Research article Available online www.ijsrr.org ISSN: 2279–0543

International Journal of Scientific Research and Reviews

Factors Influencing Adoption of Resource Conservation Technologies In Different Agro-Climatic Zones of Uttar Pradesh, India

O. P. Singh

Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi – 221005; E-mail: ompsingh@gmail.com

ABSTRACT

Mechanical revolution enabled farmers to grow more crops on same piece of land during the year. The negative consequences of farm mechanisation are groundwater depletion, decline soil fertility and reduction in total factor productivity. The resource conservation technologies (RCTs) help to reduce the negative effects of conventional agriculture. The benefits demonstrated by the RCTs are many, but popularisation and adoption of technology at farmers' field are localised and the pace of technology adoption was very slow. Present study was an attempt to find out the important influencing factors that helps farmers for adoption of RCTs for wheat crop in different agro-climatic zones of Uttar Pradesh. The study was based on the primary data and it was collected through personal interview from selected farmers. The binary logit model was used to find the most influencing factors for adoption of RCTs. Results suggest that land holding size, farming experience, age of respondents were the main responsible factor for adoption of RCTs for wheat crop. Beside this, other factors are soil type, irrigation water availability and source of irrigation etc.

KEYWORDS: Resource Conservation Technologies; Zero-tillage machine; rotavator; binarylogit model;

***Corresponding author**

O. P. Singh

Department of Agricultural Economics,

Institute of Agricultural Sciences,

Banaras Hindu University, Varanasi – 221005;

E-mail: ompsingh@gmail.com

INTRODUCTION

After transformation of Indian agriculture in 1968, Indian farmers were gradually shifting from traditional method of crop production to modern method of crop production. Farmers also shifted from bullock power to mechanical power for tillage, sowing and harvesting of crops. The self-sufficiency in front of food grain production and huge buffer stock of food grain in India has been achieved is the most successful application of science and technology in agriculture like adoption of high yielding varieties, creation of irrigation facilities, use of chemical fertilisers, plant protection measures which triggered cropping intensity at farmers' field level and food security at national level. As per fourth advance estimate, total food grain production of the country was 284.83 million tonnes during 2017-18. The Government of India is targeting food grain production of 285.2 million tonnes during 2018-19. Indian agriculture is one of the principal sources of livelihood for about 58 per cent of India's population. The gross value added by agricultural sector was estimated at Rs 17.67 trillion during financial year 2018.In the process of modernisation of Indian agriculture, the negative consequences of uncontrolled and unsustainable use of inputs of crop production were realised in the form of depletion of groundwater, declining soil fertility and reduction in total factor productivity in many parts of the country. The conventional method of crop production is characterised by intensive tillage for land preparation and crop residue burning, which leads to soil erosion. The continuous soil erosion from the agricultural field leads to reduce soil productivity.

The major concern of the researchers and policy makers is how to enhance crop productivity and production from the shrinking of land and water resources to feed fast growing population of the country. Introduction of conservation agriculture tender robust option for meeting future food-grain demands while contributing to sustainable agriculture and rural development. Conservation agriculture can enhance the efficiency of inputs use, farm income, and sustainable crop yield while protecting and revitalise soil fertility, biodiversity and the natural resource base. It is promoted among the farming community as a concept of crop production to a high and sustained production level to achieve adequate profit while saving the resources along with conserving environment (FAO, 2008).

Conservation agriculture is a set of technologies which includes minimum soil disturbance, permanent organic soil cover, improved crop rotation and integrated weed management. The conservation agriculture helps farmers to reduce the negative effects of conventional agriculture. The resource conservation technologies (RCTs) offer varieties of options. Out of these options, zero/reduce till-surface residue management system has benefited farming community of different regions of world including Uttar Pradesh by receiving higher productivity gain, good soil health and significant reduction in overall cost of cultivation by reducing inputs use for wheat cultivation (Singh, 2016; Singh, 2016a; Singh et. al, 2016; 2016a; 2016b; Singh *et. al*, 2017, 2017a, 2017b, Singh *et. al*, 2018).Many past researchers reported that after adoption of RCTs reduces the use of fossil fuel which leads to lower emission of carbon dioxide, which is one of the gases responsible for global worming (Kern and Johnson, 1993; West and Marland, 2002; Hobbs and Gupta, 2004; Holland, 2004; Govaerts et al., 2009; Singh, 2016; Singh, 2016a; Singh et al., 2016; 2016a; 2016b; Singh et al., 2017, 2017a, 2017b, Singh et al., 2018).

