

Accelerating Adoption of Zero Tillage Technology

Randhir Singh¹, Anuj Kumar² and Ramesh Chand³

Directorate of Wheat Research, Karnal, 132001, Haryana, India

ABSTRACT

India is the second largest producer of wheat. The country is producing more than 75.38 million tons of wheat from 28.34 million ha area with productivity of about 2660 kg per ha. Wheat is grown in most parts of the country, but nearly 70 per cent lies in northern plains and 20 per cent in central India. More than 90 per cent wheat area is sown to bread wheat, which is grown throughout the country. A total of 200 farmers, 100 each from adopter and non adopter categories were randomly selected from Gonder, Bhaini Khurd, Kacchwa, Pundrak, Jundla, Sultanpur, Gorgarh, Bastali, Brass, Dabri, Pakhana, Shonkra, Manjura, Janeshro, Hathlana, Northa, Jalmana villages of Karnal district. The adopters had favourable attitude and were more prone to change towards zero tillage technology as compared to non-adopters. The adopters had fairly good knowledge about zero tillage technology. The adopters exhibited satisfaction in terms of saving in time, money, timeliness of sowing and yield. The constraint like lack of adequate manpower with the state department of agriculture and input agencies was perceived as the major extension constraint in the study area. The farmers also mentioned lack of money to purchase new machines and inputs. The level of adoption can be accelerated through educational means and government policies.

Key words : Zero Tillage, Adoption, Attitude, Knowledge, Change proneness, Constraints, Impact

One of the transformations that is taking place in the cultivation of wheat in rice wheat cropping system is the evolution of zero tillage technology and there is a paradigm shift from conventional to zero tillage. Traditionally, just 10 years ago, the tillage practice for wheat showed that there were over 6 ploughing with the country plough behind the bullock and over 12 laddering (plankings to level the soil) (Saunders, 1990, Meisner 1992, 1996, 1999 and 2001). By definition, zero tillage seeding is a one pass operation which places seed and fertilizer into an undisturbed seed bed, packs the furrow and retains adequate surface residues to prevent soil erosion.

In Latin America, the Development Cooperation has achieved impressive results as a method combating soil degradation introducing zero tillage management, especially direct planting. The potential benefits of zero tillage are early planting, greater efficiency and less maintenance costs of machinery, more time for management decisions and technical upgrading, less dusty and muddy work environment, more time for family, less stress and greater satisfaction derived from caring for the environment. Gentil (1995) reported reductions in diesel fuel of 50 to 70%, or more and proportional reductions in greenhouse gas emissions. Zero tillage per se has a major impact in reducing carbon dioxide

emissions when compared to conventional tillage, by immobilizing carbon in incremental soil organic matter and surface residues (Derpsch, 1998).

Zero tillage seeding offers the benefits of surface residues and reduced soil water losses, improve soil condition over time, availability of organic nitrogen is higher in long term zero tillage seeded fields, protect young seedlings from heat and wind stress during early growth stages. Standing stubble reduces wind speed at ground level and reflects rather than absorbs heat. The potential benefits of this technology may be attractive, but unless the farmers can obtain a suitable priced drill, the benefits will remain hypothetical. An attempt has been made in this paper to analyze the factors responsible for accelerating adoption of zero tillage technology.

METHODOLOGY

First of all, a list of the adopter and non adopter farmers was prepared, thereafter, 100 adopter and 100 non-adopter farmers from Gonder, Bhaini Khurd, Kacchwa, Pundrak, Jundla, Sultanpur, Gorgarh, Bastali, Brass, Dabri, Pakhana, Shonkra, Manjura, Janeshro, Hathlana, Northa, Jalmana villages of Karnal district were randomly selected for the purpose. The responses were recorded in a pre designed interview schedule.

