

Data Literacy with Tableau

Project report submitted on

India's Agricultural Crop Production Analysis (1997 - 2021)

by

Team ID: NM2023TMID29013

Chapter 1

Introduction

The word agriculture is derived from a Latin word- ager or ‘agri’ meaning soil and ‘culture’ meaning cultivation of the soil. In modern terms, agriculture comprises “the art and science of cultivating the soil, growing crops and rearing livestock.” Farming is rather considered a complete system which includes inputs, processing, and outputs. The inputs here are seeds, fertilizers, machinery, which then, undergoes operations like ploughing, sowing, irrigation, weeding, and harvesting. And thus, we get the final outputs like crops, dairy and poultry products. With different kinds of farming methods, the farmers grow different kinds of crops, from staple grains to industrial crops and plants.

Healthy, sustainable and inclusive food systems are critical to achieve the world’s development goals. Agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity, and feed a projected 10 billion people by 2050. Growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors. Agriculture is also crucial to economic growth: accounting for 4% of global gross domestic product (GDP) and in some least developing countries, it can account for more than 25% of GDP.

But agriculture-driven growth, poverty reduction, and food security are at risk: Multiple shocks – from COVID-19 related disruptions to extreme weather, pests, and conflicts – are impacting food systems, resulting in higher food prices and growing hunger. Up to 783 million people faced hunger in 2022, which is 122 million more than before the COVID-19 pandemic. Of these, a quarter of a billion (258 million) faced acute food insecurity.

The growing impact of climate change could further cut crop yields, especially in the world’s most food-insecure regions. At the same time, our food systems are responsible for about 30% of greenhouse gas emissions.

1.1 Overview

India is one of the major players in the agriculture sector worldwide and it is the primary source of livelihood for ~55% of India's population. India has the world's largest cattle herd (buffaloes), the largest area planted for wheat, rice, and cotton, and is the largest producer of milk, pulses, and spices in the world. It is the second-largest producer of fruit, vegetables, tea, farmed fish, cotton, sugarcane, wheat, rice, cotton, and sugar. The agriculture sector in India holds the record for second-largest agricultural land in the world generating employment for about half of the country's population. Thus, farmers become an integral part of the sector to provide us with a means of sustenance.

The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. The Indian food processing industry accounts for 32% of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth.

1.2 Objective:

This project is intended to analyse the Indian Agriculture crop production for the data collected from 1997 to 2021. Let us ask interesting questions on existing data, get production and area statistics and understand more on the Indian Agriculture history for crop production.

1.3 Purpose:

Doing an exploratory data analysis of the dataset collected would give insights into India's agriculture status: state-wise, district-wise, crop-wise, area-wise and levels of productions. A complete analysis will portray an excellent plot of this important aspect of India.

Chapter 2

Problem Definition & Design Thinking

2.1 Empathy Map

An Empathy Map allows us to sum up our learning from engagements with people in the field of design research. The map provides four major areas in which to focus our attention on, thus providing an overview of a person's experience. Empathy maps are also great as a background for the construction of the personas that you would often want to create later.

An Empathy Map consists of four quadrants. The four quadrants reflect four key traits, which the user demonstrated/possessed during the observation/research stage. The four quadrants refer to what the user: Said, Did, Thought, and Felt. It's fairly easy to determine what the user said and did. At the centre of the map, a user or persona is displayed to remind practitioners and stakeholders what type of individual this research is centred around. Each category of the empathy map represents a snapshot of the user's thoughts and feelings without any chronological order.

Says category contain what the user says out loud during research or testing. Ideally, each point is written down as close to the user's original words as possible.

Thinks category contain what the user is thinking. While content may overlap with the *Says* category, *Thinks* category exists to capture thoughts users may not want to share willingly due to social factors, such as self-consciousness or politeness.

Does category contain the user's action and behaviours. This contains what the user is physically doing and captures what actions users are taking.

Feels category contain the user's emotional state in context with their experience. This typically contains information or phrases as to how they feel about the experience.

Fig 2.1 shows the empathy map designed for crop production with four quadrants. It displays the ideas of the team members regarding crop production.

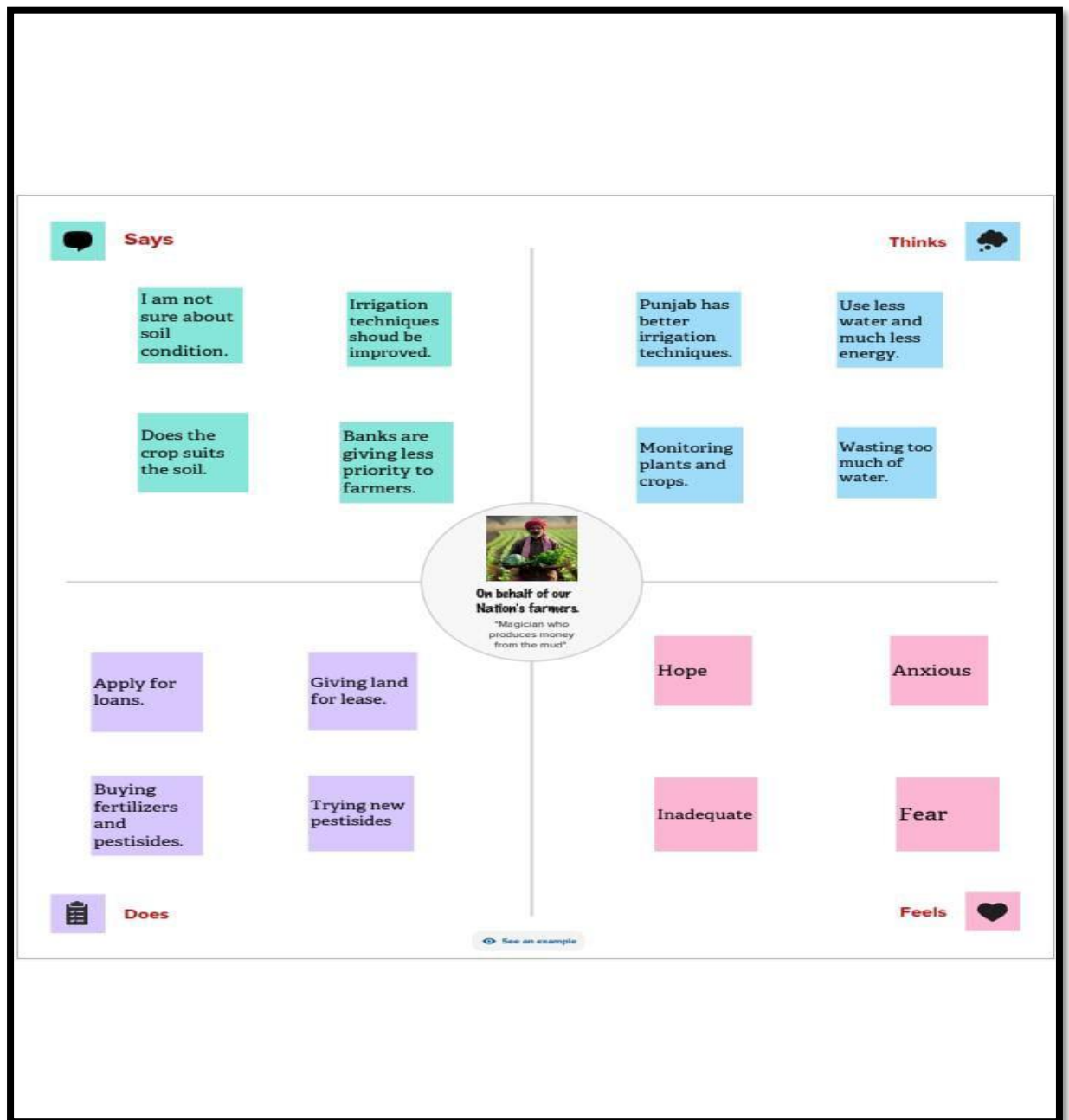


Fig 2.1 Empathy Map

2.2 Ideation and Brainstorming Map:

A Mind Map is an easy way to brainstorm thoughts organically without worrying about order and structure. It allows us to visually structure our ideas to help with analysis and recall. A brainstorming Map can turn a long list of monotonous information into a colourful, memorable and highly organized diagram that works in line with your brain's natural way of doing things. Fig. 2.2 depicts the Brainstorming map plotted for crop production analysis.

