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

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.

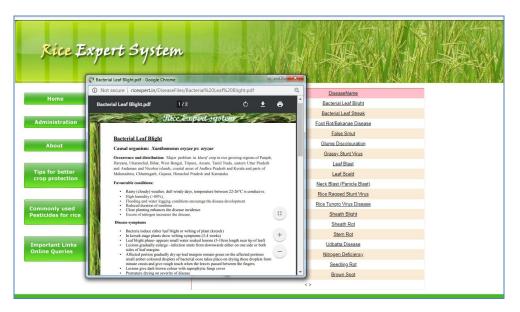


Fig 2: List of Diseases

| Rice Expert Sys | tem | | | | | H | | | | | |
|--|-----------------|-----------------------------|------------------------------------|--|--|-------------|-------------------|----------------|-------------|--------------|-------------------------|
| Home | | | | | | | | R | eleased V | arieties | Combinitational Queries |
| Administration About | All: Se Comb | electing all o Box : Sel | records ecting o | n buttons for ne Particular g the parame | r the combinations of r record aters | of Field | s retrieve from r | eleased variet | ies databas | e. | |
| Tips for better crop protection Commonly used Pesticides for rice | | Pest Nam E | ie(resista varietii co Systi | es) | BPH brown plant | hopper- | white backed pla | nt V C | | | |
| Important Links Online Queries | | 1 | State/CVI | RC O | Select | | Get your R | • esults Cle | ar Screen | | |
| | <u>ID</u> | <u>v_name</u> | let_no | state_cvrc | Cross | <u>year</u> | flowering_50% | eco_system | grain_type | var_cor | |
| | 221 | <u>Gauri</u> | <u>7428</u> | <u>Orissa</u> | T 90/IR 8//Vikram | <u>1984</u> | <u>105</u> | IRM | MS | <u>Gauri</u> | |
| | 249 | <u>Sonasali</u> | <u>7575</u> | Andhra Pradesh | Sona/Manoharsali | <u>1986</u> | <u>105</u> | IRM | LS | Sonas: | |
| | 266 | TPS 2 | <u>10437</u> | Tamil Nadu | IR 26/CO.40 | <u>1986</u> | 100 | IRM | <u>SB</u> | TPS 2 | |
| | <u>290</u> | ADT 38 | <u>10435</u> | <u>Tamil</u> Nadu | IR 1529-680-3- 2/IR 4432-52-6- 4//IR 7963-30-2 | <u>1987</u> | <u>105</u> | IRM | LS | ADT 3 | |
| | 297 | Suraksha | <u>7946</u> | CVRC | Sasyasree/CR 57-MR 1523 | <u>1988</u> | 103 | IRM | LB | Suraks | |
| | 304 | IET 7575 | 7575 | Karnataka | Sona/Manoharsali | <u>1988</u> | 135 | IRM | LS | IET 75 | |

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).

| Rice Expert S | ystem | | | | |
|--|------------------|-------------------------|-----|--------------------|----------------------------|
| Home Administration | Enquiry Form | | | | General Enquiry |
| About. Tigs for better crop protection | Weather | Where are you ECO Sy | | v | 2 |
| Commonly used Pesticides for rice | Crap Symptoms | | NE | | |
| Important Links Online Queries | Rotic Streer | | 141 | | Indicate Status of Weather |
| [| Recomendations | • | | Normal AbNormal | |

Fig 4: User interface- Location and weather details

| Rice Expe | rt System | | |
|---|---------------------------|---|---------------|
| Home Administration About | Enquiry Form | | Vairety Grown |
| Tips for better crop protection | Weather Crop | High Yielding High Yielding Varieties LOCAL Other | |
| Commonly used Pesticides for rice Important Links Online Queries | Symptoms Biotic Stress | Varieties Name Various Crop Stages | |
| | Recomendations | Name of Variety Crop Stage planting - PI • PREVIOUS | |

Fig 5: User interface- variety and crop stage details

| Rice Expe | rt System | |
|---|------------------|--------------------------------------|
| Home Administration | Enquiry Form | Symptoms How does Field Look Like |
| About Tips for better crop protection | Weather | General Field (Vellow V |
| Commonly used Pesticides for rice | Crop Symptoms | Apperance Distribution Patches |
| Important Links Online Queries | Biotic Stress | + PREVIOUS |
| | Recomendations | |
| | | |

Fig 6: User interface- Field appearance details

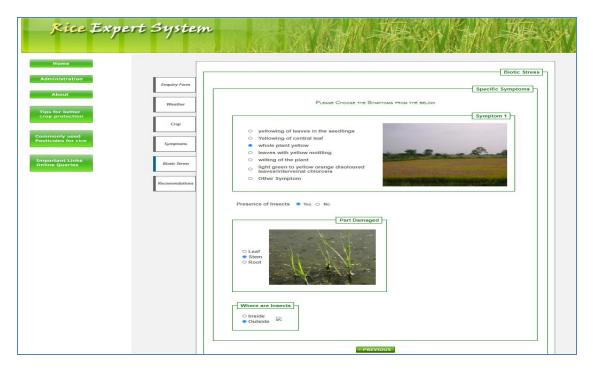


Fig 7: User interface- pest/disease symptoms

| Rice Expe | rt System | |
|---|----------------|--|
| Home | | |
| Administration | Enquiry Form | |
| About Tips for better crop protection | Weather | Sector Date of Datage |
| | Crop | CONTRO MAJORET |
| Commonly used Pesticides for rice | Symptoms | A called and a set of the set of |
| Important Links Online Queries | Biotic Stress | Drom set speed (BB) The set of the set of t |
| | Recomendations | Propulse and ender the Constant and Constant |
| | | |

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.