The benefits demonstrated by the resource conservation technologies are many, but popularisation and adoption of technology among farmers are localised and the pace of technology adoption was very slow. Sometimes farmers adopted and practice these technologies on their farm thereafter they revert to conventional method of crop production. Present study was an attempt to find out the important influencing factors that helps farmers for adoption of RCTs in wheat crop in different agro-climatic zones of Uttar Pradesh.

RESEARCH METHODOLOGY

2.1 Sampling Procedure and Data Use

Present study was based on the primary data. Primary data was collected through personal interview using pre-tested schedule. Uttar Pradesh is divided into nine agro-climatic zones. Out of these, eight agro-climatic zones were selected for present study. One district from each selected agro-climatic zone was selected purposively on the basis of highest adoption of resource conservation technologies. From each selected district, two development blocks were purposively selected. The criteria for selection of development blocks was done on the basis of one having highest adoption of RCTs and another having lowest adoption of RCTs. From each selected block, one village or cluster of village was selected purposively for primary data collection. From each village, a list of RCTs adopters and non-adopters were prepared separately. The 10 RCTs adopter and 10 RCTs non-adopter farmers were selected randomly. Total 160 RCTs adopters and 160 non-adopters were selected for the present study. Total sample size was 320 (Table 1).

Table 1: Name of Selected Blocks for Data Collection

Name of Agro-climatic Zones	Name of Selected Districts	Name of Blocks	Name of Village	Number of Respondents	
				Adopter	Non-adopter
1. Vindhyan	Mirzapur	1. Narayanpur	Bhurkura	10	10
		2. Jamalpur	Pirkhir	10	10
2. Eastern Plain	Chandauli	1. Barhani	Barhani	10	-
			Marui	-	10
		2. Sahebganj	Khilchi	10	-
			Vilaspur	-	10
3. North Eastern Plain	Gorakhpur	1. Bhatahata	Pokharbhinda	10	10
		2.Brahmpur	Belwa	10	10
4. Mid Western Plain	Bareilly	1. Nawabganj	Vakaniya	10	10
		2. Vithari Chainpur	Sisaiya	10	10
5. Central Plain	Kaushambi	1. Newada	Kadirpur Newada	10	10
		2. Muratganj	Mohnapur	10	10
6. Western Plain	Ghaziabad	1.Rajapur	Matiyala	10	10
		2. Bhojpur	Tahlata	10	10
7. Tarai and Bhabar	Bahraich	1.Risia	Patana Ghishiyari	10	10
		2. Shivapur	Itaha	10	10
8. South Western Dry Plain	Etah	1. Nidhauli Kalan	Gerhana	10	10
		2. Punehra	Awagarh	10	10

ANALYTICAL PROCEDURE

For identification of relative importance of various influencing factors for adoption of RCTs in different agro-climatic zones was worked out by using binary logit model (Mallada, 1992; Green, 2008 and Gujarati, 2003). The algebraic form of model is given below:

$$Pi = \frac{1}{1 + e^{-z(i)}}$$

Where, Pi is a probability of adoption of conservation tillage technologies for the i^{th} farmer and ranges from 0 to 1. e- represents the base of natural logarithms and Zi is the function of a vector of n explanatory variables and expressed.

$$Z_i = \beta_0 + \sum_{i=1}^{n} \beta_i X_i$$

Where β_0 is the intercept and β_i is a vector of unknown slope coefficients. The relationship between P_i and X_i, which is non-linear, can be written as follows:

$$p_i = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \dots \beta_n X_n)}}$$

Finally, the logit model is obtained by taking the logarithm

$$L_i = L_n\left[\frac{p_i}{1 - p_i}\right] = Z_i = \beta_0 + \beta_1 X_1 + \cdots + \beta_n X_n$$

RESULTS AND DISCUSSION

3.1 Agro-climatic Zone-Wise Adoption of RCTs

Farmers from the different agro-climatic zones of Uttar Pradesh were using two option of resource conservation technologies viz., zero-tillage machine and reduce tillage using rotavator (Table 2).

