Development of Evaluation System for Rural Planting Adaptability Based on Computer Technology

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Abstract. With the rapid development of computer technology, there are many researches on the use of computer technology to deal with the adaptability of rural planting. Aiming at the problem that a large number of basic farmland evaluation results have not yet been fully utilized, with the help of the enterprise manager and component technology of Map GIS K9, combined with Visual C 2008, a crop planting adaptive selection system based on the analytic hierarchy process is proposed, which realizes the rural planting Feature functions such as decision analysis, crop sales, 3D roaming and Google Map connection, and added basic functions such as spatial query, image file operation, spatial data analysis, etc., provide a reasonable and efficient evaluation system for the adaptability of rural crops. Use the design of rural planting adaptability assessment system to investigate the temperature and soil conditions in the planting area, analyze the villagers’ willingness to change land use and the ecological adaptability of alternative species, and determine the construction of standardized production bases for alternative species within the planting area. The construction of a demonstration project for the introduction of new varieties, adjustment of the industrial planting structure, increasing the income level of local farmers, improving the ecological service function of the planting area, and establishing a deeper system for the long-term sustainable use of land, the evaluation of ecosystem services, and the evaluation of rural planting adaptability Provide support for level of exploratory research.

Keywords: Computer Technology, Rural Area, Planting Adaptability, Evaluation System

1. Introduction
Agriculture, as the source of food and clothing, is also the basis for the survival of human society. Agriculture is the most basic material production department and the basis for national economic and social development [1]. Among them, the stability and sustainability of agricultural production are the key to ensuring agricultural development. According to the China National Evaluation Report on climate change, in the context of continuous global warming, frequent meteorological abnormalities, uneven water distribution, melting glaciers, rising sea levels, and unstable agricultural production risks will further increase [2]. In a sense, planting adaptability determines the success or failure of the
planting system. In planting adaptability, it includes the adaptability between agricultural organisms and between agricultural organisms and the environment. The mutual adaptation between agricultural organisms mainly considers the differences in physiological and ecological mechanisms and morphological characteristics between agricultural organisms. And coexistence, planting adaptability determines the competition or complementarity between crop planting groups, and affects the size of crop productivity. The adaptation of crop selection and local planting environment is a problem involving agricultural ecology, agricultural technology and economy, and it determines crops. The rationality of the layout [3].

Climate change will directly or indirectly worsen the poverty of residents. The direct impact is a serious meteorological phenomenon, which means the loss of agriculture, people's lives and properties, livelihoods and infrastructure [4]. Regardless of the development and progress of human science and technology, food production is still most directly affected by climate change. Rice is the grain variety with the largest sown area, largest total output and unit output in China, and has always been dominant in grain production and consumption [5]. In recent years, the Ministry of Agriculture has launched a series of investigations and quality evaluations of arable land in rural areas across the country. After a large amount of raw data collection, processing, and analysis, a basic data system for arable land resources has been initially formed. Ground analysis and application provide a solid foundation [6]. Making full use of these basic data to guide agricultural production and practice is of great significance for improving the level of agricultural modernization management and achieving increased production and income. However, based on the application of these basic data, soil testing and formula fertilization are mainly carried out on the basis of existing farming plans and crop planting area plans, and the quantitative planning of crop planting and site selection is carried out in the village, county, city and even the whole province [7].

At the same time, more attention is paid to rural construction and development. Agricultural construction is an important link for rural economic development and improvement of life quality, and it is also the core issue of current social development [8]. In the current era of gradual development of science and technology in our country, more and more agricultural technologies have achieved long-term development. Agricultural technology directly plays a role in increasing or stabilizing production in agricultural production [9]. The effectiveness of the planting system is largely affected by the level of technology. Any kind of crop has its specific physiological characteristics, morphological characteristics, and physiological and ecological mechanisms. The inherent characteristics and characteristics of the crop itself will also have different performance in different ecological environments (such as light, temperature, and daily difference). Thus showing different technical requirements, corresponding technical measures need to be adopted. Therefore, in practice, due to the different economic and technical conditions in different regions, their planting systems are also very different, which is normal. Otherwise, the investigation and reform of the planting system without considering the local technical level will inevitably lead to the consequences of the original violation [10].

