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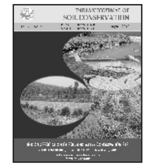

Determinants of discontinuance of soil and water conservation technologies implemented in watershed management programmes in India

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ABSTRACT

The ICAR-Indian Institute of Soil and Water Conservation (IISWC) and its Research Centres have developed many model watersheds in the country and implemented large number of soil and water conservation (SWC) technologies for sustainable watershed management. Though many evaluation studies were conducted on these watershed projects in the past, assessment of discontinuance of the SWC technologies has not been done yet. This research study was conducted during 2012-15, with the specific objective to measure the extent of discontinuance of SWC technologies and also ascertain the factors responsible for discontinuance. Indices of discontinuance of SWC technologies from 38 watersheds revealed that more than one-fourth (27.01%) of SWC technologies were discontinued by farmers of different watersheds. Technology-wise data revealed that 11.4% farmers discontinued bunding, 8% farmers discontinued land leveling, 6.5% farmers discontinued terracing, 3% farmers discontinued check dam and 1.3% farmers discontinued pond technologies. Important reasons were costly measures to maintain, regular maintenance requirement, labour constraints and marginal and small land holdings of farmers. Results imply that financial support to poor farmers for repair and maintenance of SWC structures may reduce discontinuance. Adoption of check dam, pond and bunding technologies is more beneficial in medium and large land holdings rather than marginal and small. Making farm equipment available for common use on hiring basis could help in repair and maintenance of SWC structures by overcoming the non-availability of labour.

1. INTRODUCTION

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, 1995). But, in the present times, there are so many other factors, apart from meeting of needs that push a farmer to discard a technology. Van Tongeren (2003) investigated the discontinuance of farming innovations and found that the end of subsidies and educational programming explained the majority of discontinuance. It is believed that an effective way to increase productivity is broad-based adoption of new farming technologies (Minten and Barrett, 2008). Adoption of improved technologies will not improve food security and reduce poverty if barriers to their continued use are not overcome (Oladele, 2005).

Discontinuance is a decision to reject an innovation after it has previously been adopted (Rogers, 2003), he also reported three types of technology discontinuance are: (1) replacement, (2) disenchantment and (3) forced discontinuance. Replacement discontinuance is a decision to reject an idea in order to adopt a better idea that supersedes it. Constant waves of innovations may occur in which each new idea replaces an existing practice that was an innovation in its day. For example, the adoption of tetracycline led to the discontinuance of two other antibiotic drugs (Coleman *et al.*, 1966). E-mail has replaced much postal mail. Many replacement discontinuances occur in everyday life. Disenchantment discontinuance is a decision to reject an idea as a result of dissatisfaction with its performance. Leuthold (1967) concluded from his study of a statewide sample of Wisconsin farmers that the rate of discontinuance was just as important as the rate of adoption in determining the level of adoption an innovation at any particular time. In any given year, there were about as many discontinuers of an innovation as there were first-time adopters. Third type of discontinuance is also reported as forced discontinuance, it happens when individuals are compelled to change, farmers are forced to discontinue the existing practices because of government policies. For example, chemicals like 2, 4-Dichlorophenoxyacetic acid and Benzene hexachloride are banned for use in crop cultivation by governments in some countries due to their dangerous effect on human health and environment. Inability discontinuance can also be the fourth type of technology discontinuance. Sometimes farmers discontinued an adopted technology because of his inability to maintain due to high cost or complexity of technology. For example, a poor farmer can't maintain bunding technology properly on his sloppy land and a breached concrete check dam can't be repaired by poor farmers.

The continued use of SWC technologies 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 technologies were promoted within an integrated development strategy) farmers also performed better maintenance of their measures and replication rates were higher (De Graaff *et al.*, 2008).

