**Yield Predict Recommendation**

**Project Report**

Contents

[**Abstract** 2](#_Toc121223203)

[**Introduction** 3](#_Toc121223204)

[**Motivation** 4](#_Toc121223205)

[**Problem   Statement** 4](#_Toc121223206)

[Objective 4](#_Toc121223207)

[**Background** 5](#_Toc121223208)

[Criteria/Constraints: 5](#_Toc121223209)

[Capability of Application: 5](#_Toc121223210)

[Users Handling: 6](#_Toc121223211)

[**Methodology** 6](#_Toc121223212)

[**Dataset** 6](#_Toc121223213)

[**Flowchart Steps:** 7](#_Toc121223214)

[**Idea:** 7](#_Toc121223215)

[**Proposed Solution** 7](#_Toc121223216)

[**PERFORMANCE EVALUATION** 8](#_Toc121223217)

[General Deﬁnitions 9](#_Toc121223218)

[Recall 9](#_Toc121223219)

[Clustering 9](#_Toc121223220)

[**Application** 10](#_Toc121223221)

[**EXPERIMENTAL INVESTIGATIONS:** 10](#_Toc121223222)

[**Tools/ Technologies used** 11](#_Toc121223223)

[Software requirements: 11](#_Toc121223224)

[Languages: 11](#_Toc121223225)

[**Advantages** 11](#_Toc121223226)

[**Disadvantages** 11](#_Toc121223227)

[**References:** 12](#_Toc121223228)

# **Abstract**

A career that includes interacting with nature and living is farming. We all know how unpredictable nature can be. Farmers are therefore at the whim of nature. The risk factor is very high since it could rain properly, there could be a drought, or there could be a flood. Even after working really hard, they might not see the results of their labour. Therefore, if nature has different plans, their labour could be for nothing.

7.2 billion people live on the planet as of right now. It will reach 10 billion in a few decades. Modernizing agriculture is necessary to feed 10 000 000 000 people. Where crops grown on a land may not be suitable for such conditions, traditional methods are no longer effective. Because there is a finite amount of soil fertility, it needs to be regularly examined and maintained.

One of India's oldest and most honourable professions is agroecology. In today's technologically centred world, farmers confront various challenges when adopting conventional farming practises. Compared to conventional agriculture methods, precision farming is a new strategy.

Farmers were unable to produce a profit with the agricultural field they had because of a lack of knowledge and prediction techniques. Additionally, urbanisation is increasing while the world's population is expanding. Consumption patterns are shifting, and disposable income is increasing. Farmers need to find a strategy to boost output since they are under a lot of pressure to satisfy the rising demand. In thirty years, there will be more people to feed, and since the amount of fertile land is limited, it will also be necessary to stray from traditional farming.

We must seek for methods to lessen or at the very least control the dangers faced by farmers.

# **Introduction**

Across the globe India is the second largest country having a population of more than 1.3 billion. Many people are dependent on agriculture but the sector lacks eﬃciency and technology especially in our country. By bridging the gap between traditional agriculture and data science, effective crop cultivation can be achieved.

One of civilization's earliest practises is agriculture. Traditional farming is practised based on wisdom inherited from ancestors and first-hand understanding. Due to improper crop cultivation in accordance with farming elements including soil, climate, and rainfall, the current level of food production is insufficient and does not provide farmers with a higher level of income.

About 18% of India's Gross Value Added comes from agriculture and related industries (GVA). A region's entire economy could be severely impacted by a large-scale, poorly educated farming decision. We should create a technology that can give Indian farmers predicted information so they can choose the best crops to grow. In most cases, a farmer's choice of what crop to grow is influenced by his intuition as well as other unimportant factors like making quick money, being unaware of market need, overestimating a soil's potential, and so on. The farmer's poor choice might severely strain his family's financial situation.

Python prototype for a real-time crop recommendation method utilising data analytics and machine learning. In the guise of a website, this work shows a system. In order to determine the most profitable crop in the anticipated weather and soil conditions at a certain location, the business logic in Python use machine learning algorithms. The suggested system will combine information from the weather service, crop repository, and soil data to anticipate the most suited crops based on the current state of the environment. This is done by using the machine learning method known as Multiple Linear Regression. This gives a farmer a wide range of possible crops to plant. The directory containing the business logic is /code/mlr algo.py. Node.js is used to programme the server.

# **Motivation**

With the use of our application, farmers may assess crop yields and choose which crops to produce using a digital tool.

