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RESEARCH ARTICLE :

Assessing adoption dynamics *vis-a-vis* constraints faced apropos water management technologies by trained farmers in Assam

N. DOLEY, S. BARMAN* AND R.K. THAKURIA

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SUMMARY : The study was conducted in two districts of Assam *viz*., Jorhat and Golaghat in order to assess the extent of adoption and constraints faced by the farmers in adoption of water management technologies. A purposive cum proportionate random sampling design was followed to select the respondents. All total 70 farmers trained under Scaling up of Water Productivity in Agriculture (SWPA) training programme were selected as respondents from the two districts. The study revealed that the majority of the farmers were under young age category (Below 35 years) with education up to High school level. The average land holding and annual income of the farmers were 1.50 ha and Rs. 44,000, respectively. The extent of social participation of majority of the respondents was low and more than 40 per cent farmers had regular extension contact. The extent of adoption of water management technologies were medium level for majority farmers. Size of operational holding, extent of social participation, extension contact, annual farm income were found to have a strong positive significant relationship with extent of adoption. Major problems faced by the respondents were lack of proper irrigation facilities, lack of follow-up measures, lack of proper practical demonstration, low income level, high cost of irrigation and difficulty in application of irrigation due to land fragmentation, high cost of inputs and unavailability of seeds and fertilizers in time. Proper intervention should be implemented to solve these problems in order to step up the exploitation of the full potential of these water management technologies.

KEY WORDS :
Trained farmers, Adoption, Constraints, SWPA

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Author for correspondence :
S. BARMAN
Department of Extension Education, Assam Agricultural University, JORHAT (ASSAM) INDIA
Email: sbarman72@gmail.com
See end of the article for authors' affiliations

BACKGROUND AND OBJECTIVES

Water is the most vital element for the survival on earth, has become one of the emerging environmental issues that our ecosystems are facing today. Plants need water continuously during their life and in huge quantities. Among various sectors, agriculture sector is the largest consumer of the available water accounting to 75 per cent of the available global water followed by industrial activities to 20 per cent and remaining 5 per cent is for domestic sector (Dikshit and Choukiker, 2005). Both its shortage and

excess affects the growth and development of a plant directly and consequently, its yield and quality. Inefficient use of water leads to inefficiency of all other resources/ inputs like seeds, fertilizers, etc. Over a period of time a number of water management technologies have been developed to improve water use efficiency and its sustainability, but the full potential of these could not be exploited. Efforts are being made at various levels in order to increase the level of adoption of various water management technologies. But as on date, the result is not satisfactory and worthy. One of the concerns that often sighted is scientific advice regarding water management in crops does not reach to the farming community in a timely manner. Extension agency plays a major role in bridging this gap and communicates the latest technologies to the farmers (Kumar and Ratnakar, 2011). In order to increase the productivity of crop, the adoption of improved technology is a pre–requisite (Yadav *et al.,* 2011). There are various factors which limit the adoption of technologies and to increase the adoption of improved technologies these limiting factors must properly understood. To bridge this gap the extension agency should short out the constraints and try to minimize them.

AICRP on Water Management, Assam Agricultural University, Jorhat conducted 42 numbers of farmers training programmes of seven days duration in different districts of Assam during 2008-2011. These trainings courses mainly focused in disseminating the scientific water management technologies to the farmers which will enhance the farm income and water productivity in agriculture improving their livelihoods. The study was conducted in two districts of Assam *viz.,* Jorhat and Golaghat in order to study the socio-economic characteristics of trained farmers, their extent of adoption and constraints faced by them in adoption of water management technologies.

RESOURCES AND METHODS

A proportionate random sampling design was followed to select the respondents in the study area. A total of 70 farmers trained under SWPA training programme were selected as respondents from the two districts (Jorhat and Golaghat). The data were collected from selected trained farmers through personal interview methods. The extent of adoption was measured by computing percentage of the cultivated area to the total cultivable area for a technology. In order to measure the constraints faced by the trained farmers, simple ranking technique was applied. Each farmer was asked to mention his constraints in adoption of recommended water management technologies and to arrange them in order of degree of intensity. The collected constraints were worded properly and categorized under personal constraints, socio-economic constraints, socio-psychological constraints, communicational and information constraints, technical constraints and climatic constraints. Questionnaire was devised for collecting the information regarding the various constraints faced by the trained farmers in adoption of the recommended water management technologies. Multiple responses were taken to ascertain the constraints faced by the trained farmers. The data pertaining to the socio-economic condition of trained farmers were also collected. Appropriate statistical technique was used for analysis of data.

