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A Research on Prediction of Crop Yield and Its Forecasting Methods

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Abstract

Agriculture has the biggest share of our nation's GDP. Still farmers are most suffered people in India because they don't get a reasonable profit value of their crops. This happens because of inadequacy in irrigation level or crop selections or often the yield from crops is way lower than there expectations. It is possible to estimate the net crop yield by evaluating the soil and environment at maximum crop in a given area in order to provide more crop yield. This forecast would help farmers pick appropriate crops based on the type of soil, temperature, moisture, ranging depth, water level, season, fertilizer, soil pH, and the months. Crop production early Predictions is a technique for forecasting crop yields using various parameters such as precipitation, temperature, chemicals, insecticides, ph level, pesticides and different other environmental parameters and conditions . ANN (Artificial Neural Network) is a yield-predicting tool. To put it simply, crop yield is the quantity of crop produced per land area. It is usually used for rice, cereals, wheat, or legumes, and can be recorded in kilograms / hectare or metric tons / hectare. Agricultural production is also called crop yield. Technology, including the use of nitrogen, the production of better agricultural equipment, modern growing techniques and enhanced crop hybrids have increased yields. The higher the yield and the more productive use of the soil, the greater a farmer's productivity and profitability; this improves farming families' well-being.

Keywords: Crop yield, Prediction, Data analysis, Data model, Forecasting, Production, Agriculture.

Introduction

The Analysis of data is a method of cleaning inspection, modeling data with the aim of extracting valuable knowledge and conclusions. To derive any trend, it’s a method for analyzing, extraction and prediction making using the information that can be useful from the collected massive data. Companies make use of this mechanism to convert their client's raw data to usable information. This research can also be used in the Agricultural sector [1]. Most farmers were depending on their deep-term field experience on the different fields to predict the best output from the next or upcoming harvesting season, but unfortunately they don’t get appropriate crop prices. It is often due to inadequate irrigation or crop selection or often the crop yield remains lower than the expected yield [2]. The agricultural researchers agree onto the requirement of appropriate method to forecast and better crop development, and most agricultural work relies on the biological processes to detect the growth of crops and so enhance crop yields. Crop yields results rely predominantly onto the parameters like crop size, seed quality form and other environmental factors and parameters like humidity, water, sunlight (Temperature) and soil (ph) [3]. So to provide more yield product from crops and hence net yield of crops can be estimated by measuring the soil and environment at the best crop in a given area. The forecast can assist the farmers.

To prefer suitable crops for farming, following factors are required to be satisfied as per the type of soil, the temperature, moisture, available water levels, ranging in depth, PH of soil, weather, pesticide and the seasons [4]. India ranks amongst most in list of top five producers of several types of agricultural products such as tea, coffee, sugar, cotton and so on. Although India is the biggest producer of such products as rice, jute, milk, spices, many fresh fruits etc. India is one of world’s largest sweet, sugarcane producers. For many reasons, most farmers don't earn the expected crop yield [5]. Each cultivators awaits for their field harvest that depends onto variety of different factors. Earlier times, crop yield estimation was obtained from a previous encounter with the

crop by the farmer. In Indian agriculture, the data volume is enormous. The agricultural yield of India depends mostly onto the season, weather and climatic conditions [6]. This dependence on the environment, type of land or fields, available capital contributes to the unforeseeable yields of crop. The researchers and Scientists are now developing the crops yield techniques for forecasting, that would alert the farmers earlier depending on the gathered data and techniques devised by the scientists. Maintenance of the lands for the agriculture therefore entails variety of considerations such as cultural, economic, social and environmental influences. This also consists of the numbers of farm employees, different type of farms, the regulation of areas, and finances and significantly, saying the environmental situations. Researching on these difficulties researcher faces the weather which contributes to the differences in the crop production, properties of the soil and soil simulations [7].

