

Maize Varieties Combination Model of Multi-factor and Implement

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Abstract: - The maize varieties combination model which fully uses all kinds of resources and strikes a balance between low risk and high yield has been built by taking the county as the research unit. It analyzes the factors influencing over corn production so as to determining the indexes impact on corn varieties, profits from the mature investment portfolio selection model and considers from both of qualitative and quantitative point of view. In addition, under the idea of object-oriented programming, the system of the model, which has both problem solving and visualization, has been designed and implemented in the .net platform by using C# language. The result indicated that the model can provide maize planting proportion and make useful decision support for seed companies, agricultural enterprises, agricultural extension agents, farmers and so on in accurate popularization of maize varieties.

Key-Words: - Maize varieties, combination , LPM model, markowitz mean - variance model, varietal character, climate type, terrain, pest environment, farming arrangements

1 Introduction

With the development of agriculture and the comprehensive application of information technology, agriculture, information technology has been in the national economy and people's life occupies an increasingly important position. In China, due to various reasons making the seeds of non-quality factors from the promotion of accidents occur, if an integrated aspect of factors, the use of information technology, the right mix of varieties, you can accurately promotion, reduction in agricultural production, causing a heavy a great loss.

At present, at home and abroad on the cultivation of maize varieties with relatively few

studies, mainly in qualitative research, such as the theoretical research and field trials, and most of them are between the different varieties of maize mixed cropping studies. If SHI voice and from a variety of genetic background, agronomic traits, morphological characteristics, physiological and ecological differences and resistance of maize in terms of different kinds of single cross hybrid, between the kinds of cultivation theory and discuss technical issues; Li Xue trees to suit the local good maize varieties cultivated by a certain percentage of tests carried out with research, the structure than a single plant species yield more than 11%. In 2008, Wang Wei-li, who was found in the finance portfolio research with maize varieties with great similarity, the introduction of maize varieties with

their model, a quantitative study of its precedent. However, the complete portfolio model applied, there has been no consideration of factors will affect the mix of a comprehensive, risk-return measurement scales have limitations and other issues.

In this paper, on its basis, based on the county scale, according to the regional climate, geographical environment, corn trait indicators and the local farming arrangements, a variety of factors, qualitative and quantitative combined to improve the model and programming suitable for cultivation of maize varieties with a reasonable in reducing the risk and increase cultivation of corn production, for local governments, seed companies, agriculture-related institutions to provide decision support.

2 Maize Varieties Combination

Medol Building

Corn farmers want the highest possible yield and the lowest possible risk, while in the process of corn planting, but inevitably there are many risks, the risk of the most important influence comes from the natural world, such as the accumulated temperature, rainfall, pests and diseases, and most of these risks have a hidden, and unexpected. Therefore, species with the primary task is to select seeds, give full play to the technological content of seeds. And in accordance with the regional climate, geographical environment, soil and farm infrastructure, planting varieties reproductive habits, and the length, choose the name with local characteristics, superior varieties and the introduction of marketable yet famous varieties suitable for local cultivation. Terms of reducing market risk, improve economic efficiency in areas such as selection of species and varieties with.

2.1 Multivariate Qualitative Analysis

Maize varieties with the process, give full consideration to a variety of relationships between the environment, according to some simple matching principle of variety can be the initial screening and matching, in order to achieve the purpose of quickly and accurately.

First, the variety of characteristics - type of climate to match. Existing varieties are more resistance has its own characteristics, a specific eco-regions in each of the supporting technical guidance on cultivation, there should be some differences. When choosing varieties, such as higher lodging, selected regions in the maize was born in a larger period of the wind, then this species and Lodging varieties with strong capabilities, and that its too small with the ratio.

Second, the variety characteristics - Pest environment match. Selecting species as the first disease, the second disease, the first insect pest, the second insect pest in the county to participate with the probability of a small species.

Third, the variety of characteristics - terrain match. The cultivation of maize varieties have a close relationship with the terrain, in general, more areas of the county terrain types, species diversity of large species should be selected to participate with the characteristics of different apparent.

Fourth, the species growing period - farming arrangements to match. According to Variety the length of growing period to determine the type of cooked of maize varieties. Then the choose of varieties is carried out the time to make combination.

