Web based Digital Library of Groundnut in India using Client Server methodology

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Abstract - Development of web based digital library is an attempt to share the vast research information on groundnut available at NRCG and other agricultural organizations of India. This web solution has provided complete snap shot of the groundnut research in India by collating all the information from different sources and shared through worldwide web using effective digital library technologies. These research results were accessed by different stakeholders and transformed them into educational and information services further to their stake holders. The developed portal which provides one stop shop solution related to data, information and images related to Released varieties, Wild species, Diseases, Pests and Nutrient Disorders of Groundnut in India using high end technologies like SCORM etc. This application was made available to all the stake holders involved in groundnut research and groundnut agriculture over World Wide Web and implemented using web 2.0 technologies. The Linux based Red Hat Linux operating system is used for implementing the base layer upon which MySQL Database, Apache Webserver with Tomcat Java Engine and SCORM is installed for effective implementation of digital library. This enhanced the robustness, makes resource share and shares exhaustive information related to groundnut more conveniently over worldwide web.

Key Words: Online Groundnut library, Digital Library.

Introduction

In recent years, the great expansion of distributed resources such as the Internet has set-up a framework for the realisation of an age-old vision: gaining first-hand access to vast amount of information. The concept of a digital library is a step towards the realisation of this vision, and can be regarded (from a computer science perspective) simply as a distributed information system. However, the essence of a digital library is information, and brings new challenges to information retrieval (IR). In this project, we focus on image based information model for distributed digital libraries and on techniques for using dynamic links and the implication of this digital library for the process and nature of distributed information retrieval. Likewise, this Digital Library initiative will promote and explore the innovative interface of ICTs for image-based learning and information divulgence.

The main objective was to survey, collect and create a database of images of released varieties, wild species, diseases, pests and nutrient disorders of Groundnut in India and sharing them over worldwide web by developing efficient information system that helps different target groups in the process of decision making & e-learning.

Initially we have identified varieties, pests & diseases to be photographed systematically through various

approaches like surveying and internal group discussions with crop scientists of NRCG. Once identified we proceeded with collection, documentation, compilation & editing of these photographs. Then we studied various technologies available as on date and finalized the layout designing of input formats and input screens that are used to capture data and enter in the system. Later the layout designing of output formats and output screens to be generated are finalized. Then the process logic developed that is used to process the data and creation of database using RDBMS by Oracle/MySql. Various learning modules were developed to help in capacity building of different stakeholders of Groundnut. A Groundnut Germplasm Resource Information System (GGRIS) was also developed as a part of digital library. As a part of feedback received from scientific community a Linux based CAB Abstracts information system is developed and implemented as a part of digital library which makes Digital Library as a one stop shop solution to all groundnut information and education needs of different stakeholders. These online sharing of all groundnut information and education resources is practicable and was implemented successfully at National Research Centre for Groundnut.

The digital library system described here establishes a framework in which information is directly and immediately accessible through the Internet. Moreover, it is easily extensible and offers an easy to use powerful and flexible interface for information retrieval. This is crucially important for effective decision making, and thus, for increasing productivity and profitability in the long term.

1) Materials and Methods

The system was developed with following hardware and software tools:

(A) HARDWARE

Server   : Intel Pentium IV 2.4 GHz Dual Processor, Original Intel Server Board4 GB RD RAM and 400GB HDD

Client :   Any ordinary desktop with minimum 1 GB RAM.

(B) SOFTWARE

Following is a reference list of software used to develop and implement the software:

Operating System   :   Red Hat Linux 9.0 (Linux operating system) with

WebSPIRS installed.

Client-Side Interface :   Standard Browser, Digital Library URL is provided to all.

Databases   :   All GN Information and CAB Abstracts copied to Server.

File Server   : WebSPIRS, Samba Server

Later feedback from scientists of NRCG were collected and they wanted to access these abstracts and information related to groundnut germplasm from anywhere in the world. Then it was decided to go for a Web based server called WebSPIRS to enhance the access of the information through worldwide web.

