

RESEARCH AND IMPLEMENT OF MAIZE VARIETY PROMOTION DECISION SUPPORT SYSTEM BASED ON WEBGIS

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Abstract: In China, maize is a main cereal crop. Actually maize has a huge number of varieties which are also updating day by day. However, the seed enterprises frequently don't seriously consider the suitability of the varieties but promoting blindly, leading to the loss of both enterprises and farmers. This study focuses on the design and development of a network platform which can put forward promotion proposal of maize varieties. This platform is based on Visual Studio 2005 + SuperMap IS. NET 2008 + SQL Server 2000, and considers seed enterprises as the main target. Furthermore, it integrates varieties' suitability evaluation model and combination model which are also very helpful to the promoting of maize variety. This system analyzes the specific requirements of users. It is integrated with the existing suitability evaluation model and combination model. With GIS, it sufficiently caters for their practice requirements and is easy-to-use, and can provide users support for decision-making in promoting or introducing varieties. At the same time it provides information of maize variety and regional planting environmental characteristics.

Keywords: maize varieties, promote application, WebGIS, decision support system

1. INTRODUCTION

1.1 Background

Maize is one of main crops in china. With the development of biotechnology, variety of maize is increasing, which enrich the maize market in china. At the same time, the spread and introduction of varieties become a problem(Yu Xianqiang et al. 2007). This study tries to design a web-based application system which gives support to farmers when they are making decisions in the spread of varieties. This system considers Seed Enterprise as the main target consumer, and aims to satisfy all their needs sufficiently.

1.2 The purpose and content of study

This paper, aiming to promote the maize variety effectively, studies on how to develop a network system, which is based on WebGIS and integrated with the existing suitability evaluation model and combination model. Settled the promotion staff of enterprises as the target user of the system and county as the element studied, the system can provide users promotion proposals and query function of individual regional trial data of maize variety and the basic environment information.

This paper studies on how to use WebGIS to design and actualize a network application system, aiming to provide visual and telling support of promotion and serviceable function that interactive querying of attribution and graphics for basic geographic information.

2. SYSTEM ANALYSIS

2.1 Target user analysis

According to business content, system users can be divided in to following categories:

Seed Enterprise

Integrated seed enterprise: Integrated firm integrates variety selection, seed breeding and selling. Businesses create their own varieties, brands, and then sell them to consumers by retailing network. Capital needed for enrollment of integration seed enterprise is above 5,000,000RMB usually. There are nearly 500 maize variety firms in china(Tang Qilin et al. 2008). Those companies focus on where the seeds could be sold.

Seed Retailers: Most of these firms are seed agents which in the county or lower district. The number of these kinds of firms is large (nearly 5 in each county), as there are more than 10,000 in all in china. What they concern most is whether the maize variety they sell is suitable for the area.

Seed Management Institution

Seed administration management institution

These institutions include seed control station and crop farming management departments. There are nearly 2,800 institutions in china currently. Seed control station need to supervise the quality of the seed and make sure the seed variety have passed the examination. As a result, they concern with the maize variety information, trial results, and approval circumstances.

Agro-technical institution

Agro-technical station is the department which involves with seeds in the Agro-technical institution. Agro-technical station has the responsibility to recommend proper varieties which are suitable to be grown locally to the Seed administration institution(Li Enpu et al. 2005). The varieties which be recommended by Agro-technical station have the good chance to be local good subsidy varieties. These users focus on what varieties are suitable to be grown in local circumstance.

Consequently, the system takes the integrated enterprise as the main target user, and the seed retailers, seed administration institution, agro-technical institution are the second-class target users.

2.2 Overall demand of system

Previous research on the maize variety promotion application system is focus on the query of feature library, while the research on the decision-making function is rarely. Actually what needed by users is decision-making supporting information that based on the reliable basic information. How to help users to query basic data more efficiently and providing decision-making assistant are the key of maize variety application and popularity.

Key of the research on this system is how to give users the most efficient maize variety support information by integrating with GIS, including information of varieties, region circumstance information, suitability evaluation project, variety-matching plan, and so on. In addition to this, the research also designs other reasonable functions, provides a convenient, suitable and layout friendly support tools to users.

3. SYSTEM DESIGN AND ACHIEVEMENT

3.1 Overall system designs

Maize Variety Promotion Decision Support System is constituted by four parts: feature library query, theme query, popularizing analyzing tool and popularizing plan. System function structure can be found in figure 1.

