PROJECT REPORT

Estimate the Crop Yield using Data Analysis

1. INTRODUCTION

1.1. Project Overview

Crop production is one of the most important sources of income in India and India is one of the top countries in agriculture. It is important to understand the yield of crops in different conditions in an easier way. As per this project we will be collecting some dataset, analyzing them using visualizations, creating a dashboard and this will give us more insights of Crop production in India.

1.2. Purpose

Crop yield estimation using data analytics is an important task for farmers for rapid decision-making. An accurate crop yield analysis can help farmers to decide on what to grow and when to grow. Various crops are suited for different weather conditions, geographic locations, soil types, etc., have shown satisfactory yield in certain years and it is not easy to manually collect this data and perform analysis. Visualization of the data can help understand the pattern of production through the years depending on various factors, according to which effective decisions can be made with lesser errors.

2. LITERATURE SURVEY

2.1. Existing problem

[1] In this paper Akhilesh Kumar Sharma, Oorja Garg, and Krishna Modi (2021) worked at collecting and analyzing temperature, rainfall, soil, seed, crop production, humidity and wind speed data, which will help the farmers improve the produce of their crops. K-means clustering is employed on results. Its's not always very easy to implement each and everything using machine learning algorithms like K-means, as its accuracy reduces with larger datasets.

[2] In this study NingJin, BoTao WeiRen, DongyanZhang (2022) used a regional irrigation data for winter wheat grown on the Loess. But the results aren't very accurate.

[3] In this paper Jyoti Mahajan, Kriti Banal and Samridhi Mahajan (2021) used historical production and meteorological data and processed them for analysis and applying ML algorithms. However, this was prone to over fitting.

[4] In this study Yeshanbele Alebele, Wenhui Wang, Weiguo Yu, Xue Zhang (2021) proposed Gaussian kernel regression for rice yield estimation from optical and SAR imagery using a

limited amount of ground truth data. But, efficiency was less in high dimensional spaces.

[5] In this work Laura Martínez-Ferrer, Maria Piles, Gustau Camps-Valls (2021) introduced the use of Gaussian processes (GPs) for the estimation. The proposed methodology combines synergistic information on canopy greenness, biomass, soil, and plant water content from optical and microwave sensors with the atmospheric variables. But this makes use of the entire feature sample.
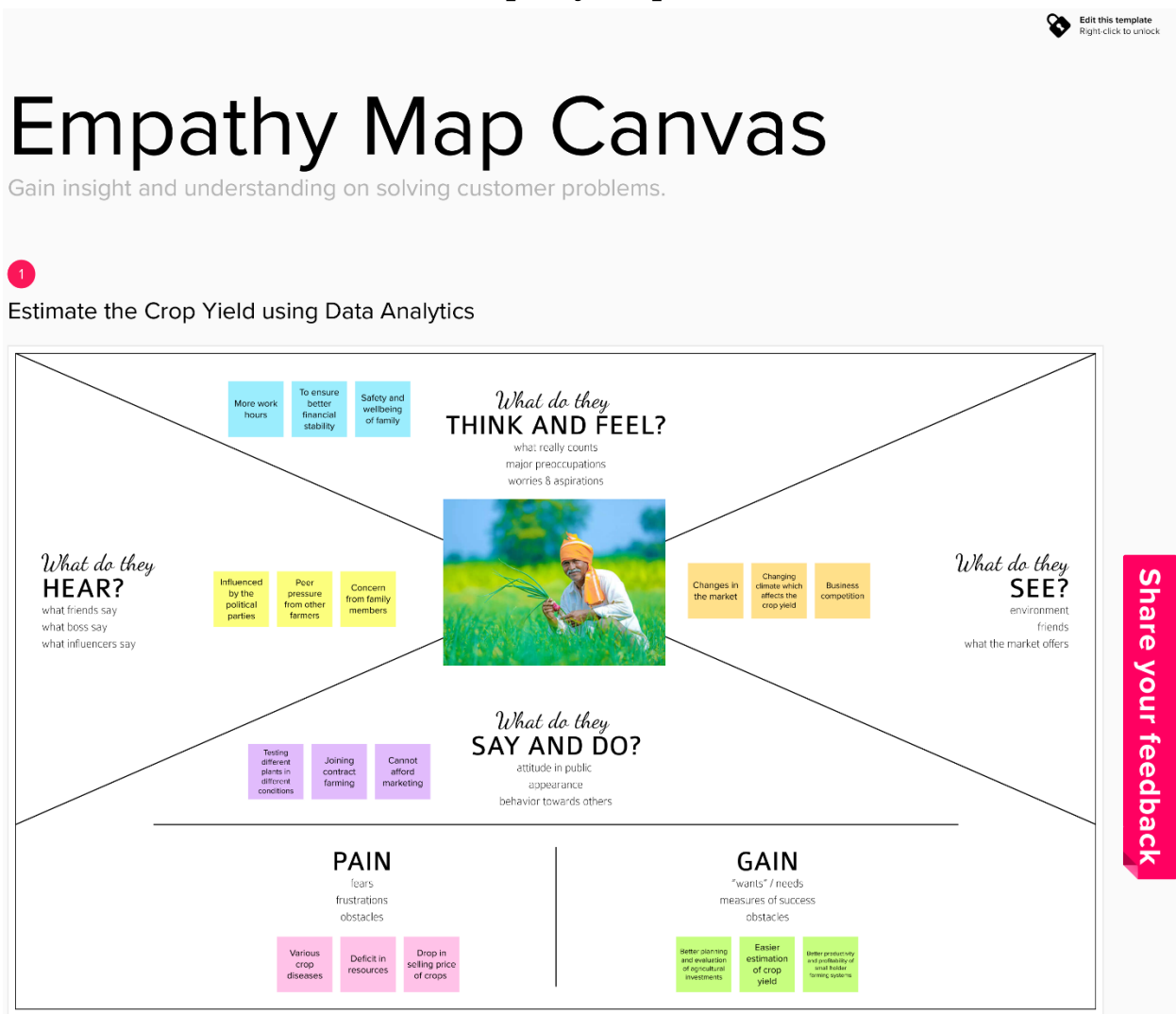
2.2. References

1. Akhilesh Kumar Sharma, Oorja Garg, and Krishna Modi (2021), "WB-CPI: Weather Based Crop Prediction in India Using Big Data Analytics," in IEEE Access, vol. 9, pp. 137869-137885, 2021.

2. Ning Jin, Bo Tao, Wei Ren, Liang He, Dongyan Zhang, Dacheng Wang, Qiang Yu, "Assimilating remote sensing data into a crop model improves winter wheat yield estimation based on regional irrigation data", Agricultural Water Management, Volume 266, 2022.

3. Mahajan, J., Banal, K. & Mahajan, S. "Estimation of crop production using machine learning techniques: a case study of J&K". Int. j. inf. tecnol. 13, 1441–1448 (2021).

4. Yeshanbele Alebele, Wenhui Wang, Weiguo Yu, Xue Zhang (2021), "Estimation of Crop Yield From Combined Optical and SAR Imagery Using Gaussian Kernel Regression," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 14.

5. L. Martínez-Ferrer, M. Piles and G. Camps-Valls, "Crop Yield Estimation and Interpretability With Gaussian Processes," in IEEE Geoscience and Remote Sensing Letters, vol. 18, no. 12, pp. 2043-2047, Dec. 2021

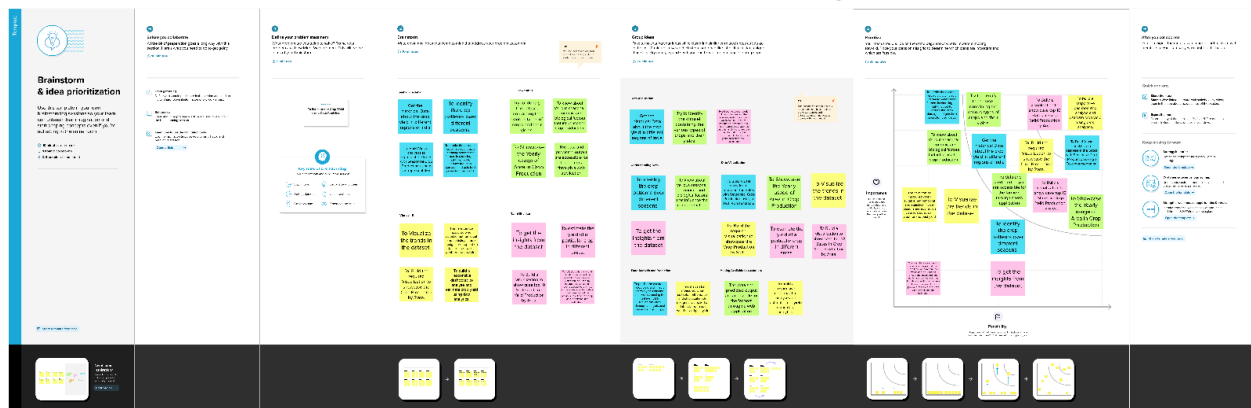## 2.3. Problem Statement Definition

It is important for farmers to better estimate and make right decisions for growing crops based on factors such as season and place, by observing the patterns of the past data, analyzing, and deciding upon the type of crop to grow and the area it should occupy. A dashboard displaying the visualized data makes it easier to read and understand.

3. IDEATION & PROPOSED SOLUTION

3.1. Empathy Map Canvas

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Estimate the Crop Yield using Data Analytics

What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations

- More work hours
- To ensure better financial stability
- Safety and wellbeing of family

What do they
HEAR?
what friends say
what boss say
what influencers say

- Influenced by the political parties
- Peer pressure from other farmers
- Concern from family members

What do they
SEE?
environment
friends
what the market offers

- Changes in the market
- Changing climate which affects the crop yield
- Business competition

What do they
SAY AND DO?
attitude in public
appearance
behavior towards others

- Testing different plants in different conditions
- Joining contract farming
- Cannot afford marketing

PAIN
fears
frustrations
obstacles

- Various crop diseases
- Deficit in resources
- Drop in selling price of crops

GAIN
"wants" / needs
measures of success
obstacles

- Better planning and evaluation of agricultural investments
- Easier estimation of crop yield
- Better productivity and profitability of small holder farming systems

3.2. Ideation & Brainstorming

3.3. Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Using data analysis, to aid farmersin making better decisions in order to have healthycrop production.
2.	Idea/ Solution description	To deliver a perfectly analysed Dashboard of historical agricultural production data from several Indian states so that farmersmay forecasttheir crop yield.
3.	Novelty / Uniqueness	The dataset contains information about the crops in various Districts, States, Seasons, andAreas. Therefore, usingall these facts,a thoroughly researched report will assist farmers in making the best crop choice for their regionduring a specificgrowing season to increase output.
4.	Social Impact / Customer Satisfaction	The issues thatfarmers have withyield potential willall be resolved by this report. Therefore, this Dashboard will have a significant impacton farmers, and by adopting theadvised crops, they can achieve enormous earnings.
5.	Business Model (Revenue Model)	Profit can be generated by marketing thesolution as a freely accessible mobile application thatanyone can use. Venture partnerships with the government may yield financial rewards.
6.	Scalability of the Solution	Regarding dataset storage and data gathering, there are no problems. As a result, the system may be readilyscaled to managerising user numbers, traffic, and requirements that must be met.

