Analyzing Agriculture in India

Team name: Agrisol

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Introduction:

The aim of this project was to perform a comprehensive analysis of agricultural productivity, rainfall patterns, and soil erosion across various states in India. The project involved collecting, processing, and analyzing multiple datasets to gain insights into the factors influencing agricultural outcomes and environmental challenges. The primary focus was to create visualizations and reports that could aid in decision-making and provide valuable information for stakeholders in the agriculture sector.

Project Purpose:

- The project aims to analyze agricultural data to gain insights into crop yield, rainfall patterns, and soil erosion. By creating informative visualizations and reports, it assists decision-makers, farmers, and researchers in making informed choices for sustainable agriculture and resource management. The purpose is to provide a comprehensive platform that aligns data-driven insights with practical solutions for enhancing crop production, addressing environmental challenges, and promoting informed decision-making in the agricultural sector.
- This project bridges data and action, empowering stakeholders to enhance agricultural sustainability, economic prosperity, and resilience.
- In essence, the purpose of this project goes beyond data analysis and visualization. It aspires to revolutionize the way stakeholders approach agriculture by providing a holistic, data-driven approach that not only addresses immediate challenges but also contributes to the resilience and sustainability of the sector in the long run.

Existing Problem in agricultural scenario:

Agriculture faces multifaceted challenges, including unpredictable weather patterns, fluctuating crop yields, and soil erosion. These issues impact food security, livelihoods, and environmental sustainability. Traditional methods of agriculture lack precision and often lead to inefficient resource utilization.

And the existing methods which are available to solve those problems are: **Precision Agriculture, Climate-Resilient Crops, Rainfall Prediction Models, Soil Erosion Control, Integrated Pest Management, Water Management, Sustainable Farming Practices.**

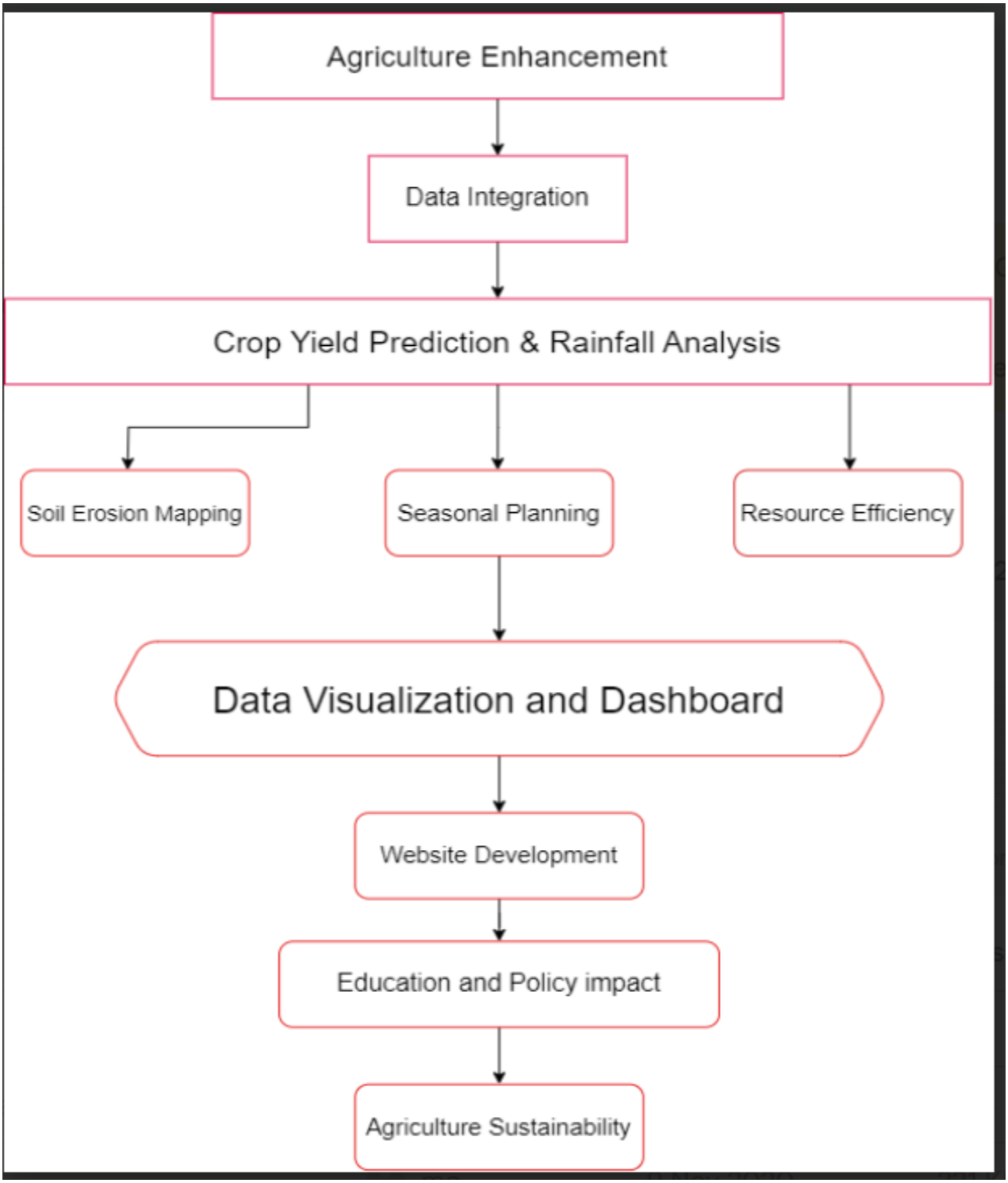
Our proposed solution:

Our project offers solutions to agricultural challenges through data-driven insights technology:

1. **Integrated Data:** Combine diverse datasets for informed decision-making.
2. **Crop-Yield Prediction:** Models forecast yields based on history and conditions.
3. **Rainfall Analysis:** Identify drought-prone areas for water planning.
4. **Soil Erosion Mapping:** Protect soil health with erosion insights.
5. **Seasonal Planning:** Optimize crops based on local climate.
6. **Resource Efficiency:** Optimal irrigation methods save water.
7. **Dashboard:** Interactive platform for data exploration.
8. **Education:** Simplify agriculture concepts for broader understanding.
9. **Policy Impact:** Support policymaking with evidence-based insights.
10. **Sustainability:** Promote eco-friendly practices for lasting impact.

In essence, this project empowers agriculture with smart data solutions for growth, sustainibility and resilience.

Flowchart of the solution:



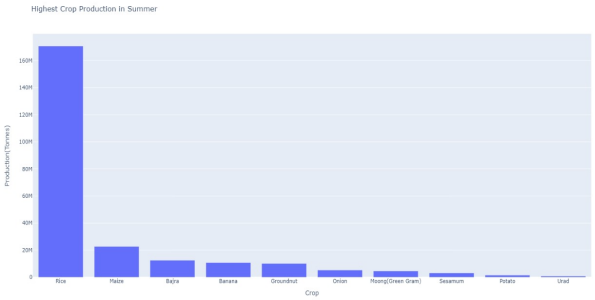
Final findings of the project:

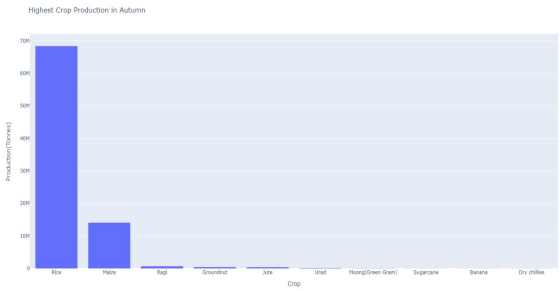
The project's key findings include:

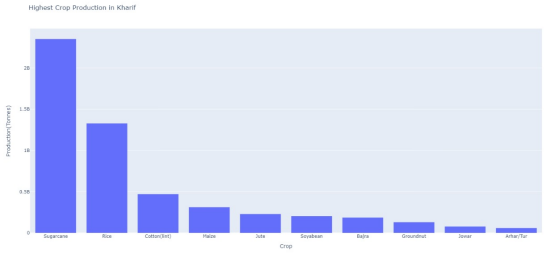
1. **Crop Production Analysis**: Identifying top states in crop production.
2. **Seasonal Impact**: Kharif and rabi seasons crucial for yield.
3. **Rainfall-Output Link**: Monsoon rainfall directly affects production.
4. **State-wise Crop Preferences**: Regional crop patterns.
5. **Soil Erosion Warning**: Vulnerable states needing soil protection.
6. **Yield vs. Population**: Higher population leads to lower yield.
7. **Optimizing Irrigation**: Improving water management methods.
8. **Crop Insights**: Specific crop dominance in states.
9. **Geospatial Crop Mapping**: Visualizing crop distribution.
10. **Dashboard & Reports**: Centralized insights for decision-makers.

