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Socio-economic impact and adoption of crop residue management with special reference to Rotavator among farming community in Haryana

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Abstract

Rotavator is a tractor driven rotary tillage machine which is used to plough the field by series of blades, that cuts, pulverizes mixes and level the soil. Rotavator plays a vital role in helping the farmer to plough the land in a much faster and effective way. An attempt has been made to know the adoption and socio economic impact of Rotavator among farmers. The study was conducted in rural areas of Hisar district of Haryana state among 120 farmers who had adopted Rotavator with the help of well structured interview schedule. Results revealed that majority of the respondents (52.50%) had high level of adoption level followed by medium (32.50%) and low (15.00%) level of adoption. Regarding reasons and advantages an overwhelming majority of the farmers (90.00%) reported that Rotavators are capable for eradicating of weeds followed by easy to mixing manure, fertilizer and crop residue into soil (89.16%), easy in preparing the land suitable for sowing (80.33%), it saves time i.e. 20-30 min/acre and fuel 2-3 l/acre as reported by 87.50 % of the respondents each. Socio-economic impact of using Rotavator was reported in terms of increased expenditure on quality and variety of food items (got 1st rank with weighted score 2.21) followed by investment on quality of education of the children. Some of the constraints faced by Rotavator adopters were like using Rotavator again and again, strongly affects tendency to form a hard pan develop soil got 1st rank with weighted mean score 3.07 followed by big horse power tractor is required for Rotavator than harrow/cultivator (rank II).

Keywords: Rotavator, adoption, advantages, socio-economic impact, constraints, etc.

Introduction

A wide range of technologies and machines for farm operations from land preparations to storage is espoused by agricultural mechanization. The efficacious mechanization on farm leads to seasonableness of operations, drudgery reduction of operator, quality of work, etc. Compared to South Korea, Japan and USA where the farm power input was found to be 6kW/ha, 14kW/ha and 6kW/ha respectively is still very low in India (Mehta, 2013) [5]. In India during 2013-14 the farm power availability was 2.02 kW/ha and the agricultural labour gone crucial in keeping up with agricultural production (Singh *et al.*, 2014) [7]. Indian agriculture has transfigured itself from a food shortfall country to superfluity of food at global level which is the result of higher crop yield without much expansion of area under crop production. With higher ferocity areas like Haryana, Punjab and Uttar Pradesh of agricultural production has attended maximum level of turnout per unit crop yield. In spite of putting higher inputs there is a decline trend on some pockets (Aulakh, 2005) [1]. Traditional methods of crop production constituted of intensive tillage which is somewhere reason for soil erosion, surface and groundwater pollution and also less water use efficiency (Wolff and Stein, 1998) [9]. Furthermore, it is incriminated in land resource degradation and global warming (Boatmann *et al.*, 1999) [2]. While sustaining the natural resources and eliminating the unsustainable agricultural traditional practices is important for future productivity gain. For the reduction in the use of and damage of natural resources; and increasing the efficiency of the resource utilization the resource conservation technologies (RCTs) have been developed.

Due to the supercilious capability of Rotavator to flatten, mix and pulverize soil the widely used tillage operation in India is rotary tilling. Rotavator is an effective machine for intensive tillage as excessive use of chemicals on the fields and other reasons lead to soil fatigue and turned the paddy fields into dry ones such as kale fields. It is proven to be the most effective tillage system solution regardless of any soil type or condition.

The Rotavator can be easily adjusted according to need of soil finishes and various working depths. Surpassing the other implements, its rotating blades chop and mix the residues evenly throughout the working depth.

A Rotavator is a specialized mechanical tool which consists of series of blades to swirl up the earth in order to plough the land (Hendrick and Gill, 1971) [4]. Recently, an increase in the utilization of Rotavator has been noticed in agricultural applications as it has simple structure and highly efficient for this type of tillage implements. Due to the Rotavators the primary and secondary tillage applications could be conjugated into one step (Topakci *et al.*, 2008) [8]. The overall power needed for these equipments is low because Rotavator can perform various type of tillage in one stage even though after having the high energy consumption (Culpin, 1981) [3].

