Extension Journal

International Journal of Agriculture Extension and Social Development

Training needs and constraints faced by farmers regarding rainwater harvesting and groundwater recharge techniques

[1]PS Jayswal, [2]N Tiwari, [3]VS Parmar, [1]KN Sondarva, [1]VA Patel and [4]V Patil

[1]Associate Professor, CAET, NAU, Dediapada, Gujarat, India

[2]Scientist, KVK, JAU, Amreli, Gujarat, India

[3]Senior Scientist & Head, KVK, AAU, Arnej, Gujarat, India

[4]Assistant Professor, CAET, NAU, Dediapada, Gujarat, India

DOI: https://www.doi.org/10.33545/26180723.2026.v9.i1f.2950

Corresponding Author: PS Jayswal

Abstract
Rain is the main source of input water in agriculture, along with that it also required to recharge groundwater resources, which harvested during monsoon period of the year. Keeping the importance in mind one survey project was done for farmers of Amreli district of Gujarat state to find the training needs of farmers regarding rainwater harvesting and groundwater recharge. For scheduled interview filling, 300 farmers were randomly selected from 5 villages of three taluka of the Amreli district facing water scarcity problem. *Ex-post-facto* research design was used in the present investigation. Outcome of the survey was that if any field extension workers of want to provide training to the farmers of Amreli district on rainwater harvesting and groundwater recharge methods must be as per the need of the area. The training venues can be selected at their village, Krishi Vigyan Kendra or Farmers' training centre. It will be more suitable for the farmers and farm women if the timing of training is arranged through field visits, demonstrations and lectures before the onset of cropping season and one to two days training with a gap of not more than 6 months.

Keywords: Training, rainwater harvesting, groundwater recharge, Amreli, *Ex-post-facto*, survey

Introduction
Rain is the main source of input water in agriculture, along with that it also required to recharge groundwater resources, which harvested during non-monsoon period of the year. Rainfall provides the water needed for plants to uptake nutrients and transport them to the leaves and stems. Groundwater (GW) has become the most important renewable resource not only for unfettered development in both industry and agriculture, but also for the survival of ecosystems. For example, GW ensures half of the irrigation water needed in south Asia and is associated with livelihood strategies at local level for many rural small holders. Rain is the main source of input water in agriculture, along with that it also required to recharge groundwater resources, which harvested during non-monsoon period of the year. In Amreli district, agriculture sector has highest land area, which can be play crucial role in potential area for rainwater harvesting as well as groundwater recharge. Farmers and farmwomen of Amreli district may or may not be aware about present scenario of groundwater level and various rainwater harvesting and groundwater recharge techniques. Various training programmes on rainwater harvesting and groundwater recharge techniques can become a step towards the future needs of water. Need based training programme acts as a catalyst for increasing the motivational level of trainees who in turn try to put their sincere efforts to learn and gain maximum from training programme. It can thus be assumed that training need identification acts as a foundation pillar of training and helps in prioritizing the training areas for particular group of trainees.

Objectives
1. To study the socio-economic profile of farmers.
2. To measure the knowledge of farmers regarding rainwater harvesting and groundwater recharge.
3. To find out the training needs of farmers regarding rainwater harvesting and groundwater recharge.
4. To find out constraints faced by farmers for application of rainwater harvesting and groundwater recharge structures on field.

Methodology
The present study was conduct in Amreli district of Saurashtra region. Three talukas i.e. Kukavav-vadia, Babra and Lathi were selected from the Amreli district, which faces water scarcity problem. Five villages from selected each talukas i.e. vadia, khadkhad, (Kukavav-vadia taluka), Toda, Zarakhiya (Lathi taluka) and Sukhpar (Babra taluka) were selected at random and 20 respondents from each selected villages constituting the total sample size of 300. *Ex-post-facto* research design was used in the present investigation. The interview schedule was developed

keeping in view the specific objectives of the study and the data were collected by survey method during year 2022-23. The result was analyzed by using frequency, percentage, and Mean Percent Score. Ranking was also assigned for each task.