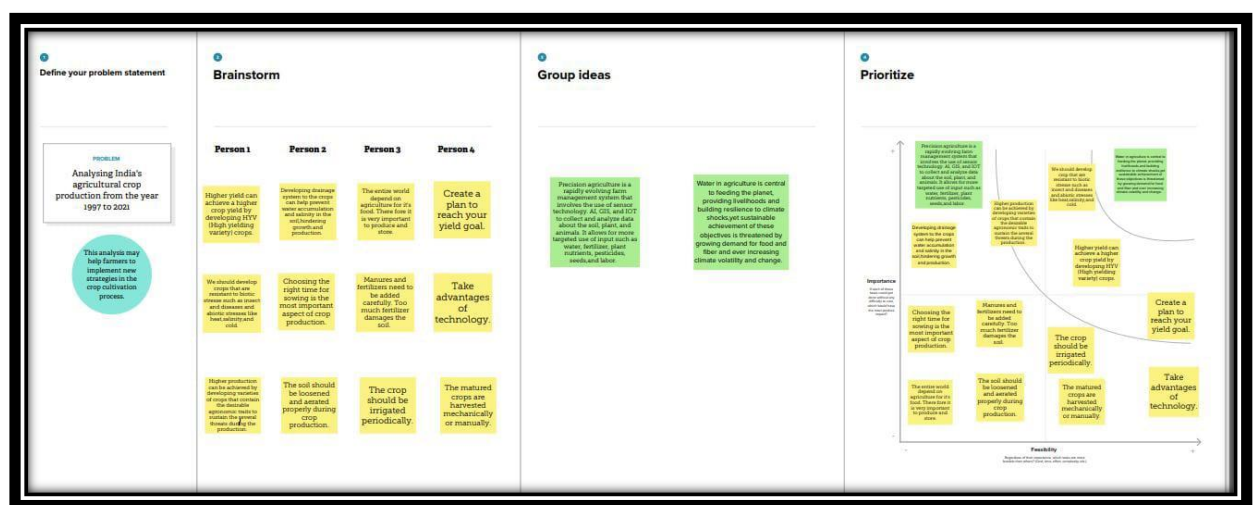


Fig. 2.2 Brainstorming Map

Chapter 3

Results

This chapter discusses the various results of the project India's agriculture crop production analysis (1997-2021) derived from the collected data set. The collected data are analysed under the following categories and visualizations are plotted using Tableau software:

- (i) State wise Agricultural Land
- (ii) Area Vs Production
- (iii) Season Based Cultivation
- (iv) Yield by Season
- (v) Crop plantation by area
- (vi) Major Crops Growth
- (vii) Crops
- (viii) Season wise production

3.1 State wise Agricultural Land:

The bar chart of state wise agricultural land is shown in Fig. 3.1. The graph shows the amount of agricultural land present in various states across India. From the graph it could be visualised that Uttar Pradesh has the largest amount of agricultural land followed by Madhya Pradesh, Rajasthan, Maharashtra and so on. Tamil Nadu ranks 14 among all the states in India.

Ladakh has the meagre amount of agricultural land.

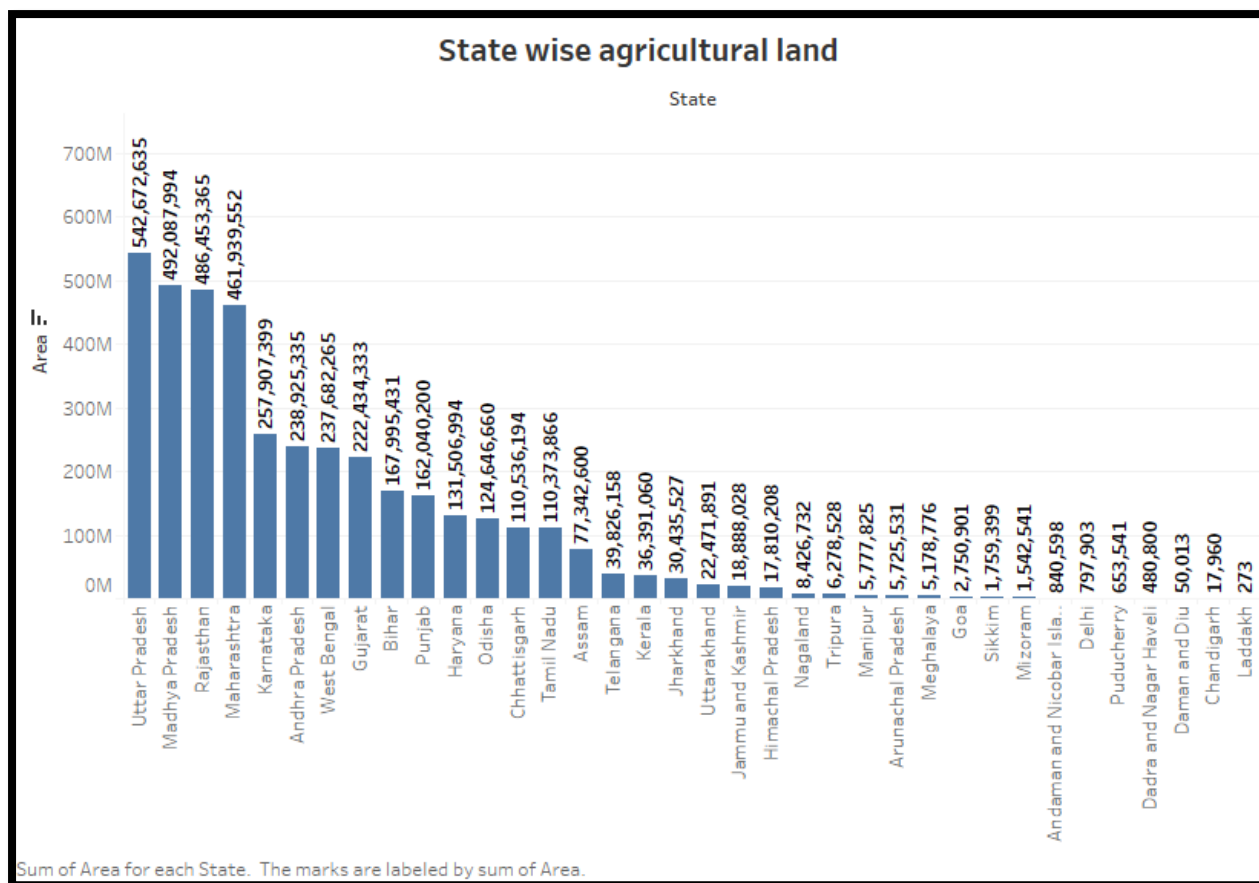


Fig. 3.1 State wise Agricultural Land

3.2 Area Vs Production

Fig. 3.2 portrays the graph between area and production. From the graph it is visible that Uttar Pradesh has the highest agricultural land, but has the lowest production of crops. Whereas Karnataka holds the fourth position in the area of agricultural land but ranks first in crop production. Andhra Pradesh holds the second and West Bengal the third positions.

