ISSN:0975-9646

RICEsmart: An Expert System to Enhance Rice Yield

Shailendra Kumar Yadav[1], Niraj Singhal[2] and Vivek Yadav[3]

[1]*M.Tech Scholar, Shobhit University, Meerut (U.P.), India*
[2]*Associate Professor, Shobhit University, Meerut (U.P.), India*
[3]*Jr. Agronomist, Zonal Research Station, Nagina (Bijnor) (U.P.), India*

***Abstract*- This paper presents a proposed expert to solve the problem of rice growers from seed to seed *i.e* from selection and sowing of varieties till harvesting of crop. Expert system is a collection of computer programs, developed for a particular area of domain that are capable of offering solutions or advices related to specific problem. An expert system is a problem solving & decision making system based on knowledge of its task & logical rules. Both knowledge and logic are obtained from the experience of specialist in the area. The expert system RICEsmart will be ontology based expert system which will intended to help the farmers, extension workers, researchers and students and provides and efficient and solving common problems related to rice.**

***Key words*- Agriculture, Expert system, Rice, Ontology**

I. INTRODUCTION

Agriculture constitutes the backbone of the Indian economy. The advantage in the field of agriculture and need of farmersthe expert system has been take decision during soil preparation, sowing, fertilizer management, irrigation management, integrated pest management, weed management & storage etc. for higher crop production. To achieve high yield, expert knowledge should be acquire, so that depending on that knowledge, farmers can take decision related to different factors. Expert system can be used to make decision at different levels in agriculture like Operation level and Planning level. Agriculture specialists and raw experiences are the common sources to provide information that the different stakeholders require for decision making to improve agricultural production.

An artificial intelligence system created to solve problems in a particular domain is called Expert System. An expert system is a computer program that uses knowledge and inference procedures to solve problems that are different enough to require human expertise for their solution [1].

The need of expert systems for technical information transfer in agriculture can be identified by recognizing the problems in using the traditional system for technical information transfer, and by proving that expert systems can help to overcome the problems addressed, and are feasible to be developed. Most of these findings, recommendations do not timely reach to the farmers. There is lack of many channels between researcher and farmers. Virtual expert who can give personalized expert advice to a large community of farmers, specific to their need. It is almost impossible for any human expert to consider every piece of available information. An expert system can provide the growers with dynamic information related to their actual situations, taking into consideration different specialties and different sources of information, reducing the update time of information in situations where it is centralized and accessible from different locations. Expert system is cheaper compared to human experts in the long-term scenario.

Rice is one of the most important cereal crops as it is staple food of 70% of the world population. Proper crop management starting from selection of variety, sowing, transplanting, weed water and nutrient management is utmost essential to get maximum yield from unit area and unit time, as all these factors adversely affect the crop yield. Keeping this background in mind and attempt has been made to design an ontology based expert system *viz.* **RICEsmart** which can solve the famer's queries regarding rice.

II. RELATED WORK

Many expert systems have been developed in agriculture to help farmers, extension workers, researcher & students that they can get more yield from per unit area per unit time. Some export systems already exist in different countries like Expert system for Wheat Yields Protection in Egypt (EXWYP) is a novel approach for the diagnoses of insect pests [2], Dr. Wheat which is expert system to diagnosis the diseases and pests for wheat in Pakistan is a rule based expert system [3], NEPER a multiple strategy wheat expert system which has been develop using multiple design approach [4]. Likewise in rice, Enhancement in Agro Expert System for Rice crop for diagnosis of common rice diseases and rule based expert system [5]. MyPEST which is used in Malaysia for pest activity prognosis in rice fields using fuzzy expert system [6]. ESRICE which can also used in forecasting and control recommendation to rice farmers [7]. An Expert system for diagnosis of diseases in

Rice Plant is rules based expert system and contains knowledge about symptoms and remedies of diseases in rice [8]. For Maize, Maize AGRIdaksh is online expert systems which give a good advice regarding variety, insect and diseases of Maize. Maize expert system has four components i.e. the knowledge acquisition module, the knowledge base, the inference engine and the explanatory interface [9]. Development of Maize Expert System Using Ada-Boost Algorithm and Naïve Bayesian Classifier is a web based application developed using machine learning techniques [10]. In sugarcane rule based expert system in the use of inorganic fertilizers for sugarcane is a expert system which helps the farmer to decide what kind of inorganic fertilizer should be used on the basis of symptoms appeared [11]. Design and implementation of expert system in irrigation of sugarcane is an expert system for automation of drip irrigation for efficient irrigation in sugarcane [12]. The expert system SUGAR-EX takes in consideration sixteen major pests of sugarcane utilizing their symptoms/detail of pest stage as identification and their management [13].