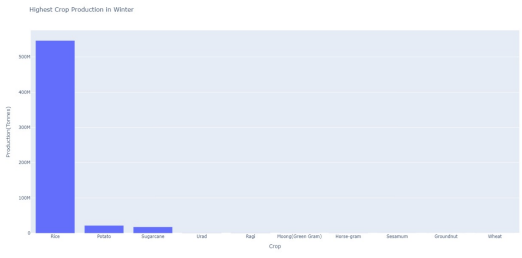
These findings aid sustainable agricultural planning and development.

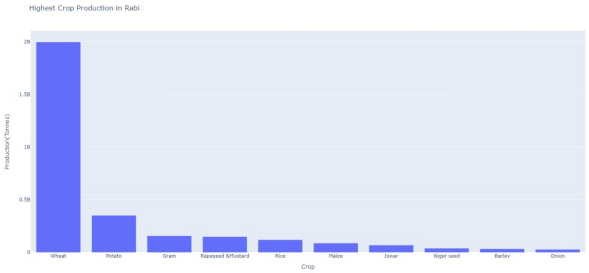
Some screenshorts of our project are:

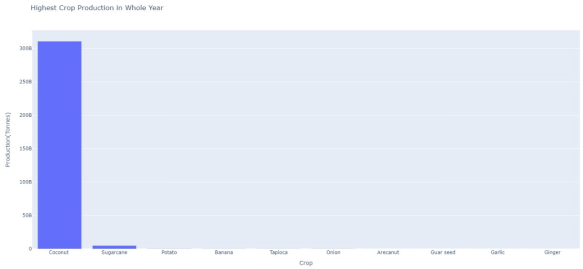


