



Impact of Several Factors on Crop Yield in India (1997-2020)

Monash Data Analytics Bootcamp - Project 1
Done by Group 3 (Nicholas, Rajendra, Duc)



Overview

Project objective: To determine factors that impacted Indian crop yield from 1997 to 2020 using datasets/APIs available in the Internet for free.

Research questions:

- What is the impact of the following factors on recorded crop yield in Indian states from 1997 to 2020?

TEMPERATURE

RAINFALL

**HARVEST
SEASON**

**AMOUNT OF
PESTICIDE USED**

GEOGRAPHY

**AMOUNT OF
FERTILISER USED**

- What was the crop with the highest total crop yield over the years?

States included in the analysis





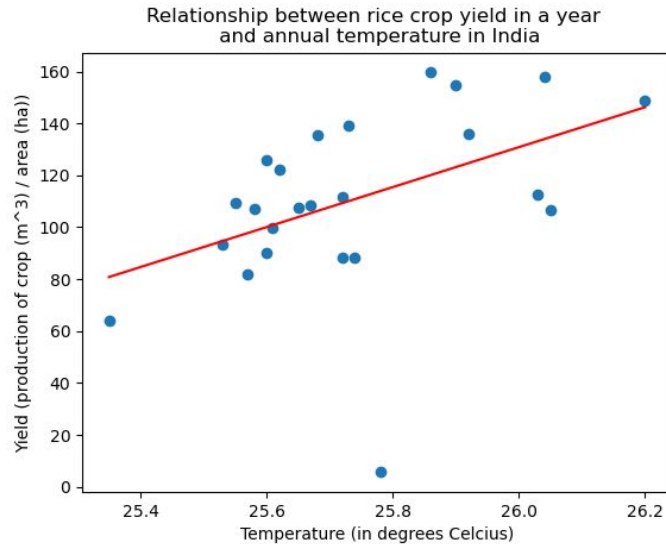
Temperature vs. Crop Yield

The following analysis is determined from the 5 most produced crops, determined in the notebook `temperature_analysis.ipynb` (rice, maize, moong, ruad and groundnut).

A limitation that should be brought into light is that the temperature dataset used here is for the entirety of India and not for each Indian state recorded. While there is a dataset recording annual temperature average for each Indian state, it is unfortunately behind a paywall. Therefore, the analysis does not consider the impact of other variables that may impact a state's average temperature.

The analysis assumes that any correlation with a p-value of less or equal to 0.05 is statistically significant.

Rice



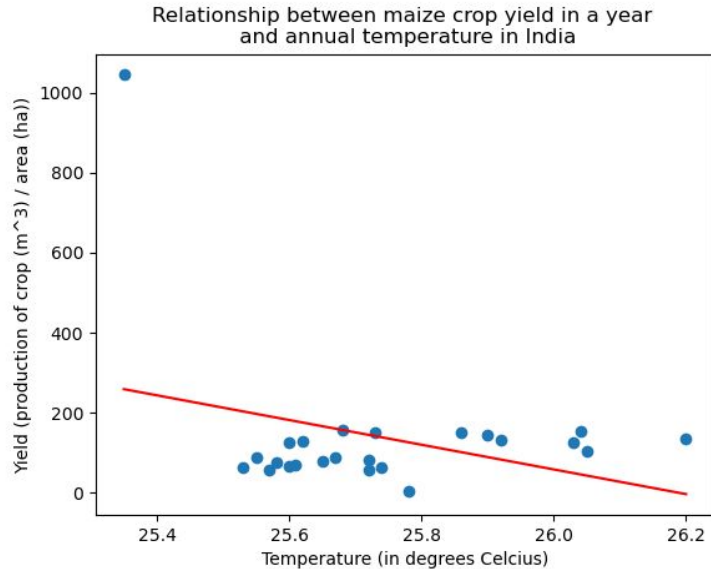
r-value: 0.457 (moderate, positive correlation)

p-value: 0.025 (significant)

This graph showcases that rice crop yield tends to increase as temperature increases.

It should be noted that throughout the analysis, there will be an obvious outlier linked to the year 2020, which so happens to be the year when the farmers' protests and shutdown occurred.

Maize



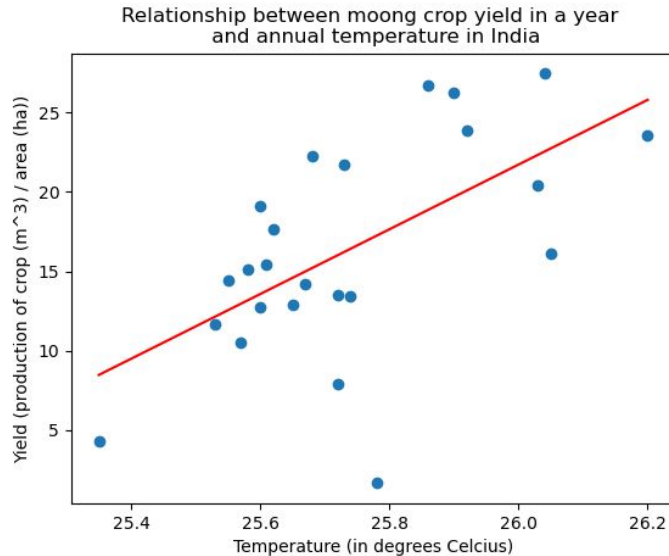
r-value: -0.315 (weak, negative correlation)

p-value: 0.133 (insignificant)

The fact that the p-value exceeds 0.05 confirms that the null hypothesis (that temperature does not impact maize crop yield) has to be accepted.

