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# Impact Of Irrigation on Agriculture Productivity(By Shafi's Method)in Marahtwada Region: A Geographical Analysis

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(17)

**Abstract-**

Irrigation is identified as a decisive factor in Indian agriculture due to high variability and inadequacy of rainfall. Irrigation is essential for successful agriculture particularly in the area, where rainfall is inadequate uncertain, and unpredictable. These areas are famine condition due to partial failure and delayed arrival or early withdrawal of monsoon. Importance of irrigation has substantially increased after the adoption of High yielding varieties in developing countries. Irrigation is basic determinants of Agriculture because its inadequacies are the most powerful constraints on increase of Agricultural production. In the study region the variation of an annual rainfall from year to year is fairly large. The rainfall is irregular and uncertain in the Study region, here agriculture is gamble with monsoon. If rainfall is scare it results into crop failure. For the assure agriculture production irrigation is most important factor. Therefore attempt is made here to examine the impact of irrigation on agriculture productivity in Marathwada region.

**Key words-** Irrigation intensity, Agriculture productivity, spatial pattern.

**Introduction**

Irrigation is basically an agriculture operation, supplying the need of water for plants. To agriculturalists it is a component of successful crop husbandry in dry climate, ranking high with the application of fertilizers, the control of weeds and destructive pests, cultivation and the position of drainage. Irrigation is the most important factor in farming according to the Agriculture Department and Irrigation Officers. Irrigation has played an important role in transforming the crop cultivation and better yield .There are various any other type of irrigation such as in their well irrigation, rivers, tanks and canal etc. But there are additional factors such as their location, their topography, geological aspect and height, hilled area depending on various elements. In The region under study mainly two types of irrigation are practised namely well and canal irrigation.

STUDY AREA:

The Marathwada region lies in the upper Godavari basin. The absolute location of region is $17^0$38□53□□ North latitude to $20^0$40□51□□ North latitude and $74^0$33□28□□ East longitude to $78^0$21□12□□ East longitude.

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Issue I Vol II, 26 April 2018
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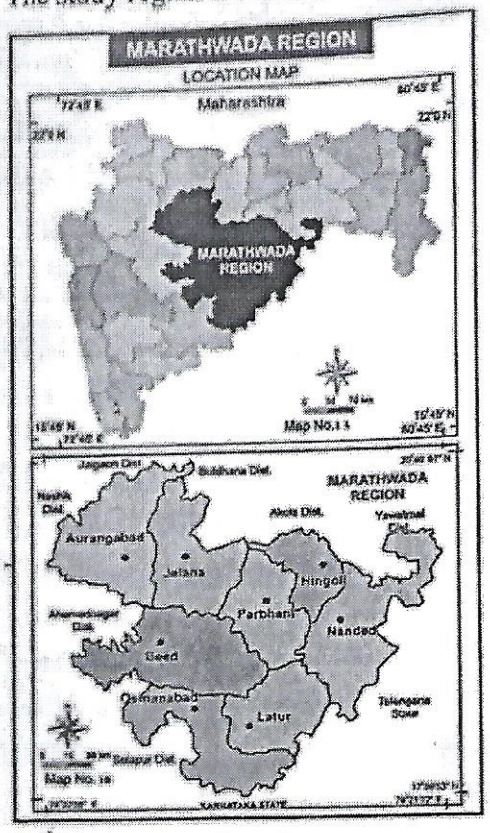
The study region is bounded to the north by Jalgaon, Buldhana, and Washim districts, to the north east by Yavatmal district to the east by Nizamabad and Adilabad districts of Telangana state to the south and south east by Bidar and Gulbarga districts of Karnataka state, to the west by Ahmednagar to the Southwest by Solapur and to the North West by Nasik district. Its shape is roughly triangular. East-West maximum extension of region is 394 Kilometers and North-south extension in of region is 330 Kilometers. Total Geographical area of region is 64434 Square Kilometer which is 20.95 per cent of the state and its population is 1.87 cores which is 16.66 percent of the state as per census of 2011. Administratively study region is divided into eight districts that are further divided into 76 tehasils.




