

On-line Soybean Germplasm Information System **SAVITA KOLHE¹ AND S M HUSAIN²**

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ABSTRACT

To facilitate an easy, efficient, accurate and rapid retrieval of the information on germplasm accessions, an on-line Soybean Germplasm Information System (SGIS), using web technologies viz., Active Server Pages (ASP), Hyper Text Markup Language (HTML), JAVA script and COM components, was developed at Directorate of Soybean Research, Indore. A data management system for germplasm data has also been developed as a separate module using Visual Basic (6.0) to facilitate the digitization and updation of crop-specific germplasm data. The system provides the retrieval of the required information on 25 characters on more than 2000 germplasm accessions in the form of comparison tables, pie charts, bar/line graphs and reports in user-friendly manner. The paper discusses the functionality of the system and experiences gained during development phase along with its benefits for the end-user.

Key words : germplasm, information system, software, soybean

Soybean exhibits a wide genetic variability worldwide. The total number of soybean germplasm accessions available with different countries/institutions is 1,47,000 (Nelson, 1999). Nearly 4000 accessions belonging to indigenous as well as exotic category (Annual Report, 2008-09) are being maintained at the Directorate of Soybean Research at Indore, which also serves as the National Active Germplasm Site (NAGS) and mandated to supply germplasm accessions for research to institutes engaged to develop location specific varieties in the country. The task of effective management of germplasm and documentation of inherent traits to strengthen the breeding programs is of utmost

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importance. Managing huge data of germplasm manually is a cumbersome, time-consuming and error-prone process demanding lot of manpower. The retrieval of specific germplasm information is also very difficult in present state. The present work facilitates the ease of management and handling valuable information on existing germplasm and accessions being acquisitioned. A few germplasm information systems are already available on web (http://gcmd.nasa.gov/records/GCMD_MUSA_MGIS.html; <http://www.ars-grin.gov/>) but they are dedicated for specific use and are useful for location-specific information. Therefore, an on-line Soybean Germplasm Information System (SGIS) for efficient management of data, rapid and accurate retrieval of information was developed which involves very less development cost. The SGIS was developed with the objectives of (i) collation of data on 25 different characters to create a database, (ii) to develop an efficient data management system for easy addition, updating and management of germplasm data and (iii) to develop a user-friendly system to retrieve the information on germplasm accession specifically needed for different objectives. The designed SGIS is user-friendly and inclusive of different Graphical User

Interface (GUI) tools. The SGIS can offer the information in the form of comparison tables, pie charts, bar/line graphs and reports by using a mouse and minimal keyboard operations.

MATERIAL AND METHODS

Data collection and digitization

For the creation of database, the data on 25 characters of soybean germplasm was gathered and compiled to generate the information useful to different end-users. To facilitate the digitization process of crop-specific germplasm data and updation of it, a database entry system for germplasm data was developed using MS-ACCESS, which had different user-friendly data-entry forms to enter the collected data into the system. The MS-ACCESS database was finally converted into SQL SERVER database to link it to on-line SGIS through open database connectivity (ODBC). The main database table has different fields for 25 characters. Since the Catalogue number and Accession name fields have no duplicate values, these were used for unique identification of records. At present, the table has more than two thousands records. Each record is a set of 25 fields and depicts one germplasm accession with 25 characters and the final data is stored in the form of numeric values of the descriptors (Table 1).

Table 1. The database table showing the 25 characters of the germplasm included in the SGIS along with numeric values of the descriptors

S.No.	Characters	Field names	Descriptors
1.	Catalogue No.	CATNO	-
2.	Accession name	ENTRY	-
3.	Alternate Identity	AI	-
4.	PI No.	PINO	-
5.	Origin	ORG	-
6.	Species	SP	-
7.	Stem termination	STT	3 = determinate, 5 = semi determinate, 7 = indeterminate
8.	Pubescence	PB	1 = present, 0 = absent
9.	Pubescence colour	PBC	1 = grey, 2 = light brown, 3 = tawny
10.	Pubescence density	PBD	7 = normal, 9 = dense
11.	Leaflet shape	LFS	3 = narrow, 5 = intermediate, 7 = broad
12.	Leaf colour	LC	1 = light, 2 = green, 3 = dark green
13.	Pod colour	PC	3 = tan, 5 = brown, 7 = black
14.	Seed coat colour	SCC	1 = yellowish white, 2 = yellow, 3 = green, 4 = buff, 5 = reddish brown, 6 = grey, 7 = imperfect black, 8 = black
15.	Hilum colour	HC	1 = yellow, 2 = light brown, 3 = brown, 4 = green, 5 = grey, 6 = imperfect black, 7 = black, 8 = others
16.	Seed coat luster	SCL	3 = shiny, 5 = intermediate, 7 = dull
17.	Flower colour	FC	3 = white, 7 = purple
18.	Days to flowering	DFL	-
19.	Days to maturity	DMT	-
20.	100 seed weight	SWT	-
21.	Seed yield per plant (g)	YPL	-
22.	Maturity group	MG	Early maturing line (up to 95 days), Medium maturing line (96 to 110 days), Late maturing line (above 110 days)
23.	Oil content (%)	OC	-
24.	Protein content	ProC	-
25.	Remarks	REM	-

