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# Changing Irrigation Pattern in Bharatpur District Rajasthan

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## ABSTRACT

*Irrigation is an artificial application of water to the soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall. Additionally, irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growing in grain fields and helping in preventing soil consolidation. In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed or dry land farming. Irrigation systems are also used for dust suppression, disposal of sewage, and in mining. Irrigation is often studied together with drainage, which is the natural or artificial removal of surface and sub-surface water from a given area*

*Rural infrastructure 'both physical and institutional" such as irrigation watershed development, rural electrification, road, markets, credit institutions, rural literacy, agricultural research and extension, etc., together play a key role in determining the agricultural output in India..([i]A. Narayanamorthy and Munir A.Hanjra,2006).*

*Irrigation is one of the most important critical inputs for enhancing the productivity that is required at different critical stages of plant growth of various crops for optimum production. The Government of India has taken up irrigation potential creation through public funding and is assisting farmers to create potential on their own farms. Substantial irrigation potential has been created through major and medium irrigation schemes. The total irrigation potential in the country has increased from 81.1 million ha in 1991-92 to 102.77 million hectare by March 2007.*

***Kewwords: Irrigation, Ground Water, Surface Water, Sustainable Agriculture, Salinization***

## I INTRODUCTION

Various types of irrigation techniques differ as to how the water obtained from the source is distributed within the field. In general, the goal is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little

presently groundwater is an important source of irrigation for the development of agriculture, which is directly related with rural development chemical quality of groundwater is an important as the quantity Therefore, the assessment of groundwater quality for irrigation is essential for sustainable Agriculture development.{V.K.Rai, 2008}iiGround water, is an important source as more than 97 percent of the total fresh water on the earth has been reported to be underground.{Rai –sharma1990}iii Ground water, supported by 12 million energized wells, contributing more than 50 percent of total irrigated area in the country has become a critical source for

agriculture growth. Rapid depletion, salinization and pollution related problems threaten regions with sustainable ground water balance, whose area is continuously shrinking. Administrative blocks categorized as 'dark' or critical increased at the rate of 5.5 percent per annum during mid-1980s to mid-1990s. If such a trend continues then 1/3 of the blocks in the country would come in the 'grey' category within two decades. Groundwater mining has resulted in fluoride contamination in north Gujarat and Rajasthan and arsenic contamination in southern West Bengal endangering the sustainable livelihood of the poor. One estimate puts a quarter of India's harvest at risk from ground water depletion. In 1995, over 50 percent of dark blocks were located in six states namely Gujarat, Haryana, Punjab, Tamil Nadu, Karnataka arid Rajasthan.

In surface irrigation systems water moves over and across the land by simple gravity flow in order to wet it and to infiltrate into the soil. Surface irrigation can be subdivided into furrow, border strip or basin irrigation. It is often called flood irrigation when the irrigation results in flooding or near flooding of the cultivated land. Historically, this has been the most common method of irrigating agricultural land. Where ground water levels from the irrigation source permit, the levels surface water are controlled by dikes, usually plugged by soil. This is often seen in terraced rice fields (rice paddies), where the method is used to flood or control the level of water in each distinct field. In some cases, the water is pumped, or lifted by human or animal power to the level of the land.

## II IRRIGATION CHARACTERISTICS

Bharatpur comes under sub humid to semi arid region, where geohydrology of the district favours ground water sources of irrigation. Here, an attempt has been made to explain irrigation charecteristics like level of irrigation, annual growth rate of gross irrgated area, irrgation intensity and share of different sources of irrgation in GIA.

During the study period 1995 and 2010, excessive development of well and tubewell irrgation has resulted into very high incrase in level of irrigation. In the year 1995, level of irrigation (percent NIA in NSA) was only 52.34 percent and it reached at its climax in the year 2009 with 84 percentand then declinded to80 percent in the year 2010. In the year, 2001-2002. Level of irrigation increased drastically from the previous year and then it sustained itself. Annual growth rate of GIA, did not reported any uniform pattern, it had both postive and negative growth but overall positive growth is seen here.