Customary draught animals have been used in India for the land preparation before the cultivation. With increased cropping intensity and demand, farmers have added-on animate power with tractors and power tillers. Availability of farm powers, technologies and energy used per hectare indicates the modernization of agriculture. Due to the lack of knowledge, facilities and experiences, farmers are still stuck to the tractors/ bullock operated ploughs and blade harrows. Farmers are presently using this technology of rotary tiller for seedbed preparation and by keeping in the view of its use this study was designed (i) to study the adoption level and factors associated with adoption and socio-economic variables of Rotavator adopters, (ii) to find out the constraints faced by the farmers, and (iii) to find out the cumulative socio-economic impact of adoption on farming families.

Methodology

The study was conducted in Hisar district of Haryana. From the selected district, two blocks namely Hisar I and Hisar II were undertaken where more no. of farmers had adopted Rotavator. From Hisar I Dabra and Ladwa villages were selected and from Hisar II Dewan village was taken for the study. On the whole, a total of 120 farmers who had adopted Rotavator were selected. Interview Schedule was prepared for collection of data. Data were analyzed and tabulated by applying frequency, chi-square, weighted mean score and rank order as per requirement of the data to draw the inferences.

Results

The results (Table 1) indicated that majority of the respondents (51.67%) were belonging to 35-50 years age group followed by up to 35 years age group 29.17. The table further indicates that more than 3/4th of the respondents (81.67%) belonged to general caste; belong to nuclear family type (74.17%); with up to 5 members (76.67%). Regarding education 41.67 per cent of the respondents were educated secondary school level followed by senior secondary school level. More than 1/3rd of the respondents (35.00%) were having small size of landholding (1-2 ha) followed by marginal (upto 1 ha) land holding. About half of the respondents (49.17%) belonged to medium (Rs.1,50001 - 2,50000) income group, had medium level of (42.50%) mass media exposure, had low (44.17%) participation and had medium level of socio economic status.

Table 1: Personal profile of the respondents of Hisar districts of Haryana (n=120)

Sr. No.	Variables	Frequency	Percentage
1	Age		
	Up to 35years	35	29.17
	35-50years	62	51.67
	Above 50 years	23	19.17
2	Caste		
	General	98	81.67
	Backward	13	10.83
	Scheduled	9	7.50. 6.25
3	Family type		
	Nuclear	89	74.17
	Joint	31	25.83
4	Family size		
	Up to 5 members	92	76.67
	6-9 members	28	23.33
5	Education		
	Illiterate	20	16.67
	Under matric	19	15.83
	Secondary school level	50	41.67
	Senior secondary school level	22	18.33
	Graduate/Post Graduate	9	7.50
6	Size of land holdings(in ha)		
	Marginal (upto 1 ha)	39	32.5
	Small (1-2 ha)	42	35.0
	Semi medium (2-4 ha)	25	20.83
	Medium (4-10 ha)	14	11.67
7	Annual income		
	Low (Rs.50,000-1,50000)	38	31.67
	Medium(Rs.1,50001 -2,50000 lakh)	59	49.17
	High(above Rs.2,50000)	23	19.17
8	Mass media exposure		
	Low (up to 6)	41	34.17
	Medium (7-12)	51	42.50

	High (above 12)	28	23.33
9	Social participation		
	Nil (0)	50	41.17
	low (1-2)	53	44.17
	medium (3-4)	17	14.17
10	Socio-economic status		
	Low (5-8)	40	33.33
	Medium (9-12)	51	42.50
	High (above 12)	29	24.17

Adoption level of the respondents

Result regarding adoption in Table 2 show that majority of the respondents (52.50%) had high level of adoption level followed by medium (32.50%) and low (15.00%) level of adoption. Similar results were also found in a study conducted in Nepal where Rotavator technology was found to be spreading rapidly (Paudel *et al.* 2020) [6]. Adoption level was calculated on the basis of adoption of Rotavator of total land.

Table 2: Adoption level of respondents regarding Rotavator in Hisar district (n=120)

S. No.	Adoption level	Frequency	Percentage
1.	Low (up to 33%)	18	15.00
2.	Medium (34-66%)	39	32.50
3.	High (more than 66%)	63	52.50