System requirements

The system was designed using web-technologies viz. Active server pages

(ASP), HTML, JAVA Script in JAVA Applets. ASP has advantages like choice of scripting

languages-VB Script or Jscript and it involves no extra cost of buying any development software. For graphical representation of the data, COM components were used. The clients can run the system on Pentium IV computers with Windows XP/2000 operating system with 128 MB RAM and at least 20 MB memory on the hard disk having IE5 and above. The server requirements include the Pentium IV computers with Windows 2000/2003 server operating system having a functional Internet Information Server (IIS) on it. The PC should have at least 512 MB RAM and 100 MB free memory. For database SQL SERVER 2000 is required with ODBC support on computer.

RESULTS AND DISCUSSION

The designed on-line SGIS is made user-friendly using GUI tools like command buttons, hyperlinks, list-box, combo-box, textbox, embedded pictures and using third party COM components and JAVA Applets. It is completely mouse-driven. One can login using authorized user name and password provided by the administrator as shown in the home page of the system (Fig. 1).

The user has different options to choose the different modes of data representation depending on his needs (Fig. 2). The user can make selections for graphical representation, simple search or advance search for textual representation and audio system for information retrieval. The simple search option of the search engine, is meant to retrieve information only on one parameter while the advance search option helps in creating complicated queries using "AND" or "OR" operators on any number of parameters. The query request reaches to the remote server using HTTP REQUEST protocol in client-side script in ASP through the web-browser. The query is processed at the server using the server side script and using the ODBC, the final required data is filtered out from the remote data-server. The final response is served by the server using HTTP RESPONSE protocol in the server-side script in ASP and presented to the client through web-browser. In this way the required information in various forms like comparison tables (Fig. 3), reports, colored pictures, bar/line graphs and pie-charts (Fig. 4) can be generated with few mouse clicks.