**Table 1.1: Irrigation charecteristics and Sources of Irrigation.**

| Year | % irrigation | Growth rate | Irrigation intensity | Canal | Well and Tube well | Others |
|---|---|---|---|---|---|---|
| 1995-1996 | 52.34 | | 102.81 | 2.77 | 95.89 | 1.34 |
| 1996-1997 | 57.62 | 10.5 | 103.11 | 2.36 | 97.64 | 0.00 |
| 1997-1998 | 48.57 | -15.6 | 103.66 | 2.48 | 95.78 | 1.75 |
| 1998-1999 | 53.27 | 10.2 | 103.02 | 2.76 | 97.24 | 0.00 |
| 1999-2000 | 53.66 | 0.2 | 103.82 | 2.58 | 97.42 | 0.00 |
| 2000-2001 | 68.38 | 26.4 | 103.05 | 1.78 | 98.22 | 0.00 |
| 2001-2002 | 72.28 | 6.7 | 103.39 | 1.68 | 98.23 | 0.09 |
| 2002-2003 | 76.40 | 3.4 | 101.74 | 1.64 | 98.36 | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2003-2004 | 75.26 | 0.0 | 102.11 | 1.52 | 98.48 | 0.00 |
| 2004-2005 | 74.38 | -0.7 | 102.21 | 1.36 | 98.64 | 0.00 |
| 2005-2006 | 77.71 | 5.1 | 102.36 | 1.06 | 98.94 | 0.00 |
| 2006-2007 | 81.61 | 4.1 | 101.66 | 0.58 | 99.42 | 0.00 |
| 2007-2008 | 83.21 | 0.8 | 101.05 | 0.47 | 99.53 | 0.00 |
| 2008-2009 | 84.71 | 2.2 | 101.42 | 0.84 | 99.16 | 0.00 |
| 2009-2010 | 80.41 | -1.2 | 101.66 | 0.66 | 99.34 | 0.00 |

*Source: Computed from Various Issues of District Statistical Abstract, Bharatpur*

It obserbed a negative annual growth rate of 15.6 percent in the year 1997-98 whereas a positve growtha rate of 26 percent has been noticed in the year 2001.Irrigation intensity simply gives the eficiency of irrigation. It is measured as ratio between NIA and GIA. But it can be said as true mesure of efficcincy since it does not consider number of watering of a particular crop. It consder crop acreage only.

In India, irrigation and monsoon has direct linkages and hence during monsoon no irrigation is required. It is mainly rabi season when we need to have irrigation. Again during summer, limited crops are grown and therefore crop acrage is limted to irrigated crops only. In these circumstance, we found very less variation in the irrigation intensity. Irrigation intensity was found in between 101 and 104 percent only during the study period

**Table 1.2: Irrigation Characteristics 1995-98**

| Tehsils | % irrigation | Conc. | Irrigation intensity | Canal | Well and Tube well | Others |
|---|---|---|---|---|---|---|
| Bayana | 59.79 | 11.09 | 102.49 | 7.79 | 91.86 | 0.36 |
| Bharatpur | 60.76 | 11.36 | 101.17 | 0.45 | 94.84 | 4.71 |
| Deeg | 30.26 | 5.99 | 100.27 | 0.00 | 100.00 | 0.00 |
| Kama | 52.93 | 7.30 | 106.48 | 14.43 | 85.57 | 0.00 |
| Kumher | 47.12 | 9.03 | 100.31 | 0.00 | 100.00 | 0.00 |
| Nadbai | 76.55 | 14.83 | 100.75 | 0.00 | 100.00 | 0.00 |
| Nagar | 34.05 | 7.07 | 108.19 | 0.00 | 94.86 | 5.14 |
| Pahari | 37.50 | 5.85 | 109.31 | 0.00 | 100.00 | 0.00 |
| Rupwas | 57.76 | 12.48 | 101.73 | 4.45 | 95.26 | 0.29 |
| Weir | 67.01 | 15.00 | 105.81 | 0.00 | 100.00 | 0.00 |
| District | 52.84 | 100 | 103.17 | 2.52 | 96.50 | 0.97 |

*Source: Computed from Various Issues of District Statistical Abstract, Bharatpur*

Last 15 year of study shows dominance of well and tube well irrigation which reported around 96 percent area of GIA in the year 1995-96 and its share increased up to more than 99 percent by the year 2009-10. The district does not have any pond and tank irrigation. Area under Canal and other sources of irrigation was also present during the study but their share has gone down to less than 1 percent .

**Table 1.3: Irrigation Characteristics in 2001-04**

| Tehsils | % irrigation | Conc. | Irrigation intensity | Canal | Well and Tube well | Others |
|---|---|---|---|---|---|---|
| Bayana | 72.85 | 9.76 | 101.62 | 0.62 | 99.38 | 0.00 |
| Bharatpur | 88.10 | 11.55 | 100.34 | 0.00 | 100.00 | 0.00 |
| Deeg | 60.69 | 8.54 | 100.54 | 3.97 | 96.03 | 0.00 |
| Kama | 75.35 | 7.48 | 106.48 | 11.08 | 88.92 | 0.00 |
| Kumher | 69.50 | 9.53 | 100.13 | 0.62 | 99.38 | 0.00 |
| Nadbai | 95.08 | 12.92 | 100.22 | 0.00 | 100.00 | 0.00 |
| Nagar | 70.25 | 10.17 | 106.04 | 0.00 | 100.00 | 0.00 |
| Pahari | 60.31 | 6.61 | 106.67 | 0.00 | 100.00 | 0.00 |
| Rupwas | 73.24 | 11.15 | 101.16 | 2.94 | 96.80 | 0.27 |
| Weir | 78.49 | 12.29 | 104.10 | 0.00 | 100.00 | 0.00 |
| District | 74.64 | 100 | 102.40 | 1.61 | 98.36 | 0.03 |