Table 2: Types of RCTs adopted by Sample farmers for Wheat Crop, Uttar Pradesh

Name of the Agro-Climatic Zones of Uttar Pradesh	Name of Selected District	Type of Technology adopted
1. Vindhyan	Mirzapur	Zero-tillage
2. Eastern Plain	Chandauli	Zero-tillage
3. North-Eastern Plain	Gorakhpur	Zero-tillage
4. Central Plain	Kaushambi	Zero-tillage
5. Western Plain	Ghaziabad	Zero-tillage
6. Mid-Western Plain	Bareilly	Rotavator
7. Tarai and Bhabar	Bahraich	Rotavator
8. South-Western Dry Plain	Etah	Rotavator

The zero-till-dill machine was used by the sample farmers from Vindhyan, Eastern Plain, North-Eastern Plain, Central Plain and Western Plain agro-climatic zones of Uttar Pradesh for sowing of wheat crop (Table 2). The rotavator was used by sample farmers for land preparation and sowing of wheat crop in Mid-Western Plain, *Tarai* and *Bhabar* and South-Western Dry Plain agro-climatic zones of Uttar Pradesh.

3.2 Vindhyan Agro-climatic Zone

The factors influencing adoption of zero-tillage for sowing of wheat crop in Vindhyan agro-climatic zone was estimated by using binary logit model. In case of dependent variable, RCTs adopter and non-adopters was used and the binary value given one for adopters and zero for non adopters. The independent variables were year of education of respondents, farming experience in year, land holding size (both owned and leased-in land minus leased-out land) in hectare, age of respondents in year and family size of respondents in number. The results showed that “B” value of year of education of respondents and land holding size was found significant with positive sign at five per cent level of significance. The “B” value of farming experience was significant at 10 per cent level of significance. It means if year of education of respondents will increase by one year, the chances of RCTs adoption will increase by 0.356. In case of land holding size, the results suggests that if increase in land holding size by one hectare, the chances of zero-tillage adoption by respondents will increase by 0.323. In case of farming experience, if farming experience increased by one year the chances of adoption of zero-tillage will increase by 0.126 (Table 3).

Table 3: Factors Influencing Adoption of Zero-tillage in Vindhyan Region

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant "a"	-6.652*	3.027	4.828	1	0.028	0.001
b. Education level (year)	0.356*	0.176	4.078	1	0.043	1.428
c. Farming experience (Year)	0.126**	0.072	3.079	1	0.079	1.135
d. Land holding size (Ha)	0.323*	0.149	4.703	1	0.030	1.382
e. Age of respondents (Year)	-1.277	1.231	1.076	1	0.300	0.279
f. Family size of respondent (No.)	-0.114	0.123	0.858	1	0.354	0.892
Model Summery						
-2 Log likelihood	42.228					
Cox & Snell R Square	0.282					
Nagelkerke R Square	0.375					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

Besides above factors which are responsible for adoption of zero-tillage, there are some natural factors which influence farmers to adopt zero-tillage machine for sowing of wheat crop in the Vindhyan agro-climatic zone. The black soil and irrigation water scarcity was found in both the sample villages. After harvesting of paddy crop, there is sufficient moisture content in the soil for sowing of wheat crop using zero-tillage machine. Once paddy field completely dry-up, crack formation takes place and it requires more irrigation water. If farmers apply preparatory irrigation in the field after harvesting of paddy crop, it required more time to dry-up for land preparation, which leads to delay in sowing of wheat crop. Therefore, farmers are using zero-tillage machine for sowing of wheat crop on time and reduce the use of prestigious irrigation water which is scarce in the region.