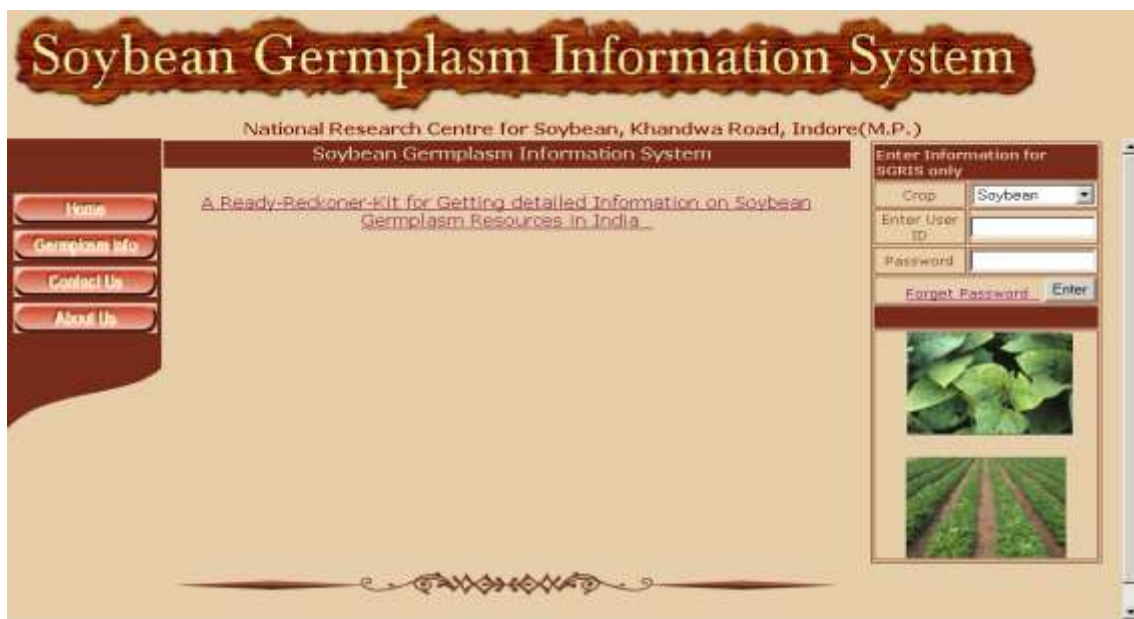


Fig. 1. The home page of on-line soybean germplasm information system

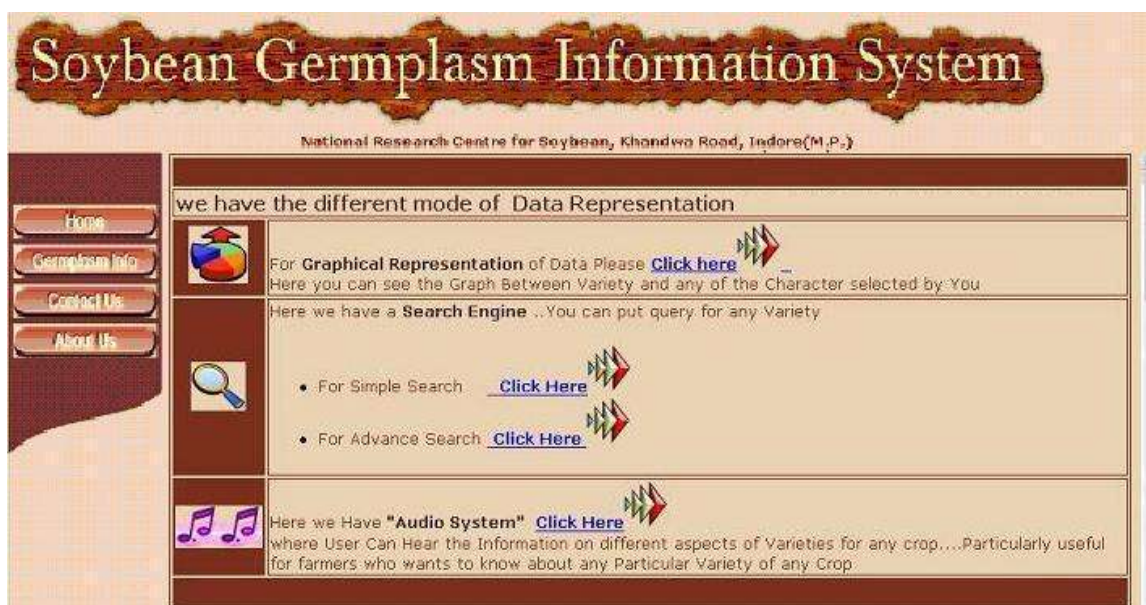


Fig. 2. The screen showing different options for choosing different mode of data representation

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Catalogue No.	Accession Name	Stem termination	Pubesence	Pubesence colour	Pubesence density	Leaflet shape	Leaf colour	Pod colour	Seed coat colour	Hilum colour	Seed coat lustre	Flower colour	Days to flowering	Days to maturity
1982	BC-22993	SemiDeterminate	Present	Grey	Normal	Broad	Light green	Tan	Yellow	Brown	Intermediate	Purple	68	
1983	BC-22994	Determinate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow	Brown	Dark	Purple	62	
1995	BC-22997	SemiDeterminate	Present	Grey	Normal	Intermediate	Light green	Tan	Yellow	Brown	Intermediate	Purple	61	
1997	BC-23001	SemiDeterminate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow	Brown	Intermediate	Purple	62	
1999	BC-23003	SemiDeterminate	Present	Grey	Dense	Intermediate	Green	Tan	Yellow	Brown	Intermediate	Purple	51	
1990	BC-23005	SemiDeterminate	Present	Grey	Normal	Narrow	Light green	Tan	Yellow	Brown	Intermediate	Purple	59	
1991	BC-341825	Determinate	Present	Grey	Normal	Narrow	Dark green	Tan	Yellow	Olive	Shiny	Purple	37	
1999	BC-343305	Determinate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow	Brown	Intermediate	Purple	37	
2000	BC-343306	Determinate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow			White	37	
2002	BC-343308	Determinate	Present	Grey	Dense	Intermediate	Green	Brown	Yellow	Light brown	Intermediate	Purple	37	
2003	BC-330664	Determinate	Present	Grey	Normal	Broad	Green	Tan	Yellow	Grey	Intermediate	Purple	37	
2009	BC-330665	SemiDeterminate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow	Grey	Intermediate	Purple	37	
2010	BC-330667	Determinate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow	Grey	Intermediate	Purple	37	
2011	BC-330668	Determinate	Present	Grey	Dense	Broad	Green	Tan	Yellow	Grey	Intermediate	Purple	42	
2012	BC-330672	Determinate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow	Grey	Intermediate	White	37	
2013	BC-330675	Determinate	Present	Grey	Dense	Intermediate	Green	Tan	Green	Grey	Intermediate	White	37	
2014	BC-330677	Determinate	Present	Grey	Normal	Intermediate	Green	Tan	Yellow	Grey	Intermediate	White	37	
2015	BC-330680	SemiDeterminate	Present	Grey	Normal	Intermediate	Light green		Yellow	Grey	Intermediate	Purple	32	

