares of rice-wheat cultivation. This uptake had led to important direct outcomes for farmers and the environment.

Many factors contributed to the successful spread of zero-tillage in the IGP. A key one was the collaborative development and local manufacture of affordable zero-tillage seed drills-which in one pass place wheat seed and fertilizer directly into unploughed land. The process of testing prototype seed drills on farmers land with farmer participation, developing drills suited to local conditions, and making them available to farmers at an affordable cost, were all vital steps. Seed drills were attractive both for farmers keen to reduce their own cultivation costs and hire themselves out for direct-seeding of neighbouring fields, as well as for profit-minded local manufacturers. Crucial as well were the use of farmer participatory approaches and the involvement of farm implement manufacturers and input suppliers to promote and support zero-tillage against the opposition of tradition-minded farmers, researchers, and policymakers. Finally, the development and spread of this innovation owes much to the conviction and hard work of national research programme champions and extension agents, as well as the continuing high-quality training and support they received through the RWC and CIMMYT.

Apart from reducing cultivation costs, the zero-tillage method increases wheat harvests by 5-7 per cent, largely thanks to timely planting. As a result, in India, it is estimated that zero-tillage has increased incomes by US$97 per hectare, with households typically increasing their annual earnings by US$180-$340. The bulk of this is from reduced costs. Zero-tillage also has environmental benefits: reducing fossil fuel use and greenhouse gas emissions, improving both fertility and water-holding capacity of the soils, reducing rates of soil erosion, and encouraging rice-wheat farmers to leave crop residues on the soil surface rather than burning them.

Furthermore, reduced tillage has provided a “platform” for introducing other resource-conserving practices such as: sowing on raised beds; surface seeding in riverain areas; smallholders in the eastern IGP using laser levelling to improve irrigation efficiency; cropping diversification (introducing for example, pulses and vegetable crops); and supporting conversion to full conservation agriculture by replacing puddled rice cropping with aerobic rice cultivation. Such practices will be crucial for the region, given that by 2050 climate-change induced heat and water stress in irrigated areas may reduce wheat yields by 12 percent and rice by 10 percent, while the unsustainable extraction of water for agriculture continues to drain aquifers.

The success of zero-tillage and the participatory approach through which it was promulgated, has helped overcome resistance to new practices among researchers, policymaker, and farmers. Support for zero-tillage has come from public-private partnerships and the facilitation of both national and international technology transfers, primarily through the RWC. State and local governments have come on board to promote and disseminate the technology, in some cases subsidizing seed drills to reduce the cost to farmers.

Adoption of zero-tillage is most widespread in India, where the RWC catalyzed the public private partnerships instrumental to its development and dissemination. So far, adoption has centered on intensive, mechanized farms in the northwest states of Haryana and Punjab. Current efforts are targeting the eastern IGP, where agriculture is less mechanized and poverty more extreme.

Systems in India Socio-Economic and Policy Issues Introduction Rice-Wheat Cropping System (RWCS) gained prominence from the mid-1960s with the introduction of short -duration and high-yielding varieties of rice and wheat during mid-1960s. The rotation has spread in the most fertile regions and has covered about 10 million ha in the Indo-Gangetic plains (IGP) region of India. It is more popular in the non-traditional rice growing states of Punjab, Haryana and Uttar Pradesh, and less in traditional rice growing states of Bihar and West Bengal. The impressive performance of the system during the last three decades resulted in a quantum jump in the production of rice and wheat, which largely contributed in achieving the food self-sufficiency in India. The food grain production increased from about 90 million tonnes in 1964-65 to about 190 million tonnes in 1994-95, at an annual growth of little over 2.5 percent.

Material and Methods

Considering the popularization of zero till technology the Etawah district has been selected for the study. The District of Etawah lies in the south-western portion of Uttar Pradesh 26’47” north latitude and 72’20” east longitude. Etawah is totally located on Gangetic plains, due to which many geographical variations can be noticed here. Average rainfall of district is 792 millimetres, which generate from Southern-Western monsoon winds from June to September. Maximum rainfall here could be noticed in August month. In Etawah excessive heat in summer and excessive cold in winter could be experienced. Here in May and June excessive heat can be experienced, which could exceed the limit of temperature to 46 degree. By the end of June, when monsoon enters the Etawah, temperature randomly decreases and by November temperature constantly keeps on decreasing, after which the city welcomes the winter season. The coldest month of winter is January, which reduces the temperature to 8-3 degree.

