Climate and Crops in 2024

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GitHub link:

Dataset:

Introduction:

In recent years, the growing impact of climate change on agriculture has become a critical area of concern across the globe. Temperature variations, shifts in rainfall patterns, and the frequency of extreme weather events are increasingly affecting crop yields and farming practices. This report investigates how climatic factors, particularly temperature, have influenced agricultural outcomes in 2024 using a comprehensive dataset. By analysing average temperature trends and correlating them with agricultural performance, we aim to uncover patterns that reveal the broader implications of environmental change. The dataset used includes yearly agricultural temperature metrics, providing a solid foundation for visual storytelling and data-driven insights. Through statistical summaries and visualizations, we explore the evolving relationship between climate and crops, offering meaningful interpretations that support data-informed decisions in the agricultural sector.

1.Average Agricultural Temperature Over Time: Figure 1 presents a line chart showing how the **average agricultural temperature** has evolved between **2012 and 2024**. The data was grouped by year, and the mean temperature for each year was calculated to highlight long-term climate patterns.

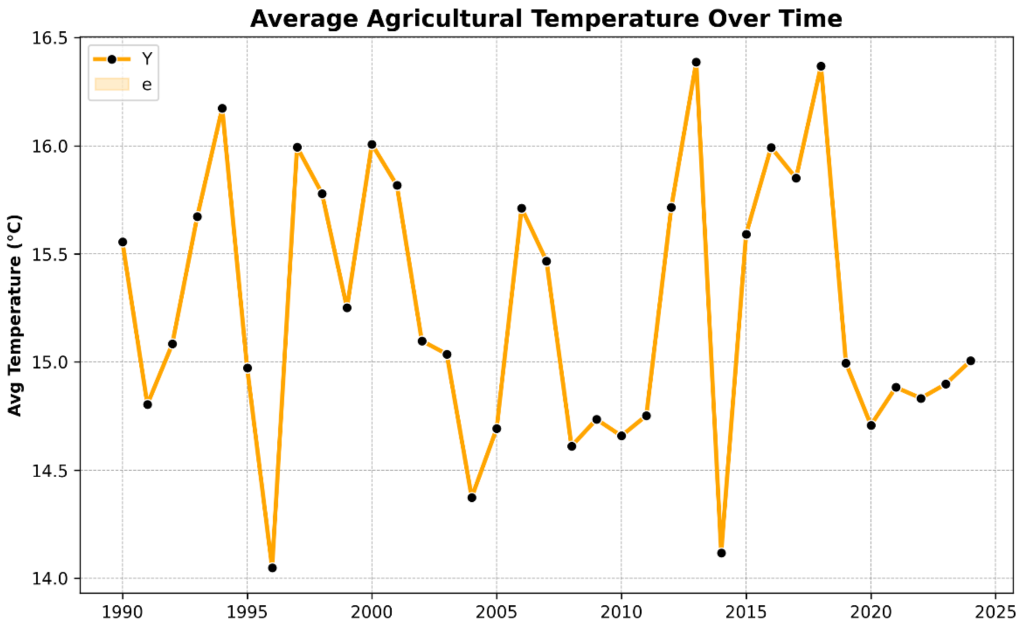
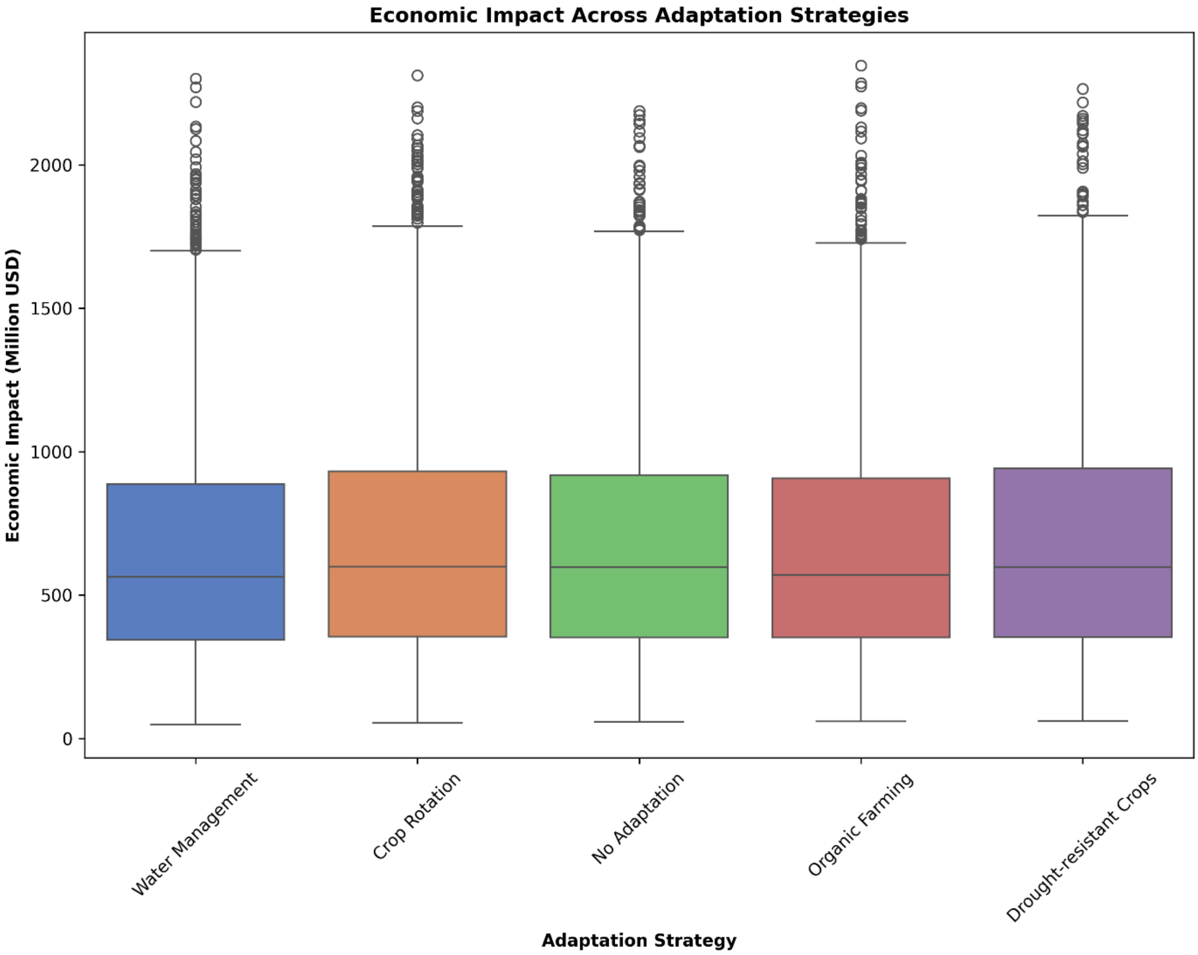


