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Impact of Net Irrigated Area on Per Hectare Yield of Sugarcane in Pune District: A Geographical Analysis

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Abstract

Irrigation plays an important role in agricultural productivity, particularly in regions where rainfall is uncertain, irregular and unevenly distributed. Sugarcane is one of the major commercial crops of Maharashtra and requires a large and regular supply of water throughout its growth period. The present study examines the impact of net irrigated area on per hectare yield of sugarcane in Pune District from a geographical perspective. The study is based on secondary data collected from the Agriculture Department, Socio-Economic Review and District Statistical Abstract of Pune District for the period 2009–2024. The study aims to analyse the spatial variation in per hectare sugarcane yield and examine the impact of net irrigated area on per hectare yield of sugarcane of Pune District. Pearson's coefficient of correlation has been used to measure the relationship between net irrigated area and per hectare yield. In 2024-25, the district recorded a total net irrigated area of 3,84,272 hectares and an average sugarcane yield of 103 tonnes per hectare. Baramati recorded the highest yield of 122 tonnes per hectare, followed by Shirur and Indapur, while Velhe recorded the lowest yield of 78 tonnes per hectare. The correlation coefficient of +0.712 indicates a high positive relationship between net irrigated area and per hectare yield. The coefficient of determination (R^2 = 0.5069) shows that approximately 50.69 per cent of the variation in sugarcane yield is explained by net irrigated area, while the remaining variation is influenced by other geographical, climatic and agricultural factors. The study highlights the importance of efficient irrigation management for improving sugarcane productivity and promoting sustainable agricultural development in Pune District.

Keywords: *Net Irrigated Area, Sugarcane, Per Hectare Yield, Irrigation, Agricultural*

Introduction

Agriculture occupies an important position in Indian economy. Cotton and sugarcane are one of the most important commercial crop produced in India. Sugarcane is most benefited commercial crop. Sugarcane cultivation and development of sugar industry runs parallel to the growth of human civilization and is as old as agriculture. The importance and use of sugarcane and sugar in the country's socio-economic milieu is deep rooted and immense. In the current day rural economy set up sugarcane cultivation and sugar industry has been focal point for socio-economic development in rural areas by mobilizing rural resources, generating employment and higher income, transport and communication facilities (M.F. Pathan, 2017). Irrigation plays an important role in Indian agriculture due to uncertain, unreliable, irregular, variable, seasonal and unevenly distribution 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 & Reddy, 1992). The agriculture in Pune district is depended on monsoon. If rainfall is scare it results into crop failure. Sugarcane is one of the major commercial crops of Maharashtra and its production is strongly influenced by the availability and distribution of irrigation facilities. Sugarcane requires a large and regular supply of water throughout its growth period; therefore, changes in the net irrigated area can have a significant influence on its productivity. A geographical study helps to understand the spatial variations in irrigation facilities and sugarcane yield among different tahsils of Pune district. Therefore, attempt is made here to examine the "Impact of Net Irrigated Area on Per Hectare Yield of Sugarcane in Pune District: A Geographical Analysis"

Study Region:

For the present investigation Pune district is selected as a study region. The Pune district is one of the agricultural district in the Maharashtra state. Geographically Pune district is located between 17º 54' N to 19º 24' N latitude and 73º 19' E to 75º 10' E longitude. The total geographical area of the Pune district is 15,642 sq.km. The proportion of area of Pune district as compare to Maharashtra is about five (5.08 %) per cent. The district is surrounded by Ahamadnagar district to

the north and east, Pune district in the southeast, Satara district in the south, Raigarh district in the west and Thane district in the northwest.

It is administratively sub-divided into 14 tahsils namely, Ambegoan, Baramati, Bhor, Daund, Haveli, Indapur, Junnar, Khed, Mawal, Mulshi, Pune City, Purandar, Shirur, Velhe etc. According to the 2011 census, Pune district has 14 tehsils having 35 towns and 1877 villages. The Pune district is a part of Bhima basin. The average annual rainfall in the district is 722 mm. Due to uneven physiography; rainfall is unequally distributed in study region.