Moreover, the outlier when temperature < 25.4 degC may have impacted the correlation calculations.

Moong

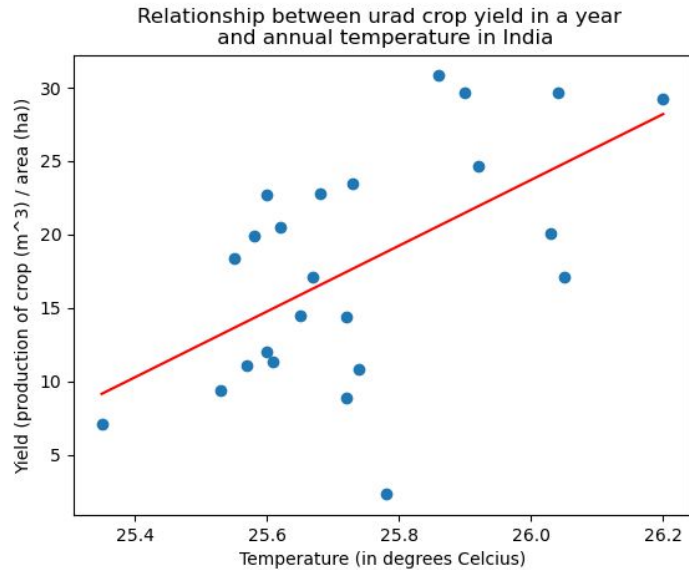


r-value: 0.602 (strong, positive correlation)

p-value: 0.002 (significant)

This graph showcases that moong crop yield is likely to increase as temperature increases.

Urad

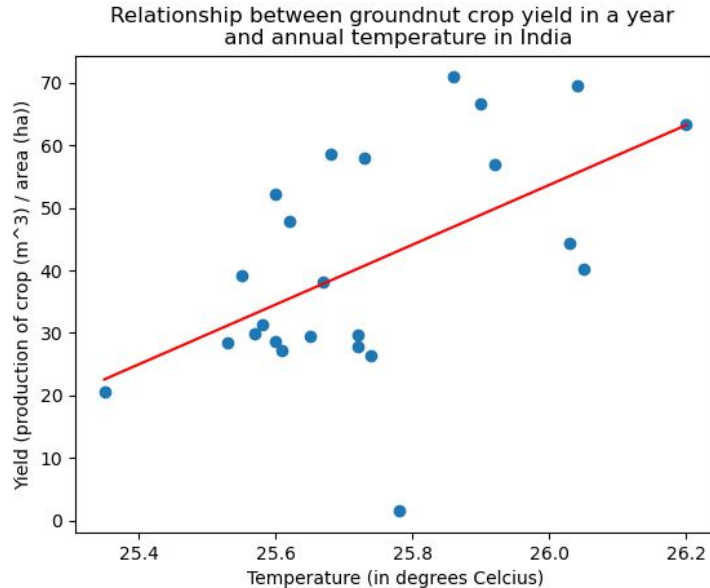


r-value: 0.573 (moderate, positive correlation)

p-value: 0.003 (significant)

This graph showcases that urad crop yield tends to increase as temperature increases.

Groundnut



r-value: 0.542 (moderate, positive correlation)

p-value: 0.006 (significant)

This graph showcases that groundnut crop yield tends to increase as temperature increases.



Overall relationship between temperature and crop yield

As temperature increases, so does crop yield.

The only exception is in the case of maize, in which temperature has no effect on crop yield.



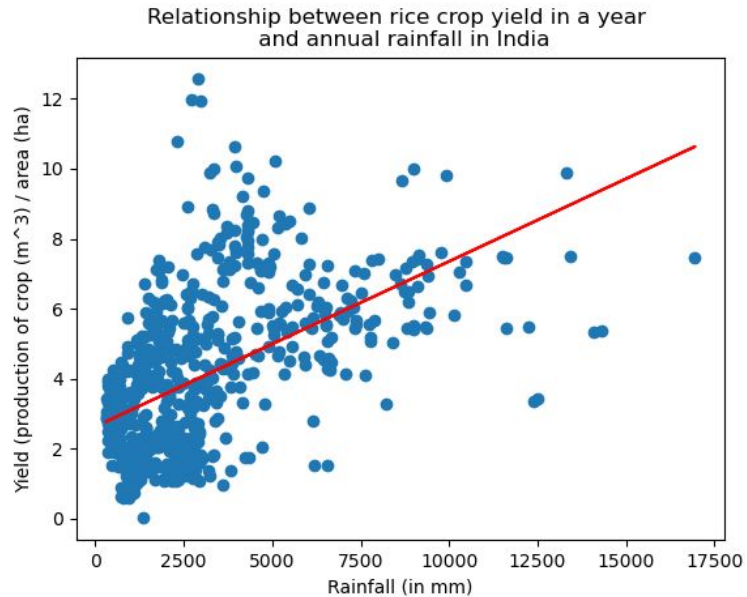
Rainfall vs. Crop Yield

The following analysis is determined from the 5 most produced crops, determined in the notebook `temperature_analysis.ipynb` (rice, maize, moong, ruad and groundnut).

