

A Web Based Rice Expert system for major varieties, pests and diseases of Rice crop (<http://www.ricexpert.in>)

Generally farmers face problems like choosing suitable varieties, diagnosing pests and diseases, pesticides/fungicides application, yield losses etc. An attempt was made to develop an expert system for rice varieties, pests and diseases to aid in the decision making at farm level.

Expert systems are computer programs that solve problems by mimicking human reasoning processes, relying on logic, rules of thumb opinion and experience. A web-based rice expert system has been developed using rule based Artificial Intelligence system for diagnosing insect pest and disease problems of rice crop. This expert system was developed using Microsoft SQL as the back end and ASP.Net as the front end. The main components of expert system are **knowledge base, inference engine and user interface**

The knowledge base contains the knowledge necessary to understand, formulate and solve problems. The knowledge base was created by entering facts and rules in tabular form (21 tables in all). The knowledge base has 90 rules for identifying insect pests and 105 rules for identifying diseases. **The inference engine** is the brain of the expert system. An inference mechanism was developed using a Microsoft .net program (<https://dotnet.microsoft.com/>) to conduct formalized reasoning to address user questions and develop corresponding rules in the knowledge base (mainly the 'If...then'type statements). A rule based Artificial Intelligence (AI) system was applied in developing the question-answer interface to diagnose the pest or disease of rice crop. This is a dynamic system as each level of the questions is dependent on the answers of the previous questions. **The user interface** (Fig 1) consists of a series of questions and answers to diagnose a problem, the ability to browse major pests/diseases/varieties, as well as access information on crop protection measures, commonly used pesticides for rice and how best to use them.

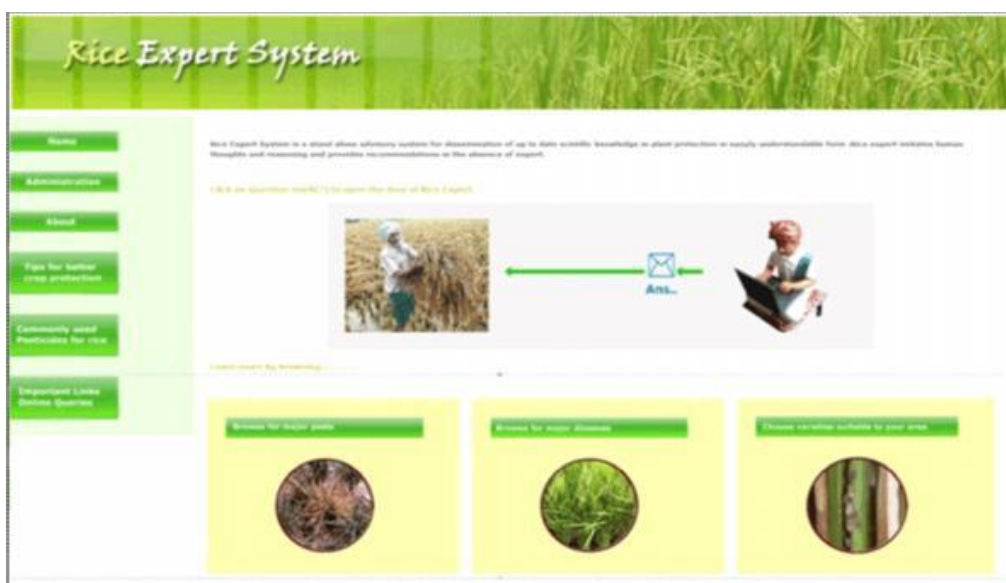


Fig 1: Home page- Rice Expert System

If user already knows the problem, then user can directly access the details by choosing insect pests, diseases (Fig 2) and varieties (Fig 3) links. If the problem is unknown then user has to select the animated ANS image from the home page to identify the problem.

