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IMPACT OF IRRIGATION ON AGRICULTURAL PRODUCTIVITY IN MARATHWADA REGION

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Abstract

Irrigation means the supply of water to the land by means of channels, streams, and sprinklers in order to permit the growth of crops. Agricultural productivity could be defined as the ratio of output to input in relation to land, capital and overall resources employed in agriculture. Agriculture productivity is a function of number of factors including physical and non-physical factors. Rainfall is uncertain and unpredictable in drought prone area; therefore irrigation is identified as a decisive factor. For the assured agriculture production irrigation is most important factor. Therefore attempt is made here to examine the impact of irrigation an agricultural productivity in Marathwada region. The paper is mainly based on Secondary data. To examine the impact of irrigated area on per hectare yield of cereal crops the Pearson's Coefficient of Correlation, Coefficient of determination and regression technique has been utilized. The study reveals that there is medium positive correlation between percentage of irrigated area and agricultural productivity in the Marathwada region. It is found that increase of one per cent of irrigated area causes for an increase of value of composite index of agricultural productivity of districts by 1.066 in study region.

Keywords: Irrigated area, Agricultural productivity, Correlation, Regression.

Introduction:

Irrigation is the watering of land by artificial means to foster plant growth (Merrium Webster's Collegiate Dictionary, 2004, p.663). Irrigation means the supply of water to the land by means of channels, streams, and sprinklers in order to permit the growth of crops (Susan Mayhew, 2004, P. 280). Irrigation is identified as a decisive factor in Indian agriculture due to high variability and inadequacy of rainfall. Irrigation is imperative for successful agriculture particularly in the arid, semi arid and sub-humid areas, which are prone to drought and famine conditions due to partial failure and delayed arrival or early withdrawal of monsoon (Reddy and Reddy, 1992). 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.

Productivity as defined in economic or agricultural geography means output per unit of input or per unit of area respectively and the importance 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 measurement of agricultural productivity helps in knowing the area that is performing rather less efficienctly in comparison was 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, Majid, 2010)

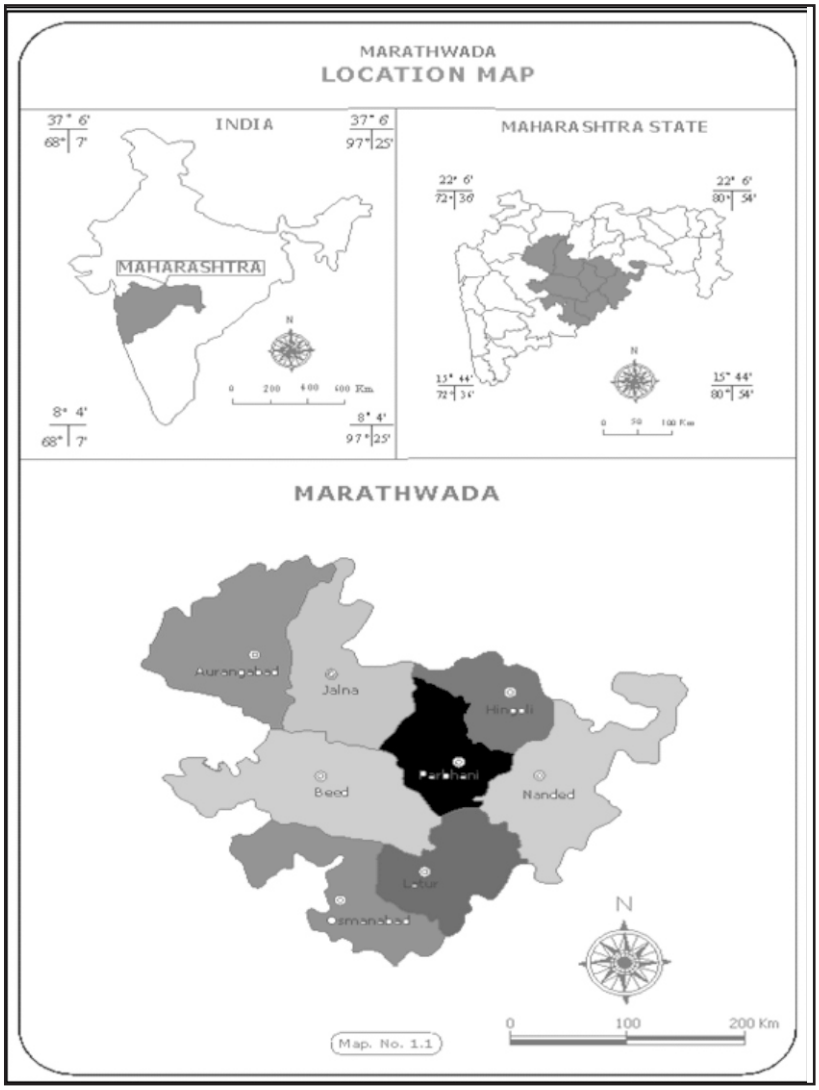
Agriculture productivity is a function of number of factors including physical, Socio economical and technical organization, mechanization (Noor Mohammad, 1995). Technological

variables have made a significant impact on both agricultural pattern and productivity. Agricultural productivity is high in irrigated area in the study region.