OBSERVATIONS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Socio-economic characteristics' of the trained farmers:

The socio-economic characteristics of the trained farmers are given in Table 1. Majority of the respondents (48.57%) were under young age category (Below 35 years). The young people were likely to adopt more and interested in having exposure through training on the modern agricultural technologies and practices. Relatively more number of young farmers call for the need of exposure through training. Around 44.29 per cent of trained farmers were educated up to high school level followed by higher secondary level (34.29%). Low income, poor motivation from their family, low self motivation, involvement in the farming activities etc. are the major factors for lower level of education of the respondents. Maximum number of the respondents (52.86%) were under small farmer category (1.0- 2.0 ha) followed by 22.87 per cent who belonged to semi-medium farmer category (2.0-4.0 ha).The similar findings reported by Patel (2000). The average land holding of the farmers was found to be approximately 1.5 ha with an average annual income of Rs. 44,000. Majority of the respondents (47.14%) belonged to the low income category. As regard to social participation maximum

number of respondents (47.14%) had no membership in any organization due to more involvement in agricultural practices and lack of interest and motivation for getting involved in some social organizations. All most equal proportion of trained farmers had contact with extension functionaries occasionally (44.28%) and regularly (42.86%). This indicates the importance of need based visit of extension personnel to farmers as well as the regular visit with weekly interval by extension personnel.

Adoption of water management practices in the training programmes under SWPA :

Data presented in Table 2 revealed that the extent of adoption of majority of trainee (72.86%) had medium level of adoption of recommended practices followed by high level of adoption with 14.28 per cent of respondents. This finding is in conformity with Chothe and Borkar, (2000), Wase (2001), Khan *et al.* (2002), Meena *et al.* (2012) and Saxena *et al.* (2000). But it is contrary to the findings reported by Ajrawat and Singh, 2004). The rest proportion (12%) of the trainees belonged to the low adoption level category. The trainings had helped trainee towards adoption of these technologies to moderate extent. Only few proportion of respondents had high level of adoption of technologies signifying the constraints in adoption for low and medium adopters.

Practice-wise adoption of water management technologies in major crops :

The details in practice-wise adoption of water management technology in major crops are presented in Table 3. Data pertaining to irrigating nursery bed was

Table 1 : Socio-economic characteristics of the trained farmers **(n=70)**

Sr. No.	Variables	Category	*f*	%
1.	Age	Young (Below 35 years)	34	48.57%
		Middle (35-50 year)	32	45.72%
		Old (Above 51 years)	4	5.71%
2.	Education level	Primary school level	1	1.42%
		Middle school level	8	11.42%
		High school level	31	44.29%
		Higher secondary level	24	34.29%
		Graduate and above	6	8.58%
3.	Size of operational holding	Marginal farmer (Below 1.0 ha)	14	20.00%
		Small farmer (1.0-2.0 ha)	37	52.86%
		Semi-medium farmer (2.0-4.0 ha)	16	22.87%
		Medium farmers (4.0-10.0 ha)	3	4.27%
		Large farmers (10.0 ha and above)	0	0.00%
4.	Annual income	Low (Up to Rs. 20,000)	33	47.14%
		Medium (Rs. 20,001-Rs.30, 000)	8	11.43%
		High (Rs. 30,001- Rs. 50,000)	11	15.72%
		Very high (More than Rs.50, 000)	18	25.71%
5.	Extent of social participation	No membership	33	47.14%
		Membership in one organization	15	21.43 %
		Membership in more than one organization	6	8.57%
		Office-bearer in one organization	12	17.15%
		Office-bearer in more than one organization	4	5.71%
6.	Extension contact	Never	9	12.86%
		Occasionally	31	44.28%
		Regularly	30	42.86%

Table 2 : Distribution of respondents according to the level of adoption of recommended water management practices **(n=70)**