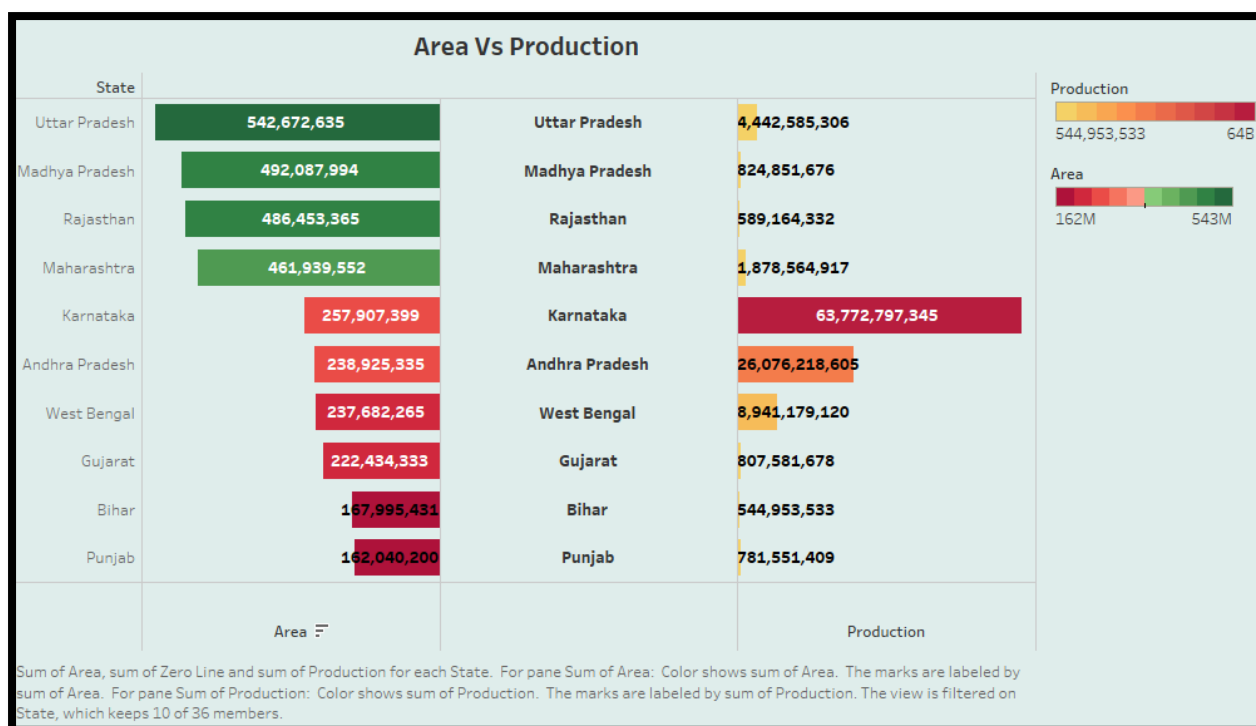


Fig. 3.2 Area Vs Production

3.3 Season based cultivation by area

Fig. 3.3 – Fig. 3.7 depicts the various crops cultivated throughout the country in various seasons. The seasons followed in India include

- (i) Kharif Season
- (ii) Autumn Season
- (iii) Summer Season
- (iv) Rabi Season
- (v) Winter Season

Fig. 3.8 shows the crops grown throughout the year in India. From the graphs it can be seen that rice is grown in four season except Rabi Season. Wheat is cultivated only in Rabi Season.