Specification of the Zero till machine used in Study

The technical specification of the machine is as below in table 1

Table 1: Technical Specification of Zero till Machine used in study.

Technical Specifications	
Name	**National Zero Till Ferti-Seed Drill**
Model	NZTD
No. of Rows	Available in 9, 11 and 13 Rows
Row to row spacing	7” Standard & adjustable
Fertilizer Metering	Agitator & Sliding Orifice type
Seed Metering	Flutted Roller type
Seed Flow control	Plastic tongue type
Rear side Platform	Wooden plank type
Depth-control Side Wheels	Two wheels (one on either side of the drill), each of 40 cm diameter
Drive wheel	Iron closed type with Fourteen lugs each of 3 cm height at an angle of 90^0
Transmission	Roller chain of 12.50 mm pitch with 14 and 37 number of teeth on the mild steel sprocket
Power from ground wheel to shaft 1	Transmitted to shaft 1 (1:1)
Power from shaft 1 to metering shafts	Seed and fertilizer metering shafts (2.5:1)
Hitch points	Standard; two lower and one upper

Data Collection

Primary survey was conducted in Etawah, in order to have it a general view, and the data were collected purposively. New questionnaires were developed according to the need of the research and the experiments to be conducted on the farmers’ fields under present study.

The representative district from Bundelkhand region has been selected i.e. Etawah from Uttar Pradesh. In the selected district, the sample size consisted of farmers with an equal number of adaptors and non-adaptors and the inverse sampling technique was employed to select the households.

The data was collected in collaboration with the Krishi Vigyan Kendra, scientists & district agriculture department functionaries. The questionnaire was tested and modified after the pilot of surveying of the field. Data collected from the farmers included information on different input uses and on various farming operations practiced. The individual perceptions about zero tillage, of both these adaptors and non-adaptors, were also recorded.

Results and Discussion

Impact Analysis of ZT Sowing

The detail of age of tractors on 2017 is given in Table 2. Out of 20 sampled farmers, 2 farmers are not having tractors and 3 were found sold out their tractors. It is obvious that 15 farmers having tractors and rest five not having tractors. The table reveals that F2, F11 and F17 are having more than 35 hp.

Table 2: Distribution of age of tractors in year 2017, used for ZT sowing

Farmers	Age of tractors (in years from 2017)				
	0 to3	4 to 6	7 to 9	10 to 12	More than 12
F1			8 (2010)		
F2		5(2013)[big]			
F3			7(2011)		
F4				10(2008)	
F5	3(2012)				
F6		6(2012)			
F7					Sold
F8	NA				
F9			8(2010)		
F10			7(2011)		
F11	3 (2015) [big]				
F12	NA				
F13			8(2010)		
F14	2(2016)				
F15			9(2009)		
F16	NA				
F17		4(2014)[big]			
F18					Sold
F19				10(2008)	
F20		5(2013)			

Figures in () is showing year of purchase and figure in [ ] is showing its capacity

Age of tractors opted for using zero till machine sowing

Out of twenty farmers as shown in table 3 six farmers were having tractors of age ranging 7 to 9 years, following by 4 to 6 years (4 No.), 0 to 3 (3 No.) and 10-12(2 No.), respectively.

Table 3: Age of tractors in year 2018, used for ZT sowing

Farmers	Age of tractors (in years)					Having no tractor	Total
	0 to3	4 to 6	7 to 9	10 to 12	More than 12		
Frequency	3	4	6	2	0	5	20
Percentage	15.00	20.00	30.00	10.00	0.00	25.00	100.00

Annual maintenance of tractors

The tractors used were under expenditure of up to Rs. 5000 found maximum frequency followed by Rs. 10000 to 15000 and others (Table 4). Average maintenance of tractor was Rs.13500 which was used for zero till machine sowing.

