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Know-hows of Zero Tillage Technology and the Associated Constraints Experienced by the Farmers in Rice-Wheat Cropping System of Eastern Uttar Pradesh

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ABSTRACT

The study was conducted in Deoria district of eastern Uttar Pradesh as the part of CIMMYT-CSISA project. Out of sixteen blocks three blocks i.e. Bhatni, Bankata and Pathardewa were selected for this study as the project was implemented in these blocks. From each blockthree villages were selected purposively. From these villages fifteenzero tillage practicing farmers were selected. Hence total sample size was 135 farmers. The data were collected from through personal interview method with the help of structured interview schedule. The knowledge and constraints in practicing zero tillage technology were analyzed. The findings revealed thatmost of the farmers had knowledge about the practices of zerotillage technology. Majority of the respondents are agreed that saving of cost to the extent of 1500/acre (97.03%), need of post-emergence herbicides application as necessary in zero tillage (94.81%), suitable for low lying areas (93.33%), saves water in first irrigation (92.59%) and phosphorus is placed at right depth in soil with zero till (91.85%)were the effect of the zerotillage technology. The findings also revealed that loose straw management is problem and lack of local mechanic to repair the machine was the major technical constraints faced by majority of respondents. Less coverage of mass media and lack of training on zero tillage technology to meet the information needs were observed as the most serious training and educational constraints. Higher cost of zero till machine (70.37%), lack of cooperation among farmers to share experience (67.40%) and lack of knowledge of farmers about minor adjustments of machine (80.74%) were reported as major constraints under financial, socio-psychological and extension constraints respectively.

Keywords: Constraints, cropping system, effect, rice-wheat, zero tillage technology

INTRODUCTION

Zero tillage in rice-wheat systems ranges fromsurface seeding to planting with seed drills drawnby four-wheel tractors (Hobbs *et al*, 1997). In surfaceseeding, wheat seeds are broadcast on a saturatedsoil surface before or after rice harvest (Tripathi *et al*, 2006). It is a simple technology for resource poorfarmers requiring no land preparation ormachinery, but its use is still largely confined to low-lying fields that remain too moist for tractorsto enter, particularly in the Eastern Indo-Gangetic plains.

Mechanicalseed drills typically open a whole, narrow slot,trench, or band of the smallest width and depthneeded to obtain proper coverage of the seed. Theprevailing ZT technology in the rice-wheat systemsuses a tractor-drawn zero-till-seed drill to establishwheat in the rice stubble. This specialized seedingimplement allows wheat seed to be planted directlyinto unplowed fields with a single pass of thetractor. Often, use is made of a zero-till-seed cum fertilizerdrill: a conventional seed drill fitted with sharp-edged modified furrow openers, a calibrated engraved disc, and a cup mechanism for placing fertilizers. The machine opens a number (6–13) ofnarrow slits for placing seed and fertilizers at a depth of 7.5–10 cm into the soil (Mehla *et al*, 2000). The ZT drills are made domestically and cost around US$ 400(Parwez *et al*, 2004).

Zero-tillage technology (ZTT) is very cost-effective, convenient and profitable provides sustainability and security to rice-wheat cropping system as it reduces the cost of cultivation and helps to advance the planting time of wheat. Development of no-till conservation agriculture and its adoption in more than 70 million ha globally, confirms that zero-tillage is an efficient strategy for management of land and water resources for producing more yield at reduced cost.

The government has been encouraging rapid adoption of this technology by subsidy in buying the zero till drill used for this technology. Over the years, the area

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under zero tillage in the state has increased from just 750 hectares in 2000-01 to over 2 lakh hectares in 2008- 09 (Anonymous, 2009).

Zero tillage technology is an innovation that reduces cost, saves time and sustains production. In conventional tillage frequent passes of tractor across vast land area burn diesel and pollute the environment. Within agriculture this is a major source of environmental degradation.

The amount of diesel used in the intensively cultivated rice-wheat cropping system especially in the lead area is more and hence it generates excessive more pollution.The emerging dominance of rice-wheat system in the northern belt of the country has recently resulted in decelerating total factor productivity and environmental degradation, which urgently demand technology to address such issues. Zero tillage technology is considered important from these angles.

ZTT refers to the planting of wheat and other crops with minimum soil disturbance in paddy harvested fields. Zero tillage can reduce the cost of tillage operations and lower down the cost of production especially in wheat crop. In addition to this it eliminates the need for number of tillage operations, reduced planting time and saves fuel and labour cost. The Zero tillage technology has the potential to give higher productivity too. At present a great deal of emphasis is being laid on to increase the area under ZTT.