ICAR-IISWC and its Centres have developed many watersheds and implemented SWC technologies. Some of the adopted SWC technologies might have discontinued by the beneficiary farmers due to availability of new better technology or inability or unwillingness to continue. Therefore, it was realized that the discontinuance behaviour of beneficiary farmers who have adopted different SWC technologies for watershed management should be studied in detail regarding their present status of discontinuance and factors responsible. Hence the study was framed with the main objective to assess the extent of discontinuance of different SWC technologies adopted during watershed development programmes by ICAR- IISWC and its Centres in India.

2. MATERIALS AND METHODS

Study Area

The research study was carried out during 2012-15 in eight states of India as a core project at the ICAR-IISWC, Research Centre, Vasad, (Gujarat) as lead Centre alongwith ICAR-IISWC headquarter Dehradun, Uttrakhand state, and its Centres *viz.*, Agra (Uttar Pradesh), Bellary (Karnataka), Chandigarh (Haryana), Datia (Madhya Pradesh), Kota (Rajasthan) and Ooty (Tamil Nadu). The already developed watersheds by ICAR-IISWC and its Centres that were at least three years old were considered for the study, out of which 4 or 5 watersheds were selected at each Centre. A total of 38 watersheds were selected from 8 research Centres of ICAR-IISWC in India as given in Table 1.

Table: 1
Selection of watersheds developed by ICAR-IISWC and its Centres and number of respondents

Name of Centre	Name of selected watersheds and number of respondents	Total respondents (No.)
Vasad	Navamota (50), Rebari (50), Sarnal (50), Antisar (50), Vejalpur-Rampura (50)	250
Agra	Etmatpur (50), Boman (50), Raghupur (50), Jalalpur (50)	200
Bellary	Joladarasi (50), Chinnatekur (50), PC Pyapli (54), Mallapuram (54),Chilakanahatti (58)	266
Chandigarh	Aganpur-Bhagwasi (50), Mandhala (49), Johranpur (26), Sabeelpur (50),Kajiana (50)	225
Datia	Bajni (50), Jigna (50), Kalipahari (50), Agora (50), Durgapur (50)	250
Dehradun	Fakot (50), Raipur (50), Sabhawala (51), Langha (60)	211
Kota	Chhajawa (50), Badakhera (50), Haripura (50), Hanotiya (50), SemliGokul (50)	250
Ooty	Salaiyur (50), Chikkahalli (50), Eramanaikkanpatti (50), Putthuvampalli (50), Thulukkamuthur (50)	250

Selection of Respondents

SWC technology-wise inventory of adopter farmers, was prepared with the help of detail project report (DPR) or by organizing meetings with farmers. The inventory contained the names of farmers, the size of land holding and the adopted technology. The inventory served as the basis to prepare list of farmers for all technologies adopted during the watershed development programmes. A stratified proportionate random sampling plan was adopted to select respondents from different inventories of farmers. At least 50 respondents were selected from each watershed, representing all the existing categories of farmers in the watershed. A detailed structured interview schedule was developed by the investigators. Data regarding personal, psychological and discontinued adoption behaviour variables were recorded on the schedule through personal interviewing of the respondents.

Categorization of Respondents

The respondents were separated into three categories in relation to the data regarding discontinue adoption behaviour of farmers towards SWC technologies for watershed management with help of the following criteria:

Range of score	Category
a) < Minimum score + CI	Low
b) > Minimum score + CI to < Maximum score - CI	Moderate
c) > Maximum score - CI	High

Where, CI = Class Interval, Class Interval (CI) was computed using the following formula:

$$CI = \frac{\text{Maximum Score - Minimum Score}}{\text{Number of classes}}$$

Measurement of Discontinuance Adoption Behavior of Farmers

To measure the extent of discontinuance adoption behaviour of farmers towards SWC technologies implemented during watershed development programmes, a detailed methodology was developed such as data collection schedule, scoring procedure and data analysis with the help of indices as follows:

(i) Technologies Discontinuance Index (TsDI): Number of technologies discontinued by a farmer out of total initially adopted SWC technologies and it was worked out as given below:

$$TsDI = \frac{\text{Number of SWC technologies discontinued by a farmer}}{\text{Number of SWC technologies initially adopted by a farmer}} \times 100 \qquad ...(1)$$

Overall Technologies Discontinuance Index (OTsDI): It can be worked on watershed level including all farmers as given below:

$$OTsDI = \frac{\sum_{i=1}^{N} TsDI_i}{N} \qquad ...(2)$$

Where, $\sum_{i=1}^{N} TsDI_i$ = Sum total of technology discontinuance indices of i^{th} farmer, N = Total number of farmers.