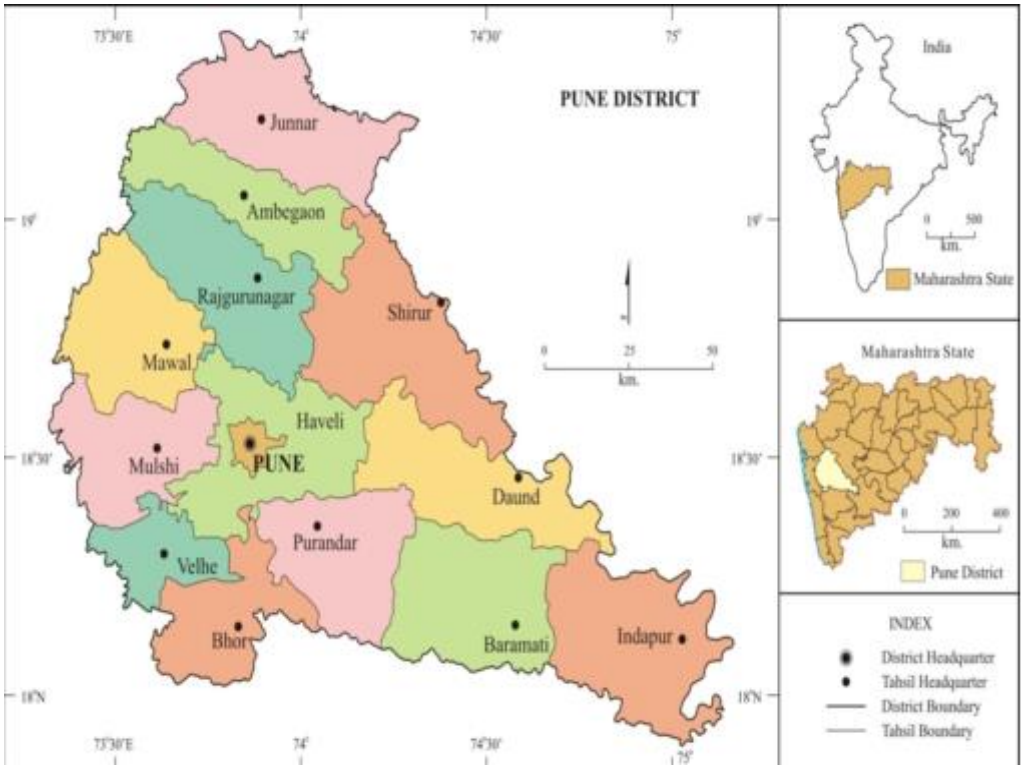

Fig. No. 01

Objective:

The main objectives of this paper are as following,

1) To study the per hector yield of sugarcane in the study region
2) To examine the impact of net irrigated area on per hector yield of sugarcane in Pune district

Database and Methodology:

The study was conducted in the Pune district in Maharashtra state. For the purpose of the study, only secondary information was collected from different sources. The secondary data like information related to net irrigated area, per hector yield of sugarcane and geographical information collected through Agriculture Department and Socio-Economic review and district Statistical abstract of Pune District from the year 2024-25 used. To examine the impact of irrigation on the per hector yield of Sugarcane, Pearson's Coefficient of Correlation technique has been utilized. The degree of relationship by considering net irrigated area as an independent variable 'X' and per hector yield of sugarcane as dependent variable 'Y' is measured.

Impact of Net Irrigated Area on Per Hector Yield of Sugarcane

The irrigation is an important factor influencing sugarcane cultivation and productivity, particularly in a region characterized by variable rainfall conditions. The table no. 01 presents the relationship between net **irrigated area and per hectare yield of sugarcane in the different tahsils of Solapur district.** It is show considerable spatial variation in both the extent of net irrigated area and per hector yield of sugarcane among the tahsils.

Table No. 01
Net Irrigated area and Per Hector Yield of Sugarcane in Pune District-2024-25

Sr.No	Tahsils	2024	Per Hector Yield of Sugarcane (Tonne)
1	Junnar	52775	99
2	Ambegoan	28116	99
3	Shirur	69962	119
4	Khed	18839	92
5	Mawal	3830	99
6	Mulshi	1808	79
7	Haveli	17512	110

8	Daund	48876	99
9	Puranda	30520	97
10	Velhe	636	78
11	Bhor	2070	103
12	Baramati	56960	122
13	Indapur	52369	115
14	District	384272	103

Source: *Compiled by Researcher on the basis of Agriculture Department and Socio-Economic review and district statically abstract of Pune District 2024-25*