The Government of Punjab has been encouraging rapid adoption of the area under ZTT by giving 25 per cent of subsidy for buying Zero till drill. Despite multifarious advantages and Government efforts, at present only 11.86 per cent (4.13 lakh hectares) area is under Zero tillage technology (Anonymous, 2006). Therefore, there is need to examine the factors that are jeopardizing the rapid adoption of this technology. Keeping in view this point, the present study was undertaken with the specific objective to study theknow-hows of the ZTT and constraints faced by the practicing farmers in adoption of Zero tillage technology.

METHODOLOGY

The present study was conducted in Deoria district of Uttar Pradesh state. Out of sixteen blocks of Deoria district three blocks *i.e.* Bhatni, Bankata and Pathardewa were selected purposively for this study, from each block three villages *i.e.* Noonkhar, Uska and Punia Chhapar from Bhatni block Rampur bujurg, Bahiyaribaghel and Ahiraulibaghel from Bankata block and Mahuadiha, Gopalpur and Malghot from Pathardewa block were selected purposively for the study. Among each village, 15 farmers were selected randomly. Hence the total sample size was 135 farmers. The data were collected through personal interview method. The interview schedule was prepared by keeping the objectives of the study in mind.

A Teacher's made test was used to assess the farmers' knowledge about different components of the zero tillage technology. The necessary care was taken to collect the unbiased and correct data. The data were collected, tabulated and analyzed. The statistical tools like frequency, percentage and rank were employed to analyze the data.

RESULTS AND DISCUSSION

Knowledge of farmers regarding zero tillage technology: The data presented in Table 1 revealed that farmers have knowledge about the practices of zero tillage technology.

Majority (97.03%) of respondents are agreed that zero tillage technology is saving of ` 1500/acre followed by use of post-emergence herbicides is necessary (94.81%) and the phosphorus is placed at right depth in soil with zero till drill (93.33%), Zero Tillage saves water in first irrigation as well as in subsequent irrigations (92.59%), The phosphorus is placed at right depth in soil with Zero Till drill (91.85%),

The Govt. is promoting this technology by providing subsidized machines (89.62%), Ideal moisture condition for sowing with Zero Tillage is a day before field normally comes under working condition (88.14%), Zero Tillage Technology conserves natural resources like soil, water and environment (86.66%), Emergence of wheat under Zero Tillage is 1 or 2 days earlier than traditional sowing method (85.18%), Zero Tillage is successful in heavy soils (82.96%),

Zero Tillage improves the health of the soil as minimum disturbance of soil (82.22%), Phalaris minor population is less in Zero Tillage than Conventional Tillage (81.48%), Sowing of wheat under Zero Tillage is 5-7 days earlier than conventional method (79.25%), The increase in organic content of soil as paddy stubbles incorporates

Table 1. Knowledge of farmers regarding Zero Tillage Technology

n=135

Items	Frequency	Percentage
Zero Tillage Technology means a new machine that will increase the yield.	92	68.14
Zero Tillage is very simple and does not require any specific skill.	99	73.33
Zero Tillage Technology conserves natural resou rces like soil, water and environment.	117	86.66
Ideal moisture condition for sowing with Zero Tillage is a day before field normally comes under working condition.	119	88.14
The technology is very suitable for low lying areas where some time wheat sowing is not possible by conventional method.	126	93.33
Standing (anchored) stubbles of rice up to 1.5 feet is not a problem.	61	45.18
Sowing of wheat under Zero Tillage is 5-7 days earlier than conventional method.	107	79 .25
Emergence of wheat under Zero Tillage is 1 or 2 days earlier than traditional sowing method.	115	85.18
The phosphorus is placed at right depth in soil with Zero Till Drill.	124	91.85
The seed is placed in the most fertile zone of the soil.	70	51.85
The crop vigor is better than conventional sowing.	90	66.66
Phalaris minor population is less in Zero Tillage than Conventional Tillage.	110	81.48
Use of post-emergence herbicides is necessary in Zero Tillage.	128	94.81
No harm by bird to seed which generally kept in open slit.	71	52.59
No effect in germination of seed as minimum soil covers the seed.	76	56.29
The saving of at least Rs. 1500/ Acre is possible by using Zero Tillage.	131	97.03
The water does not remain stagnant in Zero Tillage after first irrigation.	95	70.37
The diesel saving is in the range of 24-30 liters/ Acre.	81	60.00
Zero Tillage is successful in heavy soils.	112	82.96
Zero Tillage is also successful in relative light soils.	57	42.22
The lodging is not a problem in Zero Tillage.	97	71.85
The yield in Zero Tillage field is more than conventional sowing method.	78	57.77
There areminimum wear and tear of the tractor in Zero Tillage Technology.	91	67.40
The Govt. is promoting this Technology by providing subsidized machines.	121	89.62
Zero Tillage saves water in first irrigation as well as in subsequent irrigations.	125	92.59
Minimum effect of terminal heat in Zero Tillage sown wheat as the crop is timely sown.	100	74.07
Zero Tillage improves the health of the soil as minimum disturbance of soil.	111	82.22
The increase in organic content of soil as paddy stubbles incorporates in the soil.	105	77.77