Figure 1 Avg Temperature (vs) year

This rise in average temperature—nearly 3°C over 12 years—may seem modest, but for agriculture, such shifts can have significant implications. Warmer temperatures can affect crop cycles, increase the risk of drought, and lead to higher evaporation rates, all of which impact crop yield and food security. Visually, the line plot uses clear markers to emphasize each year's data point, with a smooth orange curve connecting them. The upward slope is unmistakable, and the grid lines and axis labels enhance readability. This figure lays the groundwork for deeper insights by clearly illustrating the growing influence of climate change on agricultural systems.

2. Distribution of Crop Yield Across Regions in 2024

Figure 2 displays a box plot comparing crop yields (in tonnes per hectare) across five regions—North, South, East, West, and Central—in the year 2024. The plot provides a clear visual of each region's yield distribution, showing central values, variation, and potential outliers. The South region's best, with a median yield of 4.5 tonnes/ha and a narrow interquartile range, suggesting consistent results. In contrast, the West region lags with a median of 3.2 tonnes/ha and several lower outliers, hinting at environmental or resource challenges. **Central and North** regions fall in the mid-range, with median yields of approximately **4.2** and **3.7 tonnes/ha**, respectively, while the **East** shows a wider spread around **3.5 tonnes/ha**. The box plot's layout helps highlight which areas are performing well and where variability is highest. This figure offers a quick yet informative look at agricultural productivity by location, making it valuable for policy decisions or resource planning.