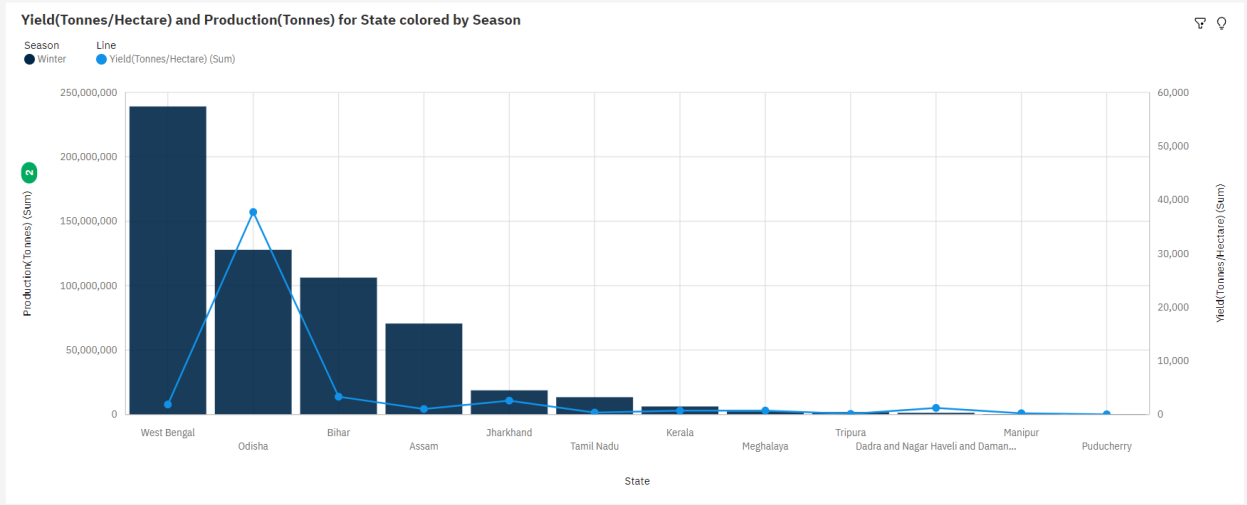


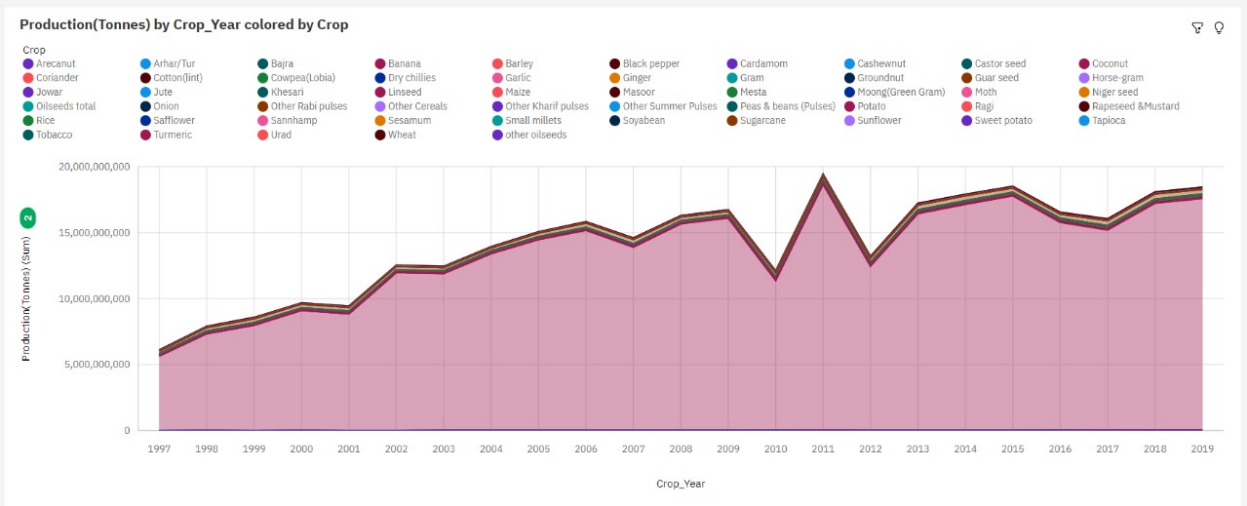


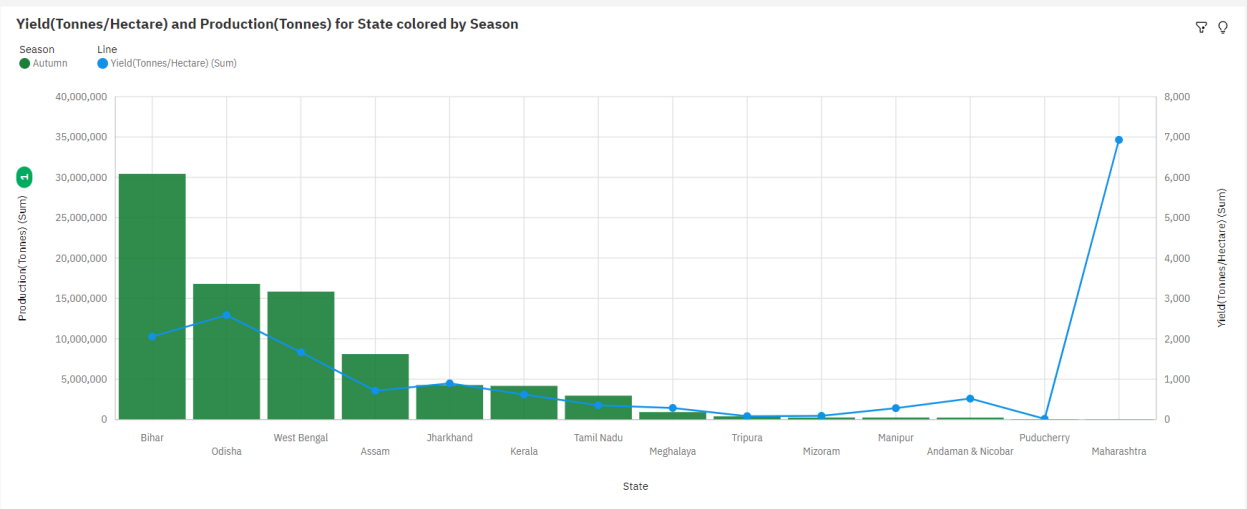


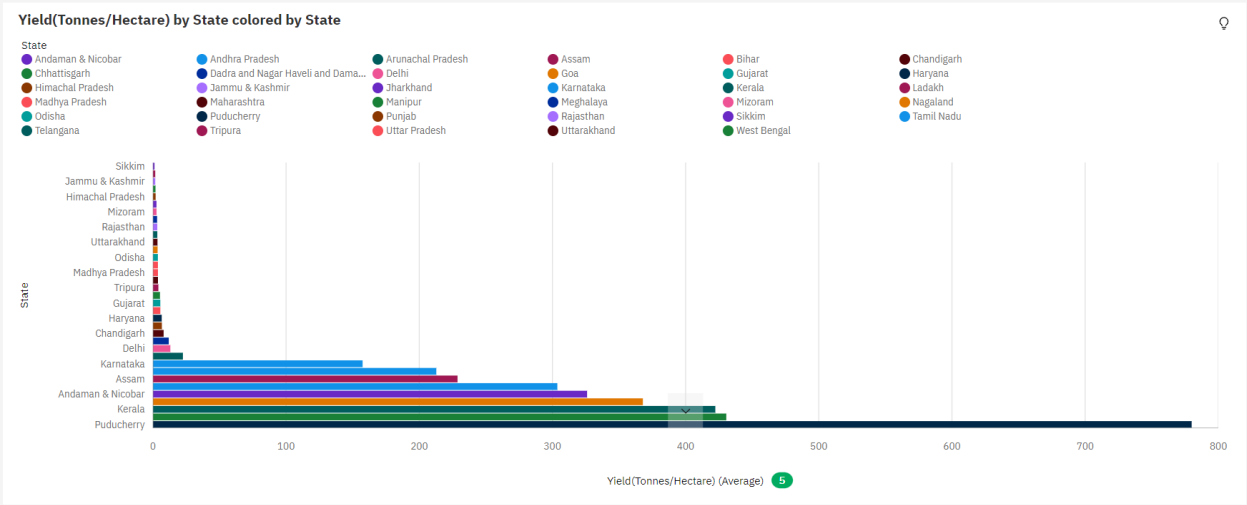

Highest Crop Production in Rabi
Production(Tonnes)
Crop
Wheat
Potato
Gram
