

FARMERS PERCEPTION AND ASSOCIATION BETWEEN THE PROFILE OF FARMERS ABOUT DIGGI BASED FARMING SYSTEM

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ABSTRACT

Agriculture in arid regions like Rajasthan faces significant challenges due to water scarcity and erratic rainfall. The Indira Gandhi Nahar Pariyojana (IGNP) canal system has transformed desert lands into productive areas, but unreliable water supply hinders optimal crop production. To address this, farmers in the IGNP command area have adopted diggi-based farming systems—micro-farm water storage structures that store canal water for timely irrigation. Despite its benefits, adoption depends on farmers' perceptions, socio-economic conditions, and awareness of micro-irrigation practices. This study evaluated farmers' perceptions about diggi-based farming systems in Agro-climatic Zone-IC of Rajasthan, focusing on socio-economic characteristics, adoption levels, and constraints. The study employed an ex-post-facto research design, selecting Bikaner district due to its high number of constructed diggi under government schemes. A sample of 180 farmers (90 beneficiaries and 90 non-beneficiaries) was selected using proportionate random sampling. Data were analyzed using statistical tools like frequency, percentage, mean, standard deviation, correlation, and regression analysis. Results revealed that 62.22% of beneficiary farmers had a medium level of perception, while 32.22% had a high perception. Non-beneficiaries showed lower perception levels (54.44% medium, 6.67% high). Beneficiaries ranked "advantages of diggi-based farming" highest (75.46 MPS), while non-beneficiaries prioritized "general information" (60.64 MPS). Significant associations were found between perception and variables like education, land holding, annual income, extension agency contact, economic motivation, and innovativeness ($p < 0.05$). Regression analysis indicated these variables explained 70% of the variation in perception. The study concludes that beneficiary farmers exhibit higher perception levels due to direct benefits and extension activities. Policymakers should focus on enhancing technical know-how and awareness to promote sustainable water management practices in arid regions.

Keywords: diggi-based farming, Indira Gandhi Nahar Pariyojana, micro-irrigation, regression analysis

INTRODUCTION

Agriculture in India, particularly in arid regions like Rajasthan, faces significant challenges due to water scarcity and erratic rainfall (Vinaya et al., 2017). In Rajasthan, during the entire monsoon season 2021, there have been abnormal, excess or normal rains in most of the districts. The actual rainfall in the period from 1 June to 30 September, 2021 in the state was 485.40 mm which is 17.10 per cent more than the normal rainfall of 414.50 mm. It is an unpleasant truth that water availability in the State is limited and inadequate emphasizing that optimum utilization of water is equally or even more important than development of water resources. Even after a hypothetical consideration that all utilizable water resources are developed, Rajasthan is still a water scarce state, according to the international classification, as the annual per capita availability of water in the state is only 857 m³ (below 1000 m³) (Anonymous, 2045). To address

this pressing issue and support the water needs of farmers in the study area, the IGHP program was initiated. The Indira Gandhi Nahar Pariyojana (IGNP) canal system has been instrumental in transforming desert lands into agriculturally productive areas. However, unreliable water supply and rigid distribution schedules often hinder optimal crop production. To address this, farmers in the IGNP command area have adopted diggi-based farming systems—micro-farm water storage structures that store canal water for timely irrigation using efficient methods like drip and sprinkler systems. The Indira Gandhi Nahar Pariyojana (IGNP) project in Rajasthan, which uses warabandi system of delivery of water, envisages irrigating 1.9 mha of crop land. It off takes from the Harika barrage, located a few kilometres downstream of the confluence of the Sutlej and the Beas rivers in Punjab, and takes water along 650 km long main canal and terminates near Jaisalmer in Rajasthan. Water scarcity is an in-built feature of irrigation distribution in the IGNP canal system.