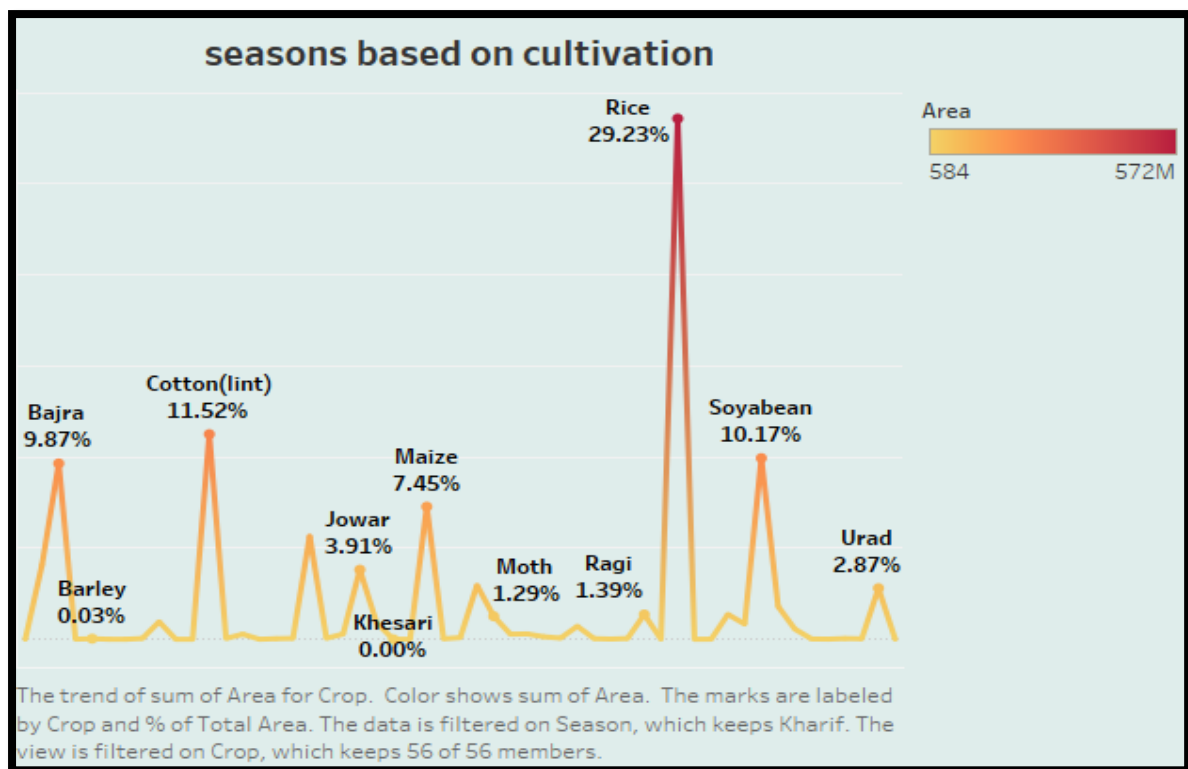


Fig. 3.3 Kharif Season Crops

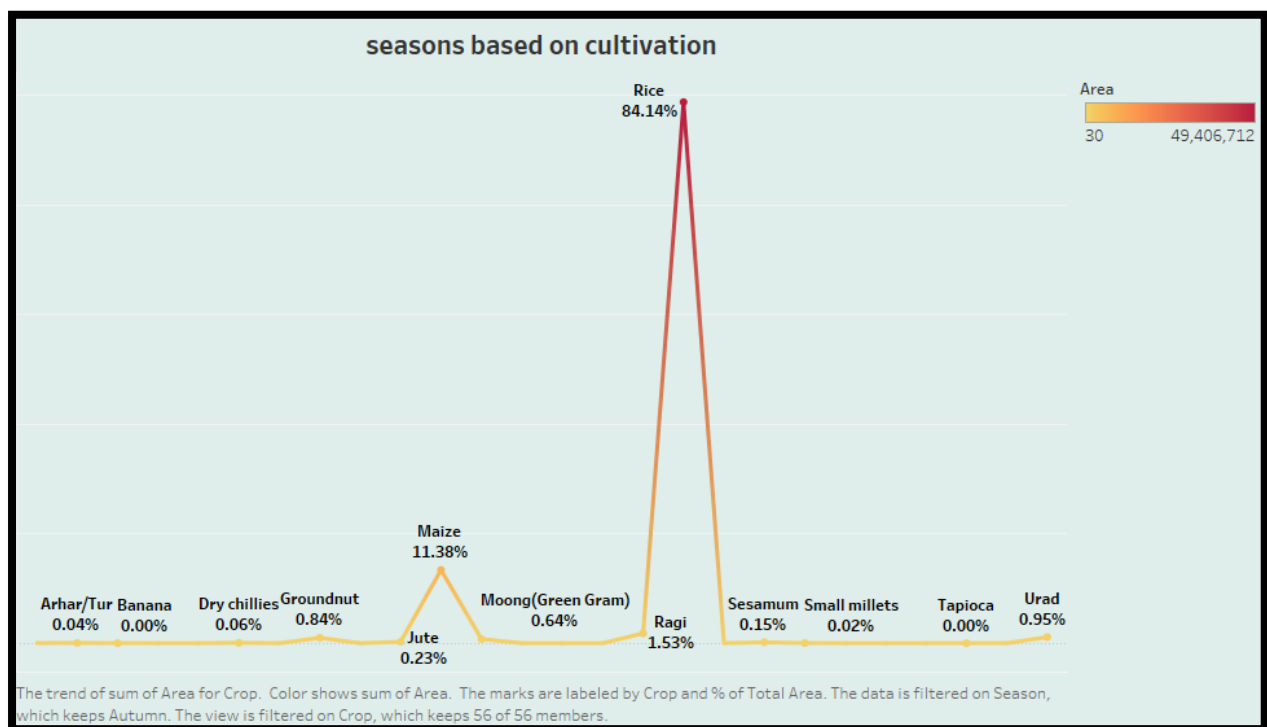


Fig. 3.4 Autumn Season Crops

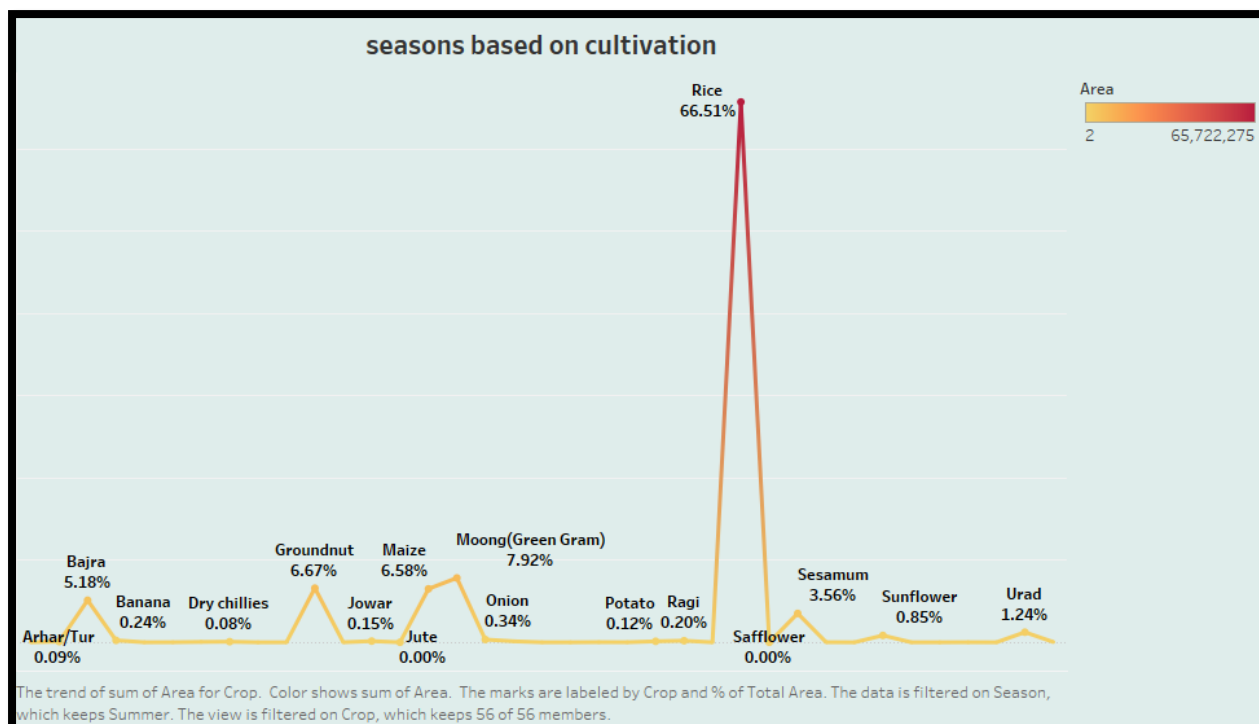


Fig. 3.5 Summer Season Crops

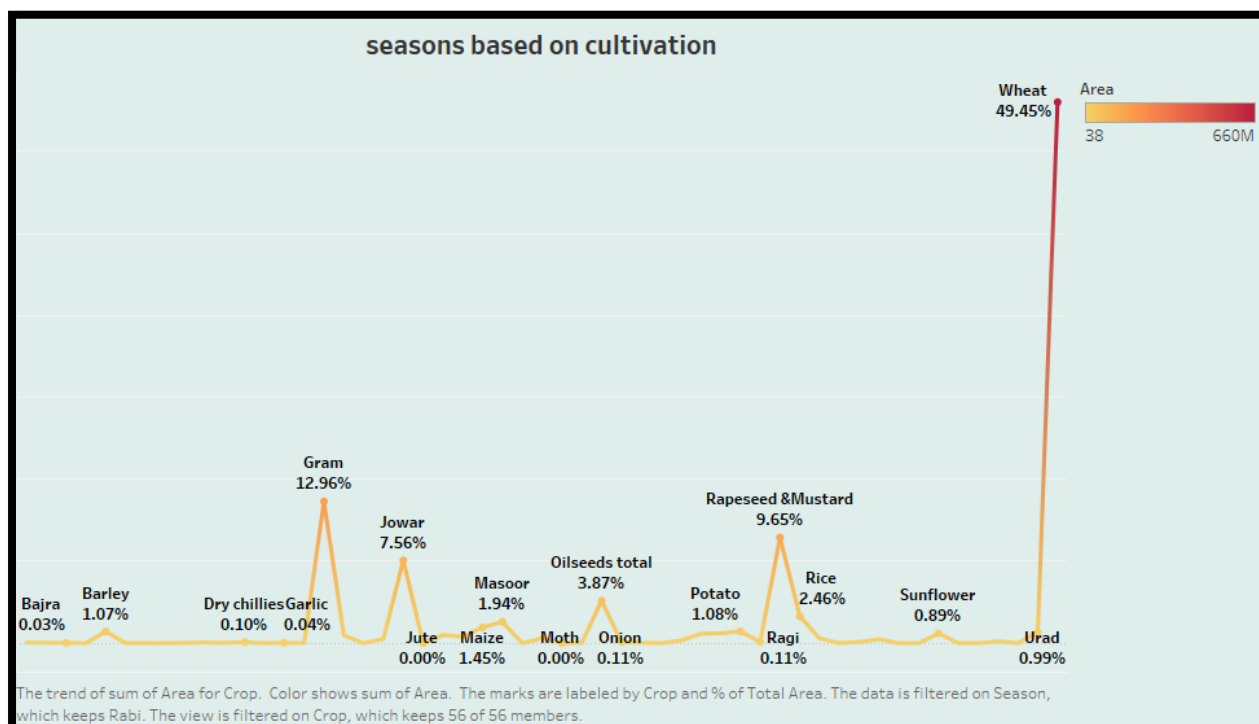


Fig. 3.6 Rabi Season Crops

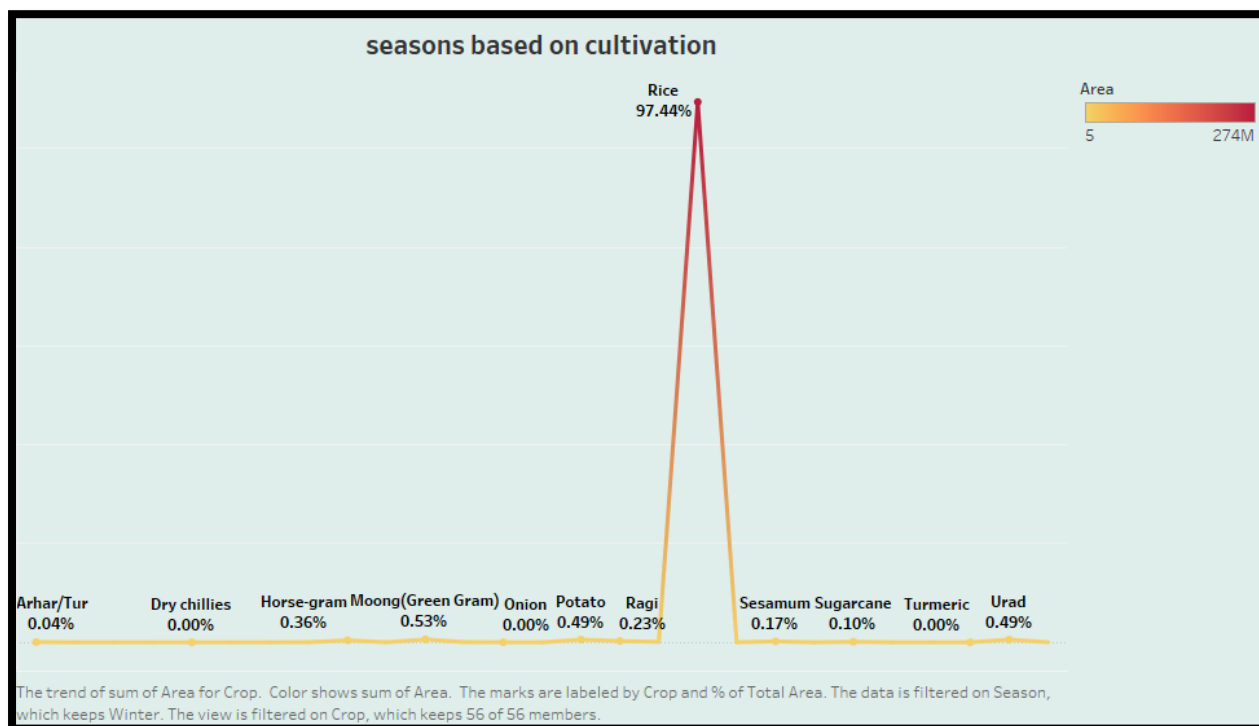


Fig. 3.7 Winter Season Crops

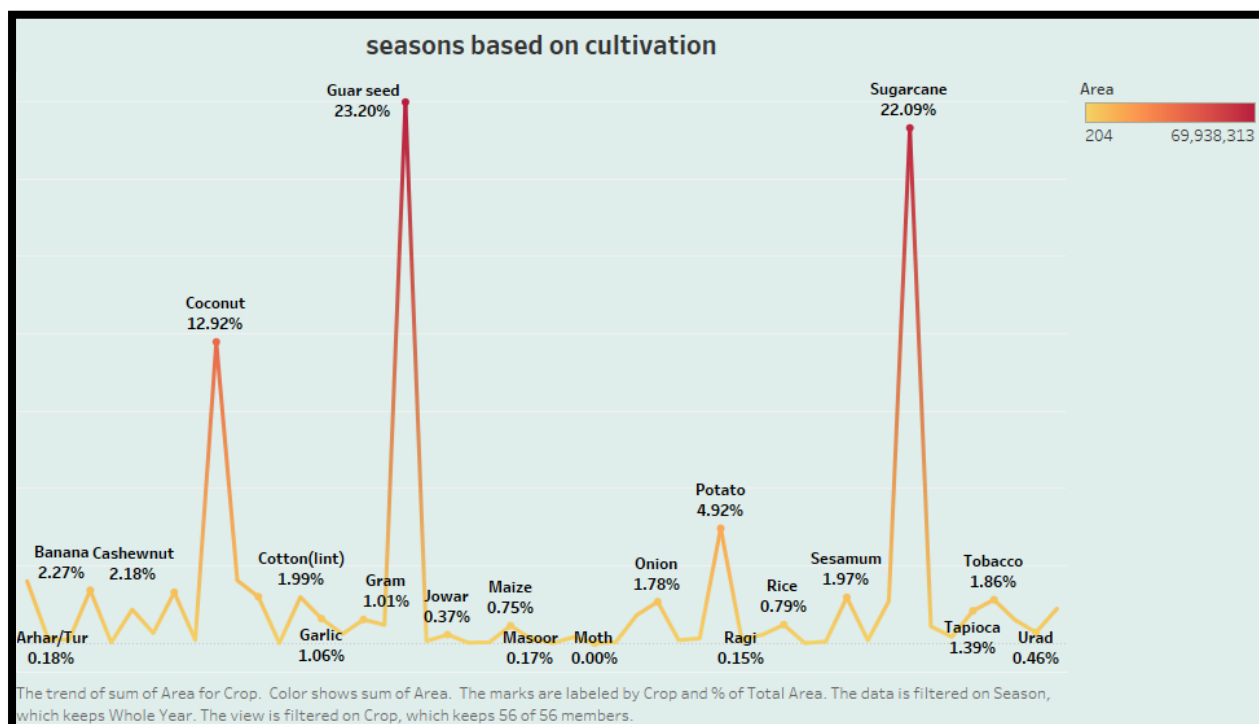


Fig. 3.8 Crops Produced During the Whole year

3.4 Yield by Season

Fig. 3.9 – Fig. 3.13 depicts the various crop yield throughout the country in various seasons. Fig. 3.14 shows the yield of crop during the whole year. From the graph it can be seen that the crop yield has decreased considerably during the year 2020 – 2021. This can be attributed to the impact of COVID-19 in our country. While analysing the plot it could be visualised that the crop yield has been maximum during the year 2011 – 2012.