(ii) Technology Discontinuance Index (TDI): Number of farmers discontinued a particular SWC technology out of total initially adopted farmers of a watershed area and it can be worked out technology wise for different SWC technologies as given below:

$$TDI = \frac{\text{Number of farmers discontinued a particular SWC technology}}{\text{Number of farmers initially adopted a particular SWC technology}} \times 100 \qquad ...(3)$$

Overall Technology Discontinuance Index (OTDI): It can be worked on large area or region basis including all watersheds for a particular SWC technology as given below:

$$OTDI = \frac{\sum_{i=1}^{N} TDI_i}{N} \qquad ...(4)$$

Where, $\sum_{i=1}^{N} TDI_i$ = sum total of particular technology discontinuance indices of i^{th} watersheds for a SWC technology, N = Total number of watersheds in a area or region.

(iii) Technology Adoption Index (TAI): Number of farmers adopted a particular SWC technology out of total farmers of a watershed area and it can be worked out technology wise for different SWC technologies as given below:

$$TAI = \frac{\text{Number of farmers adopted a particular SWC technology in a watershed}}{\text{Total number of farmers in a watershed}} \times 100 \qquad ...(5)$$

Overall Technology Adoption Index (OTAI): It can be worked on large area or region basis including all watersheds for a particular SWC technology as given below:

$$OTAI = \frac{\sum_{i=1}^{N} TAI_i}{N} \qquad ...(6)$$

Where, $\sum_{i=1}^{N} TAI_i$ = sum total of technology adoption indices of i[th] watersheds for particular SWC technology, N = Total number of watersheds in a area or region.

3. RESULTS AND DISCUSSION

Levels of Discontinuance of SWC Technologies by Farmers

The data in Table 2 show the levels of discontinuance of SWC technologies by farmers in the watersheds developed by ICAR-IISWC and its different research Centres in the country. Majority (more than 50%) of farmers had low-level discontinuance of SWC technologies at Bellary (84.9%), Ooty (84.4%), Vasad (74.8%) and Kota (65.2%) Centres at low level. Moderate level of discontinuance was reported among majority of farmers at Agra (61.5%), Chandigarh (54.2%) and Dehradun (51.7%) Centres at moderate level. A few farmers had discontinued adopted SWC technologies at high level in their fields due to various reasons. The overall pooled data revealed that majority (57.6%) of farmers had discontinued SWC technologies at low level, 32% of farmers discontinued at moderate level and only 10.4% of farmers discontinued at high level, which were adopted during watershed development programmes implemented by ICAR-IISWC and its different research Centres in India.

Extent of Discontinuance of SWC Technologies

The extent of discontinuance of SWC technologies was measured with the help of TsDI within a watershed and OTsDI across the watersheds of a region. It was revealed from the data in Table 3 that little more than one-third of SWC technologies were discontinued by farmers in Sarnal watershed (33.91%) and little less than one-third of SWC technologies

Table: 3
Technologies Discontinuance Index (TsDI) and Overall Technologies Discontinuance Index (OTsDI) of SWC technologies by farmers in different watersheds implemented by ICAR-IISWC and its research Centres in India *n = 1902*