Table 1: Selected villages

Sr. No.	Taluka	Village
1	Kukavav-vadia	Vadia
2		Khadkhad
3		Suryapratap gadh
4		Nani Kukavav
5		Khakhariya
6	Lathi	Toda
7		Zarakhiya
8		Sekh pipariya
9		Punjapar
10		Adtala
11	Babra	Sukhpar
12		Galkotadi
13		Charkha
14		Vankiya
15		Untvad

Results and Discussion
1. Personal profile of the farmers

Table 2: Distribution of the respondents according to their personal profile

Sr. No.	Personal profile	(n=300)	
		Frequency	Per cent
1.	Age		
	Young age (up to 35year)	53	17.66
	Middle age (36 to 50 year)	150	50.00
	Old age (above 50 year)	97	32.34
	Total	300	100
2.	Education		
	Illiterate	25	8.33
	Primary education	55	18.33
	Secondary education	93	31.00
	Higher secondary education	64	21.34
	College and above	63	21.00
	Total	300	100
3.	Land Holding		
	Marginal farmers (up to 1 ha)	28	9.33
	Small farmers (1.01 to 2 ha)	75	25.00
	Medium farmers (2.01 to 4 ha)	118	39.34
	Large farmers (More than 4 ha)	79	26.33
	Total	300	100
4.	Occupation		
	Agriculture	139	46.33
	Animal husbandry+ Agriculture	141	47.00
	Business+ Agriculture	18	6.00
	Service+ Agriculture	2	0.66
	Labor	0	0
	Total	300	100
5.	Herd size		
	No herd animal	70	23.34
	Herd animal Up to 2	204	68.00
	Herd animal 3 to 4	24	08.00
	Herd animal More than 5	2	0.66
	Total	300	100
6.	Family Type		
	Nuclear	159	53.00
	Joint	141	47.00
7.	Annual Income		
	Up to Rs. 50,000 /-	22	7.33

	Rs. 50,001 to Rs. 1,00,000 /-	93	31.00
	Rs. 1,00,001 to Rs. 1,50,000 /-	64	21.33
	Rs. 1,50,001 to Rs. 2,00,000 /-	27	9.00
	Above Rs. 2,00,000 /-	94	31.00
	Total	300	100
8.	**Social participation**		
	No social participation	132	44.00
	Poor social participation	112	37.33
	Moderate social participation	34	11.33
	Good social participation	22	7.34
	Total	300	100
9.	**Innovativeness**		
	Low level of innovative proneness	17	5.66
	Medium level of innovative proneness	273	91.00
	High level of innovative proneness	10	3.34
	Total	300	100
10.	**Cosmopoliteness**		
	Low level of Cosmopoliteness	21	7.00
	Medium level of Cosmopoliteness	246	82.00
	High level of Cosmopoliteness	33	11.00
	Total	300	100
11.	**Scientific Orientation**		
	Low level of scientific orientation (score up to 13)	65	21.66
	Medium level of scientific orientation (score 14 to 16)	213	71.00
	Low level of scientific orientation (score above 16)	22	7.34
	Total	300	100
12.	**Planning orientation**		
	Low level planning orientation	57	19.00
	Medium level planning orientation	167	55.66
	High level planning orientation	76	25.34
	Total	300	100
13.	**Production orientation**		
	Low level	45	15.00
	Medium level	202	67.34
	High level	53	17.66
	Total	300	100
14.	**Adaptation**	**F**	**Percentage**
	Low level of adaptation	81	27.00
	Medium level of adaptation	184	61.33
	High level of adaptation	35	11.67
	Total	300	100

Age

Majority of the respondents (50.00 per cent) belonged to middle age group, while 32.34 per cent and 17.66 per cent of them belongs to old age and young age group respectively.

Education

Data depicted in table 2 about education of the respondents shows that one-third (31.00 per cent) of the respondent had secondary education followed by 21.34 per cent and 21.00 per cent had higher secondary education and up to collage level of education. Only 18.33 per cent and of the respondents had educated up to primary level and only 8.33 per cent of the respondent were illiterate.