Rapeseed &Mustard
Rice
Maize
Jowar
Niger seed
Barley
Onion

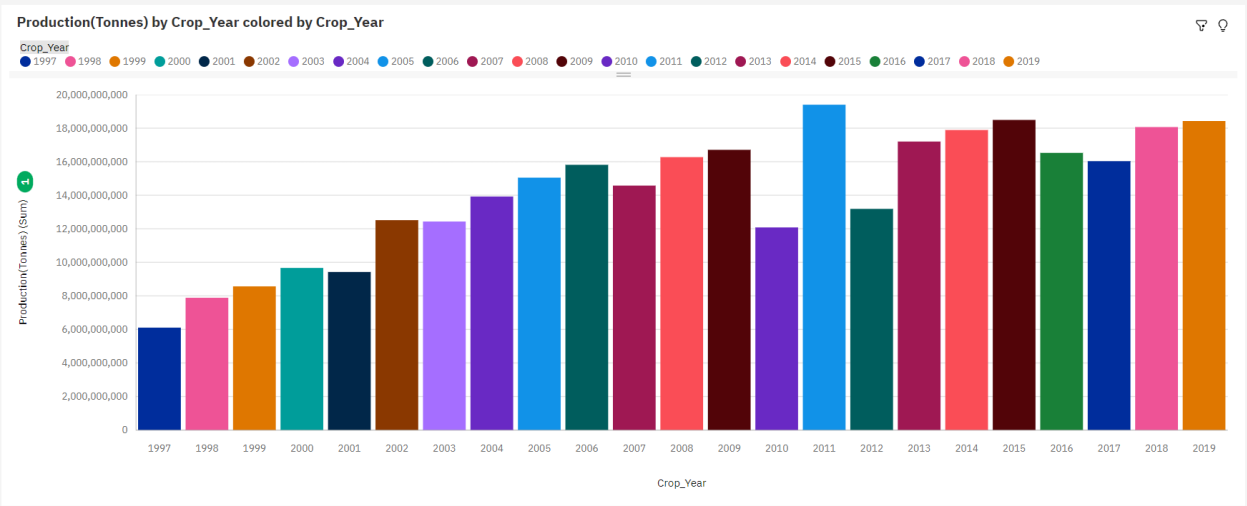

Highest Crop Production in Whole Year
Production(Tonnes)
Crop
Coconut
Sugarcane
Potato
Banana
Tapioca
Onion
Arecanut
Guar seed
Garlic
Ginger

