Indian Journal of Extension Education
Vol. 55, No. 3 (July-September), 2019, (23-28)

Post-adoption Behaviour of Farmers Towards Soil and Water Conservation Technologies of Watershed Management in Northern Shivalik Foothills

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ABSTRACT

The study was undertaken at Indian Institute of Soil and Water Conservation Research Centre, Chandigarh from November, 2012 to June 2015 in five watersheds developed by the Centre, with the objectives to study the post-adoption behaviour of farmers regarding watershed technologies. The watersheds selected were i) Aganpur Bhagwasi watershed located in Patiala district, (Punjab State) ii) Johranpur watershed in Solan district, (H.P) iii) Mandhala watershed in Solan district, (H.P.) iv) Kajiana watershed in Panchkula district (Haryana) (v) Sabeelpur watershed in Panchkula district (Haryana). The post-adoption behaviour of 225 beneficiary farmers who have adopted different soil and water conservation technologies for watershed management should be studied in detail regarding their present status of continue-adoption, diffusion, dis-adoption and also technological gap. Combining the data for all the five watersheds, it was concluded that 79 per cent of the farmers continued to adopt SWC technologies even after withdrawal of the project. Twenty one percent dis-continued the adoption of technologies and 23 per cent were adopting with certain techological gap. The diffusion of adopted SWC technologies also occurred, and 16 per cent of SWC technologies were diffused to other farmers' fields in nearby areas for natural resource conservation on a watershed basis. The analysis revealed that the adoption and spreading of SWC practices is not only a technical problem that can be solved by research, but also a socio-cultural and economic problem, with many constraints playing their role.

Keywords: Farmers, Management, Soil, Technologies, Water conservation, Watershed

INTRODUCTION

Transfer of technology is an important aspect of any research system that engages in generation of technologies. However, the onus of the system does not stop at mere transferring the technologies. It is very much imperative to ensure its proper adoption and accomplishment of the purpose for which it was adopted on a longer term. Rogers (1983) was one of the firsts to measure adoption and he termed adoption process as 'Innovation Decision Process' through which an individual passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new technology or idea, and to confirmation of this decision. In case of an agricultural research system, the situation is still complex as the beneficiaries are farmers and the technologies are adopted in field conditions. They are bound to face varied circumstances in the wake of adopting a technology and continuing it on longer time period (Valera *et al.,* 1987). Post-adoption behaviour is a decision of a farmer regarding whether to continue with an adopted technology with or without a technological gap or discontinue for adoption of another new technology or his unwillingness

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to continue with adopted technology (Bagdi, 2015). Post adoption process has two basic components i.e. the continuance/discontinuance decision; and the length of continued use (Black, 1983). Ellis (1988) and Wauters *et al.* (2010) observed that in developing countries the introduction of many new technologies has met with only partial success as measured by observed rates of adoption. Discontinuance is a decision to reject an innovation after it has previously been adopted When the farmers are satisfied with whatever new technology they have adopted, they are likely to hold on to it, but if they feel that it does not meet their needs they will discard it (Rogers, 2003). Demake (2003) assessed the factors responsible for discontinuance of soil and water conservation technologies and found that small farm size and lack of hired labour explained the majority of discontinuance. The continued use of Soil and Water Conservation (SWC) seemed mainly determined by the actual profitability and, related to that, the labour requirements for recurrent maintenance and use. Moreover, in villages with better future prospects (where SWC was promoted within an integrated development strategy) farmers also performed better maintenance of their measures and replication rates were higher (De Graaff *et al.,* 2008). If many farmers in a specific project area or village adopt a certain measure, farmers in neighbouring villages may also adopt the measures without project assistance (spontaneous diffusion), as was experienced in Mali (Bodnar, *et al.,* 2006).

It is imperative to appraise the behaviour of the farmers with regard to the continuance or discontinuance of the technologies adopted, diffusion or infusion that took place and technological gaps that occurred in due course etc. The need to examine the adoption of soil and water management technology (SWMT) options to improve agricultural production becomes imperative in order to evaluate the impact of their uptake by the resource-poor farmers (Olarinde *et al.,* 2012).

