J Krishi Vigyan 2020, 9 (1) : 218-223 DOI : 10.5958/2349-4433.2020.00196.8

Level of Determinants and Constraints in Adoption of Different Rainwater Harvesting Systems in Chandel District of Manipur

Kangjam Sonamani Singh

Krishi Vigyan Kendra, Chandel, (Manipur)-795127

ABSTRACT

The study was conducted on 80 farmers of Chandel district of Manipur state, India to delineate the constraints in adoption of rainwater harvesting (RWH) technologies. It was done to assess the major factors or determinants influencing farmers' adoption decisions and their willingness to adopt these techniques. A detailed structured pretested schedule containing a list of constraints and a focused group discussion was used and the opinion of respondents in the study area on constraints was measured on a five point continuum scale of very severe, quite severe, severe, not so severe and least severe with score of 5, 4, 3, 2 and 1, respectively. Relevancy Coefficient was determined for each constraint reported and Garret's ranking technique was used for analysis. The major constraints in rapid adoption were found to be land tenureship, rain-fed mono-cropping system and small land holdings with relevancy coefficients of 0.92, 0.76 and 0.75 respectively. Labour scarcity during the peak season too was a major constraint with a relevancy coefficient of 0.96. Farmers' high motivation to successfully integrate the time-proven scientific technologies to suit their socio-economic and agro-ecological conditions would further affect its profitability and sustainability. Identifying and overcoming the constraints would lead to wide scale adoption of the RWH technologies at the grassroot level and this would trigger conservation and harvesting of the scarce and fragile resources and to expand income generation opportunities for improved livelihoods.

Key Words: Constraints, Determinants, Opportunities, Rainwater harvesting.

INTRODUCTION

Chandel district which occupies the south eastern corner of the state lies between latitude 23^{0}50‘6.81”N to 24^{o}37”54.55”N and longitude 93^{o}46”46”12” E to 94^{o}26.6”E approximately. The district is bounded on the north by Ukhrul and Senapati districts, south and east by Myanmar (Burma), west by Thoubal and Churachandpur districts. The shape of the district is almost rectangular and its length from north to south and its breadth from east to west is 80 km and 41.5 km respectively. The total area is 3,313 sq. km and occupies the 4th position in size of the districts of Manipur. It experiences hot summer and cold winter. The mean annual temperature exceeds 22˚C and experiences summer temperature to the range of 35 to 46˚C. The mean annual precipitation varies from 2000 to 2400 mm. The area belongs to warm, humid agro-ecological zone with thermic ecosystem and length of growing period of 300-330d. The vegetation is predominated by pine including woody and herbaceous species. The soil types of Chandel district are mostly coarser, varying from fine loamy, loamy to sandy in texture and deep in soil depth and often characterized as infertile with poor water holding capacity. Highly erratic and uncertain rainfall distribution makes rainfed cropping quite risky. The rainfall in the country is highly unevenly distributed, dependent mainly on the southwest monsoon from June to September, accounting for almost 80 per cent precipitation in the country. Even though the country is blessed in terms of annual total water resources, uneven and undulating topography causes severe regional and temporal water shortages and excess in several states.

Corresponding Author's Email : sonamanisingh@gmail.com

With high-paced industrialization and enhanced lifestyle patterns of ever-growing human population, water resource available for agricultural use in India is facing a tough competition. It is not only a matter of quantity. Water quality too needs serious attention from the policy makers and all the stakeholders. Therefore in future available water resource would not be sufficient to fulfill water needs of all sectors, unless water is used efficiently and utilizable quantity is increased by all possible means. In spite of impressive achievements in food grain production, net sown area in the country remains at about 142 Mha and net irrigated area is only 60.3 Mha (Roy Chowdhury, 2016). Therefore, to produce more food with the same amount of water, productivity of water has to improve through better irrigation water management and proper harnessing of water through rainwater harvesting technologies. Better timing of water supplies can reduce stress at critical stages of crop growth period and increase yield. With reliability in water supplies farmers can confidently invest on inputs for higher productivity. Agricultural diversification has emerged as an important alternative to attain the output growth and sustainability in the developing countries (Sharma and Kumar, 2019). For effective agricultural diversification, proper implementation of rainwater harvesting is needed.

Rain water harvesting (RWH) technology generally involves harvesting rainwater and diverting it to reservoirs for the purpose of coping with rainfall variation and drought (Kattel, 2015). Extension personnel from several departments and agencies have been imparting continuous intensive training and sensitization on these technologies to the farmers. Despite that the rate of adoption of RWH amongst the farmers was found to be lower than the expected level. The present investigation was conducted in Chandel district of Manipur state with an objective to study the constraints faced by the farmers in use of rainwater harvesting measures.