Name of Centre	Name of watershed	TsDI	OTsDI
Vasad, Gujarat	Navamota (n=50)	27.64	
	Rebari (n=50)	7.54	
	Sarnal (n=50)	33.91	20.31
	Antisar (n=50)	4.56	
	Vejalpur (n=50)	27.92	
Dehradun, (UK)	Fakot (n=50)	55.78	
	Raipur (n=50)	52.85	41.45
	Sabhawala (n=51)	16.60	
	Langha (n=60)	40.56	
Chandigarh, Haryana	Aganpur Bhagwasi (n=50)	23.29	
	Mandhala (n=49)	10.77	
	Johranpur (n=26)	15.01	18.56
	Sabeelpur (n=50)	16.17	
	Kajiyana (n=50)	13.48	
Bellary, Karnataka	Joladarasi (n=50)	20.43	
	Chinnatekur (n=50)	38.53	
	PC Pyapli (n=54)	15.76	17.28
	Mallapuram (n=54)	10.37	
	Chilakanahatti (n=58)	1.32	
Kota, Rajasthan	Chhajawa (n=50)	15.30	
	Badakheda (n=50)	11.62	
	Haripura (n=50)	3	21.78
	Hanotiya (n=50)	50	
	Semli Gokul (n=50)	29	
Agra, Uttar Pradesh	Etmatpur (n=50)	43.35	
	Boman (n=50)	46.07	46.75
	Raghupur (n=50)	50.74	
	Jalalpur (n=50)	46.86	
Ooty, Tamil Nadu	Salaiyur (n=50)	16.8	
	Chhikkahalli (n=50)	19.00	
	Eramanaikkanpatti (n=50)	21.14	12.95
	Pathhuvampalli (n=50)	5.73	
	Thulukkamuthur (n=50)	2.07	
Datia, (MP)	Bajni (n=50)	43.02	
	Jigna (n=50)	37.15	
	Kalipahari (n=50)	36.58	37.07
	Agora (n=50)	36.97	
	Durgapur (n=50)	31.64	
Average			27.01

Table: 2
Levels of discontinuance of SWC technologies by farmers in different watershed projects implemented by ICAR-IISWC and its research Centres in India *n = 1902*

Level of Farmers	Research Centres of ICAR-IISWC, Dehradun								Pool (No.)
	Vasad	Dehradun	Chandigarh	Bellary	Kota	Agra	Ooty	Datia	
Low	187 (74.8)	69 (32.7)	90 (40)	226 (84.9)	163 (65.2)	40 (20)	211 (84.4)	110 (44)	1096 (57.6)
Moderate	48 (19.2)	109 (51.7)	122 (54.2)	34 (12.8)	37 (14.8)	123 (61.5)	24 (9.6)	112 (44.8)	609 (32.0)
High	15 (6)	33 (15.6)	13 (5.8)	6 (2.3)	50 (20)	37 (18.5)	15 (6)	2 8(11.2)	197 (10.4)

Note: The data in parentheses are in percentage

were discontinued by farmers in Vejalpur (27.92%) and Navamota (27.64%) watersheds, followed very less number of SWC practices were discontinued by farmers in Rebari (7.54%) and Antisar (4.56%) watersheds developed by research Centre Vasad. Further, the value of OTsDI shows that about one-fifth (20.31%) of SWC technologies were discontinued by farmers of five watersheds developed by research Centre Vasad in Gujarat state.

At ICAR-IISWC Dehradun, TsDI values revealed that more than 50% of SWC technologies were discontinued by farmers in Fakot (55.78%) and Raipur (52.85%) watersheds, followed by about 40% of SWC technologies were discontinued by farmers in Langha watershed (40.56%) and 16.60% of SWC technologies for watershed management were discontinued by farmers in Sabhawala watershed. The OTsDI value shows that about 40% (41.45%) of SWC technologies were discontinued by farmers in four watersheds developed by ICAR-IISWC Deharadun in Uttrakhand state of India.

The TsDI values show that more than one-fifth of SWC technologies were discontinued by farmers in Aganpur Bhagwasi watershed (23.29%), about 15% of SWC technologies were discontinued by farmers in Sabeelpur (16.17%) and Johranpur (15.01) watersheds and followed by about 10% of SWC technologies were discontinued by farmers of Kajiyana (13.48%) and Mandhala (10.77%) watersheds developed by research Centre Chandigarh in Haryana state. The OTsDI value shows that little less than one-fifth (18.56%) of SWC technologies were discontinued by farmers in five watersheds developed by research Centre Chandigarh in Haryana state.