There are more datapoints in this analysis than in the temperature analysis because average rainfall per year for each state is provided in the dataset.

The analysis assumes that any correlation with a p-value of less or equal to 0.05 is statistically significant.

Rice

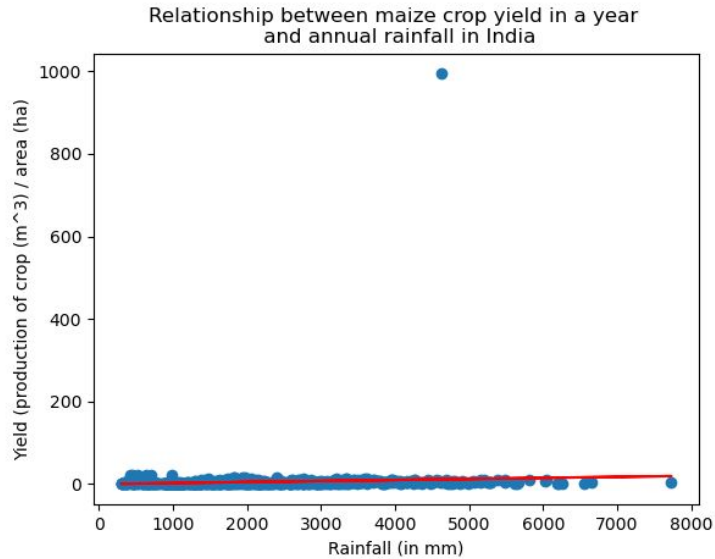


r-value: 0.534 (moderate, positive correlation)

p-value: 0.000 (significant)

This graph showcases that rice crop yield is likely to increase as rainfall increases.

Maize

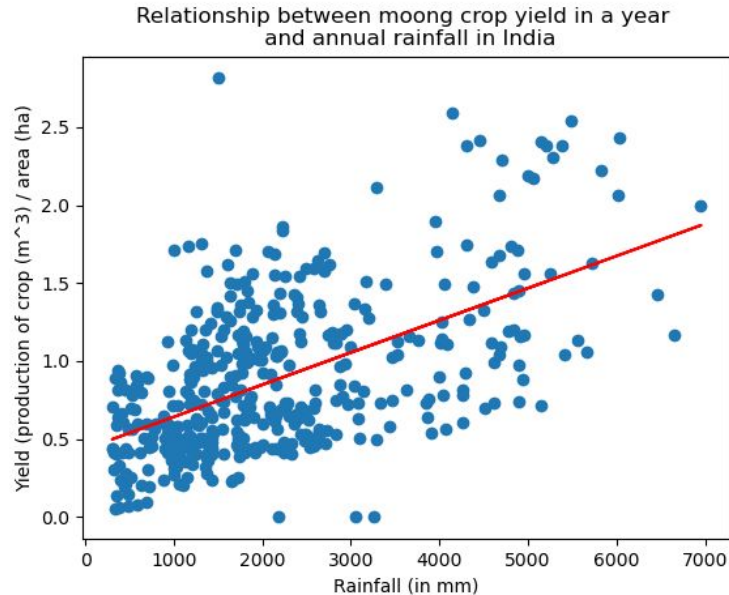


r-value: 0.086 (very weak, positive correlation)

p-value: 0.037 (significant)

While the relationship between maize crop yield and rainfall is statistically significant, it is also very weak.

Moong

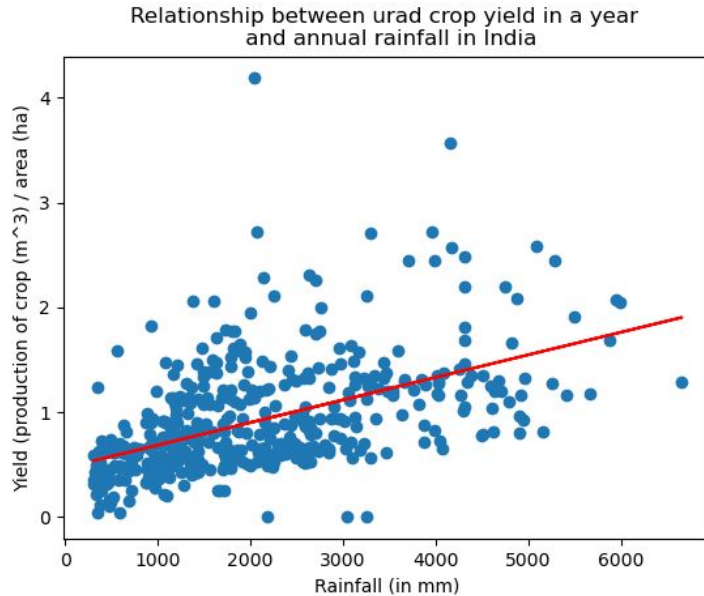


r-value: 0.559 (moderate, positive correlation)

p-value: 0.000 (significant)

This graph showcases that moong crop yield tends to increase as rainfall increases.

