

# Agro Genius: An Emergent Expert System for Querying Agricultural Clarification Using Data Mining Technique

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**Abstract:** Data mining application in agriculture is relatively a new approach for predicting agricultural crop productivity. This paper provides an expert system about agriculture which helps the farmer to cultivate the crops for high yield and giving awareness about the organic farming. This expert system contains three sections namely training, best combination for cultivation and awareness of organic farming. The training section gives basic needs of agriculture. The second section is about predicting the best combination for high yield in the crop cultivation. The third section gives awareness to farmers about organic farming. This system helps a new farmer to query his clarifications related to agriculture for better yield before cultivation.

**Keywords:** Expert system – Data Mining – Classification – Decision Tree – Training – Testing.

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## I. Introduction

An expert system is a computer system that attempts to make a replica of specific human expert intelligent activities. Typically, knowledge-based systems enable users with a problem to take counsel from a computer system as they would an expert advisor to pinpoint what may be causing a problem and figure out how to solve a problem, perform a task, or make a conclusion. Like a human expert, such a computer system can take out additional information from a user by asking questions related to the problem through a consultation. It can also answer questions asked by a user about why certain information is needed. It can make exhortation regarding the problem or decision at the end of a consultation, and it can explain the reasoning steps gone through to reach its decision when asked by a user. In Agriculture, there are many reasons accountable for low productivity. About one-third of land holdings are very small less than one hectare in size. Due to small size of land holdings we cannot use latest way of cultivation. Even today farmers are using very old methods, tools and enactment for farming. Farmers are not using artificial ways of cultivation. Inputs like-better quality of seeds, fertilizers and pesticides are also not used by most of the farmers. Utilization of marginal farmers is also responsible. There is also low productivity because of increasing stress on land and the absence of bank credit. The Review papers describe about disease and solution for particular crops. Hence an emergent expert system named Agro Genius has been designed and implemented in this research for all types of end users in Agriculture.

## II. Review Of Literature

A paper [1], an expert system exclusively for the integrated disease management in finger millet is being presented by incorporating fuzzy logic method to frame the rules and apply defuzzification to attach a value to the severity of the disease identified, based on which the control and remedial measures are suggested. Though there are many methodologies available to identify the disease and evaluate the severity, based on which the recommendations can be made, the most commonly used is the experience of the farmer and the knowledge of the agriculturist. The expert system that is been developed is a blend of both the above mentioned factors along with the application of technological advancements. Since the expert system has a module of acquiring new knowledge, the new breed of diseases that attack the crop can also be recorded. The system thus developed can also be extended to incorporate various other modules like integrated pest management, soil management and fertilizers management making it a total solution provider for in all aspect and hence increasing the yield.

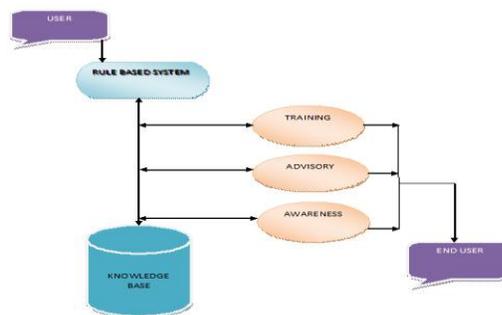
A paper [2] designed and implemented a corn disease remote diagnostic system, which is focused on the prevention, diagnosis and control of diseases that affect China corn production. The knowledge acquisition process was conducted based on the knowledge obtained from the literature and experts. Enhanced by more than 100 photos and drawings that assist the use in the identification process, the corn disease remote diagnostic system is supported by a data base containing information for the identification of 63 diseases. The system can be used as an identification tool for farmers; this system has tried hard to unify the advanced Internet and information technology and the researches of domestic domain experts, and provides one kind of highly effective corn disease diagnosis method. By incorporating the value diagnosis to improve case retrieval, this system solved the problem that it is very difficult to find match case in case retrieval.

### III. The Proposed Methodology

The proposed Agro Genius system is an Expert System for agriculture. It is aimed at a collaborative venture with eminent Agriculture Scientists and Experts with an magnificent team of computer Engineers, programmers and designers. The program is divided into two aspects: Information System and Advisory System. In Information system, the user can get all the static information about different organic cultivation and disadvantages of inorganic cultivation. In Advisory System, the user will have an interaction with the expert system like a querying system; the user has to answer the questions asked by the Expert System. Decision tree induction technique is adopted in the present study to develop innovative approaches to predict the best combination for cultivating crops. A decision tree is a flow-chart-like tree structure, where each internal node denotes a test on an attribute, each branch typifies an outcome of the test, and leaf nodes typify classes or class distributions. The top most nodes in a tree is the root node. In order to classify an unknown sample, the attribute values of the sample are tested against the decision tree. A path is discovering from the root to a leaf node that holds the class prediction for that sample. Decision trees were then coinciding to classification rules using IF-THEN-ELSE. Orthogonal Arrays (often referred to Taguchi Methods) are often employed in industrial experiments to study the effect of several control factors. An orthogonal array is a type of experiment where the columns for the independent variables are “orthogonal” to one another. Benefits: Conclusions valid over the entire region spanned by the control factors and their settings, Large saving in the experimental effort and Analysis is easy. To define an orthogonal array, one must identify: Number of factors to be studied and Levels for each factor.