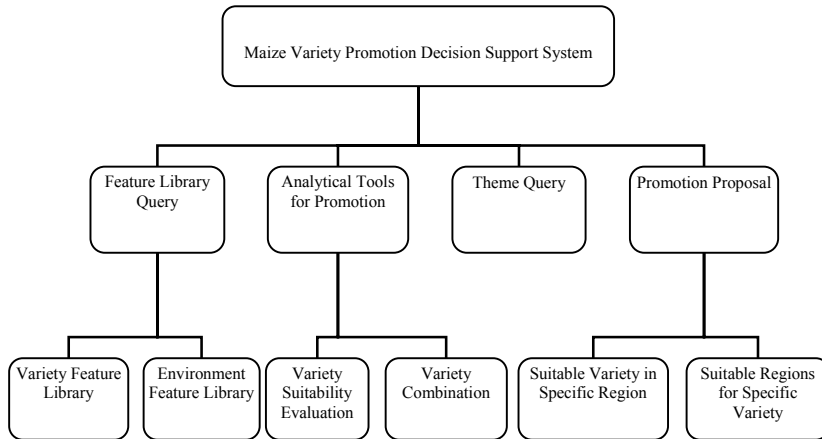


Fig. 1 Structure of Maize Variety Promotion Decision Support System

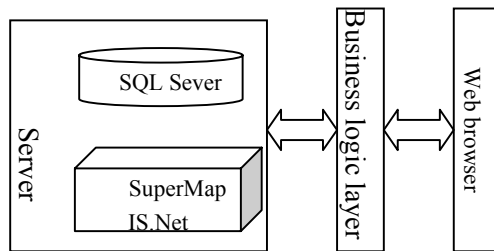


Fig. 2 Overall structure framework

3.2 Overall technology framework

Overall structure framework can be divided into 3 parts, as figure 2: After the Web browser sends request to operation logic layer, operation logic layer ask data or map data from database or SuperMap IS.NET according to the requests sent. And then it disposes the data in the operation logic layer, finally sends the results back to the Web browser.

3.3 Layout design

First page of the system is constituted by 4 elements: logo, menu bar, system introduction, and map display. Menu bar provides all the functional options. The system introduction part will turn into operation area or introduction of the module when it enters corresponding functional module. Map display part is the main area of the result information displaying. As a result, it possesses much of the total area.

3.4 Functional design and achievement

This system has four main arrangements: feature library query, theme query, analytical tools for promotion and promotion proposal. Query of feature data can help users know spread plan clearly. Theme query provides users with distributing status of nationwide relational characters of both crop level and variety level. If users do not satisfy with the plan, they can utilize analyzing tool to resolve problems according to their specific needs.

3.4.1 Feature library query

Variety Feature Library

Variety feature library query provides query about variety basic information and individual regional trial data. Users can define specific conditions to inquire about maize variety information. In addition to this, variety feature library also provide examination information of varieties to seed station users to satisfy their needs.

Environment Feature Library

Main user of this library is integrated seed enterprise and breeding enterprise. This system provides users with the basic environment information in two big maize planting districts—North East and Huang-Huai-Hai of China.

3.4.2 Theme query

This module displays all result figures for users to query. For an instance, maize dominant district layout figure.

3.4.3 Promotion proposal

The system designed this module in order to help users to know which variety suits for the specific region most, or the suitable degree distribution

of specific variety in a big region. By using this module, users can get the final spread support information without fussy operation processes.

Suitable Variety in Specific Region

Seed Retailers and Agro-technical spreading stations are the main users who query suitable varieties in specific region. By using this function, users can realize which variety is most suitable for the specific region. The total flow has 4 processes: see figure 3.

A. select the region interested;

B. map orientation: Enhance user's perceptual knowledge to specific region;

C. display simple information about the suitable variety in the specific region: usually give the top ten most suitable varieties, convenience for users to query;

D. link with other related information: some users may not satisfy with the simple information: They want to know the suitable status of all the varieties. This linkage can give users more details. Furthermore, as seed retailers and Agro-technological stations are the main users for this module, they want know more about how to arrange different varieties in groups to increase yield. In this part, arranging plan for the region can be found out.