RESULTS AND DISCUSSION

Profile of the farmers: *Most of the farmers were middle aged in both the categories. The literacy level among*

Table 1. Profile of the farmers

Variable	Category	Per cent	
		Adopters	Non Adopters
Age (Years)	Young (Up to 30)	19	22
	Middle (30- 50)	60	50
	Old (>50)	21	28
Education	Illiterate	12	15
	Primary	15	25
	Middle	25	30
	High School	30	20
	Intermediate	10	2
Caste	Graduate & above	8	8
	General	90	92
	OBC	9	8
	SC	1	0
Main Occupation	Agriculture	100	100
Secondary Occupation	Service	7	0
	Business	2	0
	Labour	11	13
Experience (Year)	Upto 10	20	24
	10-20	23	22
	> 20	57	54
Type of Family	Nuclear	46	49
	Joint	54	51

both the categories of farmers was high, therefore, the print material can be used to make the farmers aware of latest technologies. About 90 per cent of the farmers in both the categories belonged to general caste category followed by backward caste. All the farmers had agriculture as their main occupation in both the categories, a few had labour, service and business as their secondary occupation in the adopter category whereas, in the non adopter category, there were 13 per cent labourers. A trend was observed that those who had comparatively small holdings were having other

subsidiary occupations to support their family. Majority of the farmers were having more than 10 years experience in agriculture and it was the main occupation of both the categories. The average experience in agriculture was more than 22 years in both the categories and majority had joint family system, however, nuclear family is getting preference (Table 1).

Decision making on farm operations : In most of the farm operations like land preparation, seed, sowing, fertilizer, irrigation hoeing, weeding, plant protection, harvesting and threshing, marketing, purchase, borrowing, livestock purchase and care, most of the time it was husband who enjoyed decision making power, however, sometimes the decisions were jointly taken by the couple in hoeing, harvesting & threshing, livestock care and purchase in both the categories.

Involvement of school children in farm operations: Seldom have the children helped their parents in land preparation, sowing, ridging, fertilizer application, irrigation, hoeing / weeding, plant protection, harvesting, threshing and marketing in both the categories.

Interaction with fellow farmers, scientists, agriculture officials, input agencies and NGOs : The interaction level was measured at six point continuum, assigned scores of 6, 5, 4, 3, 2 and 1 respectively. Interaction of farmers with farmers of their own village, agricultural scientists and input agencies/private organizations/NGOs has indicated low level of interaction and desired more in both the categories. There was comparatively good interaction with functionaries of the state department of agriculture in the adopter category. Perhaps it was the main reason for zero tillage being adopted in almost all parts of Haryana. The interaction of non adopters was low. They attended a few trainings, field days, farmers' days, demonstrations and occasionally made office calls to input agencies/ private organizations or NGOs.

Table 2. Change Proneness

Statement	Yes (Frequency)	
	Adopter	Non Adopter
I try to keep myself updated with information on new farming practices, but that does not mean that]	98	94
I feel restless till I try out I try out all the new methods. I feel restless till I try out a new farming practice I have heard about.	20	1
They talk of many new practices these days but who knows if they are better than old ones.	80	99
I am cautious about trying a new farming practices	70	90
After all, our forefathers were right in their practices and I do not see any reason for changing these old methods.	25	98
Often new practices are not successful however, if they are promising, I would surely adopt them.	90	65
From time to time I have heard about several new farming technologies/ practices and I have tried most of them in the last few years.	28	12
I usually want to see the results my neighbors obtain before I try out new practice.	91	98
Sometimes, I believe that traditional ways of doing agriculture are the best.	10	70

Psychological traits of the farmers : Change Proneness: The adopters were more prone to change compared to the non adopters. Both the categories, however, wanted to see the results of their neighbour before trying out a new practice. The non adopters had faith in the traditional ways of doing agriculture but it can be altered through persuasive and educational means (Table 2).

Attitude towards ZT technology: Attitude was measured on a five point continuum viz. highly favourable, favourable, undecided, unfavourable and highly unfavourable . The scoring was 5,4,3,2,1 for positive and reverse for negative statements. The adopters had favourable attitude

towards zero tillage technology as compared to their non adopter counterparts. Even the non adopters were convinced that the ZT technology is profitable, no special skill is required to adopt and the crop doesn't turn yellow after the first irrigation (Table 3). The adopters feel like playing an advisor's role as a disseminator of the technology and the government should promote Zero Tillage Technology (ZTT) as it saves diesel, money and water not only in first irrigation but subsequent irrigations also. However, studies have shown that there is less saving of water (Anonymous 2003 -04).