Sr. No.	Category	Range	Frequency (%)	Percentage
1.	Low	Up to 40%	9	12
2.	Medium	41-60%	51	72.86
3.	High	Above 61%	10	14.28

recorded to be 60 per cent of sample farmers. Only 50 per cent sample farmers followed the time of irrigation (disappearance of water from the channel of two nursery bed), 45.71 per cent followed recommended number of irrigation and 35.71 per cent farmers followed the depth of irrigation (up to nursery bed height). Likewise, in main field more than 68.57 per cent farmers adopted the recommended irrigation practices (5 cm irrigation 3 days after disappearance of ponded water) in paddy this may be due to high cost of diesel and difficult to maintain level. In case of oilseed crop, early ploughing for moisture conservation (74.29%) and irrigation *i.e.*, 6 cm irrigation at 50 per cent flowering, 70 per cent followed in rapeseed and mustard crop in sample districts. This may be due to lack of skill for maintaining the depth of water and improper layout of field. In summer sesame proper surface drainage facilities were developed in the field by 47.14 per cent respondents. This may be due to the sesame was cultivated in paddy nursery bed and labour intensive for making drainage. All sample respondents followed the moisture conservation techniques like early plough and mulching. Irrigation with 4 cm depth by surface (furrow) was provided in vegetable like cabbage, brinjal and tomato by 64.29 per cent sample respondents but 51.43 per cent respondents only maintained the time of irrigation (15 days interval) in vegetables. This may be due to ignorance about technology and wrong perception about cost involvement.

Association of selected socio-economic variables with extent of adoption of water management technologies :

The Table 4 reveals that extent of adoption has strong, positive and significant relationship with the independent variables *viz.*, X_4, X_5 and X_6. In case of, variable X_3 was found significant and positive but weak relationship with the extent of adoption. On the other hand, significant but negative relationship with the extent of adoption was found in case of variable X_1. The revelation is the similar with the findings of Daya Ram *et al*. (2010) and Mazumder *et al*. (2011).

In case of age, a strong negative significant relationship was found at 1 per cent level, which indicates that those farmers who belonged to old age group had low level of adoption, but farmers with young age had higher extent of adoption. This finding is in conformity with the findings with Singh *et al*. (2010).

The educational level has a strong positive significant relationship with extent of education at 1 per cent level, therefore, it can be concluded that the respondents with higher education level are likely to have higher extent of adoption. Similar findings are reported by Ranganath

Table 3: Distribution of respondents according to adopter categories of water management technologies in paddy, oilseed and vegetables (n=70)

Sr. No.	Irrigation practices	Full adopter	Partial adopter
Paddy			
1.	Irrigation of nursery bed	42 (60.00)	28 (40.00)
2.	Number of irrigation in nursery bed	32 (45.71)	38 (54.29)
3.	Time of irrigation in nursery bed	35 (50.00)	35 (50.00)
4.	Depth of irrigation in nursery bed	25 (35.71)	45 (64.29)
5.	Irrigation (5cm) after disappearance of ponded water in main field	48 (68.57)	22 (31.43)
6.	Irrigation upto 15 days before harvest of rice	51 (72.86)	19 (27.14)
7.	Land preparation	66 (94.29)	4 (05.71)
8.	Bund making	70 (100.00)	0 (0.00)
9.	Blocking of crab hole	70 (100.00)	0 (0.00)
Oilseeds			
1.	Ploughing for moisture conservation in rapeseed and mustard	52 (74.29%)	8 (11.43%)
2.	Irrigation in rapeseed and mustard	49 (70.00%)	3 (4.28%)
3.	Time of sowing of summer sesame	50 (71.14%)	11 (15.71%)
4.	Surface drainage in sesame	33 (47.14%)	20 (28.57)
Vegetables			
1.	Moisture conservation	70 (100%)	0 (0.00)
2.	Irrigation (4cm)	45 (64.29)	25 (35.71)
3.	Time of irrigation at 15 days interval	36 (51.43)	34 (48.57)

Figure in parenthesis indicates percentage

(1997) and Badal and Singh (2001)

The independent variables such as size of operational holding, extent of social participation, extension contact and annual farm income, were found to have a strong positive significant relationship at 5 per cent level. This is conformity with the findings Pandey (2000), Tamilselvi and Somasundaram (2000), Bandgar *et al.* (2004) and Jadav and Munshi (2004). This indicates that adoption of water management technologies was more in case of rich farmers, those had more extension contact and actively participated in social activities.