Fig. 3. The retrieval of germplasm information in tabular form

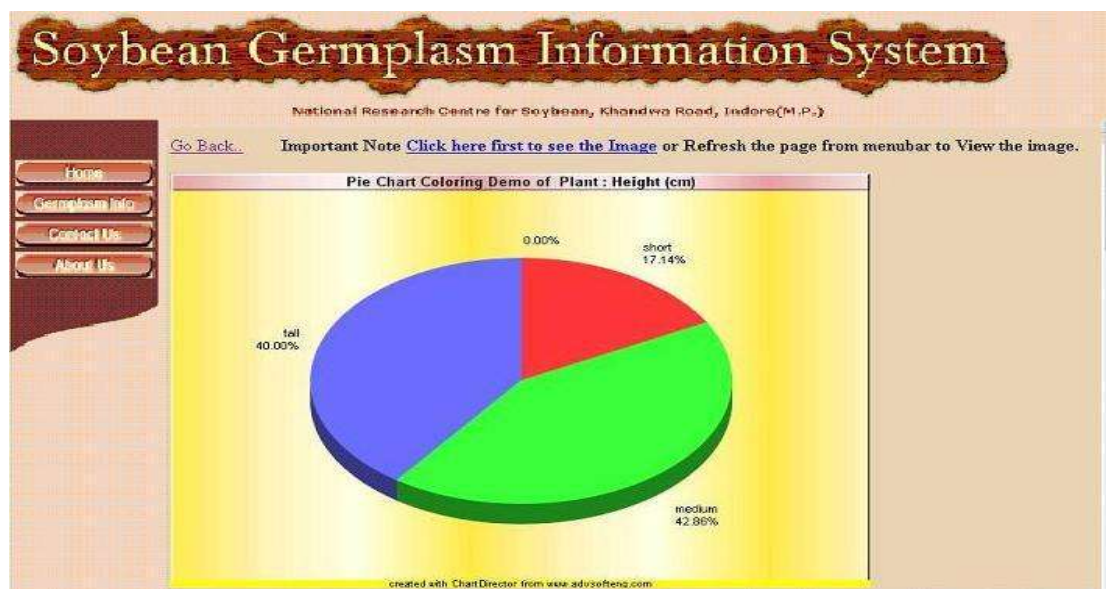


Fig. 4. The retrieval of germplasm information in the form of pie-chart

Although, the system deals with 25 characters at present, it has provision to include more characters and acquisitioned germplasm accessions in future. The system facilitates distinctness and similarity comparisons of different germplasm available in the database based on specific set of given values of the characters. The system also has the versatility to be used for digitization of germplasm resource of any of the crop commodity.

The system is being successfully implemented at the Directorate and is very informative for different end-users. The system is being loaded at the website of the Directorate (<http://www.nrcsoya.nic.in>) for use at large. This package not only serves as a reservoir for keeping a wealth of numerous character information of different germplasm resources in digital form but also as a ready-reckoner-kit for rapid and accurate retrieval of information in user-friendly manner in various forms. Its features like on-line help; attractive and user-friendly GUI and accurate, rapid retrieval of

information in the form of comparison tables, reports, color photos, bar/line graphs, pie-charts etc. make it of practical utility. The package has versatility to be used for other crop commodity as well.

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