III. PROPOSED WORK

Indian economy is based on Agriculture. Many agriculture researches are going on different Institution & SAU but dispersion of the research work between researchers, extension workers, students and farmers is lacking. The farmers are not capable enough to identify the symptoms of the diseases. Identification the diseases of cereals and other related information are totally dependent on the experts. Expert system can be defined as a tool for information generation from knowledge. Information is either found in various forms or generated from data and knowledge. Text, images, video, audio are forms of media on which information can be found, and the role of information technology is to invent, and devise tools to store and retrieve this information. Expert System of extension was designed using n-tier architecture.

The proposed expert system is ontology & web based expert system. Ontologies have been developed in AI to facilitate knowledge sharing and reuse.Web ontology Language is designed to be used by applications that need to process the content of information instead of just presenting information to humans.Ontology provides a common vocabulary to support the sharing and reuse of knowledge. Use of ontologies in information systems has become more and more popular in various research fields, such as web technologies, Information Retrieval or document management system, Natural Language Processing, database integration, etc.OWL has three increasingly-expressive sublanguages: OWL Lite, OWL DL, and OWL Full. Ontology for a knowledge based system is an explicit specification for the objects, concepts and other entities that are presumed to exist in some area of interest as well as the relationships that hold among that [14].

We used Protégé to capture conceptual and relational domain knowledge as ontologies. Protégé implements a rich set of knowledge-modelling structures and actions that support the creation, visualization and manipulation of ontologies in various representation formats. Protégé is a flexible, configurable platform for the development of arbitrary model-driven applications and components. It supports lot of plug-ins like Jambalaya, Data Master, OWL Viz etc. which adds extra functionalities. It also exports ontology in many formats (RDFS, OWL). Protégé might be used to store large ontologies; multi-user mode based on client/server architecture and might be reused for collaborative working.

The objectives to follow are storing and maintenance of farming activities of the farmer time to time and constantly validating its consistency. User can query the system with the observations made by him and accordingly answer to his query is obtained which is specific to the rice. Care is taken for proactively advising the farmer as per the inferences made from his past records.

A. Maintaining the Data

Its contain information regarding farmers and their farming practices in 5 different years. This data is performed in various aspects to validate details and find patterns in farming practices of farmers. This analysis would help in answering to queries raised by farmers regarding rice. Observations made for their records can be verified and queries be answered.

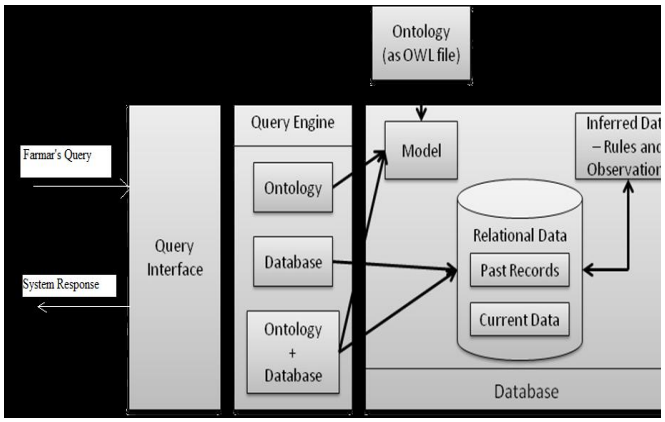
Current practices of the farmer are also captured time to time. Activities of the farmers at various stages are recorded, like when the crop was sown, its variety, location, etc. Based on the old practices, farmer may be advised on how to manage the current crop cycle.

B. Old Data for Trends and Checking Consistency

To observe for patterns for the best yielding varieties. Trends are observed like when the crop is sown, when irrigated, fertilized, etc. apart from season still giving good results. It is verified whether the knowledge base is complete or consistent with the actual farming practice. If a pattern is observed for maximum number of the farmers, then the knowledge base is updated based on the same.

It is verified with the knowledge base whether or not the farming practices are followed by farmers. Accordingly, timely advices are generated which would help the farmer in better yield of the crop. System also takes care of context-based querying and advising which takes care of responding to a farmer in specification of his crop

sown. At times some severe observations are made in the crop sown by a specific farmer.



