Let's discuss

Yes, Climate Change is real and has an effect on crops.

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Presentation by :

Group 5

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Introduction

Climate change poses a significant threat to global agricultural productivity. Extreme weather events, unpredictable rainfall, and temperature shifts are causing growing uncertainty in crop yields. This is particularly concerning in agriculturally dependent regions like Kenya, where these changes can have severe economic and societal consequences, impacting food security and stability.

BUSINESS OBJECTIVES

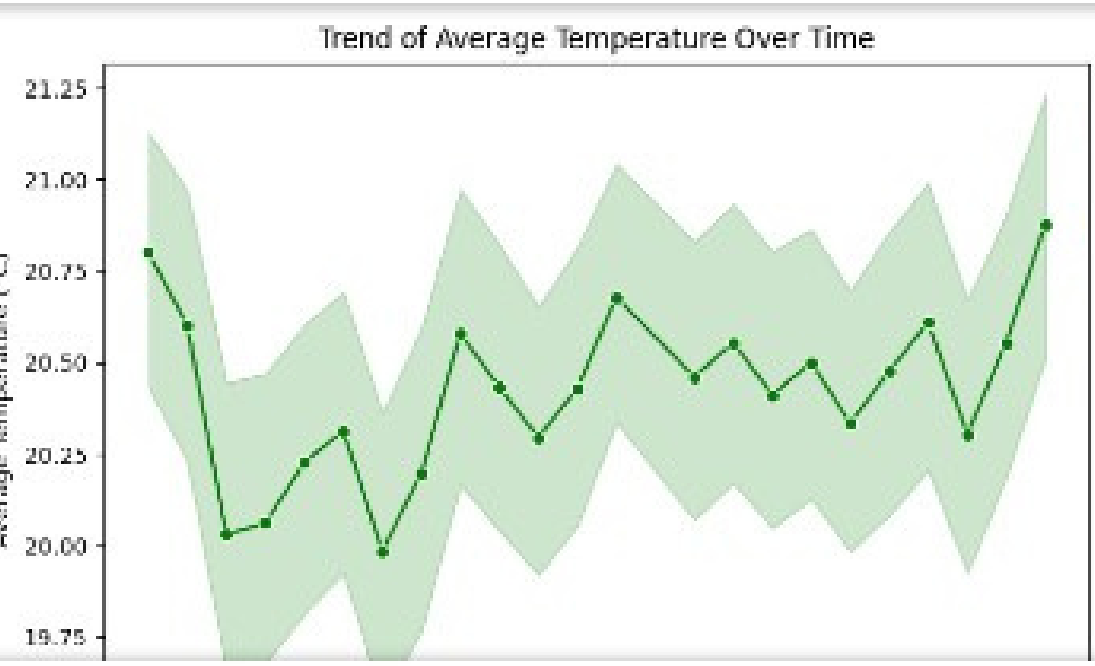
- Analyze Historical Data: Explore the impact of temperature, rainfall, and other factors on crop yields over time.
- Develop Predictive Models: Build accurate models to forecast crop yields using climate data.
- Provide Decision Support: Offer practical recommendations for stakeholders to adapt to changing conditions.
- Enhance Climate Resilience: Integrate advanced analytics into farming practices to build a more resilient agricultural sector.