#### 3.1 Rule Based System

In a Rule Based System the System takes Input and makes results with all the facts and Rules that matches with in the Knowledge base. This Rule Based System contain of Knowledge Base, Inference Engine, User Interface, Expert and the User. In the Rule Based System the systems acquire the inputs from the farmer or the user and give the advice receptacle on the exact match of facts and rules from the knowledge base. The output of the this system produce the classification based on the inputs provided by the user which most significant to a disadvantage that if any of the inputs does not match with the knowledge it will not give any output for the further proceedings.



**Fig 1.The Proposed System Architecture**

This paper used two algorithms, namely Rule based Algorithm which is used to classify the users based on the answer provided for expert systems questions.

## IV. Experimental Analysis

### 4.1 Dataset

The monitoring data is a basic agriculture detail with questions & answers, organic farming and good combination to cultivate crop Advisory System the MYSQL database. It can be used as any other data stored in a database. This greatly increases the opportunity with which you can conduct post-analysis of the monitoring data.

### 4.2 Rules

A set of rules, which constitute the program, stored in a rule memory of production memory and on an inference engine required to execute the rules. Here the users are categories based on the marks scored for the questions asked by the expert system. If the user score  $\leq 4$  the user will be moved to the training section. If the user score  $\leq 7$  the user will be moved to Advisory system. If the user answers all questions, the user will be moved to awareness section.

#### 4.2.1 Training section

It consists of basic needs of agriculture to train the user about fertilizer management, pest management, farming system, weed controlling, soil types, water management and cropping seasons.

**Table 1. Attributes and its Domain**

ATTRIBUTE	DOMAIN
A. Rain	1.High 2.Medium 3.Low
B. Soil	1.Red soil 2.Black Soil 3.Saline
C. Fertilizer management	1.Organic Fertilizer 2.Inorganic Fertilizer 3.Null
D. Farming System	1.Mono crop 2.double crop 3.Mixed crop
E. Irrigation	1.1-15 2.1-30 3.1-60
F. Season	1.June-Aug 2.Oct-Dec 3.Feb-May
G. Weed controlling	1.Manual 2.Machine 3.Null
H. Pest Management	1.Organic 2.Inorganic 3.Null

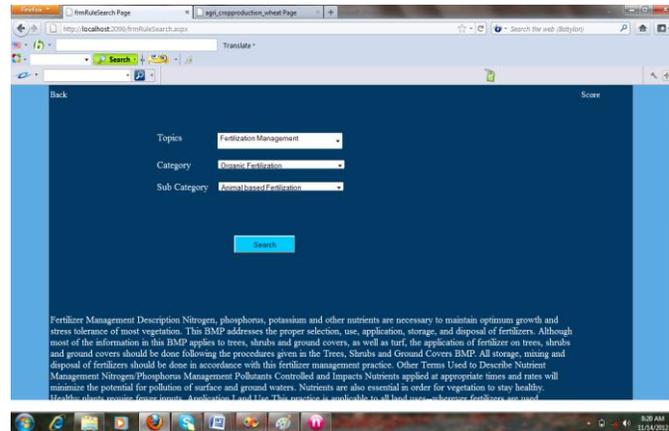


Fig 2. Basic Information about Agriculture

#### 4.2.2 Advisory section

This system is about finding a good combination to cultivate crop with the help of experts and the user obtains suggestion about the combinations which will produce good yield and sowing is best or not. The basic algorithm for decision tree induction is an insatiable algorithm that constructs decision trees in a top-down repetitive divide-and-conquer manner.

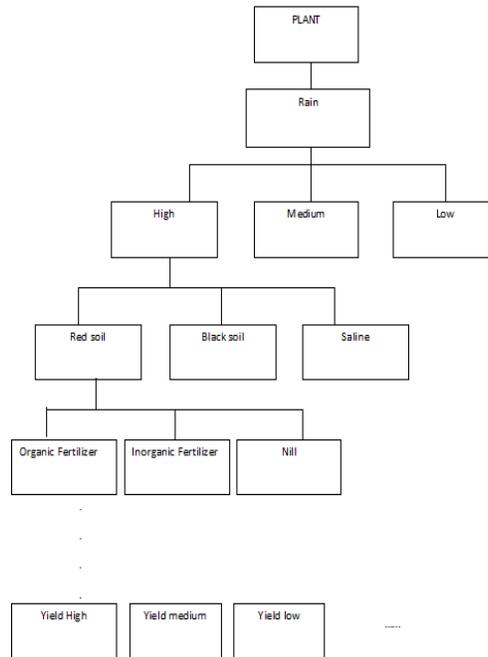


Fig 3. Decision tree

The decision tree has number of combinations. It is difficult to analyze all the combinations and find out the result. Hence the orthogonal technique is used select better combinations. The reduced combinations will be consulted with the experts to find the possible combinations for high yield. The Expert System for identification of combination of deficiency in plants has been based on inference and its theory base is in the order of first logic.

