

IMPACT OF TEMPERATURE INCREASES ON AGRICULTURE IN SOLAPUR DISTRICT: A GEOGRAPHICAL ANALYSIS

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Article Info	ABSTRACT
Article History: Received: 18th Sep 2025 Accepted: 02nd Oct 2025 Published: 17th Oct 2025 Keywords: Temperature, Agricultural sector	Agriculture is a primary economic activity which includes not only cultivation but livestock ranching, dairy farming, lumbering, irrigation and most of other activities. "Agriculture covers those productive efforts by which man settled on land, seeks to make use of and if possible, accelerate and improve upon the natural genetic or growth processes of plants and animal life, to the end that these processes will yield the vegetable and animal products needed and wanted by man" (Prithwish Roy, 2004). Increased temperatures have significant negative effects on agriculture, such as reduced crop yields due to heat stress, accelerated plant development, and increased water evaporation and soil moisture stress. These effects are particularly pronounced for foundational crops like wheat, rice, and maize. Furthermore, higher temperatures contribute to the proliferation of agricultural pests and diseases, further threatening food production and leading to increased water scarcity and soil degradation. An attempt has been made to study impact of temperature increases on agriculture in Solapur district.

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INTRODUCTION:

The agriculture occupies most important place in Indian economy. It is crucial in order to delineate agriculturally developed and under developed areas within the region. Agricultural development implies “maximum economic utilization of land and fertilizer which in conjunction with multi-cropping land to increased yield and income from the land” (Shinde S. D. 1980). In fact, agricultural change cannot be understood separately from the general process of development.

Climate change adversely affects agriculture through increased temperatures, altered rainfall patterns, and extreme weather events, which reduce crop yields, increase pests and diseases, degrade soil, and threaten food security. While increased CO₂ can offer some benefits to certain crops, the overall impact is negative, with developing countries being particularly vulnerable. Adapting agriculture through improved infrastructure, better data and forecasting, and sustainable practices is crucial to mitigate these negative impacts and ensure global food security.

Shifts in rainfall, including more intense droughts and floods, negatively affect soil moisture and water availability for crops. Increased frequency and intensity of heatwaves, storms, and cyclones directly damage crops, livestock, and agricultural infrastructure. Climate change can shift the geographic distribution and increase the incidence of agricultural pests and diseases, leading to greater crop losses. Climate extremes contribute to soil salinization, erosion, and decreased soil fertility, while also affecting the quality of irrigation water. Changes in atmospheric composition can directly affect plant photosynthesis, transpiration, and overall growth rates, further reducing yields.

Impacts of Temperature on Agriculture:

Increased temperatures from climate change negatively impact agriculture by shortening crop development cycles, reducing yields, interfering with pollination and fertilization, and increasing water needs through higher evapotranspiration. This leads to reduced grain production, particularly in already warm regions, affecting crop quality, soil health, and water availability. Extreme heat also causes physiological damage to plant cells, decreases chlorophyll content, and can inhibit seed germination.

Specific Effects of Elevated Temperatures

- **Reduced Yield and Quality:**

Higher temperatures cause crops to mature faster, resulting in less grain. Reproductive tissues are particularly sensitive, leading to poor pollen viability, reduced fertility, and sterile seeds.

- **Water Stress:**

Increased temperatures lead to higher rates of evapotranspiration (evaporation from soil and transpiration from plants), which increases water demand and can exacerbate water deficits.

- **Physiological Damage:**

Heat stress can damage plant cells and reduce chlorophyll content, negatively impacting photosynthesis and overall plant growth.

- **Impaired Growth and Development:**

Heat stress can inhibit seed germination, reduce plant height and biomass, and shorten the grain-filling period.

- **Impact on Pollination:**

High temperatures, especially during the flowering stage, can disrupt pollen-pistil interactions and reduce the ability of pollen to swell and thecae (part of the anther) to dehisce, leading to floret sterility in some crops like rice.

An attempt has been made to study impact of temperature increases on agriculture in Solapur district.

STUDY AREA:

The Solapur district is one of the most important district of Maharashtra state. The Solapur district lies entirely in the Bhima-Sina-Man basins. The Solapur district is located between 17° 34'0'' North latitudes and 18° 48'40'' North latitudes and 74° 34'0'' East longitudes and 76° 19'0'' East longitudes. The average height of Solapur district from Mean Sea Level (MSL) varies from 500 meter to 800 meter. The Solapur district has an irregular shape.

