

**RESEARCH ARTICLE :**

# Impact of drip irrigation system in Bikaner district of Rajasthan

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**ARTICLE CHRONICLE :**

**Received :**

05.02.2017;

**Revised :**

24.02.2017;

**Accepted :**

05.03.2017

**KEY WORDS :**

Drip irrigation system,  
Cropping pattern,  
Economic  
development, Yield of  
crops

**SUMMARY :** Proper economization of water would be advantageous to the farmers as well as it would be helpful in bringing the more land under cultivation. In order to use such a precious natural resource economically, drip irrigation would be a possible solution which minimizes the losses of water and fertilizer as well as increase the yield of crops resulting the more profit and quality of product. The present study was conducted in four Panchayat samities (out of six) in Bikaner district of Rajasthan. From the selected four Panchayat samities, a total of 234 respondent farmers having drip irrigation system were selected randomly for the study purpose. The data were collected by personal interview method with the help of interview schedule. Collected data were classified, tabulated and statistically analyzed. The findings of the study revealed that the area under vegetable cultivation was increased. The total gross cropped area (299 ha) and cropping intensity (20.25%) was increased. The per hectare expenditure on crop production was increased (Rs. 2999.00) after adoption of drip irrigation due to the area increased under vegetable cultivation and also fallow land utilized under such crops by the farmer. The per hectare gross income as well as net income of the farmers was increased, farmers incurred the additional expenditure (Rs. 27677.00) on education, food and clothes, house construction and maintenance, farm implements and mechanical power purchasing as well as social amenities also because of adoption of drip irrigation system. Since the farmers generated more income from their crop production, it was also observed that per hectare average yield of vegetable crops was increased significantly after the adoption of drip irrigation system which indicates the positive impact of drip irrigation system.

**How to cite this article :** Verma, H.L. and Sharma, S.K. (2017). Impact of drip irrigation system in Bikaner district of Rajasthan. *Agric. Update*, 12(2): 189-194; DOI : 10.15740/HAS/AU/12.2/189-194.

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## **BACKGROUND AND OBJECTIVES**

The agricultural production plays a very crucial role in the national economy. The increase in human population together with rapid industrial and urban development resulted in a sharp rise in the demand for agricultural products. Water is a well known basic and the most important input for agricultural production. Recognized the fast

decline of irrigation water potential and increasing demand for water from different sectors there has been a demand of management strategies and programme to save water and increase the existing water use efficiency in Indian Agriculture. In traditional surface irrigation method, the losses in water conveyance and application are large. These losses can be considerably reduced by

farmers by adopting drip irrigation technology.

Drip irrigation, also known as trickle irrigation or micro irrigation is an irrigation method which minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants, either on to the soil surface or directly on to the root zone, through a network of valves, pipes, tubing, and emitters. Drip irrigation is most suitable for row crops (vegetables, soft fruit), tree and vine crops where one or more emitters can be provided for each plant. Drip irrigation is adaptable to any farmable slope and most soils (FAO, 1988).

The drip irrigation system is especially, suitable for saline and alkaline soil and water use efficiency under drip irrigation system is 80 to 90 per cent. Bahuguna (1996) stated that by drip irrigation system 95 per cent of the irrigation water can be used efficiently and by this method 30 to 50 per cent production may be increased.

In India, there has been a tremendous growth in the area under drip irrigation during the last 15 years. The area under drip irrigation in India is around 33.87 lakh hectare has been reached with the efforts of the Government of India, while it was only 1500 hectare in 1985. The leading states of the country in respect of drip irrigation area are Maharashtra, Andhra Pradesh and Karnataka. The Rajasthan state ranks 6<sup>th</sup> in terms of area covered under drip irrigation system with an area about 170098 hectares after the area of Maharashtra (896343 ha), Andhra Pradesh (834865 ha), Karnataka (429903 ha), Gujarat (411208 ha) and Tamil Nadu (290009 ha) (Anonymous, 2015).

Rajasthan is the largest state in India having about 11 per cent area of the country, However, water availability is only 1 per cent of the country and average rain fall is 575 mm. Due to arid and semi arid climate *i.e.* negative moisture index, poor soil quality and traditional agriculture practices, the food security, nutritional security, sustainability and profitability of horticulture production system is still a distant dream in the state. Irrigation scenario of Rajasthan is characterized by erratic or scanty rainfall, dwindling ground water resources, increasing alternative demand of municipal and industrial sector that means less water available for agriculture. The farmers were largely dependent on rainfall for irrigation purposes. However, drip irrigation technique has provided solution to this intrinsic problem of the state. As a result, drip irrigation in such areas has provided a surplus income to the farmers. The adoption of drip irrigation has led to the

production of vegetable crops which has given an advantage over the farm agriculture produce and enhanced income of farmers. Keeping all these facts in mind, the present investigation on impact of drip irrigation system by the farmers in Bikaner district of Rajasthan was under taken.