The warabandi in IGNP has promoted equitable water distribution, but water deliveries at times become unreliable or inefficient. Farmers do not receive water at a time when the irrigation is critical even for the survival of crops or for higher yields (Amarasinghe *et al.* 2008) Therefore, local people of this region have constructed a number of traditional as well as improved surface water harvesting structures like diggi, tanka, kund and khadin (Khan and Narain, 2000). "Diggi", a micro-farm water storage structure has been introduced on the demand of IGNP command area farmers to store canal water with effective irrigation method to increase cropping area and farm income. Construction of diggi was felt essential to the farmers of canal command area to store canal water for optimum use with high application efficiencies and for improving the irrigation scheduling as per need. Water is transferred to diggits to be used later on as per requirement (Goyal *et al.* 2019). Farmers pump out water from diggi using electric motor and then apply to field by micro-irrigation devices such as sprinklers and drip systems. The Government too has recognized the importance of diggi in these areas and came out with a standard design of diggi (110 feet × 110 feet × 10 feet size with 18 feet side slope) to store about 25 lakh liters of water. Farmers have also prepared a system connecting the diggits with photo-voltaic solar panels to run electric pump for operating sprinkler and drip systems (Tewari, 2012). Diggi not only ensure water availability during critical crop growth stages but also enhance water use efficiency, cropping intensity, and farm income. Despite their benefits, the adoption of diggi-based farming systems depends largely on farmers' perceptions, socio-economic conditions, and awareness of micro-irrigation practices. This study evaluates farmers' perceptions about diggi-based farming systems in Agro-climatic Zone-IC of Rajasthan, focusing on their socio-economic characteristics, adoption levels, and constraints. The findings aim to guide policymakers and extension agencies in promoting sustainable water management practices in arid regions.

OBJECTIVES

- (1) To study the farmers' perception about diggi based farming system
- (2) To ascertain the association between the farmers' perception about diggi based farming system of micro-irrigation practices with selected independent variables

METHODOLOGY

Ex-post-Facto research design was used in the present study (Kerlinger, F.N., 1976). The present study was conducted in Agro-Climatic Zones IC (Hyper Arid Partial Irrigated Zone) on the basis of largest geographical area

i.e. 7.70 million hectare and availability of canal irrigation facilities among all the Agro-Climatic Zones of the state of Rajasthan. From the selected Agro-Climatic Zone Bikaner districts was purposely selected for the present study since it was having the highest number of constructed diggi under Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)/Mukhya Mantri Krishak Sathi Yojana (MKSY). Bikaner district comprises nine tehsils out of which two tehsils namely Khajuwala and Lunkaransar was selected purposely on basis of highest number of constructed diggi under PMSKY/MKSY. For the selection of respondents, out of total 664 beneficiary, 63 beneficiary farmers from Khajuwala and 27 beneficiary farmers from Lunkaransar was selected using proportionate random sampling method. To constitute the other half of sample size same number of farmers were also selected randomly from same areas who have not got the benefits under PMKSY/MKSY. Thus, a total of 180 respondents *i.e.* 90 beneficiary and 90 non-beneficiary farmers were selected from the selected tehsils as a sample of the present investigation. The collected data were analyzed by using appropriate statistical tools procedures to determine the frequency, percentage, mean, standard deviation, mean percentage score, karl pearson correlation coefficient and multiple linear regression analysis. Followed the standard methodology as followed by Khodifad *et al.* (2024)

RESULTS AND DISCUSSION

Farmer's perception about the diggi based farming system

The data presented in Table 1 shows that more than sixty-two per cent of the beneficiary respondents (62.22%) had medium level of perception followed by high 32.22 per cent and only 05.56 per cent had low level of perception, respectively. On the other hand, non-beneficiary respondents had 54.44 per cent of medium level of perception followed by low (38.89%) of perception and high (06.67%), level of perception, respectively. The data in table 1 also reveals that 58.33 per cent of overall respondents possessed medium level of perception followed by low (22.22%) and high (19.45%), respectively. Hence, data comparison study to the beneficiary and non-beneficiary farmers clearly shows that there was high level of perception among beneficiary respondents. It indicates that after receiving the advantages of a diggi-based farming system, the perception of the recipient farmers has improved. These findings are supported by the findings of Patel (2017) who reported that majority of farmers had medium level of perception towards micro-irrigation system, similar findings are also supported by Nagrale (2011) and Chavalet al. (2015); Gamit and Vinaya (2024).