3.4. Problem Solution

1. CUSTOMER SEGMENT(S) `CS`
Who is your customer?
i.e. working parents of 0-5 y.o. kids

➤ Our target customer here is the **farmer who mainly works with the crops in the field**

6. CUSTOMER CONSTRAINTS `CC`
What constraints prevent your customers from taking action or limit their choices
of solutions? i.e. spending power, budget, no cash, network connection, available devices.

➤ Farmers don't make **accurate predictions** about the climate.
➤ They also stick to **traditional methods** of farming, therefore lacking modern irrigation, fertilization facilities

5. AVAILABLE SOLUTIONS `AS`
Which solutions are available to the customers when they face the problem

or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

➤ They may have the dataset but a **proper data report** is not available to them

2. JOBS-TO-BE-DONE / PROBLEMS `J&P`
Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.

➤ Farmers need to have access to **detailed reports and predictions** to grow the right kind of crops and to take proper precautions

9. PROBLEM ROOT CAUSE `RC`
What is the real reason that this problem exists? What is the back story
behind the need to do this job?
i.e. customers have to do it because of the change in regulations.

➤ Inaccurate predictions could lead to **usage of wrong seeds, improper irrigation,** and unpreparedness for **drastic climate changes**

7. BEHAVIOUR `BE`
What does your customer do to address the problem and get the job done?
i.e. directly related: find the right solar panel installer, calculate usage and

➤ Farmers properly **study and analyze their soil** and decide what can be grown there. They also **test crops with different weather conditions**

3. TRIGGERS `TR`
What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

➤ Destruction of crops because of **climate change** and growing **competition in the market**

4. EMOTIONS: BEFORE / AFTER `EM`
How do customers feel when they face a problem or a job and afterwards?
i.e. lost, insecure > confident, in control - use it in your communication strategy & design.

➤ Many farmers have faced huge losses in crop yield, which took months of hard work, leading them to commit suicide. When they are certain with the predictions and analysis, they are **confident about making better decisions** without much loss.

10. YOUR SOLUTION `SL`
If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

➤ It would help farmers a lot if crop yield predictions were made **more accurately** and the data is **visualized and displayed on a dashboard** for easier understanding

8. CHANNELS of BEHAVIOUR `CH`
8.1 ONLINE
What kind of actions do customers take online? Extract online channels from #7

8.2 OFFLINE
What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

➤ It may not be possible online as not every farmer has access to technology and the internet, but they can benefit from it **offline from an agricultural office**

4. REQUIREMENT ANALYSIS

4.1. Functional requirement

| FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form
FR-2	User Profile	Details of User Details of Farm
FR-3	Required Data	Historical data of Crop Yield User Data(Farmer) to analyse
FR-4	Analysis	Data Pre-processing and analysis using IBM Cognos analytics Platform
FR-5	Estimation	To create an Interactive Dashboard, Report, Story visualizing the great insights about the estimation of Crop Yield.

4.2. Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	According to the past data, report is created. Crops to be sown in different Seasons will be advised or consulted to the farmers based on the Data Report.
NFR-2	**Security**	IBM Cognos platform have a secure user information.
NFR-3	**Reliability**	The interactive dashboard can make easily understandable of the data report.
NFR-4	**Performance**	Interaction makes better performance between all users and impressing by the visual advise.
NFR-5	**Availability**	The dashboard could be easily viewed and available in every smartphones, laptops, systems etc.
NFR-6	**Scalability**	The flexibility of the methodology to implement the proposed solution is very easy that can make increase in the estimation of crop yield in the different farms for different users.

# 5. PROJECT DESIGN

5.1. Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flow within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.
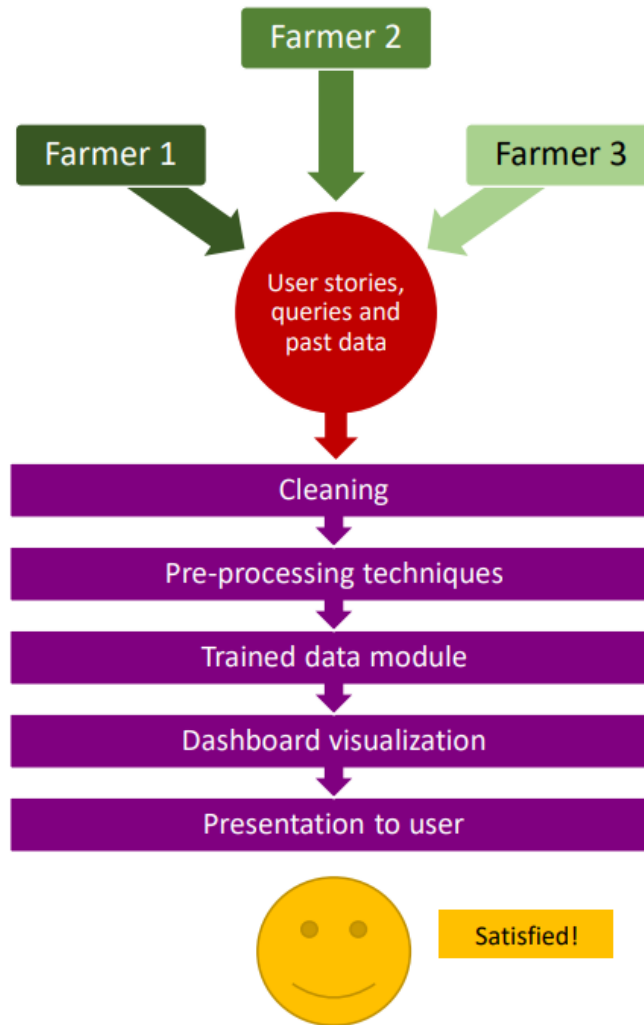
5.2. Solution & Technical Architecture

Solution Architecture

- Farmers need to be able to access this data wherever they are. They should be able to keep track of the crop yields anytime and easily
- A recent dataset can be obtained for analysis
- This data can be uploaded to a Cloud platform and processed
- Various plots can be used to represent that data and a dashboard containing all the plots can be displayed for better user experience
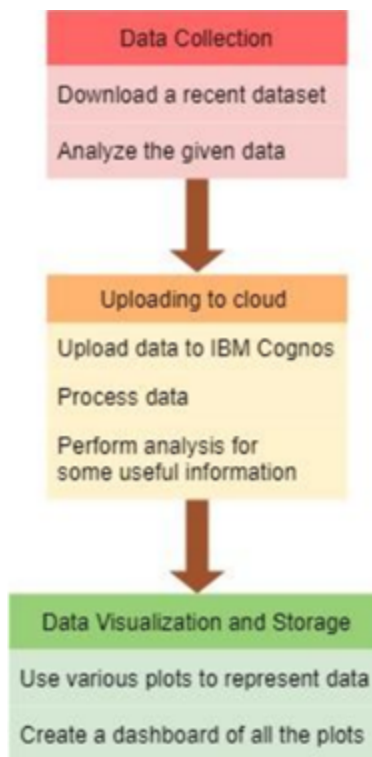
Technical Architecture
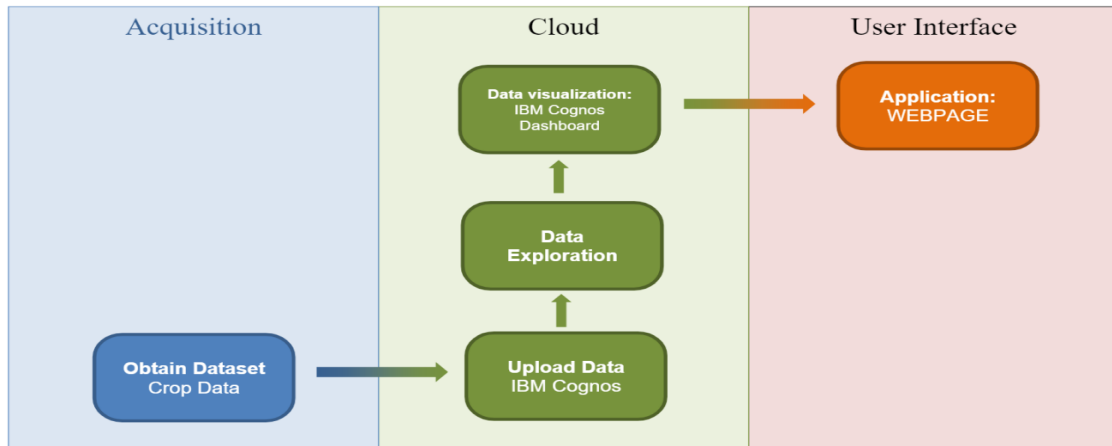
5.3. User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Farmer)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmationemail & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application throughFacebook	I can register & access the dashboard with Facebook Login	Low	Sprint-1
	Data	-	I can view the crop yield history, past profits and losses	I can access past dataset ofcrop yieldin India	High	Sprint-2
	Analysis	USN-5	I can get clean,processed and analysed data		High	Sprint-3

|						
Customer Care Executive	Customer Care Executive (Communica tion)		As a user, i can provide support systems for companies that often communicate with the customers	I can maintain strong relationships with customer and client ,so I can ease theirqueries and increase productivity	Medium	Sprint-4
Estimator	Estimation		As a user, I can view the items that are to be estimated	I have a feel for the size ofthe various items in the product based	Medium	Sprint-4

6. PROJECT PLANNING & SCHEDULING

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for website by entering my username and password and request.	3	High	Simham Tejsahan Jaswanth D Tarini shankar Vignesh s
	Login	USN-2	As a user, I can Call and request or Approach for dataset	4	High	Tarini shankar Vignesh s
	Working with the Dataset	USN-3	To work on the given dataset, Understand and Explore the Dataset.	3	High	Simham Tejsahan Jaswanth D Tarini shankar Vignesh
		USN-4	Load the dataset to IBM Cognos platform then Build the required Visualizations.	10	High	Simham Tejsahan Vignesh S
Sprint-2	Data Visualization Chart	USN-5	Using the Crop production with Indian dataset, create various graphs and charts to highlight the insights and visualizations. *Build a Visualization to showcase Average Crop Production by Seasons.	4	Medium	Jaswanth D Tarini shankar
			*Showcase the Yearly usage of Area in Crop Production.	4	Medium	Simham TejSahan Tarini Shankar
			Build a visualization to show case top 10 States in Crop Yield Production by Area.	4	Medium	Jaswanth D Vignesh S
			Build the required Visualization to showcase the Crop Production by State.	4	Medium	Tarini Shankar Vignesh S
			Build Visual analytics to represent the Sates with Seasonal Crop Production using a Text representation.	4	Medium	Jaswanth D Simham Tejsahan
Sprint-3	Creating The dashboard	USN-6	Create the Dashboard by using the created visualizations. Create the Report and Story by using the created visualizations.	20	High	Simham Tejsahan Jaswanth D Tarini shankar Vignesh
Sprint-4	Export The Analytics	USN-7	Exporting the created Dashboard, Story and Reports. Embedding the Dashboards, Story and Reports in a webpage to make them easily available to the users. Prediction of Crop Yield using Machine Learning Models	20	High	Simham Tejsahan Jaswanth D Tarini shankar Vignesh S

6.2. Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3. Reports from JIRA

Before the Start of Sprints
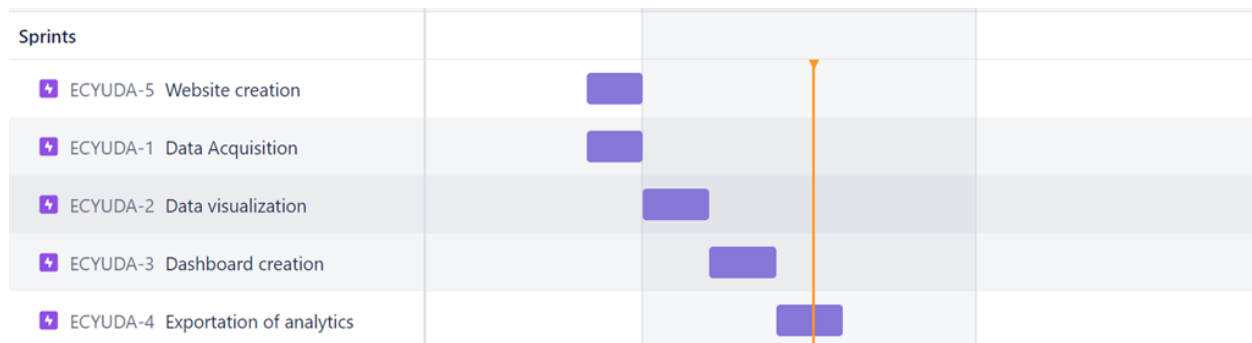
Creation of Sprints

ECYUDA Sprint 1 27 Oct – 31 Oct (2 issues)   0 **0** **0** **Start sprint** ...

