

# CROPILIZER-A RECOMMENDER SYSTEM

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**Abstract**— Agriculture is a major contributor to the Indian economy. The common problem existing among the Indian farmers are they don't choose the right crop based on their soil requirements. Due to this they face a serious setback in productivity. This problem of the farmers has been addressed through precision agriculture. Precision agriculture is a modern farming technique that uses research data of soil characteristics, soil types, crop yield and suggests the farmers the right crop based on their land specific parameters. This reduces the wrong choice on a crop and increases the productivity. In this paper, we are building a system using machine learning algorithms, to assist the Indian farmers for decision making, to grow particular crop depending on the sowing season, geographical location and soil characteristics. Further the system provides the farmer, the prediction of yield based on the crop.

**Keywords**— Precision Agriculture, geographical location, Crop, Fertilizer, Machine Learning.

## 1. INTRODUCTION

Agriculture is a significant area for the Indian economy and human survival. It is one of the primary occupations which is essential for human life. It contributes a huge part to our day-to-day life. In present times the climate is changing persistently which is harmful to the crops and leading farmers towards debts and suicide. In most cases, Farmers commit suicide due to production loss because they are not able to pay the bank loans taking for farming purposes. These risks can be minimized when various mathematical or statistical methods are applied to data and by using these methods, we can recommend the best crop to the farmer for his agricultural land. The key to agricultural success is choosing the ideal crop and soil fertilizer. When selecting the crop that is best for the soil, the kind of soil and the nutrients in the soil are key determinants. As a result, a prediction model must be developed to assist farmers for taking decisions about the crop for growing. To address this we propose a system, that would consider environmental parameters (temperature, humidity, rainfall,) and soil characteristics (N, P, K, pH value) before recommending the most suitable crop to the farmer.

## 2. RELATED WORK

Numerous ML Algorithms have been used in the agriculture industry, and a lot of work has been done. Increasing agricultural output and providing it to consumers at the greatest feasible price and quality represents agriculture's challenge. Logical

regression and Random Forest are the two most popular algorithms. These are not adequate for the recommendation system since it includes additional features and complexity.

Using A Two-Fold Machine Learning Approach for Crop And Fertilizer Recommendation System [1], A farmer adopt this technology to make his life easier and would anticipate the crop and right fertilizers to cultivate with an accuracy of 98%. This might also be used to classify plant disease using CNN and to provide a treatment for each illness. Ensembled Cropify–Crop & Fertilizer Recommender System with Leaf Disease Prediction [2], The integrated multiple modules crop recommendation, fertilizer recommendation and plant leaf disease detection will assist farmers by suggesting the ideal crop to produce depending on a variety of characteristics. System also helps to recommend the required fertilizers which are deficient in soil. Agri-Pro: Crop, Fertilizer and Market Place Recommender for Farmers using Machine Learning Algorithms [3], By considering the parameters such as temperature and humidity levels in terms of the state, as well as soil properties, to propose a suitable crop to the users.

Crop Yield Prediction and Efficient use of Fertilizer [4], This system has found the algorithm and obtained the most efficient output of the yield. Crop Yield Prediction and Fertilizer Recommendation System Using Hybrid Machine Learning Algorithms [5], The proposed framework considers data related to soil, climate and previous

crop production to recommend the most suitable fertilizers for vastly increase crop yield. The major advantage of this project is the high accuracy in the predicted value of the crop yield as it is a combination of the two efficient and powerful algorithms. Crop Recommendation System using Machine Learning [6], helps the farmers in making an informed decision about which crop to grow depending on some parameters like Nitrogen, Phosphorous, Potassium, PH value, Humidity, Temperature and Rainfall. Crop Prediction and Fertilizer Recommendation Using Machine Learning [7] system described works faster and gives better accuracy in prediction to predict the suitable crops and fertilizers for the field. Crop Yield Prediction, Forecasting and Fertilizer Recommendation using Voting Based Ensemble Classifier [8] system classify the soil based on the soil type, land type and macro nutrients, along with temperature, pH and electrical conductivity of the soil, highly appropriate crop along with the suitable fertilizer to enrich the soil and boost up the productivity is suggested to the agriculture stakeholders with accuracy of 92%.

