Department of Computer Science

MDS411

DATA DRIVEN MODELLING AND VISUALIZATION

CAC - 1

AGRICULTURE

Crop Yield Analysis of INDIAN States

INTRODUCTION

Agriculture and Analytics Overview

• Agriculture involves cultivation of crops and livestock for food, fiber, and other resources.
• Uses various practices and technologies for improved crop yields, resource management, and farming process optimization.
• Analytics in agriculture uses data analysis techniques to uncover insights, trends, and patterns.
• Leverages analytics for data-driven decisions, enhancing productivity, risk management, and efficient practices.

DATASET PREVIEW

• The dataset is a comprehensive study of crop yield across various Indian states.
• It includes specific data points about a specific crop in a specific year and within a specific state.
• Key features include:
- **Crop**: Specifies the type of crop being studied.
- **Crop_Year:** Provides the year of cultivation.
- **Season**: Defines the agricultural season during which the crop was cultivated.
- **State**: Indicates the dynamic geographical region where the crop is cultivated.
- **Area:** Indicates the total land area under cultivation for the crop.
- **Production:** Measures the total crop produce in metric tons for that specific region.
- **Annual_Rainfall**: Indicates the total rainfall received by a state in the year.
- **Fertilizer and Pesticide:** Show the quantity of inputs used in raising the crop.
- **Yield:** Provides a calculated metric of crop yield.
• The database enables multidimensional crop yield analysis, focusing on the reasons for specific agricultural productivity in India's varied landscape.

	A	B	C	D	E	F	G	H	I	J
1	Crop	Crop_Year	Season	State	Area	Production	Annual_Rainfall	Fertilizer	Pesticide	Yield
2	Arecanut	1997	Whole Yea	Assam	73814	56708	2051.4	7024878.38	22882.3	0.79608696
3	Arhar/Tur	1997	Kharif	Assam	6637	4685	2051.4	631643.29	2057.47	0.71043478
4	Castor seed	1997	Kharif	Assam	796	22	2051.4	75755.32	246.76	0.23833333
5	Coconut	1997	Whole Yea	Assam	19656	126905000	2051.4	1870661.52	6093.36	5238.05174
6	Cotton(lint)	1997	Kharif	Assam	1739	794	2051.4	165500.63	539.09	0.42090909
7	Dry chillies	1997	Whole Yea	Assam	13587	9073	2051.4	1293074.79	4211.97	0.64363636
8	Gram	1997	Rabi	Assam	2979	1507	2051.4	283511.43	923.49	0.46545455
9	Jute	1997	Kharif	Assam	94520	904095	2051.4	8995468.4	29301.2	9.91956522
10	Linseed	1997	Rabi	Assam	10098	5158	2051.4	961026.66	3130.38	0.46136364
11	Maize	1997	Kharif	Assam	19216	14721	2051.4	1828786.72	5956.96	0.61565217
12	Mesta	1997	Kharif	Assam	5915	29003	2051.4	562930.55	1833.65	4.56894737
13	Niger seed	1997	Whole Yea	Assam	9914	5076	2051.4	943515.38	3073.34	0.48235294
14	Onion	1997	Whole Yea	Assam	7832	17943	2051.4	745371.44	2427.92	2.3426087
15	Other Rabi pulses	1997	Rabi	Assam	108297	58272	2051.4	10306625.49	33572.1	0.52086957
16	Potato	1997	Whole Yea	Assam	75259	671871	2051.4	7162399.03	23330.3	7.56130435
17	Rapeseed &Mustar	1997	Rabi	Assam	279292	154772	2051.4	26580219.64	86580.5	0.55478261
18	Rice	1997	Autumn	Assam	607358	398311	2051.4	57802260.86	188281	0.78086957
19	Rice	1997	Summer	Assam	174974	209623	2051.4	16652275.58	54241.9	1.06043478
20	Rice	1997	Winter	Assam	1743321	1647296	2051.4	165911859.6	540430	0.94130435
21	Sesamum	1997	Whole Yea	Assam	15765	8257	2051.4	1500355.05	4887.15	0.4873913
22	Small millets	1997	Kharif	Assam	10490	5391	2051.4	998333.3	3251.9	0.473
23	Sugarcane	1997	Kharif	Assam	31318	1287451	2051.4	2980534.06	9708.58	41.8969565
24	Sweet potato	1997	Whole Yea	Assam	9380	32618	2051.4	892694.6	2907.8	3.44043478
25	Tapioca	1997	Whole Yea	Assam	2465	11728	2051.4	234594.05	764.15	4.41826087
26	Tobacco	1997	Whole Yea	Assam	433	26	2051.4	41208.61	134.23	0.38
27	Turmeric	1997	Whole Yea	Assam	10071	6974	2051.4	958457.07	3122.01	0.67

Source: https://www.kaggle.com/datasets/patelris/crop-yield-prediction-dataset

BENEFICIARIES

POLICY MAKERS

The analysis provides data-driven insights to develop and implement effective agricultural policies and support programs