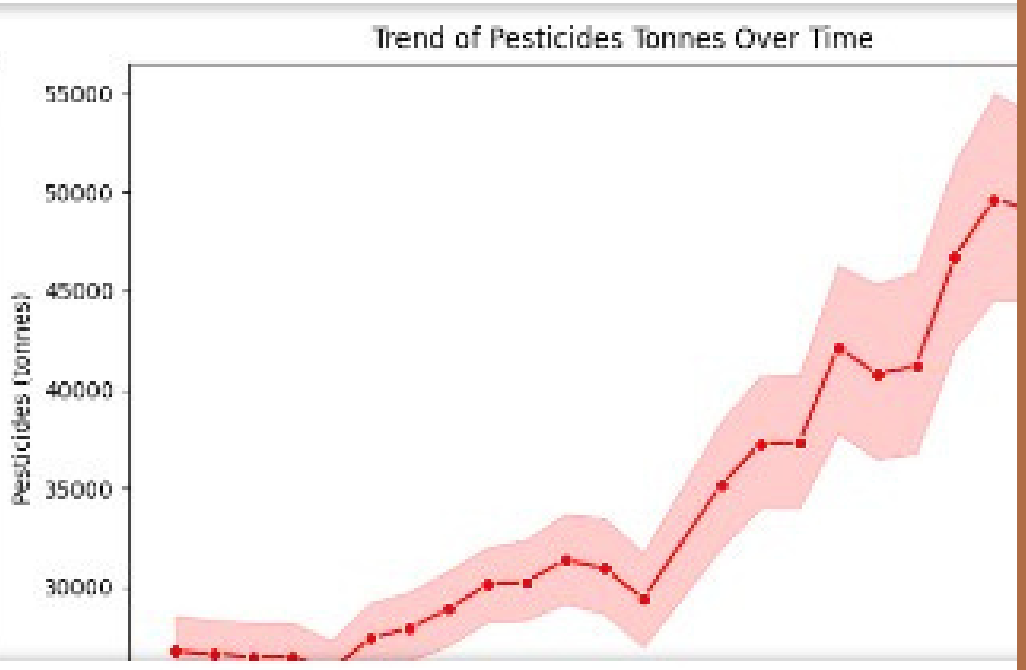
BUSINESS UNDERSTANDING

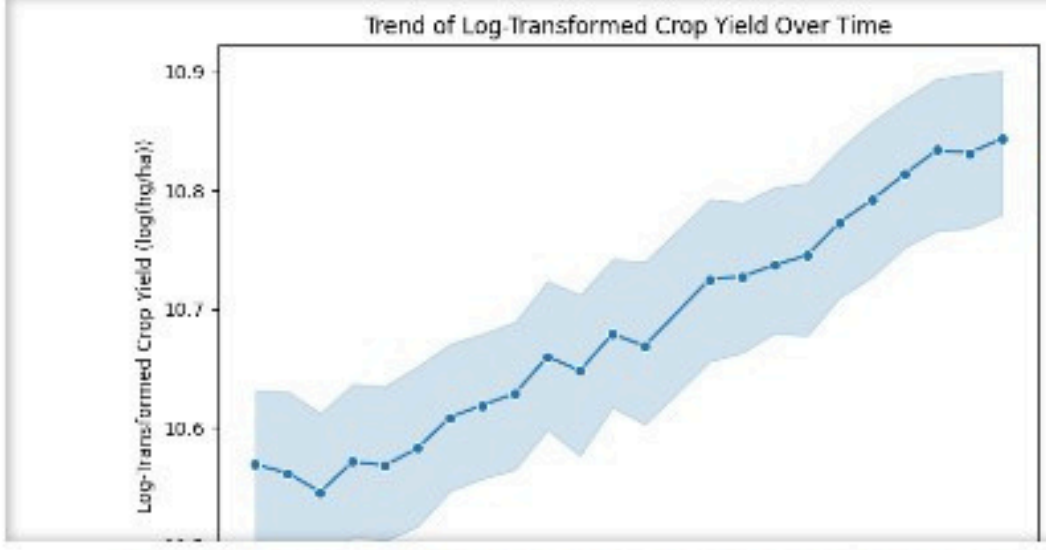
- Project addresses agricultural concerns by analyzing climate-crop yield relationship.
- Understanding climate impact on crop productivity crucial amid climate change.
- Identifying crops most vulnerable to specific climatic factors is a key goal.
- Predictive models using weather forecasts will anticipate crop yield changes.
- Aims to propose strategies enhancing agricultural resilience and sustainability.
- Benefits farmers, policymakers, and environmental advocates.