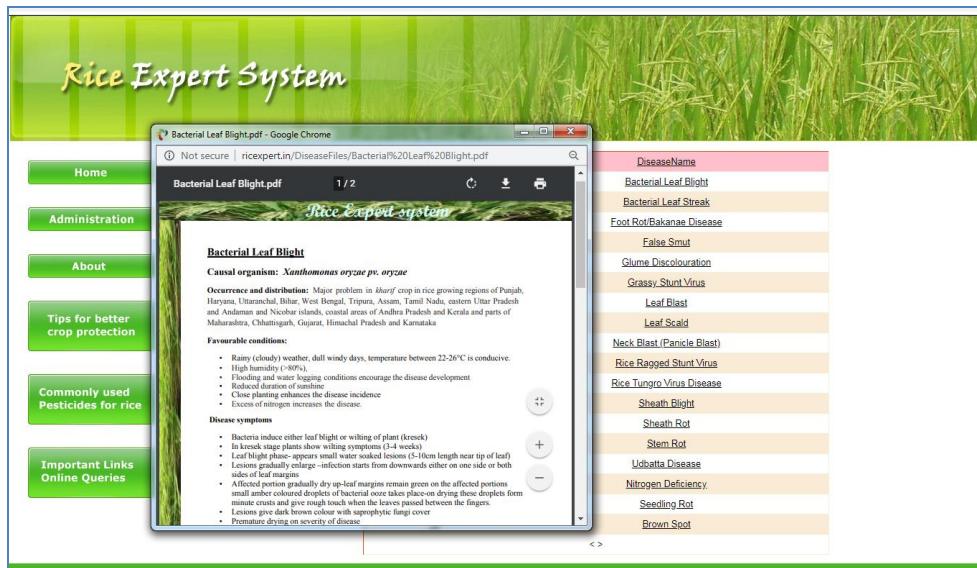


Fig 2: List of Diseases

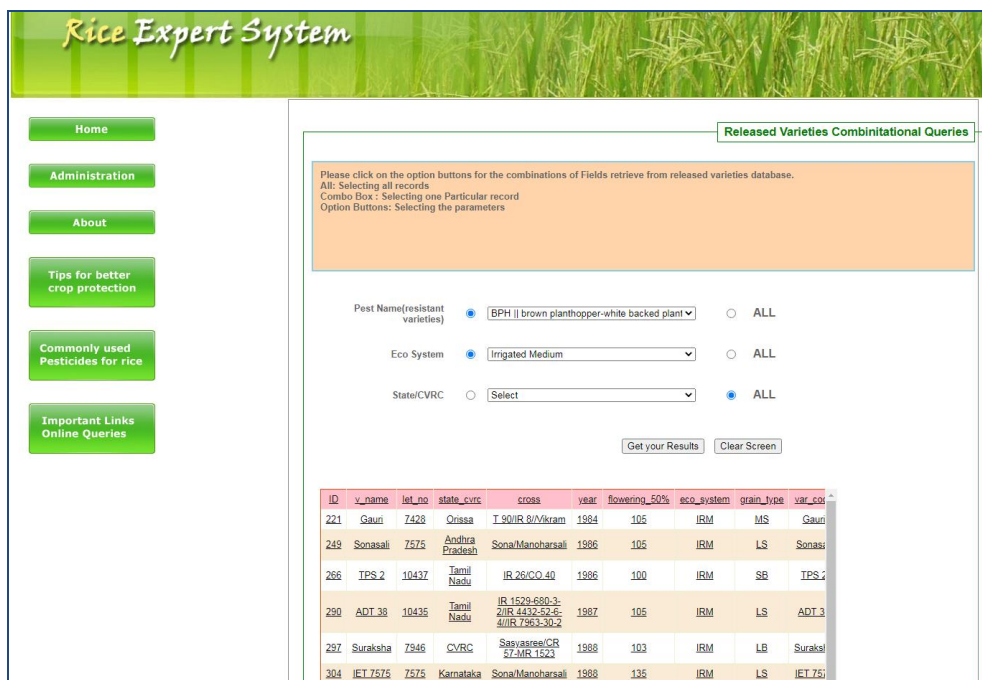


Fig 3: List of Varieties

The questionnaire menu of the expert system begins by collecting information about the location using drop-down menus. At the second level it collects information on weather followed by crop details such as variety, crop stage and so on. At the third level, questions gather information on the various symptoms in the field encountered by the user. This sequence is designed to access the right answer from the knowledge base with regard to disease or insect pest problems. After the input from the user to questions on field symptoms,