AGRICULTURE PLANNERS

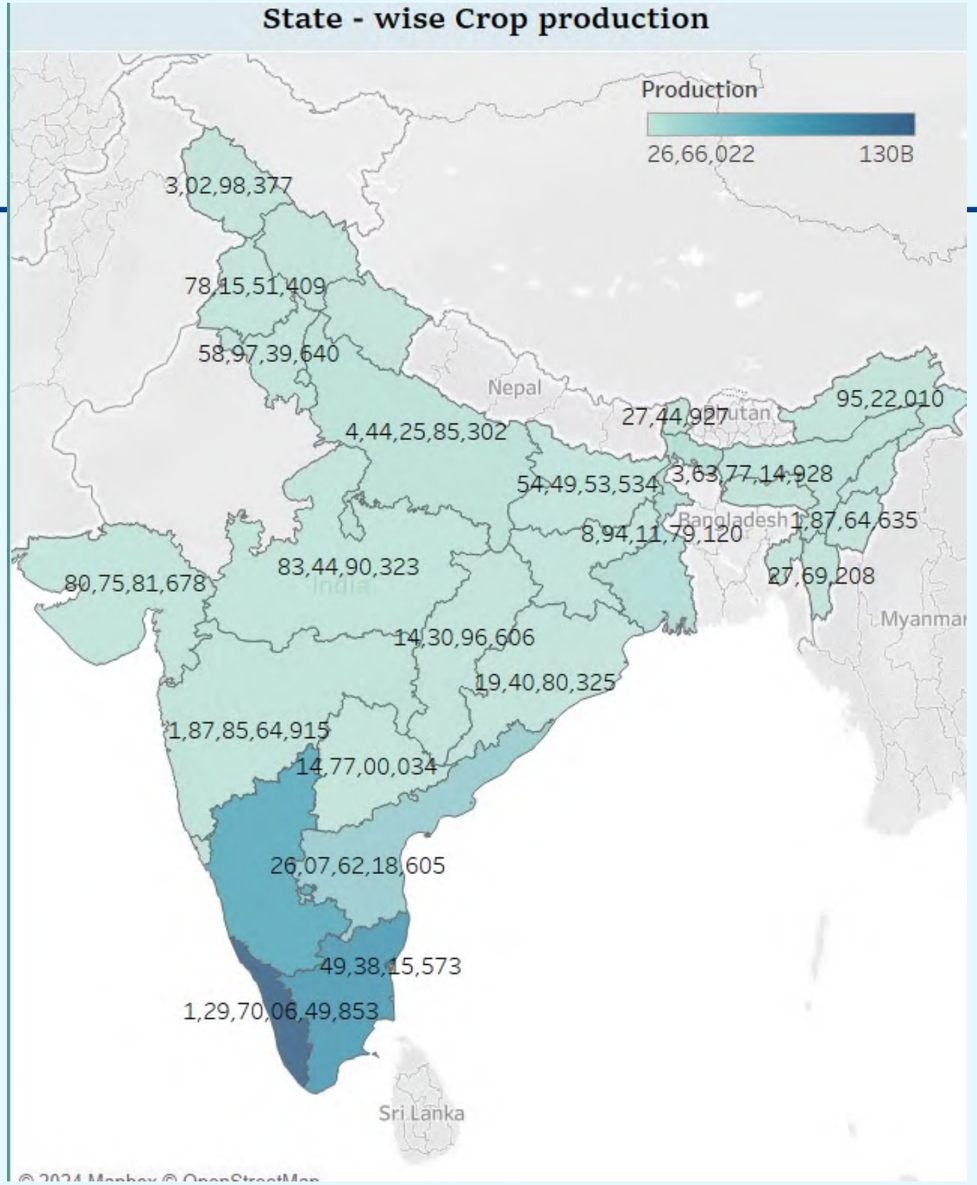
The analysis helps agriculture planners optimize resource allocation and tailor strategies to enhance regional crop productivity