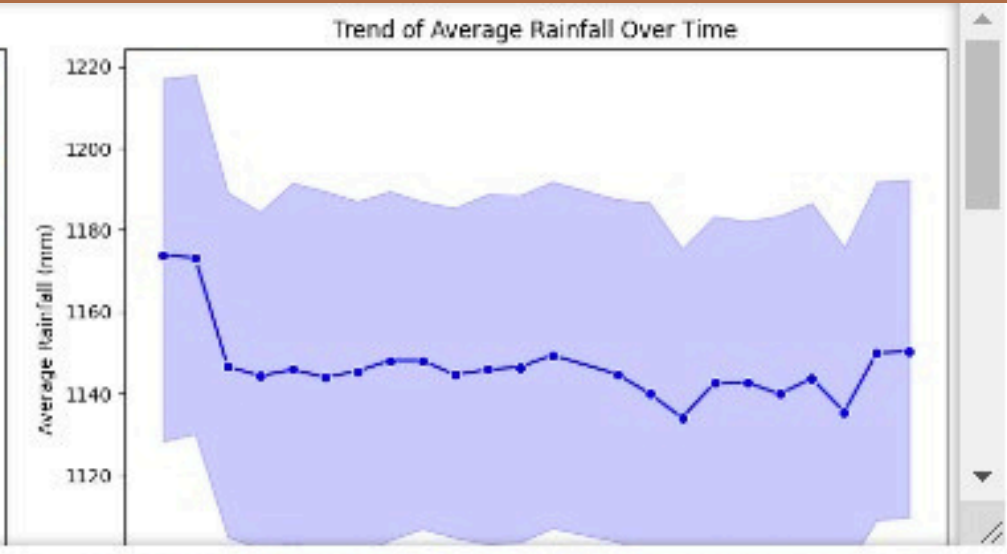
Research Questions

- How do variations in temperature and rainfall correlate with changes in crop yields?
- Which crops are most vulnerable to changes in specific climatic factors?
- Can we predict crop yield changes based on forecasted weather patterns?
- What are the most effective strategies for mitigating adverse climate impacts on agriculture?