Table 1 : Distribution of Respondents according to their Perception about Diggi Based Farming System

Sr. No.	Categories	Beneficiary respondents (n=90)		Non-beneficiary respondents (n=90)		Overall respondents (n=180)	
		F	%	F	%	F	%
1	Low (<68.20 score)	05	05.56	35	38.89	40	22.22
2	Medium (68.20 to 84.42 score)	56	62.22	49	54.44	105	58.33
3	High (>84.42 score)	29	32.22	06	06.67	35	19.45

Mean: 76.32 S.D: 8.12

Aspect-wise perception of respondents about diggi based farming system

Further, the perception of beneficiary and non-beneficiary farmers was examined separately on several

aspect levels. By placing the five aspects of the diggi-based farming system in ranking order according to their Mean Percent Score (MPS) of perception level, the relative importance of each of the five aspects were demonstrated.

Table 2 : aspect-wise perception of respondents about diggi based farming system

Sr. No.	Aspects	Beneficiary respondents (n=90)		Non-beneficiary Respondents (n=90)		Overall respondents (n=180)	
		MPS	Rank	MPS	Rank	MPS	Rank
1	General information	64.33	V	60.64	I	62.48	III
2	Technical know-how	71.15	II	52.14	V	61.64	V
3	Financial/subsidy	65.96	IV	58.48	II	62.12	IV
4	Advantages of Diggi Based Farming System	75.46	I	57.42	III	66.44	I
5	Impact of Diggi Based Farming System	68.80	III	56.40	IV	62.60	II
Pooled		69.14		57.01		63.05	

r_s = rank correlation

MPS = Mean Percent Score

**Significant at 0.01 level of probability

The data in Table 2 indicates that beneficiary farmer’s had highest level of perception about the Advantages of diggi based farming system (75.46 MPS) so this aspect was ranked first. The second rank was given to technical know-how (71.15 MPS), followed by Impact of diggi based farming system (68.80 MPS), Financial/Subsidy (65.96 MPS) and General information (64.33 MPS) which were accounted ranked third, fourth and fifth respectively. The data in Table 2 also indicates that the non-beneficiary farmers had highest level of perception regarding general information (60.64 MPS) and was ranked first. Financial/subsidy was ranked second by the non-beneficiary with 52.14 MPS followed by advantages of diggi based farming system, impact of diggi based farming system and technical know-how with 66.44 MPS, 62.40 MPS and 61.64 MPS and obtained ranked third, fourth and fifth respectively. Similarly, Table 2 also reveals that overall respondents acquired highest level of perception towards advantages of diggi based farming system with 66.44 MPS followed by perception on impact of diggi based farming system, general information and financial/subsidy with 62.60, 62.38 and 62.12 MPS, respectively. Overall

respondents had shown least perception about technical know-how with 61.64 MPS.

An effort was also made to establish the connection between the ranks assigned by beneficiary and non-beneficiary respondents with the help of rank correlation test. The value of Spearman rank correlation (r_s) was 0.72 which presents positive correlation. The significance of r_s was tested by 't' test and it was observed that calculated 't' value (5.01) was higher than the tabulated. This shows positive and significant at one per cent level of significance, which leads to conclusion that there was a similarity in rank assignment pattern of perception acquired by beneficiary and non-beneficiary respondents about diggi based farming system, however there was difference in value of Mean Per cent Score of beneficiary and non-beneficiary farmers.

Aspect-wise comparison of perception level of respondents about diggi based farming system

The data related to the perception of respondents about the diggi based farming system for both the beneficiary

and non-beneficiary respondents presented in the Table 3 illustrates that calculated 'Z' value was higher than the tabulated value in four aspects of diggi based farming system i.e. technical know-how, financial/subsidy, impact of diggi

based farming system showed significant association at five per cent level of significance and advantages of diggi based farming system showed significant at one per cent level of significance, respectively.