## 3. AIMS AND OBJECTIVE:

1. To understand the irrigation intensity in Marathwada region
2. To illustrate the agriculture productivity in study region.
3. To find out the impact of irrigation on agriculture production in study region.

## 4. DATA BASE AND METHODOLOGY:

District wise secondary data of irrigated area and agriculture productivity are used for present study. Data has been collected by referring agricultural statistical information of agriculture department of Maharashtra, Pune.The statistical equation are used for irrigation intensity. To know the agriculture productivity Measurement of productivity by shafi's method is used. The statistical and cartographic techniques are used.

## 5. DISCUSSION

### 5.1 INTENSITY OF IRRIGATION:

The intensity of irrigation expresses man's dynamic attempts to overcome the environmental limitations in the transformation of many of the barren areas in to the agriculture areas. The intensity of irrigation is the proportion of net irrigated area to net shown area of the aerial unit. It is an important indicator to determine the cropping pattern and agricultural productivity. The intensity of irrigation controlled by various factors such as source of irrigation, quantity and quality of water supply, intensity of network of water channels etc. There are imbalances in irrigation development in Marathwada region. They are natural as well as created



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imbalance. The natural imbalances are caused due to the relative advantages and disadvantages of regions with respect to irrigation sources. These natural differences in regions can described as regional disparities.

**Table No. 1: District-wise irrigated area in Marathwada Region**

**1981-85 & 2005-2010**

| Sr. No. | Districts/ Region | Irrigated area (in %) 1981-1985 | | | Irrigated area (in %) 2005-2010 | | | Change in irrigated area (1981-85 to 2005-2010) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Well | Surface | Net | Well | Surface | Net | Well | Surface | Net |
| 1 | Aurangabad | 6.23 | 1.74 | 7.96 | 17.26 | 8.01 | 25.27 | 11.03 | 6.27 | 17.31 |
| 2 | Jalna | 6.42 | 2.47 | 8.89 | 6.68 | 12.84 | 19.53 | 0.26 | 10.37 | 10.63 |
| 3 | Parbhani | 3.5 | 2.93 | 6.43 | 9.10 | 18.66 | 27.75 | 5.60 | 15.73 | 21.32 |
| 4 | Hingoli | 4.35 | 4.22 | 8.57 | 8.79 | 5.30 | 14.09 | 4.44 | 1.08 | 5.52 |
| 5 | Beed | 12.46 | 5.14 | 17.6 | 10.58 | 6.59 | 17.17 | -1.88 | 1.45 | -0.43 |
| 6 | Nanded | 2.43 | 2.59 | 5.03 | 7.18 | 3.33 | 10.51 | 4.75 | 0.74 | 5.49 |
| 7 | Osmanabad | 9.81 | 2.73 | 12.54 | 6.89 | 15.10 | 21.99 | -2.92 | 12.37 | 9.45 |
| 8 | Latur | 4.78 | 0.98 | 5.76 | 7.18 | 10.49 | 17.67 | 2.40 | 9.51 | 11.91 |
| | Region | 6.25 | 2.85 | 9.10 | 9.21 | 10.04 | 19.25 | 2.96 | 7.19 | 10.15 |

*Source: Compiled by researcher on the basis on Socio-Economic abstract of Aurangabad, Beed, Parbhani, Hingoli, Nanded, Jalna, Latur and Osmanabad 1981-82 to 2009-10*