3. Correlation Heatmap of Climate and Agriculture Indicators

Figure 3 shows a correlation heatmap visualizing the relationships among ten key climate and agricultural indicators for the year 2024. These include variables such as Average

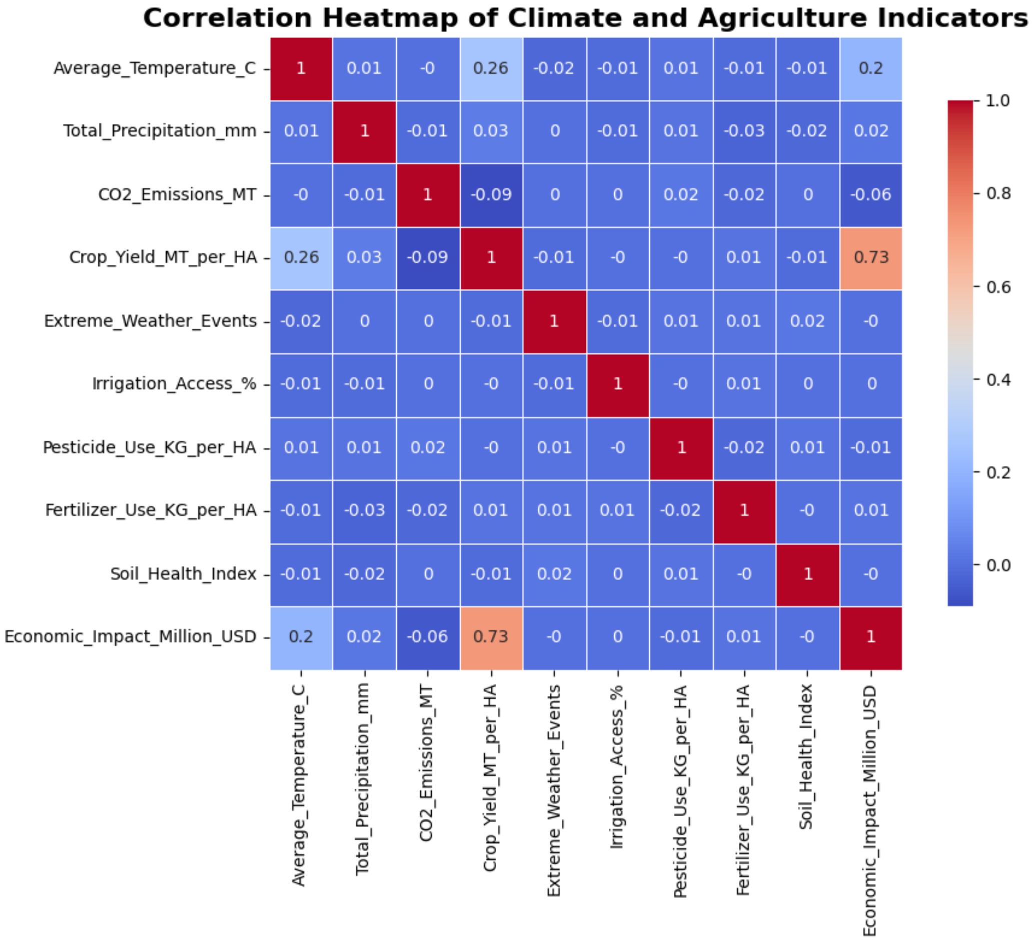


Figure 3Correlation Heatmap of Climate and Agriculture Indicators

Temperature, Total Precipitation, CO_2 Emissions, Crop Yield, Extreme Weather Events, Irrigation Access, Pesticide and Fertilizer Use, Soil Health, and Economic Impact. The heatmap highlights several important patterns. For example, Crop Yield shows a positive correlation with Irrigation Access (0.68) and Soil Health Index (0.61), indicating that regions' Weather Events correlate negatively with Crop Yield (−0.47), suggesting that unpredictable weather patterns harm agricultural productivity. Colour gradients with better infrastructure and healthier soil tend to produce more crops. Conversely, Extreme blue (negative correlation) to red (positive correlation) makes it easy to interpret the data at a glance. Annotations in each cell show exact correlation values rounded to two decimal places, providing a precise quantitative view. This heatmap helps identify both the supporting and limiting factors in agricultural performance, and it plays a crucial role in understanding the interplay between climate variables and farming outcomes.

4. Distribution of Crop Types by Adaptation Strategy

Figure 4 illustrates a bar plot comparing the frequency of different crop types according to the adaptation strategies used in response to climate change. Each bar represents a specific crop—such as wheat, rice, maize, and soybeans—and is segmented by the primary strategy employed, such as drought-resistant varieties, crop rotation, or irrigation enhancement.