Fifth, the variety of features - farmer preferences match. Farmers planting corn in the process, after many years of accumulated experience, for corn planting soil, fertilizer application is very familiar with certain characteristics of the species have certain preferences with the variety involved in this factor should be taken into account.

2.2 Multivariate Quantitative Model

2.2.1 Maize Varieties mean - variance model

Wang Wei-li maize varieties with models in the study found that with the economics of the investment portfolio has a similarity to a large extent, to borrow a Markowitz mean - variance model. Markowitz on how to select an optimal portfolio, said: investors, the choice should be made between the objectives of the two mutual restraint to achieve the best balance of reason, that is the risk in the same context, the highest expected rate of return; in the same income rate levels, the least risk.

Taking into account maize varieties with agronomic problems is the introduction of the concept of concentration of the model of improvement. Selected relief that corn acreage, unstable degrees accumulated temperature and rainfall to determine the degree of instability in the degree of concentration threshold and thus constrain the proportion of maize varieties planted. Therefore, the maize varieties mean - variance model is as follows:

$$\text{Target: } \min \sum_{i=1}^n \sum_{j=1}^n x_i x_j \text{COV}(r_i, r_j) \tag{1}$$

$$\max \sum_{i=1}^n b_i x_i \tag{2}$$

Constraints:

$$\text{s.t. } \left\{ \begin{array}{l} \sum_{i=1}^n x_i \leq 1 \\ \forall x_i \leq 1 \\ \forall x_i \geq 0 \\ \sum_{i=1}^n x_i^2 \leq C \end{array} \right. \tag{3}$$

Among the equation(1)-(3), x_i for the species with the first i -mix with the proportion of maize varieties; $\text{cov}(r_i, r_j)$ for the similarity between different species; b_i for the first i -expected production of maize varieties.

2.2.2 Model Improvement

Maize varieties with and there are some differences in the portfolio, although the model of Wang Wei-li consideration of agriculture and improved, there are

still significant problems, such as did not resolve the spatial sequence data to time-series data of the conversion, does not reflect the variety and the Environment interaction and so on.

First of all, the risk of a certain time when the pursuit of high returns, and this income should be what to say then? Wang Wei-li model using the output of maize varieties, as income portfolio is to follow the stock price time series and data integrity, and a variety of production data in a certain place

does not continuous in time. However, each corn variety is the main shape features of the data integrity can be judged from a variety of starting their own variety of benefits.

Second, a certain risk, the risk for high returns as the target constraints, the correlation coefficient ρ_{ij} comparison of covariance risk in terms of more suitable metric. From this formula 4 can be seen that with the risk of species are divided into

$$\sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n x_i x_j \text{COV}(r_i, r_j) = \sum_{i=1}^n \sum_{j=1}^n x_i x_j \rho_{ij} \sigma_i \sigma_j = \sum_{i=1}^n x_i^2 \sigma_i^2 + \sum_{i=1}^n \sum_{j=1}^n x_i x_j \rho_{ij} \sigma_i \sigma_j \tag{4}$$

In the addition, when the proceeds when the pursuit of a certain risk minimization, the introduction of benchmarks or reference levels of risk to replace the variance method, the mean μ , in order to focus on the distribution of proceeds to consider the left, that is, the risk of loss while the role of composition, at present the most

$$\text{LPM}_\alpha = \sum_{r_p = -\infty}^T (T - r_p)^\alpha P_p = \sum_{r_p = -\infty}^{+\infty} [(T - r_p)^-]^\alpha P_p = E[(T - r_p)^-]^\alpha \tag{5}$$

Compared with the variance, and low part of the moment method obviously has certain advantages: one, it does not require variance or standard deviation method as stringent as those assumptions, only some of the assumptions the utility function decision-makers (such as the decision maker's preference, etc.); 2, utility function type parameters α and target returns T makes the risk measure, together with a broader range of applications. When $\alpha = 2$, $T = E(r_p)$, when, LPM_2

Target :

systematic risk and non-systematic risk of two parts, a macro-systematic risk is the growing diversification can not be eliminated, but only affecting a variety of micro-non-systematic risk can only be through the planting different varieties in the same area to be weakening, the correlation coefficient determines the size of the non-systematic risk.

representative and which form a mature theoretical system is the HALO's LPM () method. LPM is a "Lower Partial Moment" acronym, which means that only part of the income distribution in the left tail was only used for the calculation of risk measurement factor (Equation 5)

semi-variance, when $\alpha = 0$, LPM_0 merely stated that the probability of loss; 3, with LPM_2 more accurate measurement of risk than variance, more security.