Farmers, who play a significant role in our society, are not given enough credit. They face a number of difficulties when using traditional farming methods in today's technologically advanced culture. Farmers find it difficult to understand the intricacy of the contemporary technology used to ease their suffering. The criteria frequently used in other study publications concentrate more emphasis on concepts that are challenging for farmers to understand, like soil type and nutrient content.

Therefore, we chose characteristics for this study that farmers can more easily understand, such as district, rainfall, temperature, and area.

# **Problem   Statement**

Every time the environment atmosphere is changed and that’s the reason most of the crops are destroyed because of not suitable environment atmosphere. We did not change the environmental atmosphere but we identified which crop is suitable in this environment.

I am making a crop recommendation system that aids farmers in selecting the appropriate crop to plant in their fields and predicting yield and revenue may thus be the answer to this challenge. When deciding which crops to produce on a field, the majority of farmers use traditional farming practises with the help of digital farming and precision agriculture, crops may be irrigated, fertilised, and pesticides precisely when needed to increase production, quality, and yields.

## Objective

1. AI powered web application to help farmers in identifying the right crop, right time to maximize their productivity, Quality and Yields.
2. Digital Farming and Precision Agriculture practices will be used as input: temperature, humidity, rainfall, Soil nutrients (nitrogen, potassium, phosphorous)
3. Develop a best ML based Predictive model to forecast revenue and yield from the cultivated land.
4. To build an interactive prediction system for yield predict recommend so that farmers can take advantage of that can gain profit to grow a particular crop for the suitable environment.
5. This project will provide help to the farmers regarding their crop yield so that they can enhance the productivity of crop in their area.
6. By turning on the GPS (Global Positioning System) of one’s system (laptop, mobile etc.), he/she can acknowledge the insights how much yield can be seen in the future and what will be the quality of yield by using the factors like temperature, humidity, rainfall, etc. in that specific region.
7. Utilizing machine learning tools will be beneficial for farmers and humanity in this era of advanced civilization and increasing population.
8. Data Preprocessing
9. Data Visualization

# **Background**

## Criteria/Constraints:

This proposed system product would mainly identify four types of crops according to the environmental factors of the selected plot of land. But the reason to obtain a probability of more than 90% for the above-identified crops would be the soil condition or any other changes in the selected land. But to avoid these factors affecting the crop prediction, the farmer’s feedback system is included in the system.

Following the recommendation of the crop type, the farmer is periodically prompted for information and feedback via the mobile application in order to advise him or her on the essential measures. By choosing the crop type in the mobile application, the feedback system is used to offer the appropriate feedback. By doing this, the product's overall accuracy and dependability improve over time.

## Capability of Application:

Machine Learning identifies trends and patterns in data reviewing large chunks of data and gives output in seconds. Automation and continuous improvement are game changers in agricultural sector as we have learnt in IBM courses.

The capability to deliver much more in Agriculture sector is possessed by Machine Learning. Both the country as a whole and the various communities that make it up can gain from this arrangement. Being a cloud-based solution, it may be quickly established and integrated with a variety of hardware options.

## Users Handling:

Prediction: Here the user can view want to test module. They want to predict by fill the all required columns and the result is to be displayed in a numerical value (this value contain how much production is there in a particular crop).

# **Methodology**

## **Dataset**

In the dataset we have the following columns:

**Nitrogen (N)** - ratio of Nitrogen content in soil

**Phosphorus (P)** - ratio of Phosphorous content in soil

**Potassium (K)** - ratio of Potassium content in soil

**Temperature** - temperature in degree Celsius

**Humidity** - relative humidity in %

**PH** - ph. value of the soil

**Rainfall** - rainfall in mm

## **Flowchart Steps:**

1. Get an Official Dataset from Govt. Site
2. Train and test a best ML Model
3. Deploy Auto Al Model
4. Create Flask Framework
5. Integrate ML Model in Crop Recommendation App
6. Launch App

## **Idea:**

* In order to reduce risk in their line of work and achieve the greatest outcomes with the least amount of work, farmers can benefit from the solution. Three parts make up the concept:
* An automated AI model that recommends crops to farmers and provides revenue data
* IOT Platform and Device to Provide Real-Time Predictive Analysis
* Farmers can access these Services through a Flask Web Application gateway.

## **Proposed Solution**

We suggest an intelligent crop recommendation system that makes use of machine learning to forecast crop suitability by taking into account all pertinent information, including temperature, rainfall, location, and soil quality. This system's main goal is to carry out AgroConsultant's main responsibility, which is to make crop recommendations to farmers.

