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Rice Knowledge Management Portal for Technology Dissemination: A Case Study for Haryana, Punjab and Uttarakhand States

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ABSTRACT

Information and Communication Technology (ICT) breakthroughs have brought new opportunities to restructure the knowledge transfer environment. ICT technology has opened new avenues and brought new challenges to the end users. The Knowledge Management (KM) practices using Information & Communication Technology (ICTs) has emerged as fastest viable solutions to the knowledge transfer mechanism over the traditional system, where information sharing mechanisms appear to be inadequate. In Asia, rice is not only the staple food, but also constitutes the major economic activity and a key source of employment and income for the rural population. Data, information and knowledge differ from one rice growing region to another. Knowledge varies between contexts and emerges from the flow of information around the system. In multiple stakeholders of the rice value chain, the interaction between the data, information and knowledge gets much complicated and requires a more sophisticated approach. Keeping in view the potentials of ICT applications, an attempt has been made to develop a portal for knowledge dissemination. The Rice Knowledge Management Portal (RKMP) has been envisaged to enable rice workers to create, manage and share scientific, technical and market-related information for the benefit of all stakeholders. This portal helps to strengthen communication and provides a platform for collaborative action and information sharing among various key players and stakeholders in the rice sector. The portal deals with the concepts of knowledge dissemination options using Information & Communication Technology. The RKMP portal (http://rkmp. iari.res. in) is a getaway for providing rice knowledge to the stakeholders. The portal consists of several information systems and decision support modules to give a unified solution for a particular query. A case study has also been taken for states of Haryana, Punjab and Uttarakhand by integrating the state specific content collected from these states. The portal provides many specific queries for rice research and cultivation, such as queries related to variety selection, management of disease, insect, pest of rice, rice statistics, site specific frequently asked questions (FAQ).

Key words: RKMP, IARI, Gap, Km, ICT

INTRODUCTION

Agriculture continues to remain a major sector of the Indian economy. Extension support to the farmers is still inadequate, this needs rethinking as technological progress in agriculture is crucial for overall agriculture production of the country. Therefore, we need to revamp and revitalize the extension service in such a way that it reaches the farmers more effectively. Due to the slow pace of agricultural growth during the last decade, farmers in large parts of the country are facing distressing situation owing to stagnant farm productivity, rising production costs and falling net incomes. The new agricultural paradigm in India will have to be recast to take advantage of the wealth of knowledge available to achieve multiple goals of sustaining the food security, income, jobs etc. The ICTs along with Knowledge Management strategies have significant role to play in evolving such a vibrant agricultural system. Rice is the major cereal crop grown in about 44.6 million hectares in the country. India represents all kinds of diversity under which rice is grown across the globe. No other crop is as versatile as rice. Rice crop is interwoven in the cultural, social and economic life of millions of Indian and it holds the key for food and nutritional security of the country. Rice production scenario in the country during the past decade presents a gloomy picture of compound growth rate of just 1.7 per cent. To meet a production target of 125 Mt by 2025, all inclusive of food requirement, seed for cultivation, storage in buffer stock and a share for exports, productivity in irrigated area needs to be enhanced by 1.5 tonnes/ha and in rainfed lowlands by about 1 tonnes/ha. Given the burgeoning task of further enhancing the production and productivity of rice, the existing information sharing mechanisms appear to be insufficient.

India, has the second largest number of extension workers in the world (110,000), of which majority are working in the rice regions. Farmers are beginning to set extension priorities at the district and block levels. Providing continuous knowledge support to this number of extension workers requires a 24X7 support service, and this could be possible only through building a knowledge management portal on rice (http://rkmp.iari.res.in and www.rkmp.co.in). In this backdrop, Rice Knowledge Management Portal has been developed to strengthen

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research, extension, farmers, and private sub systems, partnerships and networks, for the better flow of rice knowledge and information contributing to the overall rice development A case study has been made for the states of Haryana, Punjab and Uttarkhnad.