Finally, considering the variety and environmental factors impact on the model, the constraints is improved. Therefore, maize varieties models with improved are:

$$\min(LPM_{\alpha}(T;X)) = \sum_{r_p < T} P_p [(T - r_p)^{-}]^{\alpha} \tag{6}$$

$$\max \sum_{i=1}^n w_i r_i x_i \tag{7}$$

Constraints:

$$\sum_{i=1}^n x_i \leq 1$$

$$\forall x_i \leq 1$$

$$\forall x_i \geq 0$$

$$E(r_p) = \sum_{i=1}^n x_i E(r_i) \tag{8}$$

Among the equation(6),T is target rate, P_p is the probability of profit r_p .Among the equation (7) x_i is the proportion of maize varieties with, r_i characteristic parameters for the maize varieties, w_i is the weight of species characteristic parameters.

3 Problem Solution

3.1 Development Environment

Model has been developed by using the Microsoft SQL Server 2000 as a storage medium and in the Visual C # 2005 programming language and environment.

3.2 Database Design

Maize varieties with the system according to the data requirements, combined with database design, the standardization of the principles of practical design of data tables, the main features of the design traits of maize varieties in Table (MaizeVarietyTraitTable), regional comparison table (RegionalismContrastTable), geographical features of the table (GeoEnvironmentTrait), maize varieties with the results of the table (CombinationResult), maize varieties with detailed information sheet (RateResult) the five tables. At the same time, combined with the database provided by the mathematical functions, designed for a specific query stored procedure. On the one hand can reduce the difficulty of programs to achieve the other hand, can improve the system speed.

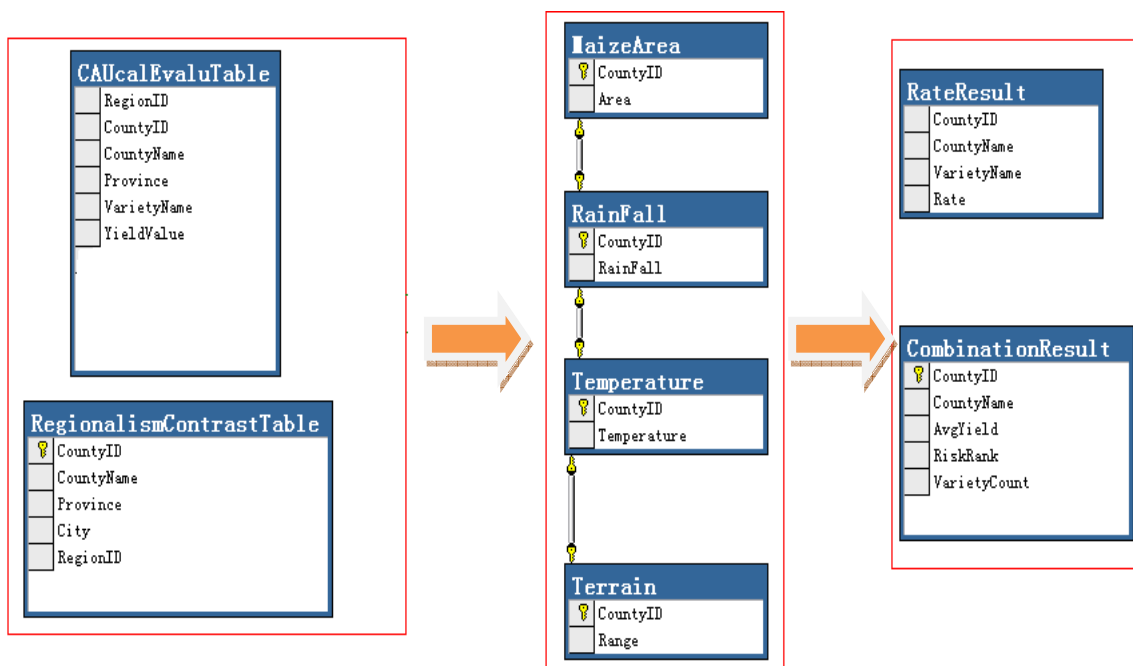


Fig.1 Database Diagram

3.3 Model implementation

Based on the analysis of maize varieties with the model, combined with the system architecture, maize varieties with model selection and the system is divided into two parts with the structure displayed. In both species - environment fit at the same time gives the proportion of maize varieties with a reasonable and provides the results of