Table 4: Annual Maintenance of tractors used in ZT Machine sowing

Farmers	Maintenance charges (in Rs.)						Having no tractor	Total	Average Per farmers (Rs.)
	Up to 5000	5000-10,000	10,000-15,000	15,000-20,000	20,000-25,000	25,000-30,000			
Frequency	5	3	4	1	1	1	5	20	13500
Percentage	25.00	15.00	20.00	5.00	5.00	5.00	25.00	100.00	

Annual fuel consumption of tractors used in ZT Machine sowing-

It is clear from table 5 that maximum frequency has been found for annual fuel consumption is under up to 1000 Rs. and average found Rs. 15364 in a year.

Table 5: Annual fuel consumption of tractors used in ZT Machine sowing

Farmers	Annual fuel consumption (in Rs.)									Having no tractor	Total
	0-1000	1000-2000	2000-3000	3000-4000	4000-5000	5000-6000	6000-7000	7000-8000	8000-9000		
Frequency	4	2	1	3	1	1	1	1	1	5	20
Percentage	20.00	10.00	5.00	15.00	5.00	5.00	5.00	5.00	5.00	25.00	100.00

ZT Machine sowing coverage in hectares for custom hiring farmers in one season in 2017

Table 6 shows the figure for zero till machine sowing by farmer in one season. However, maximum sowing is by F2 because of custom hiring and covered 139.6 hectares area while minimum as 1.5 for farmer F6 and F1 i.e. 1.5 hectares. In term of frequency the maximum area was found under up to 50 ha. The average zero till sowing of farmers is 26.79 hectares.

Table 6: ZT Machine sowing coverage in hectares for custom hiring farmers in one season in 2017

Area sown in ha.	Frequency	Percentage
0-50	10	50.00
50-100	2	10.00
100-150	3	15.00
150-200	0	0.00
200-250	0	0.00
250-300	0	0.00
>300	0	0.00
NA	5	25.00
Total	20	100.00

Frequency of interaction with farmers of own village & other villages involved in Zero till sowing

The farmers, involved with zero till sowing technique, were also watched for their interaction with the fellow villagers for interaction. However it was found that average number of farmers attending panchayat meetings for zero till farmers was 7 in comparison to non-adoptive farmers as 4. While, adopted farmers has been attended 4.5 kisan melas per year in comparison to 1.4 for non-adopters. The detail has been shown in table 7.

Table 7: Frequency of interaction with farmers of own village & other villages involved in Zero till sowing

Mode	No./year	Per farmers
Zero Tillage (Adopters)		
Panchayat Meetings	140	7
Kisan Mela (No./year)	40	4.5
Conventional Tillage (Non-Adopters)		
Panchayat Meetings	80	4
Kisan Mela (No./year)	20	1.4

Interaction of adopters and non-adopters with the extension staff of state department of agriculture/input agencies/ private organization/NGO

It was observed from the table 8 that the standard deviation was estimated at 96.90 for office calls for the adopters. It was observed that adopters showed more interest in visiting KVK farms, trainings, field days, tours and no. of office calls related to zero till activity were 45.12, 9.54, 2.52, 2.32 and 155.65 where as non-adopters comparatively took less increased as 22.34, 4.56, 2, 2.30 and 62.34 respectively.

Table 8: Interaction of adopters and non-adopters with the extension staff of state department of agriculture/input agencies/private organization/NGO

Farmers	Average	S.D.
ZT(Adopters)		
Farm Visits (No./year)	45.12	12.31
Training (No./year)	9.54	7.30
Field Days (No./year)	2.52	1.95
Tours (No./year)	2.32	1.25
Office (No./year)	155.65	96.90
CT (Non-adopters)		
Farm Visits (No./year)	22.34	7.23
Training (No./year)	4.56	2.34
Field Days (No./year)	2.00	0.98
Tours (No./year)	2.30	0.68
Office (No./year)	62.34	67.32

Prominency in Decision Making Regarding Farm Operations

It has been detailed in table no. 9. It was observed that for seed, sowing and preparatory tillage operations 13 out of 20 took single decision as a male member/husband. In decision making, the dominance of male is clear with average of 12.46, joint as 5.61 and by wife as 1.62.