3.3 Eastern Plain Agro-climatic Zone

Chandauli district was selected from Eastern Plain Agro-climatic Zone to find the factors responsible for adoption of zero-tillage machine for wheat sowing. The dependent variable was zero-tillage adopters and non-adopters and value given for zero-tillage adopters was one and zero for non-adopters for using binary logit model. The independent variables were family size (number), farming experience (year), land holding size (hectare), age of respondents (year) and adult family members (number). The results showed that "B" value of farming experience in year was significant at five per cent level of significance and age of respondents was significant at 10 per cent level of significance with negative sign. It means if farming experience will increase by one year, the chances of zero-tillage adoption will increase by 0.171. In case of age of respondents, the result suggests that if increase age of respondents by one year, the chances of zero-tillage adoption by respondents will reduce by 2.342 (Table 4).

Table 4: Factors Influencing Adoption of Zero-tillage in Eastern Plain

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant "a"	5.615**	2.982	3.546	1	0.060	274.488
b. Family size (No)	0.252	0.180	1.955	1	0.162	1.287
c. Farming experience (Year)	-.171*	0.066	6.636	1	0.010	0.843
d. Land holding size (Ha)	0.108	0.134	0.645	1	0.422	1.114
e. Age of respondents (Year)	-2.342**	1.417	2.730	1	0.098	0.096
f. Adult male (No.)	-0.224	0.301	0.553	1	0.457	0.800
Model Summery						
-2 Log likelihood	41.278					
Cox & Snell R Square	0.298					
Nagelkerke R Square	0.398					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

There are some natural and main made factors responsible for adoption of zero-tillage beside above mentioned factors those are responsible for adoption of zero-tillage in Eastern Plain agro-climatic zone of Uttar Pradesh. The soils found in the zero-tillage adopted village are clay and clay loam and irrigation water supplied to the farmers through lift canal based on perennial river Ganga. The canal is running both the seasons except 15 days for sowing of wheat crop. After harvesting of paddy crop, the moisture contain in the field was very high and it requires more time to dry-up for land preparation. This leads to delay in sowing of wheat crop. Therefore, farmers have only one option for sowing of wheat crop on time is zero-tillage machine.

3.4 North Eastern Plain Agro-Climatic Zone

The Gorakhpur district from North-Eastern Plain agro-climatic zone of Uttar Pradesh was selected for present study. The factors responsible for adoption of zero-tillage machine for sowing wheat crop by sample farmers was analyse using binary logit model. The value of one and zero was given to zero-tillage adopters and non-adopters respectively and it was used as dependent variable. The independent variables were family size of respondents (number), farming experience (year), land holding size (hectare), age of respondents (year) and adult family member (number). The results showed that "B" value of land holding size was positive and significant at 10 per cent level of significance. It means increase in land holding size of sample farmers by one hectare there will chances for adoption of zero-tillage for sowing wheat crop will increase by 1.140 in the study area (Table 5).

Table 5: Factors Influencing Adoption of Zero-tillage in North Eastern Plain

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant "a"	-1.576	2.024	0.606	1	0.436	0.207
b. Family size (No)	-0.030	0.077	0.149	1	0.699	0.971
c. Farming experience (Year)	0.029	0.043	0.468	1	0.494	1.030
d. Land holding size (Ha)	1.140**	0.621	3.370	1	0.066	3.126
e. Age of respondents (Year)	-0.024	0.047	0.267	1	0.606	0.976
f. Education level (Year)	0.051	0.096	0.285	1	0.594	1.052
Model Summery						
-2 Log likelihood	47.594					
Cox & Snell R Square	0.178					
Nagelkerke R Square	0.238					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

The district is characterised as abundant irrigation water and black soil was found in the study area. The physical property of black soil is relatively higher water holding capacity. After harvesting of paddy crop, there was very high moisture contain in the soil and farmers were unable to plough their field for sowing wheat crop. If they wait for drying the excess moisture in the field lead to delay in sowing of wheat crop. Therefore, farmers are using zero-tillage machine for sowing wheat crop. In case of Belwa village, irrigation water availability was plenty and soil type was sandy loam. After harvesting of paddy crop, farmers from Belwa village trying to use whatever moisture is available in the field they trying sow wheat crop. Therefore, farmers were using seed-cum-fertiliser dill machine for sowing of wheat crop without land preparation.

