KAAMADHENU ARTS AND SCIENCE COLLEGE, SATHYAMANGALAM

DEPARTMENT OF MATHEMATICS

Course Name: Data Analytics with Tableau

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A project report entitled as

"India's Agricultural Crop Production Analysis (1997 to 2021) with Tableau"

Work done by

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

1. INTRODUCTION

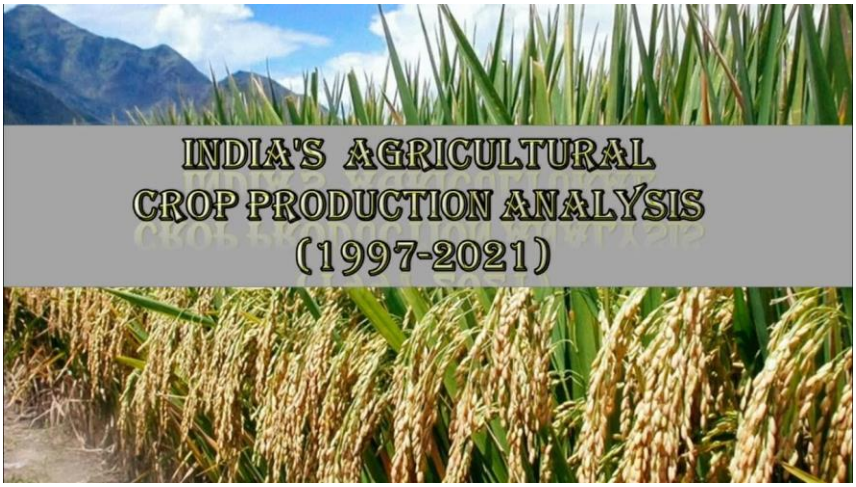
1.1 OVERVIEW

According to The World Bank, India is a global agricultural powerhouse. It is the world's largest producer of milk, pulses, and spices, and has the world's largest cattle herd (buffaloes), as well as the largest area under wheat, rice and cotton. It is the second largest producer of rice, wheat, cotton, sugarcane, farmed fish, sheep & goat meat, fruit, vegetables and tea. While agriculture's share in India's economy has progressively declined to less than 15% due to the high growth rates of the industrial and services sectors, the sector's importance in India's economic and social fabric goes well beyond this indicator.

There is a rising demand for food security in the face of threats posed by a growing human population. Bees as an insect play a crucial role in crop pollination alongside other animal pollinators such as bats, birds, beetles, moths, hoverflies, wasps, thrips, and butterflies and other vectors such as wind and water. Bees contribute to the global food supply via pollinating a wide range of crops, including fruits, vegetables, oilseeds, legumes, etc. The economic benefit of bees to food production per year was reported including the cash crops, i.e., coffee, cocoa, almond and soybean, compared to self-pollination. Bee pollination improves the quality and quantity of fruits, nuts, and oils. Bee colonies are faced with many challenges that influence their growth, reproduction, and sustainability, particularly climate change, pesticides, land use, and management strength, so it is important to highlight these factors for the sake of gainful pollination.

Pollination plays a significant role in the agriculture sector and serves as a basic pillar for crop production. Plants depend on vectors to move pollen, which can include water, wind, and animal pollinators like bats, moths, hoverflies, birds, bees, butterflies, wasps, thrips, and beetles. Cultivated plants are typically pollinated by animals. Animal-based pollination contributes to 30% of global food production, and bee-pollinated crops contribute to approximately one-third of the total human dietary supply. Bees are considered significant pollinators due to their

effectiveness and wide availability. Bee pollination provides excellent value to crop quality and quantity, improving global economic and dietary outcomes.



1.2 PURPOSE

Pollination plays a significant role in the agriculture sector and serves as a basic pillar for crop production. Plants depend on vectors to move pollen, which can include water, wind, and animal pollinators like bats, moths, hoverflies, birds, bees, butterflies, wasps, thrips, and beetles. Cultivated plants are typically pollinated by animals.

Animal-based pollination contributes to 30% of global food production, and bee-pollinated crops contribute to approximately one-third of the total human dietary supply. Bees are considered significant pollinators due to their effectiveness and wide availability.

The main purpose of the project is a comprehensive yet generalized analysis which will act as valuable reference material for future and hence would beeasy to use and refer to by concerned authorities and users.

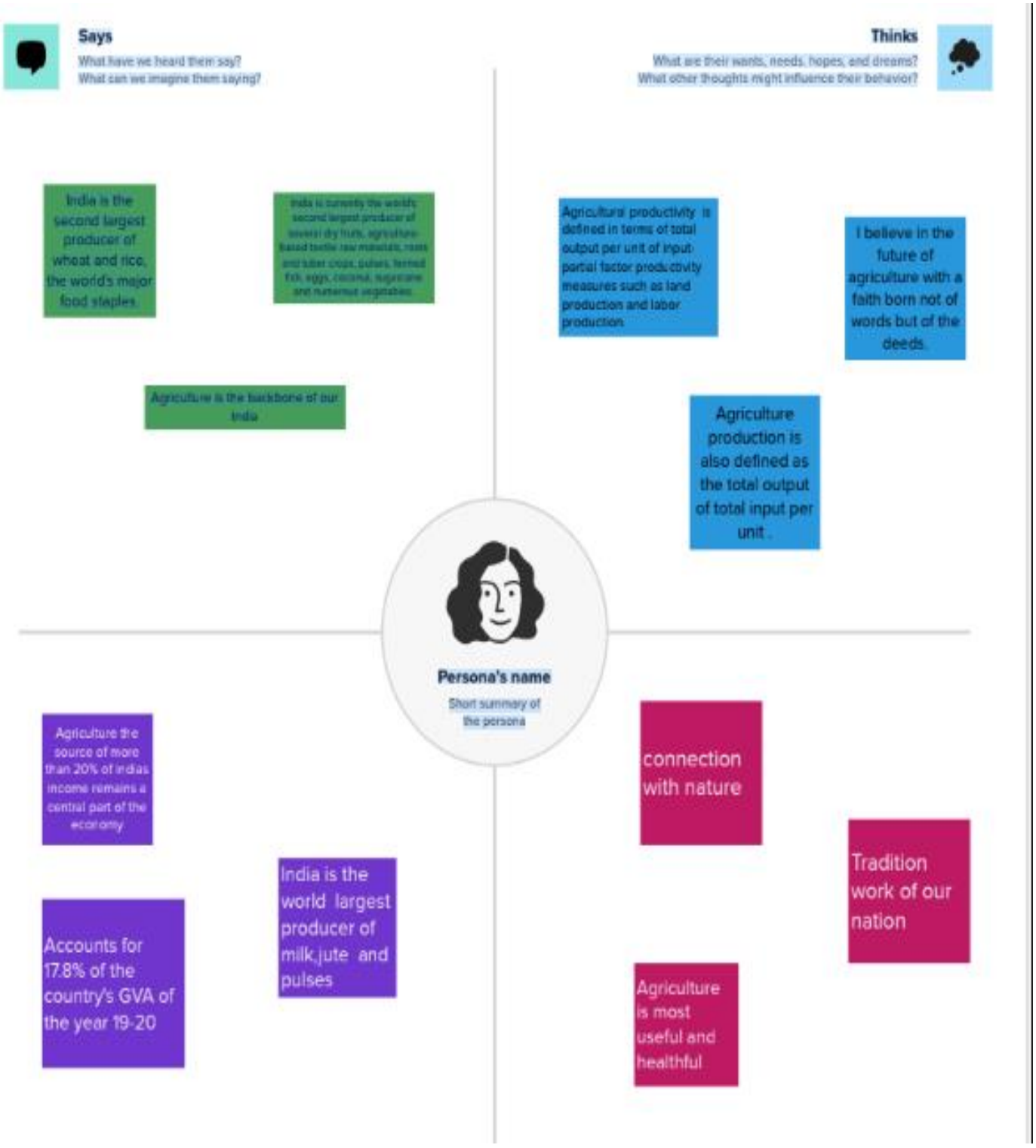
The project uses various Machine Learning Algorithms and compares them with each other to find the best one suited for the problem statement.This is a low cost and easy implementation technique when compared to other IOT and image processing models coexisting in the market.

The project aims to remove the deficiency of good and comprehensive visualization and interpretation of the entire problem statement. Along with that We are proposing the study of a large amount of production data specific to Indian agriculture production scenario.