The TsDI values in Table 3 show that more than one-third (38.53%) of SWC technologies were discontinued by farmers in Chinnatekur watershed, followed by one-fourth (20.43%) of SWC technologies were discontinued by farmers in Joladarasi watershed, about 15% of SWC technologies were discontinued in PC Pyapli (15.76%), 10% in Mallapuram (10.37%) and only 1.32% in Chilakanahatti watersheds developed by research Centre Bellary. The OTsDI value shows that 17.28% of SWC technologies were discontinued by farmers in these five watersheds developed under government sponsored programmes by research Centre Bellary in Karnataka state.

The TsDI values show that 50% of SWC technologies were discontinued by farmers in Hanotiya watershed, more than one-fourth (29%) of SWC technologies discontinued by farmers in Semli Gokul watershed, 15% of SWC technologies discontinued by farmers in Chhajawa (15.30%), 11.62% in Badakheda and 3% in Haripura watersheds developed by research Centre Kota in Rajasthan state. The OTsDI value shows that overall about one-fifth (21.78%) of adopted SWC technologies were discontinued by farmers in these five watersheds developed under different government sponsored programmes by research Centre Kota in Rajasthan state.

The TsDI values show that 50% of SWC technologies were discontinued by farmers in Raghupur watershed (50.74%), followed by more than 40% of SWC technologies adopted were discontinued by farmers in Jalalpur (46.86%), Boman (46.07%) and Etmatpur (43.35%) watersheds. Similarly, the OTsDI value revealed that overall 46.75% of SWC practices were discontinued by farmers in these four watersheds implemented by research Centre Agra in Uttar Pradesh state.

The Table 3 revealed that about one-fifth of adopted SWC technologies were discontinued by farmers in Eramanaikkanpatti (21.14%) and Chikkahali (19%) watersheds, followed by about 15% SWC technologies were discontinued by farmers in Salaiyur (16.8%), 5.73% in Patthuvampalli and 2.07% in Thulukkamuthur watersheds. The OTsDI value revealed that overall 12.95% of adopted SWC practices were discontinued by farmers in these five watersheds developed by research Centre Ooty in Tamil Nadu state of Country.

At Research Center Datia, the TsDI values show that maximum 43.02% of SWC technologies were discontinued by farmers in Bajni watershed and more than one-third of adopted SWC technologies were discontinued by farmers in Jigna (37.15%), Agora (36.97%), Kalipahari (36.58%) watersheds and also little less than one-third of SWC technologies discontinued by farmers in Durgapur watershed (31.64%). Similarly, the OTsDI value shows that more than one-third (37.07%) of SWC technologies were discontinued by farmers in these five watersheds developed by research Centre Datia in Madhya Pradesh state. Further, the overall average value of OTsDI indices shows that more than one-fourth

(27.01%) of adopted SWC technologies were discontinued in different watersheds developed by ICAR-IISWC and its research Centres in India.

Technology-wise Discontinuance of Important SWC Technologies

The TDI data presented in Table 4 revealed that bunding technology was discontinued by 20.4% farmers in watersheds developed by Kota Centre, 12.5% farmers in watersheds developed by Agra Centre, 11.2% farmers in watersheds developed by Datia Centre and only 1.5% farmers in watersheds developed by Vasad Centre. The OTDI value revealed that 11.4% farmers discontinued bunding technology in the watersheds as against the OTAI of 75.2%.

Check dam technology was discontinued by 4% farmers in watersheds developed by Ooty and Datia Centres, 3.2 and 3% farmers in watersheds developed by Vasad and Chandigarh Centres respectively and only 2% farmers in watersheds developed by Kota and Agra Centres. The OTDI value revealed that overall, only 3% farmers had discontinued check dam technology in these watersheds. However, OTAI revealed that less than one-fourth (23.8%) farmers adopted the check dam technology initially during development of watersheds implemented by six research Centres of ICAR-IISWC in India.