3.5 Central Plain Agro-climatic Zone

From the Central Plain agro-climatic zone of Uttar Pradesh, two villages viz., Newada and Muratganj from Kaushambi district was selected for present study and sample farmers were using zero-tillage machine for sowing wheat crop. The binary logit model was used to find out factors influencing adoption of zero-tillage machine in the study area. Results showed that "B" value of land holding size was positively and significantly associated with dependent variable. It means increase in land holding size of sample farmers by one hectare there will chances for adoption of zero-tillage machine for sowing wheat crop will increase by 0.792 in the study area. The family size of the respondents were negatively associated with the adoption of zero-tillage machine for sowing of wheat crop, but number of adult male member of the family positively associated with the adoption of zero-tillage machine (Table 6)

Table 6: Factors Influencing Adoption of Zero-tillage in Central Plain

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant "a"	0.993	2.284	0.189	1	0.664	2.700
b. Family size (No)	-0.361**	0.208	2.996	1	0.083	0.697
c. Farming experience (Year)	-0.019	0.051	0.140	1	0.708	0.981
d. Land holding size (Ha)	0.792*	0.350	5.109	1	0.024	2.207
e. Age of respondents (Year)	-0.075	0.048	2.467	1	0.116	0.928
f. Adult male (No.)	0.498**	0.272	3.348	1	0.067	1.645
g. Education level (Year)	0.127	0.115	1.222	1	0.269	1.135
Model Summery						
-2 Log likelihood	37.122					
Cox & Snell R Square	0.368					
Nagelkerke R Square	0.490					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

Adjacent to above mentioned factors, there were some other factors which are responsible for adoption of zero-tillage machine for sowing wheat crop in Kaushambi district. In both the villages black and clay soils with plenty of irrigation water is available. During the field survey, sample farmers were told that their farm lands are located near the river and generally they face the inundation of flood water during monsoon season. At the time of sowing of wheat crop, lot of moisture found in the soil and they are unable to use normal plough to perform the tillage in the field. Therefore, sample farmers were using zero-tillage machine for sowing of wheat crop. Secondly zero-tillage machine is available with *Krishi Vigyan Kendra* (KVK) on hiring basis. The flood water, black and clay soil and availability of zero-tillage machine were responsible factors beside land holding size and number of adult male member in the family for adoption of zero-tillage machine for sowing of wheat crop.

3.6 Western Plain Agro-climatic Zone

Rajapur and Bhojpur villages of Ghaziabad district was selected for present study and district falls in Western Plain Agro-climatic zone of Uttar Pradesh. The sample farmers were adopted and using zero-tillage machine for sowing of wheat crop. The binary logit model was used to identifying the factors influencing adoption of zero-tillage machine in the study area. The results showed that "B" coefficients for land holding size and age of respondents was found to be statistically significant at five per cent level of significant, whereas farming experience and education level of sample farmers were significant at 10 per cent level of significance. In case of land holding size of sample farmer suggests that if we increase the land holding by one hectare, there will be a chance of adoption of zero-tillage machine for sowing wheat crops was 0.532, whereas in case of age of respondents were negatively associated with the adoption of technology in the study area. It means if we reduce the age of respondents by one year there is a chance of adoption of technology by 0.233. The farming experience was positively associated with adoption of zero-tillage machine for sowing of wheat crop. The education level of respondents was negatively associated with the adoption of zero-tillage machine in the study area (Table 7).