MATERIALS AND METHODS

This study was an attempt to offer an insight into the determinants and constraints that influences the adoption and use of rainwater harvesting measures. The data were collected through personal interview with the help of interview schedule by contacting 80 farmers. Approximately 30 min. on an average were spent at each household during which interviews and focus groups with householders were used to add better depth, detail and richness to the actual scenario. This helped in contextualizing quantitative understanding of the RWH situation in the district by allowing the researchers to see for themselves the situations the respondents were describing and also allowing the respondents to draw attention to the salient features of their local environments. A series of list of constraints was prepared and the opinion of respondents in the study area on constraints was measured on a five point continuum scale of very severe, quite severe, severe, not so severe and least severe with score of 5, 4, 3, 2 and 1 respectively. The following formula was used for the Relevancy Ranking Technique:

$$RC_i = \frac{\text{Total score of all the respondents for } i^{th} \text{ constraint}}{\text{Maximum on the continuum} \times \text{Total number of respondents}}$$

RC_i refers to Relevancy Coefficient for the i^{th} constraint. The rankings of each constraint was done according to its relevancy coefficient such that the particular constraint having the highest relevancy coefficient is ranked 1st and subsequent ranks given according to the scores obtained in that order.

The strategies to overcome the hurdles faced by farmers in adoption of rainwater harvesting technology were pooled based on revelations done by the respondents during the study. The constraints were tabulated and analysis was done using the Garrett's ranking technique.

Table 1. Brief profile of the respondents. (n=80)

Sr. No	Category	No.	Percentage
	Farming experience		
	Low	5	6.25
	Medium	15	18.75
	High	60	75.00
2.	Literacy level		
	Illiterate	1	1.25
	Non-Matriculate	23	28.75
	Matriculate	40	50.00
	Graduate	16	20.00
3.	Family size		
	Low	28	35.00
	Medium	41	51.25
	High	11	13.75
4.	Agricultural land holding		
	Marginal farmers	68	85.00
	Small farmers	7	8.75
	Medium farmers	5	6.25
	Big farmers	-	-
5.	Social interaction		
	Low	26	32.50
	Medium	38	47.50
	High	16	20.00
6.	Scientist contact		
	Low	22	27.50
	Medium	42	52.50
	High	16	20.00
7.	Work motivation		
	Low	21	26.25
	Medium	52	65.00
	High	7	8.75
8.	Risk preference		
	Low	58	72.50
	Medium	14	17.50
	High	8	10.00

Table 2.General constraints as perceived by farmers in adoption of RWH. (n=80)

Constraint	Relevancy coefficient	Rank
Land Tenure	0.92	I
Cropping pattern	0.76	II
Farm size	0.75	III
Lack of coordination	0.74	IV
Attitude and motivation	0.68	V
Perception of soil erosion	0.63	VI
Age	0.58	VII

RESULTS AND DISCUSSION

The study revealed (Table 1) that a majority (75 %) of the respondents was having high farming experience, of which 50 per cent were educated upto matriculation level, while 51.25 per cent of the beneficiaries were having medium family size. It was also found that 85 per cent of the respondents were marginal farmers and were having 47.50 per cent level of medium level of social interaction and 52.50 per cent had medium contact with the agricultural scientists. Amongst the farmers, 65 per cent were having medium level of work motivation, followed by 72.5 per cent of the beneficiaries were having low risk preferences.

General constraints

Generally, farmers having their own land holdings were more inclined to adopt the rainwater harvesting technologies (Table 2). A majority of respondents practiced slash and burn cultivation in the hills generally over communal land. Farmers who practiced mono-cropping i.e. only rice cultivation was found to be solely dependent on the seasonal rain for their field water needs. As against these, only a handful of respondents went for second cropping (mostly seasonal vegetables) who were more concerned about water availability in the lean period. He, Cao and Li (2007) in China also reported similar findings. A significant relationship was found between land tenureship and adoption rate. Marginal or landless farmers were least inclined towards adoption of RWH whereas respondents having a sizable land area were seen to be more inclined towards RWH. The reason might be the hesitation to part away with the meager land area for other purposes besides the crucial need for cultivation. Many a times, land owners in adjacent fields often do have a clash of interest in adoption of RWH technologies in terms of sharing of resources. The attitude of the farmers was a major constraint in this context. Many of the farmers were of happy-go-lucky types wherein self-motivation was hugely lacking. Respondents who were even slightly concerned about soil degradation and other environmental issues were more likely to adopt the RWH techniques. One very interesting constraint which arose in the study was age factor. Contrary to expectations, young farmers were less inclined to adopt the RWH technologies neither were old farmers despite their huge and vast knowledge gathered over a lifetime. The majority of farmers who were more likely to adopt water harvesting

Table 3. Labour constraints as perceived by farmers in adoption of RWH. (n=80)

Constraint	Relevancy coefficient	Rank
Labour scarcity during peak demand	0.96	I
High wages of skilled labour	0.71	II
Lack of availability of skilled labour	0.44	III

were middle-aged farmers who have a perfect balance of knowledge and self-driven motivation. Thus willingness to adopt refers to a farmer's motivation to adopt a new innovation, technology and/or practice Anderson (1993).