## RESOURCES AND METHODS

The present study was conducted in Bikaner district of Rajasthan. Out of six, four Panchayat samities were selected purposely on the basis of highest area and large number of beneficiary farmers of drip irrigation system. From the selected four Panchayat samities 25 per cent farmers having drip irrigation system were selected randomly. Hence, total sample of 234 respondent farmers were selected for the study purpose. The data were collected by personal interview method with the help of interview schedule. The data so collected were tabulated and analyzed. Inferences were drawn after subjecting the data to statistical analysis.

## OBSERVATIONS AND ANALYSIS

In the present study impact has been measured in terms of change in cropping pattern, economic development of respondents as a result of adoption of drip irrigation system and enhancement in the yield of crops after adoption of drip irrigation system. In order to know about the change in cropping pattern by the respondents after adoption of drip irrigation system, the data about allocation of the area to the crops before and after the adoption of drip irrigation system were ascertained in tabular form by all respondents. Likewise the yields obtained by the respondents at two different periods *i.e.* before and after the adoption of drip irrigation system were also recorded. In case of economic development of the respondents, two aspects have been taken *i.e.* increase in per hectare income of the farmers and enhancement of the livelihood expenditure by the farmers on his family. The data regarding both the aspects were recorded at two steps *i.e.* before and after the adoption of drip irrigation system.

The impact assessment of drip irrigation system in terms of cropping pattern, economic development and yield enhancement was done by making comparison between the before and after the adoption of drip irrigation system which are as follows :

### Cropping pattern:

The actual area under cultivation of different crops before and after adoption of the drip irrigation system in *Kharif*, *Rabi* and summer season crops are presented in Table 1.

Table 1 explains about the impact of drip irrigation system on cropping pattern of the respondents. A cursory look at the table brings to the fore that there was little bit reduction in the total area under cultivation of *Kharif* crops and simultaneously vegetable crops have been adopted by the respondents after adoption of drip irrigation system. The area under groundnut was reduced to 11 hectares and similarly in cluster bean and moth the

area was reduced 15.5 and 18.5 hectares, respectively. A total of 217 hectares area has been additionally devoted to vegetable cultivation by the farmers after adoption of drip irrigation system.

In case of *Rabi* crops also the area under cultivation has been reduced to 43 hectares, there was no increase in the area under cultivation as such in *Rabi* crops. However, the farmers kept the land fallow for cultivation of *Zaid*/summer crops like watermelon, muskmelon, Longmelon (*Kakri*), Tinda etc. Although the summer crops were also taken by the farmers prior to adoption of drip irrigation system but it was only 53 hectares. There has been a tremendous increase in the area under

Sr. No.	Crops	Area under cultivation		
		Before adoption of drip irrigation Total area (ha.)	After adoption of drip irrigation Total area (ha.)	Area increased (+) / decreased (-) Total area (ha.)
<b>Kharif crops</b>				
1.	Groundnut	352	341	11(-)
2.	Cluster bean	471.5	456	15.5 (-)
3.	Moth	148.5	130	18.5 (-)
4.	Brinjal	-	89.1	89.1 (+)
5.	Tomato	-	82.2	82.2 (+)
6.	Cluster bean (veg.)	-	45.7	45.7 (+)
	Total	972	1144	172 (+)
	%	65.85	77.51	11.66 (+)
<b>Rabi crops</b>				
1.	Wheat	463.5	463.5	Constant
2.	Gram	303.5	287	16.5 (-)
3.	Mustard	163	136.5	26.5 (-)
	Total	930	887	43 (-)
	%	63.01	60.09	2.92 (-)
<b>Zaid/summer crops</b>				
1.	Watermelon	14	55.3	41.3 (+)
2.	Muskmelon	10	35.0	25 (+)
3.	Longmelon ( <i>Kakri</i> )	13	39.5	26.5 (+)
4.	Bottle gourd	9	53.4	44.4 (+)
5.	Tinda	7	33.8	26.8 (+)
	Total	53	217	164 (+)
	%	3.59	14.70	11.11 (+)
<b>Perennial crop</b>				
1.	Kinnow orchard	16	22	6 (+)
	Total	16	22	6 (+)
	%	1.08	1.49	0.41(+)
	Total gross cropped area (A+B+C+D)	1971	2270	299 (+)
	Cropping intensity (%)	133.54	153.79	20.25 (+)

Note: Total land holding of respondents: 1476 ha  
Average land holding of respondents: 6.307 ha

cultivation from 53 to 217 hectares under Zaid/summer crops. The total gross cropped area and cropping intensity (299 ha and 20.25%) was increased after the adoption of drip irrigation system by the farmers.