Table 7: Factors Influencing Adoption of Zero-tillage in Western Plain

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant "a"	10.177*	4.976	4.183	1	0.041	26285.040
b. Family size (No)	-0.074	0.229	0.105	1	0.746	0.928
c. Farming experience (Year)	0.149**	0.089	2.827	1	0.093	1.161
d. Land holding size (Ha)	0.532*	0.175	9.256	1	0.002	1.702
e. Age of respondents (Year)	-0.233*	0.117	3.955	1	0.047	0.792
h. Education level (Year)	-0.301**	0.172	3.054	1	0.081	0.740
Model Summery						
-2 Log likelihood	39.221					
Cox & Snell R Square	0.334					
Nagelkerke R Square	0.445					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

Beside above mentioned factors, there was some natural factors which triggers the adoption of zero-tillage in the study area viz., soil types and water availability. The Ghaziabad as characterised as water abundant district. The major soil types found in the district are loam, sandy loam and alkaline soil. In the loamy soil, water holding capacity is relatively high, whereas in case of sandy loam water holding capacity is relatively lower. Sample farmers where largely using diesel pump for irrigating their field. Due to marginal cost associated with the running diesel pump, sample farmers were trying to save the cost diesel, therefore they use zero-tillage machine for sowing wheat crop just after harvesting of paddy crop with available moister in the sandy soil. In case of loamy soil, the moisture contain in soil is very high as compared to sandy loam soil and farmers have to wait longer time to reduce the moisture in the soil, which leads to delay in sowing of wheat crop. Therefore, farmers were using zero-tillage machine for sowing wheat crop on time.

3.7 *Mid-Western Plain Agro-climatic Zone*

The Bareilly district from Mid-Western Plain agro-climatic zone of Uttar Pradesh was selected for the study. The sample farmers of the district were using rotavator for land preparation and sowing of wheat crop. The binary logit model was used to find out the factors influencing adoption of rotavator in the study area. The results showed that "B" value of family size was significant at ten per cent level of significance. The "B" value of adult male was significant at 10 per cent level of significance. It means if family size increases farming will increase by one, the chances of RCTs adoption will increase by 0.360. In case of adult male (number), the result suggests that if increase in adult male in the family, the chances of rotavator adoption by respondents will reduce by 0.686 (Table 8).

The other factors which are responsible for adoption of rotavator for land preparation and sowing of wheat crop in Bareilly district were soil types and irrigation water availability. The district falls under the *Tarai* region of state where water table is very low from the ground and soils contains very high humus. The water retention capacity is very high. All most all the sample farmers were growing popular tree on the bund of their field and roots are spreading in the agricultural field and due to high moisture contain in the soil lot of the natural grass are grown in the agricultural field. In such situation farmers are not able to do deep ploughing using harrow. Therefore, farmers were bound to use rotavator for land preparation and sowing of wheat crop after harvesting of paddy crop.

Table 8: Factors Influencing Adoption of Rotavator in Mid-Western Plain

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant "a"	3.185	3.205	0.987	1	0.320	24.167
b. Family size (No)	.360**	0.201	3.188	1	0.074	1.433
c. Farming experience (Year)	0.075	0.097	0.606	1	0.436	1.078
d. Land holding size (Ha)	-0.173	0.256	0.458	1	0.499	0.841
e. Age of respondents (Year)	-0.111	0.109	1.039	1	0.308	0.895
f. Adult male (No.)	-.686**	0.371	3.422	1	0.064	0.504
g. Education level (Year)	0.033	0.115	0.083	1	0.773	1.034
Model Summery						
-2 Log likelihood	49.676					
Cox & Snell R Square	0.134					
Nagelkerke R Square	0.179					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

3.8 *Tarai and Bhabar Agro-climatic Zone*

From the Tarai and Bhabar agro-climatic zone of Uttar Pradesh, Bahraich district was selected for the present study. Factors influencing adoption of rotavator in Bahraich district was estimated using binary logit model. Results showed that the farming experience and land holding size was positively and significantly affecting the adoption of rotavator in the study area, whereas age of the respondents was negatively associated with adoption of rotavator in the study area. The "B" value of farming experience suggests that one year increase in farming experience, there will chance in adoption of rotavator by 0.279. In case of land holding size suggests that if we increase land holding by one hectare then there is a chance of adoption of rotavator by 0.459. If age of the farmers increased, then there was very little chance for the adoption of rotavator in the study area (Table 9).