multi-angle display. Model includes qualitative and quantitative analysis, quantitative analysis is a two-goal programming model, commonly used method is to double-objective to single objective, another objective as a constraint to solve it. Therefore, the model is designed to provide three options approach (Fig.3).

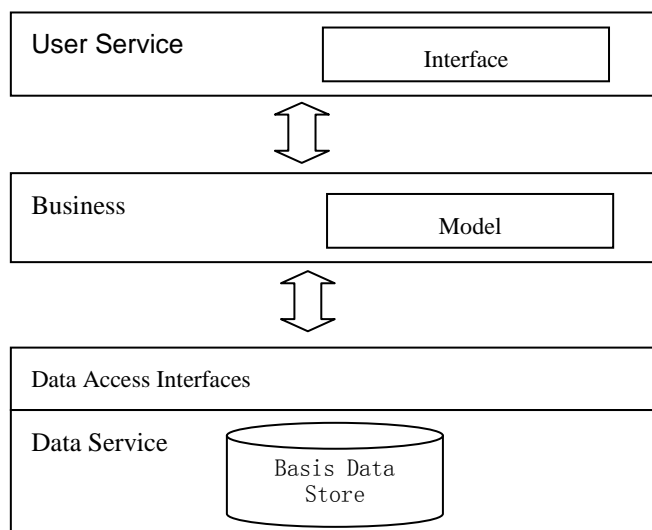


Fig.2 GDSS Architecture

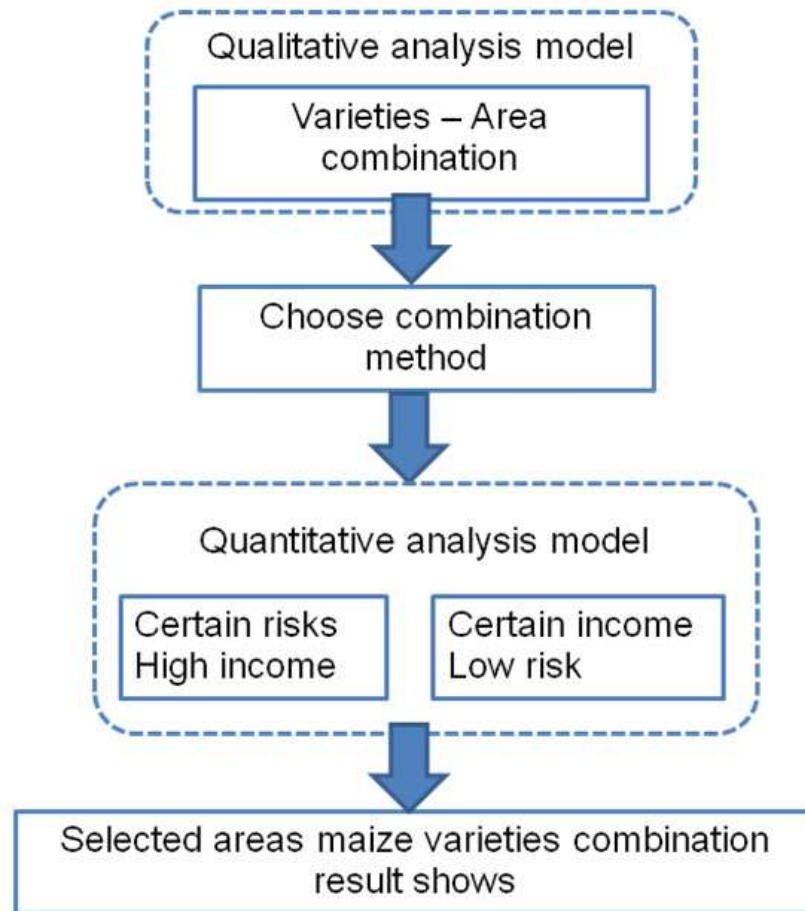


Fig.3

Variety-Regional match:Maize varieties with the county as a unit is carried out, first of all counties should be making a choice, choose the environment. System in accordance with the two major maize growing areas in north and east to carry out division of the Huang-Huai. The main growing areas in accordance with - Province - City - County division to carry out the tree structure is conducive to the user area selection. Meanwhile the model provides a map of the region operation to select. Then according to decision-makers prefer, you can choose varieties. Corn Variety Trial data mainly from the National Agricultural Technology Center, North East, 2001-2008, Huanghuaihai District of New Varieties of Maize regional trial data. Carried out in accordance with qualitative analysis.

Quantitatively match:Because of the production

expectations or tolerance for risk varies, so this module design with parameter settings, allowing users to combine their own preferences to set (with a constraint), such as setting an expected output, the system is given in the The expected level of yield, with the smallest cut the risk of the program; or specify a risk tolerance level to arrive at this level of risk with the highest yield under the program.

3.4 Application examples

In this paper, Langfang City, Hebei Province, as specific examples of the object. First select the Langfang City area, that is to be selected for planting of maize varieties with the environment. Then select the 620697,628318,6319, A3303, AY316, as with species in the quantitative model of high-risk target a certain return, and set the risk-bearing capacity as a general carried out with (Fig.4).