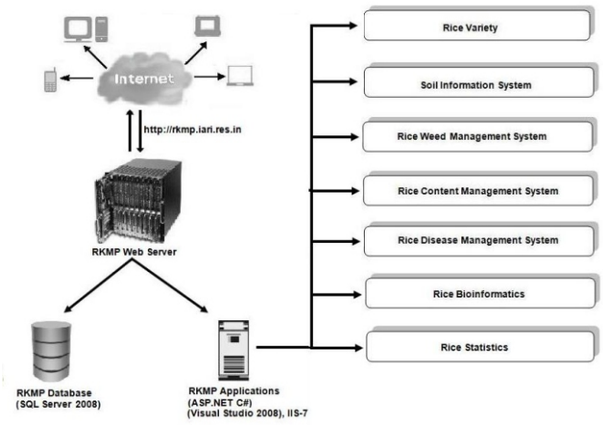
Rice Knowledge Management Portal (RKMP) directly contributes towards the vision of promoting the knowledge as an essential component in bringing about sustainable rice development. It also helps in building the comprehensive digital content related to rice, improving access to textual, graphical, audio, video and bibliographic information for the use of millions of rice farmers, community of scientists, line department personnel, developmental professionals, key players in public and private sector, export houses, students, trainers, market forces, millers and general public. The portal will enable millions of rice workers located in various parts of the country to be effective and efficient in collecting, organizing, summarizing, analyzing and synthesizing the rice knowledge helping in better decision making. The Rice Knowledge Management Portal (RKMP) has been envisaged to enable rice workers to create, manage and share scientific, technical and market-related information for the benefit of all stakeholders.

METHODOLOGY

The prototype and design of system looked at http://rkmp.iari.res.in was developed at Unit of Simulation and Informatics, Indian Agricultural Research Institute, New Delhi. India during the year 2009-2011. The data from different states collected from Rice Research station, Kaul, (Haryana), Panjab Agricultural University, Ludhina and GBPUAT, Pant Nagar (Uttarakhand). The information to different relating attribute *e.g.,* rice diseases, pests, weeds, variety were collected and integrated to the system. The database design was developed with proper normalization to reduce the data redundancy. Site specific data were compiled and integrated to the portal for user friendly use through user interface.

Systems design

A proper system design methodology was adopted consisting of architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design is therefore, the process of defining and developing systems to satisfy specified requirements of the user. The system follows object-oriented analysis and through design methods which becoming the most widely used methods for computer systems design.



Microsoft web technology (ASP.NET) has been used to develop the system as it has many advantages over other platforms when it comes to creating Web applications. Probably the most significant advantage is its integration with the Windows server and programming tools. Web applications created with ASP.NET are easier to create, debug, and deploy because all tasks can be performed within a single development environment, Visual Studio.NET. Microsoft ASP.Net has been used as front end and MS-SQL server as back end. The applications developed in ASP.NET Framework (version 3.5) as the front end and SQL-Server 2008 as the back end. The use of Java Script is the key point in the development of different bioinformatics tools. The .NET environment uses to facilitate the flexibility to customize the portal. This system provides online storage/ updations and retrieval facility in addition to information to rice researchers, farmers and others. The site specific information can be retrieved very easily. The Portal consists of fine modules *i.e.* Module-1, module-2, module-3, module-4, module-5. After inserting the data in database, the output in the form of reports can be created. In this way the required output can be obtained in the form of grid view as well as graphical representation like charts.

Module 1: Security (Login with valid user name, Password and login type)

The module deal with the authentication of users. If a user enters a user name, password and login type (administrator, RKMP users, scientist, extension officers, private sector, rice researchers, farmers),the application checks its validity. If the password is valid then, option is given to control panel of the RKMP web application, otherwise "Invalid User/Password" message is displayed. The validity of data entered by the user during the various processes is checked through different validation checks. For example, there should not be any characters entered in

the numeric fields. Likewise, if error occurs, then it handles that particular error and give the required messages.

Module 2. (Add records to RKMP database)

This module is used for maintaining database of the RKMP Portal. This function includes: User registration, Crop detail information, Rice disease information, Location specific information, Soil test information, Variety information, Deficiency information, Rice weed information, statistics for Area, production and productivity. Different field of the variety and diseases were customized and stored in the database so that user can search site content selection and disease management.

Module 3. (Update records to RKMP database) This function is used to update records to RKMP database which is updated by administrator only

Module 4. Bioinformatics tools

Different bioinformatics tools are integrated into the rkmp portal *i.e. o*nline analysis of the sequences are also possible to the portal. One of the online platforms i.e. Rice Protein Station (RPS) is built for the analysis of rice proteins sequences. Rice Protein Station is a platform where user can browse the structures of available rice proteins (58). These structures can be viewed by protein properties like charge, secondary structure etc. We can also find the specific amino acids and atoms used in the construction of these proteins can also be found on it.

Sequences of all the known proteins (58) were downloaded from R.C.S.B. (http://www.pdb.org/pdb/home/home.do) in the form of PDB.