Table 9: Factors Influencing Adoption of Rotavator in Tarai and Bhabar

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant "a"	5.795**	3.413	2.884	1	0.089	328.811
c. Farming experience (Year)	0.279*	0.114	5.973	1	0.015	1.322
d. Land holding size (Ha)	0.459**	0.260	3.116	1	0.078	1.582
e. Age of respondents (Year)	-0.296*	0.117	6.348	1	0.012	0.744
f. Adult male (No.)	-0.352	0.228	2.394	1	0.122	0.703
g. Education level (Year)	0.078	0.106	0.542	1	0.462	1.081
Model Summery						

-2 Log likelihood	38.433					
Cox & Snell R Square	0.347					
Nagelkerke R Square	0.462					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

Form the Bahraich district two villages viz., Rasia and Shivpur village was selected for the present study. Beside above mentioned factors, there are some natural factors which playan important role in adoption of rotavator viz., soil types and irrigation water availability in the study area. The Bahraich district is characterised as water abundant district. The major soil types of the district are sandy and sandy loam. After harvesting of paddy crop, farmers need to apply preparatory irrigation to the field for land preparation and sowing of wheat crop. Rotavator is playing an important role for converting fine soil in just one ploughing which leads to save cost of land preparation. Therefore, sample farmers were using rotavator of land preparation and sowing of wheat crop in the study area.

3.9 South-West Dry Plain Agro-Climatic Zone

Etah district was selected from the South-West Dry Plain agro-climatic zone of Uttar Pradesh. Two villages viz., Gerhana and Awagarh was selected for the present study. Factors influencing adoption of rotavator by sample farmers in Etah district was estimated using binary logit model. The results showed that the education level of the respondents was positively and significantly associated with the adoption of rotavator in the study area. It means if education level of respondents increased than more chances of adoption of the rotavator in the study area. The land holding size of the respondent was positively associated with the adoption of rotavator in the study area. The age of respondents was found significant with negative sign. It means, if age of respondents increases by one year, than there will be chance for non-adoption of rotavator by 0.107 (Table 10).

Table 10: Factors Influencing Adoption of Rotavator in South-Western Dry Plain

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
a. Constant “a”	-6.278	4.225	2.207	1	0.137	0.002
c. Farming experience (Year)	0.013	0.062	0.046	1	0.830	1.013
d. Land holding size (Ha)	1.077**	0.586	3.383	1	0.066	2.936
e. Age of respondents (Year)	-0.107**	0.059	3.270	1	0.071	0.899
f. Family size (No.)	0.018	0.146	0.016	1	0.900	1.019
g. Education level (Year)	0.639*	0.291	4.828	1	0.028	1.895
Model Summery						
-2 Log likelihood	24.663					
Cox & Snell R Square	0.537					
Nagelkerke R Square	0.716					

* and **: Significant at 5.0 and 10 per cent level of significance respectively.

The Etah district is characterised as water scarce district and major soil types of the district are sandy and sandy loam. The water retention capacity of the soils is very poor which leads to frequent application of irrigation to crops. After harvesting of paddy crop, farmers bound to give preparatory irrigation for land preparation and sowing of wheat crop. The rotavator is best ploughing machine which pulverise the soil just in one ploughing. Therefore, sample farmers in the study area were using rotavator for land preparation and sowing of wheat crop.

SUMMERY AND CONCLUSION

The resource conservation technologies (RCTs) are playing an important role to enhance the crop productivity and reduce the inputs use for crop production in different regions of the world. Due to enhance in crop yield and reduction in cost of inputs use leads to increase in net income of the farmers. Out of several options of RCTs, zero-tillage machine and rotavator are adopted and used by the farmers for land preparation and sowing of wheat crop in the study area. In case of Uttar Pradesh, every agro-climatic zone has some peculiarity, which bound farmers to adopt either zero-tillage machine or rotavator for sowing of wheat crop. Therefore, researchers, policy makers and extension workers should advocate and popularise the adoption of new technologies to farmers based on the location specific factors.