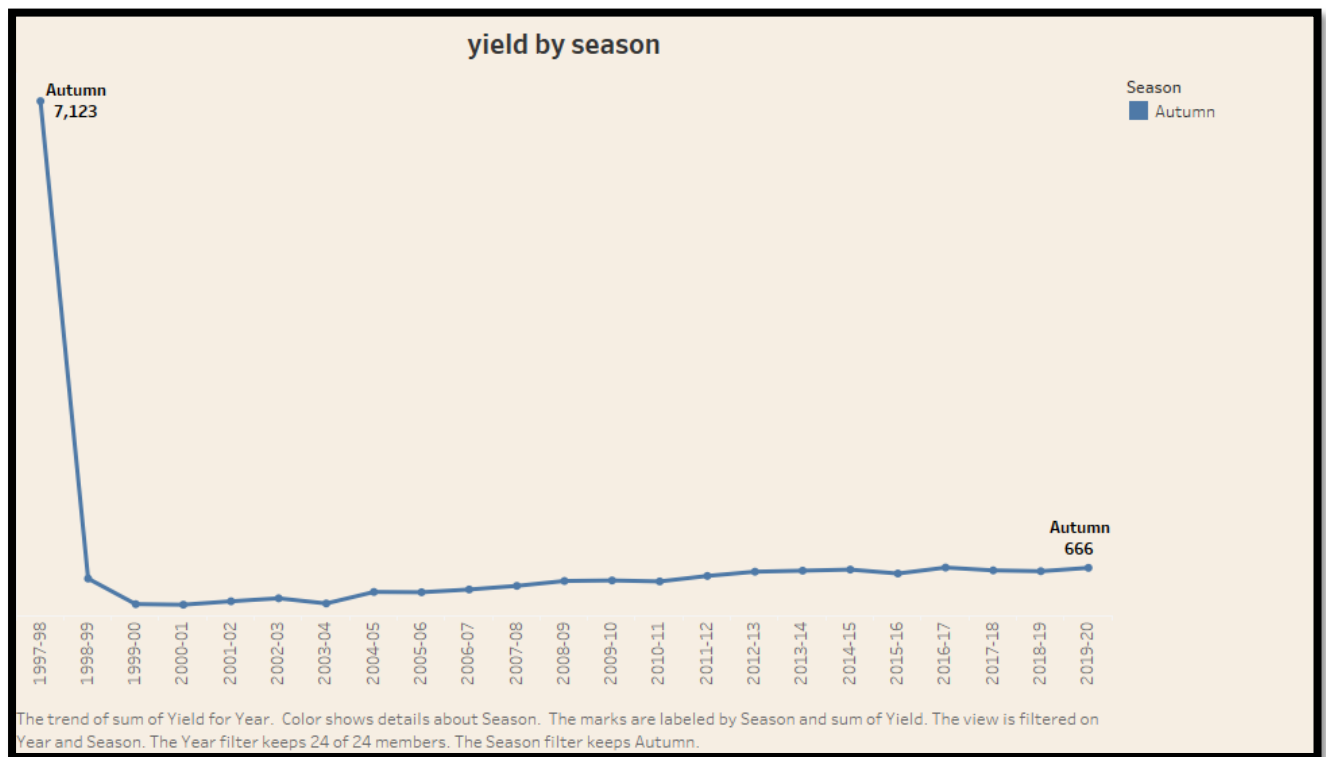


Fig. 3.9 Yield during Autumn Season

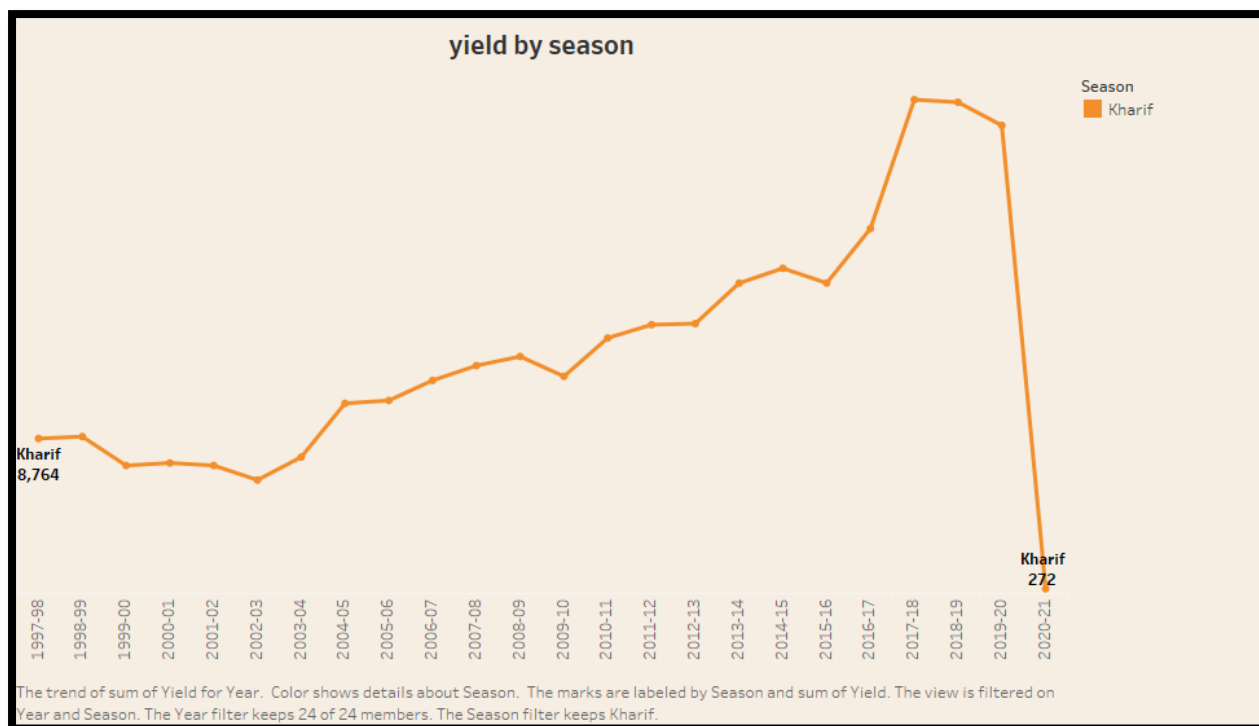


Fig. 3.10 Yield during Kharif Season



Fig. 3.11 Yield during Rabi Season



Fig. 3.12 Yield during Summer Season

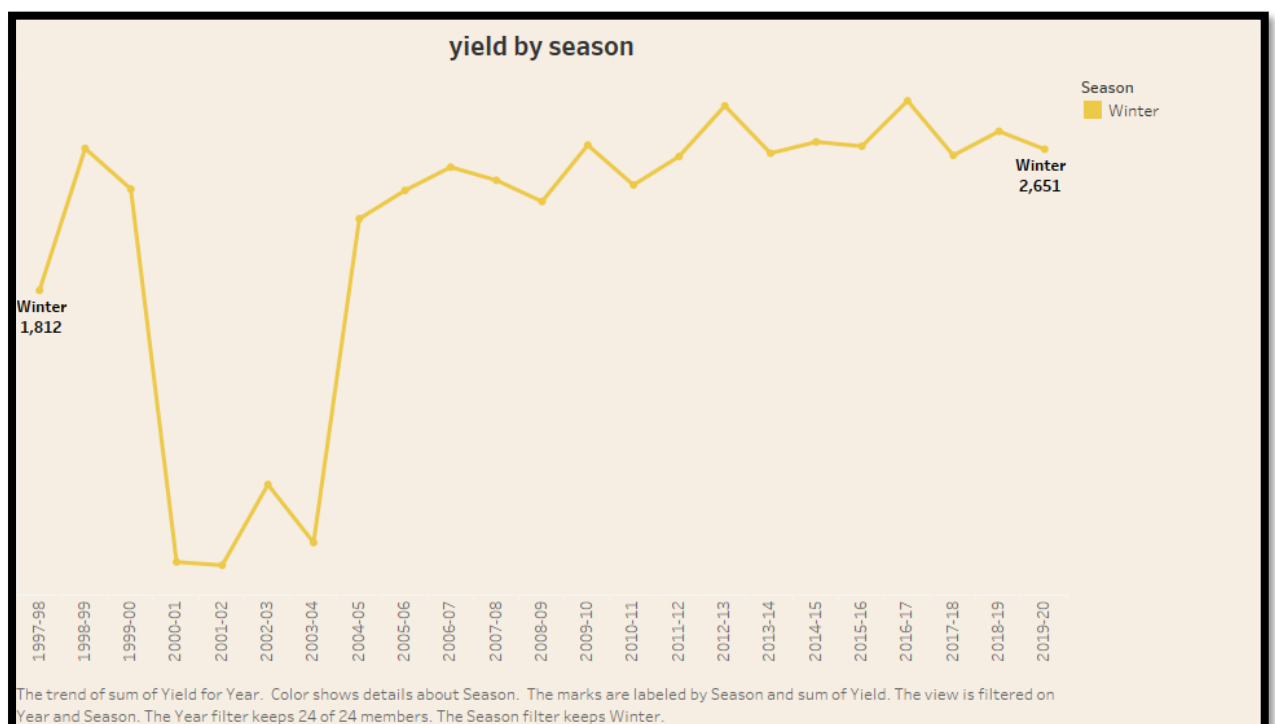


Fig. 3.13 Yield during Winter Season

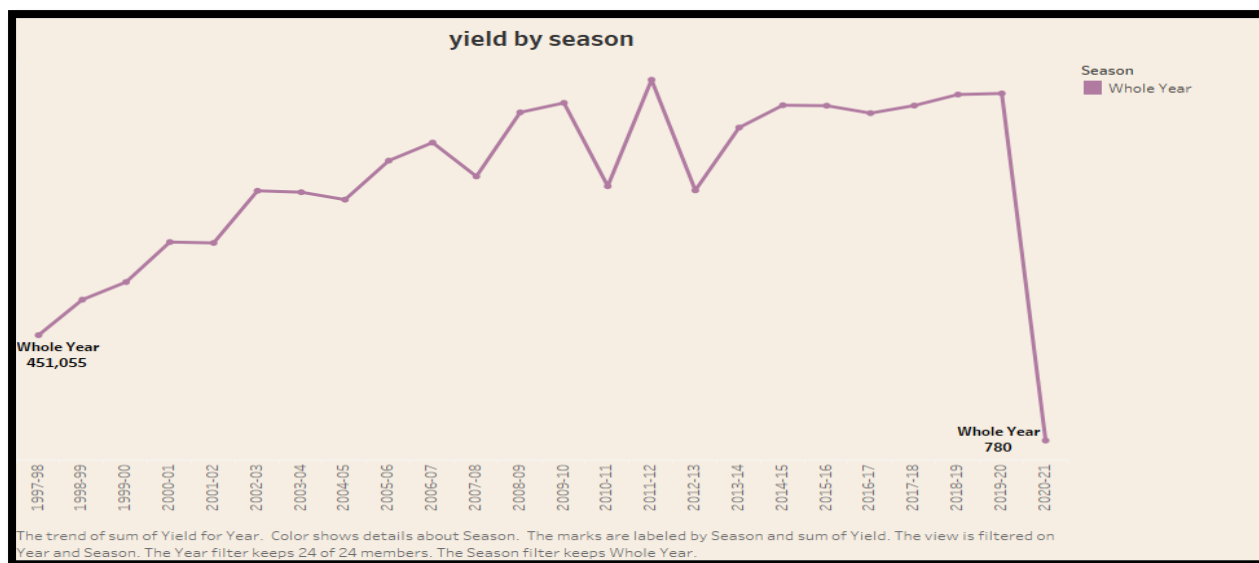


Fig. 3.14 Yield during Whole Year

3.5 Crop plantation by Area

Fig. 3.15 shows the plantation of crops area wise. From the chart it can be visualised that rice and wheat are the major crops cultivated in India.