Table 3: Aspect-wise comparison of perception level of respondents about diggi based farming system

Sr. No.	Aspects	Beneficiary respondents (n=90)		Non-beneficiary respondents (n=90)		'Z' Value
		Mean	SD	Mean	SD	
1	General information	15.33	3.44	14.41	3.09	0.86 ^{NS}
2	Technical know-how	15.78	2.84	14.49	2.54	2.04*
3	Financial/subsidy	18.29	3.50	16.64	3.57	2.17*
4	Advantages of Diggi Based Farming System	15.34	3.14	13.60	2.72	2.84**
5	Impact of Diggi Based Farming System	15.20	2.80	14.10	2.92	2.40*
Pooled		15.99	3.14	14.65	3.03	2.06*

**Significant at 0.01 level of probability

*Significant at 0.05 level of probability

NS= Non Significant

SD= Standard deviation

The Table 3 also represents that calculated 'Z' value was lower than the tabulated value in one aspect i.e. general information. It showed non-significant difference in the perception level of beneficiary and non-beneficiary farmers. This reveals that in all the five aspects of perception about the diggi based farming system, the beneficiary and non-beneficiary respondents had huge difference in their perception level. That means beneficiary farmers had high level of perception as compare to the non-beneficiary respondents in the above mentioned five aspects as well as the overall perception of beneficiary and non-beneficiary respondents towards diggi based farming system. But in the aspect regarding general information, it shows no such difference in beneficiary and non-beneficiary farmers because in the study area canal water supply is not certain which leads to the lack of availability of water for irrigation and cultivation purposes. Farmers possessed high level of perception in all the aspects of diggi based farming system except general information among the beneficiary farmers in contrast with the non-beneficiary farmers. It might be due to the reasons that beneficiary respondents had actively participated in various training programmes, campaign regarding adoption of new technology, farmers fair and other extension activities organized by the Department of Agriculture, Rajasthan and had more contacts with the extension experts related to diggi based farming system for effective adoption. Also, the non-beneficiary was not benefitted by diggi based farming system and consequently got deprived from the advantages of diggi based farming system. That's why beneficiary farmers had high level of perception about diggi based farming system than the non-beneficiary.

Association between the farmers' perception about diggi based farming system of micro-irrigation practices with selected independent variables

To find out the association between selected socio-personal, socio-economic, communication pattern and psychological characteristics (independent variables) of diggi based farming system respondents with the dependent variable viz. perception about diggi based farming system of micro-irrigation practices under diggi based farming system, correlation analysis and multiple linear regression analysis was done. Correlation describes the relationship between the two attributes, and the correlation coefficient, whose ranges are from minus one to plus one, is used to quantify the strength of the association. The degree of prediction of dependent variables from independent variables is determined by the partial regression coefficient (b). The prediction of dependent factor with independent variables (chosen attributes) has been investigated using the multiple linear regression analysis

Correlation analysis between independent variables with perception of respondents about diggi based farming system

The data presented in table 4 shows that the relationship between independent variables with perception of overall respondents about diggi based farming system revealed that education (0.510**), land holding (0.472**), annual income (0.390**) and risk orientation (0.446**) of overall respondents had positive and significant relation with farmers' perception about diggi based farming system and the association was found significant at one per cent level of significance. Extension agency contact (0.268*), economic

Table 4 : Correlation analysis between independent variables with farmers’ perception about diggi based farming system

