Design and implementation of on-line data submission and retrieval system for coordinated research trials in food legumes

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ABSTRACT

Online data submission and retrieval system for coordinated research trials in food legumes has been developed with an aim to reduce the time and cost in collection, compilation, data analysis, retrieval and report generation. At the first instance, efforts were made to use plant breeding data as it covers more than 60% of total trials. The system has been developed using ASP.NET with C# as the front-end and SQL Server 2005 as back-end. This system has three online functional modules viz., Data Entry and Submission Module, Data Analysis Module and Report Generation Module. The system is designed to be user-friendly and is completely menu-driven with options for assigning login IDs and passwords. It can be accessed efficiently through URL: http://www.aicrpmullarp.res.in. The complete system has been presented, tested and validated during different Group Meets of AICRP on MULLaRP. The implemented system being satisfactorily used by the centres of AICRP on MULLaRP since last one year and has significantly reduced the manpower and processing time required for compilation, data analysis and preparation of annual report. The present article describes the design and implementation of on-line data submission and retrieval system for coordinated research trials in food legumes.

Key words: AICRP, Trials, Retrieval System, ASP.NET, JavaScripts, SQL Server 2005, Data Booklet.

INTRODUCTION

In India, the All India Coordinated Research Projects on various crops/commodities are unique in the world which are undertaking basic, strategic and applied research programmes conducted in different locations situated in different agro-climatic zones. Voluminous data on different aspects of these coordinated trials are being generated, recorded, analyzed and disseminated in the form of Annual Reports by various centres of AICRPs (All India Coordinated Research Projects). Under AICRP on MULLaRP (Mungbean, Urdbean, Lentil, Lathyrus, Rajmash and Pea), trials are conducted every year on different crops in different zones/ parts of the country in all three seasons (viz., Kharif, Rabi and Spring & Summer) in plant breeding, agronomy, plant pathology, entomology, microbiology and Nematology disciplines. These trials are conducted on 27 centres located in different parts of the country.

In the manual system of data collection, compilation, analysis and report preparation of coordinated trials data, the problems like lack of complete information at one place, delay in retrieving the data from respective centres, problems in accurate and correct data analysis and delay in preparation of final report before the workshop were observed. All this requires the development of online information system that can be accessed by participating centres using Internet (Sharma et al., 2006; Kumar et al., 2006; Francis et al., 2010). A user-friendly data submission and retrieval system for AICRP on MULLaRP has been developed with an aim to reduce the time and cost on collection, compilation, data analysis, retrieval and report generation for plant breeding trials. Therefore, a research project was initiated during the year 2010 at Indian Institute of Pulses Research, Kanpur for designing “On-line data submission and retrieval system for AICRP on MULLaRP”. At first instance, efforts were made to use plant breeding trials data as it confined to more than 60% of total trials. The developed system is beneficial over the existing one. The present article describes the design and implementation of data submission and report generation system for AICRP on MULLaRP.

MATERIALS AND METHODS

The study was conducted during 2010-2012 at IIPR, Kanpur. On-line data submission and retrieval system for AICRP on MULLaRP is developed using data collected from trials (AVT 1, AVT 2, IVT, AVT 1+AVT 2) conducted at five
agro-climatic zones: North West Plain Zone (NWPZ), North East Plain Zone (NHZ), South Zone (SZ), Central Zone (CZ) and North Hill Zone (NHZ) for five pulse crops: Mungbean, Urdbean, Lentil, Lathyrus, Rajmash and Pea grown in three seasons: Kharif, Rabi and Spring & Summer in the country. Proposed system has been developed as a web-based application using ASP.NET technology. It has client-server based three tier architecture comprising Client side interface layer, Server side application layer and Database layer. All the layers in this architecture are independently developed using appropriate technology (Dahiya et al., 2008; Dahiya et al., 2004 and Theophile et al., 2014).

The Client side interface layer has been developed using HTML and JavaScript that contain forms and reports for accepting information from user and validating those form using JavaScripts. Server side application layer is implemented using ASP.NET with C#. These Active Server Page (ASP) generate HTML pages according to the user’s action and request. Database layer for which the relational and normalized database structure was used with its implementation done using SQL Server 2005. It is used for designing the tables and relationship among the tables (Stafne et al., 2001; Morris and Raykowski, 1993; Mundankar and Karibasappa, 2008 and Dariusz et al., 2010). All tables have

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FIG 1: Flow of information for online data submission & retrieval system.
proper linking via primary key-foreign key relationship. Fig. 1 shows flow of data/information for the proposed system.