An Analysis of Agricultural Soils by using Data Mining Technique [9] a farmer can use a suggestion system provided by data mining to help with crop production. It employs this tactic so that the suggested crops are determined by their climatic qualities and quantity. The production of important agricultural database extraction is made possible by data analytics. Crops are suggested once the agricultural data set has been analysed based on their production and the season. Intelligent Crop Recommendation System using Machine Learning [10] develop a method that gives extraordinary accuracy in price predicting in the farm market, using the Grey Prediction Technique. The suggested system considers environmental variables such as rainfall, temperature, and geographical position in terms of the state, as well as soil attributes such as soil type, pH value, and nutrient concentration, to recommend a suitable crop to the user [11]. Additionally, if the farmer picks the appropriate crop, he or she will obtain a yield forecast. The goal is to develop an accurate version that can anticipate crop durability in a particular state depending on soil type and meteorological conditions. So that the farmer doesn't really lose money, make choices for the finest crops in the region. Provide a profitability evaluation for different crops on the basis of prior year's data.

A system developed takes into account soil properties like soil type, pH value, and nutrient concentration as well as climatic factors like

rainfall, temperature, and geographic location in terms of the state when recommending a suitable crop to the user. Also, if the farmer chooses the appropriate crop, they will also receive a yield projection. Among the following machine learning techniques, neural networks perform the best in terms of accuracy compared Decision Tree Nearest Neighbour, KNN with cross validation, Naive Bayes, Neural Network, and Support Vector Machine [12]. Efficient Crop Yield Recommendation System Using Machine Learning for Digital Farming proposed a system to identify particular crop according to given particular data. By applying Support Vector Machine (SVM) acquired higher precision and productivity. This research paper mainly worked on two datasets: sample dataset of location data and sample dataset of crop data. By using this proposed system recommended particular crop according to their nutrients (N, P, K, and PH) values and also identified available nutrients values and required fertilizers quantities for the particular crop [13].

Agro Consultant: Intelligent Crop Recommendation System Using Machine Learning Algorithms a research paper, developed an intelligent system called Agro Consultant. This proposed system can be divided into two sub-systems: i) Crop Suitable Predictor ii) Rainfall Predictor. In this proposed system different machine learning algorithms like Decision Tree, K Nearest Neighbour (KNN), Random Forest and Neural Network and performed multi-label classification on it. This proposed system achieved 71% accuracy by using rainfall predictor model and achieved 91.00% accuracy by applying neural network algorithm on crop suitable predictor system[14]. Experiments are performed with Rapid-Miner 5.3. Two important and well-known classification algorithms, K- Nearest Neighbour (KNN) and Naive Bayes (NB) are applied to the soil data set prepared by Jabalpur Soil Research Laboratory, M.P. Soil classification into low, medium and high categories is performed to predict yields using the available data set. This study can help soil analysts and farmers decide where to plant and on which soils better crop production can be achieved[15].

### 3. PROPOSED METHOD

Farmer's or cultivators need proper assistant regarding crop cultivation as now-a-days many youngsters are interested in agriculture. To eliminate the aforementioned drawbacks, we propose a system- which takes into consideration all the appropriate parameters, including temperature, humidity, pH, rainfall, and soil

condition, to predict crop suitability. This system is fundamentally concerned with performing the primary function, which provides crop recommendations to farmers. In the system, we propose testing of multiple algorithms and by reading the classification report we compare the algorithms and select the best one. It should find accuracy for the given datasets, test database accuracy, precision and recall by comparing algorithms. The architecture for the proposed system given in figure 1.