Sr. No.	Variables	Correlation Coefficient (r)		
		Beneficiary respondents (n=90)	Non-beneficiary respondents (n=90)	Pooled (n =180)
A	Socio-personal			
	Age	-0.114 ^{NS}	-0.087 ^{NS}	-1.072 ^{NS}
	Gender	0.107 ^{NS}	0.045 ^{NS}	0.118 ^{NS}
	Caste	0.019 ^{NS}	-0.146 ^{NS}	1.137 ^{NS}
	Marital status	-0.147 ^{NS}	-0.083 ^{NS}	-0.118 ^{NS}
	Family type	-0.033 ^{NS}	-0.172 ^{NS}	-0.061 ^{NS}
	Family size	0.169 ^{NS}	0.125 ^{NS}	0.039 ^{NS}
	Farming experience	0.054 ^{NS}	-0.025 ^{NS}	-0.106 ^{NS}
	Education	0.470 ^{**}	0.424 ^{**}	0.510 ^{**}
Social participation	-0.137 ^{NS}	-0.036 ^{NS}	-0.112 ^{NS}	
B	Socio-economic			
	Occupation	-0.013 ^{NS}	-0.006 ^{NS}	-0.035 ^{NS}
	Land holding	0.427 ^{**}	0.343 ^{**}	0.472 ^{**}
	Annual income	0.370 ^{**}	0.290 [*]	0.390 ^{**}
C	Communication Pattern			
	Extension agency contact	0.244 [*]	0.235 [*]	0.268 [*]
	Mass media exposure	0.119 ^{NS}	0.058 ^{NS}	0.048 ^{NS}
D	Psychological			
	Risk orientation	0.326 [*]	0.318 [*]	0.446 ^{**}
	Scientific orientation	0.165 ^{NS}	0.123 ^{NS}	-0.034 ^{NS}
	Economic motivation	0.249 [*]	0.212 [*]	0.278 [*]
	Innovativeness	0.304 [*]	0.228 [*]	0.296 [*]

NS = Non Significant

* = Significant at 0.05 level of probability

** = Significant at 0.01 level of probability

motivation (0.278*) and innovativeness (0.296*) of overall respondents were found positively and significantly related with the farmers’ perception at five per cent level of significance. As a result, the null hypothesis (Ho) was rejected and alternate hypothesis (H₁) was accepted. The findings are in line with the findings of Subhash and Shukla (2020) who revealed that age and farming experience had negative and non-significant relationship with farmers’ perception. The findings are contradictory with the findings of Patel *et al.* (2017); Singh *et al.* (2024); Lekha *et al.* (2024); Vihariya *et al.* (2023); Selvarani *et al.* (2023); Patel *et al.* (2018), who concluded that education was failed to establish any significant relationship with farmers’ perception about micro irrigation system.

Regression analysis between independent variables with farmers’ perception about diggi based farming system

For the overall respondents (irrespective of beneficiary and non-beneficiary) the coefficient of determination (R²) was calculated as 0.70 which means 70

per cent variations because of these 18 independent variables selected for the present investigation and remaining 30 per cent variation in the perception was due to presence of other elements outside the periphery of the investigation. The data in Table 5 indicates that there was significant association found between the perception of overall respondents with education (3.287**), extension agency contact (3.406**) and economic motivation (3.358**) at one per cent level of significance. Whereas, land holding (2.943*), annual income (2.061*) and innovativeness (2.930*) had shown significant association at five per cent level of significance. The variables such as age, gender, caste, marital status, family type, family size, farming experience, social participation, major occupation, mass media exposure, scientific orientation and risk orientation were found non-significantly associated with the perception of overall respondents. Hence, the null hypothesis was accepted and alternative hypothesis was rejected. Therefore, from the above findings it can be concluded that education, land holding, annual income, extension agency contact, economic motivation and innovativeness were the important

Table 5 : Association between selected independent variables with farmers' perception about diggi based farming system