Fig.4

In proportion with the end, that is, there are "species with results" dialog box, in the dialog box, first select the county you want to view and varieties, and then click on "Click to view the results table" button, you can see the selected varieties In the counties with the proportion of data

sheets click on the row headings to select one or more lines of data, you can position the lower right shows the corresponding results of the graphical display, switching, "Bar", "Column" and "pie chart" option, you can display the corresponding graphic. As shown Fig.6.

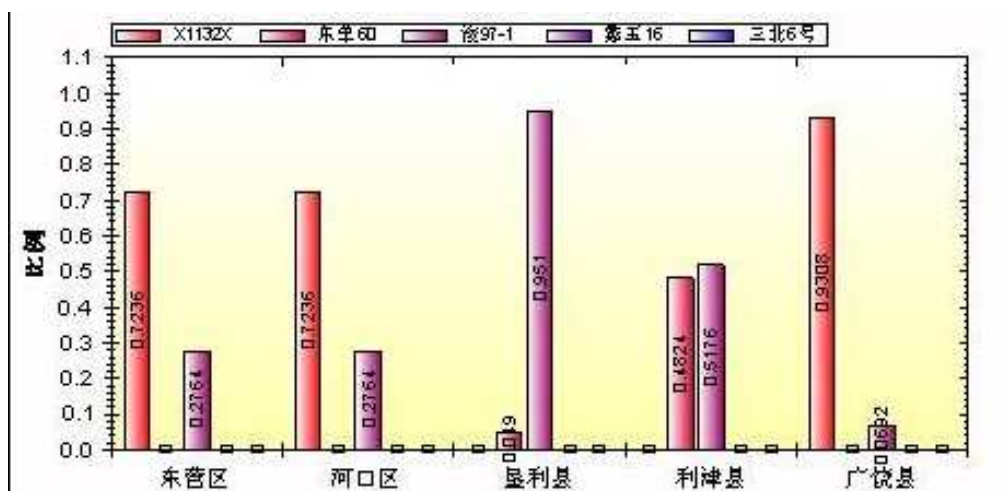


Fig.5 Combination Result



Fig.6

4 Conclusion

This paper introduces the LPM model portfolio, considering the maize varieties with medium-specific factors - characteristics of main characters of maize varieties, weather patterns, terrain type, terrain undulating degrees, pest and disease environment, farming arrangements, will be cross-species and environmental analysis, pairs of maize varieties mean - variance model has been improved in order to better comply with requirements of maize varieties. According to a large number of case studies, reached the following conclusions: one, the risk and yield a positive correlation between risk tolerance, the stronger the higher the expected return; expected yield more conservative lower risks. 2, with the number of varieties is proportional to the number and types of terrain, with undulating terrain is also proportional to the degree. At the same time implements a system, giving local governments, seed companies,

agriculture-related institutions to provide decision support, and production practices to provide effective guidance, not only has theoretical significance, but also practical significance.

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