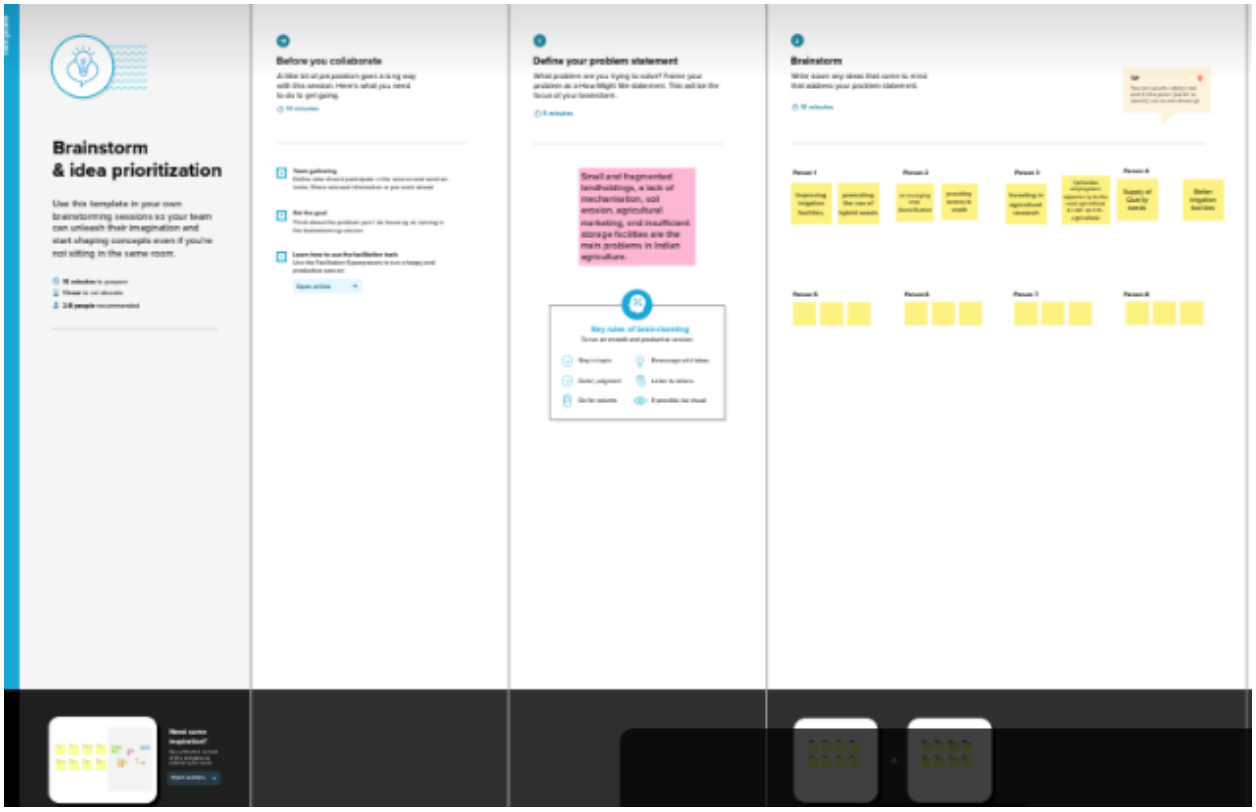
The project is focussed mainly on the deployment of the project to an Interactive Data Driven Web Application using Stream lit which can then be accessed by anyone. The amount of production levels predicted by the model of the project will help farmers to decide the amount of pesticides and other agriculture tools that they might want to use to meet the predictedproduction requirement (Rajeshkumar J and Kowsigan, M., 2011), lavanya et al 2020.