Land holding

More than one- third of the respondents (39.34 per cent) had belonged to medium farming group while 26.33 per cent and 25.00 per cent of them had large and small farmers respectively. Only 9.33 per cent of the respondents were marginal farmers.

Occupation

Nearly fifty percent of respondents (47.00 per cent) were practicing agriculture with animal husbandry followed by 46.33 per cent of the respondents engaged in agriculture whereas 06.00 percent of the respondents associate with agriculture + Business. Only, 00.66 per cent of the respondents were practicing farming with services.

Herd Size

Majority of the respondents (68.00 per cent) had up to 2 herd size followed by 23.34 per cent and 8. 00 per cent had zero herd size and 3 to 4 herd size respectively. Only 0.66 per cent had more than 5 herd size.

Family Size

Majority of the respondents (53.00 per cent) belonged to nuclear family while, 47.00 per cent of the respondents living in Joint family.

Annual income

One third of the respondents (31.33 per cent) had annual income above Rs. 2,00,000 /- where as 31.00 per cent have

annual income Rs. 50,001 to Rs. 1,00,000 /-. However, 21.33 percent of the respondents had earned Rs. 1,00,001 to Rs. 1,50,000 /- annually. Very few of the respondents 9.00 percent had annual income Rs. 1,50,001 to Rs. 2,00,000 /-. Only 7.33 per cent had annual income up to Rs. 50,000 /-.

Social participation
More than two-fifth of the respondents (44.00 per cent) had no social participation whereas 37.33 per cent and 11.33 per cent among them had poor and moderate social participation. Only, 7.34 per cent of the respondents had good social participation.

Innovativeness
Majority of the respondents (91.00 per cent) had medium level of innovativeness whereas, 5.66 and 3.34 per cent of them had low and high level of innovativeness respectively.

Cosmopoliteness
Majority of the respondents (82.00 per cent) had medium level of cosmopoliteness whereas, 11.00 and 07.00 per cent of them had high and low level of cosmopoliteness respectively.

Scientific Orientation
Majority of the respondents (71.00 per cent) had medium level of scientific orientation whereas, 21.66 and 07.34 per cent of them had low and high level of scientific orientation respectively.

Planning orientation
Majority of the respondents (55.66 per cent) had medium planning orientation whereas, 25.34 and 19.00 per cent of them had high and low level of planning orientation respectively.

Production orientation
Majority of the respondents (67.34 per cent) had medium production orientation whereas, 17.66 and 15.00 per cent of them had high and low level of production orientation respectively.

Adaptation
The data presented in table- found that Majority of the responds (61.33 per cent) had medium level of adaptation about rainwater harvesting and groundwater recharge techniques while 27.00 per cent and 11.67 per cent among them had low and high level of adaptation about rainwater harvesting and groundwater recharge techniques, respectively.

Table 3: Distribution of the respondents according to their knowledge level about rainwater harvesting and groundwater recharge techniques

Sr. No.	Techniques	Know	Partially Know	Not Know	Mean score	Rank
1.	Rooftop water harvesting	203 (67.66)	52 (17.33)	45 (15.00)	2.53	I
2.	Farm pond (lined/ unlined)	40 (13.33)	77 (25.66)	183 (61.00)	1.52	V
3.	Check dam (Earthen/ Masonary)	74 (24.66)	47 (15.66)	179 (59.66)	1.65	III
4.	Gabion structure	0.0 (0.00)	23 (7.66)	277 (92.33)	1.08	X
5.	Recharging of bore wells	49 (16.33)	78 (26.00)	173 (57.66)	1.59	IV
6.	Recharging of dug wells (with sand filter) (live/dead)	25 (8.33)	65 (21.66)	210 (70.00)	1.38	VI
7.	Recharge through handpumps	15 (5.0)	42 (14.00)	245 (81.66)	1.24	VII
8.	Recharge pits	09 (3.00)	30 (10.00)	261 (87.00)	1.16	VIII
9.	Recharge Trenches	03 (1.00)	33 (11.00)	264 (88.00)	1.13	IX
10.	Soakaways or Recharge Shafts	0.0 (0.00)	12 (4.00)	288 (96.00)	1.04	XI
11.	Percolation Tanks	0.0 (0.00)	29 (9.66)	271 (90.33)	1.16	VIII
12.	Boribandh	09 (3.00)	29 (9.66)	262 (87.33)	2.12	II