Land leveling technology was discontinued by about 22.5% farmers in watersheds developed by Agra Centre, 8.4% farmers in watersheds developed by Datia Centre and only 0.5% farmers in watersheds developed by Vasad and Kota Centres. The OTDI value revealed that overall 8% farmers discontinued land leveling technology as compared to the OTAI indicating 44.2% farmers were adopting the land leveling technology during development of watersheds.

Pond technology was discontinued by 2.4% farmers in watersheds developed by Bellary Centre, 1% farmers in watersheds developed by Vasad Centre and only 0.4% farmers in watersheds developed by Datia Centre. As indicated by the OTDI values 1.3% farmers discontinued pond technology although only 6.8% farmers had adopted the technology initially.

Terracing technology was discontinued by 10% farmers in watersheds developed by Dehradun, 7.5% farmers in watersheds developed by Agra Centre and 2% farmers in watersheds developed by Bellary Centre. Overall, 6.5% farmers discontinued terracing technology although one-third (33.5%) farmers had adopted the terracing technology during development of watersheds.

Reasons for Discontinuance of Bunding Technology

The data in Table 5 show that 15.4% farmers discontinued bunding technology due to reason of costly measure to maintain in the watersheds. The next important reasons were regular maintenance requirement (6% farmers) and money crisis (5.3% farmers). Labour intensiveness, not serving the purpose and no proper grass sodding on bunds were the other reasons for discontinuing the bunding technology. Therefore, it can be inferred from the findings that the financial provisions should be made for repair and maintenance of breached out bunds in the fields of poor farmers after completion of watershed implementation phase for sustainable SWC.

Table: 4
Technology Discontinuance Index (TDI) and Overall Technology Discontinuance Index (OTDI) of important SWC technologies in different watersheds implemented by ICAR-IISWC and its research Centres in India

Name of Technologies implemented in watersheds	Technology Discontinuance Index (TDI) and Technology Adoption Index (TAI in parenthesis)								OTDI and OTAI (in parenthesis)
	Vasad	Dehradun	Chandigarh	Bellary	Kota	Agra	Ooty	Datia	
Bunding	1.5 (61.5)	-	-	-	20.4 (86)	12.5 (97.5)	-	11.2 (56)	11.4 (75.2)
Check Dam	3.2 (22)	-	3 (22.5)	-	2 (48)	2 (22)	4 (16)	4 (12.8)	3.0 (23.8)
Land Leveling	0.5 (34)	-	-	-	0.5 (37.5)	22.5 (63)	-	8.4 (42.4)	8.0 (44.2)
Pond	1 (6)	-	-	2.4 (10.4)	-	-	-	0.4 (4)	1.3 (6.8)
Terracing	-	10 (86)	-	2 (2)	-	7.5 (12.5)	-	-	6.5 (33.5)

Note: The data in parentheses are in percentage

Reasons for Discontinuance of Check Dam Technology

The pooled data in Table 6 show that small land holdings and lack of money with farmers were the most important reasons for discontinuance of check dam technology as perceived for 47.6% and 31.6% farmers, respectively. Check dams were washed away due to heavy rain in the fields of 3% farmers of watersheds developed by Ooty and Vasad Centres. Check dams were demolished due to road construction in the fields of 3% farmers of two watersheds developed by Ooty Centre. Waste of space and not harvested any water was another reason for discontinuance check dam technology 1.8% of farmers of Mallapuram watershed developed by Bellary Centre of ICAR-IISWC in the country. Therefore, the check dam technology should be adopted in medium and large land holdings and financial provisions must be made for repair and maintenance of check dams.