FARMERS

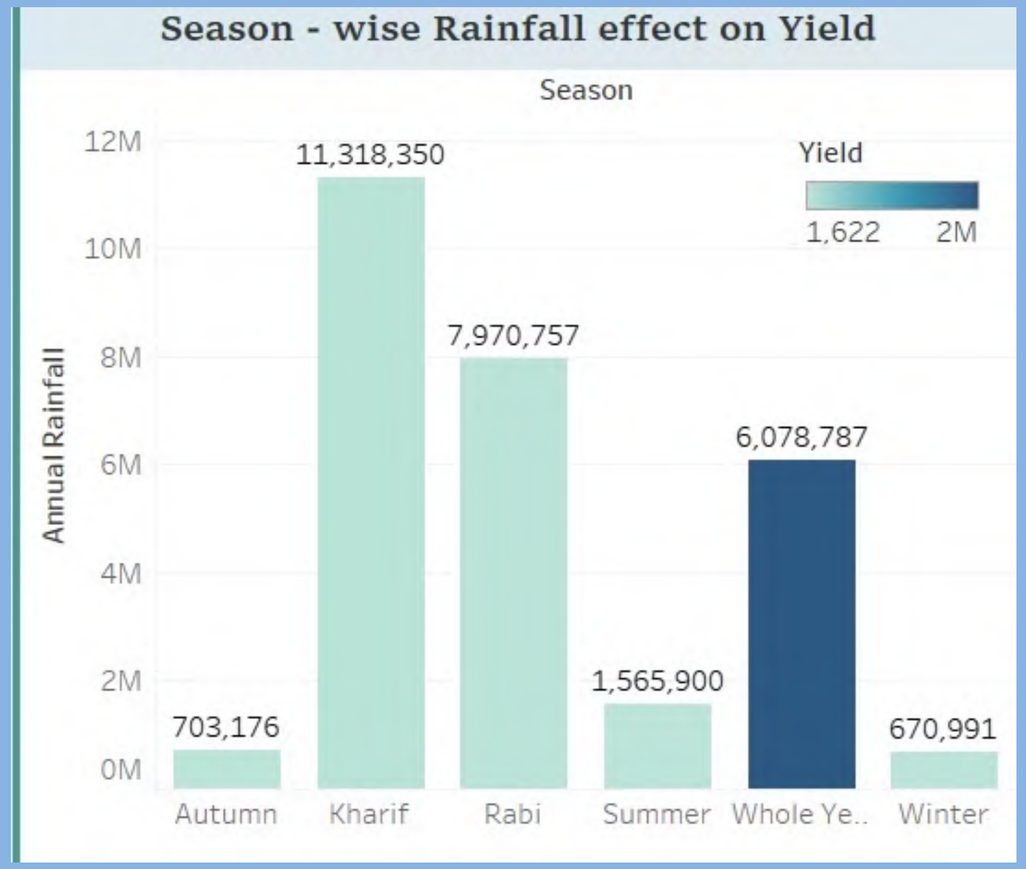
The analysis offers actionable insights to improve crop yields and resource management through informed decision-making and targeted practices

Graphs Created

The graph is entitled "State-wise Crop Production." It is a choropleth map showing crop production levels across various Indian states. High-producing states, such as Tamil Nadu, Maharashtra, and Uttar Pradesh, are shaded darkly to reflect their immense contribution to the country's agricultural output. This map is quite illustrative of a geographical perspective in terms of pinpointing important agricultural regions and their production capacities.