Indian Institute of Soil and Water Conservation, Research Centre Chandigarh has developed many watershed projects successfully in the country in past and implemented many soil and water conservation technologies for watershed management. Therefore, it was realized that the post-adoption behavior of beneficiary farmers who have adopted different soil and water conservation technologies for watershed management should be studied in detail regarding their present status of continue-adoption, dis-adoption, diffusion, infusion, and also technological gap.

MATERIALS AND METHODS

The research study was carried out during 2012–2015 in five watersheds developed by Indian Institute of Soil and water Conservation, Research Centre, Chandigarh. The watersheds developed were selected purposively to study the present condition regarding watershed technologies after passing of few years. Therefore, post-adoption behaviour of beneficiary farmers was studied regarding soil and water conservation technologies adopted by them for watershed management. The watersheds selected are i) Aganpur Bhagwasi watershed located in Patiala district (Punjab State) ii) Johranpur watershed in Solan district, (H.P) iii) Mandhala watershed in Solan district, (H.P.) iv) Kajiana watershed in Panchkula district (Haryana), (v) Sabeelpur watershed in Panchkula district in Haryana State.

The farmers of selected watersheds who have adopted soil and water conservation technologies were selected as respondents in the study. At least 50 respondents were selected from each watershed from all the existing categories of farmers in the watershed. A list of SWC technologies was prepared which were implemented during each watersheds development programme. A SWC technology-wise inventory of respondent farmers, who have adopted the technologies with the help of Detailed Project Report (DPR) or by organizing meetings with farmers was prepared. The Inventory listed the names of farmers the size of land holding and the adopted technology. These were used to prepare inventories of farmers for all technologies adopted during the watershed development programmes. A stratified proportionate random sampling plan was followed to select respondents from different inventories or lists of farmers. At least 50 respondents were selected from each watershed, selected from all the existing categories of farmers in the watershed. A detailed structural interview schedule was developed by the investigators and data regarding personal, psychological

and post-adoption behaviour variables were recorded on a structured schedule by interviewing the respondents personally.

RESULTS AND DISCUSSIONS

The data in Table 1 shows the levels of continue adoption of soil and water conservation technologies by farmers in the watersheds developed by IISWC Research Centre Chandigarh in various watersheds. It was revealed that the majority of farmers have continued the adopted SWC technologies at a moderate level at Mandhala (58%) and Aganpur-Bhagwasi Datia (56%) and Kajiana (50%) watersheds, whereas the majority of farmers have continue adopted SWC technologies at low level at Sabeelpur (53.07%) watershed. Less than 27 per cent of farmers have continued the adopted SWC technologies at high levels in their fields for natural resource conservation in all the watersheds developed by IISWC Chandigarh. The overall pooled data revealed that a maximum 49.33 per cent of farmers have continued adopted SWC technologies at a moderate level for natural resource conservation for sustainable management of watersheds. Similarly, 33.77 per cent of farmers have also continued adopted SWC technologies at a low level and only 16 per cent of farmers have continued adopted SWC technologies at a high level for soil and water conservation in various watersheds developed by the Centre.

The data in Table 2 presents the level of discontinuance of soil and water conservation technologies by farmers in the watersheds developed by IISWC Chandigarh. The majority of farmers have discontinued technologies at Aganpur (70%), Mandhala (64%) and Kajiana (54%) watersheds at a low level, while a majority of farmers discontinued SWC technologies at Sabeelpur (53%) at moderate level. A very few farmers have discontinued SWC technologies at a high level from their fields. The overall pooled data revealed that more than fifty percent of farmers have discontinued SWC technologies at a low level. About one-third (35%) of the farming population discontinued SWC technologies at a moderate level and only 10.4 per cent of farmers discontinued SWC technologies at a high level due to non-suitability to their field conditions or inability to continue the adopted technologies in various watersheds.