REFERENCES

1. Food and Agriculture Organisation. What is conservation agriculture. In: FAO-Conservation Agriculture. 2008. website, http://www.fao.org/ag/ca/1a.html.
2. Govaerts, B., Verhulst, N., Castellanos-Navrrete, A., Sayre, K. D., Dixon, J. and Dendooven, L. Conservation agriculture and soil carbon sequestration: between myth and farmer reality. Critical Review Plant Science.2009; 28: 97-122.
3. Green, H. W. *Econometric analysis*: sixth edition, Prentice-hall Inc. Upper Saddle River, New Jersey. 2008.
4. Gujarati, D.N. *Basic economics*.4th (ed), McGraw Hill, New York. 2003.
5. Hobbs, P. R. and Gupta, R. K. Problems and challenges of notillage for the rice-wheat system of the Indo-Gangatic plains in south Asia. In Lal, R., Hobbs, P., Uphoff, N. and Hasen D. O. (eds) *Sustainable agriculture and the rice-wheat system*, Ohio State University/Marce Dekker, Columbus, 2004; 101-119.
6. Holland, J. M. The environmental consequences of adoption of conservation tillage in Europe: reviewing the evidences.Agriculture Ecosystem Environment. 2004; 103: 1-25.
7. Kern, J. S. and Johnson, M. G. Conservation tillage impacts on national soil and atmospheric carbon levels. Soil Science Society of America Journal, 2004; 57: 200-210.
8. Mallada, G.S. *Introduction to econometrics*, Second edition, Macmillan Publishing Company, New York. 1992.

9. Singh, O. P. Economic and environmental benefit of zero-tillage in Chandauli district of Uttar Pradesh, India, International Journal of Innovative Research and Advanced Studies. 2016; 3(11):97-101.
10. Singh, O. P. Impact of zero-tillage on environment and farmers' livelihood sustainability in western plain agro-climatic zone of Uttar Pradesh, India, International Journal of Current Research in Biosciences and Plant Biology. 2016a; 3(11): 61-68.
11. Singh, O. P., Singh, Rakesh, Lakra, Kerobim and Singh, P. K. Improving environmental and economic benefits through zero-tillage in Mirzapur district of Uttar Pradesh, India.International Journal of Current Research in Biosciences and Plant Biology. 2016. 3(9): 89-96.
12. Singh, O. P., Singh, Rakesh, Srivastava, Ajay Kumar, Lakra, Kerobim and Singh, P. K. Farm level impact of zero-tillage on wheat production in Kaushambi district of Uttar Pradesh, India. Interdisciplinary Journal of Contemporary Research. 2016a; 3(2): 155-162.
13. Singh, O. P., Singh, R., Lakra, K. and Singh, P. K. Impact of zero tillage on environment and wheat productivity: evidences from Gorakhpur district of eastern Uttar Pradesh, India. International Journal of Agricultural and Statistical Sciences. 2016b; 12 (Suppliant – 1): 21-28.
14. Singh, O. P., Singh, Rakesh., Lakra, K., Srivastava, A. K. and Singh, P. K. Problems and prospects of rotavator use in Etah district of Uttar Pradesh, Trends in Biosciences. 2017; 10(6): 1415-1421.
15. Singh, O. P, Singh Rakesh and Lakra Kerobim. Augmenting wheat productivity through resource conservation technologies: A case study of rotavator in Bareilly district of Uttar Pradesh, India, Trends in Biosciences.2017a; 10(15): 2637-2644.
16. Singh, O. P, Singh Rakesh and Singh Balvir. Economic and environmental impact of resource conservation technologies in Uttar Pradesh, India,Trends in Biosciences. 2017b; 10(44): 9145-9154.
17. Singh, O. P; Gautam Yash; Singh, P. K. and Singh, H. P. Enhancing inputs use efficiency through resource conservation technologies: Empirical evidences from different agro-Climatic zones of Uttar Pradesh, India. Indian Journal of Agricultural Economics. 2018; 73(3): 249-268.
18. West, T. O. and Marland, G. A synthesis of carbon sequestration, carbon emissions and net carbon flux in agriculture: Comparing tillage practices in the United States, Agriculture, Ecosystem and Environment, 2002; 91: 217-232.