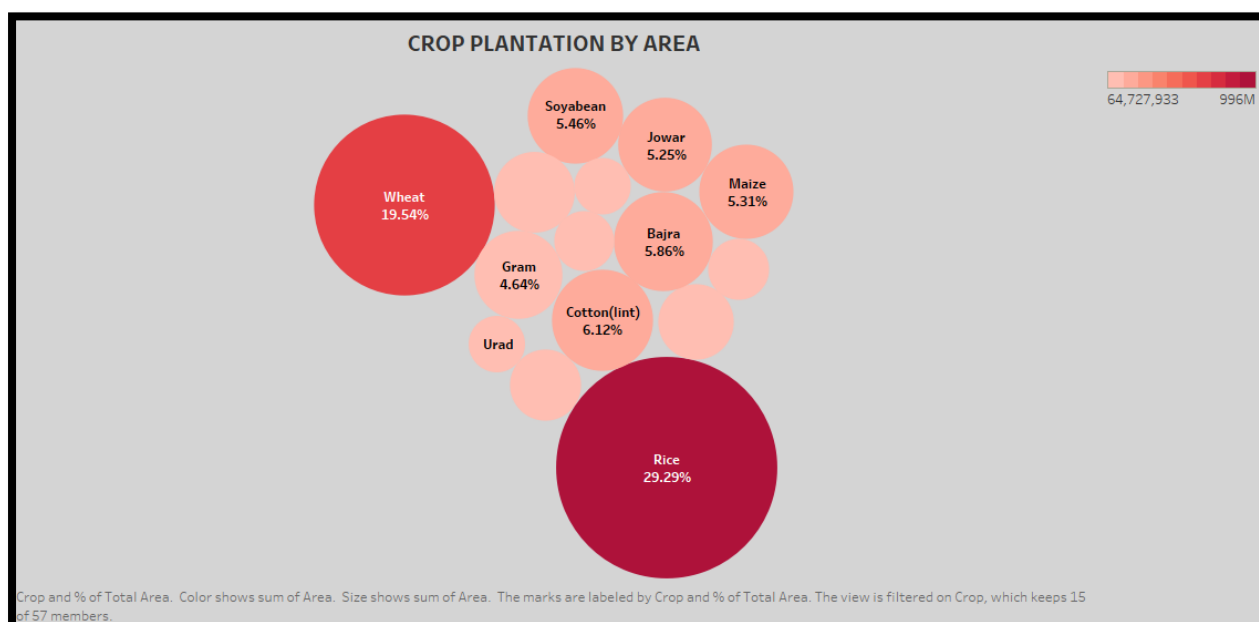


Fig. 3.15 Crop plantation by Area

3.6 Major crops growth YOY

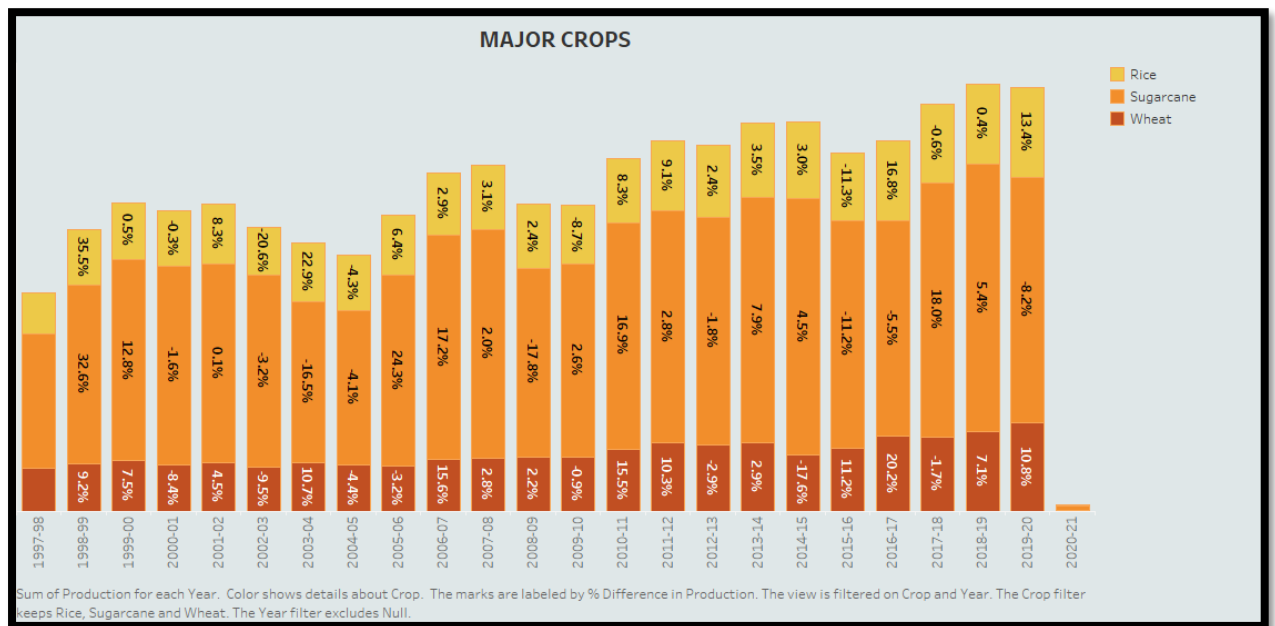


Fig. 3.16 Major crops growth year over year

Fig. 3.16 shows the major crops that are grown year over year for a time period of 1997 – 2021

3.7 Crops plantation by count

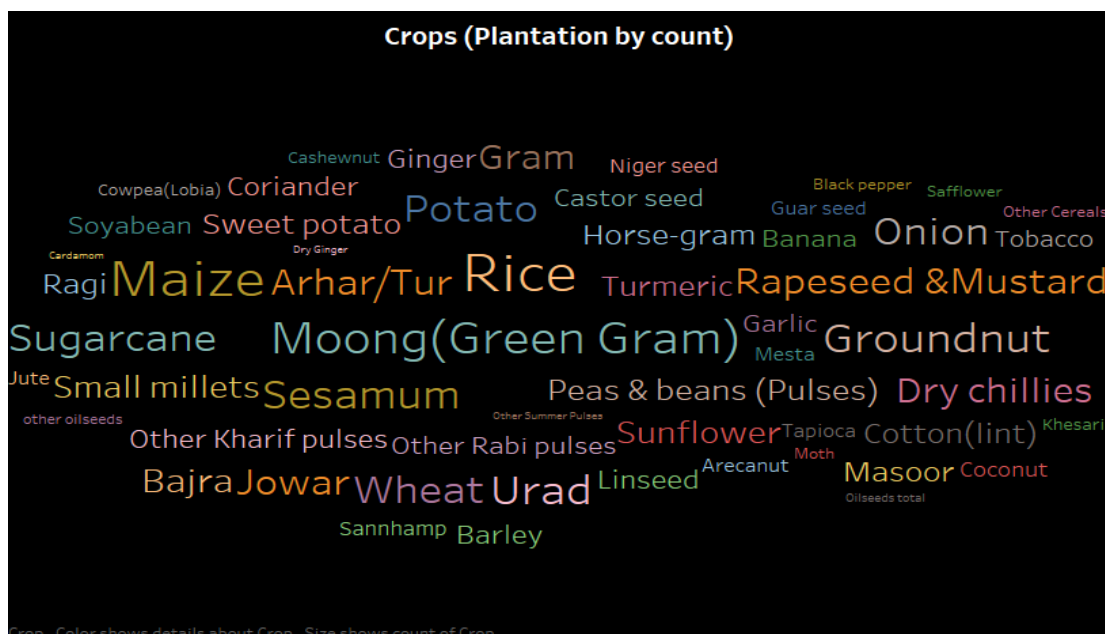


Fig. 3.17 Crop plantation by count

Fig. 3.17 shows the plantation of crop by count. From the graph we can see that rice crops are found in abundance.