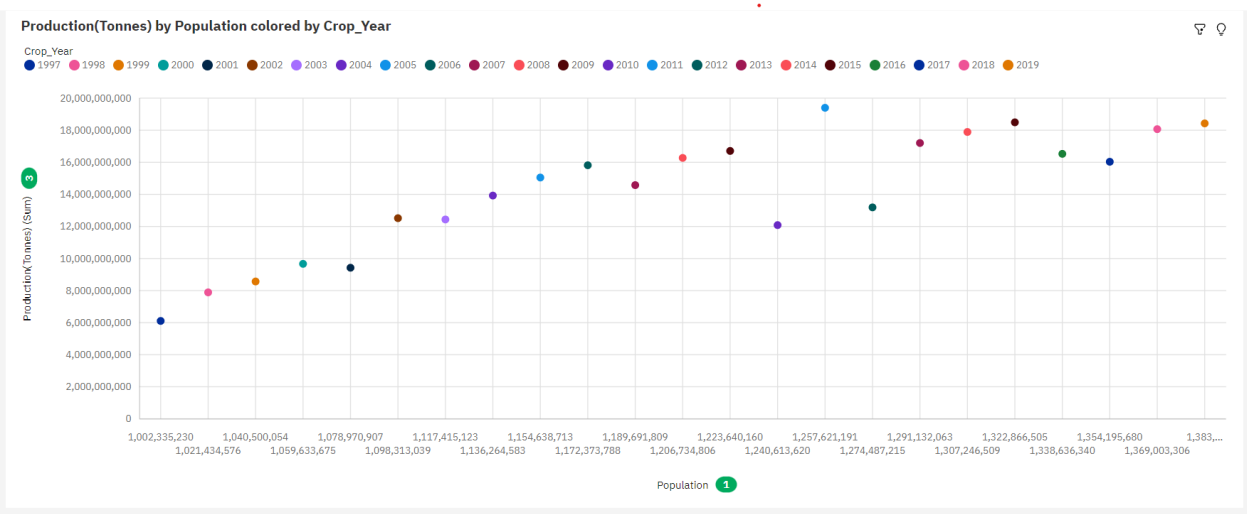

Yield(Tonnes/Hectare) and Production(Tonnes) for State colored by Season
Season
Winter
Line
Yield(Tonnes/Hectare) (Sum)
Production(Tonnes) (Sum)
Yield(Tonnes/Hectare) (Sum)
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
0
60,000
50,000
40,000
30,000
20,000
10,000
0
West Bengal
Odisha
Bihar
Assam
Jharkhand
Tamil Nadu
Kerala
Meghalaya
Tripura
Dadra and Nagar Haveli and Daman...
Manipur
Puducherry
State

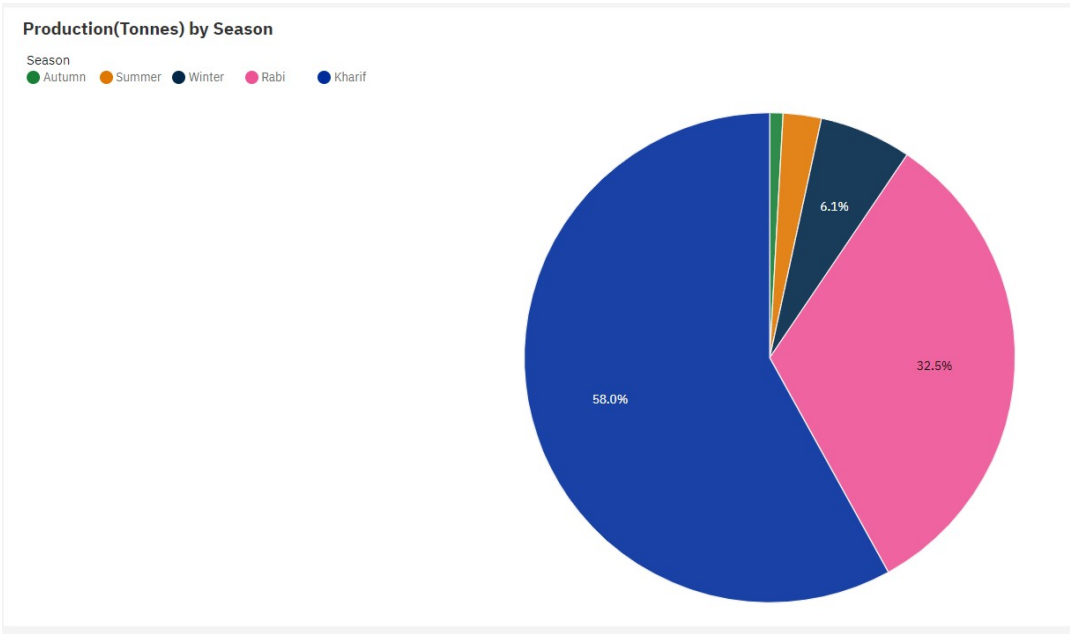

Production(Tonnes) by Crop_Year colored by Crop
Crop
Arecanut
Arhar/Tur
Bajra
Banana
Barley
Black pepper
Cardamom
Cashewnut
Castor seed
Coconut
Coriander
Cotton(lint)
Cowpea(Lobia)
Dry chillies
Garlic
Ginger
Gram
Groundnut
Guar seed
Horse-gram
Jowar
Jute
Khesari
Linseed
Maize
Masoor
Mesta
Moong(Green Gram)
Moth
Niger seed
Oilseeds total
Onion
Other Rabi pulses
Other Cereals
Other Kharif pulses
Other Summer Pulses
Peas & beans (Pulses)
Potato
Ragi
Rapeseed &Mustard
Rice
Safflower
Sannhamp
Sesamum
Small millets
Soyabean
Sugarcane
Sunflower
Sweet potato
Tapioca
Tobacco
Turmeric
Urad
Wheat
other oilseeds
Production(Tonnes) (Sum)
20,000,000,000
15,000,000,000
10,000,000,000
5,000,000,000
0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Crop_Year