Urad

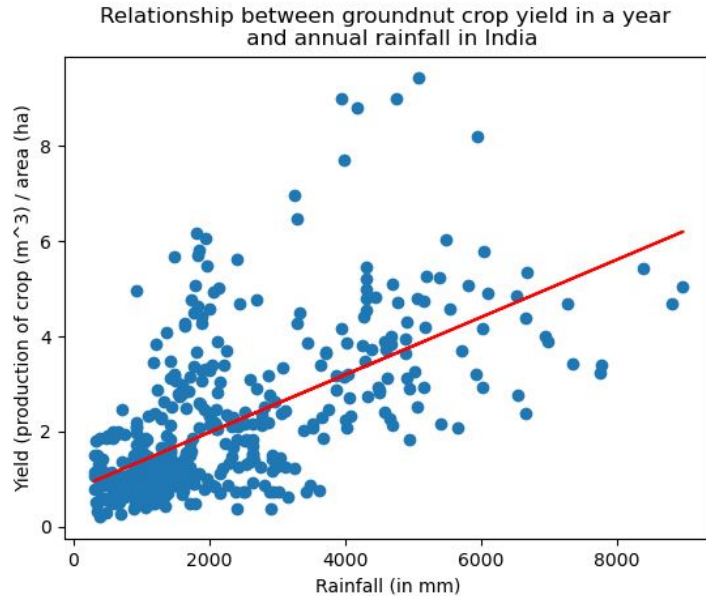


r-value: 0.507 (moderate, positive correlation)

p-value: 0.000 (significant)

This graph showcases that urad crop yield tends to increase as rainfall increases.

Groundnut



r-value: 0.621 (strong, positive correlation)

p-value: 0.000 (significant)

This graph showcases that groundnut crop yield is likely to increase as rainfall increases.



Overall relationship between rainfall and crop yield

As rainfall increases, crop yield increases.

The only exception is again maize, with a very weak correlation between rainfall and crop yield.

- RAJENDRA BONDILI

Seasons vs Crop Yield



TYPES OF **CROP SEASONS** IN INDIA

KHARIF

RABI

ZAID



India has a diversity of Seasons across its states from North to South and East to West

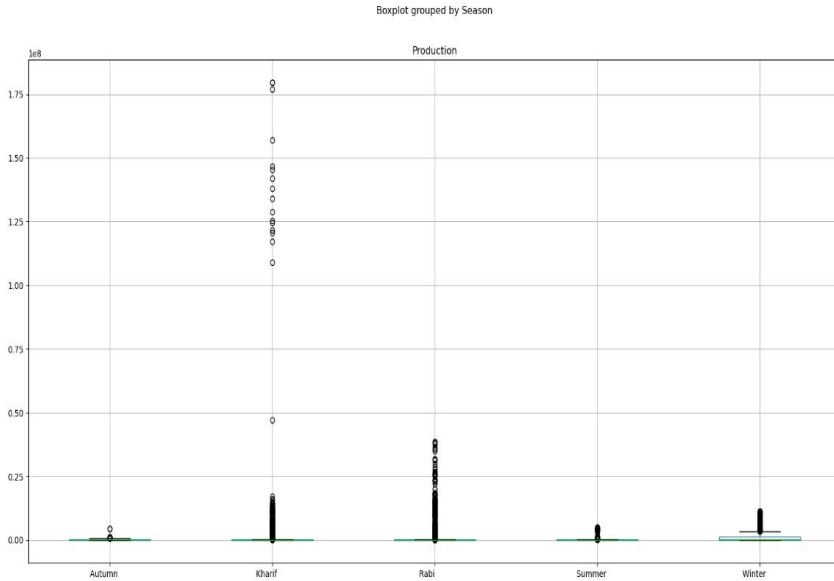
As part of this Analysis, trying to establish the relationship between Seasons and Crop Yield.

I believe there could be significant impact of Seasons on the Crop Production/Yield, as each season has different climatic conditions such as Temperature, Rainfall, Wind and humidity.

This Analysis provides insights for the Farmers to choose right crop on each season to have **maximum yield or profits with minimum loss** depends on their agricultural area and water supply for each state/region.

One-way ANOVA Hypothesis

ANOVA hypothesis says that seasons are having impact on Crop Production, which is confirming the

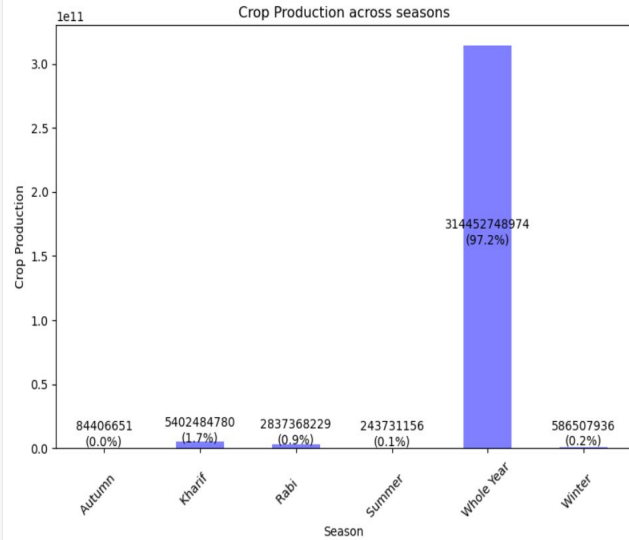


After excluding Whole year from the seasons, Kharif stands at the top which has maximum crop yield, though there are some outliers.

