Crop Production Analysis

By RUDRA

Resourceful Unit For Data Research and Analysis

Submitted by

Rakshitha K - 1RVU23CSE369

Mitesh K - 1RVU23CSE270

Pema Tshering Sherpa - 1RVU23CSE333

Mohammed Ismail - 1RVU23CSE280

Sujay V Kulkarni - 1RVU23CSE482

in partial fulfillment for the award of the degree of

B.Tech (Hons) – Computer Science & Engineering

***in* Data Analysis with Python**

to Prof. Vaidyanathan Sivasubramanian

School of Computer Science and Engineering

RV University

RV Vidyaniketan, 8th Mile, Mysuru Road, Bengaluru, Karnataka, India – 562112.

December 2023

1. INTRODUCTION

Crop analysis, often referred to as crop monitoring or precision agriculture, involves the use of various functions in data analysis techniques to assess and manage the health, performance, and conditions of crops in agricultural fields. This process aims to optimize agricultural practices, enhance crop yields, and reduce resource inputs.

Crop production is a crucial aspect of agriculture and plays a fundamental role in providing food, fiber, and other essential products for human and animal consumption. It involves the cultivation of plants, known as crops, on a large scale for various purposes.

WHY DID WE CHOOSE THIS CONCEPT ?

This project mainly aims upon the summarized analysis of factors related to crops, which will help the farmers to recognize the loopholes and give them a statistical approach towards the future trends coming up.

2. METHODOLOGY

Data Cleaning: Remove null values to ensure dataset accuracy.
Data Segmentation: Create subsets for each state and crop to analyze independently.
Yield Analysis:

- Determine yield ranges for each crop.
- Calculate mean yields per crop for each state and across different crops.

Data Visualization with Power BI: Use Power BI for insightful visualizations:

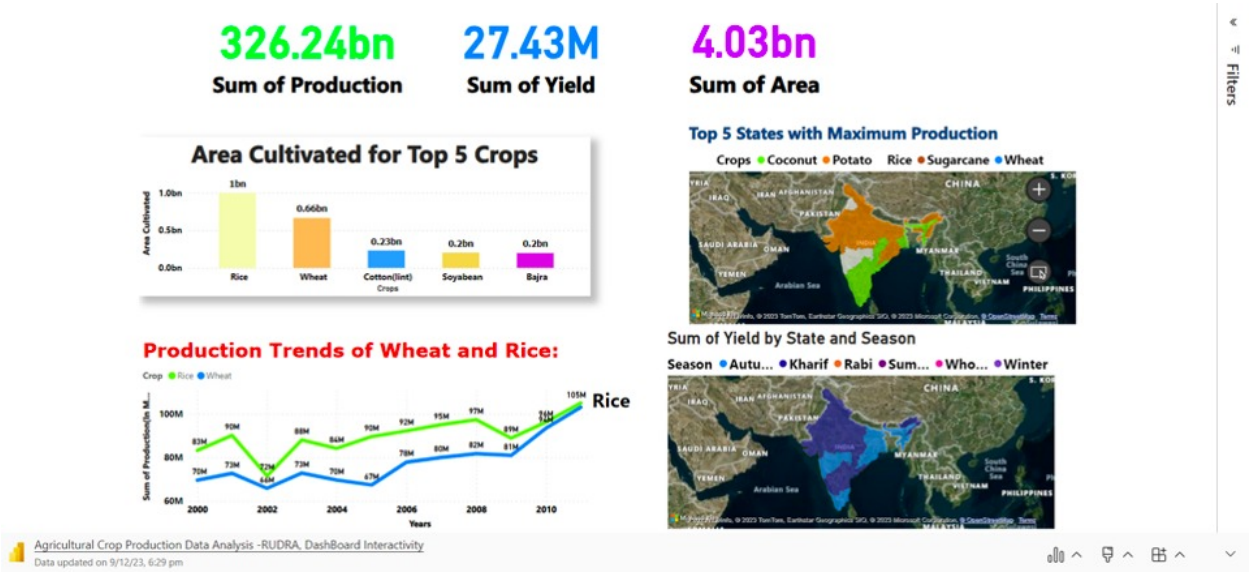
- Pie Chart: Display crop distribution by total production.
- Filled Map: Highlight top 5 states with maximum production.
- Line Charts: Show production trends over years for total production and per crop.