in the soil (77.77%), Minimum effect of terminal heat in Zero Tillage sown wheat as the crop is timely sown (74.07%), Zero Tillage is very simple and does not require any specific skill (73.33%), The lodging is not a problem in Zero Tillage (71.85%), The water does not remain stagnant in Zero Tillage after first irrigation (70.37%), Zero Tillage Technology means a new machine that will increase the yield (68.14%), There is minimum wear and tear of the tractor in Zero Tillage Technology (67.40%), The crop vigor is better than conventional sowing (66.66%), The diesel saving is in the range of 24-30 liters/ Acre (60.00%), The yield in Zero Tillage field is more than conventional sowing method (57.77%), No affect in germination of seed as minimum soil covers the seed (56.29%), No harm by bird to seed which generally kept in open slit (52.59%), The seed is placed in the most fertile zone of the soil (51.85%), Standing (anchored) stubbles of rice up to 1.5 feet is not a problem (45.18%) and Zero Tillage is also successful in relative light soils (42.22%).

Constraints faced by the ZT practicing farmer: The Constraints were classified into five categories namely technical constraints, Training and Educational constraints, financial constraints, Socio-Psychological constraints and extension constraints. The important constraints faced by the practicing farmers in adoption of zero tillage technology have been presented in Tables 2 to 6.

Technical constraints: The data pertaining to technical constraints faced by farmers is presented in Table 2 that loose straw management in problem 84.44 percent was the most important problem faced by the farmers as it ranked on first position, lack of local mechanic to repair the machine (82.22%) got rank II, straw burning (77.77%) got rank III, Every third successive season one has to shift to the conventional tillage for the sowing of wheat due to soil compactness and reduction in the yield (74.07%) got rank IV, Difficulty to judge the proper moisture level (75.55%) got rank V, Lack of easy availability of machine parts at local level (73.33%) got rank VI, Non availability of the quality seed drill (65.92%) got rank VII, Difficulty in bund making (60.74.%) got rank VIII, Poor quality material used on subsidized drills (57.77%) got rank IX, Problem of termite (56.29%) got rank X, Higher population of weeds at the time of sowing (53.33%) got rank XI, Late emergence of wheat seedlings (51.55%) got rank XII, Problem of standing stubbles (48.14%) got rank XIII, Problem of rats (44.44%) got rank XIV and Late harvesting of rice (37.77%) got last rank were also constraints in adopting zero-tillage technology.

Table 2: Distribution of the respondent according to the Technical constraints faced in adoption of Zero Tillage Technology

Technical constraints	Frequency	Percentage	Rank
Nonavailability of the quality seed drill	89	65.92	VII
Poor quality material used on subsidized drills	78	57.77	IX
Loose straw management is problem	114	84.44	I
Problem of standing stubbles	65	48.14	XIII
Difficulty in bund making	82	60.74	VIII
Difficulty to judge the proper moisture level	102	75.55	V
Higher population of weeds at the time of sowing	72	53.33	XI
Lack of local mechanic to repair the machine	111	82.22	II
Lack of easy availability of machine parts at local level	99	73.33	VI
Problem of termite	76	56.29	X
Late harvesting of rice	51	37.77	XV
Straw burning	105	77.77	III
Problem of rats	60	44.44	XIV
Late emergence of wheat seedlings	69	51.11	XII
Every third successive season one has to shift to the conventional tillage for the sowing of wheat due to soil compactness and reduction in the yield.	100	74.07	IV

Table 3: Distribution of the respondents according to the Training and Education constraints faced in adoption of Zero Tillage Technology

Training and Education constraints	Frequency	Percentage	Rank
Inadequate training programmes/facilities regarding zero tillage technology	94	69.62	II
Inadequate extension literature on Zero Tillage Technology	81	60.00	III
Less coverage by the mass media	101	74.81	I
Lack of knowledge regarding calibration of the seed drill	75	55.55	IV

Training and Education constraints: Regarding the training and educational constraints as evident from the data presented in Table 3. Less coverage by the mass media was observed as the most serious constraints (74.81%) got rank I followed by inadequate training programmes (69.62%), Inadequate extension literature on zero tillage technology (60.00%) and lack of knowledge regarding calibration of the seed drill (55.55%) got rank II, III and IV respectively.