Seasons impacts on crop Production across Indian States

Highest Crop season : Kharif with the Crop Production : 5402484780

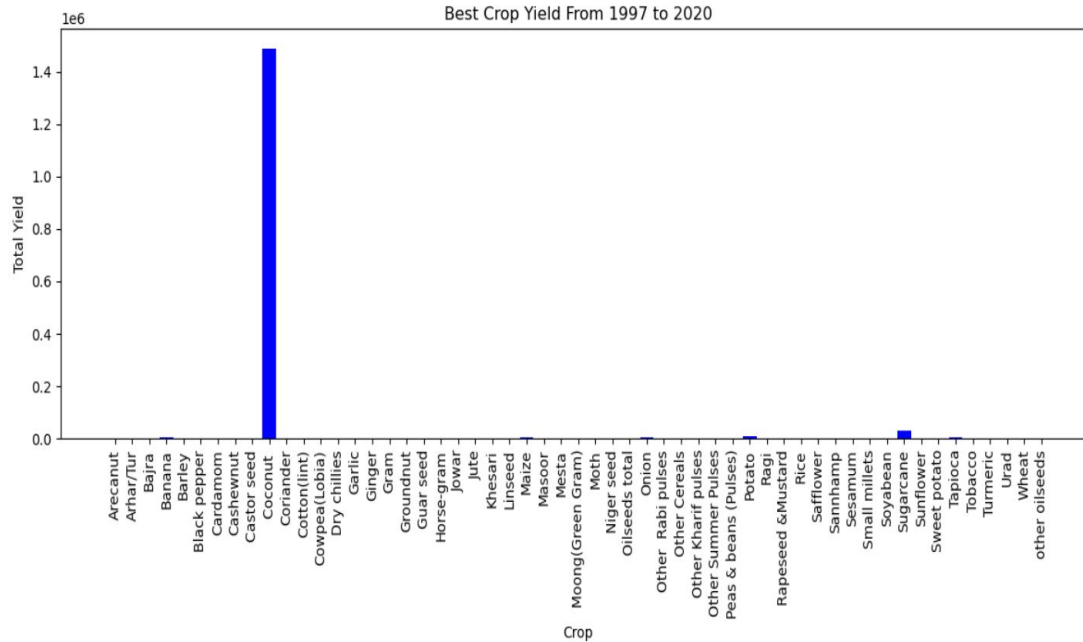
Lowest Crop season : Autumn with the Crop Production : 84406651



This clearly shows definitely season has significant impact on the crop yield, as per the data Kharif has the highest crop yield and Autumn has the lowest crop yield.

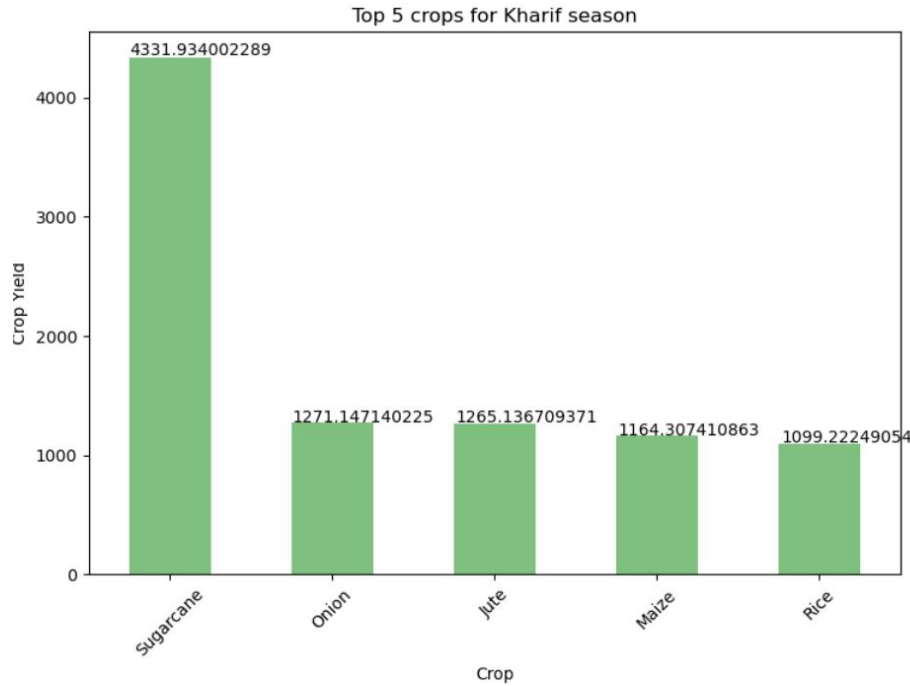
So it is preferred that Farmers can focus on the Kharif season to have maximum yield in India.