Table: 5
Reasons for discontinuance of bunding technology by farmers of watersheds developed by research Centres of ICAR-IISWC

Reasons for discontinuance of bunding technology	Number of farmers		Total
	Kota Centre (n=150)	Agra Centre (n=200)	
Costly measure	41 (27.3)	13 (6.5)	54 (15.4)
Labour intensive	6 (4)	-	6 (4)
Not serving the purpose	6 (4)	-	6 (4)
Money crisis	8 (5.3)	-	8 (5.3)
Regular maintenance required	-	12 (6)	12 (6)
No proper grass sodding on bunds	-	3 (1.5)	3 (1.5)

Note: The data in parentheses are in percentage

Reasons for Discontinuance of Land Leveling Technology

Table 7 shows that land leveling technology was discontinued by 16.5% farmers of watersheds developed by Agra Centre due to the reason of regular maintenance is required. Costly measure was considered second important reason for discontinuance of land leveling as perceived by 11.5% of farmers, about same number of farmers (11%) also discontinued the land leveling practice due to non-availability of equipment, Only about 3% farmers discontinued the

Table: 7
Reasons for discontinuance of land leveling technology by farmers of watersheds developed by Agra Centre of ICAR-IISWC

Reasons for discontinuance of land leveling technology	Number of farmers Agra Centre
	Etmatpur, Boman, Raghupur and Jalalpur watersheds (N=200)
Regular maintenance required	33 (16.50)
No equipment available	11 (5.50)
Costly measure	23 (11.50)
No knowledge of leveling work	6 (3)

Note: The data in parentheses are in percentage

Table: 6
Reasons for discontinuance of check dam technology by farmers of watersheds developed by research Centres of ICAR-IISWC

Reasons for discontinuance of check dam technology	Farmers (No.)						Total (No.)
	Vasad Navamota, Sarnal (n=100)	Chandigarh Aganpur Bhagwasi (n=50)	Bellary Mallapuram (n=54)	Kota Chhajawa (n=50)	Ooty Salaiyur, Ermanaikkanpatti (n=100)	Datia Bajni, Jigna, Kalipahari, Agora and Durgapur (n=250)	
Lack of money	1 (1)	3 (6)	-	1 (2)	-	137 (54.8)	142 (31.6)
Washed away due to heavy rain	1 (1)	-	-	-	5 (5)	-	6 (3)
Waste of space and not harvested any water	-	-	1 (1.8)	-	-	-	1 (1.8)
Due to road construction it was demolished	-	-	-	-	3 (3)	-	3 (3)
Small land holdings	-	-	-	-	-	119 (47.6)	119 (47.6)

Note: The data in parentheses are in percentage

land leveling practice due to lack of knowledge about leveling work in the fields in four watersheds developed by Agra Centre. Kumar (2005) has also reported similar findings that lack of information / guidance and non-availability of inputs / material / labour considered as major reason for low / no adoption of different SWC practices.

Reasons for Discontinuance of Pond Technology

One-third (33.8%) farmers discontinued pond technology due to their marginal and small land holdings in the watersheds developed by Datia and Bellary Centres (Table 8). Another 6% farmers discontinued the pond technology due to damage in high density polyethylene (HDPE) sheet lined in ponds in the Salaiyur watershed developed by Ooty Centre. Storage of water for short duration due to less rainfall and pond siltation were the other reasons for discontinuance of the pond technology by 1.3% farmers in watersheds developed by Bellary Centre and also 0.6% farmers discontinued the pond to use the land in cultivation purpose in the watersheds developed by Bellary Centre. Therefore, it can be inferred from the findings that pond technology should be adopted in medium and large land holdings with concrete lining of pond for its proper utilization and sustained benefits to suitable farmers.