details and images of potential diseases or insect pests will start appearing on screen to help the user narrow down identification. At the final level, the engine generates various control measure options as recommendations for controlling the disease or insect pest (Figs 4-8).

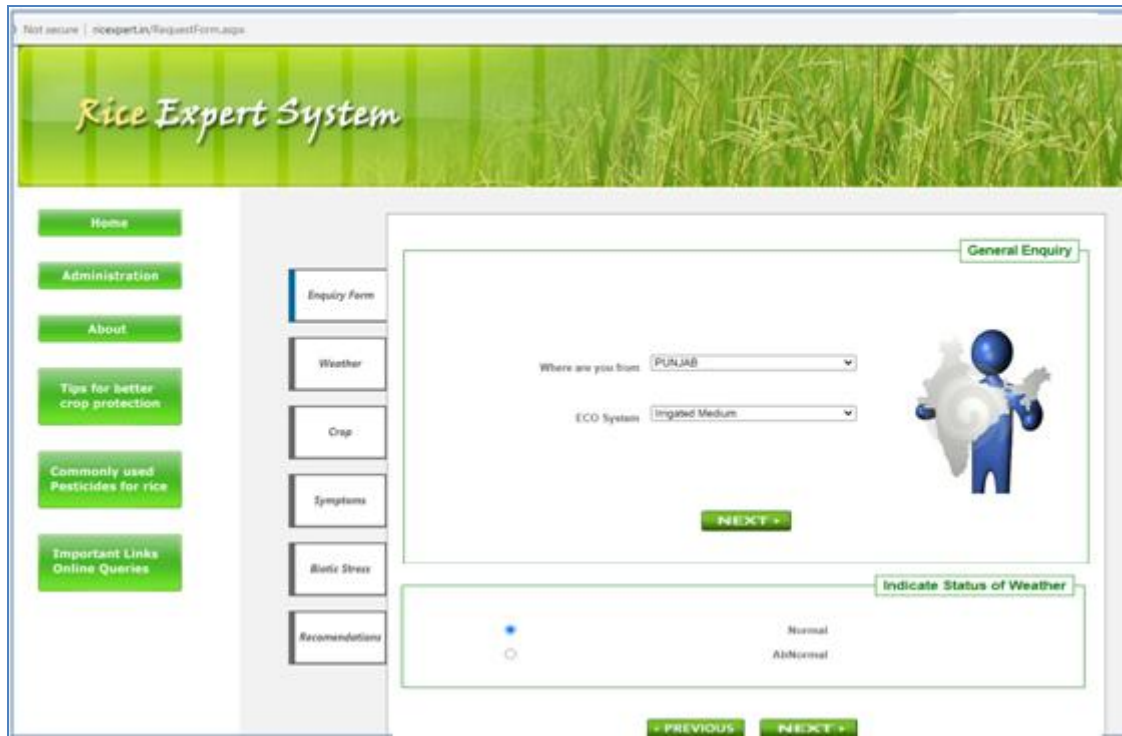


Fig 4: User interface- Location and weather details

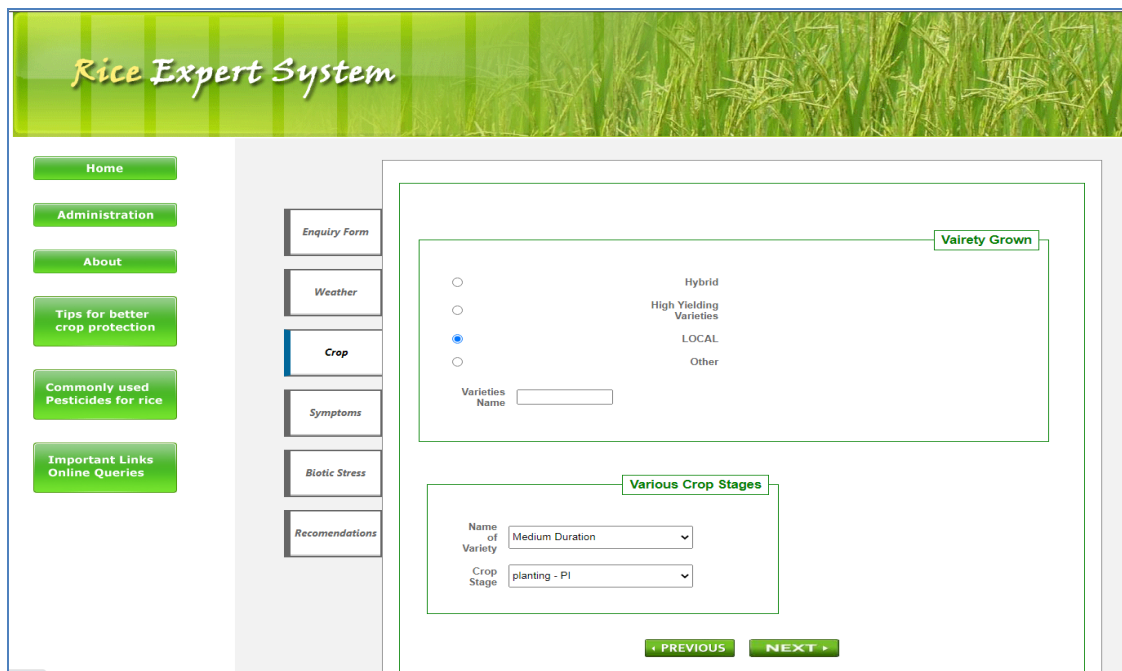


Fig 5: User interface- variety and crop stage details

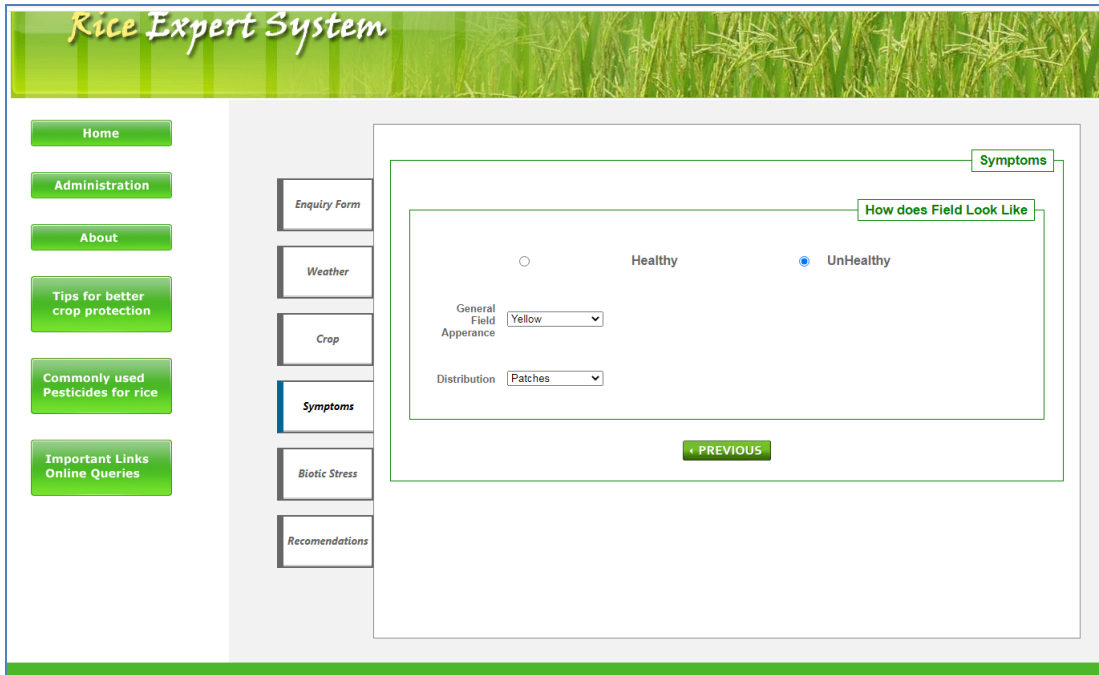