Table 3. Attitude towards ZT technology
Statements

Statements	Mean	
	Adopter	Non Adopter
ZT is a highly profitable technology	4.26	2.52
I would not advise anyone to adopt ZT	3.97	1.45
ZT does not increase yield from wheat at all	3.97	2.40
I earned a lot of money for myself and my family due to adoption of ZT	4.36	1.0
Govt. is simply wasting money on popularizing ZT	3.98	1.20
ZT technology is a risky proposition	4.03	1.25
I would suggest that Govt. should strongly promote ZT	4.27	1.35
ZT will never be successful in our state	3.96	2.01
I feel all the farmers should adopt ZT technology	4.37	1.36
ZT does not save diesel - it is just myth	4.02	2.12
ZT saves money	4.56	2.32
ZT saves water in first irrigation	4.26	1.54
ZT saves water in the subsequent irrigations	4.02	2.15
The crop does not turn yellow after first irrigation in ZT	4.22	3.30
ZT technology is very simple and does not require any special skill.	4.36	3.25
Mean	4.17	1.88

Table 4. Knowledge about ZT technology
Statements

Statements	Mean	
	Adopter	Non Adopter
Ideal moisture condition for sowing with ZT is a day before field normally comes under working condition	0.84	0.65
Standing (Anchored) stubbles of rice upto 15 inches is not a problem	0.89	0.34
Emergence of wheat under ZT is 1 to 2 days earlier than CT	0.87	0.35
The seed is placed in the most fertile zone of the soil	0.89	0.25
The crop vigour is better than CT	0.88	0.80
Phalaris minor population less in ZT than in CT	0.83	0.65
Use of Post-emergence herbicides is necessary in ZT	0.42	0.46
The saving of at least Rs. 1000/-acre is possible by using ZT	0.85	0.21
The crop does not remain yellow after first irrigation	0.83	0.75
The diesel saving is in the range of 20-25 liters/acres	0.84	0.62
Zero-tillage is successful only in heavy soils	0.80	0.12
Zero-tillage is also successful in relatively light soil	0.85	0.23
The lodging is not a problem in ZT	0.60	0.45
Insect population specially yellow stem borer does not increase in rice after wheat using ZT	0.59	0.51
The population of rats does not increase if we use ZT	0.60	0.39
The yield in ZT field is more than in CT	0.66	0.34
There is definitely saving in labour if one uses ZT	0.83	0.69
Mean	0.77	0.46

Knowledge about Zero Tillage Technology :The farmers had fairly good knowledge about zero tillage technology in the adopter category but poor in the non adopter category. The adopters were aware of ideal moisture condition required for zero tillage sowing, height of stubbles, utility in different kinds of soils, emergence of wheat, seed placement, crop vigour, weed infestation, input saving, etc. Even the non adopters also knew that the crop vigour is better, less Phalaris minor and labour and fuel saving in zero tillage compared to conventional (Table 4). Similar findings have been reported by Singh and Kumar (2005). Still more efforts are needed to motivate farmers particularly the non adopters to accelerate adoption of zero tillage technology. The development officials can play an important role in educating the farmers.

Satisfaction with Zero Tillage Technology : The level of satisfaction was measured on a five point continuum viz highly satisfied, satisfied, not satisfied, dissatisfied and highly dissatisfied and assigned scores of 5,4,3,2 and 1, respectively for positive and reverse for negative statements. The farmers exhibited satisfaction due to adoption of zero tillage technology. They were satisfied with saving in time, money, advantage of technology to women, status enjoyed, timeliness of sowing and yield, about role of institutes and SAUs in transferring of technology (Table 5). They had little satisfaction about role of NGOs in technology transfer.

Table 5. Level of Satisfaction after adoption of ZT technology

Statements	Mean
Achievement attained through zero-tillage	3.71
Scope to prove merit for promotion of technology	4.26
Technical feasibility of technology	4.38
Ability to reduces stress of hard labour	4.48
Appreciation by neighbor	4.21
Saving in time	4.64
Saving in energy	4.66
Advantage of technology to women	3.49
Status and prestige you enjoy from adoption of this technology	3.54
Role of Institute/SAU in introduction of Zero-Tillage	2.87
Role of State Department in transfer of zero-tillage technology	3.45
Role of NGOs in transfer of zero-tillage technology	2.25
Opportunities of using zero-tillage in wheat in the areas other than rice-wheat technology	3.86
Cost saving you get	4.26
Improvement in yield	3.84
Interest of family women in adoption of zero-tillage	3.42
Scope of advancement technology in the whole village	4.14
Timeliness of sowing through zero-tillage	4.30
Guidance from other villagers	4.00
Overall Mean	3.88