Yield(Tonnes/Hectare) and Production(Tonnes) for State colored by Season
Season
Autumn
Line
Yield(Tonnes/Hectare) (Sum)
Production(Tonnes) (Sum)
Yield(Tonnes/Hectare) (Sum)
State
Bihar
Odisha
West Bengal
Assam
Jharkhand
Kerala
Tamil Nadu
Meghalaya
Tripura
Mizoram
Manipur
Andaman & Nicobar
Puducherry
Maharashtra


Yield(Tonnes/Hectare) by State colored by State
State
Andaman & Nicobar
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Chhattisgarh
Dadra and Nagar Haveli and Dama...
Delhi
Goa
Gujarat
Haryana
Himachal Pradesh
Jammu & Kashmir
Jharkhand
Karnataka
Kerala
Ladakh
Madhya Pradesh
Maharashtra
Manipur
Meghalaya
Mizoram
Nagaland
Odisha
Puducherry
Punjab
Rajasthan
Sikkim
Tamil Nadu
Telangana
Tripura
Uttar Pradesh
Uttarakhand
West Bengal
State
Yield(Tonnes/Hectare) (Average)


Production(Tonnes) by Crop_Year colored by Crop_Year
Crop_Year
Production(Tonnes) (Sum)
Crop_Year


Production(Tonnes) by Population colored by Crop_Year
Crop_Year
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Production(Tonnes) (Sum)
20,000,000,000
18,000,000,000
16,000,000,000
14,000,000,000
12,000,000,000
10,000,000,000
8,000,000,000
6,000,000,000
4,000,000,000
2,000,000,000
0
1,002,335,230
1,021,434,576
1,040,500,054
1,059,633,675
1,078,970,907
1,098,313,039
1,117,415,123
1,136,264,583
1,154,638,713
1,172,373,788
1,189,691,809
1,206,734,806
1,223,640,160
1,240,613,620
1,257,621,191
1,274,487,215
1,291,132,063
1,307,246,509
1,322,866,505
1,338,636,340
1,354,195,680
1,369,003,306
1,383,...
Population


Production(Tonnes) by Season
Season
Autumn
Summer
Winter
Rabi
Kharif
6.1%
32.5%
58.0%


District hierarchy colored by District and sized by Production(Tonnes)
Production(Tonne...
District
ADILABAD
AGAR MALWA
AGRA
AHMADABAD
AHMEDNAGAR
AIZAWL
AJMER
AKOLA
ALAPPUZHA
ALIGARH
ALIPURDUAR
ALIRAJPUR
ALLAHABAD
ALMORA
ALWAR
AMBALA
AMBEDKAR NAGAR
AMETHI
AMRAVATI
AMRELI
AMRITSAR
AMROHA
ANAND
ANANTAPUR
ANANTNAG
ANJAW
ANUGUL
ANUPPUR
ARARIA
ARAVALLI
ARIYALUR
ARWAL
ASHOKNAGAR
AURAIYA
AURANGABAD
AZAMGARH
BADGAM
BAGALKOTE
BAGESHWAR
BAGHPAT
BAHRAICH
BAKSA
BALAGHAT
BALANGIR
BALESHWAR
BALLARI
BALLIA
BALOD
BALODA BAZAR
BALRAMPUR
BANAS KANTHA
BANDA
BANDIPORA
BANGALORE RURAL
BANKA
BANKURA
BANSWARA
BARABANKI
BARAMULLA
BARAN
BAREILLY
BARGARH
BARMER
BARNALA
BARPETA
BARWANI
BASTAR
BASTI
BATHINDA
BEED
BEGUSARAI
BELAGAVI
BEMETARA
BENGALURU URBAN
BETUL
BHADRADRI
BHADRAK
BHAGALPUR
BHANDARA
BHARATPUR
BHARUCH
BHAVNAGAR
BHILWARA
BHIND
BHIWANI
BHOJPUR
BHOPAL
BIDAR
BIJAPUR
BIJNOR
BIKANER
BILASPUR
BIRBHUM
BISHNUPUR
BISWANATH
BOKARO
BONGAIGAON
BOTAD
BOUDH
ERNAK...
KASARAGOD
ALAPP...
KOZHIKODE
MALAPPURAM
PALAK...
KANNUR
COIMBATO...
K...
KOLLAM
KA...
EAS...