Jmol: Jmol (3) is a freely available Java applet used to view the 3d structure of proteins, has been easily integrated here. Java and ASP.NET (C#) scripts were used to integrate Jmol and its buttons with the RKMP portal which is based on C#. Several radio buttons (4) like select PDB, schemes, chain, color, elements and amino-acid composition (including Ramachandran Plot), also check boxes (4) like label, surface (dot surface), backbone, cartoons, spin were used for the ease of user.

Rice BLAST: Rice BLAST tool is a homology search service to compare a query sequence to a specified rice sequence database. This search tool uses sequence data to facilitate specific homology search of any given sequence data. In this tool, users can select specific database *e.g.* rice genome DB, japonica genome DB, indica genome DB, EST DB, chloroplast genome DB and mitochondrial genome DB. This facilitates target-oriented comparisons for optimal local alignments. Rice BLAST tools are accessed through http://riceblast.dna.affrc.go.jp/ link.

Bioinformatics Tool Suite: This is one of the tools which has been integrated with the portal for retrieving and analysis of biological data and extracting the information from them. These Biological data can be DNA or protein sequence. This set of tools allows user to carry out detailed analysis on query sequence. Java scripts and .NET(C#) script have been used to develop the tool suite.

Module 5. (Search records from RKMP database) Searching of a particular information from a large database is a key features of a system. This module provides a quick search tool for developing the desired information on the screen. This function is used to Search RKMP dtatabase *e.g.* display crop detail information, search diseases of rice, search area-wise soil test information, search variety information area-wise, ecosystem-wise, search deficiency information, weed information, graphical as well as tabular statics report on area , production and productivity.

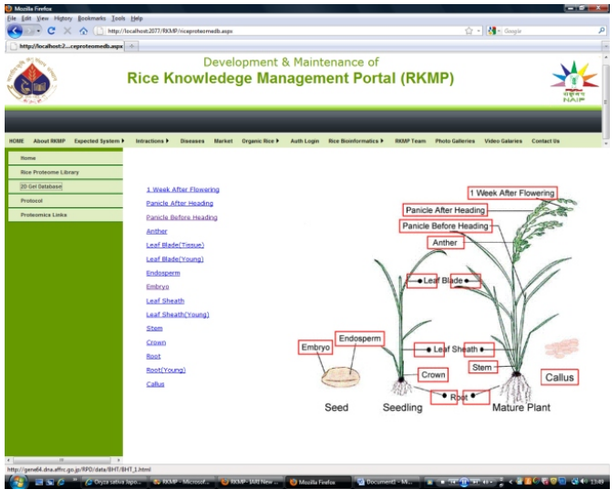
RESULTS AND DISCUSSION

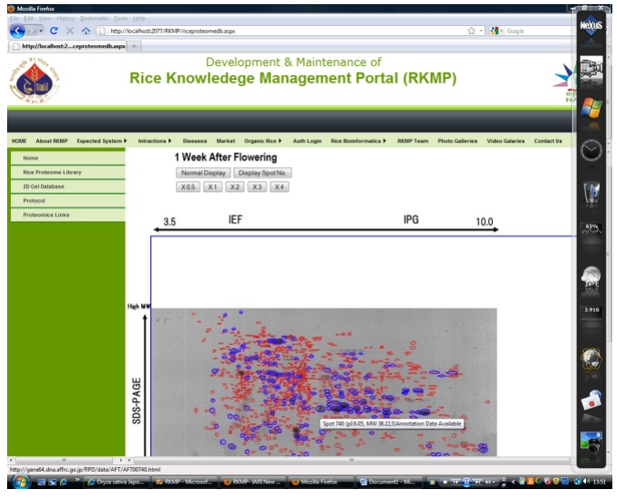
The output briefly describes the systematic approach adopted to develop and integration of various aspects of site specific content management system, disease, weed management system, soil information system, variety selection system, FAQ system, Bioinformatics Rice Knowledge Management Portal (RKMP). Rice content management system for Punjab, Haryana, Uttarakhand. Rice species specific BLAST tools are successfully integrated in RKMP. The Bioinformatics Tool Suits contains 25 tools for various bioinformatics analysis work. Rice varieties and their information are successfully integrated in RKMP. User can access the data according to provided by options *e.g.* varieties from different Ecosystem, State and Region wise in the dropdown list. Rice Protein Station is one of the most comprehensive databases available for the rice proteins (58). The database collected from RCSBP rotein Data Bank (www.pdb.org). It can be useful for the Molecular model display & analysis in biochemistry, molecular biology, organic & inorganic chemistry. We can find the sequence and 3d structure of the protein in a single click on a single platform. Rice varieties 445 and their information are successfully integrated in RKMP database. User can access the data according to the by options provided *e.g.* varieties from different Ecosystem, State varieties, Region varieties etc. Rice Diseases are divided into 5 major causing agents namely. Bacterial, Fungal, Nematodes, Nutrient Deficiency/Toxicity and