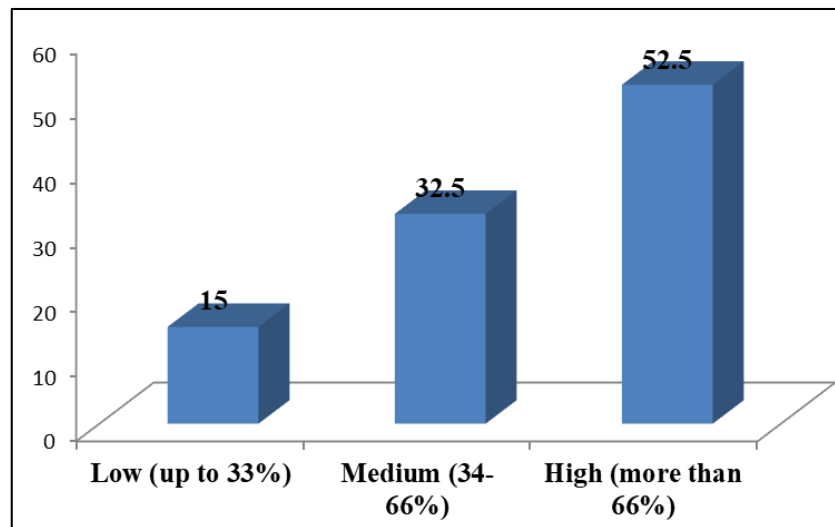


Fig 1: Adoption level of the respondents

Reasons/Advantages of adoption of Rotavator

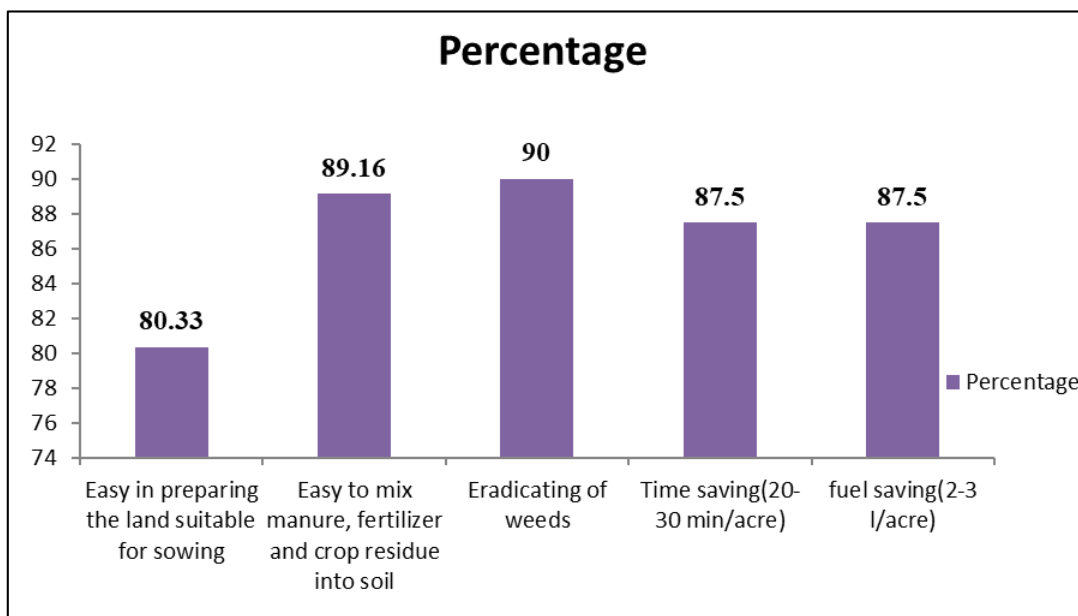
The results shown in Fig.2 depict main reasons for adopting Rotavator by farmers. An overwhelming majority of the farmers (90.00%) reported that Rotavators are capable for eradicating of weeds followed by easy to mixing manure,

fertilizer and crop residue into soil (89.16%), easy in preparing the land suitable for sowing(80.33%),it saves time i.e. 20-30 min/acre and fuel 2-3 l/acre as reported by 87.50 % of the respondents each.

Table 3: Reasons/Advantages of adoption of Rotavator by the respondents in Hisar district (n=120)

S. No.	Reasons	Frequency	Percentage
1	Easy in preparing the land suitable for sowing	97	80.33
2	Easy to mix manure, fertilizer and crop residue into soil	107	89.16
3	Eradicating of weeds	108	90.00
4	Time saving (20-30 min/acre)	105	87.50
5	fuel saving (2-3 l/acre)	105	87.50

Responses were multiple



*Responses were multiple

Fig 2: Reasons/Advantages of adoption of Rotavator

Constraints of Rotavator faced by the respondents

The results revealed (Table 4) some of the constraints faced by Rotavator users like by using Rotavator again and again, strongly affects tendency to form a hard pan develop soil got 1st rank with weighted mean score 3.07 followed by big horse

power tractor is required for Rotavator than harrow/cultivator (rank II), so this technology is not much suitable for marginal and small farmers. Further, Rotavator is expensive got IIIrd rank with weighted mean score 2.95 (Fig 3).