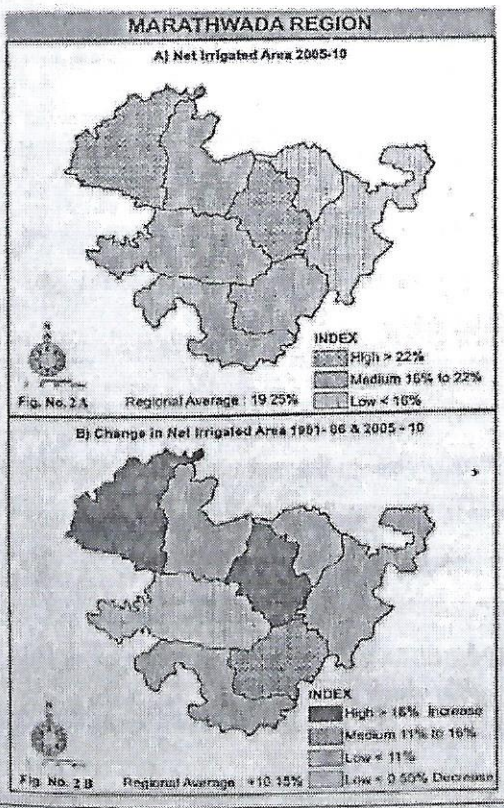


Table No.1 indicates that region as a whole has 9.16 percent net irrigated area to total net sown area in 1981-85, but spatial distribution varies from district to district, high net irrigated area is recorded only in Beed district i.e. 17.6 percent to total net sown area, due to development of surface irrigated facility. The moderate net irrigated area is observed only in Osmanabad district i.e. 12.54 percent, while low net irrigated area is found in Aurangabad, Jalna, Parbhani, Hingoli, Nanded and Latur districts i.e. below 9 percent to total net sown area.

19.25 percent net irrigated area to net sown area in 2005-2010, but spatial distribution varies from district to district, high in net irrigated area is recorded in Aurangabad and Parbhani district i.e. above 22 percent to total net sown area, due to Jayakwadi Major

Irrigation project. The moderate net irrigated area is observed in Beed, Osmanabad, Jalna and Latur district ranging from i.e. 16 to 22 percent, while low net irrigated area is found in Hingoli and Nanded district i.e. below 16 percent to total net sown area.

The table No. 1 indicates that region as a whole has 10.11 percent positive change in net irrigated area, but spatial distribution varies from district to district. The high positive change is recorded in Parbhani and Aurangabad district i.e. 16 percent. The moderate positive change is recorded in Latur district i.e.11.91 percent, while low positive change is recorded in Hingoli, Jalna, Osmanabad and Nanded district i.e. below 11 percent. The negative change in net irrigated area is recorded only in Beed district i.e. - 0.43 percent. *(Fig.1.B)*

**5.2 AGRICULTURAL PRODUCTIVITY**

In economic or agricultural geography productivity as defined means output per unit of input or per unit of area respectively and the important in agricultural productivity is generally the result of a more efficient use of factors of production viz. environment, arable land, labour and capital (Jasbir Singh & Dhillon S.S.,"1997). Bhatia (1967) defined "Agricultural efficiency as the aggregate performance of various crops in regard to their output per acre but the contribution of each crop to the agricultural efficiency would be relative to its share of the crop land".

Agricultural productivity is a measure of efficiency with which inputs are used to provide an output. When a given combination of inputs produces a maximum output, the productivity is said to be at its maximum. The measurements of agricultural productivity enable a comparison of the relative performance of farmers between farm, between types of farming and between geographical areas. The comparison of productivity goes to the heart of economic performance and can provide guidance for planning and development decisions (Dayal, 1984).

The measurement of agricultural productivity helps in knowing the area that is performing rather less efficiency in comparison to the neighboring areas. By delimiting the areas of low, medium and high productivity, agricultural plans may be formulated to remove and minimize for the regional inequalities. It is also provides an opportunity to ascertain the ground reality, the real cause of agricultural backwardness of a region. (Husain, Majid2010)

**5.3 MEASUREMENT OF PRODUCTIVITY BY SHAFI'S METHOD**

After measurement of productivity by Bhatia's method, efforts are made to find out regional imbalance in agricultural productivity of Marathwada region by using Shafi's method (1972), because this technique helps to examine overall yield in relation to the region. While using this method eight crops of each district selected. To measure agricultural productivity the following formula is used.

$$\sum \frac{y1}{t1} + \frac{Y2}{T2} + \text{---} n \quad : \quad \sum \frac{y1}{t1} + \frac{Y2}{T2} + \text{---} n$$



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$$\sum \frac{yn}{tn} \; ; \; \sum \frac{Yn}{TN}$$

Where,

$y_1, y_2$------ n = Total production of the selected crops in the district.