The farming sector may experience a paradigm shift thanks to AI solutions. With less effort and greater outcomes, these solutions can lessen the physical and emotional strain farmers experience, resulting in:

* Use ML models to automate plantation and crop harvesting, which can provide precise time estimates.
* Using the dataset, provide farmers with information on crop revenue and production costs.
* Using ML Models, determine the most lucrative crop for a specific plot of land by streamlining crop selection.
* In the system, we propose tests of many algorithms and by studying the classiﬁcation report we compare the algorithms and choose the best one.
  + AI has the ability to revolutionize the way we think about agriculture by allowing farmers to produce more with less work while also providing many additional advantages, such as those listed below.
  + AI can be used to automate harvesting and even predict when it will be most effective.
  + AI can make crop selection easier and assist farmers in determining which crops will be the most profitable.
  + We suggest developing an application that advises farmers on the best crops to be grown based on climatic factors and also forecasts the yield and income that would be created for cultivated area. This will assist farmers in reducing the risk associated with agriculture.
* The newest cutting-edge technology in the IOT Sphere is real-time predictive analysis. Farmers can gather the information and decide how best to employ irrigation, plantation systems, and fertilizers. With IOT solutions, they can act immediately.

## **PERFORMANCE EVALUATION**

Let us ﬁrst brieﬂy understand some of the performance evaluation metrics:

### General Deﬁnitions

1. True Positive (TP) counts the number of times the system flags a condition as present even though it isn't.
2. True Negative (TN) shows the percentage of times a condition is absent and the system still detects it. Observations in comparison to the overall projected positive observations. Precision is high if the false positive rate is low. In this study, a respectable accuracy of 0.788 is attained.

### Recall

Positive observed values proportion is correctly predicted. (Actual defaulter ‘s model will correctly predict the proportion)

Recall = TP / (TP + FN)

Recall (Sensitivity) - Recall is the ratio of correctly predicted positive observations to the all observations in actual class -yes.

### Clustering

After applying clustering, we plotted the elbow graph to check how many clusters gave optimal results.

For classiﬁcation algorithms, Logistic regression performed the best for predicting the proﬁt on a given crop, state, costs of cultivation (C1, C2), cost of production (Cp), and support prices provided by the government for the year 2020-21.

As we saw the second dataset did not perform so well. Additional columns like rainfall and temperature need to be added to improve the accuracy of the models.

# **Application**

* This solution can be applied in the modern farming sector.
* Accurate Crop and its production can be predicted.
* Both small-scale and large-scale farms can use the Crop Speak and Crop Sense Systems. Even urban gardens can employ the Crop Sense IOT device. The Crop Sense Device can automate irrigation systems. Combining Hardware and Software Solutions using the IBM IOT Platform enables automatic watering of plants.
* This app can assist newcomers to farming or gardening by explaining the times for planting and harvesting various crops.
* Agriculture's modernization can benefit society as a whole. If irrigation and fertilizer systems are automated, it is no longer required to stand in the sun for hours each day.
* An emerging sector that has the potential to improve employment, GDP, and productivity of the country is automated farming. If quick modernization can be applied to this industry, crops can be grown in excess and exported to other nations.

## **EXPERIMENTAL INVESTIGATIONS:**

90% of data was used for training the algorithm and the rest 10% for testing purpose. In case of crop production data, regression prediction type.

# **Tools/ Technologies used**

## Software requirements:

1. Jupyter Notebook (Anaconda Navigator
2. Sublime Text (Version: 3.2)

## Languages:

1. Machine Learning
2. Python 3.7
3. Flask
4. JavaScript
5. HTML5 and CSS3

# **Advantages**

* Using these automatic generated recommendations on the basis of their soil efficiency that were 99.1% accurate.
* The dashboard shows real-time predictive analysis provided by IOT sensors.
* If consumers don't have a crop sense sensor, they can enter their sensor value data on an interactive website.
* You can use the Website without paying anything.
* This dataset is compiled by using data from an oﬃcial government site which proves its authenticity.
* Farmers can directly ﬁnd out if the crop they are about to sow will result in proﬁt after cultivation.

# **Disadvantages**

* Crop Sense Sensors must have access to the Internet in order to connect to the Cloud. It's possible that something is unavailable in India's interior.
* Farmers with lesser acreage may not be able to afford the AI Assisted Solution's additional cost for Crop Sense Sensors.

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