Fig. 3 Promotion proposal-- suitable variety in specific region

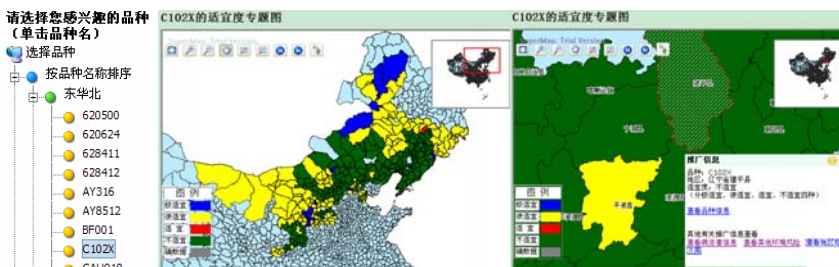


Fig. 4 Promotion proposal-- suitable regions for specific variety

Suitable Regions for Specific Variety

Main users who query the suitable region for specific variety are integrated seed enterprises and breeding enterprises. Users can know certain specific variety's suitable degree distribution status in a big district. This flow has 4 steps: see as figure 4.

A. select variety interested in: as there are so many various varieties, the system have designed 3 different method to display those varieties—order it according to variety name, yield per unit or procreating period; besides, each ordering method has its corresponding specific regions;

B. theme figure for suitability degree;

C. select region: users can query variety suitable degree information of the interested region in the theme figure;

D. specialized thematic maps of degree of suitability(DS): a specialized thematic map is generated real-time according to the selected variety and the corresponding examination region;

E. link with other related information: variety suitable degree is depend upon plant diseases, insect pests, and growing environment analysis, so it is necessary to offer information about plant diseases, insect pests, and environment information. Additionally, because main users for this module is integrated seed enterprise and breeding enterprise, they want know whether the variety is suitable for arranging in groups to grow in this region. In this linkage, users can check the arranging plans in the region.

3.4.4 Analytical tools for promotion

Variety Suitability Evaluation

Suitability evaluation means analyzing a new maize variety's suitability degree in a specific region, finishing qualitative, quantitative, and orientation evaluation for a specific maize variety in an idiographic area (Smith et al. 2001).

Variety Combination

Maize variety combination is combining various suitable varieties together effectively to balance the yield and risk of maize production.

4. KEY TECHNOLOGY IN PROGRAMMING

4.1 Dynamically loading data of treeview

The selectable data of regions and varieties is plenty. To facilitate the users to select, TreeView which is hierarchical is chosen to load the data. Nevertheless, in case the data is completely loaded when the page is loading, the response duration of page is too long and user should pay much time to wait. In addition, TreeView provided by ASP.NET has several defects, such as slow response speed, complex operation, and ugly guise.

Dynamically loading data of TreeView is adopted. In this case, not only the response is accelerated, but also the flexibility of connection with dataset is improved. The introduction of the new control, about_ASPTreeView_2_NET, brings high response speed and convenient operation.

4.2 Real-time generating specialized thematic maps

SuperMap IS.NET, the platforms system adopts, can generate specialized thematic maps with property fields included in the layers. But the property data, which system needs generate thematic maps, is stored in the SQL Sever. Furthermore, SuperMap doesn't provide the interface, which allows joining the dataset.

If the layer contains the property fields (such as DS) which need to be generated thematic maps, SuperMap will assign with different colors according the values of DS as long as DS is set as the expression of the thematic maps. However, the data isn't contained in the attribution of layers. Observing the attribution of layers and the dataset, a same field, CountyID (Standard Code of County), is found between the layers and the dataset. Set it as the expression of thematic maps, then assign the CountyID searched from the dataset the corresponding color, which is decided by the corresponding DS stored in the dataset. As a circulation, the same values of DS are assigned the same color. Namely the mutual field, CountyID, joins the layers and the SQL Sever. As a result, the function of real-time generating specialized thematic maps is accomplished.

4.3 Stored procedure

There are many interactions with SQL Sever in programming, including data acquisition from several tables and even acquiring operational result of data storing in the dataset. Achievement in the program must lead to enormous code and low efficiency.

System uses Stored Procedure. Stored Procedure can not only settle the problem that have listed, but also greatly ameliorate the performance of SQL. In addition, Stored Procedure runs at sever, which can reduce the pressure of the custom and consequently decrease the network traffic ([Liu Xin 2008](#), [Lv Jing et al. 2001](#), [Wen Rui et al. 2007](#), [Zhang Yueting et al. 2007](#)).

5. CONCLUSION

This system is integrated with the existing suitability evaluation model and combination model. With GIS, it sufficiently caters for users' practice

requirements and is easy-to-use, and can provide support for decision-making in promoting and introducing varieties. At the same time it provides information of maize variety and regional planting environmental characteristics.

Integrated seed companies and breeding enterprises can acquire the decision support information in promoting varieties, which can help their products be popularized to the appropriate region more accurately; seed retailers and agro-technical station can obtain the support information in stocking varieties, which can improve the pertinence and validity of their spread, leading to the increase of yield.

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