$t_1, t_2$------ n = Total cropped area under those crops in the district.

$Y_1, Y_2$------n = Total production of selected crops in region.

$T_1, T_2$------n = Total cropped area under those crops in region.

### 5.3.1 AREA OF HIGH PRODUCTIVITY

The table 6.25 indicates that the high prductivity is confined in Central partand northern part of the Marathwada region, which constist Aurangabad, Parbhani and Latur districts during the 2005-10. These districts covers 36.54 per cent of total reported area of Marathwada region share 37.35 per cent of the total net sown area. These districts having high overall yield index in relation to other districts, because of high fertile soil in Godavari and Manjara basin and high development of technological factrors.

**Table No. 2: Overall Yield Index by Shafi's Method (1972)**

**1981-82 to 1985-86 and 2005-06 to 2009-10**

| Sr. No | District | Productivity Index 1981-85 | Productivity Index 2005-10 |
|---|---|---|---|
| 1 | Aurangabad | 13.58 : 10.87 | 71.65 : 67.11 |
| 2 | Jalna | 11.6 : 10.87 | 30.79 : 67.11 |
| 3 | Parbhani | 9.2 : 10.87 | 91.71 : 67.11 |
| 4 | Hingoli | 9.68 : 10.87 | 63.32 : 67.11 |
| 5 | Beed | 10.85 : 10.87 | 68.61 : 67.11 |
| 6 | Nanded | 9.82 : 10.87 | 63.95 : 67.11 |
| 7 | Osmanabad | 11.47 : 10.87 | 62.13 : 67.11 |
| 8 | Latur | 9.47 : 10.87 | 71.37 : 67.11 |

*Source: Complied by Researcher, on the basis of Socio economice Review and district Statistical Abstract of all district of marathwada region 1981-82 to 2009-10, and Chief Statistical Office of Agriculture Maharashta state pune.*

### 5.3.2 AREA OF MODERATE PRODUCTIVITY

The moderate productivity is confined Eastern and Western part of Marathwada region which comprises Hingoli, Nanded, Osmanabad and Beed districts. These districts covers 51.46 percent of total reported area of Marathwada region and shares 49.82 percent of the total net sown area of region.

### 5.3.3 AREA OF LOW PRODUCTICITY

The table 2 indicates that low productivity is recorded only in Jalna district in 2005-10, which covers 11.99 percent of total Geographical area of Marathwada region and 12.63 of total net sown area of region.

### 5.4 CHANGES IN PRODCTIVITY AS SHAFI'S METHOD

During the period of investigation, agricltural productivity increased in all districts of Marathwada region. As per gradation low to high productivity change is obseved in Parbhani and Latur districts, due to development of irrigation. Moderate to low change is found in Jalna district.

### 5.5 IMPACT OF IRRIGATED AREA ON AGRICULTURAL PRODUCTIVITY

An attempt is made here to assess the impact of percentage of irrigated area on agricultural productivity in districts of Marathwada region.

In the context of objective the following findings have come to light.

1) The moderate positive correlation is observed in between net irrigated area and agricultural productivity of districts. The coefficient of correlation in this regard is +0.606578. The degree of linear association between these two variable obtained by using the coefficient of determination ($r^2$) is found to be at 0.367937, which reveals that the independent variable (X) i.e. net irrigated area are explaining 36.79 per cent of the total variations in dependant variable (Y) i.e. agricultural productivity of districts of Marathwada.

It is good explanation because 36.79 per cent of variation in 'Y' agricultural productivity of districts of Marathwada region to be influenced by the variable 'X' i.e. net irrigated area and about 63.21percent of variation is left to be influenced by other variables.