Reasons for Discontinuance of Terracing Technology

The data in Table 9 show that 8% farmers discontinued terracing technology due to non availability of labour in the watersheds developed

Table: 8

Reasons for discontinuance of pond technology by farmers of watersheds developed by Centres of ICAR-IISWC

Reasons for discontinuance of pond technology	Number of farmers			Pool
	Bellary Joladarasi, Chinnatekur and Chilakanahatti (N=158)	Ooty Salaiyur (N=50)	Datia Bajni, Jigna, Kalipahari, Agora and Durgapur (N=250)	
Store water for short duration due to less rainfall	2 (1.3)	-	-	2 (1.3)
Silted up	3 (1.9)	-	-	3 (1.9)
For cultivation purpose	1 (0.6)	-	-	1 (0.6)
HDPE sheet damaged	-	3 (6)	-	3 (6)
Marginal and small land holdings	1 (0.6)	-	137 (54.8)	138 (33.8)

Note: The data in parentheses are in percentage

Table: 9

Reasons for discontinuance of terracing technology by farmers of watersheds developed by research Centres of ICAR-IISWC

Reasons for discontinuance of terracing technology	Number of farmers			Pool
	Dehradun Fakot and Langha (N=110)	Bellary Joladarasi (N=50)	Agra Etmatpur, Boman, Raghupur and Jalalpur (N=200)	
High cost of maintenance	4 (3.6)	-	16 (8)	20 (6.5)
Lack of joint efforts by farmers	3 (2.7)	-	-	3 (2.7)
Fragmentation of land holdings	2 (1.8)	-	-	2 (1.8)
Damage by wild animals	5 (4.6)	-	-	5 (4.6)
Labour constraints	-	2 (4)	18 (9)	20 (8)

Note: The data in parentheses are in percentage

by Agra and Bellary Centres. High cost required in maintenance of terraces was second important reason for discontinuance of terracing technology by 6.5% farmers in the watersheds developed by Agra and Dehradun Centres. Farmers (4.6%) also discontinued the terracing technology due to damages by wild animals in Fakot and Langha watersheds. The other reasons for discontinuance of terracing technology were lack of joint efforts by farmers and fragmented land holdings as perceived by 2.7 and 1.8% of farmers, respectively. Therefore, it can be concluded that the farm equipments should be provided to farmers in watershed development programmes so that the SWC structures cane be repaired and maintained by farmers in non availability of labour situations.

4. CONCLUSIONS

It was found out that 57.6% farmers were discontinued SWC technologies at low level, 32% farmers discontinued SWC technologies at moderate level and only 10.4% farmers discontinued SWC technologies at high level from the watersheds implemented by ICAR-IISWC and its research Centres in India. The study further revealed that the average value of OTsDI shows that more than one-fourth (27.01%) of adopted SWC technologies were discontinued in different watersheds developed by ICAR-IISWC and its research Centres in India.

The OTDI values revealed that 11.4% farmers discontinued bunding technology, 8% farmers discontinued land leveling, 6.5% farmers discontinued the terracing, 3% farmers discontinued check dam and 1.3% farmers discontinued pond technologies in the watersheds developed by ICAR-IISWC and its research Centres in India. Bunding technology was discontinued due to its costly measure, regular maintenance requirement and money crisis with farmers as perceived by 15.4, 6 and 5.3% farmers, respectively. The important reasons for discontinuance of land leveling technology were regular maintenance requirement, costly measure and non-availability of suitable equipment for about 16.5, 11.5 and 5.5 farmers, respectively. Labour constraints, high cost of maintenance and damage by wild animals were the reasons for discontinuance of terracing by 9, 6.5 and 4.6% farmers, respectively. Check dam technology was discontinued by farmers due to small land holdings, lack of money and washed away due to heavy rain as considered by 47.6, 31.6 and 3% farmers, respectively. Marginal and small land holdings, HDPE sheet damage and silting of ponds were the reasons for discontinuance of pond by 33.8, 6 and 1.9% of farmers in the watersheds developed by ICAR-IISWC and its Research Centres in India.

It can be inferred from the findings that the financial provisions should be made in planning for repair and maintenance of SWC structures after completion of watershed projects. SWC technologies like check dam, pond and bunding should be adopted in medium and large land holdings. Farm equipments should be provided to poor farmers from watershed development projects so that the SWC structures could be repaired and maintained by farmers in case of non availability of labours for long-term sustainable benefits to farmers from SWC structures.

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