The data presented in table-3 indicated that according to the need hierarchy, the respondent's assigned first rank to Rooftop water harvesting (2.53) followed by Boribandh (2.12), Check dam (Earthen/ Masonary) (1.65), Recharging of bore wells (1.59), Farm pond (lined/ unlined) (1.52), Recharging of dug wells (with sand filter) (live/dead) (1.38), Recharge through handpumps (1.24), Recharge pits and Percolation Tanks (1.16), Recharge Trenches (1.13), Gabion structure (1.08), Soakaways or Recharge Shafts (1.04) with ranked II, III, IV, V, VI, VII, VIII, IX, X and XI

respectively. The possible reason behind knowledge regarding rooftop water harvesting may be due to this technique was popularized by govt. organization like gram panchayat and other organizations like NGOs. The other reasons found were ease of adoption and farmer friendly technology. Further, the reason behind low level of knowledge about other techniques like Soakaways or Recharge Shafts, Gabion structure, Recharge Trenches etc was due to low level of awareness and lack of training programmes.

Table 4: Distribution of the respondents according to their knowledge level about rainwater harvesting and groundwater recharge techniques

Sr. No.	Level of Knowledge	F	Percentage
1.	Low level of knowledge (Index score up to 35)	27	09.00
2.	Medium level of knowledge (Index score 36 to 56)	210	70.00
3.	High level of knowledge (Index score more than 56)	63	21.00
	Total	300	100
	Mean=46.03 S.D.=10.24		

The data presented in table - 4 found that majority of the responds (70.00 per cent) had medium level of knowledge about rainwater harvesting and groundwater recharge techniques while 21.00 per cent and 09.00 per cent among them had high and low level of knowledge about rainwater harvesting and groundwater recharge techniques, respectively.

Table 5: Distribution of the respondents according to their training need on rainwater harvesting and groundwater recharge

Sr. No.	Rainwater harvesting techniques	Most needed	Needed	Not needed	Mean Score	Rank
1.	Rooftop water harvesting	232 (77.33)	52 (17.33)	16 (5.33)	2.72	I
2.	Farm pond (lined/ unlined)	177 (59.00)	52 (17.33)	71 (23.66)	2.35	IX
3.	Check dam (Earthen/ Masonary)	203 (67.33)	53 (17.66)	44 (14.66)	2.53	III
4.	Gabion structure	186 (62.00)	35 (11.66)	79 (26.33)	2.36	VIII
5.	Recharging of bore wells	207 (69.00)	58 (19.33)	35 (11.66)	2.57	II
6.	Recharging of dug wells (with sand filter) (live/dead)	201 (67.00)	40 (13.33)	59 (19.66)	2.47	IV
7.	Recharge through hand pumps	178 (59.33)	49 (16.33)	73 (24.33)	2.35	IX
8.	Recharge pits	180 (60.00)	52 (17.33)	68 (22.66)	2.37	VII
9.	Recharge Trenches	183 (61.00)	52 (17.33)	65 (21.66)	2.39	VI
10.	Soakaways or Recharge Shafts	197 (65.66)	38 (12.66)	65 (21.66)	2.44	V
11.	Percolation Tanks	177 (59.00)	58 (19.33)	65 (21.66)	2.37	VII
12.	Boribandh	157 (52.33)	60 (20.00)	83 (27.66)	2.25	X

The data presented in table-5 indicated that according to the need hierarchy, the respondent's assigned first rank to Rooftop water harvesting (2.72) followed by Recharging of bore wells (2.57), Check dam (Earthen/ Masonary) (2.53), Recharging of dug wells (with sand filter) (live/dead) (2.47), Soakaways or Recharge Shafts (2.44), Recharge Trenches (2.39), Percolation Tanks (2.37), Recharge pits (2.37), Gabion structure (2.36), Farm pond (lined/ unlined) and Recharge through hand pumps (2.35), Boribandh (2.25) with ranked II, III, IV, V.VI,VII, VIII, IX and X respectively. All the technologies were very much needed by farmers for good farming practices and to tackle constrains of irrigation water were the main reasons behind high training needs.