Table 4: Constraints of Rotavator faced by the respondents in Hisar district (n=120)

Sr. No	Constraints	Agreed	Some-what agreed	Not agreed	W.S.	W.M.S.	Rank
1.	By repeated use of Rotavator, hard pan develop soil	71 (59.17)	45 (37.5)	4 (3.33)	307	3.07	I
2.	High horse power tractor is required for Rotavator than harrow/cultivator	69 (57.5)	43 (35.83)	8 (6.67)	301	3.01	II
3.	Rotavator is expensive	67 (55.83)	41 (34.17)	12 (10.0)	295	2.95	III

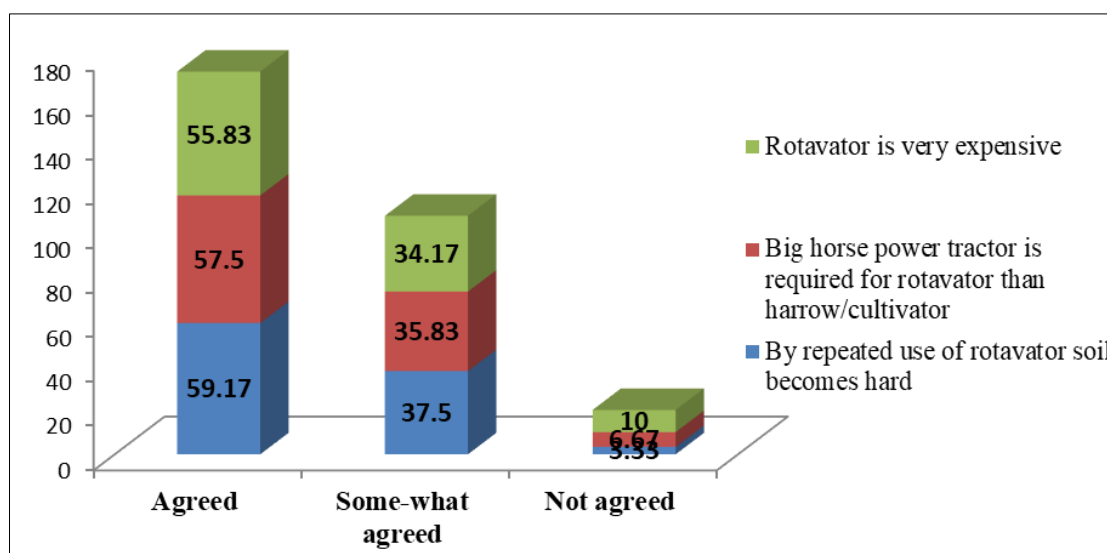


Fig 3: Constraints of Rotavator faced by the respondents

Cumulative socio-economic impact of adoption of Rotavator on farming families

Analysis of data revealed (Table 5) socio-economic impact of using Rotavator, i.e increased expenditure on quality and variety of food items got 1st rank with weighted score 2.21 followed by investment on quality of education of the

children. Further, increased household construction/ assets got IIIrd rank with mean score 2.18. Increased number and quality of dresses got IVth rank while increase in extension contact got Vth rank with mean score 2.11. Increase in extension contact had Vth rank (2.09) followed by social mobility (rank VI).

Table 5: Cumulative Socio-economic impact of adoption of Rotavators in Hisar district (n=120)

S.N.	Aspects	Socio-economic impact					
		Increased	Partially increase	No change	W.S.	W.M.S.	Rank
1	Expenditure on quality and variety of food items	52(43.33)	42(35.0)	26(21.67)	266	2.21	I
2	Investment on quality education of the children	51(42.5)	41(34.17)	28(23.33)	263	2.19	II
3	Household construction/assets	51(42.5)	39(32.5)	30(25.0)	261	2.18	III
4	Number and quality of dresses	50(41.67)	40(33.33)	30(25.0)	260	2.17	IV
5	Extension contacts	48(40.0)	38(31.67)	34(28.33)	254	2.11	V
6	Social mobility	47(39.17)	37(30.83)	36(30.0)	251	2.09	VI