Power BI Implementation Steps:

- Import cleaned and segmented datasets.
- Establish appropriate dataset relationships.

- Create calculated measures for mean yields and key metrics.
- Develop visuals based on specified charts.
- Customize visuals for readability and aesthetics.
- Use Power BI features for filtering and interactivity.

3) INFERENCES



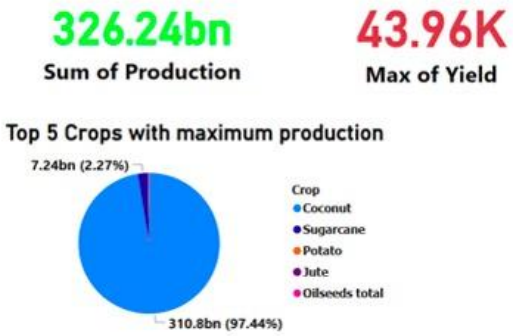
Graph/Plot-4:

The above visualization shows what is the sum of yield season-wise in all states/ regions.

1. We notice that most of the country experiences a maximum sum of yield in winter.
2. We also notice that a good amount of production happens in Autumn as well.
3. Most of the northern-western india lying above the Vindhyas and Satpura and also arunachal pradesh in the west experiences high production in Winter and the most of the southern parts and the western part below the vindhyas including states of maharashtra, tamil-nadu,kerala and the eastern and north eastern parts of the country including states like west bengal, parts of odisha, chhattisgarh and

north-eastern states of assam, manipur, meghalaya, mizoram, tripura experience high production in autumn.

4. These factors will help better policy implementation for the government to aid farmers, help the businesses to understand the production, seasons and regions in India. These factors will influence the geopolitical events and also the economic events of the country.



Pie chart:

This chart visualizes the sum of production of top five crops with their percentage in being in the top 5 in India:

1. Coconut tops the list with 310bn which is 97.44% of the sum of production.
2. The next crop is Sugarcane with 7.24 bn which is 2.27% of the total.
3. Other crops, though significant, can go unnoticed to the magnitude of the sum of coconut production of coconut.
4. Since Coconut is so abundantly produced, the government can implement policies which will affect the import export and businesses can spot an opportunity here.

Graph / plot 1: This graph visualizes the area of cultivation of top 5 crops

1. Rice is cultivated on most of India's land amounting to about 1bn hectares.
2. Wheat follows it with 0.54 bn hectares and cotton is next with 0.23bn hectares of India's land, then follows the soybean with 0.23 bn and bajra with 0.2bn hectares.
3. Knowing how much area each crop is grown on will enable further analysis and decision making. For example we notice that though rice is grown in most of the area it is not in the crops which have the maximum sum of production. Instead coconut, which is not even in top5 crops grown in most of the area, tops the list. This can be a topic of investigation and the reason can help us refine our agricultural practices for a better future of this nation with an agrarian economy.

The filled map(graph/plot 2): This map shows the top few crops and their corresponding regions:

1. Potato is grown in northern india and eastern india
2. Rice is grown in haryana, maharashtra and certain southern states.
3. Coconut is grown in most of the southern states and chhattisgarh, west bengal and northeastern states.
4. Analyzing the crops grown in each region will give us insights on what crops businesses must target in the specific regions.

Graph/plot 3: The graph analysis the trends of sum of production of two important staple crops of India: wheat and Rice:

1. We see that the time of rise and fall of both the crops are more or less the same implying that the factors affecting them are more or less the same.
2. We also see that the drops are in 2002 after the natural calamity and also we see that rice which is immediately dependent on natural factors has fallen directly during 2004 during which time we had a natural calamity and on the other hand wheat seems to be little resistant that it has dropped not immediately but in a year or two after it.
3. Trends show that production of wheat is rising and is reaching the level of rice and both are being almost equal in subsequent years like 2018, 2019,2020, etc.
4. Knowing the trends helps us analyze the progress over years and tackle the problems in the coming years better by using insights of progress achieved and problems faced in these years