RESULTS AND DISCUSSION
Functionalities of System: Developed system is web-based, user-friendly and integrated system. Fig. 2 shows the home page of the system.
Types of Users: There are normally three types of users for the system. These are:
1. System Administrator
2. Centre Incharge
3. Reporting Scientist

Each type of user having own authentication through valid user name and password. System Administrator is the user who manages the overall system operations and has the right to add, update and delete any part of the information entered in the database. In add, update and delete operation, System Administrator can see the category options like Centre Name, Centre Incharge, Reporting Scientist, authentic Username and Password, Zone-wise Variety Code and Number of Replication. Data analysis and report generation is done by the System Administrator. Centre Incharges are the users who approve/disapprove the Data Booklet information entered by the Reporting Scientist of the centre. They have the right to add, update and delete season, crop, trial and year captured in the database for a particular centre. Reporting Scientists are the persons who can enter information regarding Data Booklets. They are only the users responsible for data entry and its submission of coordinated trial data through valid user id and password.

System Modules: Proposed system has three basic functional modules viz., Data Entry and Submission Module, Data Analysis Module and Report Generation Module.

Data Entry and Submission Module: Data Entry and Submission Module of the system has been developed for entering data related to Data Booklet details, general notes on growing conditions, yield data, days to 50% flowering, days to maturity, 100-seed weight (g) and plant height (cm). Various data entry forms have been designed and developed for entering the basic information about each Data Booklet.
for every plant breeding trial of a particular centre (Fig. 3, Fig. 4 & Fig. 5). This functionality of the system is required at centre level and done by the Reporting Scientist through valid user id and password assigned by the respective Centre Incharge. Facility for adding, deleting, updating and viewing the records of the database have been provided to the Reporting Scientist before the approval of the Centre Incharge.

Various validation checks (like approve/disapprove of Data Booklets) have been incorporated in the system to ensure the accuracy and integrity of data. This functionality is done by the Centre Incharge. The developed system also provides the facility of data entry and submission through MS-Excel file format at the browser itself.

**Data Analysis Module:** Most of the on-line systems provide data in the form of on-line reports, but these don’t provide the facility to analyze the data at the browser itself (Miliar et al., 1982; Kumar et al., 2013 and Ravishankar et al., 2009). Data Analysis Module of this system has the facility of data analysis at the browser level. In this Module, RBD (Randomized Block Design) analysis is done for yield data of selected Data Booklet. After selection of data booklet code, all the related information of data booklet are filled up automatically. By clicking on “Calculate ANOVA” button for calculation of CV%, CD (P=0.05) in kg/ha, General Mean (GM) in kg/ha, and state average yield are calculated. When all the information is calculated by the system automatically using statistical formulae, click on “Submit ANOVA” button to save the data for report generation (Fig. 6).

**Reports Generation Module:** Report Generation Module of the system has been developed to retrieve the information as per requirements of the users (Sarkar and Naik, 1996 and Chen and Huang, 2007). User customized reports in the form of PDF format have been designed to generate the comprehensive/integrated information on various parameters of yield data. The search results comes in the form of a table including various fields of information. This functionality is also used by the System Administrator for preparation of final report before the AICRP Workshop. Report Generation Module of the system generates two types of reports:

(i) **Information Sheet Reports:** This report generates the information sheet for a particular zone during a desired year and particular trial. The desired information sheet constitutes following information (as per the options selected by the user: Zone, Season, Year, Crop, Trial): Name of Location/
Centre, Name of Reporting Scientist, Date of Sowing, Net Plot Size (sq. mt.), Number of Irrigation/Rainfed, Net Plot Fertilizer (N:P:K), Date of Harvesting and Date of Data Received. After selecting the required parameters the following information sheet report (Fig. 7) is generated.

(ii) Location-wise data reports: System generates quick and accurate report on location-wise yield data which provide ranking (rejected/accepted) of varieties based on particular trial in a specific zone for average yield performance and other related characters independently. This report shows the Variety code, Location-wise yield data (kg/ha) and Mean data (kg/ha) for a particular zone chosen for a particular trial during a desired year and season. This is a very significant report for the users of the system and also useful for preparation of Annual Report presenting in Workshop/Group Meet.

CONCLUSION
On-line data submission and retrieval system for coordinated research trials in food legumes is of much help to the Planners/Researchers associated with AICRPs activities. This system facilitates collection, compiling the data, data analysis and report generation at a central place of project coordinating unit, while allowing entry of data from different locations/centres on-line. Quality reports on every aspects of developed system can be generated online. It also provides the facility of analyzing yield data (RBD analysis) on-line without having much knowledge of statistical analysis and computer operation. Data security has been taken care off by providing security at administrator and data entry/data analysis level. The system ensures that only valid information is entered into the system.

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REFERENCES