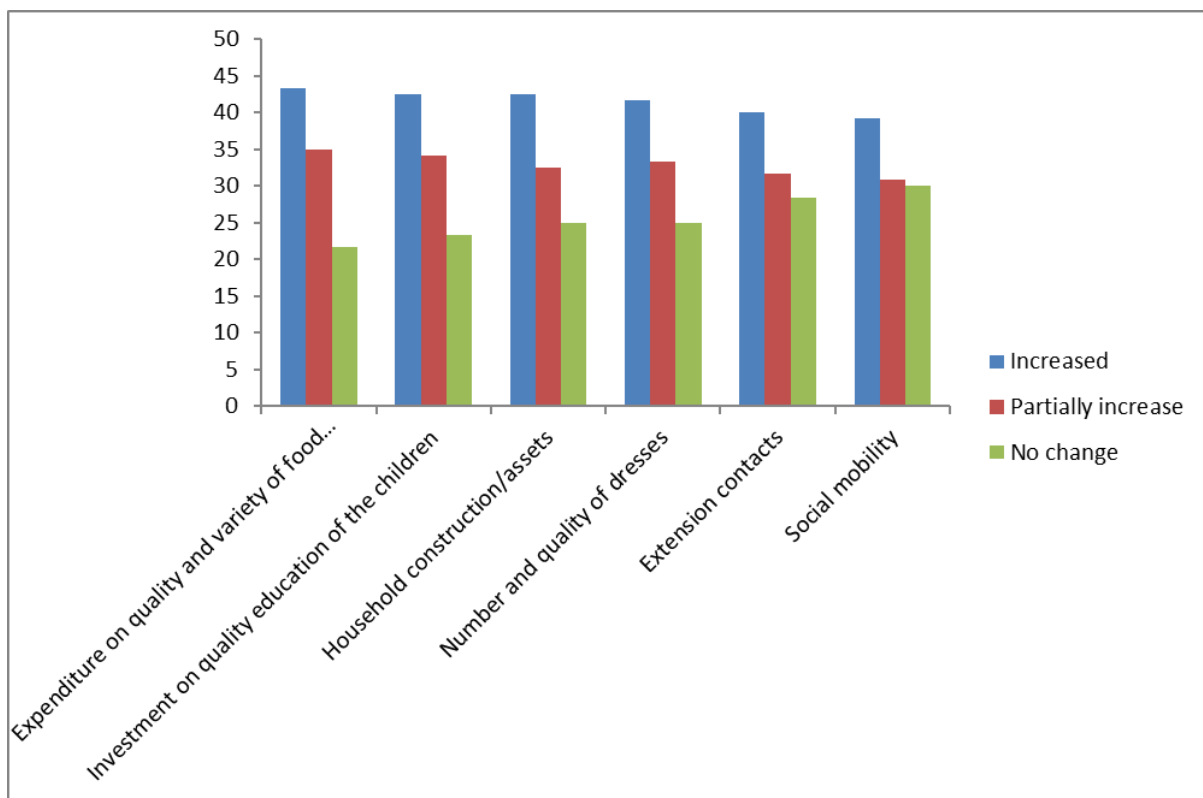


Fig 4: Socio-economic impact of adoption of Rotavator

Association between adoption level and socio-economic variables

Regarding the adoption level, majority of the respondents (52.50%) had high level followed by medium (32.50%) and low (15.0%) level of adoption.

It was found (Table 6) many socio-economic variables had significant association with adoption level of Rotavator i.e. age, education, size of land holdings, annual income, socio economic status and mass media exposure at 5% level of significance.

Majority of the respondents belonged to 35-50 years of age group (51.67%) had high level of adoption (54.83%). 41.67

percent of the secondary school level passed respondents had high (54.00) level of adoption. 35.0 per cent of the respondents who had small (2.51-5.00 acres) landholding had high (47.61%) level of adoption. Majority of the respondents (49.17%) who belong to medium (Rs.1,50001 -2,50000 lakh) income group had high (57.62) level of adoption.42.50% of the respondents who belonged to medium socio-economic group had high (54.90%) level of adoption. Similarly significant findings were observed with mass media exposure. On the other hand caste and social participation were found non- significantly associated with adoption of Rotavator.