This can be made possibly just by using the detailed analysis of the approaches such as planting, fertilization, drainage, harvesting, weather patterns, crop forecasting. Scientists have worked to develop the yield forecasting techniques or methods field and conservation strategies that can improve efficient agricultural production management. Besides this, socio and economic factors and the ecological shifts that has to be considered into account for experiments with the crops and the soil properties [8]. The difficulty to consider methodologies in the field management, ideal for the sustainable production of crops using the long-term land trials with the correct geographical and time data. Therefore crop and soil simulation approaches are influenced in various areas by a variety of factors. Time and environment warrant specific management approaches. It can be built by evaluating modeling models under different conditions and integrating management techniques to support the majority of the farming population [9]. Agriculture also provides jobs to the very significant majority of people, Moreover with supplying the foods and unprocessed substances. Attacks of the diseases and pests in crop production is the main 2 factors that require attention. Pre-harvest crop productivity projections are required for a variety of policy agreements on production, storage, ranking, import-export, marketing, etc. The pests, insects and the disease is the main elements of the crop yield reductions [10].

Crop Prediction and its history:

Crop prediction relies heavily on established evidence about a given time, which is based on the expectation that the conditions will be exactly the same in that time. Farmers use these inputs to provide inputs and accurately forecast the crop yields. Agarawal researched this and described the main crop yields forecast model in terms of the weather information and techniques of forecast [11].

Another important field work is by Jame and Cutforth, who provide valuable observations as their thesis illustrates modern agronomic work focused on statistical analysis that has many shortcomings. Based on their report, they noted that conventional agricultural decision-making approach includes crop yields relative to certain identified the variables completely based on the analysis of the correlation and the regression [12]. These implementations of the study on the correlation and the regression that has provided several methodological and technical variables for interpretation. Yet there are also drawbacks about this quantitatives and applicability of these linear extrapolation-based type for crop yield models especially for the predefined decision-making. Hence Jame and Cutforth proposed the DSSAT also known as decision support systems for the transition of the agro-technology that they believe will enhance process comprehension and promote the strategical agricultural researches [13]. The DSSAT are devices that makes farmers capable to adapt a crop's biological condition to the physical characteristics of the soil to achieve different goals.

Knowing the complexities of the farming environment, it concludes that the knowledge-based methodological - approach works are the secret for futuristic crop predictions sector and this will slowly grow in value over conventional approach based on experience. The background of the climate changes and issues with soil quality, soil-plan inputs and soil biota Fischer et al. also investigated plant genetic influences on soil function. For sustainable competitive structures a detailed analysis of these variables and statistical models can be planned.

Crop Yield Prediction:

The crop production measurement are used for the food grains and the legumes, and are typically expressed in the metric tons every hectare. The Crop harvesting may refer to actual plants and seed innovations. For example, maize production that produces four creative maize outputs will have a 1:4-ratio crop harvest. It is also called agrarian efficiency. It is the responsibility of the yielded crops forecasting models architectures that includes the input modules to take feedback from the farmers [14]. These input components includes the name of the crop, land area, type of soil, pH of the soil, specifics of the disease, temperature, available water level and the size of seeds. For choosing the attributes from the main crop information's in the subset. Predictive models for crop yield are utilized for forecasting the plant growths and information related to the diseases of plans and crops. After the selecting an element, these collected data goes to the different classification rules written for grouping the related material.

The Crops Simulation Models:

The Crops Simulation Models (CSM) are simulation model which explains the growth of crops and the production process as these are arising from the climate, land, soil conditions and the field managements, etc. The main power of these CSM lies in the capability of them to draw conclusions based on temporal crop growth yields and patterns and yield within a single site of experiment. Hoogenboom *et al*. has researched both agriculture and crop effects of genome and have established a mutation-based model [15]. For solving some of these spatial soils heterogeneity issues, the soil products are being divided into the small homogeneous unit and the tests are aggregated further using the deterministic formulas for the production of the whole crop yield. In particular, these growth in crops mechanism is even more stochastic than the deterministic ones since certain areas of these preceding ecosystems is heterogeneous in nature [16]. However, the crop models using a stochastic methods yet not being established to the utility points in decision taking even in situations where this is a use of deterministic models accounts for year-to-year weather variations. It is known that it is possible to divide deterministic crop systems into the 3 basic types mechanistic, statistical and the functional [17]. So the data input numbers and also the amounts and degrees of the feature complexity aid in contrasting styles of the crop systems.