Table 9: Prominency in Decision Making Regarding Farm Operations

Sl. No.	Farm Operations	Husband	Joint	Wife
1	Preparatory Tillage/Harrowing/Planking/Cultivator	17	3	0
2	Seed	17	3	0
3	Sowing	17	3	0
4	Fertilizer Management	14	2	0
5	Irrigation	10	6	4
6	Weeding	11	9	0
7	Plant Protection	6	6	8
8	Harvesting	7	10	3
9	Threshing	9	10	1
10	Marketing	9	10	1
11	Purchase of New Machinery	17	2	1
12	Borrowing	15	4	1
13	Preparatory Tillage/ Harrowing/ Planking/Cultivator	13	5	2
	Decision making Average	12.46	5.61	1.62

No. of years of using zero till machine by farmers

The farmers selected randomly for the impact study had used machine ranging from 0 to 4 years with an average of 2.07 years and standard deviation of 1.032796 and detail can be seen in the table 10.

Table 10: No. of years of using zero till machine by the farmers

Farmers No.	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**
No. of years	4	2	3	2	2	1	0	0	1	2
Farmers No.	**F11**	**F12**	**F13**	**F14**	**F15**	**F16**	**F17**	**F18**	**F19**	**F20**
No. of years	3	0	2	3	3	0	2	0	1	1

Table 11: Crop Lodging in Wheat in ZT & CT fields (2017-2018)

Farmers	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20
Zero Tillage (ZT)																				
Lodging (%)	0.1	-	-	0.05	-	0.13	-	-	-	0.12	-	-	-	-	-	-	0.1	-	-	-
Ripening (Uniform/Non-uniform)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Maturation (Slower/Normal/Fast)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Conventional Tillage (CT)																				
Lodging (%)	21	32	14	20	11	15	9	17	19	16	32	31	28	26	29	21	16	32	15	9
Ripening (Uniform/Non-uniform)	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU
Maturation (Slower/Normal/Fast)	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast	Fast

NU = Non Uniform, U = Uniform, S = Slower, N = Normal, F = Fast

Table 12: Economics of Wheat Cultivation in Zero Tillage Sowing of Randomly Selected Farmers 2017(per acre Average)

S. N.	Particular	ZT					CT				
	A. Expenditure	**Quality Kg/hrs**	**Cost**	**Labour used (day/man hours)**	**Cost**	**Total Expense**	**Quality**	**Cost**	**Labour used (day/man hours)**	**Cost**	**Total Expense**
1	Land Preparation										
2	Labour charges and tractor + preparatory implement (L.S.)	-	-	-	-	-	-	3500	2	300	3800
3	Seed (Kg)	42	840	3	452	1292	50.3	1316	1	150	1466
4	Sowing	One pass	920	2	300	1220	-		-	-	-
5	Fertilizer (Kg)										
	Urea	80	736	2	300	1036	80	736	3	750	1486
	DAP	60	1440	-		1440	60	1440	-	-	1440
	MOP	40	200	-		200	40	200	-		200
	Zn (ZnSO4)	6.4	128	1	125	253	6.4	128	1	125	253
6	No. of hrs Irrigations by diesel pumpset	34.97	2797.6	25.6 (man hours)	553	3350.6	38.18	3054.4	28.4(mh)	613	3667.4
7	Weeding (Isoproturon)	0.5 Kg	250	1	150	400	0.5	250	1.5	225	475
8	Harvesting	-		10	150	1500	-	-	10	150	1500
9	Threshing(hrs)	6	1200	6	900	2100	5.5	1100	6	900	2000
10	Transport L.S.	-	500	6	900	1400	-	500	6	900	1400
11	Total Expenditure per acre					14192					17687.4
12	Total Expenditure per ha.					35479					44218.75
	A. Income										
1	Extra saving in investments in ZT(Rs./ha)					8740					
2	Total yield(q/ha)	34	47600				28.6	34320			
3	Straw income	31.10	12440				28.22	11288			
4	Total income		60040					45608			
5	Net profit per ha		24561					1389			

Crop Lodging in Wheat in ZT & CT in randomly selected farmers' fields

The table 11 has shown the lodging phenomenon which has been seen in CT plots in maximum in F11 and F2 plots as 32 and minimum as 9 in F7 and F20 plots. The standard deviation of the percentage of occurrence in CT is 7.88 percent. It can be observed that in ZT plots no lodging except five farmers were seen with much lower than 0.02 percent and that is also in five farmers.

