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STUDIES ON EXPERT SYSTEMS USED IN AGRICULTURE FOR CEREAL CROPS

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Agriculture constitutes the backbone of the Indian economy. Farmer need advance expert knowledge to take decision during land preparation, sowing, fertilizer management, irrigation management, integrated pest management, storage etc. for higher crop production.
In any agricultural production system, accumulation and integration of related knowledge and information from many diverse sources play important role. Agriculture specialists and raw experiences are the common sources to provide information that the different stakeholders require for decision making to improve agricultural production. Expert system - a branch of Artificial Intelligence is a collection of programs which has the ability to reason, justify and answer the queries in a particular domain as a human expert would do. 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/or 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. 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. 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, and transferring real experience that is not documented in any form of media by gathering it from various experts extension workers and experienced growers. Many expert systems have been developed in agriculture to help farmers that they can get more yield from per unit area per unit time. Some of the already existing expert systems in agriculture domain are presented in this study.

Existing Expert Systems in Agriculture

1. Wheat

Dr. Wheat : A Web-based Expert System for Diagnosis of Diseases and Pests in Pakistani Wheat is a web-based expert system for wheat crop in Pakistan. The rule-based expert system covers two main classes of problems namely diseases and pests, normally encountered in wheat crop (1).

The cereal aphid expert system and glance n' go sampling for greenbugs : Questions and Answers : The cereal aphid pest management system is a set of computer programs to help the user manage cereal aphids in winter wheat. The expert system has a Greenbug Economic Threshold Calculator, which will calculate a treatment threshold for greenbugs based upon data the user provides. It also allows the user to print Glance 'NGO' sampling plans for the appropriate economic threshold that can be used to sample several fields using a single form. Treatment thresholds calculated by the expert system incorporate weather data to predict growth rates of the greenbug population, in addition to the price of insecticide treatment and the value of the crop. The expert system also has modules to help in insecticide selection, cereal aphid identification, and natural enemy identification (2).

2. Rice

MyPEST, Pest activity prognosis in rice fields using fuzzy expert system approach to provide information to the farmers and researchers through the Internet since rice is the main staple food of the Malaysian and Kedah is known as 'rice bowl'. On the other hand, Fuzzy Logic approach is used to forecast the pest activity level. This is important so that early treatment or action can be applied before damage to the plant becomes worst. The system allows the users to input percentage of symptoms in uncertainty forms (high, very high, medium) rather than the common form of yes/no or absence/presence form (3).

ESRICE : An expert system for management of rice pest insects – design and implementation. It was implemented in NEW language, BASIC and dBASE III. It is composed of 13 subsystems which can forecast the population dynamics and gave the control recommendations for farmers. The results of the system application have shown that the level of the

system ESRICE has been as high as that of the domain experts in the rice pest management (3).

An expert system for rice kernel identification using optimal morphological features and back propagation neural network was developed for identifying five different varieties of rice, using the morphological features. The algorithm consists of several steps: image acquisition, segmentation, feature extraction, feature selection, and classification. A back propagation neural network-based classifier was developed to classify rice varieties (5).

A Web GIS Expert System for Rice Brown Planthopper Disaster Early-Warning in China's Shanghai was developed for rice varieties susceptibility, pest density and climatic factors in Shanghai rice planting region. The system used a straightforward set of IF-THEN rules to classify disaster. It was developed since the brown planthopper (BPH) *Nilaparvata lugens (*Stal) is one of the most devastating insect pests in rice planting region of China's Shanghai (6).

A Quantitative Knowledge-based Model for Designing Suitable Growth Dynamics in Rice was developed for time-course growth dynamics including stem number, leaf area index (LAI) and aboveground dry matter accumulation with desired target yield under different conditions in rice. This model overcomes the weakness of poor spatial and temporal adaptation of traditional rice management patterns and expert systems (7).

An Expert System for diagnosis of diseases in Rice Plant is a rule based expert system, using the shell ESTA (Expert System for Text Animation) (8).

3. Maize

Maize AGRIdaksh : A Farmer Friendly Device: Maize expert system has four essential components i.e. the knowledge acquisition module, the knowledge base, the inference engine and the explanatory interface. The knowledge acquisition module consists of gathering of knowledge from the panel of experts of different field of maize e.g. varieties, insects, diseases, etc. It also stores the facts from textbooks, technical /extension /research bulletins. A knowledge engineer further processes it through programming and refinements. The explanatory interface allows the user to get the results in Hypertext markup language, Java script and Cascaded style sheets. This system also explains the procedure to be followed by users to get answers of queries related to maize. Thus it is very useful tool for dissemination/ accessing relevant information related to maize across the globe (9).

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