2. PROBLEM DEFINITION AND DESIGN THINKING

2.1 EMPATHY MAP

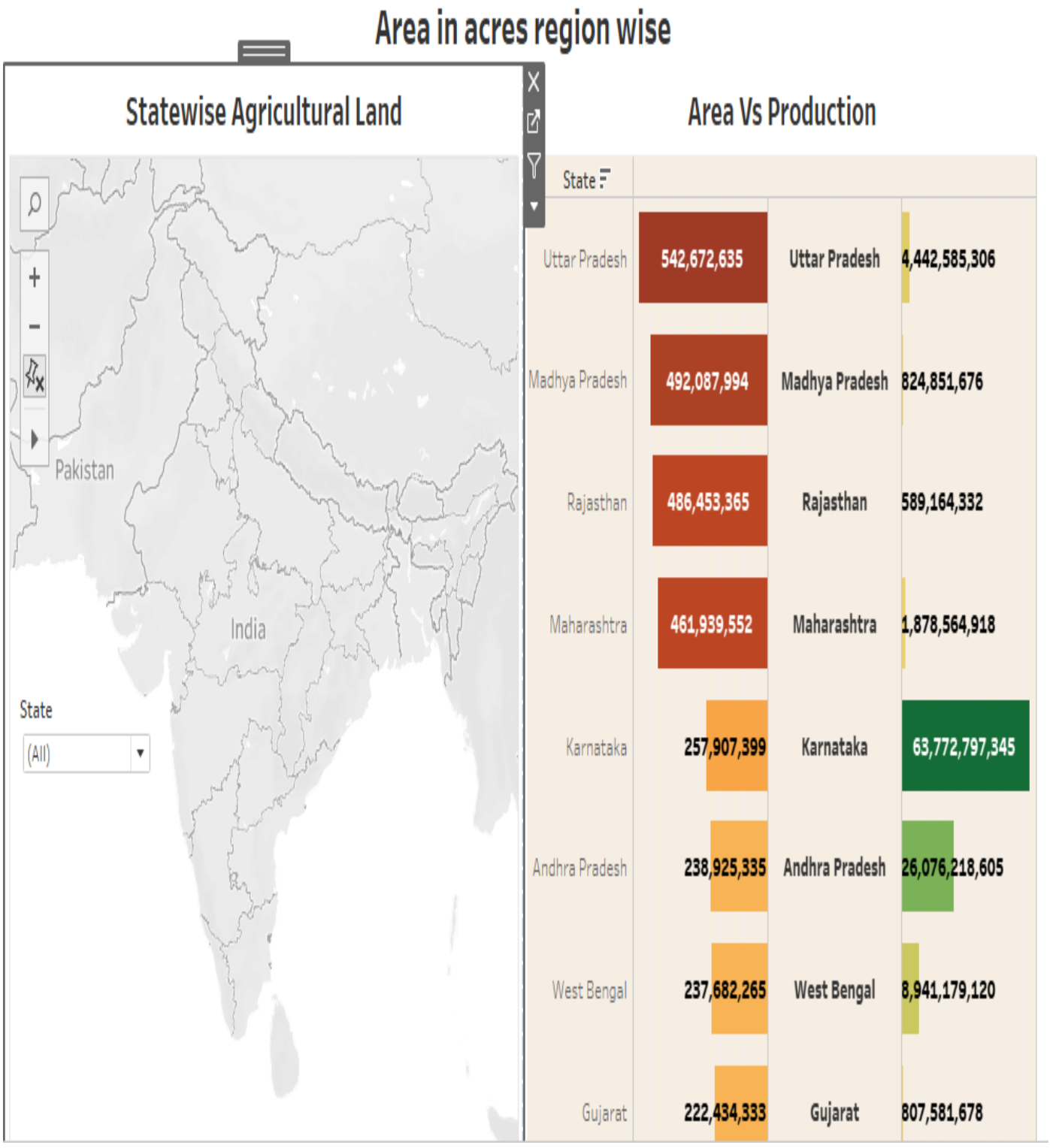


2.2 IDEATION AND BRAINSTORMING MAPPING

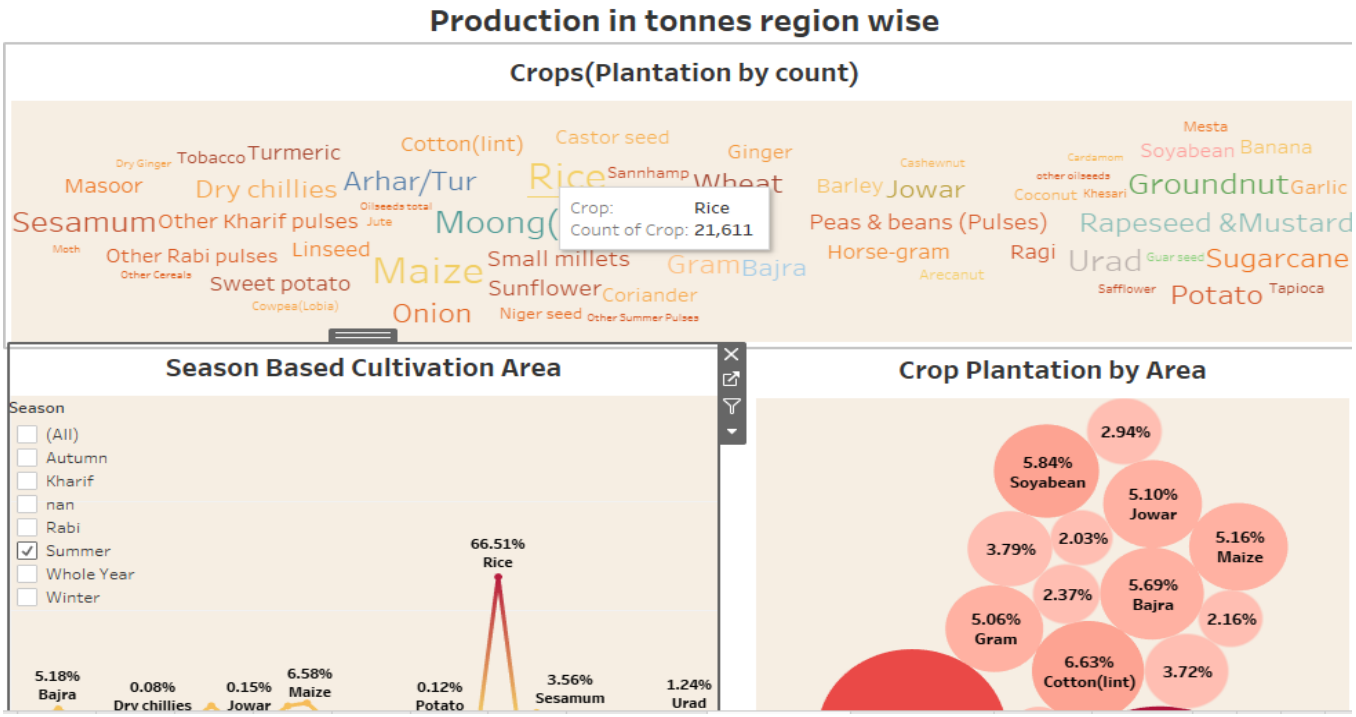


3. RESULT

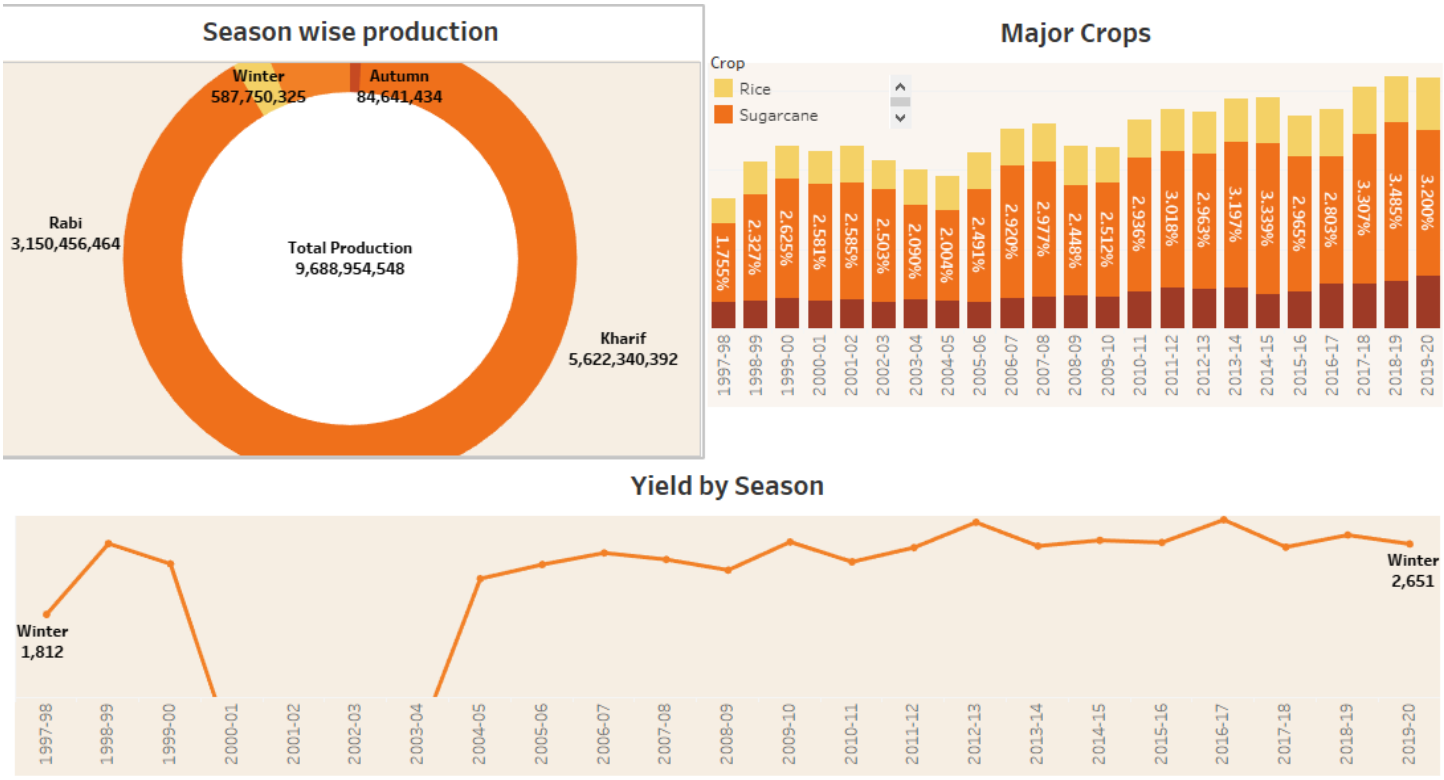
DASHBOARD 1


Area in acres region wise
Statewise Agricultural Land
Pakistan
India
State
(All)
Area Vs Production
State
Uttar Pradesh
542,672,635
Uttar Pradesh
4,442,585,306
Madhya Pradesh
492,087,994
Madhya Pradesh
824,851,676
Rajasthan
486,453,365
Rajasthan
589,164,332
Maharashtra
461,939,552
Maharashtra
1,878,564,918
Karnataka
257,907,399
Karnataka
63,772,797,345
Andhra Pradesh
238,925,335
Andhra Pradesh
26,076,218,605
West Bengal
237,682,265
West Bengal
8,941,179,120
Gujarat
222,434,333
Gujarat
807,581,678