The finding revealed that the cropping pattern has been affected in positive direction by adoption of drip irrigation system by the farmers. The finding of the study are supporting with the findings of Tayde *et al.* (2003) who reported that changed the cropping pattern by replacing traditional crops. Kumar and Palanisami (2010) also reported that adoption of drip irrigation technology increased the net sown area, gross cropped area, cropping intensity and irrigation intensity.

### Economic development of the respondents:

To assess the impact of drip irrigation system in respect of economic development, the results are presented in Table 2.

Table 2 clearly indicated that per hectare expenditure on crop production before adoption of drip irrigation was Rs. 22468.00 whereas, the after adoption of drip irrigation per hectare expenditure was 25467.00. The expenditure on crop production was increased after adoption of drip irrigation due to the area increased under vegetable cultivation and also fallow land utilized under such crops by the farmers. Thus, per hectare expenditure on crop production was increased about Rs. 2999.00.

The data show that per hectare gross income of the farmers was before adoption of drip irrigation Rs. 52875.00 which was after adoption of drip irrigation system Rs. 62979.00 and it was increased about Rs. 10104.00. Likewise, per hectare net income of the farmers was increased after adoption of drip irrigation

in their field about Rs. 7105.00.

Further the table revealed that expenditure on other aspects such as expenditure on education, food and clothes, house construction and maintenance, farm implements and mechanical power purchasing and social amenities also indicated that farmers incurred the additional expenditure on such aspects, because of adoption of drip irrigation system. Since the farmers generated more income from their crop production. Therefore, they incurred more expenditure on various social aspects.

The data in the Table 2 show that total expenditure on all aspects (except expenditure on crop production) was Rs. 118609.00 before adoption of drip irrigation and it was Rs. 146286.00 after adoption of drip irrigation. There was an additional expenditure by the farmers on such aspects Rs. 27677.00.

From the above results it can be concluded that in respect of economic development of the farmers, after adoption of drip irrigation system farmers gain an additional income as a result of adoption of drip irrigation system and improved the livelihood expenditure of their family. The results seemed to be quite logical that enhancement of farm income leads to improved living standard and farmers have incurred more expenditure in respect of economic development aspects. The findings of the study are supported by the findings of Umesh and Mayani (2014) and Bhuriya *et al.* (2015).

### Yield obtained by the respondents:

Table 3 speaks about the impact of drip irrigation system on the yield of crops obtained by the respondents. The average yield of the crops was computed per hectare

Sr. No.	Particulars	Before adoption of drip irrigation (Rs.)	After adoption of drip irrigation (Rs.)	Gain as a result of adoption of drip irrigation (Rs.)
	<b>Expenditure on crop production per hectare</b>	22468.00	25467.00	2999.00
	Gross income per hectare	52875.00	62979.00	10104.00
	Net income per hectare	30407.00	37512.00	7105.00
	<b>Expenditure on other aspects</b>			
1.	Expenditure on education to children's per farm family	19415.00	25107.00	5692.00
2.	Expenditure on food and clothes per farm family	30504.00	36205.00	5701.00
3.	Expenditure on house construction and maintenance per farm family	32141.00	38897.00	6756.00
4.	Expenditure on farm implements and mechanical power purchasing per farm family	24254.00	30474.00	6220.00
5.	Expenditure on social amenities per farm family	12295.00	15603.00	3308.00
	Total expenditure on other aspects	118609.00	146286.00	27677.00

and presented below.

Table 3 revealed that there was no change in the average yield of groundnut, cluster bean and moth because the drip irrigation system has not been employed in these crops. However, the vegetable crops have been introduced by the farmers as a result of acceptance of drip irrigation system which has given additional income to the farmers. Similar is the case in *Rabi* season crops where average yield of wheat, gram and mustard was unchanged as the drip irrigation system was not employed in these crops. The impact of drip irrigation system was visible in *Zaid*/Summer crops where the area has been increased tremendously as well as there has been increased in average yield of crops per hectare like in

watermelon 57.14 qt (27.18%), muskmelon 37.81 qt (26.04%), Long melon (*Kakri*) 17.61 q (28.50%), bottle gourd 53.00 q (34.87%) and Tinda 17.00 q (25.37%) after the adoption of drip irrigation system by the farmers.