At the core of the system is implemented by Apache Server which is a open source software and Cab Abstracts has to be purchased from Silver Platter. CAB Abstracts is the largest professionally-produced database covering international issues in agriculture, forestry, and allied disciplines in the life sciences. The database contains over 6.3 million records (with 300,000 abstracts added each year) from over 7,500 journals. books, and conference proceedings. It is an

applied life sciences bibliographic database emphasising agricultural literature, which is international in scope. Being NRC for Groundnut is a national agricultural institute working in the area groundnut, NRCG has purchased agricultural abstracts from CABI. These Abstracts is a fully searchable abstracts database of internationally published research on agriculture, from genetic resources to gene expression, and propagation to storage. Developed from CAB Abstracts, the original applied life sciences database, Agricultural Science Abstracts' coverage includes genetic resources, breeding, propagation, crop management, pests and diseases, plant physiology, storage and marketing.

We developed and implemented Digital Library which uses a combination of Apache HTTP Server and Tomcat Java Engine. All requests for static content is served by Apache and requests for dynamic content is forwarded to Tomcat engine.

Apache HTTP Server is free and open-source cross-platform web server software and is developed and maintained by an open community of developers under the auspices of the Apache Software Foundation. Apache HTTP Server is cross-platform, meaning that it is built for Unix-like systems (e.g., macOS, Linux and FreeBSD) as well as Windows. Tomcat Server, is an open-source Java Servlet Container and implements several Java Enterprise specifications including Java Servlet, JavaServer Pages (JSP), Java EL and provides a "pure Java" HTTP web server environment in which Java code can run. Tomcat is developed and maintained by an open community of developers and is open-source software.

2) Results and Discussion

The system architecture of DL is implemented by using Client – Server architecture which is shown in the following figure.
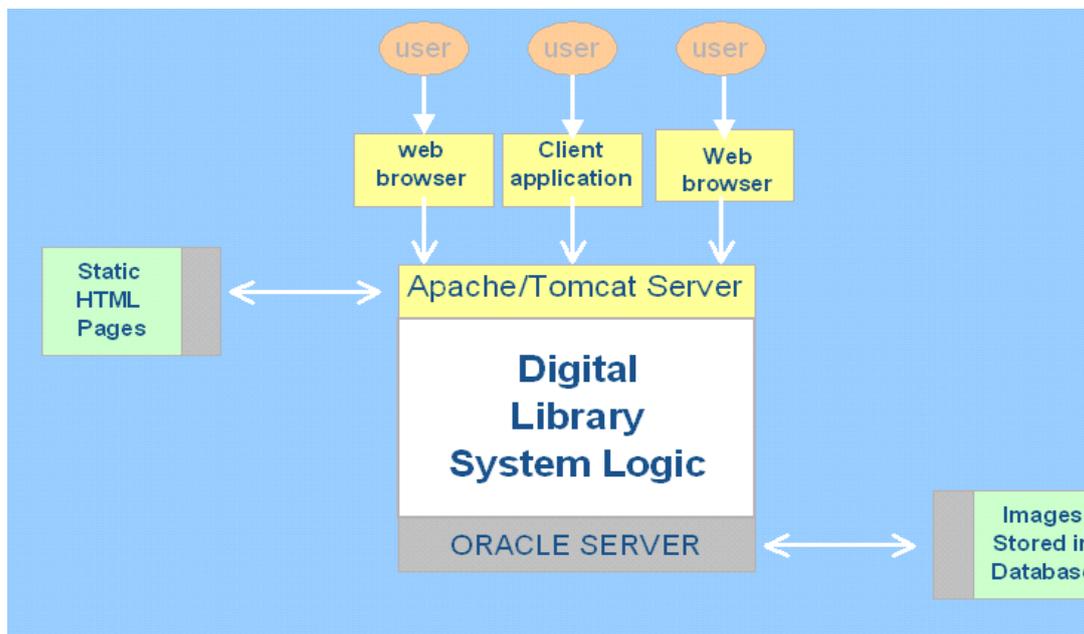
The salient features of this software are as follows:

a). Server: The Apache Server receives requests from clients for various operations. The server is responsible for concurrency control, recovery, transaction and storage management. The Server is responsible for query processing and all the operations on Digital Library database through Tomcat engine. After initialization, the server waits for a query from its client. The results of the query that are obtained by processing it are sent back to the client through Apache server in case web based solution and through Samba server in case of LAN based solution.
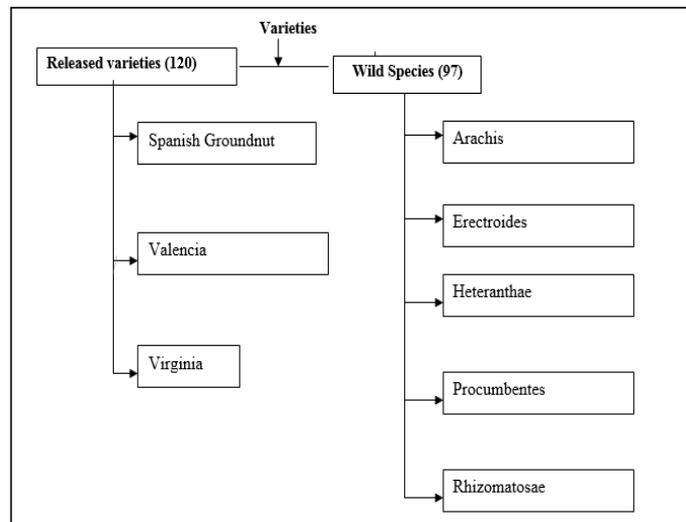
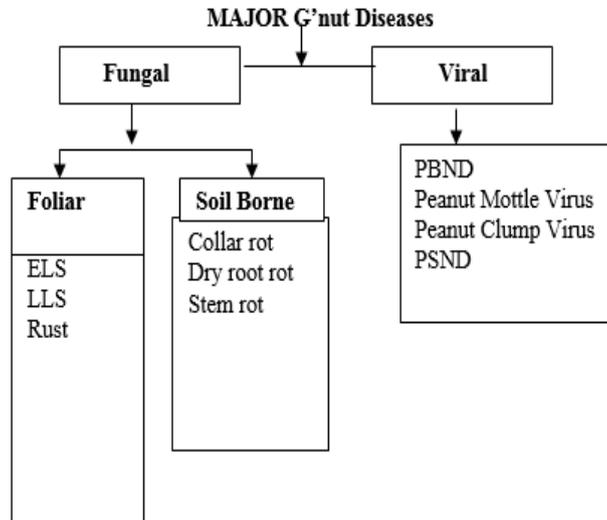This is the middle tier between the Client and the Database is Digital Library System Logic which includes SCORM. The user interacts with the SCORM form based GUI from the client and the request that is sent to the Server is served by the Apache-Tomact / Samba Server. The both the cased Apache-Tomact / Samba Server waits for the result of the request from the file system/database and sends it back to the client in proper format.

b). Client: An up to date Browser will serve the purpose. The system should be developed in such a way that it becomes user friendly.
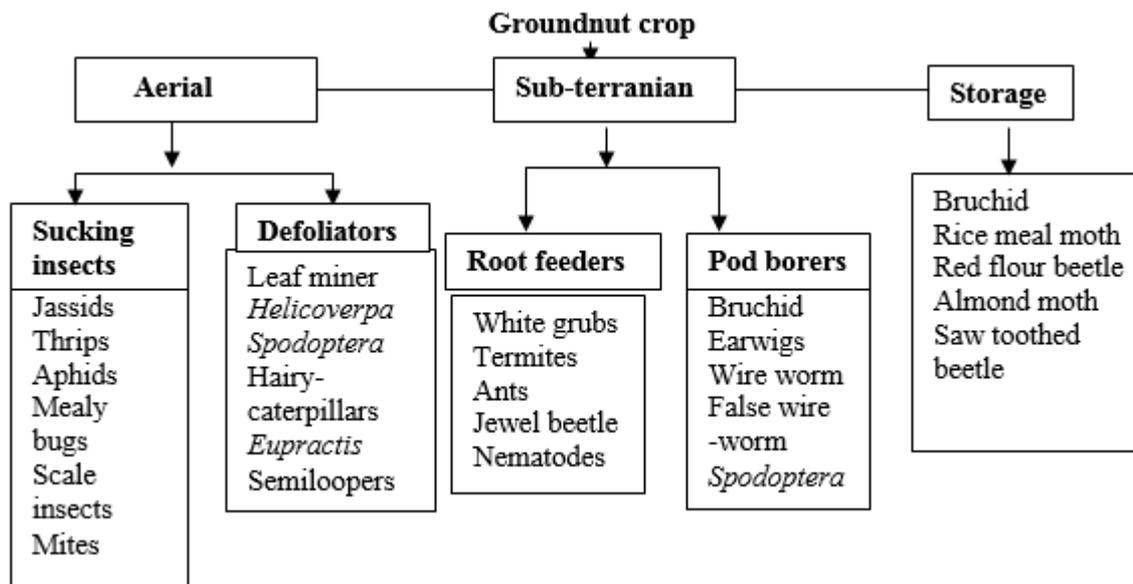
Following components form various modules of digital library:

Digital Library comprises Released Varieties, Wild species, Pests, diseases and Nutrient disorders of groundnut in India as classified below.