Advantages of this project:

- Informed Decision-Making: Provides data-driven insights for better agricultural planning.
- Resource Optimization: Helps optimize resources like water and land for maximum yield.
- Environmental Awareness: Identifies regions prone to soil erosion, aiding conservation efforts.
- Regional Tailoring: Enables region-specific crop recommendations for enhanced productivity.

Disadvantages of this project:

- Data Dependency: Relies heavily on accurate and up-to-date data for meaningful results.
- Complex Implementation: Requires collaboration with local authorities for successful adoption.

Applications of this proposed solution:

1. **Agricultural Planning**: This solution assists farmers and agricultural experts in making informed decisions about crop selection, planting schedules, and irrigation techniques. By analyzing historical yield data and rainfall patterns, stakeholders can optimize their choices to enhance productivity and resource utilization.

2. **Disaster Preparedness**: The project helps in identifying regions prone to soil erosion by analyzing historical erosion data. This information is crucial for disaster management authorities to devise strategies to prevent soil degradation, mitigate potential damages, and protect agricultural land.

3. **Resource Management**: Understanding the distribution of monsoon rainfall across states and years can aid in effective water resource management. Authorities can allocate water supplies more efficiently and plan for potential water shortages in regions with inconsistent rainfall patterns.

4. **Policy Formulation**: The project findings can support government policymakers in shaping agricultural policies. For instance, recognizing the predominant crops in a region can help tailor subsidies, incentives, and support schemes to enhance crop production.

5. **Crop Insurance**: Insurance companies can utilize the data on crop yields and weather patterns to assess risks accurately and determine appropriate premiums for crop insurance policies. This ensures fair coverage and accurate payouts for farmers in case of yield loss.

6. **Sustainable Agriculture**: By analyzing the correlation between irrigation methods, crop yield, and rainfall, the project promotes sustainable agricultural practices. This encourages farmers to adopt water-efficient techniques and reduce their environmental footprint.

Software Tools Used for this project:

- Python (Jupyter Notebook, Plotly, Pandas, Geopandas)
- IBM Cognos
- VS Code
- GitHub (Version Control)
- PyCharm
- HTML/CSS (Website Development)

Experimental Investigations for this project:

- Engaged in comprehensive data analysis throughout the project, involving in-depth exploration of diverse datasets. Conducted thorough investigations into crop production patterns, rainfall distribution, and soil erosion data. Employed various statistical and visualization techniques to uncover significant trends and relationships within the data.
- Explored the variations in crop yields, identifying the highest producing crops in different regions and seasons. Investigated the impact of monsoon rainfall on agricultural productivity, analyzing historical trends and anomalies. Examined the extent of soil erosion in different states and its potential repercussions on crop

cultivation.

- The analysis phase included data cleaning, transformation, and integration to ensure the accuracy and reliability of the results. By carefully examining the datasets from multiple angles, we gained a comprehensive understanding of the agricultural landscape and its challenges.
- These investigations served as the foundation for developing meaningful solutions and recommendations to address the identified issues. The insights gained from the analysis guided the formulation of strategies aimed at improving crop yield, optimizing irrigation methods, and mitigating the effects of soil erosion.

Conclusion:

- **In conclusion, this project delved into a detailed analysis of agricultural dynamics, rainfall distribution, and soil erosion. By leveraging data-driven insights, we uncovered patterns and relationships crucial for informed decision-making. Through effective visualizations and rigorous investigation, we were able to identify optimal crop production strategies, understand the role of monsoon rainfall, and highlight soil erosion hotspots. This project demonstrates the power of data analysis in addressing agricultural challenges and fostering sustainable practices.**

Future Scopes:

Future enhancements could include refining predictive models for crop yields using advanced machine learning techniques, integrating real-time weather data for more accurate insights, expanding the dataset to encompass a wider range of years and states, and incorporating satellite imagery for precise monitoring of soil erosion. Additionally, incorporating socioeconomic data could provide a more holistic view of the agricultural landscape and enable more targeted policy recommendations.

References:

Kaggle dataset link

Appendix:

http://localhost:8888/notebooks/Agriculture%20analysis%20in%20India.ipynb

The above link is the jupyter notebook file in which code is there in oreder to prepare the relevant datsets for this project.

Our Website link:

https://hy-18.github.io/AGRISOL/

THANK YOU!!!!!