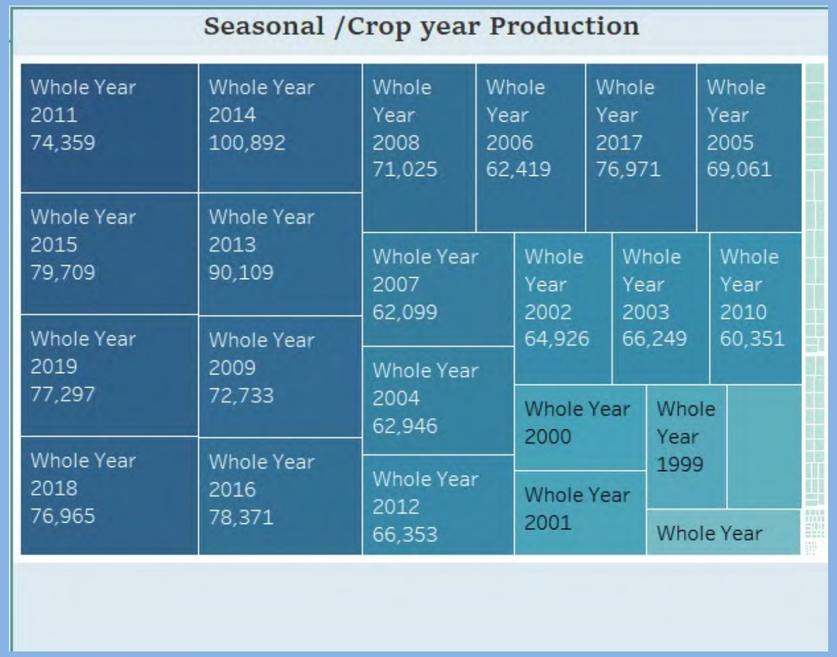


Graphs Created

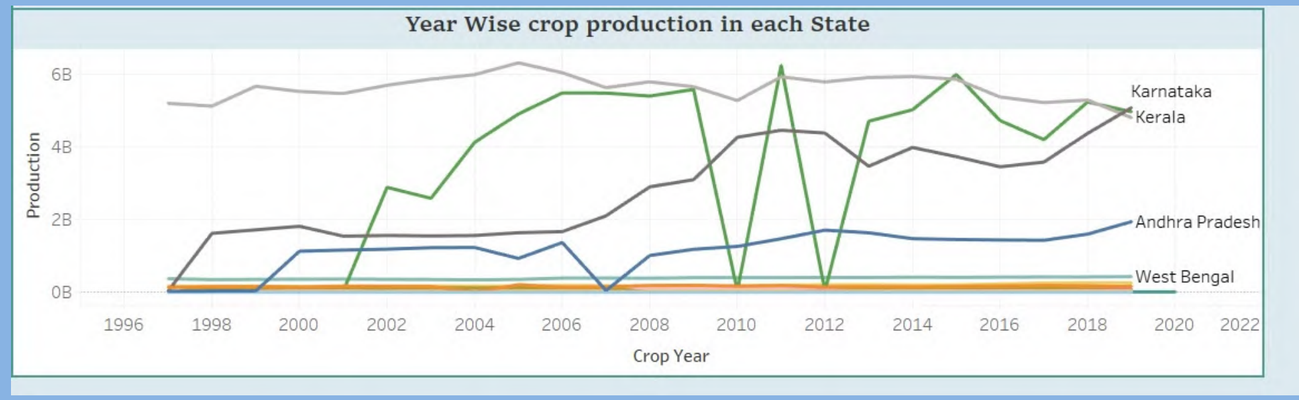


This graph is a bar graph on "Season-wise Rainfall Effect on Yield." From this graph, it is observed that high rainfall in the Kharif season seems to result in maximum yield, followed by the Rabi season. It can be suggested that either lower rainfall or further crop dependence on irrigation, hence reduced yields, occurs in the summer and winter seasons.

Graphs Created

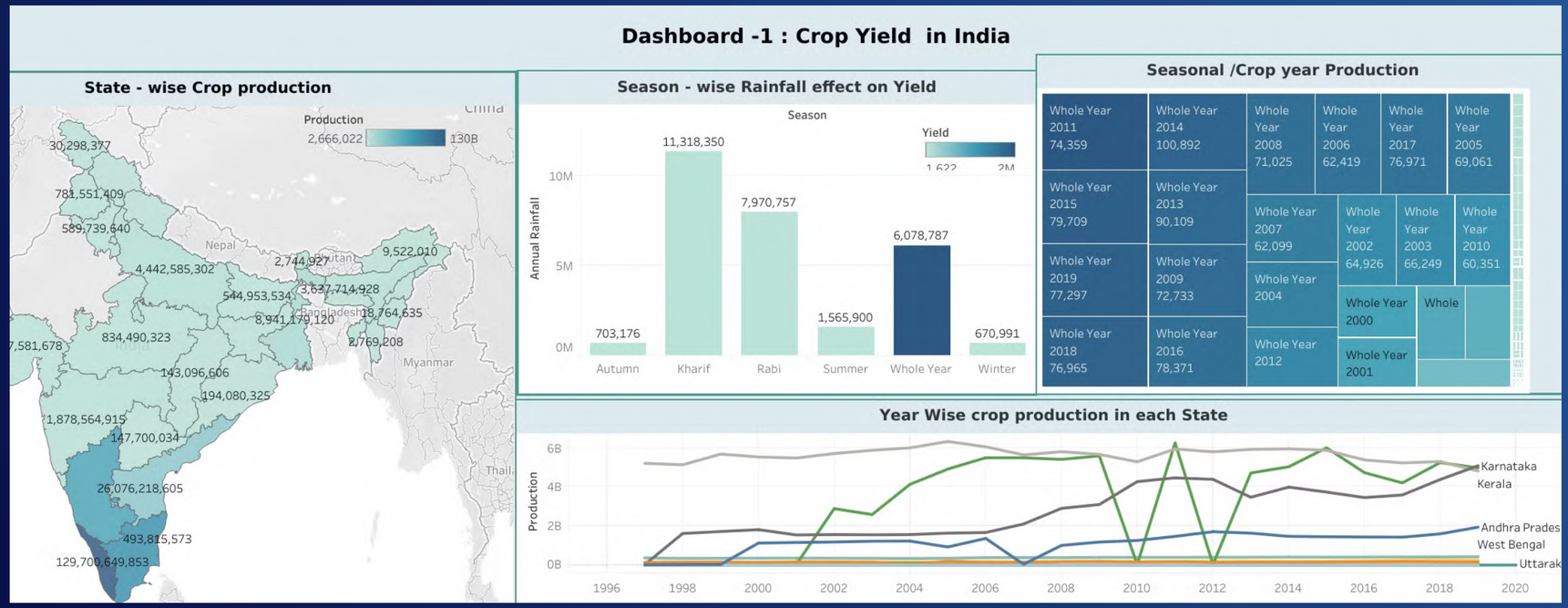


The graph, "Seasonal/Crop Year Production", is a heatmap of production for crops over several years and seasons. Each cell gives the amount of production for that particular crop during that season and in that year. This allows the reader to compare production levels over time with a single glance, and it allows them to identify trends, such as high production in specific years or dominance in general yield during specific seasons.