Average Economics of Wheat Cultivation in Zero Tillage Sowing (per acre)

The average economics and cost of cultivation is shown below both for ZT and CT cultivations in table 12. The table has been computed after taking the average of all the sixteen farmers under survey in Rabi 2017-2018. It shows that cost of cultivation in land preparation, seed sowing, fertilizer, irrigation charges, weeding, harvesting, threshing and transporting the produce in total comes to Rs. 44218.75 for one hectare for CT. In the same way, expenditures in ZT for aforesaid operations come (expect land preparation charges) to Rs. 35479 per hectare. The extra savings in ZT are Rs. 8740. Total income in ZT was Rs. 60040 per hectare and net profit was Rs. 24561 per hectare which was Rs. 23171 more than CT. It has been observed that in CT the net profit was Rs. 1389.

Summary and Conclusion

The study has identified the economic benefits of zero-tillage farming, and the different factors affecting its adoption using primary data from Etawah districts. The results show that zero-tillage saves diesel and reduces the cost of cultivation resulting in yield increase of wheat in three states, although the yield increase is significant in other states like Bihar only. Further, the adoption of zero-tillage may be successfully implemented through the timely availability of zero-tillage machines, developing markets for hired services and proper administration. The result also indicates that the probability of adoption is higher for the experienced but relatively young farmers. The government policies to improve human capital in the form of training and awareness are beneficial for the adoption of zero- tillage. Thus there is a need for resource allocation to improve the human capital through extension programme, village community meetings, fanner fairs, etc., for enhancing the efficiency of adoption. The availability of credit plays a very important role in this decision making process. Therefore, for promoting new technology, the availability and accessibility of credit should be ensured. This result has a particular relevance with respect to the area of less intensive agriculture where adoption gives higher benefits. Some of site factors influencing the adoption differ in the two districts and hence the adoption programmes should be more focused and targeted in accordance with the requirement of specific area.

Reference

1. Ageeb OAA. Agronomic aspects of wheat production in Sudan. In Saunders DA, Hettel GP eds. Wheat in heat-stressed environments: irrigated, dry areas and rice-wheat farming systems, Mexico, D.F., and CIMMYT. 1994; 402:67-74.
2. Ahaneku IE. “Infiltration Characteristics of Two Major Agricultural Soils in North Central Nigeria”, Agricultural Science Research Journals, Available at www.resjournals.com/ARJ,ISSN:L-2026-6073©2011 International Research Journals: 2011; 1(7):166-171.
3. Ahmad Perviz *et al*., “Comparison of Different Tillage practices among various Wheat Varieties”, *App. Sci. Report*.4 (2), © PSCI Publications, 2013, 203-209.
4. Ahmad Perviz *et al*. “Comparison of Different Tillage practices among various Wheat Varieties”, *App. Sci. Report*.4 (2): © PSCI Publications, 2013, 203-209.
5. Ali, MB. Characteristics and production costs of US wheat farms, USDA, SB-974-5 ERS, 2002.
6. Baranwal SP. Fertilizer management in Zero till planted wheat. Thesis, M. Sc. (Agron.) G.B. Pant University of Agriculture & Technology, Pantnagar, 1995, 78.
7. Chandra A, Guru SK, Thakur TC. Impact of different tillage practices on soil biochemical parameters, root and shoot growth and yield attributes of winter wheat, Journal of Pharmacognosy and Phytochemistry. 2017; 6(5):1915-1922.
8. Chauhan AM, Ramesh Kumar. Review of research and development in seed cum fertilizer drills in India and areas for further work. J Agril. Engg. 1992; 9(3):31-43.