Fig 6: User interface- Field appearance details

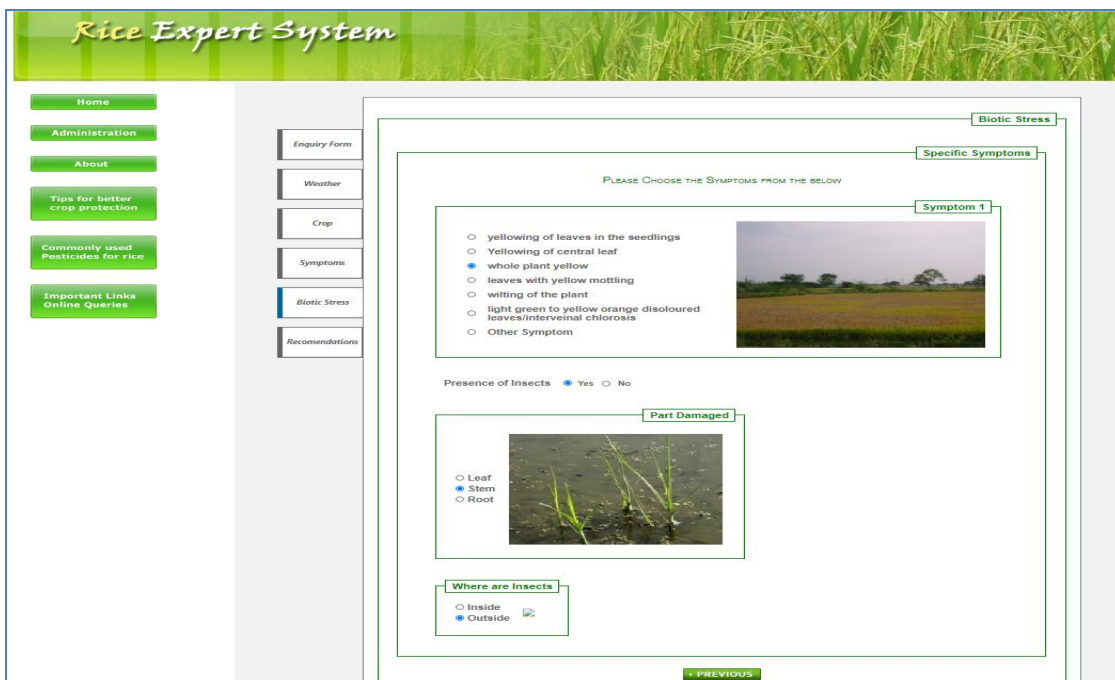


Fig 7: User interface- pest/disease symptoms



Fig 8: User interface- diagnosing and recommendations

In addition to pest/disease identification, the system also provides advice on crop nutrient deficiency. If the system could not diagnose the problem then the symptoms will be added to the database and sent to the expert for diagnosing the pest or disease problem. The system is not only used to diagnose pest or disease problems but also maintains a database of newly emerging rice pests. This data can be further analysed to identify location-specific pest/disease problems, movement of pest/diseases and so on.

This facility is useful to progressive farmers and extension officers to tackle biotic stresses without waiting for an expert advice. Further this system can be integrated with mobile phones and translated the content to regional languages to reach each and every farmer in the country.