Table 6. Constraints in adoption of ZT technology

Technical Constraints	Mean	
	Adopter	Non Adopter
Non availability of quality drill	2.03	2.35
Lack of appropriate loose straw management	1.80	2.45
High cost of drill	2.32	2.59
Lack of local manufacturer facility	1.89	1.58
Standing (anchored) stubbles	1.54	2.31
Appropriate moisture at sowing	1.52	1.24
More population of weeds at the time of drilling	1.52	1.54
Increased problem of yellow stem borers	1.66	1.65
Hardening of upper soil	1.46	1.65
Late harvesting of rice	1.32	1.42
Too early harvesting of rice	1.48	1.45
Straw burning	1.34	1.56
Mean	1.66	1.82
Extension Constraints		
Lack of adequate manpower from state extension agencies	2.93	2.51
Lack of extension literature	2.50	2.35
Lack of attention of mass media	2.16	2.10
Lack of knowledge of extension agencies	2.04	2.20
Inadequate extension facility at the disposal of input agencies	2.96	2.65
Lack of fellow farmers Co-operation	2.10	1.95
Mean	2.45	2.29
Financial constraints		
Lack of credit facilities	2.09	2.29
Lack of money to buy new machine	3.21	3.85
Lack of money to buy other inputs	3.21	3.01
Mean	2.84	3.05

Constraints in adoption of zero tillage technology : The constraints were measured on a five point continuum viz most serious, very serious, serious, not so serious and not serious and assigned 5,4,3,2 and 1, scores respectively. No technical constraints were viewed seriously by the farmers in the adopter category, however, there were few extension constraints like lack of adequate manpower with the state department of agriculture and input agencies. The farmers also mentioned lack of money to purchase new machines and inputs. Lack of appropriate loose straw management, high cost of drill, lack of money to buy machines and inputs, inadequate extension facilities were the serious constraints perceived by the non adopters (Table 6).

CONCLUSION

The farmers had favourable attitude towards zero tillage technology, but the non adopters need to be motivated to adopt zero tillage technology. The known adopters are also aware of the benefits of zero tillage technology, however, efforts are required to motivate them through participatory mode. The adopters had fairly good knowledge about zero tillage and were satisfied with its performance. They had low level of interaction with other agencies which need to be increased particularly the input agencies. Development agencies should interact more with non adopters. The farmers were ready for a change but needs persuasive strategy to accelerate adoption of zero tillage technology.

REFERENCES

1. Derpsch, R. (1998.) Historical review of no tillage cultivation of crops. JIRCAS Working Report No. 13. Pp.1-18.
2. Gentil, L.V. (1995). In: I seminário internacional do sistema plantio directo. Resumos. EMBRAPA-CNPT, Ponta Grossa, RS. Agosto. Pp.9-12.
3. Malik R.K., Gupta, R.K., Yadav, A., Sardana, P.K. and Singh, C.M. (2005). Zero Tillage – The voice of farmers. Directorate of Extension Education, CCS HAU, Hisar, Pp5-37
4. Meisner, C.A. (1992). Report of on farm survey of the Mymensingh Region and Tangail: wheat growers' practices, perceptions and their implications. Monograph No. 9, Bangladesh Agricultural Research Institute. Wheat Research Centre, Nashipur Dinajpur. September 1992.
5. Meisner, C.A. (1996). Report of on farm survey of the Greater Comilla Region: Wheat growers' practices, perceptions and their implications. Monograph No. 13, Bangladesh Agricultural Research Institute. Wheat Research Centre, Nashipur Dinajpur. June 1996.
6. Meisner, C.A. (1999). Report of on farm survey of the Greater Faridpur Region: Wheat growers' practices, perceptions and their implications. Monograph No. 14, Bangladesh Agricultural Research Institute. Wheat Research Centre, Nashipur Dinajpur. June 1999.
7. Meisner, C.A. (2001). Report of On Farm Survey of the Greater Sylhet Region: Wheat growers' practices, perceptions and their implications. Monograph No. 16, Bangladesh Agricultural Research Institute. Wheat Research Centre, Nashipur Dinajpur. July 2001.
8. Saunders, D.A. (1990). Crop management research summary of results. Wheat Research Center Monograph 5, Nashipur, Bangladesh : WRC.
9. Singh, R and Kumar, S. (2005). Multidimensional impact assessment of zero tillage technology. Zero Tillage- The voice of farmers. Technical Bulletin No.9. Directorate of Extension Education, CCS HAU, Hisar, PP.53-61