*Source: Computed from Various Issues of District Statistical Abstract, Bharatpur*

During the TE 1995-98, the district had only 52.84 percent area under irrigation and performance of tehsils was entirely diverse. At the one end, Deeg has very low level of irrigation with only 30 percent GCA under irrigation and on the other end Nadbai observed more than 76 percent GCA under irrigation. Nadbai and Weir emerged as the two most irrigated tehsil which jointly have around 30 percent irrigated area of the district. Irrigation intensity was also varying from Pahari (109 percent) to Deeg (100 percent) across the tehsils with district average of 103 percent.

Irrigated sources are limited to canal and well and tube well irrigation. Around 1.61 irrigated areas has been reported under canal irrigation during TE 2001-04. Canal as an irrigation source has been found mainly in the tehsils of Kama (11.08 percent) and Rupwas (2.94 percent). Deeg, Kumher, Nadbai, Pahari and Weir emerged as those tehsil where percent irrigation was under this ground water source i.e. well and tube well. In Nagar, Rupwas and Bharatpur other sources of irrigation were significant.

74.64 percent area of the district was found under irrigation during TE 2001-04. Performance of tehsils had reported better position by now and level of irrigation was varying from 30.31 percent in Deeg tehsil to 95 percent in Nadbai. More than two third area of NSA was found irrigated in Bharatpur, Kama, Nadbai and Weir tehsils. Nadbai and Weir emerged as the two most irrigated tehsil which jointed had around 25 percent irrigated area of the district and Pahari (6.61 percent) reported minimum irrigated area in the district. Irrigation intensity was also varying from Pahari (106 percent) to Kumher (100 percent) across the tehsils with district average of 102 percent.