Best Commercial Crop in India



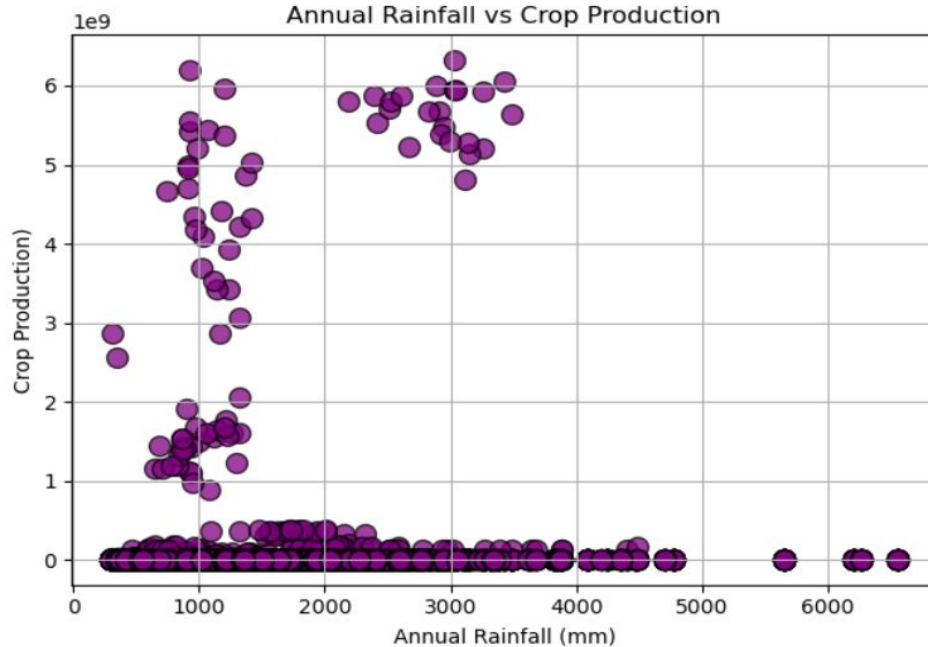
This Analysis shows **Coconut** is the best commercial crop which has maximum yield, so it could be another best option for the Farmers to have huge profits who has good cultivated land, which can be harvested every month and exported to different countries across the world.

Top 5 crops for the Kharif season



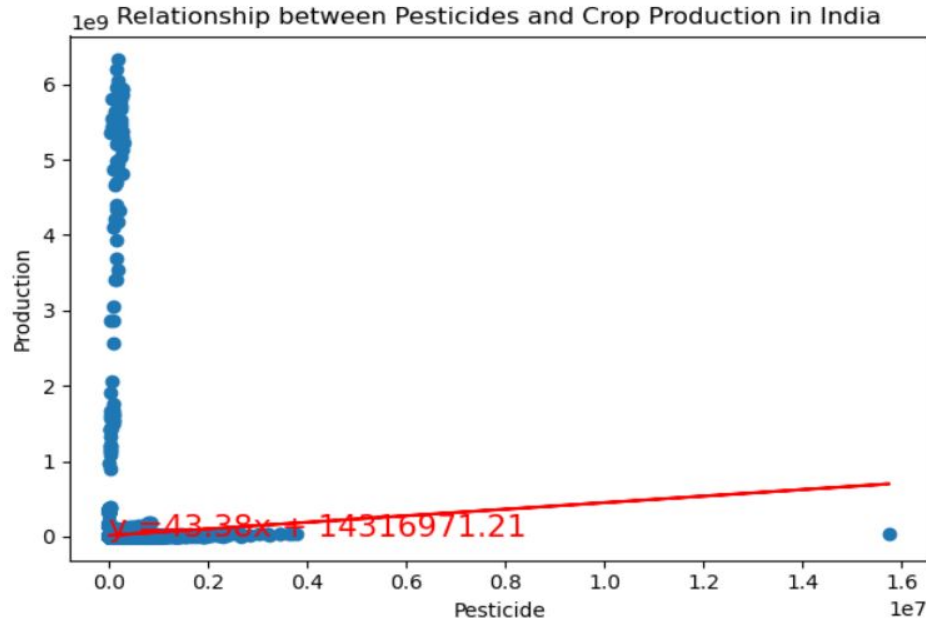
This Analysis helps Farmers to choose one of the top crops in Kharif season based on the region to have max yield

Annual Rainfall Vs Crop Production



This Analysis shows what percentage of rainfall can have maximum yield which provide insights to agricultural scientists to suggest when to have the crops based on the states of India

Pesticides Vs Crop yield



This Analysis shows that there is no significant impact of Pesticides usage on Crop Yield, below Hypothesis analysis confirms the results as well.

NULL Hypothesis: Low Pesticide usage will increase Crop Yield

ALTERNATE Hypothesis: High Pesticide usage will increase Crop Yield

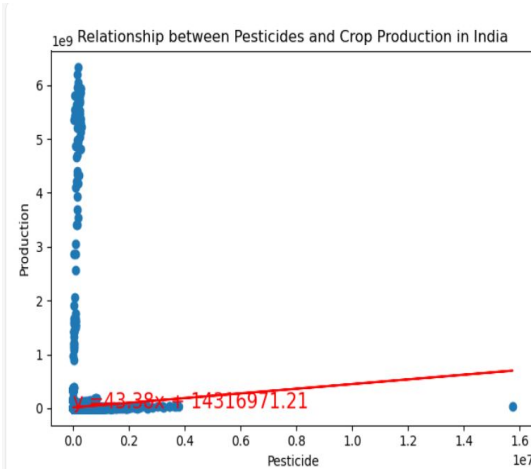
r-value is 3.1742187184668185e-06

Hypothesis testing:

Accepting Null hypothesis and rejecting Alternative hypothesis

p value is 0.0000, test statistics is 32.0835 and correlation is statistically significant

Pesticides Vs Crop Production



This Analysis shows that there is no significant impact of Pesticides usage on Crop Production, below Hypothesis analysis confirms the results as well.