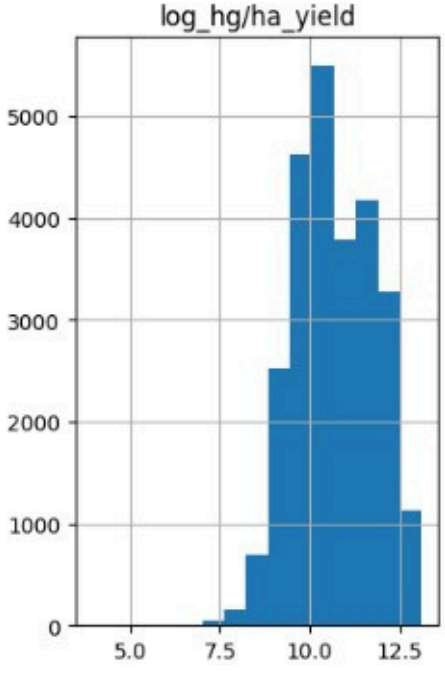


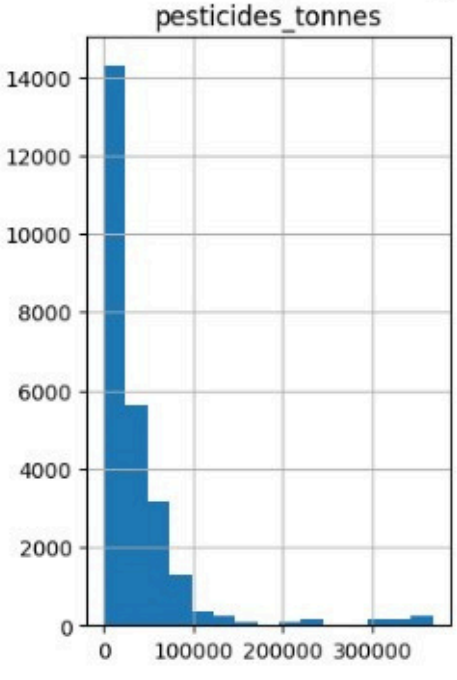


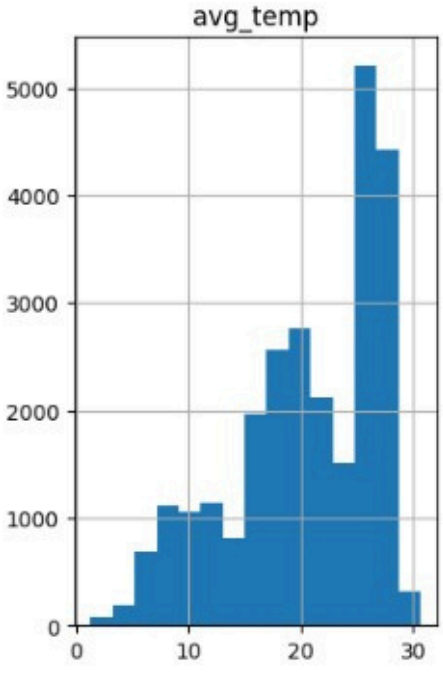


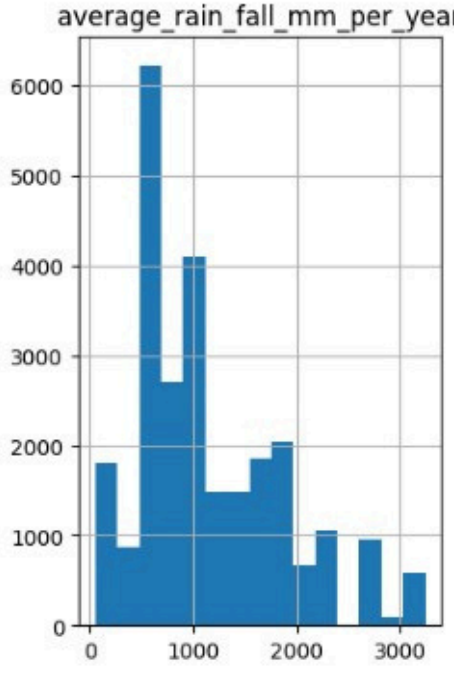


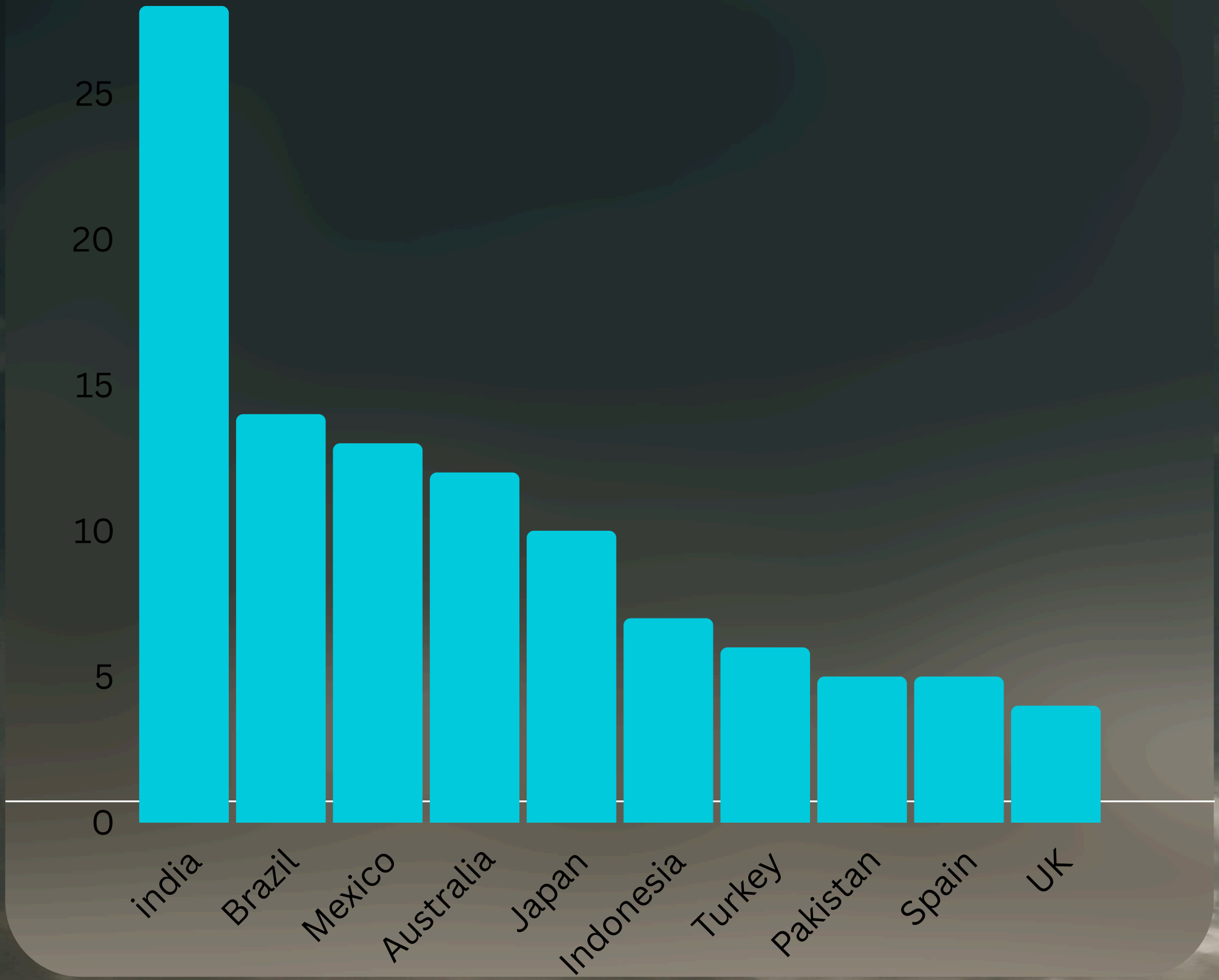
Rainfall and Temperature: These variables show their trends over time, which are crucial for understanding environmental impacts on crop production. Pesticides: The trend in pesticide usage over time can correlate with changes in agricultural practices and technological advancements in farming.