Table 6: Distribution of the respondents according to their selection of venue for Effective Training programme

Sr. No.	Venue	Degree of training needs			Mean	Rank
		Most preferred	Preferred	Not preferred		
1.	Krushi Vigyan Kendra, Amreli	172 (57.33)	100 (33.33)	28 (9.33)	2.48	II
2.	At the village level	264 (88.00)	28 (9.33)	8 (2.66)	2.85	I
3.	Farmers' training centre	54 (18.00)	145 (48.33)	101 (33.66)	1.84	III
4.	At the site of demonstration	53 (17.66)	117 (59.00)	130 (43.33)	1.74	IV
5.	At the taluka level	63 (21.00)	97 (32.33)	140 (46.66)	1.74	IV

The data presented in table 6 show that according to the venue of training programme hierarchy, the respondent's assigned first rank to 'at the village level' (2.85) followed by Krushi Vigyan Kendra, Amreli (2.48), Farmers' training

centre (1.84) and At the site of demonstration and At the taluka level (1.74) and ranked II, III, and IV respectively. The reason behind majority of the respondents chosen their village as a venue of training programme so that their farming, animal husbandry and household work will not suffered.

Table 7: Distribution of the respondents according to their time Suitability for effective training programme

Season time	Degree of training needs			Mean	Rank
	Most preferred	Preferred	Not preferred		
Before the onset of cropping season	254 (84.66)	32 (10.66)	14 (4.66)	2.79	I
During the cropping season	15 (5.00)	192 (64.00)	93 (31.00)	1.80	II
Post harvesting season	55 (18.33)	126 (42.00)	119 (39.66)	1.29	III

The data presented in table 7 revealed that according to the time suitability hierarchy, the respondent's assigned first rank given to 'before the onset of cropping season' (2.79) followed by 'during the cropping season' (1.80), post harvesting season (1.29) and ranked II and III.

Table 8: Distribution of the respondents according to their preference for Duration of training programme

Duration	Degree of training needs			Mean	Rank
	Most preferred	Preferred	Not preferred		
One day	196 (65.33)	90 (30.00)	14 (4.66)	2.61	I
Two days	92 (30.66)	208 (69.33)	0 (0.00)	2.31	II
Three days	66 (22.00)	211 (70.00)	23 (7.66)	2.14	III
Four days	34 (11.33)	219 (73.00)	47 (15.66)	1.96	V
Five days and above	134 (44.66)	58 (19.33)	108 (36.00)	2.09	IV

The data presented in table 8 found that according to the preference for duration of training hierarchy, the respondent's assigned first rank given to 'one day training programme' (2.61) followed by two days (2.31), three days (2.14), five day and above (2.09), four day (1.96) and ranked II, III, IV, V, respectively.

Table 9: Distribution of the respondents according time Interval between the training programmes

Time interval	Degree of training needs			Mean	Rank
	Most preferred	Preferred	Not preferred		
Up to 6 months	245 (81.66)	46 (15.33)	9 (3.00)	2.79	I
6 months to 1 year	37 (12.33)	166 (55.33)	97 (32.33)	1.80	II
1 year or above	2 (0.66)	84 (28.00)	214 (71.33)	1.29	III

The data presented in table 9 exposed that according to time interval between the training hierarchy, the respondent's assigned first rank given to Up to 6 months (2.79) followed

by 6 months to 1 year (1.80), 1 year or above (1.29) and ranked II and III.