As the Earth's energy (Heat) equilibrium is constantly disrupted do of human activities, the Earth's atmosphere and climate change subsequently continuously take place. Weather as variable has a significant effect on agricultural production at the national and global levels. Global climate statistical simulations of the national climate models about land, atmosphere, surface, ocean and the sea ice features. These Models for crop simulation, by CERES-Maizes (Land Ecosystem Capital Synthesizes), SWAP (soil-water-atmosphere-plant), the CERES-Wheat and Fo-Crop were commonly utilized for the determination of the effects of the climate change on the crop yields. Kang et al. also explores the various effects of the climate change onto the crop yields and production, farm water quality and food health [18-20].

Advantages:

- Model lets the users for customization of the parameters affecting the crops.
- Authentication is provided to the system.
- Model provides faster, convenient and easier access to the basic informations about the.
- Good understanding among the farmers about farming trends in various areas.
- Easy to understand the results and prediction.

Methods of Crop Forecasting:

According to Spinks 'Research into methods of gathering and processing the agricultural information that have only been undertaken over a quite comparatively limited period of the time.' Most of these researches are carried out in the designing approaches that is effective at the both theoretical and the practical points of view is largely distributed through the individual journals [21]. Spinks study considers Sanderson to be the most systematic work, although only the approaches used in the United States are discussed here. Such methods were introduced in all nations, and substantial potential for development was seen. While examining the methods of CFM, it's remembered for the processes that requires detailed surveys and the field assessments done by the crops correspondents which must be stationed in the region during the successful time [22]. Eventually, their surveys help locate forecasts of the crops. The Researchers also has established the two major components which decides the crop predictions, naming the regions utilized for the agricultural crop productions and the respective yields per unit. Multiplication of these two elements seeks the outcome for projection. The Forecaster may utilize either the subjective or the analytical approach in this regard [23]. Where subjective approaches are based on human opinion, and where quantitative approaches rely on statistical evidence and techniques. Subjective as well as analytical approaches have been used in the future forecasting about both the regions and the crop yield issues.

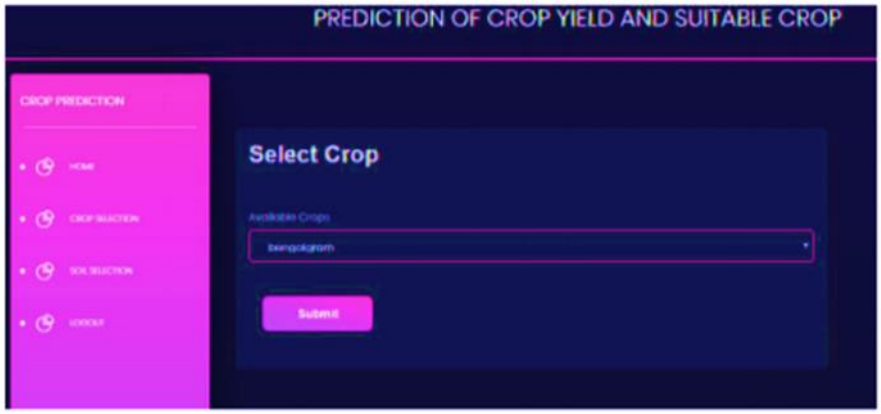

Figure 1: Selection of Crop

Remote sensing techniques:

It is characterized as the Part of science that collects the knowledge forms about reflection of the lights or the radiations, regarding the objects, or the crop canopies and the forests, by examining data collected by the computers, satellites or even the aircrafts that are not in direct contact with the objects [24]. It continuously recorded earth surface details, field coverages the area, the forest vegetation's, primarily the soil properties, the climate and the water monitoring techniques are some the main remote sensing applications [25]. Thus remote sensing is a kind of revolution in difficult environments for sustainable agriculture and land conservation. It plays a important role in forecasting of the agricultural growths, the crop managements and trend creation in the future [26].