System consists of the following components:

Query Interface: This is an interface where farmer can post his query. Query is mainly a keyword-based query. This query is parsed, tokenized and mapped to resources in the ontology.

Query Engine: This is the core of the system which handles farmer query. Farmer query can be any of the 3 types: ontology-based query, database query or ontology & database query. Currently we are handling ontology-based query.

Database: This is the repository which holds complete information about the crop in the form of ontology. This ontology is stored as a graph in database.

IV. CONCLUSION

Expert system is computer program which can be used as virtual expert to guide the rice growers. Expert system is a technological way to deliver agricultural knowledge from books, research papers, thesis etc. to actual implementation level i.e. at growers. The system needed to update to the new diseases, insects and weeds of rice prevailing in the region with their best management. This expert system will guide to rice growers to take decision into different aspects of crop management like land preparation, seed selection, pest management, fertilizer management, weed control, irrigation management etc. **RICEsmart** will be a better option for the grower over existing expert systems. In future, crop management practices of more cereal crops will be added in a single expert system.

REFERENCES

[1] Feigenbaum. E. "Knowledge Engineering in 1980's Department of Computer Science", Stanford University, Stanford CA, 1982.

[2] Nermin K. Negied."Expert System for Wheat Yields Protection in Egypt (ESWYP)". International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-11, 2004.

[3] Fahad Shahbaz Khan, Saad Razzaq, Kashif Irfan, Fahad Maqbool, Ahmad Farid, Inam Illahi and Tauqeerulamin. "Dr. Wheat: A Web-based Expert System for Diagnosis of Diseases and Pests in Pakistani Wheat". Proceedings of the World Congress on Engineering WCE, Vol.1, 2-4 July, 2008.

[4] Soliman A. Edrees, Ahmed Rafea, Ibrahim Fathy, Mohamed Yahia. "NEPER: a multiple strategy wheat expert system". Computers and Electronics in Agriculture 40, 27-43, 2003.

[5] Milind K. Tatte, Mangesh K. Nichat. "Enhancement in Agro Expert System for Rice Crop. International Journal of Electronics Communication and Computer Engineering". Volume 4, Issue (2) REACT-2013, ISSN 2249–071X.

[6] Nureize Binti Aibaiy. "Pest activity prognosis in rice fields using fuzzy expert system approach". A project submitted to the Graduate School in partial fulfillment of the requirements for the degree Master of Science (Intelligent System), University Utara Malaysia, 2004.

[7] Hu Quansheng and Zhang Xiaoxi. "ESRICE and expert system for management of rice pest insects – design and implementation". Chinese J. Rice Sci., 7(3):159-166, 1993.

[8] Shikhar Kr. Sarma, Kh. Robindro Singh and Abhijeet Singh. "An Expert System for diagnosis of diseases in Rice Plant". International Journal of Artificial Intelligence, Vol.1(1), 2008.

[9] Yadav,V.K., Sudeep Marwaha, Sangit Kumar, Kumar,P., Jyoti Kaul, Parihar, C.M. and P. Supriya. "Maize AGRIdaksh: a farmer friendly device". Indian Res. J. Ext. Edu., 12 (3), September, 2012.

[10] M. S. Prasad Babu, Venkatesh Achanta, N. V. Ramana Murty, Swapna. K. "Development of Maize Expert System Using Ada-Boost Algorithm and Naïve Bayesian Classifier". International Journal of Computer Applications Technology and Research (IJCATR), Volume 1 Issue 3 November-December 2012

[11] Jadhav, S.K., Yelapure, S.J. and V. M. Babar. "Rule based Expert System in the Use of Inorganic Fertilizers for Sugarcane Crop". International Journal of Computer Applications, Vol. 36(4), December, 2011.

[12] Ms. Nilam U. Khamkar. "Design and Implementation of Expert System in Irrigation of Sugarcane": Conceptual Study. ISBN: 978-81-927230-0-6, 2014.

[13] T. Rajula Shanthy, N. Mukunthan. "SUGAR-EX: An information and communication technology based decision making tool". January 2009, Volume 11, Issue 1, pp 69-72.

[14] Gruber T.R. "A translation approach to portable ontology specifications, Knowledge Acquisition". 5 199–220, 1993.