Financial constraints: Among the Financial constraints higher cost of zero till drill (70.37%) of respondents reported major constraints followed by Inadequate funds due to purchase of other inputs (65.18%) and 54.07 percent of respondents reported that the subsidy usually availed by high profile farmers as indicated in Table 4.

Social-Psychological constraints: The data presented in Table 5 reveals that among the most serious constraints Lack of the cooperation among fellow farmers to share their experiences on Zero Tillage Technology (67.40%) got rank I, community pressure (61.48%) got rank II, poor field experience (58.51%) got rank III and hearsays and rum ours about Zero Tillage Technology (45.18%) got last rank were also constraints in adoption of Zero Tillage Technology.

Extension relatedConstraints: The data presented in Table 6 reveals that the most serious constraints like lack of knowledge of farmer about minor adjustments of machine (80.74%) got rank I, Lack of trained field experts who give live demonstration of machine setting at farmers' field (76.29%) got rank II, lack of extension literature (55.55%) got rank III, Inadequate extension facility at the disposal of input agencies (51.11%) got rank IV, lack of adequate manpower from state extension agencies (46.66%) got rank V, lack of knowledge of extension agencies (25.92%) got rank VI and Lack of attention of mass media (22.96%) got last rank.

Table 4: Distribution of the respondents according to the Financial constraints faced in adoption of Zero Tillage Technology

Technical constraints	Frequency	Percentage	Rank
Subsidy usually availed by high profile farmers	73	54.07	III
Higher cost of zero till drill	95	70.37	I
Inadequate funds due to purchase of other inputs	88	65.18	II
Lack of incentives or any insurance policy	67	49.62	IV

Table 5: Distribution of the respondents according to the Social-Psychological constraints faced in adoption of Zero Tillage Technology

Social-Psychological constraints	Frequency	Percentage	Rank
Lack of cooperation among fellow farmers to share their experiences on Zero Tillage Technology	91	67.40	I
Poor field appearance	79	58.51	III
Hearsays and rum ours about Zero Tillage Technology	61	45.18	IV
Community pressure	83	62.48	II

Table 6: Distribution of the respondents according to the Extension Constraints faced in adoption of Zero Tillage Technology

Extension Constraints	Frequency	Percentage	Rank
Lack of adequate manpower from state extension agencies	63	46.66	V
Lack of extension literature	75	55.55	III
Lack of attention of mass media	31	22.96	VII
Lack of knowledge of extension agencies	35	25.92	VI
Inadequate extension facility at the disposal of input agencies	69	51.11	IV
Lack of trained field experts who give live demonstration of machine setting at farmers' field	103	76.29	II
Lack of knowledge of farmer about minor adjustments of machine	109	80.74	I

These findings are supported by the findings of Malik *et al*, (2006), Singh and Pandey (2006), Kumar *et al*, (2006), Singh and Kumar (2006) and Cummins (2002), who reported that higher cost of zero till drill, nonavailability of quality seed drill and less coverage about Zero Tillage Technology by the mass media as the constraints in adoption of Zero Tillage Technology.

CONCLUSION

It can be concluded that Zero Tillage Technology is saving ` 1500/acre, Phalaris minor population is less in zero tillage than conventional tillage, Technology is very suitable for lying areas where some time wheat sowing is not possible by conventional method, saves water in first irrigation, phosphorous is placed at right depth in soil with zero till drill. Besides it also controlsthe environmental hazards by minimum diesel consumption in agriculture practices. It minimizes CO2 emission into atmosphere, improves soil health by minimal disturbance and incorporation of paddy stubbles into the soils. As the management of loose straw and lack of local mechanic to repair the machine were the major technical constraints, so there is need to develop suitable equipments and practices for collecting loose straw left in the paddy fields. Less coverage of mass media was the major constraints. Among the financial constraints higher cost of zero till drill, inadequate funds due to purchase of other inputs and availing of subsidy only by high profile farmers were reported as the major constraints 70-95 per cent of the respondents. Lack of cooperation among farmers to share their experience and lack of knowledge of farmers about minor adjustments of machine was reported as constraints by the majority of the respondents.

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