Application of User Interface:

The application and various options for forecasting/predicting the yield of the crops are just illustrated in the below Figures one, two, three and four respectively.

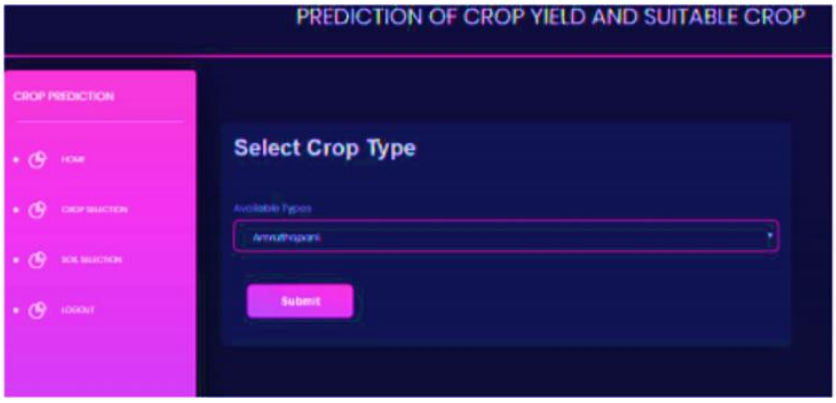

Figure 2: Selection of Crop Types

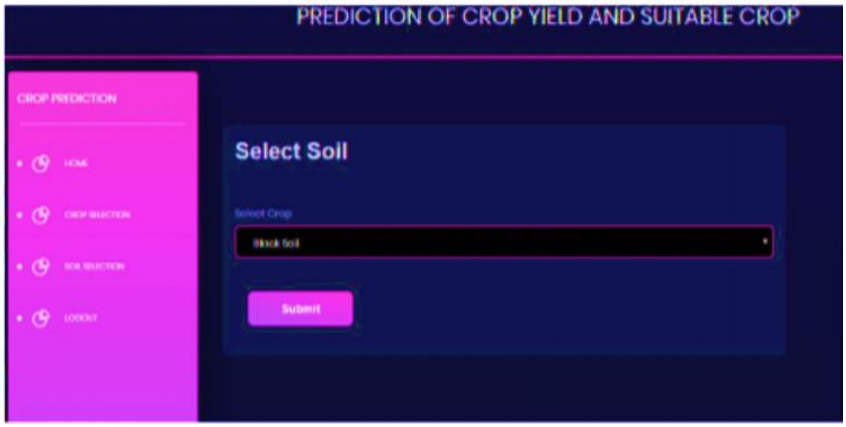

Figure 3: Selection of Soil

Figure 4: Predicted Result

CONCLUSION

In this paper suggestions about a system that would allow the farmers or makes them capable to get more understanding about the yields forecasts/predictions based on the weather conditions, other parameters and the area under the production. In case yield projections are unfavorable, farmer will get more confident on their decision making about problems like whether to cultivate the specific crop in which particular season or to go for some other more beneficial alternate crops. Paper overviews about the crop yield and its forecasting it was hypothesized that the crop simulation the models differ significantly between all of them. For minimizing the

errors in the predicting crop productions as an output, with high-quality gathered information on the soil, environment, the crop management aspects and highly efficient equipments for computing with problems, qualified human resources for the production are required for the input-data analysis's through simulation models. Furthermore, detailed and highly reliable data are needed for calibration, which is why it does not extend to certain developed countries. RS, yield difference and CSM integration provides an important solution for the future seed yields forecasting. The Remote sensing can be measured for crop status in a spatial sense at the given duration while the growing seasons, while CSM can characterize crop development throughout the season every day.

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