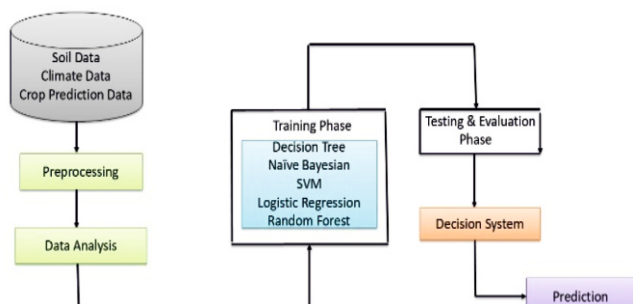


Fig.1. Architectural Diagram of Proposed System

### A. Algorithms

The algorithms decision tree, naïve Bayes, logistic regression, support vector machine(SVM) and random forest are used for our dataset.

### B. Data Cleaning and Pre-processing

Missing values in the dataset are replaced with the average values of particular column. To normalize the dataset quantile transformation on the characteristics of the dataset is applied.

### C. Data Analysis and Visualization

Data analysis and visualizations performed on the dataset to identify patterns in the dataset.

### D. Feature Selection

A correlation matrix developed to find the linear link between the feature and each of the other feature.

### E. Building a User Interface

User interface created for the user to enter the data. The user enters the data soil, N, P, and K values, temperature, humidity, rainfall, Ph. The developed model processes the information and recommend the best kind of crop to be grown in those conditions. The machine learning model will predict the crop that the user must cultivate once the user provides the following values and submits as given in figure 2. User interface with input for crop prediction given in figure 3.

**Crop Recommendation**

Nitrogen:

Phosphorus:

Potassium:

Temperature:

Humidity:

pH:

Rainfall:

Fig.2. User Interface with Input for Crop Prediction

**Fertilizer Suggestion**

Crop:

Nitrogen:

Phosphorus:

Potassium:

Fig.3. User Interface with Input for Fertilizer Suggestion

## RESULTS

Machine learning algorithms Decision Tree, Naïve Bayes, SVM, Logistic Regression and Random Forest are used for the prediction of the crop based on the features N (Nitrogen), P (Phosphorous), K(Potassium) values of the soil, temperature, humidity, rainfall and pH value. If the value of K(Potassium) is low in the soil recommendation are given to increase soil fertility as given in figure 4.

**The K value of your soil is low.**

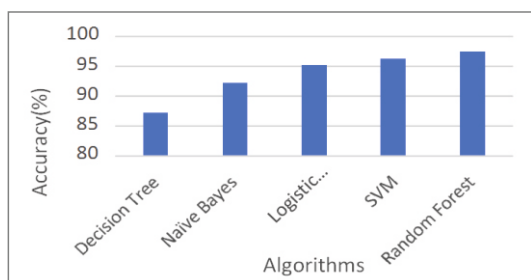
**Please consider following suggestions:**

1. Mix in muricat of potash or sulphate of potash
2. Try kelp meal or seaweed
3. Try Sul-Po-Mag
4. Bury banana peels an inch below the soil surface
5. Use potash fertilizer since they contain high values of potassium

Fig.4. Fertilizer Suggestion



The algorithm random forest give high accuracy of 97.5% compared with decision tree of 87.2%, Naïve bayes of 92.3%, logistic regression of 95.2% and Support vector Machine of 96.3%. Accuracy graph given in figure 5 and table give in table 1.



**Fig. 5. Accuracy Graph**

**Table 1: Accuracy Comparison**

Algorithms	Accuracy (%)
<b>Decision Tree</b>	<b>87.2</b>
<b>Naïve Bayes</b>	<b>92.3</b>
<b>Logistic Regression</b>	<b>95.2</b>
<b>SVM</b>	<b>96.3</b>
<b>Random Forest</b>	<b>97.5</b>

## 5. CONCLUSION

This developed system helps the farmer to choose the right crop by providing insights that ordinary farmers don't keep track of thereby decreasing the chances of crop failure and increasing productivity. It also prevents them from incurring losses. The system can be extended to the web and can be accessed by millions of farmers across the country.

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