📗 ECYUDA-6 Create a website   TO DO ⌄ J

📗 ECYUDA-7 Collect the dataset   TO DO ⌄ VS

+ Create issue

ECYUDA Sprint 2 1 Nov – 6 Nov (1 issue)   0 **0** **0** Start sprint ...

📗 ECYUDA-8 Visualize the Dataset   TO DO ⌄ T

+ Create issue

ECYUDA Sprint 3 7 Nov – 12 Nov (3 issues)   0 **0** **0** Start sprint ...

📗 ECYUDA-9 Create dashboard   TO DO ⌄ VS

📗 ECYUDA-10 Create story   TO DO ⌄ S

📗 ECYUDA-11 Create Report   TO DO ⌄ T

+ Create issue

ECYUDA Sprint 4 13 Nov – 18 Nov (2 issues)   0 **0** **0** Start sprint ...
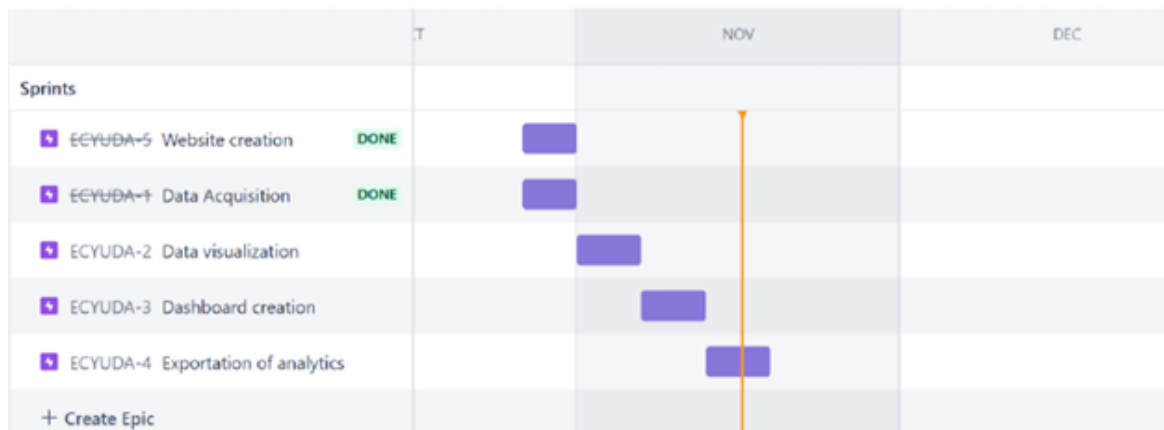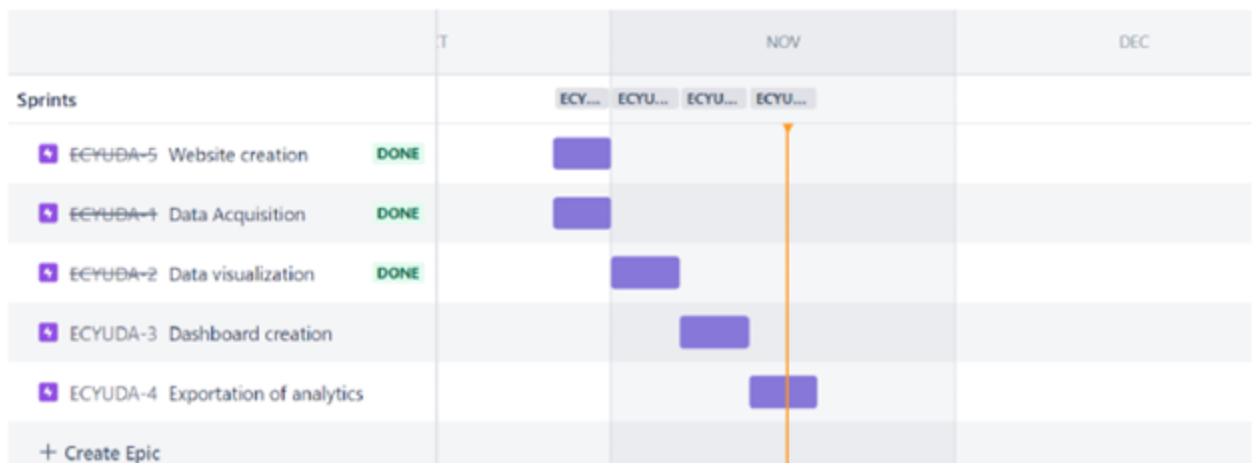
📗 ECYUDA-12 Export the analytics   TO DO ⌄ J
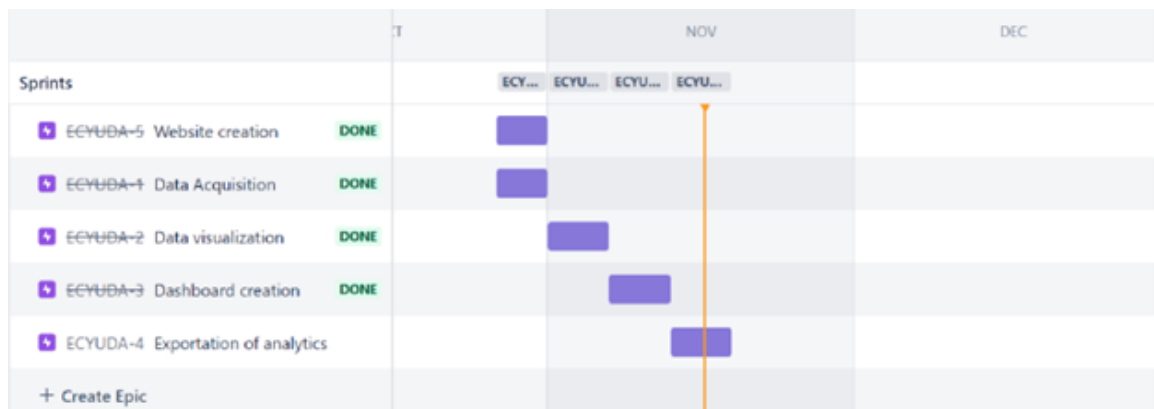
📗 ECYUDA-13 Integrate dashboard with website   TO DO ⌄ S

Sprint 1

		NOV	DEC
Sprints			
⬛ ~~ECYUDA-5~~ Website creation **DONE**	▪		
⬛ ~~ECYUDA-1~~ Data Acquisition **DONE**	▪		
⬛ ECYUDA-2 Data visualization	▪		
⬛ ECYUDA-3 Dashboard creation		▪	
⬛ ECYUDA-4 Exportation of analytics		▪	
+ Create Epic			

Sprint 2

		NOV	DEC
Sprints		ECY... ECYU... ECYU... ECYU...	
⬛ ~~ECYUDA-5~~ Website creation **DONE**	▪		
⬛ ~~ECYUDA-1~~ Data Acquisition **DONE**	▪		
⬛ ~~ECYUDA-2~~ Data visualization **DONE**	▪		
⬛ ECYUDA-3 Dashboard creation		▪	
⬛ ECYUDA-4 Exportation of analytics		▪	
+ Create Epic			

Sprint 3

		NOV	DEC
Sprints		ECY... ECYU... ECYU... ECYU...	
⬛ ~~ECYUDA-5~~ Website creation **DONE**	▪		
⬛ ~~ECYUDA-1~~ Data Acquisition **DONE**	▪		
⬛ ~~ECYUDA-2~~ Data visualization **DONE**	▪		
⬛ ~~ECYUDA-3~~ Dashboard creation **DONE**		▪	
⬛ ECYUDA-4 Exportation of analytics		▪	
+ Create Epic			

Sprint 4

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1. Data set extraction from Kaggle using Kaggle-API

!pip install -q kaggle

!mkdir ~/.kaggle #creating kaggle directory

!cp kaggle.json ~/.kaggle/ #copying json file to folder

!kaggle datasets download -d abhiseklewan/crop-production-statistics-from-1997-in-india

!unzip /content/crop-production-statistics-from-1997-in-india.zip

7.2. Exploratory data analysis and estimation of crop yield using ML algorithm

Libraries

```python
import seaborn as sns
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
%matplotlib inline
```