In the study area the rainfall is irregular, uncertain and variation in annual rainfall from year to year is fairly large. Here agriculture is gamble with monsoon. If rainfall is scare it results into crop failure. For the assures agriculture production irrigation is most important factor. On this basis it can be hypothesized, that the higher the percentage of irrigated area, the more is the agricultural productivity. Therefore attempt made here to examine the impact of irrigation on agricultural productivity in Marathwada region.

The Study Area

The Maharashtra state is administratively divided into six divisions, viz. Konkan, Nasik, Pune, Amravati, Nagpur and Aurangabad. The Aurangabad division is also known as Marathwada region, which was formerly a part of Hyderabad state.



Marathwada forms the central portion of Maharashtra with Aurangabad city being located almost in the centre of the state (Fig. -1). Marathwada is one of the most backward regions of Maharashtra state. The Marathwada region lies in the upper Godavari basin. The absolute location of district is 170 35' to 200 40' North latitude and 74° 40' to 78° 19' East longitude. The study region is bounded on the North by Jalgaon, Buldhana, and Akola districts, to the North-east by Yavatmal district, to the East by Kamareddi, Nizamabad and Adilabad districts of Andhra Pradesh, 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 extent is 394 Kilometers and North-south extent is 330 Kilometers. The total geographical area of district is 64434 Sq. Km. which constitutes 20.95 percent of the state and its population is 1.87 cores which is 16.66 percent of the state (2011). Administratively area is divided into eight districts and76 tehsils.

Objectives:

The main objectives of this paper are as follows

1) To examine the impact of irrigated area on agricultural productivity

2) To estimate the rate of change in composite index of agricultural productivity in relation to change in percentage of irrigated area.

Data collection and Methodology:

The present study is based on secondary data source. In order to meet these objectives the relevant information and data regarding irrigated area, area under selected crops, per hectare yield and production of selected crops collected from Socio Economic Review and District Statistical Abstract of Districts in Marathwada region and Season and Crop Reports for the year of 2005-2010. The data regarding population is collected from census of Maharashtra, the information about geographical area is collected from Gazetteers.

Collected rough data are processed. To determine agricultural productivity Bhatia's method (1967) of weighted average yield index and Shafi's method (1972), is used. Eight crops are selected for this purpose. The index value of Bhatia's method and Shafi's method is taken into consideration for the calculation of composite index.

To examine the impact of irrigated area agricultural productivity the Pearson's Coefficient of Correlation technique has been utilized. The degree of relationship by considering percentage of irrigated area as an independent variable 'X' and per hectare yield as dependent variable 'Y' is measured. The functional form of linear relationship has been measured by using regression equation Y on X i.e. $y = a + bx$. The rate of change in dependent variable has been estimated with the help of 'b' coefficient, which is the line of best fit. The 't' test is used with the view to understand the confidence level. Analysis of the study has been made with help of the statistical techniques and on the basis of this results and conclusion are drawn.

Discussion:

Composite Index of Agricultural Productivity

The table 1 shows that the composite index indicates that high level of agricultural productivity is observed in Aurangabad and Parbhani district, due to fertile soil in Godavari basin, development of irrigation facility and other technological factors. These two districts covers 25.43 percent of total Geographical area of Marathwada region and shares 25.96 per cent of net sown area. The modetate level of Productivity is found in Latur and Hingoli districts, which covers 18.34 percent of total Geographical area, contribute 18.66 percent of net sown area. The low agrrigate productivity is found in Jalna, Beed , Nanded and Osmanabad district. These districts covers 55.38 per cent of net sown area, it is low in Jalna, Beed and Osmanabad districts, because inadquate, rainfall it is low in Nanded, due to lower development of irrigation facility.

Table - 1: Composite Index of Agricultural Productivity (2005-06 to 2009-10)

District	2005 -06 to 2009 -10		
	PI Shaffi's	EiBhatia's	Composite Index
Aurangabad	71.65	115.70	93.68
Jalna	30.79	115.2	73.00
Parbhani	91.71	104.65	98.18
Hingoli	63.32	110.94	87.13
Beed	68.61	92.37	80.49
Nanded	63.95	79.86	71.91
Osmanabad	62.13	85.79	73.96
Latur	71.37	103.15	87.26

Source: Complied by Researcher, on the basis of Socio economicc Review and district Statistical Abstract of all district of marathwada region 1981-82 to 1985-86 and 2005-06 to2009-10, and Chief Statistical Office of Agriculture Maharashta state Pune.