The graph is "Year-Wise Crop Production across Each State", which is a line chart depicting, across time, how crop production has been done by different states. We focus here on the possibility to drill into the details of how crop production has changed over time for major agricultural states. For example, the steadily rising production in states like Karnataka and Kerala without any jerks or breaks could indicate regularity in agricultural growth, while the undulating trends seen in other states like West Bengal could possibly represent the influence of exogenous factors such as variability in climate and changes in agricultural practices.

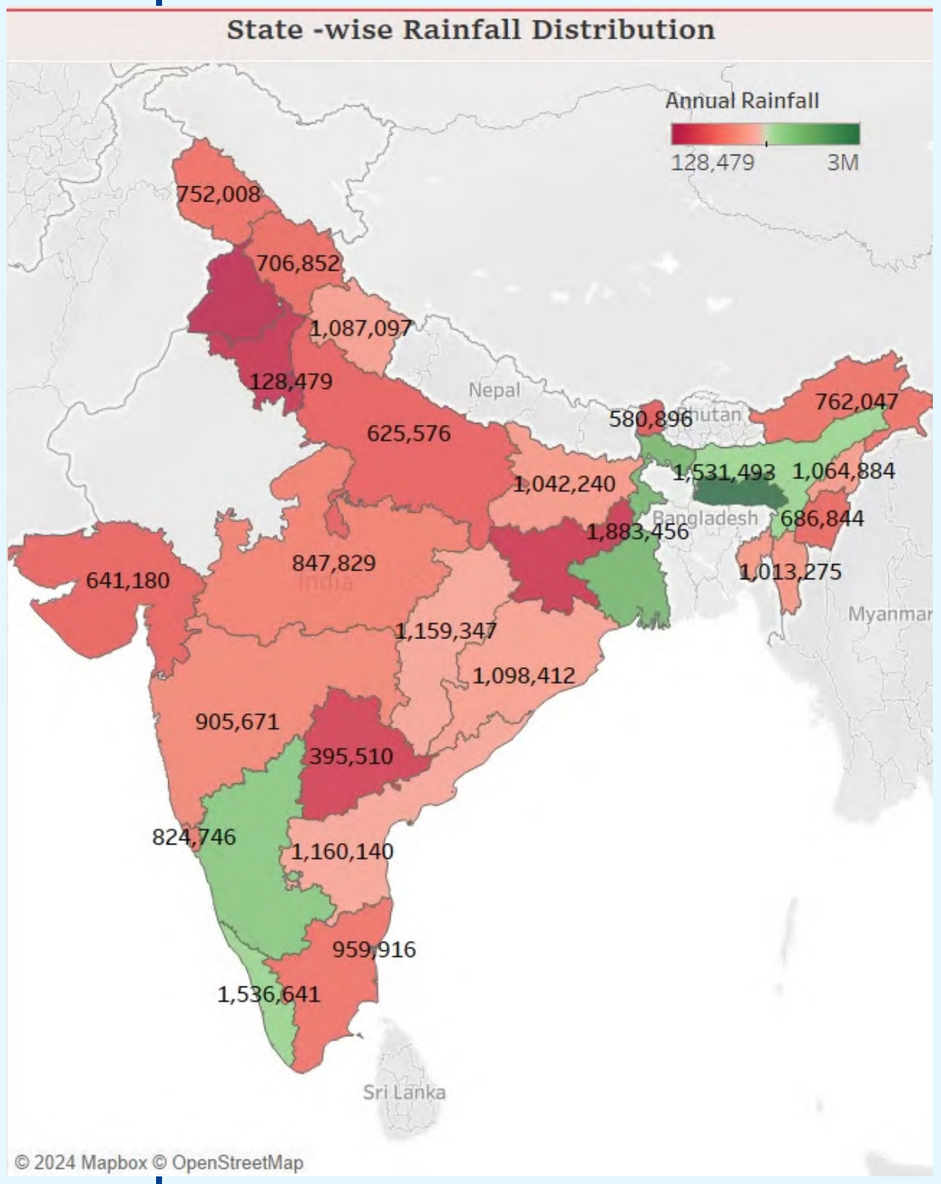
DASHBOARD 1



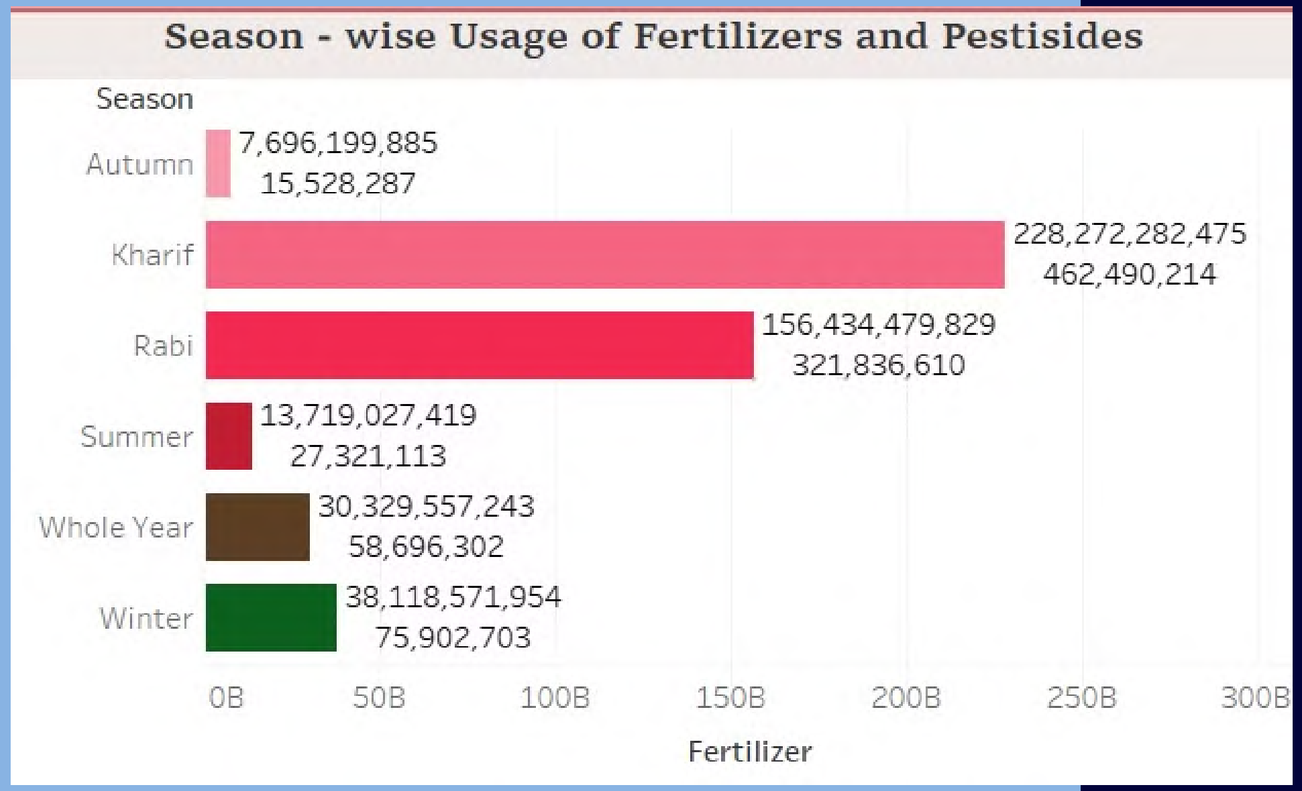
Summary: Ultimately, Dashboard 1 provides an analytical account with a level of detail and elaboration for crop production in India, showing how geographic location, seasonal rainfall, and year-to-year variations are causative to crops' yield. The learnings from this dashboard can act as inputs into the making of critical decisions, agricultural planning, resource allocation, and strategy formulation for increasing crop productivity in areas where this is relatively low in yield.

Graphs Created

This graph shows "State-wise Rainfall Distribution," which is a geographical map of India, indicating the distribution of annual rainfall across different states. The different shades shown on this map indicate rainfall in different amounts; the dark shade shows higher and light shade shows lower rainfall. This graph depicts different climatic conditions within the country and how this difference in rainfall due to these climatic conditions affects agricultural productivity in various parts of the country.