2) The functional form of linear relationship of 'Y' on 'X' found to be at y = 62.65 + 1.066x. The line of best fist is shown in *figure 6.27*.The regression coefficient indicates that increase of one percent net irrigated area causes for increase of value of composite index of agricultural productivity of districts by 1.066 in study region. By testing the significance of regression coefficient (a test of significance), the validity of this causal relationship has been confirmed.

**Table 3: Percentage of Net Irrigated Area and Composite Index of Agricultural Productivity- 2005-06 to 2009-10**

| Sr. No | Districts | X ( % of Net irrigated area to net area sown) | Y (Composite index of agricultural productivity |
|---|---|---|---|
| 1 | Aurangabad | 25.27 | 93.68 |
| 2 | Jalna | 19.53 | 73.00 |
| 3 | Parbhani | 27.75 | 98.18 |
| 4 | Hingoli | 14.09 | 87.13 |
| 5 | Beed | 17.17 | 80.49 |
| 6 | Nanded | 10.66 | 71.91 |

| | | | |
|---|---|---|---|
| 7 | Osmanabad | 21.99 | 73.96 |
| 8 | Latur | 17.67 | 87.26 |
| Coefficient of correlation | | | 0.606578 |
| Coefficient of determination | | | 0.367937 |

Source: Compiled by researcher *on the basis of Socio economicc Review and district Statistical Abstract of all district of marathwada region 1981-82 to 2009-10, Chief Statistical Office of Agriculture Maharashta state, pune.*

The equation used $t = (b-\beta)\sqrt{(n-2)\Sigma(Xi-X^{-})^2 \div \Sigma (Yi-yi)^2}$

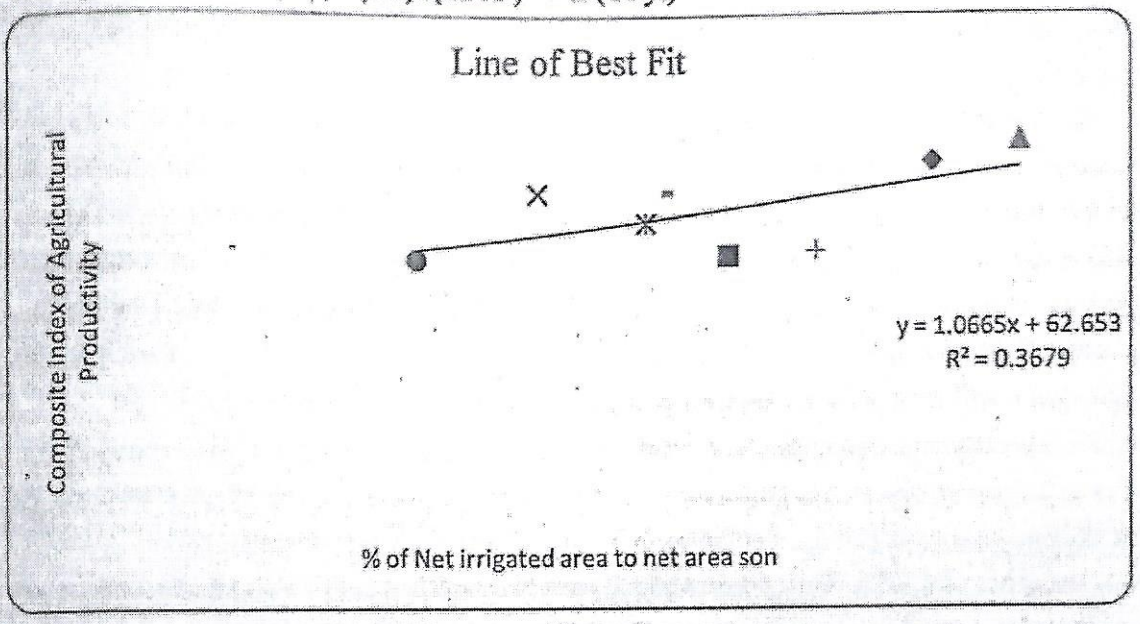


Figure 3

The calculated value of 't' in this exercise is found at 1.87. It is observed that this calculated value is higher than the tabulated value of 't' (1.44) at the 6 degree of freedom (df = n –2, where 'n' is 8) at 20 per cent level of significance.