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Findings:

Crop yields varied significantly, with the highest reaching an impressive 501,412 metric tons/hectare and the lowest at a modest 50 metric tons/hectare. On average, yields were around 77,053.33 metric tons/hectare. Annual rainfall showed a wide range, from a minimum of 51 mm/year to a maximum of 3,240 mm/year, with an average of about 1,149.06 mm/year. Pesticide usage also varied greatly, ranging from 0.04 tonnes to 367,778 tonnes, with an average of approximately 37,076.91 tonnes. Temperatures fluctuated between 1.30°C and 30.65°C, averaging around 20.54°C.

Thus making India is the most frequent seen with high yields followed by Brazil and Mexico.

MODELLING

Model Development:
Several models were developed and tested, including Random Forest, Gradient Boosting, and Decision Trees. The best-performing model was the Random Forest, which achieved a Mean Squared Error (MSE) of 0.035984 and an R^2 of 0.970, indicating that it could explain about 97% of the variance in the crop yields. Feature importance analysis highlighted that specific crops like Potatoes, Cassava, and Sweet Potatoes, along with pesticide usage and average temperature, were significant predictors of yield.

Model Parameters and Tuning:
GridSearchCV was used to fine-tune the hyperparameters of the Random Forest model, ensuring the model's robustness and accuracy. The best parameters indicated an optimal mix of complexity and learning capacity, suitable for the predictive needs of the dataset.

RECOMMENDATIONS

- Deploy Machine Learning Models: Regularly update and retrain the Random Forest model with new data to keep predictions accurate.
- Consider ensemble techniques that combine several models to improve prediction accuracy.
- Utilize Remote Sensing Data: Incorporate satellite imagery and remote sensing data to assess vegetation health, soil moisture, and other climatic impacts on crop in real time.
- Develop Climate-Resilient Crop Varieties: Invest in genetic and biotechnological research to develop crop varieties that are resistant to extreme temperatures, drought, and flood conditions.
- Enhanced Water Management: Implement advanced irrigation systems that optimize water use efficiency. Promote rainwater harvesting and the construction of water storage facilities to buffer against periods of drought.

NEXT STEPS

Additional Steps:

- Collect More Data: If possible, enhance your dataset with more variables that could affect crop yields, such as soil quality data, crop variety information, and more detailed local climate data.

- Stakeholder Engagement: Work with local farmers, agricultural experts, and climatologists to refine your models and recommendations to ensure they are practical and grounded in local realities.