DASHBOARD 2

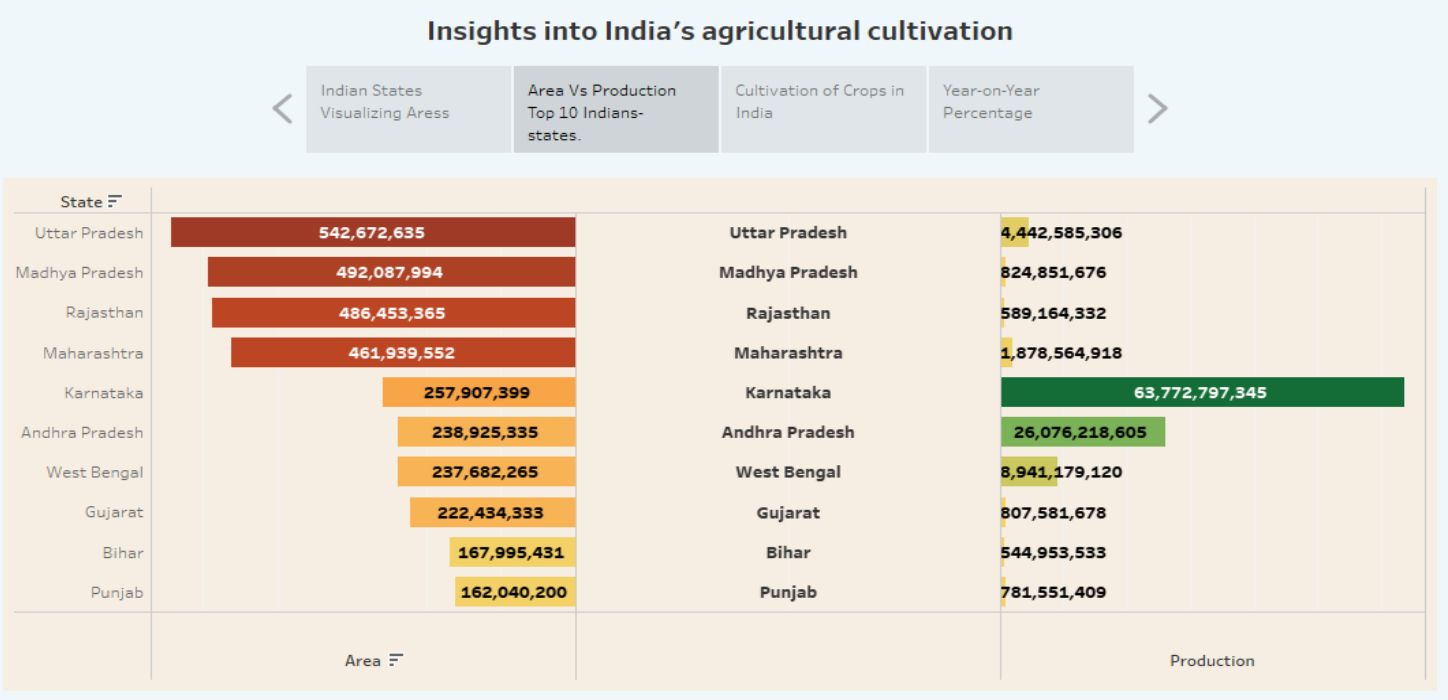


DASHBOARD 3

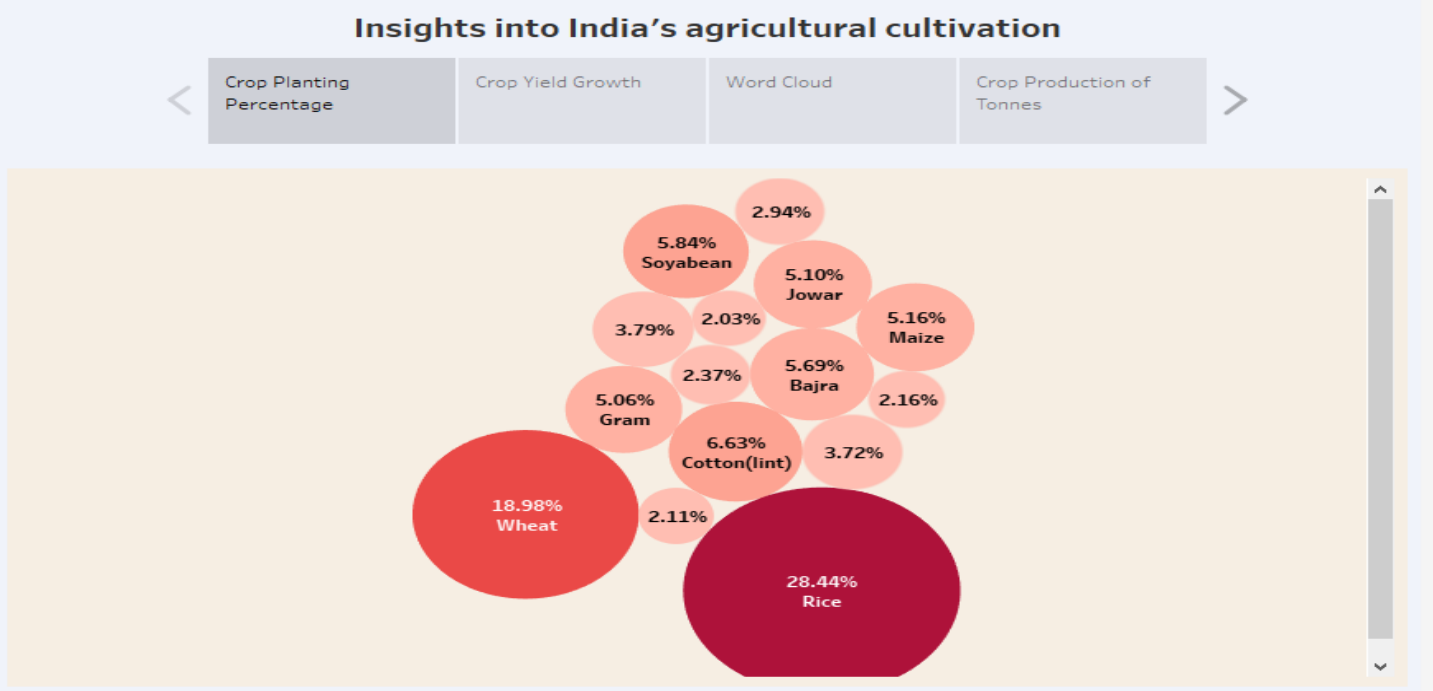


STORY

STORY 1

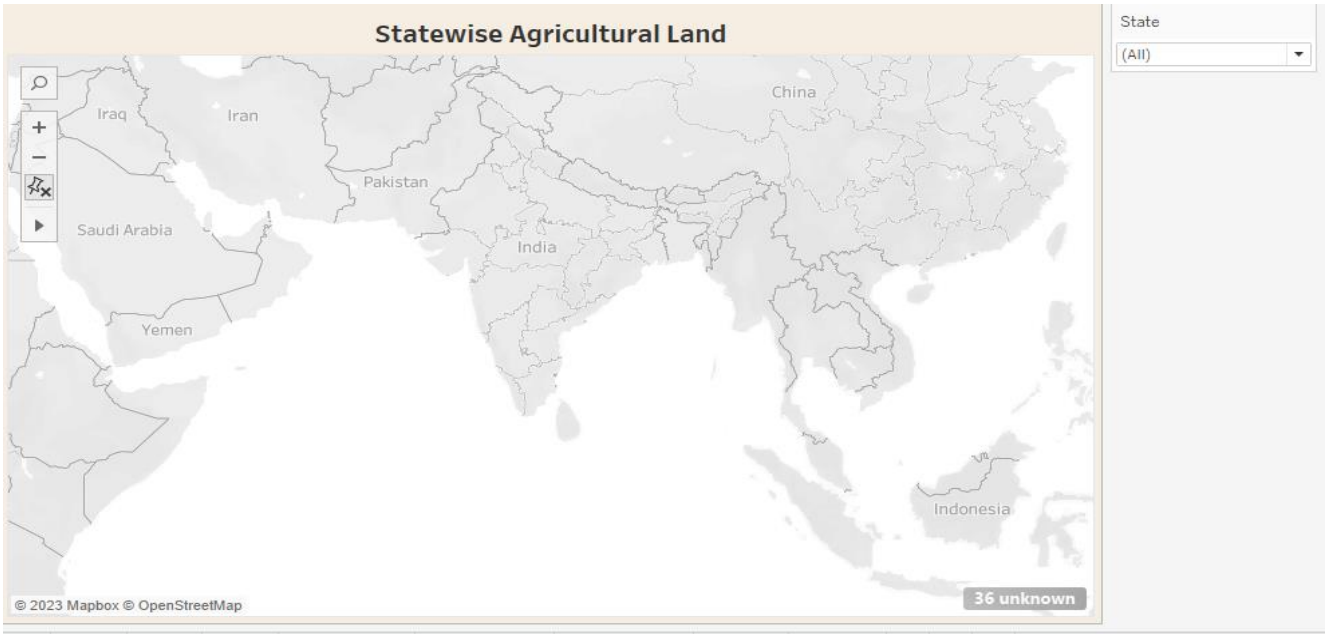


STORY 2

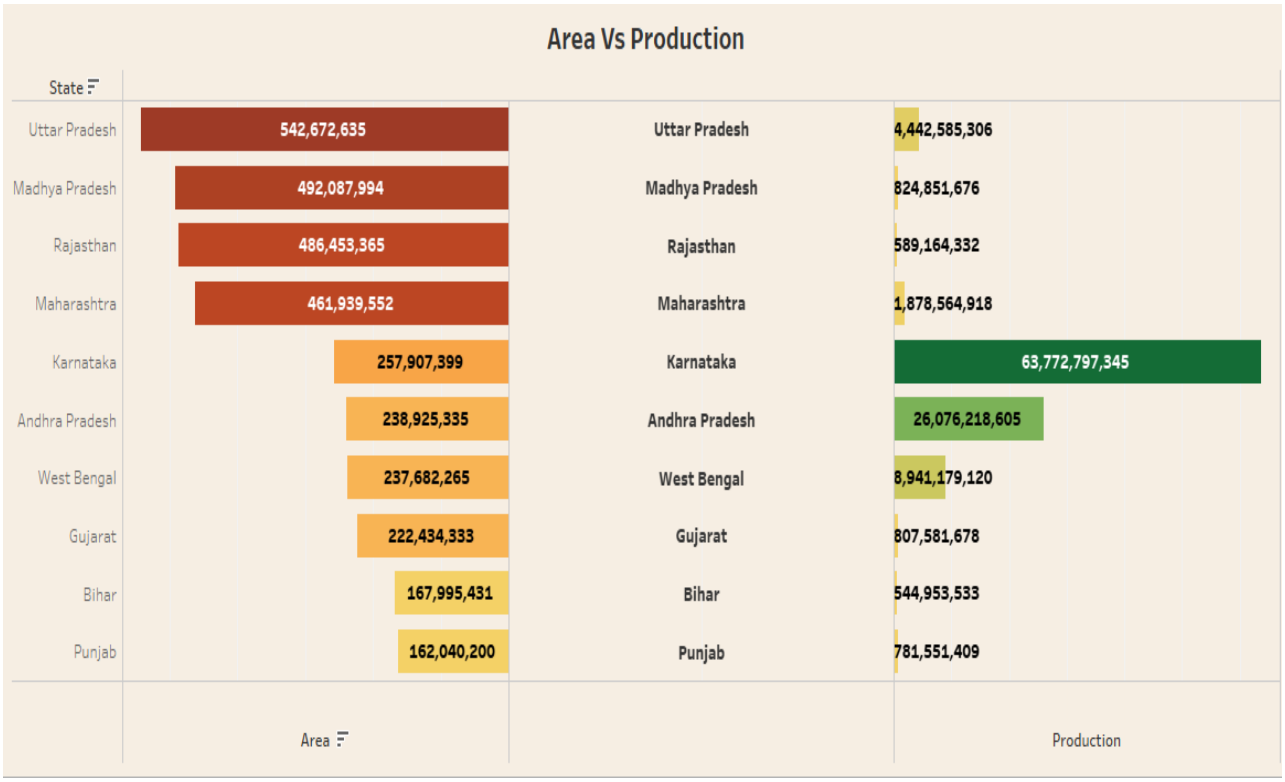


VISUALIZATION

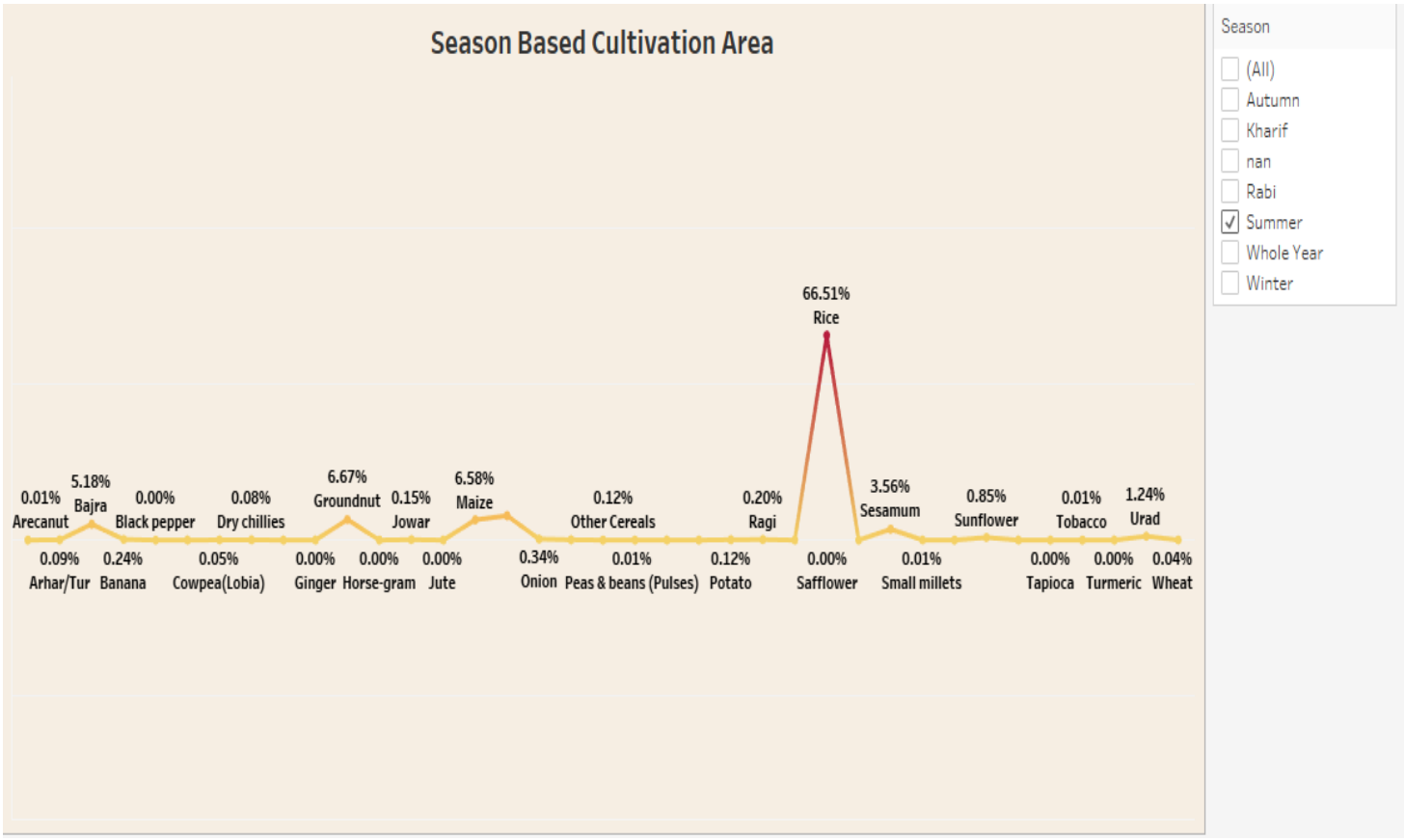
Statewise Agricultural Land



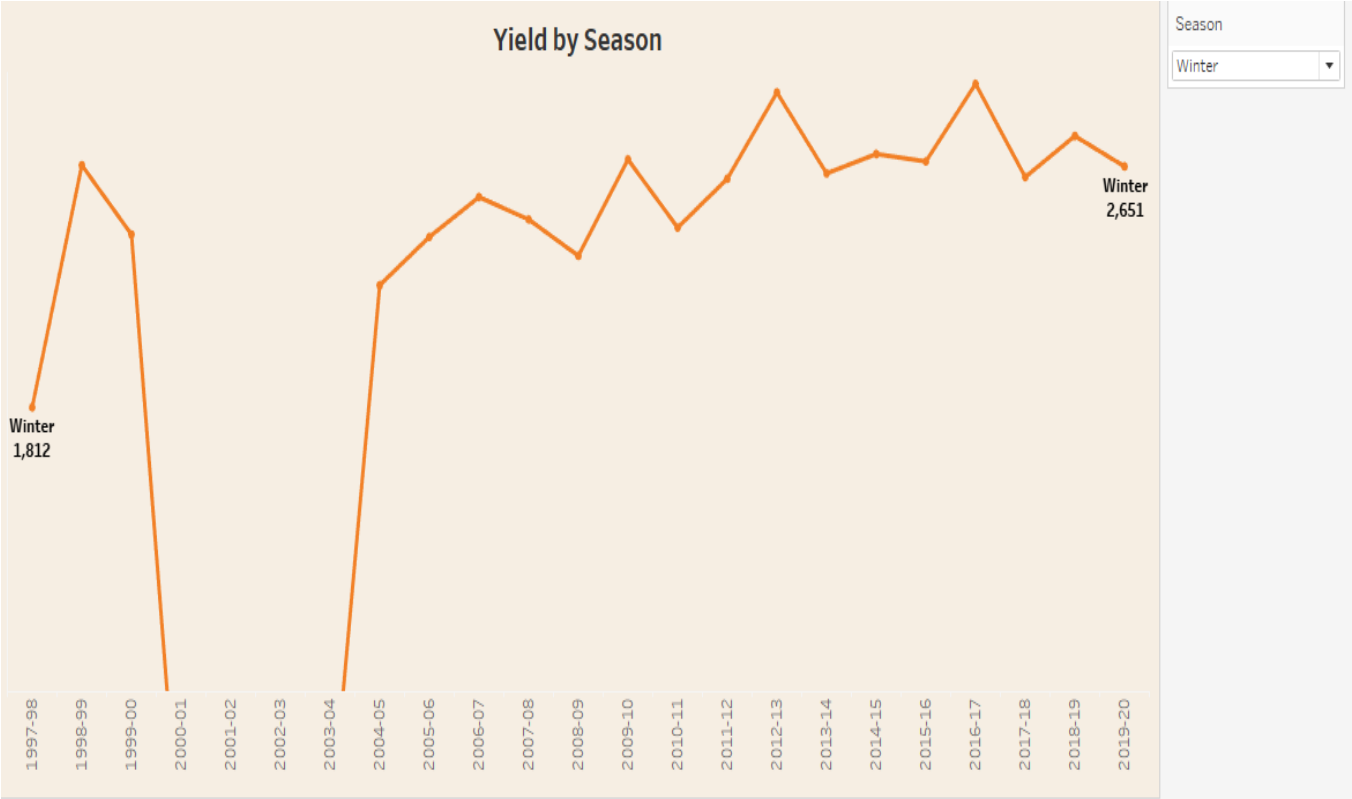
Area Vs Production



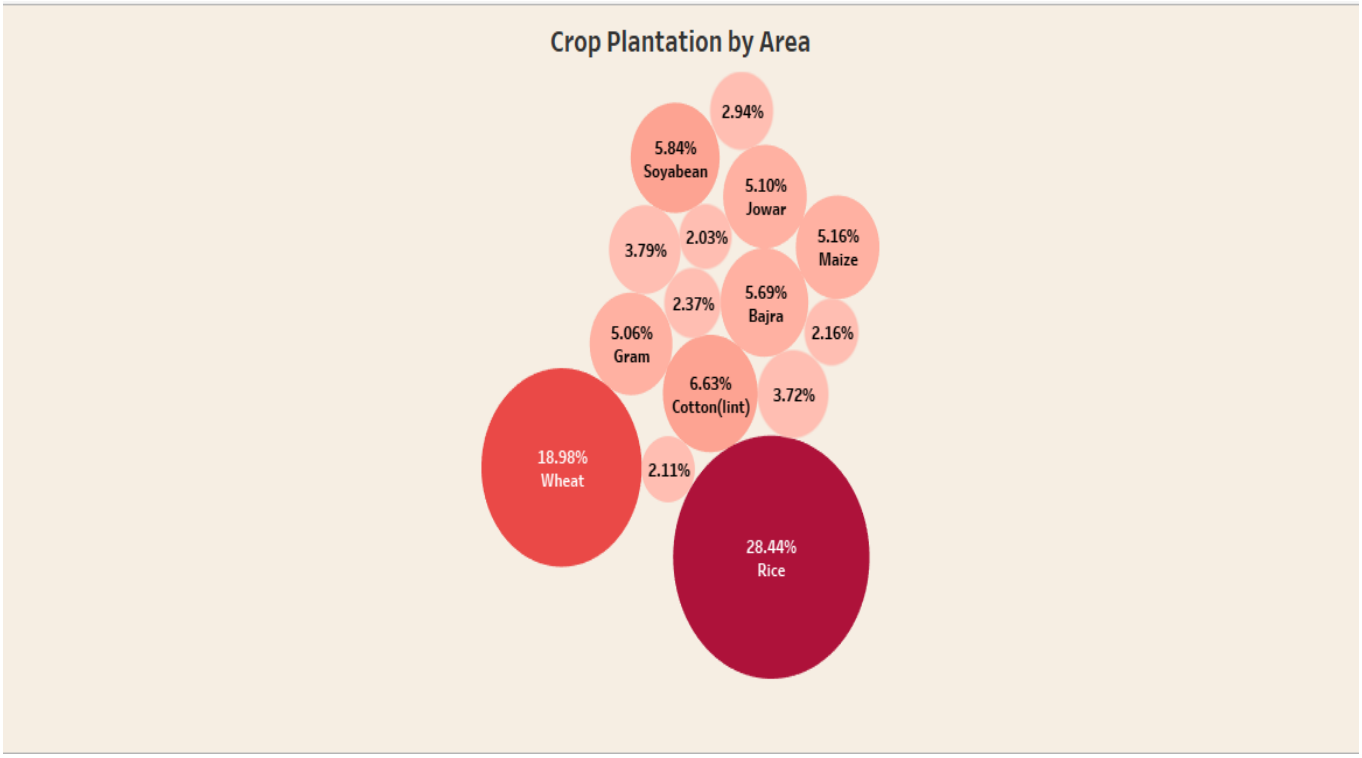
Season Bases Cultivation Area



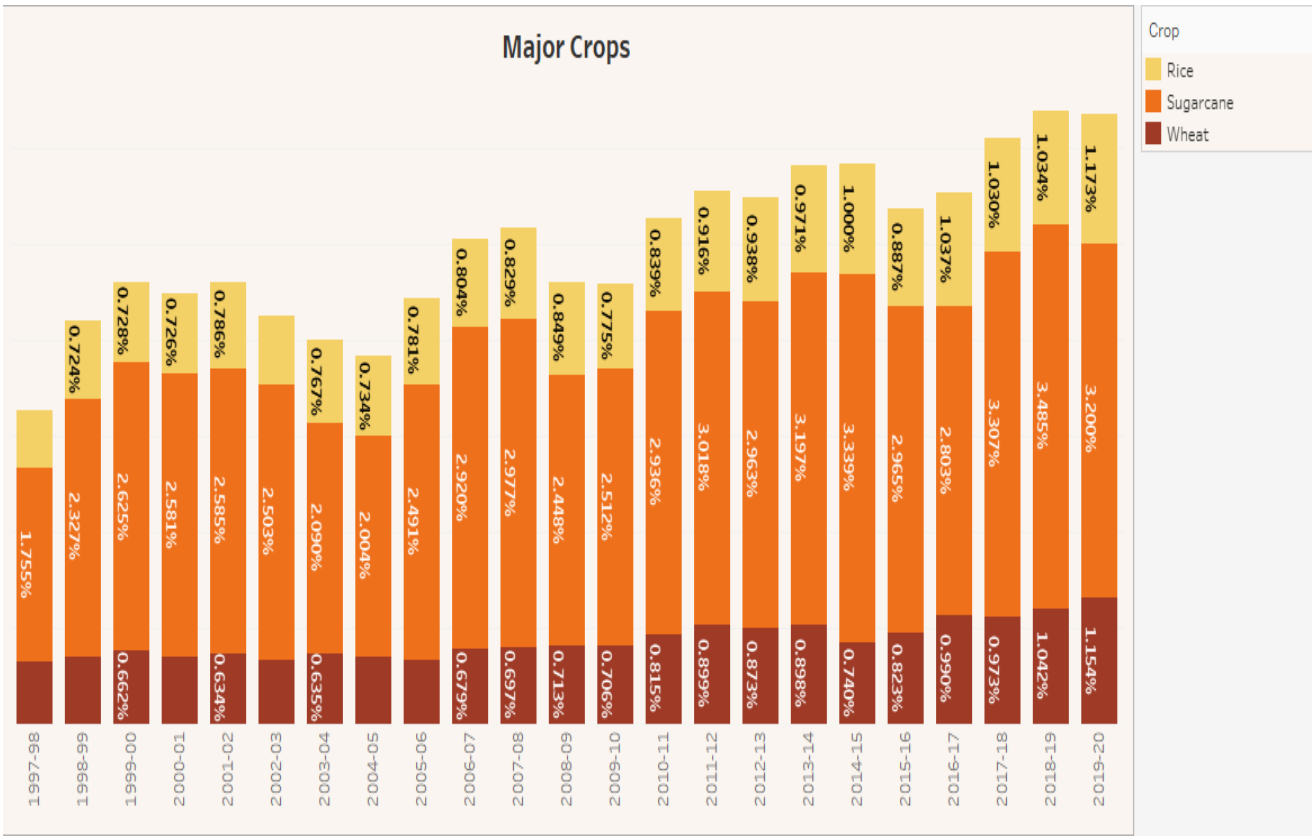
Yield by Season



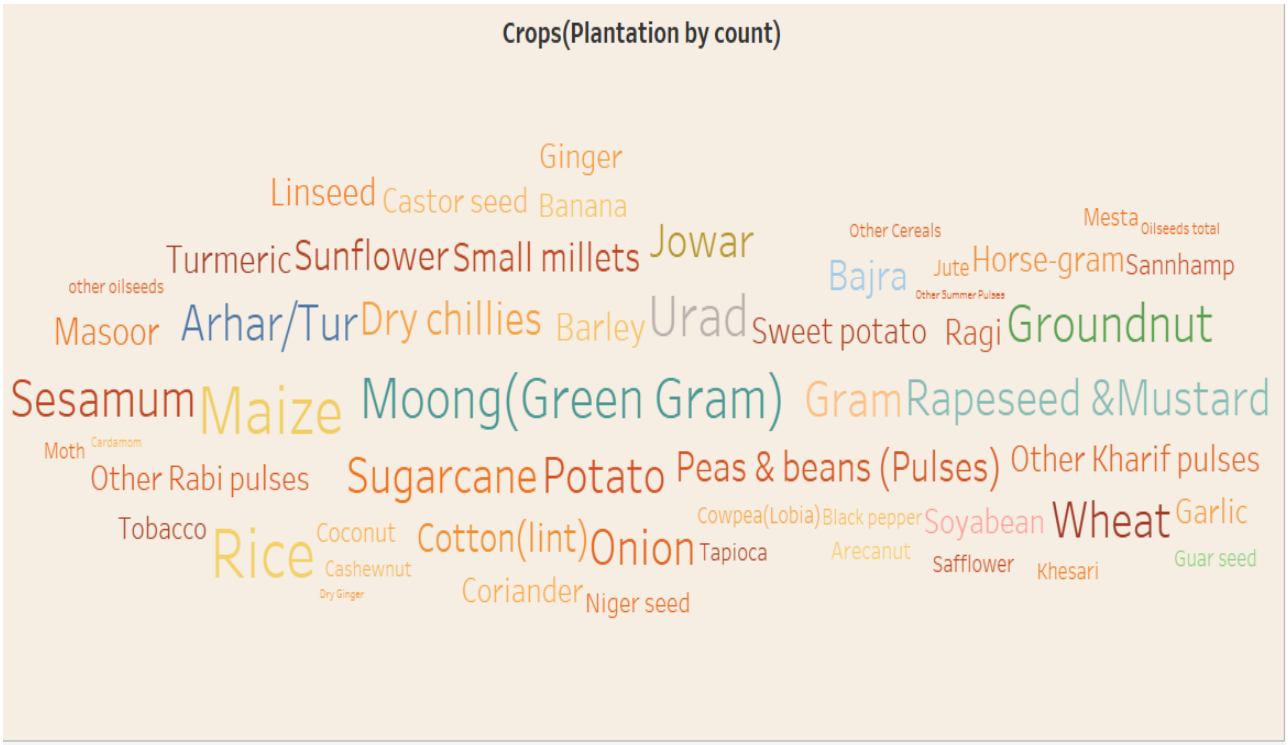
Crop Plantation Area



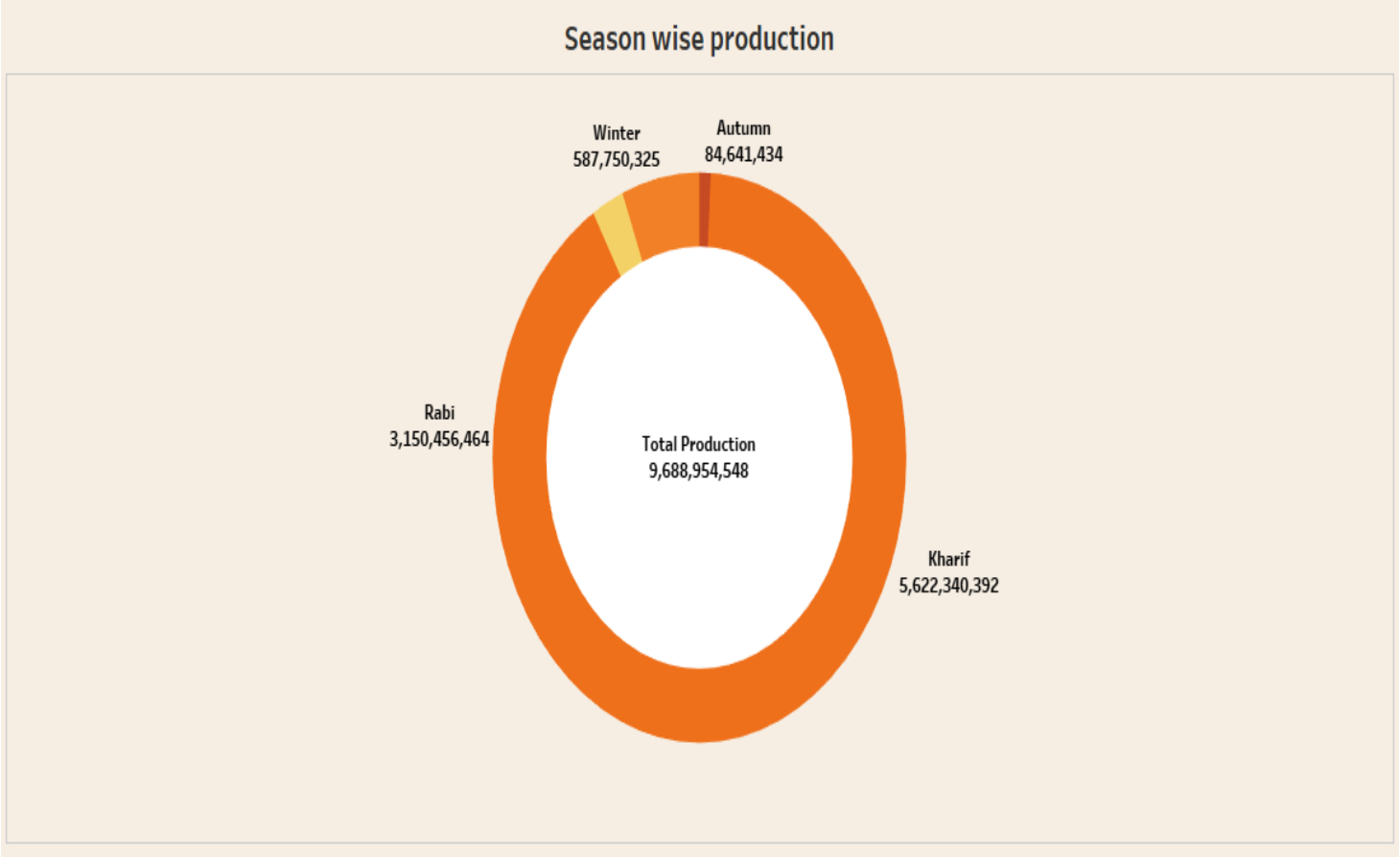
Major Crops



Crops (Plantation by count)



Season Wise Production:



4. ADVANTAGES AND DISADVANTAGES

4.1 ADVANTAGES

(1) Contribute to improving the sharing of agricultural information resources, thereby increasing agricultural productivity and promoting the healthy and stable development of the agricultural industry.

(2) It is helpful to strengthen the communication between different agricultural regions, promote agricultural production to industrialization, and the development of production standardization, and enhance the competitiveness of the agricultural economy.

(3) It is helpful to promote the development of agricultural economy in multiple directions and transform the traditional agricultural economic management mode.