Data Exploration

```
df=pd.read_csv('/content/drive/MyDrive/IBM_CROP YIELD/CROP YIELD
DATASET/crop_production.csv')
df.head()
```

```
                 State_Name District_Name  Crop_Year      Season  \
0  Andaman and Nicobar Islands    NICOBARS       2000  Kharif
1  Andaman and Nicobar Islands    NICOBARS       2000  Kharif
2  Andaman and Nicobar Islands    NICOBARS       2000  Kharif
3  Andaman and Nicobar Islands    NICOBARS       2000  Whole Year
4  Andaman and Nicobar Islands    NICOBARS       2000  Whole Year


                Crop    Area  Production
0           Arecanut  1254.0      2000.0
1  Other Kharif pulses     2.0         1.0
2               Rice   102.0       321.0
3             Banana   176.0       641.0
4           Cashewnut   720.0       165.0
```

```
df.shape
df.info()
```

```
  <class 'pandas.core.frame.DataFrame'>
  RangeIndex: 246091 entries, 0 to 246090
  Data columns (total 7 columns):
   #   Column         Non-Null Count   Dtype
  ---  ------         --------------   -----
   0   State_Name     246091 non-null  object
   1   District_Name  246091 non-null  object
   2   Crop_Year      246091 non-null  int64
   3   Season         246091 non-null  object
   4   Crop           246091 non-null  object
   5   Area           246091 non-null  float64
   6   Production     242361 non-null  float64
  dtypes: float64(2), int64(1), object(4)
  memory usage: 13.1+ MB
```

```
df.isnull().sum()
```

```
        State_Name          0
        District_Name       0
        Crop_Year           0
        Season              0
        Crop                0
        Area                0
        Production       3730
        dtype: int64
```

```
3730/246091
```
```
0.015156994770227274
```
```
data = df.dropna()
```
```
print(data.shape)
```
```
(242361, 7)
```
```
df.isnull().sum()
```
```
State_Name          0
District_Name       0
Crop_Year           0
Season              0
Crop                0
Area                0
Production       3730
dtype: int64
```

```
sum_maxp = data["Production"].sum()
```
```
data["percent_of_production"] = data["Production"].map(lambda
x:(x/sum_maxp)*100)
```
```
data[:5]
```

```
               State_Name District_Name Crop_Year   Season \
0 Andaman and Nicobar Islands   NICOBARS   2000 Kharif
1 Andaman and Nicobar Islands   NICOBARS   2000 Kharif
2 Andaman and Nicobar Islands   NICOBARS   2000 Kharif
3 Andaman and Nicobar Islands   NICOBARS   2000 Whole Year
4 Andaman and Nicobar Islands   NICOBARS   2000 Whole Year

                Crop   Area Production percent_of_production
0   Arecanut 1254.0   2000.0   1.416670e-06
1 Other Kharif pulses   2.0   1.0   7.083351e-10
2   Rice   102.0   321.0   2.273756e-07
3   Banana   176.0   641.0   4.540428e-07
4   Cashewnut   720.0   165.0   1.168753e-07
```
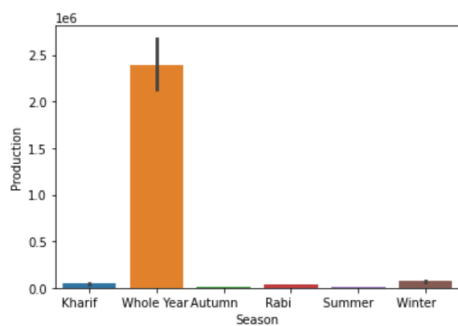
```
sns.lineplot(data["Crop_Year"],data["Production"])
```
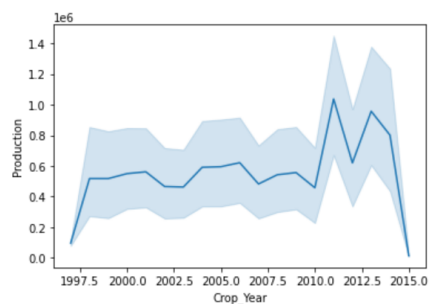
```
plt.figure(figsize=(25,10))
sns.barplot(data["State_Name"],data["Production"])
plt.xticks(rotation=90)
```
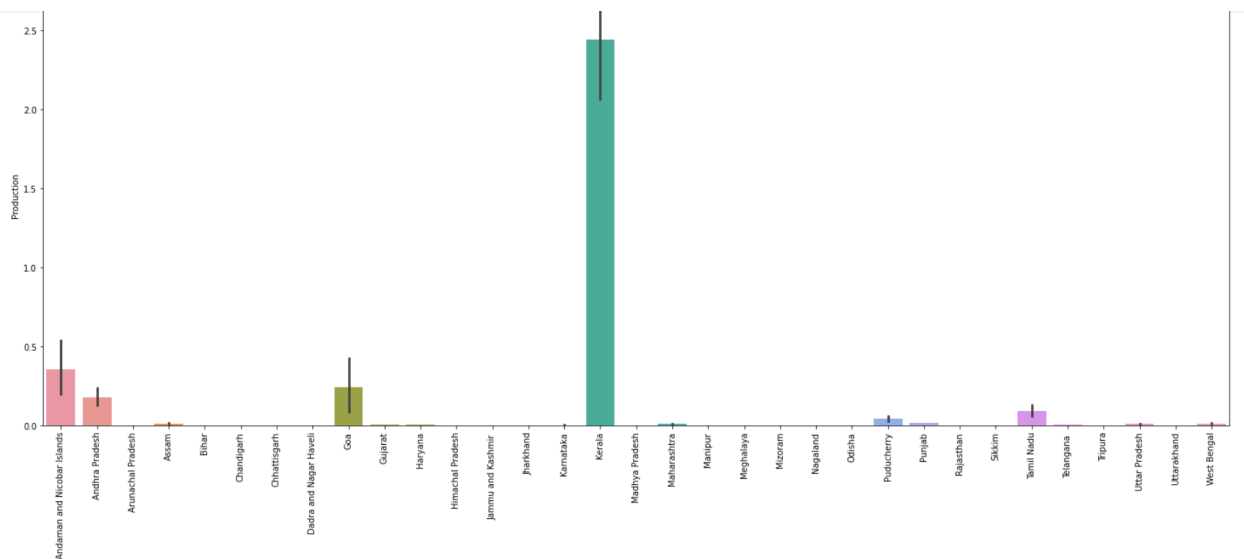


```
sns.barplot(data["Season"],data["Production"])
```



```
data.groupby("Season",axis=0).agg({"Production":np.sum})
```

	Production
Season	
Autumn	6.441377e+07
Kharif	4.029970e+09
Rabi	2.051688e+09
Summer	1.706579e+08
Whole Year	1.344248e+11
Winter	4.345498e+08

```python
data["Crop"].value_counts()[:5]
```

```
Rice                  15082
Maize                 13787
Moong(Green Gram)     10106
Urad                   9710
Sesamum                8821
Name: Crop, dtype: int64
```

```python
top_crop_pro =
data.groupby("Crop")["Production"].sum().reset_index().sort_values(by='Production',asc
ending=False)
top_crop_pro[:5]
```

	Crop	Production
28	Coconut	1.299816e+11
106	Sugarcane	5.535682e+09
95	Rice	1.605470e+09
119	Wheat	1.332826e+09
87	Potato	4.248263e+08

Coconut

```python
coc_df = data[data["Crop"]=="Coconut "]
print(coc_df.shape)
coc_df[:3]
```

	State_Name	District_Name	Crop_Year	Season
5	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year
14	Andaman and Nicobar Islands	NICOBARS	2001	Whole Year
23	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year

	Crop	Area	Production	percent_of_production
5	Coconut	18168.0	65100000.0	0.046113
14	Coconut	18190.0	64430000.0	0.045638
23	Coconut	18240.0	67490000.0	0.047806

```python
sns.barplot("Season","Production",data=coc_df)
```
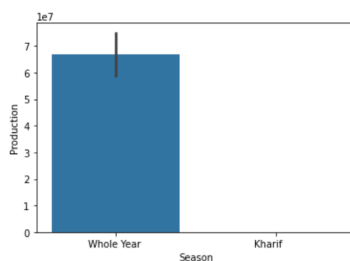
```python
plt.figure(figsize=(13,10))
sns.barplot("State_Name","Production",data=coc_df)
plt.xticks(rotation=90)
plt.show()
```
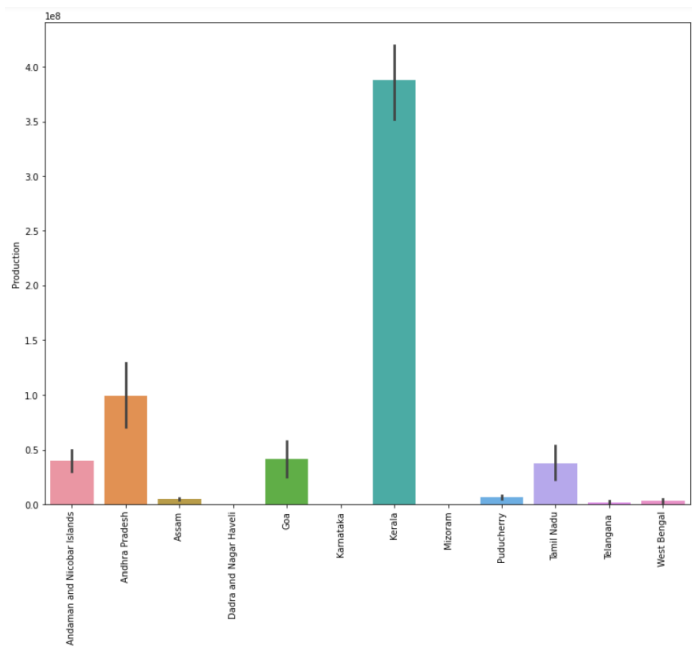


```python
top_coc_pro_dis =
coc_df.groupby("District_Name")["Production"].sum().reset_index().sort_val
ues(
    by='Production',ascending=False)
top_coc_pro_dis[:5]
sum_max = top_coc_pro_dis["Production"].sum()
top_coc_pro_dis["precent_of_pro"] =
top_coc_pro_dis["Production"].map(lambda x:(x/sum_max)*100)
top_coc_pro_dis[:5]
```

	District_Name	Production	precent_of_pro
77	KOZHIKODE	1.527871e+10	11.754512
86	MALAPPURAM	1.451252e+10	11.165052
129	THIRUVANANTHAPURAM	1.001337e+10	7.703678
131	THRISSUR	9.920739e+09	7.632416
64	KANNUR	9.780310e+09	7.524379

```python
plt.figure(figsize=(18,12))
sns.barplot("District_Name","Production",data=top_coc_pro_dis)
plt.xticks(rotation=90)
plt.show()
```
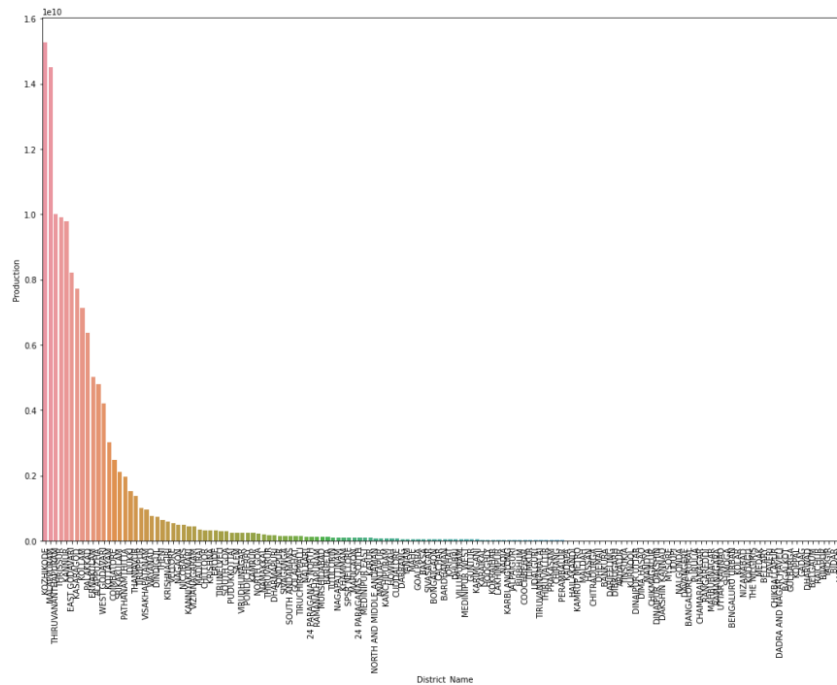


```python
plt.figure(figsize=(15,10))
sns.barplot("Crop_Year","Production",data=coc_df)
plt.xticks(rotation=45)
#plt.legend(rice_df['State_Name'].unique())
plt.show()
```
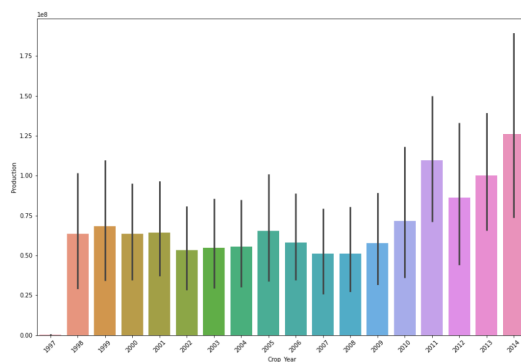
```
sns.jointplot("Area","Production",data=coc_df,kind="reg")
```
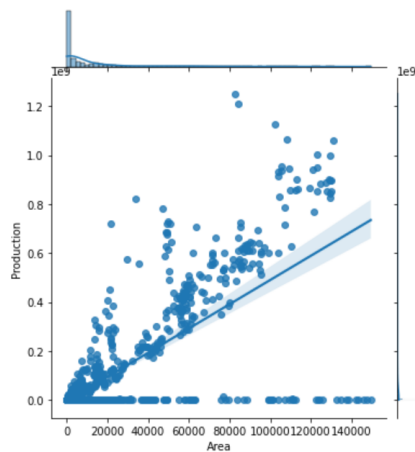