2. Method

2.1 Heckman Probit Two-Step Algorithm

Regarding the adaptability of farmers to crop planting, the first is the farmers’ understanding of climate change. Only by recognizing the changes in the cultivation results can farmers decide whether to take actions to adapt to crop cultivation. In other words, the first stage is for farmers to recognize changes in planting, and the second stage is to decide whether to adapt to planting changes under the premise of cognizing planting changes. This method regards the two stages as a sequence of independent processes. If only farmers who are aware of planting changes are selected as specimens, specimen selection bias will occur. The Heckman Probit two-stage model can be used. Avoid bias in the selection of samples. Assuming the following mathematical relationship:
\[ y^* = \beta_0 + \beta e \]

Assuming that \( e \) obeys the standard normal distribution, then there is \( G(-z) + G(z) = 1 \) for any real number \( z \).

It can be concluded from this:

\[
P(y = 1|x) = P(y^* > 0|x) = P[e > -(\beta_0 + \beta x)] = 1 - G[-(\beta_0 + \beta x)]
\]

That is:

\[
P(y = 1|x) = G(\beta_0 + \beta x) = G(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)
\]

Where \( G \) is a function whose value range is strictly between 0-1, that is, for all real numbers \( z \), there is \( G(z) \in (0,1) \).

Using the more commonly used Probit model in real applications, the cumulative distribution function of \( G(z) \) has the following form:

\[
G(z) = \Phi(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{z} e^{-s^2/2} ds
\]

The regression equation is estimated by MLE.

You can define:

\[
f(y|x;\beta) = [G(x\beta)]^y [1 - G(x\beta)]^{1-y}, y = 0,1
\]

Then the log-likelihood function of the \( i \)-th observation can be obtained as:

\[
l_i(\beta) = y_i log[G(x_i\beta)] + (1 - y_i) log[1 - G(x_i\beta)]
\]

Therefore, by summing all observations, the log likelihood function with a sample size of \( n \) is obtained:

\[
\ell(\beta) = \sum_{i=1}^{n} [y_i log[G(x_i\beta)] + (1 - y_i) log[1 - G(x_i\beta)]]
\]

After \( G \) is determined, the estimator of the model parameters is solved by the first-order condition of maximizing the above equation.

### 2.2 Land Suitability Evaluation

In terms of the adaptability of crops, an area has factors suitable for the growth of certain crops, but also factors that are relatively suitable for the growth of other crops. In many cases, how to arrange various crops to reach the scale often depends on the economic needs and production level of the villagers in a certain period of time. Due to the needs of human society and the differences in social economic conditions, sometimes a certain crop cannot be developed where it is most suitable for growth, but it must be developed where it is not suitable. The ecological adaptability of crops is relative, the most important manifestation is the arrangement and choice of human needs. Natural conditions are the basis for determining the crop planting system, and socio-economic conditions restrict the development and change of the planting system. The demand for products is the most important socio-economic factor.

### 2.3 Establish a Database for Analysis

The database is the basis for the development of a rural planting adaptability evaluation system based on computer technology. Establish an evaluation database to record in detail the rural planting environment, the number of crops planted, the economic benefits of planting crops, the harvest of
planted crops, some unexpected situations during planting, and detailed records of planting methods and planting locations. The data is composed of point layer, line layer, area layer, annotation layer, etc. The point layer includes the acquisition point layer and the village layer. Line layers include road layers, planting boundaries, and river layers. The surface layer includes the sand planting zoning map and the lake layer. The annotation layer includes planting area annotation, river annotation, lake annotation, and acquisition point annotation. All data are acquired and managed through MapGISK9, most of which are digitized based on rural maps and imported into the MapGISK9 database module enterprise manager. The most important data is rural soil attribute data, which is vector data based on plots (evaluation units). Use the enterprise manager provided by MapGISK9 as the database server to realize the storage and query management functions of GIS-related resources, including the creation and logout, opening and closing of the database, and viewing the simple feature classes, object classes, annotation classes, and features in the database. The number of sets, raster datasets, etc.

3. Experiment

3.1 Subject
In the field of climate change, the impact of climate change on agriculture is mostly limited to yield. The main research content is the relationship between climate fluctuations and yield changes and the combination of climate models and crop models to simulate the relationship between climate change and yield. However, more in-depth research, such as how climate change affects production components, is less. This paper selects multiple rice sites in long-term A villages to analyze the correlation between meteorological elements and rice yield components, aiming to further study and develop the theoretical mechanism of rice yield changes and lay the foundation for the development of the rural planting adaptability evaluation system. Provide a scientific basis for the selection of adaptation measures.