MAJOR G'nut Diseases

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                        MAJOR G'nut Diseases
                    ┌──────────┴──────────┐
                 Fungal                  Viral
          ┌────────┴────────┐              │
       Foliar          Soil Borne      ┌───────────────────┐
    ┌─────────┐      ┌──────────────┐  │ PBND              │
    │ ELS     │      │ Collar rot   │  │ Peanut Mottle Virus│
    │ LLS     │      │ Dry root rot │  │ Peanut Clump Virus │
    │ Rust    │      │ Stem rot     │  │ PSND              │
    └─────────┘      └──────────────┘  └───────────────────┘
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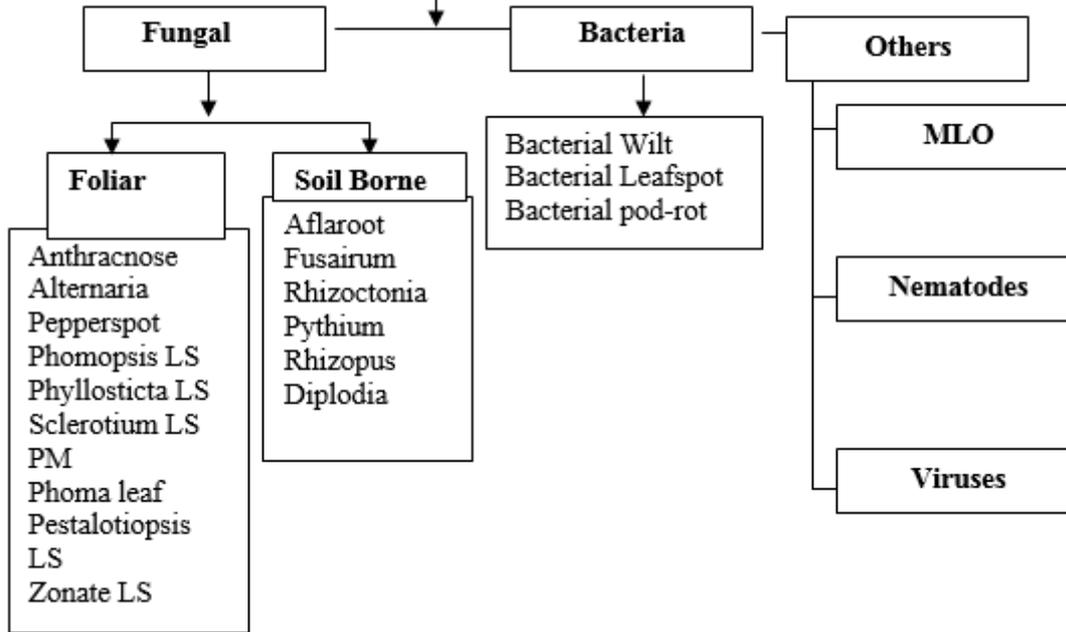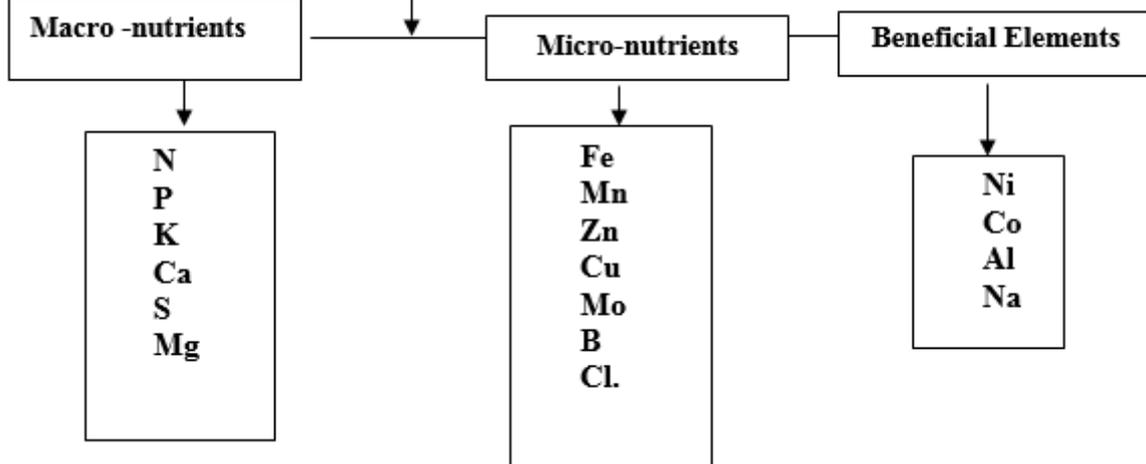
The identified diseases for Digital library covered by their Photographs, Damage Symptoms and Cultural & Management practices