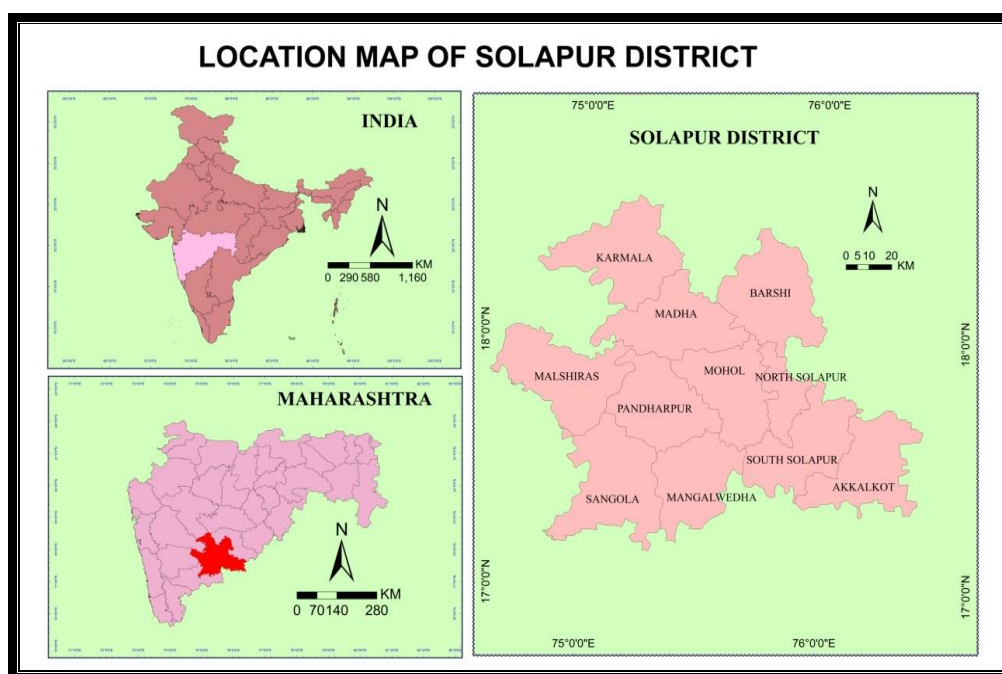


Fig. 1

The total Geographical area of the Solapur district as per 2011 census is 14895.40 sq.kms out of which 348.80 sq.kms. (2.34%) is urban and 14546.60sq.kms (97.66%) is rural. The East-West length of the district is about 200 km. and North-South is about 150 km. Its proportion as

compared with Maharashtra state area is about 4.84 percent. Within the region under study, Malshiras is the largest tahsil in area and the lowest is North Solapur tahsil. (Socio-economic review and District Statistical abstract 2010-11).

OBJECTIVE:

The present study has following specific objective.

1. To study importance of temperature on agriculture.
2. To study impact of temperature increases on agriculture in Solapur district.

DATA COLLECTION AND METHODOLOGY:

The proposed research paper based on secondary data. The secondary data is collected from District Gazetteers, Socio-Economic Review of Solapur district, and census. The data processed and analyzed by using different cartographic techniques, statistical and quantitative techniques, etc.

INTERPRETATION:

Temperature plays a critical role in agriculture, as optimal temperatures are essential for plant growth, development, and reproduction, while extreme temperatures can severely damage crops, disrupt pollination, and lead to reduced yields. Temperature fluctuations also impact the water cycle and increase the presence of pests and diseases, forcing farmers to adopt resilient crop varieties and management practices to ensure food security. The economic viability of farming and food affordability are directly affected by temperature changes, highlighting the need for sustainable adaptation strategies to cope with varying climates.

The following table shows the average temperature distribution of Solapur district (1991-2021).

Table No. 1 Average maximum temperature distribution of Solapur district (1991-2021)

Sr. No	Months	Average Maximum Temp. ^o C (1991)	Average Maximum Temp. ^o C (2021)	Average Maximum Temp. ^o C Change
1.	January	31.15	32.29	1.14
2.	February	33.11	34.46	1.35
3.	March	37.76	39.93	2.17
4.	April	40.21	41.12	0.91
5.	May	40.24	41.69	1.45
6.	June	33.52	35.78	2.26
7.	July	32.26	34.23	1.97
8.	August	31.49	33.12	1.63
9.	September	31.95	32.87	0.92
10.	October	33.64	35.02	1.38
11.	November	31.94	32.38	0.44
12.	December	30.84	31.55	0.71

Source: Socio-economic abstract of Solapur district 1991-2021.