**Sugarcane**

```
sug_df = data[data["Crop"]=="Sugarcane"]
print(sug_df.shape)
sug_df[:3]
```

	State_Name	District_Name	Crop_Year	Season	\
7	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	
16	Andaman and Nicobar Islands	NICOBARS	2001	Whole Year	
26	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	

	Crop	Area	Production	percent_of_production
7	Sugarcane	1.0	2.0	1.416670e-09
16	Sugarcane	1.0	1.0	7.083351e-10
26	Sugarcane	5.0	40.0	2.833340e-08

```
sns.barplot("Season","Production",data=sug_df)
```
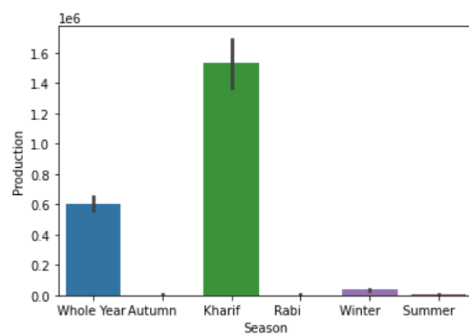
```python
plt.figure(figsize=(13,8))
sns.barplot("State_Name","Production",data=sug_df)
plt.xticks(rotation=90)
plt.show()
```
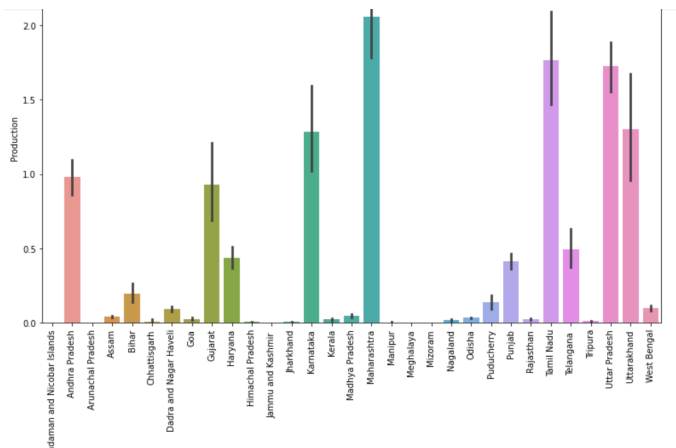


```python
top_sug_pro_dis =
sug_df.groupby("District_Name")["Production"].sum().reset_index().sort_val
ues(
    by='Production',ascending=False)
top_sug_pro_dis[:5]
sum_max = top_sug_pro_dis["Production"].sum()
top_sug_pro_dis["precent_of_pro"] =
top_sug_pro_dis["Production"].map(lambda x:(x/sum_max)*100)
top_sug_pro_dis[:5]
```
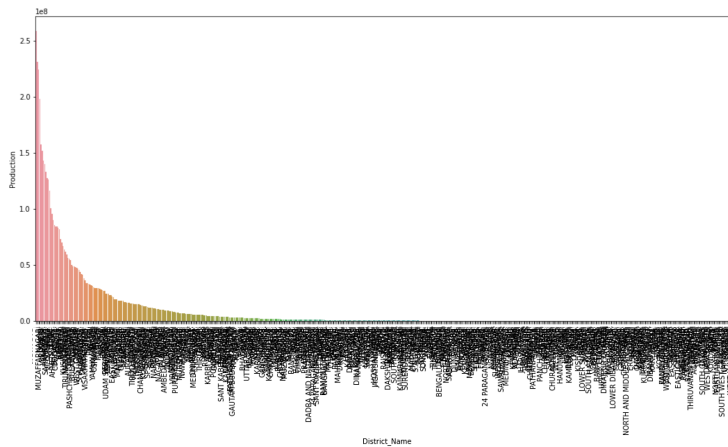
	District_Name	Production	precent_of_pro
360	MUZAFFARNAGAR	258698795.0	4.673296
81	BIJNOR	230907185.0	4.171251
283	KHERI	224383685.0	4.053407
63	BELGAUM	198207649.0	3.580546
294	KOLHAPUR	157210426.0	2.839947

```python
plt.figure(figsize=(18,8))
sns.barplot("District_Name","Production",data=top_sug_pro_dis)
plt.xticks(rotation=90)
```
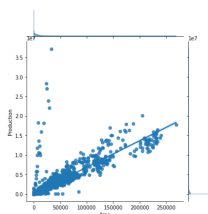
```
plt.show()
```



```
plt.figure(figsize=(15,10))
sns.barplot("Crop_Year","Production",data=sug_df)
plt.xticks(rotation=45)
#plt.legend(rice_df['State_Name'].unique())
plt.show()
```
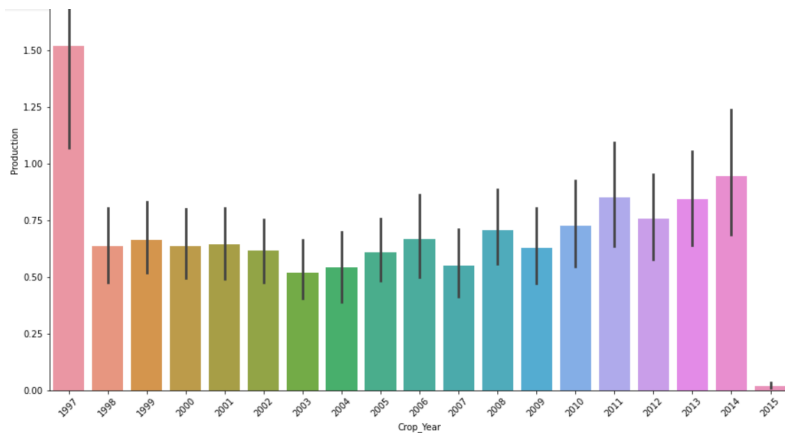


```
sns.jointplot("Area","Production",data=sug_df,kind="reg")
```

Rice

```python
rice_df = data[data["Crop"]=="Rice"]
print(rice_df.shape)
rice_df[:3]
```

```
     (15082, 8)

                     State_Name District_Name  Crop_Year     Season  Crop  \
    2   Andaman and Nicobar Islands       NICOBARS       2000  Kharif      Rice
    12  Andaman and Nicobar Islands       NICOBARS       2001  Kharif      Rice
    18  Andaman and Nicobar Islands       NICOBARS       2002  Kharif      Rice

         Area  Production  percent_of_production
    2   102.0      321.00           2.273756e-07
    12   83.0      300.00           2.125005e-07
    18  189.2      510.84           3.618459e-07
```

```python
sns.barplot("Season","Production",data=rice_df)
```
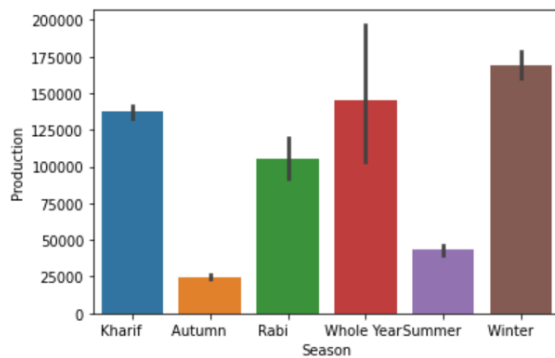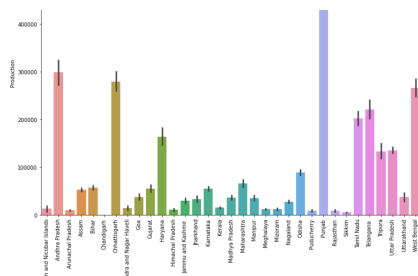


```python
plt.figure(figsize=(13,10))
sns.barplot("State_Name","Production",data=rice_df)
plt.xticks(rotation=90)
plt.show()
```

```python
top_rice_pro_dis =
rice_df.groupby("District_Name")["Production"].sum().reset_index().sort_va
lues(
    by='Production',ascending=False)
top_rice_pro_dis[:5]
sum_max = top_rice_pro_dis["Production"].sum()
top_rice_pro_dis["precent_of_pro"] =
top_rice_pro_dis["Production"].map(lambda x:(x/sum_max)*100)
top_rice_pro_dis[:5]
```
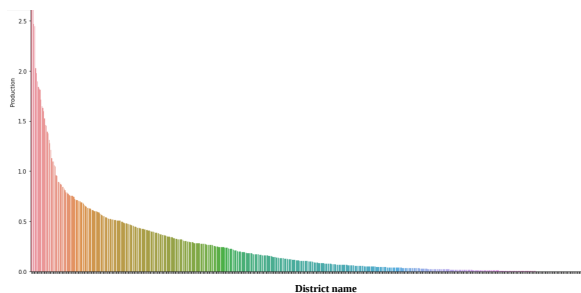
```
        District_Name  Production  precent_of_pro
58          BARDHAMAN  34239976.0        2.132707
374    MEDINIPUR WEST  29192719.0        1.818328
612     WEST GODAVARI  27845309.0        1.734402
169     EAST GODAVARI  24690929.0        1.537925
494           SANGRUR  24448000.0        1.522794
```

```python
plt.figure(figsize=(18,12))
sns.barplot("District_Name","Production",data=top_rice_pro_dis)
plt.xticks(rotation=90)
plt.show()
```
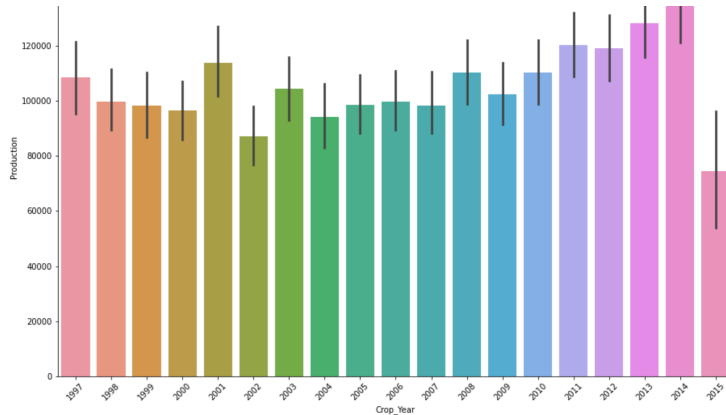


```python
plt.figure(figsize=(15,10))
sns.barplot("Crop_Year","Production",data=rice_df)
plt.xticks(rotation=45)
#plt.legend(rice_df['State_Name'].unique())
plt.show()
```
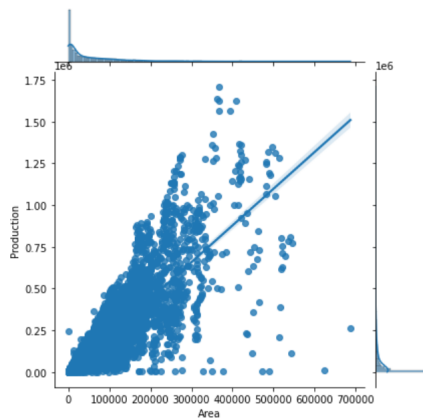
```
sns.jointplot("Area","Production",data=rice_df,kind="reg")
```