**Table 1.4: Irrigation Characteristics in 2007-10**

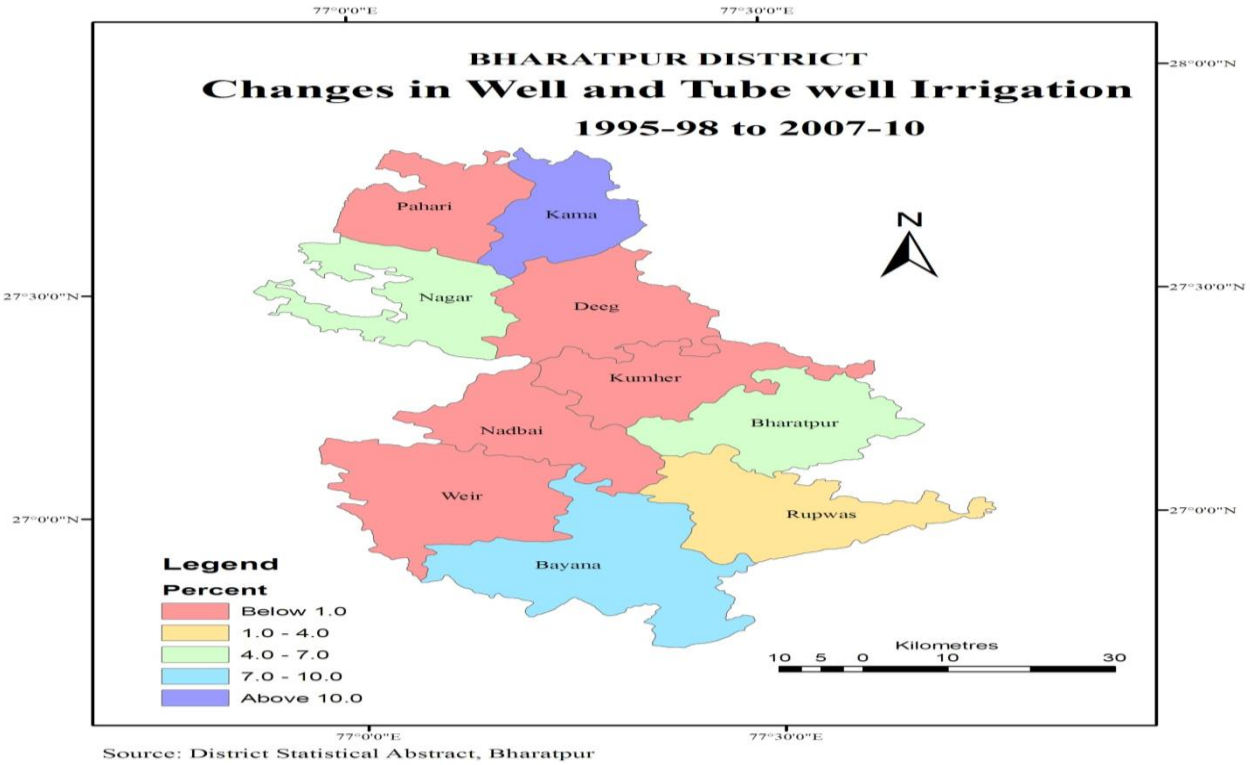
| Tehsils | % Irri | Concentration in Dist | Irrigation intensity | Canal | Well and Tube well | Others |
|---|---|---|---|---|---|---|
| Bayana | 85.02 | 10.68 | 101.69 | 0.79 | 99.21 | 0.00 |
| Bharatpur | 93.45 | 11.01 | 100.95 | 0.00 | 100.00 | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Deeg | 74.17 | 9.47 | 101.82 | 1.89 | 98.11 | 0.00 |
| Kama | 88.27 | 7.66 | 103.34 | 0.95 | 99.05 | 0.00 |
| Kumher | 72.82 | 8.81 | 100.65 | 0.34 | 99.66 | 0.00 |
| Nadbai | 96.90 | 11.58 | 100.20 | 0.00 | 100.00 | 0.00 |
| Nagar | 84.82 | 10.44 | 100.90 | 0.00 | 100.00 | 0.00 |
| Pahari | 65.51 | 7.19 | 101.43 | 0.00 | 100.00 | 0.00 |
| Rupwas | 77.59 | 10.68 | 100.97 | 2.72 | 97.28 | 0.00 |
| Weir | 89.01 | 12.49 | 102.30 | 0.00 | 100.00 | 0.00 |
| District | 82.75 | 100 | 101.38 | 0.66 | 99.34 | 0.00 |

*Source: Computed from Various Issues of District Statistical Abstract, Bharatpur*

Around 0.66 irrigated areas have been reported under canal irrigation during TE 2007-10. Canal as an irrigation source has been found mainly in the tehsils of Deeg (1.89 percent), Rupwas (2.72 percent) and Bayana (0.79 percent). Bharatpur, Kumher, Nadbai, Pahari and Weir emerged as those tehsil where cent percent irrigation was under this ground water source i.e. well and tube well. In Nagar, Rupwas and Bharatpur other sources of irrigation were significant.

Sources of irrigation across the tehsil have changed its proportional share across the nine tehsils of the district during the year 2007-10. Other sources of irrigation were found absent. Similarly, canal irrigation has reported decline in its proportional. Only four tehsils of the district had canal irrigation. Bayana and Kama tehsils had some significance of canal irrigation but ground water irrigation was prime.