3.8 Season wise Production

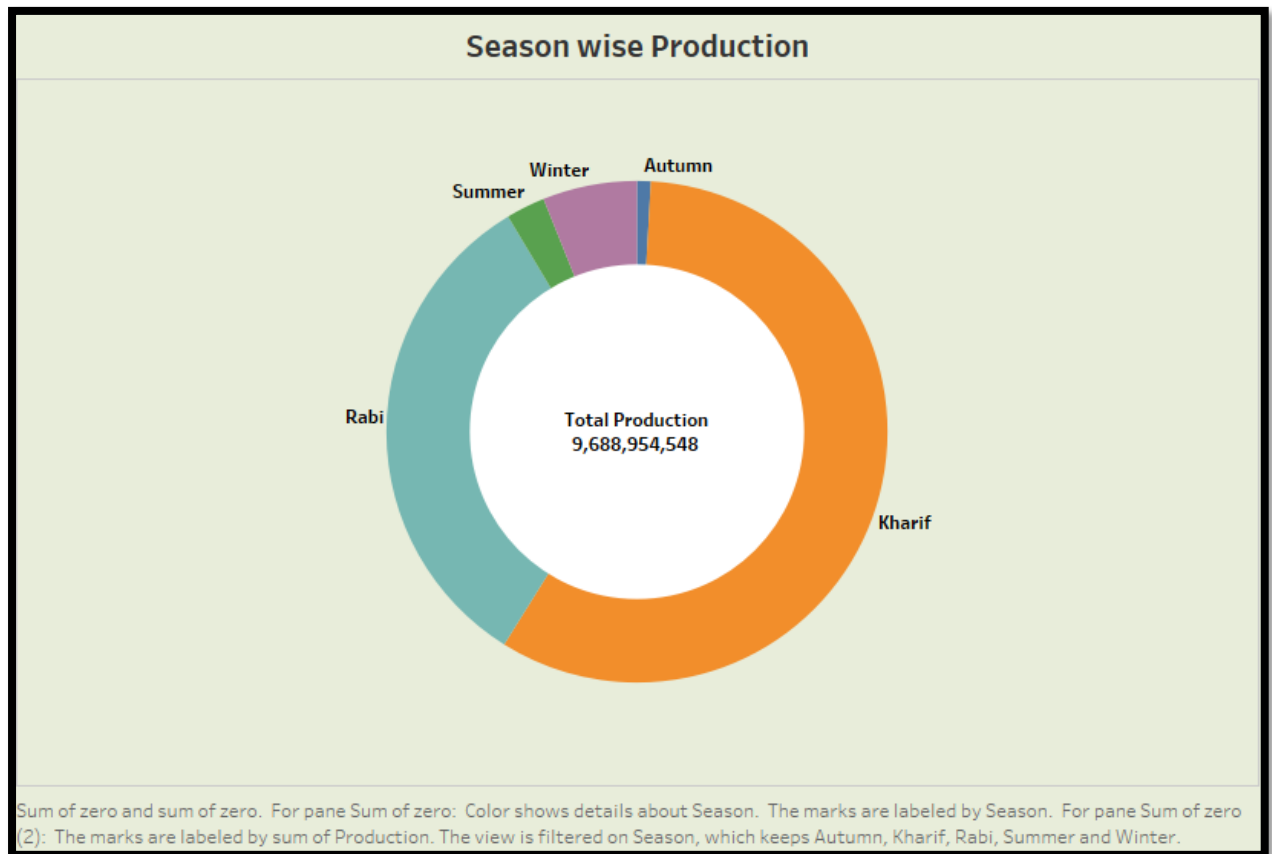


Fig. 3. 18 Season wise Production

Fig. 3.18 depicts the production of crops in a particular season. The pie chart shows that crop production is maximum during the Kharif season and minimum during the Autumn season.

Chapter 4

Advantages and Disadvantages

4.1 Advantages:

In general, the areas in which the study has gained substantial accomplishments are

The study has helped to

- (1) Increase awareness among farmers about the adoption of weather based advisory.
- (2) Further improve the assessment of economic impact agro advisory services on farm decision making
- (3) Enhance the capacity of the farming community to take weather-based farm management decision related to weather sensitive operations.
- (4) Upgrade the existing knowledge of farmers as well as scientists on identification of
 - (i) weather sensitive crops
 - (ii) weather sensitive stages of different crops
 - (iii) weather sensitive farm operations

4.2 Disadvantages:

Agriculture is both a cause of and sensitive to environmental degradation, such as biodiversity loss, desertification, soil degradation, and climate change, all of which can cause decreases in crop yield. While the study was designed and conducted in the most impartial way, yet, there is a possibility that some unexpected but unavoidable bias might have percolated into the survey. Although these shortfalls/ deficiencies are obvious and expected in such types of projects and due efforts are made to avoid these, yet some of them might have influenced the final results. A few of them are listed below.

- (i) Raising agricultural productivity per unit of land: Raising productivity per unit of land will need to be the main engine of agricultural growth as virtually all cultivable land is farmed. Water resources are also limited and water for irrigation must contend with increasing industrial and urban needs. All measures to increase productivity will need exploiting, amongst them: increasing yields, diversification to higher value crops, and developing value chains to reduce marketing costs.
- (ii) Reducing rural poverty through a socially inclusive strategy that comprises both agriculture as well as non-farm employment.
- (iii) Ensuring that agricultural growth responds to food security needs.

Chapter 5

Applications

- (i) Farmers use seasonal yield data to plan their planting and harvesting schedules for the most productive time.
- (ii) Farmers employ yield data to plan crops rotation that optimise soil health and reduce the build-up of pests and diseases.
- (iii) The application of season-based cultivation is central to sustainable and efficient agriculture, aligning crops production with natural cycles, resources availability and market demand. It contributes food, security, environmental sustainability, and the preservation of traditional farming knowledge.
- (iv) The application of season wise production data is fundamental in agriculture and related management and addressing challenges related to production supply and sustainability.
- (v) Season wise production data helps farmers and agricultural agencies plan planting and harvesting schedules based on historical trends and seasonal factors.
- (vi) Data on agricultural land is essential for urban agriculture initiatives and planning the use of land in urban and peri urban areas.
- (vii) Analysing the relation between the area under cultivation and crop production estimating crop yields this information is crucial for food security, marketing planning and distribution.
- (viii) Yearly crop production data help in adapting to change in climate pattern allowing for adjustments in planting times and crop varieties. Data on yearly crop production influence import and export decision trade balances and international market dynamics.

Chapter 6

Conclusion

The science or practice of farming, including cultivation of soil for the growth of crops and the rearing of animals to provide food, wool or other products. Crop production includes the production and management of row crops for profit. Extension programs in this area focus on challenges facing crop producers and supporting industries in marketing integrated pest management sustainable cultural practises, environmental and human health risk, invasive species, a regulation and profitability. In this project entitled “India’s agricultural crop production analysis 1997-2021”. We have studied the various crop grown in India and their state wise and season-based cultivation. Nearly 8 visualizations have been plotted through tableau software. By using these various charts like major crops, crop plantation, yield by season, from the year 1997- 2021. we can analyse the importance of agricultural sector and overlook production for past 24 years (1997-2021).

Chapter 7

Future Scope

- (i) **Drought:** Prolong periods of inadequate rainfall or water scarcity can lead to crop withering reduced yields and in severe cases complete crop failure.
- (ii) **Flood:** Excessive rainfall or water raising levels can inundate fields leading to water logged soil crop damage and rotting of crops.
- (iii) **Heat waves:** Prolonged periods of extremely high temperatures can stress crops leading to wilting reduced yields and in some cases crop failure.
- (iv) **Insect infestation:** Insect like locusts or army worms can devour crops leading to significant crop damage and loss.
- (v) **Plant diseases:** Fungal, bacterial or viral diseases can spread rapidly and devastate crops leading to yield reduction and quality issues.

The above listed data can be collected from various sources and charts can be visualised using Tableau Software. More precise analysis on crop production can be studied using these details.