Feature Selection

```
data1 = data.drop(["District_Name","Crop_Year"],axis=1)
data1.head()
print(data1['Season'].unique())
print(data1['State_Name'].unique())
data1['Crop'].unique()
```

```
['Kharif     ' 'Whole Year ' 'Autumn     ' 'Rabi       ' 'Summer
'
 'Winter     ']
['Andaman and Nicobar Islands' 'Andhra Pradesh' 'Arunachal Pradesh'
 'Assam' 'Bihar' 'Chandigarh' 'Chhattisgarh' 'Dadra and Nagar
Haveli'
 'Goa' 'Gujarat' 'Haryana' 'Himachal Pradesh' 'Jammu and Kashmir '
```

```
 'Jharkhand' 'Karnataka' 'Kerala' 'Madhya Pradesh' 'Maharashtra'
'Manipur'
 'Meghalaya' 'Mizoram' 'Nagaland' 'Odisha' 'Puducherry' 'Punjab'
 'Rajasthan' 'Sikkim' 'Tamil Nadu' 'Telangana ' 'Tripura' 'Uttar
Pradesh'
 'Uttarakhand' 'West Bengal']
array(['Arecanut', 'Other Kharif pulses', 'Rice', 'Banana',
'Cashewnut',
       'Coconut ', 'Dry ginger', 'Sugarcane', 'Sweet potato',
'Tapioca',
       'Black pepper', 'Dry chillies', 'other oilseeds', 'Turmeric',
       'Maize', 'Moong(Green Gram)', 'Urad', 'Arhar/Tur',
'Groundnut',
       'Sunflower', 'Bajra', 'Castor seed', 'Cotton(lint)', 'Horse-
gram',
       'Jowar', 'Korra', 'Ragi', 'Tobacco', 'Gram', 'Wheat',
'Masoor',
       'Sesamum', 'Linseed', 'Safflower', 'Onion', 'other misc.
pulses',
       'Samai', 'Small millets', 'Coriander', 'Potato',
       'Other  Rabi pulses', 'Soyabean', 'Beans &
Mutter(Vegetable)',
       'Bhindi', 'Brinjal', 'Citrus Fruit', 'Cucumber', 'Grapes',
'Mango',
       'Orange', 'other fibres', 'Other Fresh Fruits', 'Other
Vegetables',
       'Papaya', 'Pome Fruit', 'Tomato', 'Mesta', 'Cowpea(Lobia)',
       'Lemon', 'Pome Granet', 'Sapota', 'Cabbage', 'Rapeseed
&Mustard',
       'Peas  (vegetable)', 'Niger seed', 'Bottle Gourd', 'Varagu',
       'Garlic', 'Ginger', 'Oilseeds total', 'Pulses total', 'Jute',
       'Peas & beans (Pulses)', 'Blackgram', 'Paddy', 'Pineapple',
       'Barley', 'Sannhamp', 'Khesari', 'Guar seed', 'Moth',
       'Other Cereals & Millets', 'Cond-spcs other', 'Turnip',
```

```
      'Carrot',
              'Redish', 'Arcanut (Processed)', 'Atcanut (Raw)',
              'Cashewnut Processed', 'Cashewnut Raw', 'Cardamom', 'Rubber',
              'Bitter Gourd', 'Drum Stick', 'Jack Fruit', 'Snak Guard',
      'Tea',
              'Coffee', 'Cauliflower', 'Other Citrus Fruit', 'Water Melon',
              'Total foodgrain', 'Kapas', 'Colocosia', 'Lentil', 'Bean',
      'Jobster', 'Perilla', 'Rajmash Kholar', 'Ricebean (nagadal)',
              'Ash Gourd', 'Beet Root', 'Lab-Lab', 'Ribed Guard', 'Yam',
              'Pump Kin', 'Apple', 'Peach', 'Pear', 'Plums', 'Litchi',
      'Ber',
              'Other Dry Fruit', 'Jute & mesta'], dtype=object)
from sklearn.preprocessing import LabelEncoder
crop_encoder=LabelEncoder()
data1['State_Name']=crop_encoder.fit_transform(data1['State_Name'])
data1['Season']=crop_encoder.fit_transform(data1['Season'])
data1['Crop']=crop_encoder.fit_transform(data1['Crop'])
data1.head()
     State_Name  Season  Crop   Area  Production  percent_of_production
0             0       1     2  1254.0      2000.0           1.416670e-06
1             0       1    74     2.0         1.0           7.083351e-10
2             0       1    95   102.0       321.0           2.273756e-07
3             0       4     7   176.0       641.0           4.540428e-07
4             0       4    22   720.0       165.0           1.168753e-07
print(data1['Season'].unique())
print(data1['State_Name'].unique())
data1['Crop'].unique()
[1 4 0 2 3 5]
[ 0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
 24 25 26 27 28 29 30 31 32]
array([  2,  74,  95,   7,  22,  28,  38, 106, 108, 109,  15,  37, 123,
       114,  59,  63, 116,   3,  43, 107,   6,  25,  33,  45,  48,  53,
        90, 111,  41, 119,  61, 102,  57,  98,  67, 122,  99, 103,  32,
        87,  69, 105,  10,  13,  18,  27,  35,  42,  60,  68, 121,  73,
        75,  77,  85, 112,  62,  34,  55,  86, 101,  19,  92,  80,  65,
        17, 117,  39,  40,  66,  88,  49,  81,  16,  76,  83,   8, 100,
        52,  44,  64,  70,  31, 115,  21,  93,   1,   5,  23,  24,  20,
```

```
       97,  14,  36,  46, 104, 110,  29,  26,  71, 118, 113,  51,  30,
       56,   9,  47,  82,  91,  96,   4,  11,  54,  94, 120,  89,   0,
       78,  79,  84,  58,  12,  72,  50])
```

Test Train Split

```python
x = data1.drop("Production",axis=1)
y = data1[["Production"]]
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.33,
random_state=42)
print("x_train :",x_train.shape)
print("x_test :",x_test.shape)
print("y_train :",y_train.shape)
print("y_test :",y_test.shape)
```
```
      x_train : (162381, 5)
      x_test : (79980, 5)
      y_train : (162381, 1)
      y_test : (79980, 1)
```

```python
x_train[:5]
```

	State_Name	Season	Crop	Area	percent_of_production
4843	1	1	59	785.0	1.486087e-06
20626	3	0	95	1250.0	5.829598e-07
240277	32	4	106	2.0	1.452087e-07
20664	3	1	49	60.0	4.646678e-07
157859	22	3	63	605.0	6.729184e-08

1)Random Forest

```python
from sklearn.ensemble import RandomForestRegressor
model = RandomForestRegressor()
model.fit(x_train,y_train)
preds = model.predict(x_test)
from sklearn.metrics import r2_score
r = r2_score(y_test,preds)
print("R2score when we predict using Randomn forest is ",r)
```
```
      R2score when we predict using Randomn forest is  0.9981341380489299
```

```
preds[:5]
     array([4479.26     ,  436.42     ,  123.3237381 ,    7.982     ,
            183.38333333])
y_test[:5]
            Production
     51163      4529.0
     55141       425.0
     104122      254.0
     161230        7.0
     229232      130.0
```

2)Linear Regression

```python
from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(x_train,y_train)
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=None,
normalize=False)
preds_lg = model.predict(x_test)
from sklearn.metrics import mean_squared_error, r2_score
mean_squared_error(y_test,preds_lg)
     1.7004942250319832e-11
preds_lg[:5]

     array([[4529.00000093],
            [ 425.00000081],
            [ 253.99999425],
            [   7.00000048],
            [ 130.00000039]])
y_test[:5]
            Production
     51163      4529.0
```

```
    55141          425.0
    104122         254.0
    161230           7.0
    229232         130.0
```

3) Decision Tree

```python
from sklearn.tree import DecisionTreeRegressor
regressor = DecisionTreeRegressor(random_state=42)
regressor.fit(x_train,y_train)
preds_dt = regressor.predict(x_test)
mean_squared_error(y_test,preds_dt)
r2_score(y_test,preds_dt)
    0.9986419000899257
preds_dt[0]
    4355.0
y_test[0:]
    Production
    51163        4529.0
    55141         425.0
    104122        254.0
    161230          7.0
    229232        130.0
    ...             ...
    23491     6710000.0
    164745         30.0
    31176       26496.0
    22509         411.0
    42211       97846.0

    [79980 rows x 1 columns]
```

8. TESTING

8.1. Test Cases

Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed By
1.Enter URL and click go 2.Click on the Register here button 3.Verify Singup options for new user displayed 4.Verify Login options for existing user.	https://crop-yield-data-analytics.s3.ams03.cloud-object-storage.appdomain.cloud/Estimate-crop-yield/login%20Page.html	Login/Signup options or elements should display	Working as expected	Pass	Login or Signup are displayed.	NO	NO BUG	Simham Tejsahan
1.Enter URL and click go 2. New coustomer?Click on the Register here 3.Verify Singup with below UI elements: a.Username text box b.password and Reconfirm Passwordtext box c.Submit and Reset button d.Already a user?Verify Login with below UI elements : 1.Username text box 2.Password text box	https://crop-yield-data-analytics.s3.ams03.cloud-object-storage.appdomain.cloud/Estimate-crop-yield/login%20Page.html	Application should show below UI elements: a.Username text box b.password text box c.Submit button with Blue colour d.New customer? Create account by clicking on Register here e. password and Confirm password text box.	Working as expected	Pass	All the UI elements added for user login are available.	NO	NO BUG	D Jaswanth
1.Enter URL and click go 2.Enter Valid username text box 4.Enter valid password in password text box 5.Click on Submit button	Username: sahan password: sahan123	User should navigate to user account homepage	Working as expected	Pass	User is able to navigate to home page	NO	NO BUG	Tarini Shankar
1.Enter URL and click go 2.Enter Valid username text box 3.Enter Invalid password in password text box 4.Click on Submit button	Username: sahan password: sa123	Application should Popup 'Incorrect Username or password ' validation message.	Working as expected	Pass	Invalid username or password popup is obtained	NO	NO BUG	Vignesh S
1.Enter URL and click go 2.Enter Invalid username text box 3.Enter valid password in password text box 4.Click on Submit button	Username: sah password: sahan123	Application should Popup 'Incorrect Username or password ' validation message.	Working as expected	Pass	Invalid username or password popup is obtained	No	NO BUG	Simham Tejsahan
1.Enter URL and click go 2.Enter Invalid username text box 3.Enter Invalid password in password text box 4.Click on Submit button	Username: sah password: saha1	Appplication should Popup 'Incorrect Username or password ' validation message.	Working as expected	Pass	Invalid username or password popup is obtained	NO	NO BUG	D Jaswanth
Check whether the Home page has Technical Archtecture and Navigation Bar.		User should navigate to user account homepage	Working as expected	Pass	User is navigated to home page.	NO	NO BUG	Tarini Shankar
Check whether the user is able to Navigate using navigation bar.		User should navigate to different pages using navigation bar	Working as expected	Pass	User was able to navigate to different pages	NO	NO BUG	Vignesh S