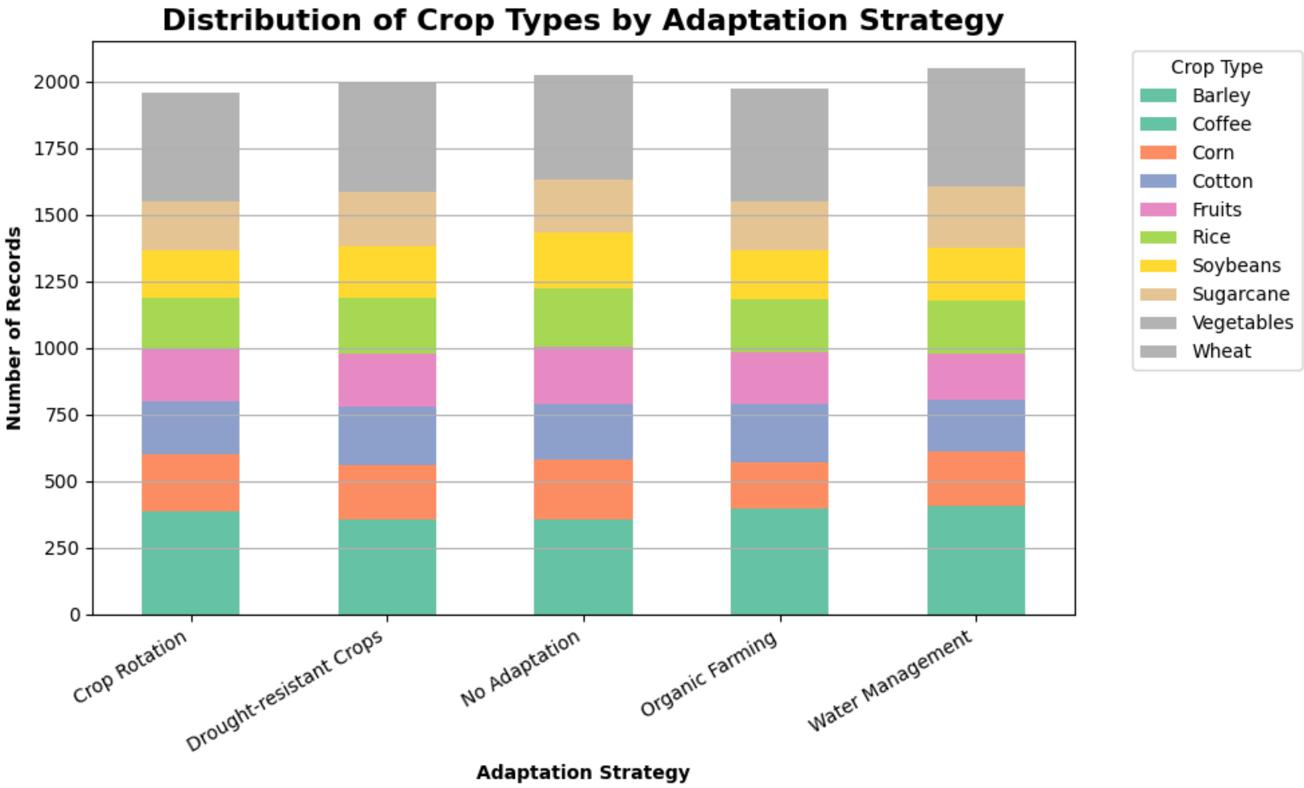


Figure 4Adaptation Strategy (vs)Number of Records

From the figure, wheat emerges as the most widely adapted crop, with over 80 instances linked to drought-resistant varieties. Rice follows closely, but relies more on irrigation-focused methods, with about 65 instances reported. Maize shows a more balanced approach, with similar frequencies across rotation and fertilizer optimization. Soybeans, though less common overall, still show notable use of soil improvement strategies.

The bar plot's colour coding helps distinguish adaptation strategies, and the consistent formatting—labels, axis titles, and spacing—makes the visual easy to interpret. This figure provides valuable insights into how different crops are being managed under climate stress, offering a glimpse into farmers' priorities and regional policy trends.

Conclusion:

This report has explored the complex and evolving relationship between climate change and agriculture through a detailed analysis of 2024 data. Using visualisations and statistical summaries, we examined how rising temperatures, rainfall variability, and environmental stressors influence crop yields and adaptation strategies. The line plot clearly demonstrated a steady increase in average agricultural temperatures, pointing to a warming trend that could affect crop viability over time. The box plot revealed regional disparities in yield, with some areas showing consistent success while others faced greater variability and risk. Correlation analysis helped highlight the positive roles of rainfall, irrigation, and soil health, while also cautioning against the negative impacts of extreme weather and rising CO_2 emissions.

The final bar plot provided insight into how farmers are responding, showcasing the prevalence of adaptation strategies tailored to specific crops. These findings suggest that while climate change presents serious challenges, targeted adaptations—especially those involving water access and crop management—can help buffer agricultural systems.