(4) It is helpful for farmers to quickly and comprehensively understand the dynamic information of the agricultural market, thereby adjusting the agricultural structure, producing agricultural products with large market demand, obtaining higher economic benefits, and promoting rural economic development, and realizing agricultural product marketing information management in agriculture The application in the economy plays an important role in promoting the development of agriculture in our country.

1) Environmental benefits: Organic farming practices typically involve the use of natural fertilizers, crop rotation, and other techniques that help to preserve soil health, reduce erosion, and support biodiversity.

2) Health benefits: Organic crops are typically grown without the use of synthetic pesticides and fertilizers, which can reduce the risk of exposure to harmful chemicals in the food we eat.

3) Social benefits: Organic farming often involves small-scale, community-based farming operations, which can help to support local economies and promote social equity.

4) Higher prices: Organic crops often fetch higher prices in the marketplace, which can help to increase the profitability of farming operations and support the financial viability of small-scale farming.

DISADVANTAGE

1). Lower yields: Organic crops may have lower yields than conventionally grown crops due to the use of natural fertilizers and pest management techniques.

2). Higher costs: Organic farming practices can be more labor-intensive and may require more time and resources to implement, which can increase production costs.

3). Inconsistent quality: Organic crops may be more susceptible to variation in quality due to the lack of synthetic chemicals to control pests and diseases.

4). Limited availability: Organic crops may not be as widely available as conventionally grown crops, which can limit consumer choice and accessibility.

1. It Involves Risk : In crop rotation, investing in a season involves a lot of money to buy different seedlings of the different types of crops to be planted.

2. Improper Implementation Can Cause Much More Harm Than Good : Improper implementation of this technique causes much more harm than good. If one lacks the technical know-how, there is no need to experiment with it. Otherwise, it can result in nutrient buildup that will take longer to correct.

3. Obligatory Crop Diversification : For crop rotation to work, one has to plant different crops every time. Nonetheless, it does not allow a farmer to specialize in a single crop type. The farmer cannot produce a single crop on a large scale over a long period because of the damage it will do to the soil.

4. Requires More Knowledge and Skills : Crop rotation means a variety of crops; therefore, it requires a deeper set of skills and knowledge regarding each type of crop harvested.

5. APPLICATIONS

Gross Domestic Product:

In this study GDP at factor cost is taken as a proxy for economic performance which measures the total amount of goods and services produced in an economy (Lipsey & Crystal, 1999). It measures how big the economy is and has been chosen as a favourable indicator in this case because it captures all the variables that concerns economic growth. GDP has been included because it measures the output produced in any one period at prices of the same base year.

Cereals:

Cereals is the combined production of foodgrains like rice, wheat, jowar, maize, ragi, small millets and barley. It is the staple food and one of the major exported products of the country. It is grown in almost all parts of India. Rice, maize and wheat together accounted for 89 percent of all cereal production (FAO, 2012). Uttarpradesh is at the top of the list for cereals production with 48413 Thousand Tonnes followed by Punjab i.e.28490 Thousand Tonnes. This crop is mainly grown for domestic consumption, stock feed production, starch manufacture and export purposes.