1.Click on the Dashboard button in navigation bar. 2.After clicking the Dashboard option you will get page with different dashboards. 3.Choose any one of the dashboard and explore them.		User able to see different dashboards and use them.	Working as expected	Pass	User was able to view different dashboards and analyse them.	NO	NO BUG	Simham Tejsahan
1.Click on the Report button in navigation bar. 2.After clicking the Report option you will get page with different Report cards.		User is able to navigate to Report page and view the report page	Working as expected	Pass	User was able to view different report pages and analyse them.	No	NO BUG	Tarini Shankar
1.Click on the story button in navigation bar. 2.After clicking the story button you will get page with different story .		User is able to navigate to Story page and view the Story page	Working as expected	Pass	User was able to view different slides in a story and analyse them.	NO	NO BUG	D Jaswanth
1.Click on the Contatct us button in navigation bar. 2.After clicking the contact button you will get the contact deatails of contibutors and you can directly contact with them.		User is able to navigate to Contact us page and view the details of contributers.	Working as expected	Pass	User was able to navigate to ContactUs page to contact the team.	NO	NO BUG	Vignesh S
1.Click on the logout button in navigation bar. 2.After clicking the logout button you will directed to the login page.		User is able to navigate to login page after clicking the logout option.	Working as expected	Pass	User was able to logout from the page	NO	NO BUG	Simham Tejsahan

8.2. User Acceptance Testing

Defect Analysis

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	5	2	4	21
Duplicate	1	0	2	0	3
External	3	2	0	1	6
Fixed	12	3	3	20	38
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	4	2	1	7
Totals	26	14	11	27	78

T

9. RESULTS

9.1. Performance Metrics

Machine Learning

```
Random forest R2score=0.9981341380489299

Linear Regression mean squared error=1.7004942250319832e-11

Decision Tree R2score=0.9986419000899257
```
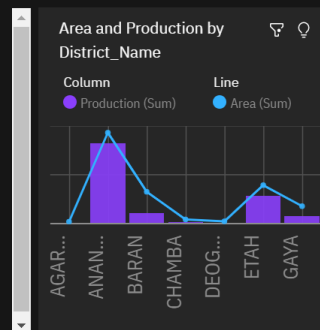
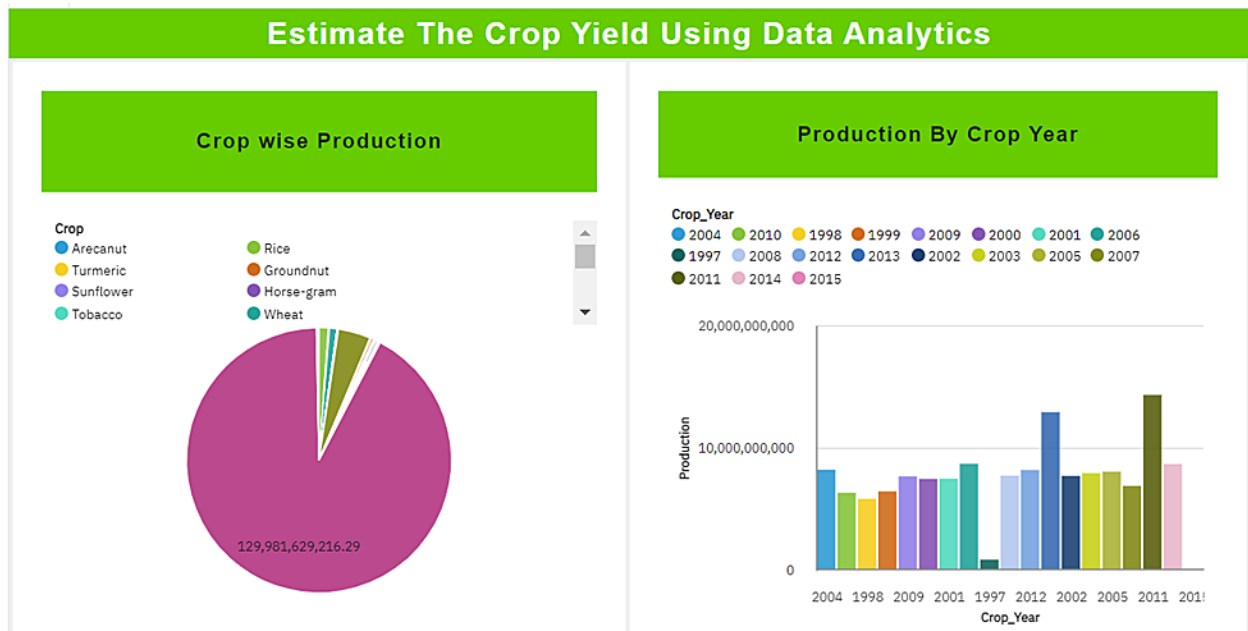## Dashboard:

Story:

Report:

10. ADVANTAGES & DISADVANTAGES

Advantages

- Applying different algorithms according to the dataset and based on visualization.

- Knowledge of building ML models

- You will be able to know how to pre-process/clean the data using different data pre-processing techniques.

Disadvantages

- As the given dataset is very small, the model is not able to make predictions on large values.

- For more accurate and real time results, we would need a dataset which contains millions

of datapoints.

11. CONCLUSION

This project, "ESTIMATE THE CROP YIELD USING DATA ANALYTICS", has helped to predict the crop yield using the attributes such as State_Name,District_Name,Crop_Year,Season,Crop,Area and Production.The model is build using IBM Cognos Watson. Technology has helped largely in the agricultural field. New concepts like digital agriculture, smart farming, precision agriculture etc have come up today. Successful analysis has been performed on the crop data based on weather condition, geographic location and area coverage. Also, the major trends have been identified.

12. FUTURE SCOPE

Lot of steps were involved in the data visualization and creation of dashboard. It would be much more convenient and efficient to identify the target attribute only, hence reducing the computational work. There should also be a proper algorithm selection process

13. APPENDIX

13.1. Source Code

Login Page

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0"
/>
    <link rel="preconnect" href="https://fonts.googleapis.com" />
    <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin />
    <link

href="https://fonts.googleapis.com/css2?family=Open+Sans:wght@300;600&disp
lay=swap"
      rel="stylesheet"
    />
```

```html
<title>LOGIN SYSYEM</title>
<style>
  body{
    background-size: cover;
  }
  * {
    font-family: "Open Sans", sans-serif;
  }
  .container_login {
    background-color: #f5f5f5;
    display: flex;
    justify-content: center;
    align-items: center;
    height:  100vh;
    width:  100vw;
  }
  div {
    margin-bottom: 10px;
  }
  input {
    padding: 10px 15px;
    border: 1px solid dodgerblue;
    border-radius: 5px;
    width: 200px;
    outline: 0px;
  }
  input:focus {
    border: 2px solid darkblue;
  }
  button {
    background-color: blue;
    font-size: larger;
    width: fit-content;
    border-radius: 5px;
    padding: 5px 8px;
    color: white;
```

```css
      margin: 0px 10px 10px 0px;
      border: 0;
    }
    button:hover {
      background-color: dodgerblue;
    }
    #CB {
      width: auto;
    }
    p {
      margin: 0px;
    }
    a {
      text-decoration: none;
    }
    #fp {
      margin-left: 30px;
    }
    a:hover {
      color: dodgerblue;
      text-decoration: none;
    }
    #b {
      color: white;
    }
  </style>
</head>
<body>
  <article class="container_login" >
    <form>
      <h2>Please sign in</h2>
      <div>
        <input
          type="text"
          placeholder="Username"
          id="username"
```

```html
          required
        />
      </div>
      <div>
        <input
          type="password"
          placeholder="Password"
          id="password"
          required
        />
      </div>
      <div><input id="CB" type="checkbox" /> Remember Me</div>
      <button type="button" onclick="login()" class="btn btn-primary">
Submit</button>
      <p>
        New Users,
        <a href="registration.html" target="_blank">Register here!!</a>
      </p>

        <script src="javascript.js">
        </script>

    </form>
  </article>
  </body>
</html>
```

Registration

```html
<!DOCTYPE html>
<html lang="en">
<head>
  <title>Registration</title>
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.min.
```

```
css" rel="stylesheet">
  <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle
.min.js"></script>
  <style>
    body{
        background-size: cover;
      }
    body{
     background-size: cover;
    }
    h2{
        font-size:40px;
        color: rgb(8, 94, 215);
    }
    div.mt-3{
        color: rgb(8, 94, 215);
        font-size:20px;
    }
    p{
        font-size:25px;
        color: rgb(8, 94, 215);
    }
  </style>
</head>
<body background="ICONS/home1.jpg">
<br><br>
    <h2><center>REGISTRATION</h2>

        <form>
            <div class="d-flex align-items-center justify-content-center">
                <div class="mb-3 mt-3 p-5 text-dark" >
                    <div class="p-5">
                        <div class='mt-3'>
                            <label for="username" class="form-
label">Username</label>
```

```html
                            <input type="text" class="form-control"
id="username" placeholder="Enter your username" maxlength="20"
minlength="3" required>
                        </div>
                        <div class="mt-3" >
                            <label for="password" class="form-label"
required>Password</label>
                            <input type="password" class="form-control"
id="password" placeholder="Enter your password" maxlength="15">
                        </div>
                        <div class="mt-3" >
                            <label for="password1" class="form-label"
required>Reconfirm Password</label>
                            <input type="password" class="form-control"
id="password1" placeholder="Enter your password">
                        </div>
                        <div>
                            <br>
                            <button type="button" onclick="register()"
class="btn btn-primary">Submit</button>
                            <input type="reset" class="btn btn-primary">
                        </div>
                        <br>
                        <p>Already an user?<a href="login
Page.html">Login</a></p>
                    </div>
                </div>
            </div>
        </form>
    </div>
    </div>
    <script src="javascript.js"></script>
</body>
</html>
```

Index

```html
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0"
/>
    <title>Home</title>
    <style>
      body{
        background-size: cover;
      }
      .container {
        height: 50px;
        font-family: Arial, Helvetica, sans-serif;
        background-color: rgb(8, 94, 215);
        display: flex;
        flex-direction: row;
        justify-content: flex-end;
        align-items: center;
      }
      a {
        color: whitesmoke;
        text-decoration: none;
      }
      a:hover {

        color: navy;
        text-decoration: none;
      }
      .nav_items {

        color: whitesmoke;
        padding: 0px;
        font-size: larger;
        margin: 0px 40px 0px 40px;
```

```css
    }
    input,
    textarea {
      padding: 10px 15px;
      margin-top: 5px;
      margin-bottom: 10px;
      border: 1px solid navy;
      border-radius: 5px;
      width: 500px;
      outline: 0px;
    }
    input:focus,
    textarea:focus {
      border: 2px solid navy;
    }
    ul {
      padding-left: 0px;
    }
    .contactGrid {
      display: grid;
      grid-template-rows: repeat(2, 170px);
      grid-template-columns: repeat(2, 300px);
    }
    .contactBox {
      background-color: dodgerblue;
      color: white;
      border: 2px solid white;
      padding: 20px;
      display: flex;
      flex-direction: column;
      justify-content: center;
      align-items: center;
    }
    h4 {
      margin: 0px;
    }
```