Sr. No.	Variables	Beneficiary respondents (n=90)			Non-beneficiary respondents (n=90)			Pooled (n=180)			
		b value	Standard error	t value	b value	Standard error	t value	b value	Standard error	t value	
A	Socio-Personal										
	Age	-0.004	0.104	-0.905 ^{NS}	0.150	0.091	1.075 ^{NS}	0.050	0.065	0.721 ^{NS}	
	Gender	0.154	0.055	0.130 ^{NS}	-0.185	0.231	1.134 ^{NS}	-0.112	0.174	-0.638 ^{NS}	
	Caste	0.131	0.309	-0.819 ^{NS}	0.013	0.218	0.056 ^{NS}	0.086	0.167	1.149 ^{NS}	
	Marital status	0.196	1.480	1.193 ^{NS}	1.234	0.334	1.656 ^{NS}	0.168	1.204	1.062 ^{NS}	
	Family type	0.064	0.176	-0.496 ^{NS}	0.055	0.117	0.413 ^{NS}	-0.002	0.107	-0.008 ^{NS}	
	Family size	-0.096	0.135	-0.407 ^{NS}	-0.107	0.129	-0.846 ^{NS}	0.056	0.094	0.515 ^{NS}	
	Farming experience	1.241	0.105	0.165 ^{NS}	0.117	1.056	0.115 ^{NS}	1.142	1.058	1.086 ^{NS}	
	Education	0.118	0.273	2.994 ^{**}	0.108	0.283	2.763 ^{**}	0.239	0.042	3.287 ^{**}	
Social participation	-0.255	0.132	-0.401 ^{NS}	-0.110	0.127	-0.846 ^{NS}	0.049	0.096	0.514 ^{NS}		
B	Socio-Economic										
	Occupation	1.159	1.163	1.130 ^{NS}	0.171	1.206	1.107 ^{NS}	1.078	0.095	1.097 ^{NS}	
	Land holding	2.303	0.470	2.506 [*]	0.166	0.354	2.282 [*]	0.105	1.142	2.943 [*]	
	Annual income	2.917	1.124	3.190 [*]	0.275	0.179	2.071 [*]	1.271	1.013	2.061 [*]	
C	Communication Pattern										
	Extension agency contact	2.182	0.058	3.470 ^{**}	0.163	0.121	2.872 ^{**}	1.036	0.141	3.406 ^{**}	
	Mass media exposure	0.451	0.162	1.036 ^{NS}	0.114	0.103	0.132 ^{NS}	0.180	0.027	0.062 ^{NS}	
D	Psychological Characteristics										
	Risk orientation	0.380	0.468	0.055 ^{NS}	0.150	0.111	0.181 ^{NS}	0.159	1.089	0.094 ^{NS}	
	Scientific orientation	0.072	1.910	0.203 ^{NS}	0.121	1.735	0.117 ^{NS}	2.102	2.019	1.126 ^{NS}	
	Economic motivation	1.538	0.417	4.180 ^{**}	0.512	0.182	2.375 ^{**}	0.391	0.234	3.358 ^{**}	
	Innovativeness	1.312	0.465	2.562 [*]	0.154	0.071	2.194 [*]	1.882	0.389	2.930 [*]	
	R ² =0.72					R ² =0.69					R ² =0.70

NS = Non Significant; * = Significant at 0.05 level of probability; ** = Significant at 0.01 level of probability; R² = Coefficient of multiple determinants

predictors of perception of beneficiary, non-beneficiary and overall respondents. The findings are contradictory with the findings of Parganiha *et al.* (2019) who concluded that education had non-significant contribution on predicting the farmers' perception about the climate change.

CONCLUSION

The above study concluded that perception of farmers about diggi based farming system as reported by the respondents, it was found that majority of farmers have medium level of perception about diggi based farming system. The comparison study between beneficiary and non-beneficiary farmers clearly shows that beneficiary farmers have high level of perception as compare to non-beneficiary farmers. It indicates that after receiving the advantages of a diggi-based farming system, the perception of the recipient farmers has improved. Further the study shows that farmers have highest level of perception towards advantages of diggi

based farming system, followed by perception on impact of diggi based farming system. Whereas overall respondents had shown least perception about technical know-how. It was also observed by the investigator that almost all the farmers in the study area were not aware about the quantity of water to be supplied by the canal system in one time (*bari*). Hence, it is suggested that before deciding the capacity of diggi, a farmer must be aware about his/her share of water.

CONFLICTS OF INTEREST

All authors declare that they have no conflict of interest.

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