3.2 Experimental Method
1. Data collection
Collected relevant climate data from the Meteorological Bureau of District A, and learned about the socio-economic conditions of each village in the poverty alleviation bureaus and subordinate village committees of various districts and counties; other auxiliary materials also include news newspapers, periodical articles, and government reports; more This kind of data provides relevant basis for this study.

2. Field research
This study specifically applied Participatory Rural Appraisal (PRA) Semi-structured Interview tools, field questionnaire surveys, etc. to conduct household surveys in 12 poor villages in District A. The survey content includes survey sites. Basic information of farmers, basic agricultural information, climate change and its impact, adaptation measures, etc., to obtain a large amount of basic data.

3. Expert consultation
Cooperate with the Poverty Alleviation Office of City A and the relevant administrative departments of the district and county governments to conduct a symposium to understand the actual situation of the surveyed area in detail. At the same time, the design of the questionnaire also asks relevant experts to modify and correct the preliminary work.

4. Data processing
Use Excel to sort out the questionnaire data, and use R language to build and analyze the model based on the data. At the same time, SPSS was used to analyze and map the collected meteorological data, and the correlation between the objects was analyzed by correlation and Pearson test.

4. Results
In order to achieve a scientific and rigorous experimental attitude, this experiment recorded in detail the number of high temperature days (>35 degrees Celsius), annual average maximum temperature,
annual average minimum temperature, annual rainfall, and rainfall in the 12 villages in District A in recent years in the area where the planting sites are located. The five data of days, as shown in the following table

Table 1. The number of high temperature days, annual average maximum temperature, annual average minimum temperature, annual rainfall, and rainfall days in the area where the 12 villages in Zone A are located

|                  | 2009 | 2010 | 2011 | 2012 | 2013 |
|------------------|------|------|------|------|------|
| High temperature days (days) | 15   | 18   | 16   | 18   | 19   |
| Annual average maximum temperature (Celsius) | 35.6 | 36.0 | 35.7 | 35.8 | 35.7 |
| Annual average minimum temperature (Celsius) | 6.5  | 5.2  | 5.6  | 4.9  | 5.5  |
| Annual rainfall (mm) | 1536 | 1802 | 1654 | 1822 | 1912 |
| Rainy days (days) | 42   | 45   | 33   | 43   | 39   |

According to the detailed information in the above table, the preliminary development test of the rural planting adaptability assessment system is carried out in combination with some detailed data in other regions. The preliminary test is carried out to determine the suitability rate of rice planting in the next year and 12 months in Area A, which can reduce the farmers’ planting Unnecessary losses in this regard, reduce the pressure on farmers and increase their income. The data obtained through the preliminary computer evaluation experiment has detailed data in the figure below:

Figure 1. Appropriate seeding rate for 12 months after preliminary estimation

It can be understood from the data in the above figure that the appropriate time for rice planting is the most suitable time for rice planting from April to August. In fact, based on the actual experience of the villagers and the actual situation inquired by the experts, we can know that the suitable time for planting rice is from the end of April to before August. The temperature, rainfall, and sunshine time for planting rice during this period are the most suitable rice. The conditions required for planting, so the preliminary judgment that this evaluation system can obtain accurate data is of practical effect. However, we also conducted a questionnaire survey on the names of the rice-growing villages in 12 villages in District A, asking them about their attitudes towards the results of the planting adaptability assessment system, and asking them about their specific conditions to judge the practicability of the system. The results of the questionnaire are shown below:
After the analysis of the survey results, many growers are satisfied with the evaluation results. After this, the survey evaluation system development department will carry out a comprehensive upgrade and reform of the rural planting adaptability evaluation system, comprehensively improve the evaluation system and finally make it public. The contribution of rural planting industry has brought a good guarantee for rural economic development.

5. Conclusion

In the past 10 years, with the development of intelligent agriculture and precision agriculture, the application of agricultural technologies such as communication networks, intelligent sensing chips, and mobile embedded systems has gradually become the focus of research. The Internet of Things technology based on the communication network is very suitable for modern agriculture. Through the real-time monitoring and real-time adjustment of the actual planting and breeding environment, the planting and breeding environment is kept stable and optimal. The rural planting adaptability assessment system developed by the current high-tech technology can not only predict in advance the appropriate time and location for planting crops, what fertilizer to use, the watering time and water volume comprehensive analysis, and give the grower. Scientific and reasonable planting method. This evaluation system can combine the actual distribution of food crops in our country to determine typical areas, starting from two aspects, and further analyze the impact of climate change on agricultural production, as well as the ways and measures that can be adopted for rural planting adaptability.

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