```css
.contactInfo,
.lastPart {
  display: flex;
  justify-content: space-around;
  align-items: center;
  margin-bottom: 40px;
}
.icons {
  width: 30px;
  height: 30px;
  margin-right: 10px;
}
.contactBox:hover {
  background-color: dodgerblue;
}
button {
  background-color: tomato;
  font-size: larger;
  border-radius: 5px;
  width: 150px;
  height: auto;
  padding: 10px;
  color: white;
  margin: 0px 10px 10px 0px;
  border: 0;
}
button:hover {
  background-color: dodgerblue;
}
.matter {
  color: #1b0760;
  font-weight: bold;
  text-align: center;
  font-size: large;
}
img {
```

```html
        margin: 50px;
        height: 250px;
        width: 1000px;
        border-radius: 5px;
    }
  </style>
</head>
<body background="ICONS/home1.jpg">
  <nav>
    <article class="container">
      <ul>
        <a class="nav_items" href="index.html">Home</a>
      </ul>
      <ul>
        <a class="nav_items" href="dashboard.html">Dashboard</a>
      </ul>
      <ul>
        <a class="nav_items" href="report.html">Report</a>
      </ul>
      <ul>
        <a class="nav_items" href="story.html">Story</a>
      </ul>
      <ul>
        <a class="nav_items" href="contactUs.html">Contact Us</a>
      </ul>
      <ul>
        <a class="nav_items" href="login Page.html">Log out</a>
      </ul>
    </article>
  </nav>

  <!-- BODY -->
  <article style="text-align: center">
    <h1>Estimate the Crop Yield using Data Analytics</h1>

    <p class="matter">
```

```
        Crop production in India is one of the most important sources of
income
        and India is one of the top countries to produce crops.
        As per this project we will be analyzing some important
visualization,
        creating a Dashboard, Story, Report and by going through these we
will
        get most of the insights of Crop production in India.
      </p>


      <h2>Technical Architecture :</h2>
      <img src="ICONS/ibm_image.png" alt="Architecture" />
    </article>
  </body>
</html>
```

Dashboard

```html
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0"
/>
    <title>Dashboard</title>
    <style>
      body{
        background-size: cover;
      }
      .container {
        height: 50px;
        font-family: Arial, Helvetica, sans-serif;
        background-color: rgb(8, 94, 215);
        display: flex;
        flex-direction: row;
        justify-content: flex-end;
```

```
      align-items: center;
    }
    a {
      color: whitesmoke;
      text-decoration: none;
    }
    a:hover {
      color: black;
      text-decoration: none;
    }
    .nav_items {
      color: whitesmoke;
      padding: 0px;
      font-size: larger;
      margin: 0px 40px 0px 40px;
    }


    ul {
      padding-left: 0px;
    }


    h4 {
      margin: 0px;
    }
  </style>
</head>
<body background="ICONS/home1.jpg">
  <nav>
    <article class="container">
      <ul>
        <a class="nav_items" href="index.html">Home</a>
      </ul>
      <ul>
        <a class="nav_items" href="dashboard.html">Dashboard</a>
      </ul>
      <ul>
```

```html
        <a class="nav_items" href="report.html">Report</a>
      </ul>
      <ul>
        <a class="nav_items" href="story.html">Story</a>
      </ul>
      <ul>
        <a class="nav_items" href="contactUs.html">Contact Us</a>
      </ul>
      <ul>
        <a class="nav_items" href="login Page.html">Log out</a>
      </ul>
    </article>
  </nav>
  <h1 style="text-align: center;">Dashboard</h1>
  <div>
    <iframe
src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRe
f=.my_folders%2FCROP%2BPRODUCTION%2BIBM%2BPROJECT%2FDashboards%2FDashboard
%2B1&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=fals
e&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView=mo
del00000184813c1c8f_00000000"
      width="1250"
      height="1000"
      frameborder="0"
      gesture="media"
      allow="encrypted-media"
      allowfullscreen=""></iframe>
  </div>
</br>
  <div>
    <iframe
src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRe
f=.my_folders%2FCROP%2BPRODUCTION%2BIBM%2BPROJECT%2FDashboards%2FDashboard
%2B2&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=fals
e&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView=mo
del00000184894b86be_00000003"
```

```
      width="1250"
      height="800"
      frameborder="0"
      gesture="media"
      allow="encrypted-media"
      allowfullscreen=""></iframe>
    </div>
  </br>
    <div>
      <iframe
src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRe
f=.my_folders%2FCROP%2BPRODUCTION%2BIBM%2BPROJECT%2FDashboards%2FDashboard
%2B3&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=fals
e&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView=mo
del000001848965777c_00000002"
      width="1250"
      height="800"
      frameborder="0"
      gesture="media"
      allow="encrypted-media"
      allowfullscreen=""></iframe>
    </div>
  </br>
    <div>
      <iframe
src="https://us1.ca.analytics.ibm.com/bi/?perspective=dashboard&amp;pathRe
f=.my_folders%2FCROP%2BPRODUCTION%2BIBM%2BPROJECT%2FDashboards%2FDashboard
%2B4&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=fals
e&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard&amp;subView=mo
del000001848985cb66_00000004"
      width="1250"
      height="800"
      frameborder="0"
      gesture="media"
      allow="encrypted-media"
      allowfullscreen=""></iframe>
```

```
      </div>
    </br>
        </body>
</html>
```

Report

```html
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0"
/>
    <title>REPORT</title>
    <style>
      body{
        background-size: cover;
      }
      .container {
        height: 50px;
        font-family: Arial, Helvetica, sans-serif;
        background-color: rgb(8, 94, 215);
        display: flex;
        flex-direction: row;
        justify-content: flex-end;
        align-items: center;
      }
      a {
        color: whitesmoke;
        text-decoration: none;
      }
      a:hover {
        color: black;
        text-decoration: none;
      }
```

```html
    .nav_items {
      color: whitesmoke;
      padding: 0px;
      font-size: larger;
      margin: 0px 40px 0px 40px;
    }


    ul {
      padding-left: 0px;
    }


    h4 {
      margin: 0px;
    }
  </style>
</head>
<body background="ICONS/home1.jpg">
  <nav>
    <article class="container">
      <ul>
        <a class="nav_items" href="index.html">Home</a>
      </ul>
      <ul>
        <a class="nav_items" href="dashboard.html">Dashboard</a>
      </ul>
      <ul>
        <a class="nav_items" href="report.html">Report</a>
      </ul>
      <ul>
        <a class="nav_items" href="story.html">Story</a>
      </ul>
      <ul>
        <a class="nav_items" href="contactUs.html">Contact Us</a>
      </ul>
      <ul>
        <a class="nav_items" href="login Page.html">Log out</a>
```

```html
      </ul>
    </article>
  </nav>

  <h1 style="text-align: center;">Report</h1>

  <div>
    <iframe
src="https://us1.ca.analytics.ibm.com/bi/?pathRef=.my_folders%2FCROP%2BPRO
DUCTION%2BIBM%2BPROJECT%2FREPORT%2FREPORT_P1&amp;closeWindowOnLastView=tru
e&amp;ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;actio
n=run&amp;format=HTML&amp;prompt=false"
      width="1250"
      height="500"
      frameborder="0"
      gesture="media"
      allow="encrypted-media"
      allowfullscreen=""></iframe>
  </div>
  </br>
  <div>
    <iframe
src="https://us1.ca.analytics.ibm.com/bi/?pathRef=.my_folders%2FCROP%2BPRO
DUCTION%2BIBM%2BPROJECT%2FREPORT%2FREPORT_P2&amp;closeWindowOnLastView=tru
e&amp;ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;actio
n=run&amp;format=HTML&amp;prompt=false"
      width="1250"
      height="500"
      frameborder="0"
      gesture="media"
      allow="encrypted-media"
      allowfullscreen=""></iframe>
  </div>
  </br>
  <div>
    <iframe
```

```
src="https://us1.ca.analytics.ibm.com/bi/?pathRef=.my_folders%2FCROP%2BPRO
DUCTION%2BIBM%2BPROJECT%2FREPORT%2FREPORT_P3&amp;closeWindowOnLastView=tru
e&amp;ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;actio
n=run&amp;format=HTML&amp;prompt=false"
      width="1250"
      height="500"
      frameborder="0"
      gesture="media"
      allow="encrypted-media"
      allowfullscreen=""></iframe>
    </div>
    </br>
  </body>
</html>
```

Story

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0"
/>
    <title>STORY</title>
    <style>
      body{
        background-size: cover;
      }
      .container {
        height: 50px;
        font-family: Arial, Helvetica, sans-serif;
        background-color: rgb(8, 94, 215);
        display: flex;
        flex-direction: row;
        justify-content: flex-end;
        align-items: center;
```

```
      }
      a {
        color: whitesmoke;
        text-decoration: none;
      }
      a:hover {
        color: black;
        text-decoration: none;
      }
      .nav_items {
        color: whitesmoke;
        padding: 0px;
        font-size: larger;
        margin: 0px 40px 0px 40px;
      }

      ul {
        padding-left: 0px;
      }

      h4 {
        margin: 0px;
      }
    </style>
</head>
<body background="ICONS/home1.jpg">
  <nav>
    <article class="container">
      <ul>
        <a class="nav_items" href="index.html">Home</a>
      </ul>
      <ul>
        <a class="nav_items" href="dashboard.html">Dashboard</a>
      </ul>
      <ul>
        <a class="nav_items" href="report.html">Report</a>
```

```html
      </ul>
      <ul>
        <a class="nav_items" href="story.html">Story</a>
      </ul>
      <ul>
        <a class="nav_items" href="contactUs.html">Contact Us</a>
      </ul>
      <ul>
        <a class="nav_items" href="login Page.html">Log out</a>
      </ul>
    </article>
  </nav>
  <h1 style="text-align: center;">Story</h1>
  <iframe
src="https://us1.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.m
y_folders%2FCROP%2BPRODUCTION%2BIBM%2BPROJECT%2FStory%2FSTORY_CROP%2BYIELD
&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=false&am
p;shareMode=embedded&amp;action=view&amp;sceneId=model00000184813fdfa4_000
00000&amp;sceneTime=10000"
  width="1250"
  height="500"
  frameborder="0"
  gesture="media"
  allow="encrypted-media"
  allowfullscreen=""></iframe>
  </body>
</html>
```

JavaScript

```javascript
var data = [
    {
        username:"jaswanth",
        password:"jash123"
    },
    {
```

```javascript
            username:"sahan",
            password:"sahan123"
        },
        {
            username:"tarini",
            password:"tarini123"
        },
        {
            username:"vignesh",
            password:"vignesh123"
        },
        {
            username:"ramani",
            password:"ramani123"
        }
]
function login(){
    var uname = document.getElementById("username").value
    var pass = document.getElementById("password").value

    for (i = 0; i<data.length; i++){
        if (uname == data[i].username && pass == data[i].password){
            window.location.replace("index.html")
            return false
        }
    }
    alert("Incorrect password")
}
function register(){
    var runame = document.getElementById("username").value
    var rpass = document.getElementById("password").value
    var rpass1 = document.getElementById("password1").value
    if (rpass == rpass1){
        var rdata = {
            username: runame,
            password: rpass
```

```
        }
    }else{
        alert("password doesn't match")
        return
    }


    for (i = 0; i<data.length; i++){
        if (runame == data[i].username){
            alert("Username not available")
            return false
        }
    }
    data.push(rdata)
    window.location.replace("index.html")
}
```

13.2. GitHub & Project Demo Link

Github Link : IBM-EPBL/IBM-Project-20202-1659714613

Project Demo Link :