3) In order to understand the degree of fit of regression equation and the accuracy level of predicted values (y) agricultural productivity of districts of Marathwada region the standard error (SE) of estimate is being done with the equation $SE(Y) = SY\sqrt{1-r^2}$, where SE (Y) is the standard deviation of residuals (Y-y); and 'SY' is the standard deviation of 'Y'.

4) The confidence intervals of the predicted values are worked out at $Y \pm SE(Y)$ (The SE (Y) for the present exercise is 8.17 and SY is the 9.93). Thus it is assumed that if the values of 'Y' (Y-y) lie within the range of Zero to ± SE, the prediction could be expected to be accurate. In other words, the role of independent variables in explaining the change in dependent variable can be accepted as correct.

## 6. CONCLUSION

The high net irrigated area in Aurangabad and Parbhani district is a result of Jayakwadi Major Irrigation project, which is favorable for agricultural production. As per Shafi's method the level of agricultural productivity is high in central part of study region comprise Aurangabad, Parbhani and Latur District than the region as whole, which contributes 37.35 percent of the total net sown area, it is due to high increase in irrigation facility and fertile soil in Godavari and Manjara basin and high development of technological factrors.

During the period under review all district shows positive change in level of agricultural productivity by Shafi's method. low to high productivity change in Parbhani districts is mainly due to development of irrigation.

Considering impact of irrigated area on agricultural productivity, it is found that the moderate positive correlation (+0.606578) between net irrigated area and agricultural productivity of districts of Marathwada region. The degree of linear association between these two found to be at 0.367937, which reveals that the independent variable (X) i.e. net irrigated area are explaining 36.79 per cent of the total variations in dependant variable (Y) i.e. agricultural productivity. About 63.21percent of variation is left to be influenced by other variables.

The regression coefficient indicates that increase of one percent net irrigated area causes for increase of composite index of agricultural productivity by 1.066 in study region.

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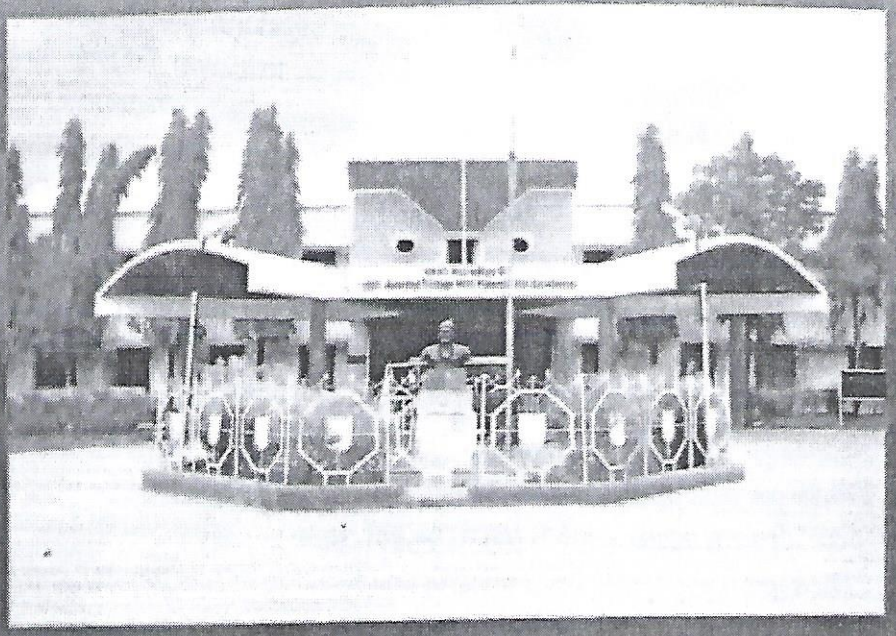

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