Table 10: Distribution of the respondents according to preference for training methods

Sr. No.	Training methods	Most preferred	Preferred	Not preferred	Mean	Rank
1.	Demonstration	248 (82.66)	43 (14.33)	09 (3.00)	2.80	I
2.	Study tour	205 (68.33)	66 (22.00)	29 (9.66)	2.59	V
3.	Exhibition	202 (67.33)	79 (26.33)	19 (6.33)	2.61	IV
4.	Field visit	231 (77.00)	57 (19.00)	12 (4.00)	2.73	II
5.	Videos films	158 (52.66)	97 (32.33)	45 (15.00)	2.38	VII
6.	Discussion	188 (62.66)	69 (23.00)	43 (14.33)	2.48	VI
7.	Lecture	237 (79.00)	25 (8.33)	38 (12.66)	2.66	III
8.	Other	145 (48.33)	26 (8.66)	129 (43.00)	2.05	VIII

According to data presented in table 10, it was found that according to preference for training methods hierarchy, the respondent's assigned first to demonstration (2.80) followed by Field visit (2.73), Lecture (2.66), Exhibition (2.61), Study tour (2.59), Discussion (2.48), Videos films (2.38), Other (2.05) with ranked II, III, IV, V, VI, VII and VIII.

Table 11: Constraints faced by respondents in adoption of rainwater harvesting and groundwater recharge

Sr. No.	Constraints	F	%
1.	Lack of awareness	285	95
2.	Lack of training programme	295	98.33
3.	Financial constrains	158	52.66
4.	Social constraints	66	22.00
5.	Possibility of submergence of agricultural land	34	11.33
6.	Location or site	146	48.66
7.	Land availability	90	30.00
8.	Conflicts with neighbors	29	9.66
9.	Loss of land for construction of water harvesting sites like farm pond etc.	11	3.66

Data in table 11 depict that majority of the respondents (98.33 per cent) faced lack of training programme was the main constraints followed by lack of awareness (95 per cent), whereas more than half of the respondents (52.66 per cent) faced financial constraints and nearly half of the respondents 48.66 per cent faced location and site constraints. One third of the respondents (30.00 per cent) and one fourth of the respondents (22.00 per cent) had faced constraints like land availability and social constraints respectively. However very few of the respondents 11.33, 9.66 and 3.66 faced constraints like possibility of submergence of agricultural land, conflicts with neighbors and loss of land for construction of water harvesting sites like farm pond etc.

Conclusion
It can be concluded from the study that knowledge level of all the respondents were poor regarding all the selected

techniques of rainwater harvesting and ground water recharge though all the techniques were very much required for farmers. Further it can be concluded that high training needs were observed in all the techniques due to lack of groundwater and uneven distribution of rainfall in Amreli district.

References

1. Sajeev MV, Venkatasubramanian V, Singha AK. Identifying training needs of farmers and rural youth of Nagaland. Indian Journal of Extension Education. 2021;57(2):115-122.
2. Joshi K. Assessment of training needs of farmwomen: a case of Western Uttar Pradesh. Technofame - A Journal of Multidisciplinary Advance Research. 2018;7(1):106-109.
3. Elakkiya S, Karthikeyan C. An analytical study on training needs of farmers on organic farming. International Journal of Farm Sciences. 2020;10(1):1-5.
4. López Felices B, Aznar-Sánchez JA, Velasco Muñoz J, Mesa-Vázquez E. Farmers' profiles and attitudes towards the implementation of rainwater harvesting systems in intensive agriculture. International Journal of Agricultural Sustainability. 2023;21:2189402.
5. Boyaci S, Kartal S. Rainwater harvesting on greenhouse roof and use in irrigation. International Journal of Research - Grantaalayah. 2020;7(2):93-100.
6. Greve P, Kahil T, Mochizuki J, Schinko T, Satoh Y, Burek P, *et al*. Global assessment of water challenges under uncertainty in water scarcity projections. Nature Sustainability. 2018;1(9):486-494.