4. Results and Discussion:

4.1 Seasonal Yield Analysis

The analysis of seasonal crop yield distribution across various states/regions of India reveals insightful patterns. Winter emerges as the predominant season for maximum crop production across the majority of the country, notably in the northern-western regions above the Vindhyas and Satpura, alongside Arunachal Pradesh. Conversely, the southern parts, encompassing states like Maharashtra, Tamil Nadu, and Kerala, along with eastern and northeastern states such as West Bengal, parts of Odisha, Chhattisgarh, Assam, Manipur, Meghalaya, Mizoram, and Tripura, exhibit substantial production during autumn. These observations not only aid in policy formulation to support farmers but also offer crucial insights for businesses aiming to understand production patterns, seasonal variations, and region-specific opportunities. Such factors profoundly influence geopolitical and economic events within the country.

4.2 Crop Production Insights

4.2.1 Dominance of Coconut Production

Coconut emerges as the leading crop in India with a staggering production value of 310 billion, comprising 97.44% of the total sum of production. This dominance underscores a substantial opportunity for policy interventions targeting export strategies, while businesses can capitalize on this abundance by exploring associated commercial prospects.

4.2.2 Importance of Lesser-Known Crops

While Coconut holds a substantial majority, other crops, despite being significant in their production, might often go unnoticed due to the overwhelming magnitude of Coconut production. Investigating and understanding this disparity could offer valuable insights for refining agricultural practices and potentially balancing crop production diversity for a more robust agrarian economy.

4.3 Cultivation Area Analysis

Examining the cultivated land area for the top 5 crops elucidates essential information. For instance, Rice commands the most extensive cultivation area, covering approximately 1 billion hectares of India's land. Conversely, Coconut, though not among the top 5 crops in terms of cultivated area, holds the highest production magnitude. This discrepancy merits further investigation to optimize agricultural practices and align crop cultivation with production to enhance the nation's agrarian economy.

4.4 Regional Crop Analysis

Mapping the distribution of crops across different regions highlights distinct cultivation patterns. Potato cultivation is prevalent in northern and eastern India, while Rice is prominent in states like Haryana, Maharashtra, and specific southern regions. Coconut cultivation, on the other hand, is widespread across southern states, Chhattisgarh, West Bengal, and northeastern states. Analyzing regional crop preferences provides crucial insights for businesses aiming to target specific crops in particular regions for optimal market penetration strategies.

4.5 Analysis of Staple Crop Trends: Wheat and Rice

Graph 5 presents a comparative analysis of the production trends of two essential staple crops in India: Wheat and Rice. Several noteworthy observations emerge from this analysis:

1. **Synchronized Seasonal Trend**s: The rise and fall patterns for both Wheat and Rice display synchronicity, suggesting a correlation in the factors influencing their production. This synchronicity indicates a potential commonality in the agricultural factors affecting the growth of these staple crops.
2. **Impact of Natural Calamities**: Notably, significant drops in production occur following natural calamities, particularly evident in the years 2002 and 2004. Rice, being more directly influenced by natural factors, experiences an immediate decline in 2004, aligning with the occurrence of a natural calamity. Conversely, Wheat, showing a relatively delayed decline, implies a slightly greater resilience or delayed reaction to such adverse events.
3. **Convergence of Wheat and Rice Production:** Over time, the trends indicate a rising trajectory in Wheat production, nearing the levels of Rice. The convergence becomes particularly apparent in subsequent years, such as 2018, 2019, 2020, signaling a potential shift or equilibrium in the production dynamics of these staple crops.

4. Implications for Future Planning: Understanding these production trends provides invaluable insights into the progress achieved and challenges faced over the years. This analysis serves as a foundational resource for devising strategies to address agricultural challenges more effectively, leveraging insights gained from historical trends.

4.6 Comprehensive Insights for Future Agricultural Strategies

The collective analysis of seasonal variations, dominance of specific crops like Coconut, disparities in cultivated areas versus production volumes, regional crop preferences, and the trends in Wheat and Rice production offers a comprehensive understanding of India's agricultural landscape. These insights serve as a cornerstone for informed decision-making, enabling policymakers, businesses, and agricultural practitioners to craft more targeted and effective strategies. Leveraging historical data trends aids in better preparedness to tackle future challenges and capitalize on emerging opportunities in the dynamic agricultural sector of India.