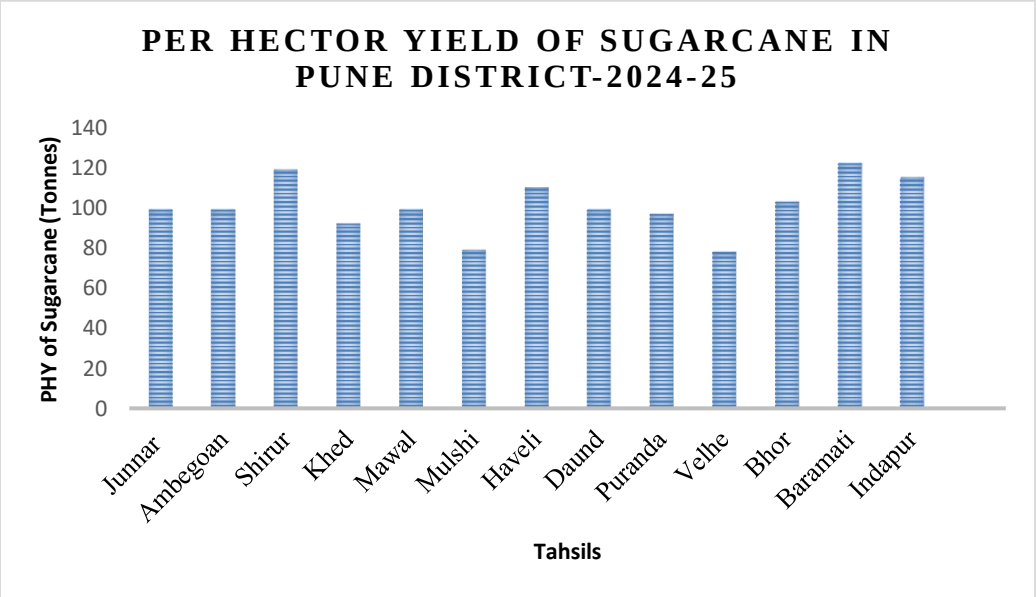

Fig. No. 02

According to table no. 1, the **high level** of per hectare sugarcane yield is observed in **Baramati** tahsils i.e. **122 tones/ha**, followed by Shirur (**116 tones/ha**,), Indapur (**115 tones/ha**,). The relatively higher per hector yield indicates favorable agricultural conditions and better availability or utilization of irrigation for sugarcane cultivation. The **low level** per hector yield of sugarcane is observed in Velhe tahsil i.e. **78 tones/ha,** followed by Mulshi (**79 tones/ha**,), Khed (**92 tones/ha**,), and Purandar (**97 tones/ha**,). The very low yield in Velhe, despite an irrigated area of **636 hectors**. The low per hectare yield of sugarcane in **Velhe, Mulshi, Khed and Purandar tahsils** can be attributed to several geographical, climatic and agricultural factors. In **Velhe**, the yield is only **78 tonnes/ha,** despite having about **636 hectares of irrigated area.** This indicates that irrigation play an important role in per hectare yield of sugarcane in study region.

Table No. 02
Impact of Net Irrigated area on Per Hector Yield of Sugarcane in Pune District-2024-25

Sr. No	Tahsils	2024	Per Hector Yield of Sugarcane (Tonne)
1	Junnar	52775	99
2	Ambegoan	28116	99
3	Shirur	69962	119
4	Khed	18839	92
5	Mawal	3830	99
6	Mulshi	1808	79
7	Haveli	17512	110
8	Daund	48876	99
9	Puranda	30520	97
10	Velhe	636	78
11	Bhor	2070	103
12	Baramati	56960	122
13	Indapur	52369	115
Coefficient of correlation			0.712
Coefficient of determination			0.5069

The high positive correlation is observed in between net irrigated area and per hector yield of sugarcane in the tahsils of Pune district. The coefficient of correlation in this regard is +0.712. The degree of linear association between these two variable obtained by using the coefficient of determination (r2) is found to be at 0.5069, which reveals that the independent variable (X) i.e. net irrigated area are explaining 50.69 per cent of the total variations in dependent variable (Y) i.e. per hector yield of sugarcane of Pune district. It is good explanation because 50.69 per cent of variation in „Y" per hector yield of sugarcane of Pune district to be influenced by the variable „X" i.e. net irrigated area and about 49.31 percent of variation is left to be influenced by other variables.

Conclusion and suggestion:

The present study concludes that net irrigated area has a significant positive influence on the per hectare yield of sugarcane in Pune District. Considerable spatial variation is observed in both irrigation availability and sugarcane yield among the tahsils. Baramati recorded the highest per hectare yield of 122 tonnes, followed by Shirur and Indapur, whereas Velhe, Mulshi, Khed and Purandar recorded comparatively lower per hector yields. The low per hector yield in Velhe, despite having irrigated area, indicates that irrigation availability alone does not determine sugarcane productivity; efficient utilization of water and other agricultural and geographical factors are also important.

The Pearson correlation coefficient of +0.712 demonstrates a high positive relationship between net irrigated area and per hectare sugarcane yield. The coefficient of determination ($R^2 = 0.5069$) indicates that net irrigated area explains about 50.69 per cent of the variation in sugarcane yield, while approximately 49.31 per cent is associated with other factors. Thus, improvement in irrigation facilities, together with appropriate agricultural practices, can contribute substantially to increasing sugarcane productivity in Pune District.

The empirical results suggest that, there is an urgent need to use of modern irrigation technology like drip irrigation in low and moderate per hector yield of sugarcane region. It is also suggested that, High-yielding and locally suitable sugarcane varieties should be promoted to increase per hector yield of sugarcane and Farm ponds, watershed development, rainwater harvesting, and groundwater recharge measures should be promoted to ensure sustainable water availability.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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