Based on the feeding behavior, the insect, infesting groundnut may be broadly classified as below:
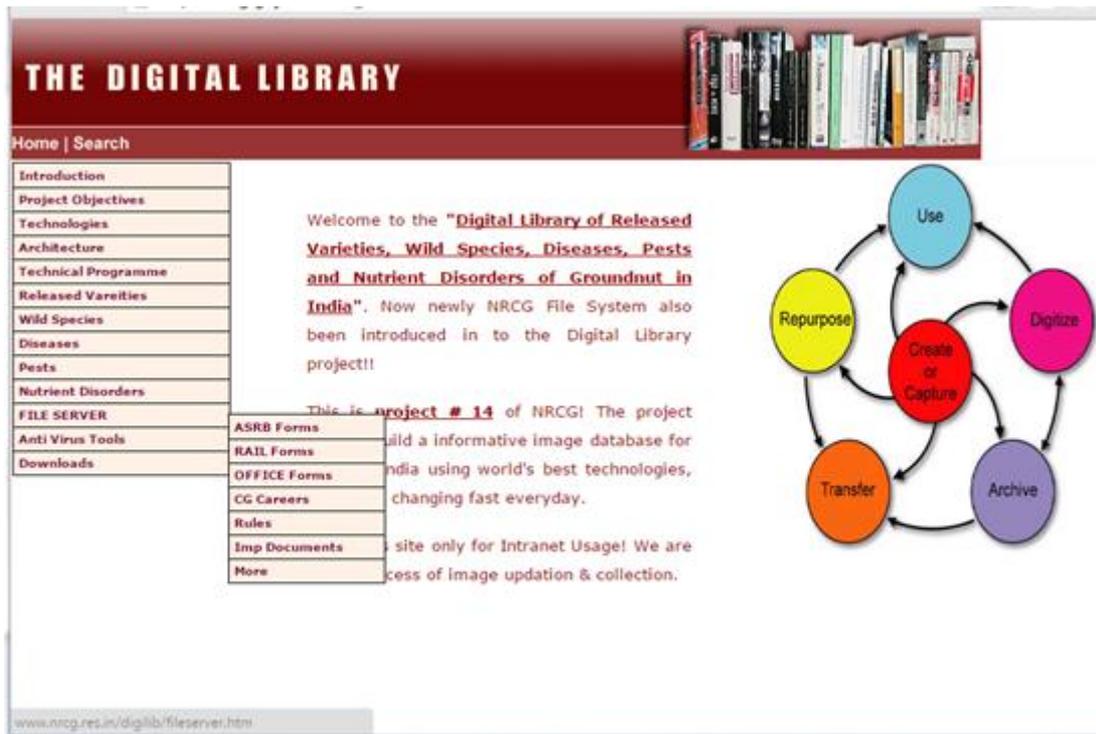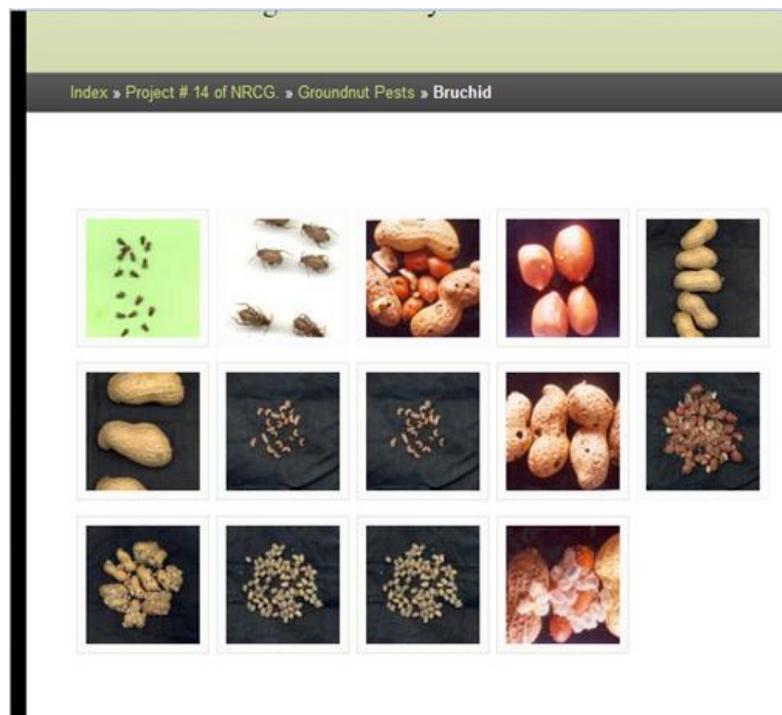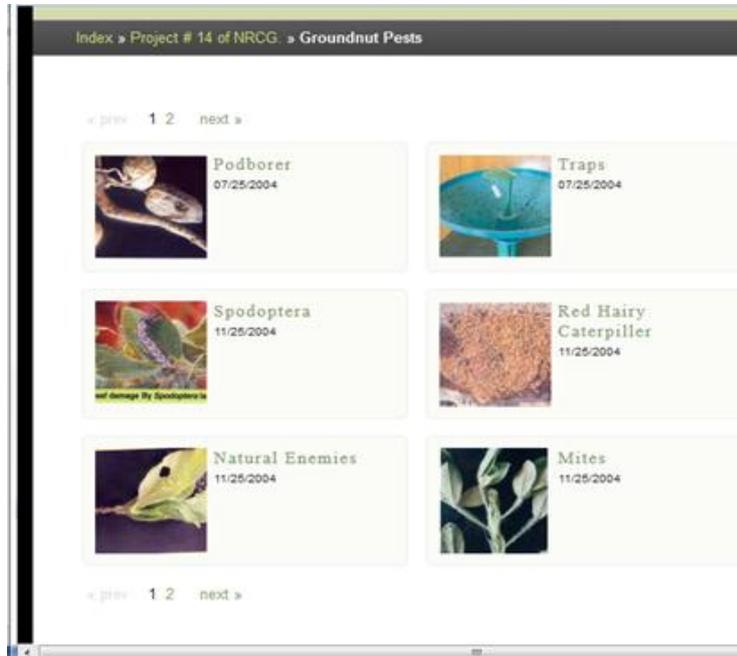
```
                        Groundnut crop
        ┌──────────────────┼──────────────────────┐
     Aerial           Sub-terranian             Storage
   ┌─────┴─────┐      ┌──────┴──────┐              │
Sucking    Defoliators  Root feeders  Pod borers   Bruchid
insects                                            Rice meal moth
Jassids    Leaf miner   White grubs   Bruchid      Red flour beetle
Thrips     Helicoverpa  Termites      Earwigs      Almond moth
Aphids     Spodoptera   Ants          Wire worm    Saw toothed
Mealy      Hairy-       Jewel beetle  False wire   beetle
bugs       caterpillars Nematodes     -worm
Scale      Eupractis                  Spodoptera
insects    Semiloopers
Mites
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MINOR G'nut Diseases

Fungal

Bacteria

Others

Foliar

Anthracnose
Alternaria
Pepperspot
Phomopsis LS
Phyllosticta LS
Sclerotium LS
PM
Phoma leaf
Pestalotiopsis
LS
Zonate LS

Soil Borne

Aflaroot
Fusairum
Rhizoctonia
Pythium
Rhizopus
Diplodia

Bacterial Wilt
Bacterial Leafspot
Bacterial pod-rot

MLO

Nematodes

Viruses

G'nut Nutrient Disorders

Macro -nutrients

Micro-nutrients

Beneficial Elements

N
P
K
Ca
S
Mg

Fe
Mn
Zn
Cu
Mo
B
Cl.

Ni
Co
Al
Na

Home page and Screenshots of Digital Library Portal:

Conclusion

An efficient sharing of Groundnut data, Information, Research publications has become very essential for researchers, agricultural scientists and policy makers for their research, educational and information needs. An attempt was made to address the problem of online sharing of data related to research results, crops information. A web based solution like Digital Library proved to be more efficient method by providing any time and any where access through worldwide web. An efficient information and e-learning system like Digital Library proved very useful in providing the required information from the millions of data records that are available with NRCG.

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