Source: District Statistical Abstract, Bharatpur

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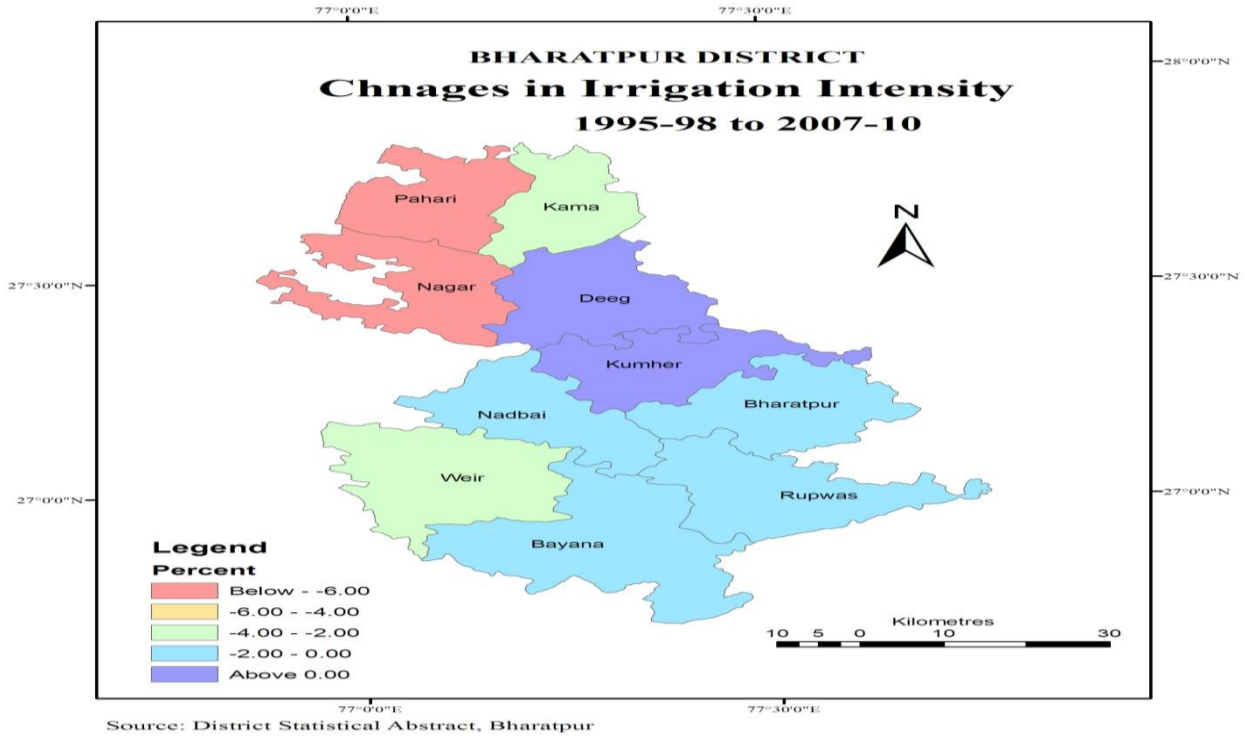

Source: District Statistical Abstract, Bharatpur

Well and Tube well occupied more than 96 percent share in the irrigated area and its share 100 percent in four of the tehsils. Kama has reported minimum share of ground water sources which is also 87 percent.

**Table 1.5: Changes in Irrigation Characteristics 1995-2010**

| Tehsils | Change in Irr lev | Change in GIA | Irrigation intensity | Canal | Well and Tube well | Others |
|---|---|---|---|---|---|---|
| Bayana | 25.23 | 12016 | -0.80 | -6.99 | 7.35 | -0.36 |
| Bharatpur | 32.69 | 12563 | -0.23 | -0.45 | 5.16 | -4.71 |
| Deeg | 43.91 | 18885 | 1.55 | 1.89 | -1.89 | 0.00 |
| Kama | 35.34 | 10016 | -3.14 | -13.48 | 13.48 | 0.00 |
| Kumher | 25.70 | 10156 | 0.33 | 0.34 | -0.34 | 0.00 |
| Nadbai | 20.35 | 7027 | -0.55 | 0.00 | 0.00 | 0.00 |
| Nagar | 50.77 | 19794 | -7.28 | 0.00 | 5.14 | -5.14 |
| Pahari | 28.01 | 11543 | -7.89 | 0.00 | 0.00 | 0.00 |
| Rupwas | 19.82 | 9033 | -0.76 | -1.73 | 2.02 | -0.29 |
| Weir | 22.00 | 9712 | -3.52 | 0.00 | 0.00 | 0.00 |
| District | 29.91 | 120745 | -1.79 | -1.87 | 2.84 | -0.97 |

*Source: Computed from Various Issues of District Statistical Abstract, Bharatpur*

Ground water sources of irrigation across the ten tehsil during the year 2001-04 have achieved prime place. Now 98.6 percent irrigated area of the district is under well and tube well irrigation. Canal irrigation has reported decline in its proportional. Only four tehsils of the district had canal irrigation. Only Kama tehsils has

some significance of canal irrigation. Well and Tube well occupied 100 percent share in five of the tehsils. Kama has reported minimum share of ground water sources which is also 92 percent.

## III CONCLUSION

Bharatpur district has observed around 30 percent increases in level of irrigation during the study period with increase in 1.2 lakh hectare irrigated area. Nagar tehsil has noticed exceptionally well where irrigated area has shown an increase of around 20 hectare. Level of irrigation has increased by 50.7 percent from just 30 percent during 1995-96. Deeg emerged as the second most important tehsil from increase in irrigation point of view. In Deeg, a total of 18885 hectare area became irrigated and level of irrigation increased by 43.9 percent from base of 30 percent in the year 1995-96. In fact every tehsil of the district has added significant irrigated area during the study period. Nadbai (20.3 percent) and Rupwas (19.8 percent) are found as the two tehsil which has minimum increase in level of irrigation with increase in irrigated area by 7027 and 9033 hectare respectively

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