The Table 3 revealed that the majority of farmers have adopted SWC technologies with a technological gap at Mandhala (74%) and Aganpur- Bhagwasi (72%) at a low level. The majority of farmers of Kajiana and Johranpur watersheds adopted SWC technologies with a technological gap at a moderate level. About 57 per

Table 1: Levels of continue adoption of SWC technologies by farmers in different watersheds implemented by IISWC Research Centre Chandigarh (N =225)

Level of continue adoption of SWC technologies	Percentage farmers in different watrsheds					
	Aganpur Bhagwasi (N=50)	Johranpur (N=26)	Mandhala (N=50)	Kajiana (N=50)	Sabeelpur (N=49)	Pool (N=225)
Low	10 (20.0)	9 (34.62)	11 (22.00)	20 (40.00)	26(53.07)	76 (33.77)
Medium	28 (56.0)	10 (38.46)	29 (58.00)	25 (50.00)	19 (38.77)	111 (49.33)
High	12 (24.0)	7 (26.92)	10 (20.00)	5 (10.00)	4 (8.16)	38 (16.88)

Table 2: Levels of discontinuance of SWC technologies by farmers in different watersheds implemented by IISWC Research Centre Chandigarh (N =225)

Level of discontinuance of SWC technologies	Percentage farmers in different watrsheds					
	Aganpur Bhagwasi (N=50)	Johranpur (N=26)	Mandhala (N=50)	Kajiana (N=50)	Sabeelpur (N=49)	Pool (N=225)
Low	35 (70.0)	12(38.9)	32 (64)	27 (54)	18 (36.7)	124 (54.2)
Medium	12(24.0)	10(38.5)	13 (26)	19 (38)	26 (53.1)	80 (35.4)
High	3(6.0)	4(15.4)	5(10)	4(8)	5 (10.2)	21(10.4)

Table 3: Levels of technological gap of SWC technologies by farmers in different watersheds implemented by IISWC Research Centre Chandigarh (N =225)

Level of discontinuance of SWC technologies	Percentage farmers in different watrsheds					
	Aganpur Bhagwasi (N=50)	Johranpur (N=26)	Mandhala (N=50)	Kajiana (N=50)	Sabeelpur (N=49)	Pool (N=225)
Low	36 (72)	7 (26.9)	37 (74)	12 (24)	9 (18.4)	101 (44.9)
Medium	10 (20)	15 (57.7)	8 (16)	30 (60)	12 (24.5)	75 (33.3)
High	4 (8)	4 (15.4)	5 (10)	8 (16)	28 (57.1)	49 (21.8)

cent of the farmers in Sabeelpur watershed adopted SWC technologies at a high level. The overall pooled data revealed that 45 per cent of farmers adopted SWC technologies with a technological gap at a low level, 33 per cent at a moderate level and only 22 per cent have adopted SWC technologies with a technological gap at a high level in the five watersheds developed by the centre.

It was found from the levels of diffusion by a majority of farmers of Mandhala (74%), and Bhagwasi (72%), watersheds diffused SWC technologies at a low level.While the majority (60%) of farmers of Kajiana and Johranpur watersheds (57.7%) diffused SWC technologies at a moderate level from their fields to other farmers' fields for natural resource conservation from the watersheds developed by the Centre (Table 3). Similarly, the overall pooled data also revealed that a majority (44.9%) of farmers diffused SWC technologies at low level, followed by 33 per cent at moderate level and 21.8 per cent of farmers diffused SWC technologies at a low level from the watersheds developed by IISWC Chandigarh to other farmers' fields for soil and water conservation.