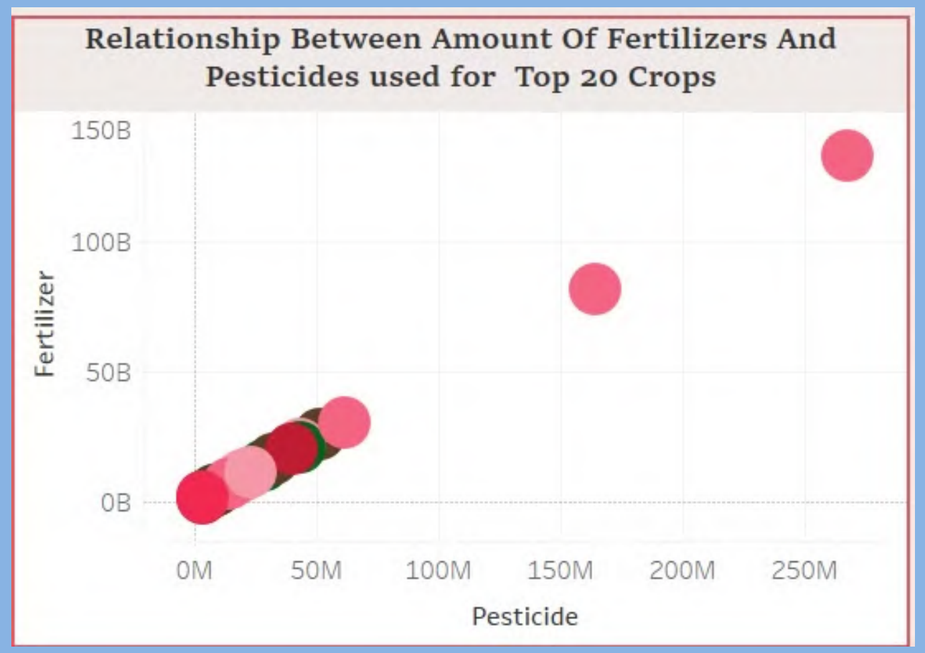


Graphs Created



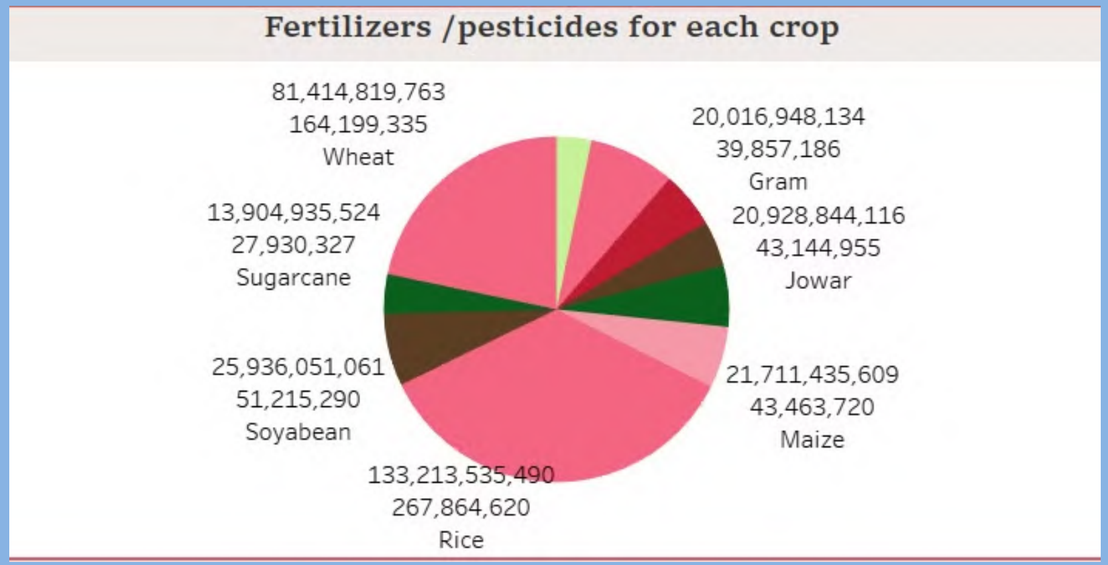
The second graph, "Season-wise Usage of Fertilizers and Pesticides," shows the trend of usage of these agrochemicals during different agricultural seasons. This graph indicates that the use of fertilizers is maximum during winter and Rabi seasons, which could be related to the heightened requirement of soil nutrients during these months. Contrarily, pesticide usage, though at a lower scale compared with fertilizers, indicates seasonality also, hence pointing to the importance of the months in terms of pest control for crop protection.