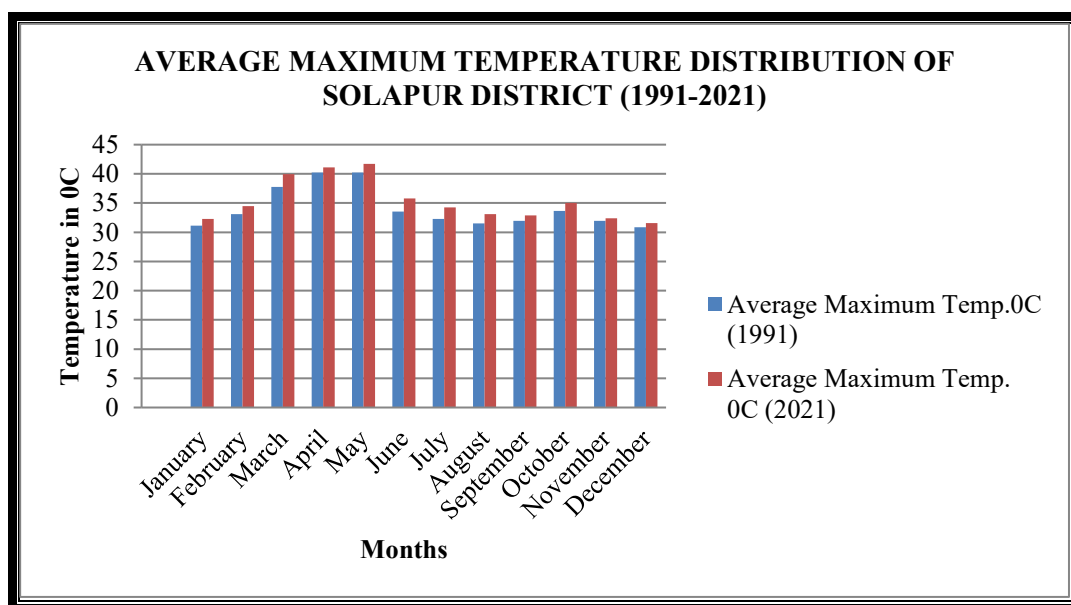


Fig. no. 2

The table no.1 and Fig. no. 2 shows the average maximum temperature distribution of Solapur district (1991-2021). Average maximum temperature data shows the temperature increases of Solapur district from 1991 to 2021. Every month from January to December average maximum temperature of 2021 year increases considering the 1991-year average maximum temperature. The months of April, September, November and December have below 1⁰ C average maximum temperature increases but remaining all months have above 1⁰ C average maximum temperature increases. The months March and June have above 20 C average maximum temperature increase. Temperature is increasing daily due to human-caused emissions of greenhouse gases, primarily from burning fossil fuels, trapping heat in the atmosphere and leading to global warming. Other factors like deforestation, agriculture, and changes in land use contribute to these emissions, while natural cycles can cause short-term variations, the long-term upward trend is driven by human activity

Increased temperatures, a key aspect of climate change significantly harm agriculture by reducing crop yields through heat stress and water loss, altering crop suitability in regions, and increasing pest and disease outbreaks. These impacts lead to lower food production, soil degradation, and can be devastating for food security, especially in developing countries. Heat stress also negatively impacts livestock productivity and fertility, and poses risks to the health of agricultural workers.

Impacts on Crops

- Reduced Yields:

High temperatures cause heat stress in plants, leading to reduced growth, leaf damage, and impaired pollen development, all of which decrease crop yield.

- Physiological Damage:

Heat can affect photosynthetic membranes, leading to ion leakage, and inhibit root growth,

making it harder for plants to absorb water and nutrients.

- Flowering and Pollination Disruption:

Extreme heat during critical flowering stages can prevent seed development or reduce the number of grains.

- Altered Physiology:

High temperatures can change gene expression, affecting carbohydrate metabolism, starch, and sucrose production in crops.

CONCLUSION:

Increased temperatures from climate change negatively impact agriculture by shortening crop development cycles, reducing yields, interfering with pollination and fertilization, and increasing water needs through higher evapotranspiration. The temperature is increasing daily due to human-caused emissions of greenhouse gases, primarily from burning fossil fuels, trapping heat in the atmosphere and leading to global warming. Other factors like deforestation, agriculture, and changes in land use contribute to these emissions, while natural cycles can cause short-term variations, the long-term upward trend is driven by human activity. The average maximum temperature data shows the temperature increases of Solapur district from 1991 to 2021 and which adversely affects on agriculture sector of Solapur district.

REFERENCES:

1. Carmen (2010): *"Sustainable Agricultural Development- Concept, Principles, Eco-Efficiency, Eco-Equity, Eco-Conditioning"*. Gheorghe Asachi Technical University of Iasi, Cercetari Agronomica in Moldova. Bol. XLIII, No. 3(143)/2010, p.92.
2. Hussain Majid, (2015): *"Systematic agricultural Development"*, Rawat Publications, Jaipur, 2010.
3. Rajpati, Ram (1989): *A New Techniques of measuring agricultural productivity in Haryana India*, National publication Mumbai, pp.45-58.
4. Roy, Prithwish (2004) *'Economic Geography'- A Study of Resources*. New Central Book Agency, Kolkata-West Bengal, pp.147-148.
5. Shinde, S. D. (1980): *Agricultural Geography*, Rawat Pub., Jaipur, pp-78.
6. Singh, J. and Dhillon S.S. (2004): *Agricultural Geography*, Third edition, Tata McGraw Publishing Company Limited, New Delhi, pp-3.
7. Socio- economic Abstract of Solapur district-1990-91 to 2021.
8. Tipe, Harish (2010): *"Geographical analysis of agricultural technology in Solapur district"* unpublished thesis.
9. Tirtha, Ranjit (2002): *"Geography Of India"* Rawat Publication, Jaipur- Rajasthan, pp.131-132.