The data in Table 4 reveals the extent of post-adoption behaviour of farmers towards different SWC technologies implemented during various watershed development programmes carried out by the IISWC Chandigarh Centre. The TCAI values were maximum for Mandhala watershed which meant that more than 88 per cent of SWC technologies were continue adopted by farmers in this watershed followed by Kajiana (78.6%), Aganpur (75.37) and Johranpur (70.22). The pooled TCAI value also showed that overall 79 per cent of SWC technologies were being continue adopted by farmers in the watersheds developed by the Centre for the cause of natural resources conservation. According to DTI values, less than 25 per cent of SWC technologies were discontinued or dis-adopted by farmers in the watersheds developed by the Centre except Sabeelpur (34%).

Woldeamlak Bewket (2007) also reported that the major factors that were discouraging the farmers from adopting the introduced SWC technologies on their farms were found to be labour shortage, land tenure insecurity and problem of fitness of the technologies to the farmers' requirement sand to the farming system circumstances. Regarding TGI, it was found that less than one-fifth of SWC technologies were adopted along with technological gap by the farmers in the different watersheds developed except Sabeelpur (30%) and Aganpur Bhagwasi (26%).The overall pooled TGI data also revealed similar findings that 22 per cent of SWC technologies were adopted with a technological gap by farmers out of the

Table 4: Extent of post-adoption behaviour of farmers towards SWC technologies in selected watersheds

Extent of post-adoption behaviour of farmers	Percentage farmers in different watrsheds					
	Aganpur Bhagwasi (N=50)	Johranpur (N=26)	Mandhala (N=50)	Kajiana (N=50)	Sabeelpur (N=49)	Pool (N=225)
TCAI	75.37	70.22	88.14	78.6	65.7	79.1
DTI	24.63	19.78	10.77	21.8	34.3	20.8
TGI	26.05	12.17	16.24	18.9	30.3	22.8
TDI	26.2	11.16	12.99	17.8	25.6	15.7

total continue adopted technologies in the watersheds developed by the Centre. Diffusion of SWC technologies was also evaluated using the Technology Diffusion Index (TDI) and it was found that less than 18 per cent of SWC technologies were diffused to other farmers' fields in near by areas from the fields of farmers who had adopted SWC technologies during the watershed development programs, except for the Aganpur Bhagwasi and Sabeelpur. Similarly, the overall pooled TDI data also revealed a similar condition, 16 per cent of SWC technologies were diffused to other farmers' fields in nearby areas from the watersheds developed by the Centre for the cause of soil and water conservation on a watershed basis.

CONCLUSION

The study results showed that 79 per cent of SWC technologies were continue adopted by beneficiary farmers in watersheds developed by IISWC Research Centre, Chandigarh in the region for the cause of natural resources conservation. The farmers discontinued 21 per cent of SWC technologies from their fields in the watersheds. It was also found out that 23 per cent of SWC technologies were adopted with a technological gap by farmers in the watersheds. The diffusion of adopted SWC technologies also occurred, and 16 per cent of SWC technologies were diffused to other farmers' fields in near by areas for natural resource conservation on a watershed basis. Therefore, it can be concluded from the study that in the government sponsored watershed development programmes about three-fourth of SWC technologies were continue adopted for natural resources conservation and about one-fourth of technologies were discontinued due to the non-suitability or the inability of farmers to continue the technologies. Out of the total continue adopted technologies, about one-fifth of the technologies were adopted with a technological gap. About one-fourth of technologies were also diffused in nearby areas fields in the developed watersheds through farmers' efforts. The study suggests that simply demonstrating technologies that improve productivity or have soil conservation value may be insufficient. Majority of farmers continued adopting the SWC structures implemented during watershed development projects with technological gap due to lack of proper maintenance by beneficiary farmers because of their poor economic condition. The majority of farmers suggested that the subsidy should also be provided to farmers for maintenance of structures or financial provision should be made in planning of watershed projects for future maintenance of structures. Understanding farmer specific characteristics and behavior as well as production environment where farmer operate, is an essential requirement before the dissemination of any S&WC technologies at the farm level for higher adoption., the adoption and spreading of SWC practices is not only a technical problem that can be solved by research, but rather a socio-cultural and economic problem, with many constraints playing a role.

Paper received on : August 08, 2019
Accepted on : August 18, 2019

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