NULL Hypothesis: Low Pesticide usage will increase Crop Production

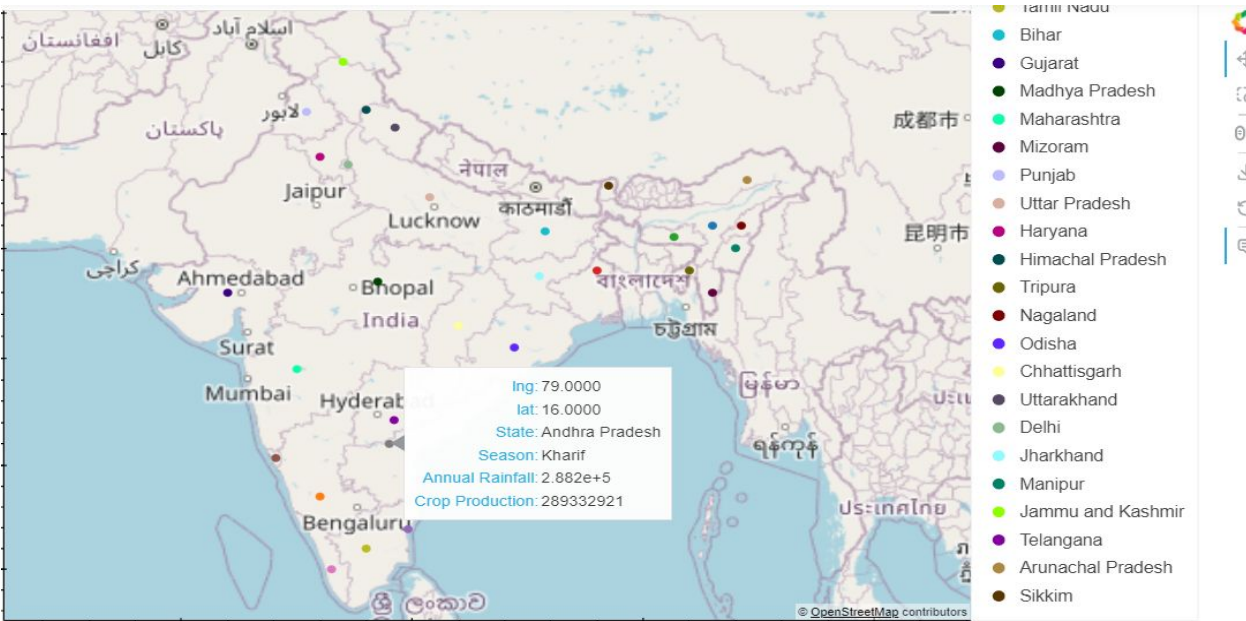
ALTERNATE Hypothesis: High Pesticide usage will increase Crop Production

r-value is 0.0012370316329160002

Hypothesis testing:

Accepting Null hypothesis and rejecting Alternate hypothesis
p value is 0.0000, test statistics is -8.7411 and correlation is statistically significant.

Annual Rainfall & Crop Production for Kharif season across each state in India using Weather API for the coordinates



This analysis shows the summary of Annual Rainfall, Crop Yield for each state in Kharif season, which helps meteorologist, agricultural scientist to suggest the best crop across each state for max crop yield.

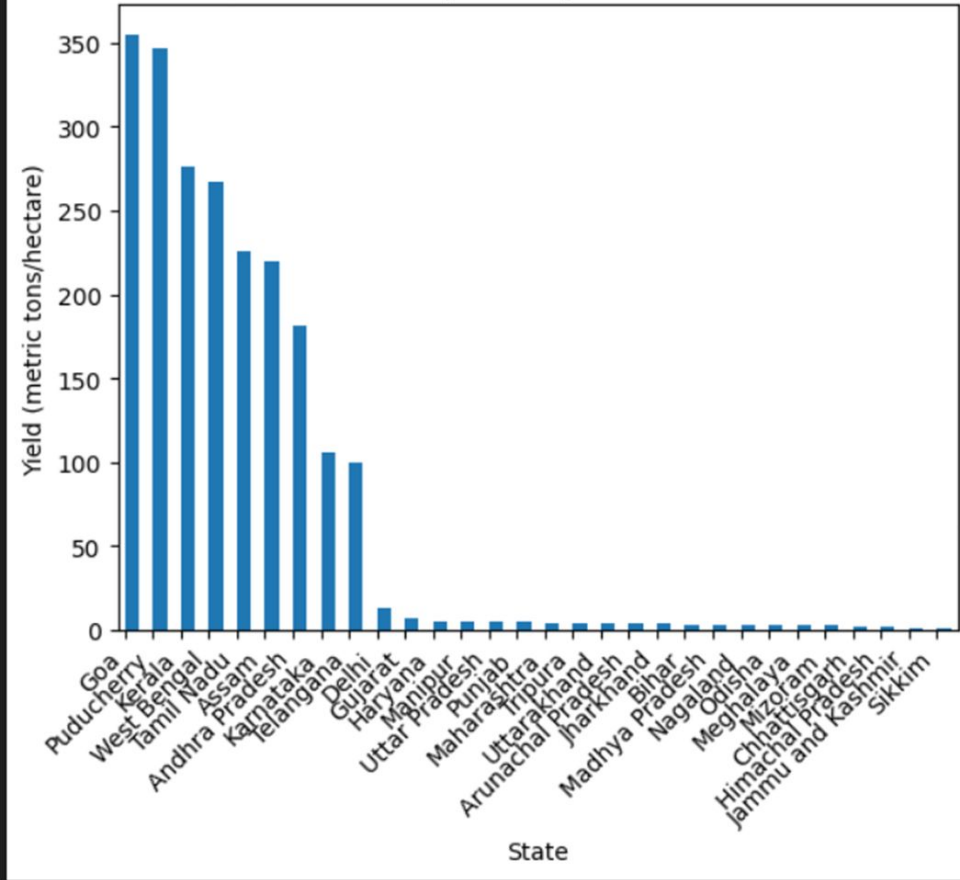
Note: This Analysis can be extended to other seasons as well.