Table 6: Association between socio-economic variables and adoption level the respondents in Hisar district (n=120)

Socio-economic variables	Adoption level			
	Low(18)	Medium(39)	High(63)	Total
Age				
Up to 35years	8(22.85)	12(34.28)	15(42.85)	35(29.17)
35-50years	9(14.51)	19(30.64)	34(54.83)	62(51.67)
Above 50 years	1(04.34)	8(34.78)	14(60.86)	23(19.17)
Total	18(15.0)	39(32.50)	63(52.50)	120(100.0)
$\chi^2 = 10.21^*$				
Caste				
General Caste	13 (13.26)	32(32.65)	53(54.08)	98(81.67)
Backward Class	3(23.07)	4(30.76)	6(46.15)	13(10.83)
Scheduled Caste	2(22.22)	3(33.33)	4(44.44)	9(7.50)
$\chi^2 = 5.51$				

Education				
Illiterate	3(15.00)	8(40.00)	9(45.00)	20(16.67)
Under matric	2(10.52)	6(31.57)	11(57.89)	19(15.83)
Secondary school level	8(16.00)	15(30.00)	27(54.00)	50(41.67)
Senior secondary	3(13.63)	7(31.81)	12(54.54)	22(18.33)
Graduate/Post Graduate	2(22.22)	3(33.33)	4(44.44)	9(7.50)
$\chi^2 = 15.32^*$				
Size of land holdings				
Marginal (< 2.50) acres	3(07.69)	12(30.76)	24(61.53)	39(32.5)
Small (2.51-5.00) acres	9(21.42)	13(30.95)	20(47.61)	42(35.0)
Semi medium (5.01-10.00) acres	4(16.00)	9(36.00)	12(48.00)	25(20.83)
Medium (10.01-25.00) acres	2(14.28)	5(35.71)	7(50.00)	14(11.67)
$\chi^2 = 16.23^*$				
Annual income				
Low (Rs.50,000-1,50000)	9(23.68)	13(34.21)	16(42.10)	38(31.67)
Medium(Rs.1,50001 -2,50000 lakh)	6(10.16)	19(32.20)	34(57.62)	59(49.17)
High(above Rs.2,50000)	3(13.04)	7(30.43)	13(56.52)	23(19.17)
$\chi^2 = 17.23^*$				
Socio-economic status				
Low(5-8)	8(20.00)	13(32.50)	19(47.50)	40(33.33)
Medium(9-12)	6(11.76)	17(33.33)	28(54.90)	51(42.50)
High(13-15)	4(13.79)	9(31.03)	16(55.17)	29(24.17)
$\chi^2 = 19.31^*$				
Mass media exposure				
Low (<6)	8(19.51)	13(31.70)	20(48.78)	41(34.17)
Medium (7-12)	5(09.80)	15(29.41)	31(60.78)	51(42.50)
High (>12)	5(17.85)	11(39.28)	12(42.85)	28(23.33)
$\chi^2 = 13.23^*$				
Social participation				
Nil(0)	6(12.00)	16(32.00)	28(56.00)	50(41.17)
Low (1-2)	6(11.32)	18(33.96)	29(54.71)	53(44.17)
Medium (3-4)	6(35.29)	5(29.41)	6(35.29)	17(14.17)
$\chi^2 = 3.31$				

*Significant at 5% level of significance

It's concluded that majority of the farmers had high level of adoption (52.50%) of Rotavator. Adoption was found significantly associated with age, education, land holding, SES and mass media exposure. Regarding advantages of adoption of Rotavator overwhelming majority of the respondents reported that Rotavators are capable of eradicating of weeds (83.33%) followed by easy to mixing manure, fertility and crop residue into soil (81.67%). Other benefits are easy in preparing the land suitable for sowing and Rotavator saves time upto 20-30 min/acre and fuel upto 2-3 l/acre. Socio-economic impact of Rotavator was observed in terms of expenditure on variety of food items (21%) on quality education of the children (51%), household assets (51%), increase in number and variety and dresses (50%), increase in extension contacts and changes in social-mobility, while some of the constraints were also observed in using Rotavator like by repeated use of Rotavator soil becomes hard (Rank I), big horse power tractor is required for Rotavator (rank II) and it's expensive. It is suggested that farmers should be motivated to use Rotavator by demonstrating its benefits.

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