Viral Diseases. Bacterial diseases Management contain necessary information about 6 Major Rice diseases categories. These are fungal, Nematodes, Nutrient Deficiency/Toxicity and Viral Diseases. These categories contain 12, 4, 15/6 and 5 diseases information accordingly.

Basmati Rice varieties and their provided information are successfully integrated in RKMP. User can access the data according to option *e.g.* Pusa Basmati Rice and All India Basmati Rice categories.

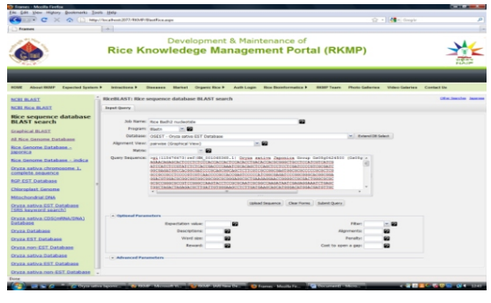
Rice Proteome Database: The 15 reference maps comprise around 10,000 identified proteins showing tissue and subcellular localization, corresponding to around 4000 separate protein entries have been reflected in the database. It also provides links to rice proteomics protocols, 2D-PAGE gels database, and other useful link.





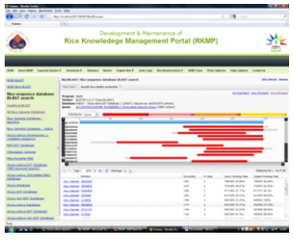
2D Gel PAGE database for different tissue of Rice

84 definitions are integrated in the bioinformatics Key-words field.Almost 80 nucleotide sequences and information related sequence e.g. of chromosome no.11 (nucleotides which have been worked by India) has been integrated in the database and rice sequence search (RSS) tool has been developed.The portal has a several tools related to bioinformatics which ha ve been integrated here.



Graphical BLAST- Providing a graphical interface can show useful information as full length graphical alignment of query and all hit subject sequences. (With screen enlargement /reduction) and one line alignment of query and each hit Subject sequence.

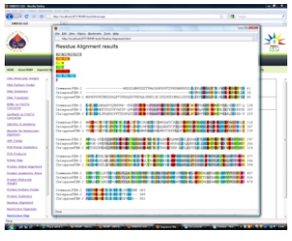
Rice Genome Database: All rice genome sequences collected from the GenBank ftp server have been integrated on the portal.



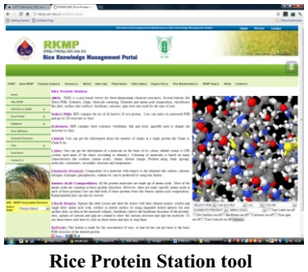

Graphical BLAST tool

Result of Graphical BLAST tool

The Bioinformatics Tool Suits is a collection of programs of analysis of nucleotide or protein sequence. 25 tools are successfully integrated in RKMP Bioinformatics Tool Suite.



Interface of DNA pattern finder



Rice Protein Station tool

Rice protein Station

58 common rice proteins were successfully integrated in the portal. User can easily see the structures of rice protein and its features on this platform (RPS) by Jmol applet.

CONCLUSION

There is always scope to improve any real life situation. If it would not be the case every commercial software package would not have various successive improved versions after the first release. At present we see the following enhancement which can be carried in RKMP

RKMP has been developed for Rice crop. The present database has been implemented using SQL Server 2008. Better support at the backend in terms of security, concurrent usage etc. A day will come when RKMP will be enriched with all sorts of information regarding the rice crops. This will become the starting point for the development of Rice portal. RKMP has been developed taking into account the job of providing decision support to the agriculture workers, students, research workers, extension workers and others. They will have information ready on hand through this software. A module on on-line chat can be build up so that end users (farmers, extension workers etc.) can interact with the experts and get required information and identification services. Last but not least other software can be developed following the lines of RKMP but related to other fields of technology. Financial support to the work by NAIP, ICAR is duly acknowledged.

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