Sugar industry:

Most of the sugar production in India takes place at mills owned by local cooperative societies. The members of the society include all farmers, small and large, supplying sugarcane to the mill. Over the last fifty years, the local sugar mills have played a crucial part in encouraging political participation and as a stepping stone for aspiring politicians. This is particularly true in the state of Maharashtra where a large number of politicians belonging to the Congress party or NCP had ties to sugar cooperatives from their local area and has created a symbiotic relationship between the sugar factories and local politics. However, the policy of "profits for the company but losses to be borne by the government", has made a number of these operations inefficient.

Marketing:

As with sugar, cooperatives play a significant part in the overall marketing of fruit and vegetables in India. Since the 1980s, the amount of produce handled by Cooperative societies has increased exponentially. Common fruit and vegetables marketed by the societies include bananas, mangoes, grapes, onions and many others.

Organic agriculture:

Organic agriculture has fed India for centuries and it is again a growing sector in India. Organic production offers clean and green production methods without the use of synthetic fertilisers and pesticides and it achieves a premium price in the market place. India has 6,50,000 organic producers, which is more than any other country.India also has 4 million hectares of land certified as organic wildculture, which is third in the world (after Finland and Zambia).

6. CONCLUTION

Agriculture is an integral part of smart growth. The ability to feed one's own population is critical to the independence of any state. Ontario is blessed with resources that have facilitated the development of a world class agricultural industry that provides safe, nutritious, and reliable food.

The ability to feed the local population from local sources should not be underestimated. Perhaps because of its long-term presence in the study area, agriculture tends to be taken for granted. Many people expect that it will continue in perpetuity and that as it is pushed out of one area by urban expansion, it will relocate in another area that is less subject to growth pressure. This assumption is false.

Agriculture is a diverse industry with very specific locational connections. Certain crops can only be grown in specific locations where the combination of a variety of factors including soil, moisture, temperature, and topography is right. When such areas are lost to agriculture, the ability to produce the crops that require that particular combination of factors is also lost.

The public needs to understand that agricultural land is a nonrenewable resource requiring appropriate management techniques. Before allowing land to go out of production, decision makers must consider the implications of that decision and evaluate it in terms of the long-term loss to Ontario.

The challenge of the smart growth initiative will be to establish an environment that will allow the continued existence of a healthy agricultural industry. Competing demands for land will have to be balanced against the benefits of maintaining a healthy agricultural base. To date, the Ontario government has supported a policy that nominally protects agricultural land.

However, when faced with demands for urban expansion, growth has usually taken precedence. This trend is eating away at the resource. Hard decisions must be made about what will be protected, where it will be protected, how it will be protected, and whether a healthy agricultural industry is a government priority.

This will not be an easy task; forecasting is never easy. The agricultural industry has advanced greatly in the past few decades. What was not possible 20 years ago is now routine. Crops that were unheard-of are now common, growing seasons can be extended, land that had little value 20 years ago is now some of the most profitable land in production. Agricultural policies must be flexible enough to accommodate further changes.

The basic building blocks, including land and work force, must be preserved and allowed to respond to advances in technology. When an opportunity arises, the land and personnel must be there to seize on it.

Preserving the quality of life is perhaps the most fundamental goal of smart growth. A healthy agricultural industry close to urban areas contributes to the quality of life in ways that should not be underestimated. This contribution can be evaluated in terms of:

- the national security value of being able to provide a secure and nutritious food supply;
- the economic value of a world-class industry run by experienced and knowledgeable operators;
- the social value of providing products in response to the demands of a changing ethnic population seeking alternative foods;
- the recreational value of being able to travel to pick-your-own operations and spend time in a rural setting;

For the agricultural community, uncertainty is a major issue. Farmers are used to dealing with uncertainty related to weather, they expect it and are prepared for it. What they do not expect and cannot deal with is ongoing economic uncertainty, uncertainty related to the legislative context within which they must work, uncertainty about land use controls or environmental regulations. The pervasive pessimism among even the most successful farmers needs to be addressed. The average age of farmers is rising and the pessimistic attitude discourages the younger generation from entering the sector.

Regulation of this sector is often rigid. Traditionally, issues have been compartmentalized and dealt with individually. This is the antithesis of what a successful farm operation requires, where issues are inter-related and need to be considered together. Rigid regulations that are slow to change preclude the flexibility the industry needs to be successful.

To preserve agriculture, it is not enough to preserve the land; society must also preserve the farmer. For this to happen, farmers must operate in an environment where they are certain of the rules and can respond quickly to changing local, national, and international markets.

The Smart Growth panel has a difficult job. To respond to the mandate of "steering growth pressures away from significant agricultural lands", a strategy that is both rigorous and flexible is required. *Rigour* will be required to withstand the considerable pressures on agricultural land and the agricultural community. *Flexibility* is needed to provide an environment in which farmers can operate successfully.

7. FUTURE SCOPE

The development made during and after Green Revolution has transformed Indian agriculture from a 'ship-to-mouth' status in the 1960s to a 'right to food' situation at present. In today's scenario of food sufficiency, goal is shifted from cereal-intensive food security to nutrient-rich diet security to ensure nourishment and Achievements in Field Crops in Independent India combat malnutrition. The goal of 'Zero Hunger' by 2030 can be achieved with sustainable development. Despite witnessing Green, Yellow, and Pulse Revolutions, and having attained impressive food production of 314.51 Mt in 2021-22, India has to continue advancement for increasing crop productivity to sustain food security. Newer methods of harnessing the heterosis, speeding up the breeding processes, and insulating crop varieties against diseases and insects are to be adopted for accelerating the genetic gains in staple crops..

Scientific advancements are reshaping Indian agriculture rapidly. The achievement of cereal self-sufficiency is gradually shifting towards other commodities such as pulses. On the production side, market and price-responsive commodities like milk, meat, fish, fruits, vegetables, and other cash crops are increasingly being grown, and income and profits are replacing supply augmenting strategies. A pattern of diversified agriculture is clearly visible. Simultaneously, business ecosystem is gradually expanding and supportive mechanisms for agri-preneurship/startups such as technology business incubators and financial infrastructure is concentrating. At this front, technologies and policies ensuring sustainability need continuous efforts – ranging from sustainability in resource use, environmental impacts, risk-handling, information and business ecosystem development. On the other side, encouraging and incentivizing private sector participation, notably in commercialization of agricultural technologies, developing agripreneurship through start-ups, and supporting innovative organizations like FPOs would help to balance the agricultural ecosystem in the coming years.

Agricultural Drone Technology- Drones are used widely for medical delivery to protection assistance and are used in agriculture to improve the growth of crops, maintenance, and cultivation methods. For example, these ariel carriers are used to access crop conditions and execute better fertilization strategies for more yields. Even the accessibility of hovering robots help farmers through a survey of large areas and data collection to generate better insights about their farms. Using drones in agriculture has provided

more frequent, cost-effective remote monitoring of crops and livestock. It also helps analyse field conditions and determine appropriate interventions such as fertilizers, nutrients, and pesticides.

Diversification of Agriculture-The agricultural sector produces generic consumption needs as well as crops like fruits, vegetables, spices, cashews, areca nuts, coconuts, and floral products such as flowers, orchids, etc. With the increasing demand for these products, there's a huge potential in terms of production and trade of these products. This shows how the agricultural sector is being transformed into a dynamic and commercial sector by shifting the mix of traditional agricultural products towards higher quality products, with a high potential to accelerate production rates. The diversification in agriculture is being supported by changes in technology or consumer demand, trade or government policy, transportation, irrigation, and other infrastructure developments.

Increasing Trend in Horticulture Production- The availability of diverse physiographic, climatic, and soil characteristics enables India to grow various horticulture crops. It includes fruits, vegetables, spices, cashew, coconut, cocoa, areca etc. The total horticulture production in FY22 is estimated at 342.333 million tonnes which is an increase of about 7.03 million tonnes (2.10% increase) from 2020-21.

8. APPENDIX

DASHBOARD 1

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DASHBOARD 2

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DASHBOARD 3

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STORY 1

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STORY 2

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VISUALIZATION

VISUALIZAION 1

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VISUALIZAION 2

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VISUALIZAION 3

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VISUALIZAION 4

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VISUALIZAION 5

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VISUALIZAION 6

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VISUALIZAION 7

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VISUALIZAION 8https://public.tableau.com/views/IndianAgriculture_16974491937120/Sheet8?:language=en-US&publish=yes&:display_count=n&:origin=viz_share_link

VIDEO DEMONSTRATION LINK :

https://drive.google.com/file/d/1DQuXT7XeuAPTY_3UaMcuDGVJ__pWxeXy/view?usp=share_link