**4.2.3 Awareness section**

In this section the users will be provided awareness about the usage of organic farming and also the disadvantage of inorganic farming. The organic farming will reduce the global warming and also provides a full-fledged eco-friendly agricultural system.

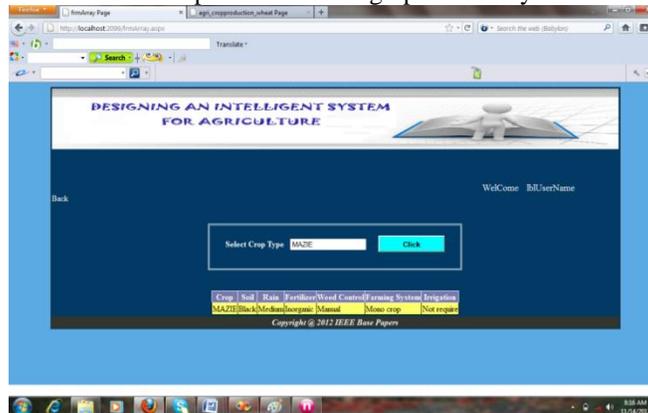
**V. Result And Discussion**

The knowledge base of this system contains production rules derived from the decision tree (figure-2).

L18(L8x3) Array								
Expt. No.	Conditional Attributes							
	A	B	C	D	E	F	G	H
1	1	1	1	1	1	1	1	1
2	1	1	2	2	2	2	2	2
3	1	1	3	3	3	3	3	3
4	1	2	1	1	2	2	3	3
5	1	2	2	2	3	3	1	1
6	1	2	3	3	1	1	2	2
7	1	3	1	2	1	3	2	3
8	1	3	2	3	2	1	3	1
9	1	3	3	1	3	2	1	2
10	2	1	1	3	3	2	2	1
11	2	1	2	1	1	3	3	2
12	2	1	3	2	2	1	1	3
13	2	2	1	2	3	1	3	2
14	2	2	2	3	1	2	1	3
15	2	2	3	1	2	3	2	1
16	2	3	1	3	2	3	1	2
17	2	3	2	1	3	1	2	3
18	2	3	3	2	1	2	3	1

**Table 2. Number of Combination**

The best combination will be selected and implemented for high productivity.



**Fig 4. Best combination for maize**

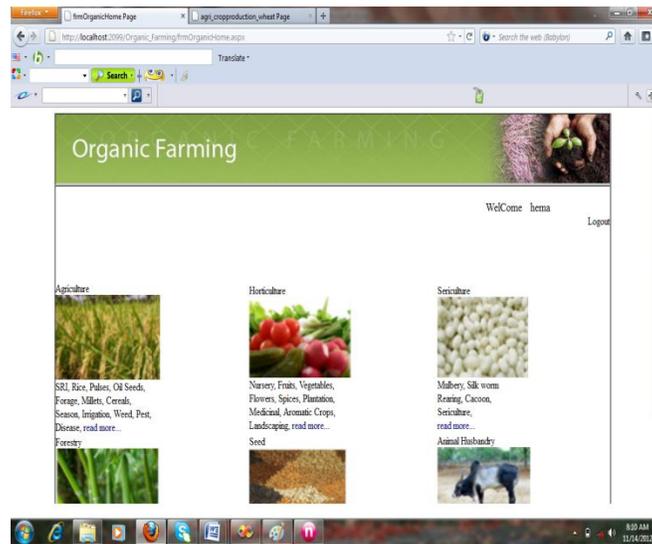


Fig 5. Awareness about Organic Farming

## VI. Research Directions

This kind of research will be useful for all users. Farmer can easily identify the ideal crop for particular monsoon season. In future it can be further developed to be approachability by the mobile phones. The mobile platform provides the advantage for person to obtain consultation practically anytime and anywhere. Animation, sound and video features can be added to behave like Guru because Guru does not issue only facts, but explains and provides solutions in the form of examples. It can also work as a Guru.

## VII. Conclusion

This paper provides an Expert system for agriculture. This expert system provides basic information about agriculture for the beginners in farming, giving the best combination for cultivate the crops and creating awareness about the organic farms. This expert system advices and suggestions in the area of crop field by providing facilities like dynamic interaction between expert system and the user without the need of expert (crop) at all times. By the interaction with the users and beneficiaries the functionality of the System can be extended further to many more areas in and around the world. A proper understanding of the above section will result in a better agriculture system.

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