Constraints faced by the trained farmers in adoption of the recommended water management technologies :

Multiple responses were taken to ascertain the constraints faced by the trained farmers. The constraints presented in Table 5 reveal that under the personal constraints, majority of the trained farmers face the constraints of low income level (50%) followed by land

Table 4 : Association of selected socio-economic characteristics of trained farmers with the extent of adoption of recommended technologies

Sr. No.	Variables	'r' values	Cal 't'
1.	Age (X_1)	-0.19164	1.66829 *
2.	Educational level (X_2)	0.167411	1.450835*
3.	Size of operational holding (X_3)	0.268464	2.38117**
4.	Annual farm income (X_4)	0.649209	7.292622**
5.	Extent of social participation (X_5)	0.429849	4.06759**
6.	Extension contact (X_6)	0.387815	3.594833**

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 5 : Constraints faced by the trained farmers in adoption of the recommended water management technologies (n=70)

Sr. No.	Constraints	*f*	%	Rank order
Personal constraints				
1.	Low level of education	16	22.85	XVI
2.	Low income level	35	50.00	V
3.	Land fragmentation/ Scattered land	23	32.86	XI
4	Small size of farm	21	30.00	XIII
Socio - economic constraints				
1.	Small scale and scattered cultivation of crop	25	35.71	X
2.	Lack of proper irrigation facilities from the Govt.	53	75.71	II
3.	High cost of irrigation	29	41.43	IX
4.	Lack of sufficient credit facilities	15	21.43	XVII
Socio-psychological constraints				
1.	Low level of social participation	33	47.14	VIII
2.	Not eager to adopt innovation	20	28.57	XIV
3.	Perceived complexity in understanding of the recommended practices	8	11.43	XVIII
4.	Perceived complexity in application of the recommended practices	57	81.43	I
Communicational and information constraints				
1.	Lack of follow-up measures after the training programme	50	71.43	III
2.	Lack of practical demonstration	49	70.00	IV
3.	Less contact with extension officer	40	57.14	VI
Technical constraints				
1.	Inadequate skill for application of irrigation management techniques	45	64.28	V
2.	High cost and non-availability of agricultural inputs	23	32.86	XII
Climatic constraints				
1.	Occurrence of flood	19	27.14	XV

fragmentation/ scattered land (32.86%) and small size of farm (30%) as the major constraints for the adoption of the water management technologies. Lack of proper irrigation facilities from the Govt. (75.71%), high cost of irrigation (41.43%) and small scale and scattered cultivation of crop (35.71%) were the major socio economic constraints faced by them. The major socio-psychological constraints were perceived complexity in application of the recommended practices (81.43), low level of social participation (47.14%) and lack of eagerness to adopt innovation (28.57%). Maximum respondents face the communicational and information constraints such as lack of follow-up measures after the training programme (71.43%), lack of practical demonstration (70.00%) and less contact with extension officer (57.14%) which prevents the exploitation of full potential of these water management technologies. Inadequate skill for application of irrigation management techniques (64.28%) and high cost and non-availability of agricultural inputs (32.86%) were the major technical constraints faced by respondents. This findings are conformity with the findings of Gogoi and Phukan (2000). Climatic constraints such as occurrence of flood (27.14%) limit the adoption of these technologies.

Conclusion :

The training programmes were aimed at dissemination of various water management technologies so that the farmers can utilize their limited water resources to the maximum level to produce more with less amount of water. The adoption of water management technologies was found medium level and young farmers were better adopter as compared to old farmers. Level of education, extension contact, social participation and annual farm income were important socio-economic factors which determined the adoption level of water management technologies. So, implementing agencies specifically department of agriculture should consider these socio-economic factors for selection farmers for different programmes. Moreover, resource poor farmers *viz.*, small and marginal farmers are also important section among the farmers which required to mobilized through group approach so that they can also adopt the water management technologies. Besides, various constraints faced by the farmers act as major limiting factors in the adoption of these water management technologies. Thus, the factors limiting the adoption of these water management technologies cannot be ignored and proper intervention should be implemented by the concerned agencies to solve these problems in order to step up the exploitation of the full potential of these water management technologies. The extension agencies should conduct more numbers of training programme along with field demonstrations in order to improve the skill in application of these technologies. They should also make provisions for proper follow-up measures after the training programme. The researchers should try to develop simple and cost effective farmer's friendly water management technologies which can be applied under scattered land situation. The main role of government agencies will be to provide agricultural inputs and irrigation facilities through the involvement of the local body.

Authors' affiliations :

N. DOLEY, Department of Extension Education, Assam Agricultural University, JORHAT (ASSAM) INDIA

R.K. THAKURIA, AICRP on Water Management, Assam Agricultural University, JORHAT (ASSAM) INDIA

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