Impact of Irrigated Area on Agricultural Productivity

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

1. The moderate positive correlation is observed in between percentage of 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 (r2) 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 Marathwadaregion 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.

Table - 2: 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 researcheron 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.

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 2. 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.

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 √1-r2, where SE (Y) is the standard deviation of residuals (Y-y); and 'SY' is the standard deviation of 'Y'.

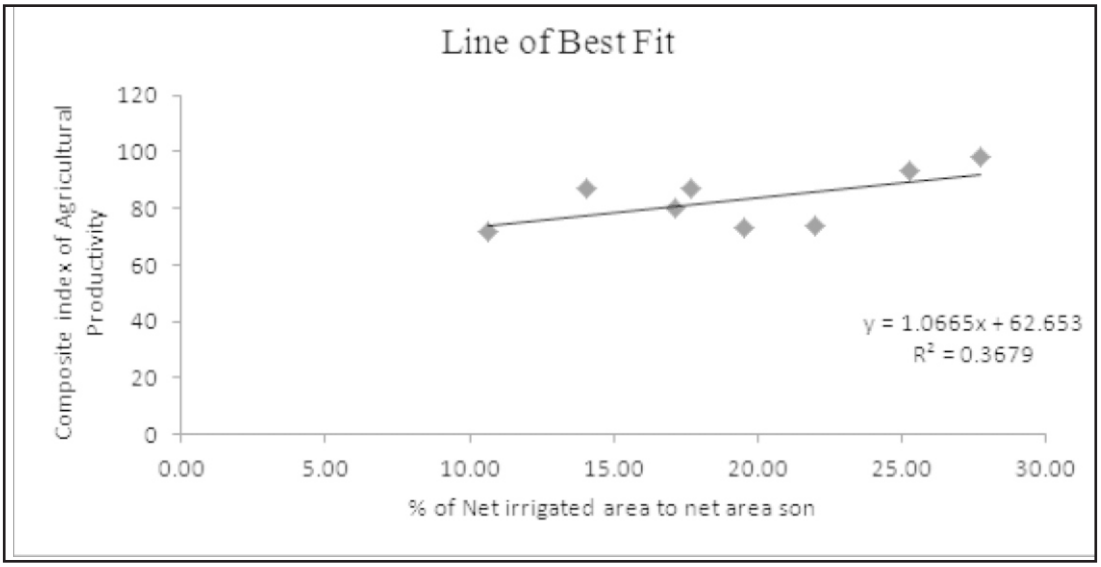


Figure 2

The confidence intervals of the predicted values are worked out at Y ± 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.

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

In this context it has been observed that the predicted values (given in table-) of 5 out of 8 districts in the present study lie within the range of ± SE and 3 within ± SE to ± 2 SE. Now the obvious inference is that the 62.5 per cent of the total number of observation (n is 8) the regression is a good indicator meaning thereby that the

Table -3: Residuals from Regression of Composite Index of Agricultural Productivity

Sr. No,	District	yi	Yi - yi
1	Aurangabad	89.59	4.09
2	Jalna	83.47	- 10.47
3	Parbhani	92.23	5.95
4	Hingoli	77.67	9.46
5	Beed	80.95	- 0.46
6	Nanded	74.01	- 2.10
7	Osmanabad	86.09	- 12.13
8	Latur	81.49	5.77

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.

variations in agricultural productivity of districts in Marathwada region is the function of the variations in net irrigated area. In the case of other districts with residuals between > ± SE to ± 2 SE the situation is different because here the regression is a poor indicator. It clearly indicates that these are the districts whom the influence of variables other than the independent one. The variations in agricultural productivity of districts in the latter case may be due to the variation in soil, variation in use of fertilizer and variation in consciousness of farmers

Conclusions

This study reveals that there is medium positive correlation between percentage of irrigated area agricultural productivity of districts of Marathwada region. 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 (r2) 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. The percentage of irrigated area is found to be more effective than the other variables considering agricultural productivity. The functional form of linear relationship of 'Y' on 'X' found to be at $y = 62.65 + 1.066x$. 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. Therefore it is to be stated that the increase in percentage of irrigated area is helpful to improve agricultural productivity, where rainfall is inadequate and unpredictable. Public awareness should made regarding water conservation, drip irrigation and proper utilization of water in the districts to increase irrigated area in turn to increase agricultural productivity.

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