INDIAN STATS vs CROP YIELD





Crop Yield by States



- Some states show very high yield, while the others have very low one.
- Some investigations are needed. This could be the crops, the quality of soil...

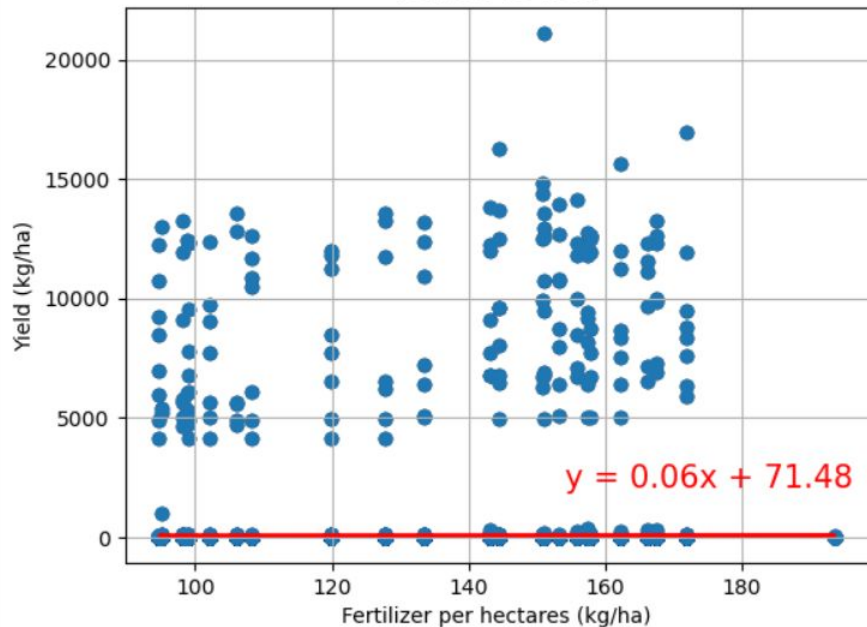
FERTILIZER vs CROP YIELD



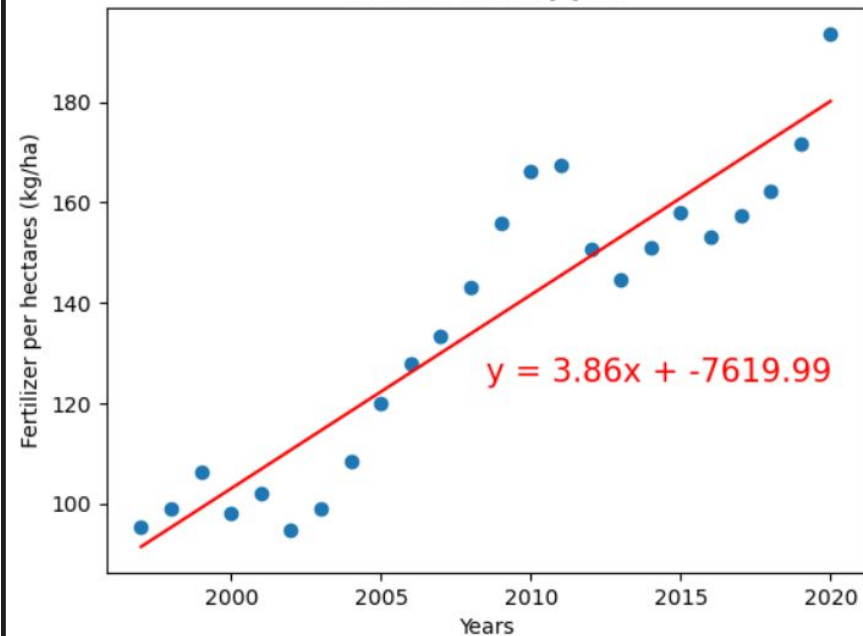
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Fertilizer vs Yield



Fertilizer used by year





Thank you for your listening <3!!!