Labour related constraints

Rainwater harvesting measures is labour intensive and demands skilled labour specially at the initial stages. Not surprisingly, availability of skilled labour is a critical issue for farmers in the district especially during the peak season (Table 3). On top of that migration of tribal rural folk to urban areas in search of better job opportunities, alternative opportunities for employment at the village level (including MNREGA scheme) and indifferent attitude of educated or semi-educated youth towards agriculture has led to acute shortage of skilled labour especially in the peak seasons of pre-monsoon. This has naturally raised the wage rates of skilled labour required for rainwater harvesting structures. The average per day wage rates in the peak season of sowing/planting and harvesting in the open paddy field conditions in the study area was Rs.350/-. Similar findings were reported by Supe *et al* (2017).

Chandel faces a big challenge in terms of average food production even during good rain years due to its highly erratic nature. Therefore, simply increasing the agricultural land area or attempting to increase agricultural yield alone cannot be a means to enhance food security in the district, due to several other environmental impacts (expansion into marginal land, deforestation) and unpredictable natural factors (unpredictable weather). Chandel alongwith the rest of the state needs to combine these with enhancing water availability for enhancing agricultural production and productivity that can lead to security in terms of getting a reliable harvest as well as crop intensification. This should be combined with intensive RWH, improved partitioning and storage to increase plant water availability and use of rainwater to overcome erratic rainfall. Sincere efforts of agricultural extension team towards intensive mobilization and sensitization is not enough. Any new innovation or technology should not be imposed but should be driven by the willingness and self-motivation of the farmers. This is in synchronization with the findings of Akroush *et al*, (2017). Hence, enabling the farmers in overcoming their constraints is the prime need of the hour as against solely imparting of technical knowhow.

CONCLUSIONS

Highly erratic pattern of rainfall is a major problem for efforts to enhance agricultural productivity, which in turn threatens the livelihood of several farmers in the district. Hence to mitigate this problem, Rain Water Harvest (RWH) technology plays a vital role in enhancing the socio-economic status of tribal farmers of Chandel district.

To mitigate the nature of rainfall in the district, development and implementation of rainwater harvesting technologies will be helpful to promote productivity and sustainable intensification of the rainfed agriculture. Already several awareness programs and extension services to farmers have been provided for better dissemination of RWH technology through which intensive mobilization and sensitization was done. However, the success of the technology adoption was mainly constrained by problems related to typical ground realities. Therefore there was a strong need to identify the constraints amongst the farmers and stakeholders so as to accelerate the adoption process and to improve land and water productivity and to stabilize farmers' income of the district. Overcoming the identified constraints would lead to the adoption of conservation and harvesting of the scarce and fragile resources and to expand income generation opportunities for improved livelihoods

REFERENCES

Anderson J R (1993). The economics of new technology adaptation and adoption. *Rev Marketing and Agril Econ* **61**, 301-309.

He X F, Cao H & Li F M (2007). Econometric analysis of the determinants of adoption of rainwater harvesting and supplementary irrigation technology (RHSIT) in the semi-arid Loess Plateau of China. *Agril Water Manage* **89**: 243-250.

Kattel R R (2015). Rain water harvesting and rural livelihoods in Nepal, South Asian Network for Development and Environmental Economics (SANDEE) Working paper no. 102-25.

Roy Chowdhury S, Rautaray S K, Panda R K, Das M, Srivastava R C and Ambast S K (2016). *Technological Options for Agricultural Water Management in Eastern Region of India*. ICAR-Indian Institute of Water Management, Bhubaneswar.

Samia Akroush, Boubaker Dehehibi, Bezaiet Dessalegn, Omamah Al-Hadidi and Malek Abo Roman (2017). Factors affecting the adoption of water harvesting technologies: a case study of Jordanian arid area. *Sustainable Agri Res* **6** (1); 80-89.

Sharma D and Kumar V (2019). Extent of diversification and constraints in adoption of different farming systems in Chamba District of Himachal Pradesh. *J Krishi Vigyan* **8** (1) : 122-127.

Supe D V, Kadam R P and Pawar G S (2017). Constraints faced by the beneficiaries in the use of farm pond in Marathwada region. *Agri Update* **12**(4): 593-596.

Received on 29/06/2020 *Accepted on 05/11/2020*