It may be said from the above description that the farmers were the gainer as a result of adoption of drip irrigation system. They have gained in terms of increased in per hectare average yield of the crops already grown by the farmers as well as new crops like brinjal, tomato and cluster bean (veg.) could also be taken by them. This has ultimately enhanced the income of farmers and the living standard. The results of the study have similarity with the findings of Palanisami *et al.* (2014) and Chandran and Surendran (2016).

Sr. No.	Crops	Average yield (q) per ha			Yield change in percentage
		Before adoption of drip irrigation	After adoption of drip irrigation	Gain as a result of adoption of drip irrigation	
<b>Kharif crops</b>					
1.	Groundnut	22.50	22.50	-	No change
2.	Cluster bean	5.75	5.75	-	No change
3.	Moth	4.50	4.50	-	No change
4.	Brinjal	-	231.41	231.41	100
5.	Tomato	-	252.77	252.77	100
6.	Cluster bean(veg.)	-	63.00	63.00	100
<b>Rabi crops</b>					
1.	Wheat	28.20	28.20	-	No change
2.	Gram	9.80	9.80	-	No change
3.	Mustard	11.50	11.50	-	No change
<b>Zaid/summer crops</b>					
1.	Watermelon	210.21	267.35	57.14	27.18
2.	Muskmelon	145.19	183.00	37.81	26.04
3.	Longmelon ( <i>Kakri</i> )	61.79	79.40	17.61	28.50
4.	Bottle gourd	152.00	205.00	53.00	34.87
5.	Tinda	67.00	84.00	17.00	25.37
<b>Perennial crop</b>					
1.	Kinnow orchard	55.00	66.00	11.00	20.00

Sr. No.	Crops	Before adoption		After adoption		'Z' Value
		Mean±	S.D.	Mean±	S.D.	
1.	Watermelon	210.21	36.80	267.35	25.88	19.43**
2.	Muskmelon	145.19	21.39	183.00	29.00	16.05**
3.	Longmelon ( <i>Kakri</i> )	61.79	9.33	79.40	9.76	19.95**
4.	Bottle gourd	152.00	34.68	205.00	33.69	16.77**
5.	Tinda	67.00	9.85	84.00	7.34	21.17**
6.	Kinnow	55.00	6.14	66.00	6.68	18.55**

\*\* indicates significance of value at P=0.01

### Comparison between yield of crops before and after adoption of drip irrigation system :

An attempt was made to test the significance of impact of drip irrigation system in terms yield obtained by the respondents (before-after) by employing 'Z' test. The data are furnished in Table 4.

Table 4 reveals that the mean yield of all six crops *i.e.* Watermelon, Muskmelon, Longmelon, Bottle gourd, Tinda and Kinnow showed significant difference between before and after adoption of drip irrigation system. The calculated value of 'Z' in case of watermelon (19.43\*\*), muskmelon (16.05\*\*), longmelon (19.95\*\*), bottle gourd (16.77\*\*), Tinda (21.17\*\*) and Kinnow (18.55\*\*) was found greater than the tabulated value at 1 per cent level of significance. Thus, it could be inferred that there was a definite significant difference in yield of all six crops between before and after adoption of drip irrigation system. This could be considered as impact of drip irrigation system. The results of the study have similarity with the findings of Kumar and Palanisami (2010) and Palanisami *et al.* (2014) who found that drip method of irrigation have a significant impact in yield of crops.

### Conclusion:

The study concluded that in case of cropping pattern of the farmers, the area increased under vegetable cultivation by the farmers and little area was reduced under traditional crops. Likewise the per hectare expenditure on crop production was slightly increased after the adoption of drip irrigation due to the area increased under vegetable cultivation and also fallow land utilized under such crops by the farmers. It was also found that per hectare gross income as well as net income of the farmers was increased and average yield of vegetable crops was significantly increased after the adoption of drip irrigation in their field. So, the farmers incurred the additional expenditure on education, food and clothes, house construction and maintenance, farm implements and mechanical power purchasing as well

as social amenities also because of after adoption of drip irrigation system the farmers generated more income from their crop production and they have improved their living standard.

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