Graphs Created

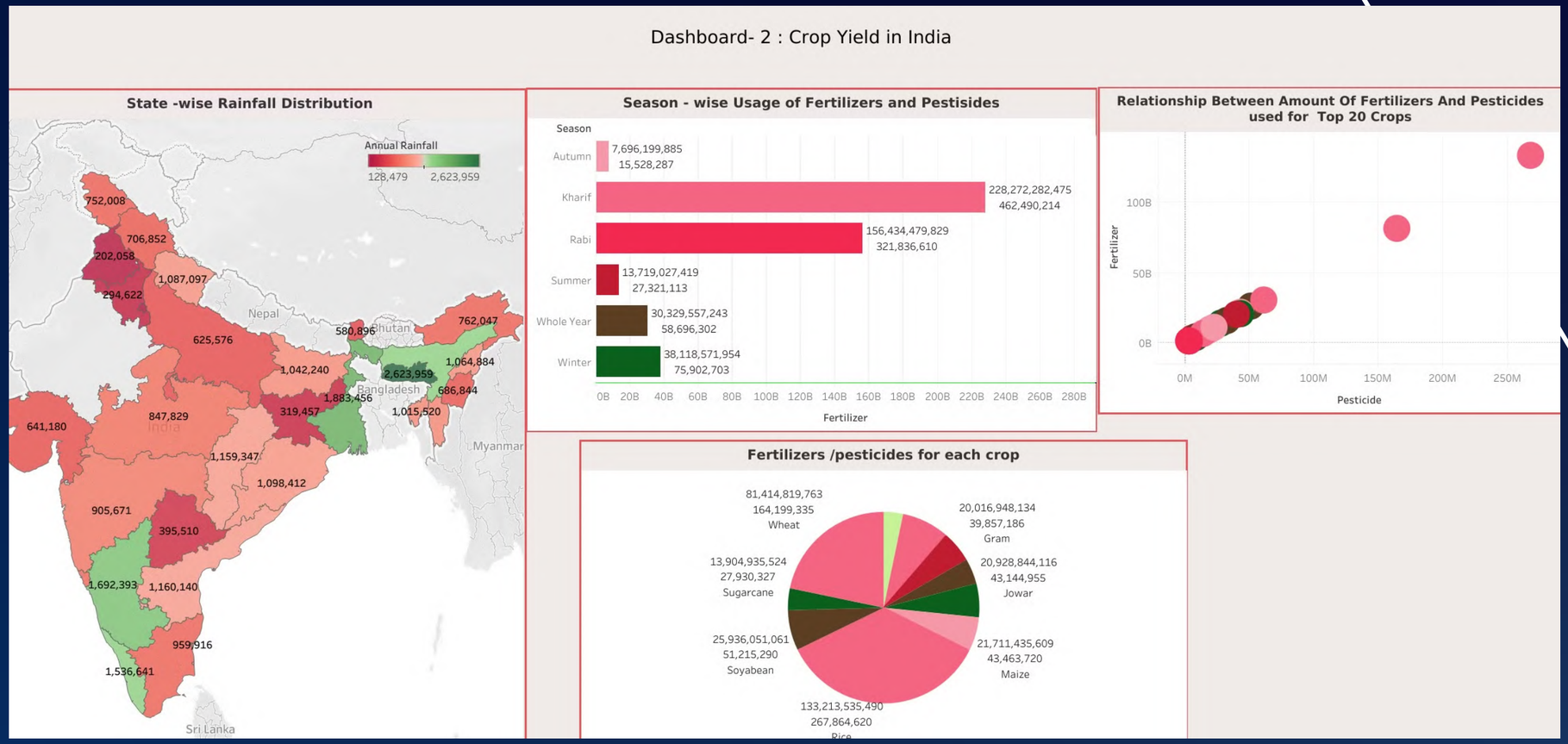


The graph, "Relationship Between Amount of Fertilizers and Pesticides Used for Top 20 Crops," is a bubble chart that represents the relationship between fertilizer use and pesticide use in different crops for the top 20 crops grown in India. Each bubble is a crop, with size proportional to the amount of fertilizers and pesticides used. This graph illustrates that increasing use of fertilizer is often coupled with increased pesticide application, again pointing to interdependence between two major inputs aimed at achieving maximum yields of crops.

The graph, "Fertilizers/Pesticides for Each Crop," is a pie chart giving the breakup of fertilizer and pesticide usage across various crops. Major crops like wheat, sugarcane, and soyabean come out as large consumers of these inputs in the graph. It gives one view of the input distribution from a crop-specific perspective, indicating which ones are the most resource-intensive and where to make improvements in efficiency.



DASHBOARD 2



Dashboard 2 outlines the important lessons learnt about India's agricultural landscape and reflects on how strategizing for the sector would have been impossible without an understanding of regional rainfall patterns, seasonal input usage, and the needs of different crops. This information would be germane to policymakers, agricultural scientists, and farmers working in such a way to optimize resource allocation, better crop yields, and enhance agricultural sustainability in totality in India

Overall Analysis

Crop Yield Drivers in India: A Comprehensive Overview

- Dashboard 1: Analyzes state-wise crop production and input usage, revealing yield dispersion and seasonality.
- Dashboard 2: Provides a geographical map of state-wise rainfall, season-wise fertilizer and pesticide usages, and their relationship with major crops.
- Both dashboards highlight the need for strategic input management and policies for regionally-based crop yield optimization.
- The insights from these dashboards can help formulate strategies for increased productivity, regional convergence, and sustainable farming practices.

Conclusion

How Does this Analysis Help Beneficiaries help take decisions?

The two dashboards provide beneficiaries with valuable insights into crop yield dynamics by visually representing the impact of key factors like rainfall, fertilizer, and pesticide usage on agricultural productivity. For agriculture planners and policymakers, the dashboards offer a clear view of regional disparities and trends, enabling them to make informed decisions about resource allocation and policy formulation. Farmers benefit from these insights by understanding how different variables affect their yields, allowing them to adopt more effective practices and optimize their use of inputs for improved crop performance. Overall, the dashboards facilitate data-driven decision-making, supporting more efficient and sustainable agricultural practices.

The report examines crop yield dynamics in India, focusing on climatic factors, regional conditions, and practices. It highlights regional variations in productivity due to climate, soil type, and agricultural practices. The study finds that crop yields depend on seasonal rainfall, with adequate rainfall correlated with high productivity. Water management and irrigation strategies are crucial to mitigate water scarcity. The report also evaluates the impact of fertilizer and pesticide application on yields, emphasizing the need for precision in input management to maximize yields while minimizing negative impacts.

Thank You

By

Blessy Louis

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