4.7 Discussion

The findings underscore the importance of seasonality in crop production, the dominance of Coconut in the agricultural landscape, and the disparities between crop cultivation areas and their corresponding production volumes. These insights serve as a foundational basis for policy formulation, business strategies, and refining agricultural practices. Aligning cultivation with production patterns could facilitate a more sustainable and resilient agrarian economy in India.

5. CONCLUSION

5.1 Data Cleaning and Segmentation: Foundation for Detailed Analysis

The meticulous process of data cleaning and segmentation, executed primarily using Python in the Jupyter Notebook, laid the groundwork for this analysis. Elimination of null values and segmentation of datasets based on states and crops facilitated a granular examination of India's agricultural crop yields. This step, executed with Python libraries,

ensured the accuracy and completeness of subsequent analyses, forming the bedrock for insightful findings.

5.2 Seasonal Yield Analysis: Insights into Seasonal Patterns and Geographical Variations

The examination of seasonal yield patterns, illuminated distinct variations in production across seasons and regions. Winter emerged as a prominent season for maximum production in specific northern-western regions, while autumn showcased substantial yields in southern and eastern parts. The understanding of these seasonal dynamics will be pivotal for targeted policy interventions and informed decision-making.

5.3 Dominance of Coconut and Lesser-Known Crops: Implications for Policy and Agricultural Practices

Our analysis highlighted the dominance of Coconut in production, emphasizing the need for nuanced policy measures to balance crop diversity. Moreover, the significance of lesser-known crops, despite their cultivation on less area, prompted a reevaluation of agricultural practices to optimize yields and foster a more resilient agrarian economy.

5.4 Cultivation Area Analysis and Regional Crop Preferences: Insights for Businesses and Policy

Python-based analysis, visualized with Power BI, shed light on disparities between cultivated areas and production volumes, advocating for aligned cultivation and production strategies. Understanding regional crop preferences offered invaluable insights for businesses, ensuring targeted approaches for sustainable growth in specific geographical markets.

5.5 Trends in Wheat and Rice Production: Resilience and Equilibrium Analysis

The examination of Wheat and Rice production trends, unveiled synchronized patterns and highlighted the impact of natural calamities. This analysis showcased immediate and delayed responses to adverse events in Rice and Wheat production, indicating varied resilience and evolving equilibrium in production dynamics.

5.6 Significance and Achievements

This comprehensive analysis of India's agricultural crop yields, holds paramount significance for stakeholders. It offers nuanced insights into seasonal variations, crop dominance, disparities between cultivation and production, regional preferences, and temporal trends. The achievements lie in the actionable insights derived, empowering stakeholders to collaborate and innovate for a more sustainable, resilient, and prosperous agricultural landscape in India.

5.7 Recommendations for Future Endeavors

1. Policy Tailoring: Tailor policies catering to seasonal variations and regional crop preferences for enhanced farmer support and optimized agricultural outputs.
2. Crop Diversification Initiatives: Encourage diversification of crops by incentivizing the cultivation of lesser-known but potentially impactful crops for a more diverse and resilient agricultural landscape.
3. Resilience Strategies: Develop strategies to enhance agricultural resilience against natural calamities, drawing insights from varied responses observed in Wheat and Rice production trends.
4. Business Expansion Approaches: Equip businesses with insights into regional crop preferences to devise effective market penetration strategies and ensure sustainable growth in specific markets.
5. Continued Analysis and Adaptation: Foster continuous analysis of crop production trends to adapt swiftly to evolving agricultural dynamics and challenges.

5.8 Reflection and Conclusion

This project, primarily conducted using Python in Jupyter Notebook for data analysis and Power BI for visual presentation, encapsulates a call to action for stakeholders. The achievements and revelations derived from this analysis, largely driven by Python-based analysis, serve as a beacon guiding future endeavors towards a more resilient, sustainable, and prosperous agricultural future in India.