Research Article

Research and Development of Statistical Analysis Software System of Maize Seedling Experiment

Hui Cao

Henan Radio and Television University, Zhengzhou 450008, China

Abstract: In this study, software engineer measures were used to develop a set of software system for maize seedling experiments statistics and analysis works. During development works, B/S structure software design method was used and a set of statistics indicators for maize seedling evaluation were established. The experiments results indicated that this set of software system could finish quality statistics and analysis for maize seedling very well. The development of this software system explored a new method for screening of maize seedlings.

Keywords: Economic character, growth period, maize seedling experiment, statistical analysis software

INTRODUCTION

Maize, known in some English-speaking countries as corn, is a large grain plant domesticated by indigenous peoples in Mesoamerica in prehistoric times. The leafy stalk produces ears which contain the grain, which are seeds called kernels. Maize kernels are often used in cooking as a starch.

Maize seedling regional testing is used for identifying and evaluating the manifestation of selective and introduced new maize variety in aspects of resisting diseases, pests and weeds, as well as its lodging-resistant, stability, adaptability and stress-resistance, etc., so as to provide important scientific basis for the examination, popularization and rational distribution of the new species (Boomsma *et al.*, 2010). The testing gained large amount of original data information after experiencing serious and careful field observation record and indoor seedling test, however, the department responsible for the test can only record most of the statistical analysis of testing results by means of general statistical analysis software of calculator or SPSS, etc., (Gido *et al.*, 2013), which resulted in difficulties of analyzing and processing the original data, low data information utilization, low work efficiency and even data statistics mistakes which ha d no way to examine. In order to have accurate and efficient statistic analysis to enormous test data information and improve the quality level and work efficiency of regional tests, a new statistical analysis software of maize variety experimental statistical software system has been researched by combining perfectly the specialized knowledge and computer programming techniques on the basis of long term of bearing maize seedling regional tests (Febri *et al.*, 2013).

Statistical software are specialized computer programs for statistical analysis. Statistical Analysis Software is designed to handle large data sets from disparate sources, enabling you to take advantage of all data that is available for analyses. As the value of big data analytics continues to grow, SAS remains a leader in freeing analysts to focus on analysis rather than data issues (Yamada and Kawahara, 2009). In this study, software engineer measures were used to develop a set of software system for maize seedling experiments statistics and analysis works.

MATERIALS AND METHODS

Modern agricultural and food industrial software proposed more scientific demand for various factors influencing maize evaluation system, which allowed agricultural meteorological condition analysis to develop gradually from qualitative analysis to quantitative analysis, as well as from simple numerical relationship to complex mathematical model. The mathematical statistic analysis methods used for the designed software were as follows: regression analysis, screening analysis and clustering analysis.

System development method: In order to avoid the traditional statistical analysis program's defects of bad interactivity, improve the workability of the software system and enhance the comprehensive quality of software system, we made use of the thought of "session independence" to design. In traditional software system, user interfaces interwove with application computers together and distributed in the whole system (Chen *et al.*, 2010). If one separated the user interfaces from application computers and allowed them to constitute separately the program module of software system, then a whole software system would consist of two separate modules, one would be used for managing the communication between users and systems, called

session part, the other would be used for realizing system calculation function, called calculation part. Such thought of dividing system software into session part and calculation part can be called session independence. The advantage of using session independence thought to design software lied in the improvement of the independence of software development.

In the process of system design, prototype development technology was employed, with the purpose of shortening the development cycle, advancing the software quality, reducing development cost, as well as satisfying the needs of users at best. The main procedures of prototype technology were as follows.

Demand analysis: Which was the basis of designing initial prototype.

Develop working model: Establish prototype's initial scheme and begin iteration from it.

Model verification: Which was mainly to inspect, evaluate and test the model.

Amendment and improvement: Which was to amend the improper parts of prototype and to be the basis of the development of new models.

Prototype accomplishment determination: If the prototype can meet the key needs of users on the whole, the developed prototype would come to a conclusion.

Of course, new demands and applications can be proposed with the users' further research on the investigated objects. Then, the above procedures can be repeated for continuous development on the basis of the already developed prototype.

Hardware equipment of the system: This system applied software development program on the basis of Browser/Server structural pattern. Client can make use of the mobile terminal equipment of Android system, server-side applied Dell PowerEdge Servers minitype commercial server with the configuration of CPU: Xeon E5-2609, RAM: 16 GB. Besides, 4 TB RAID 0 SSD hot-plug drives were used in order to allow multiple client sides to complete the uploading and storage of data convenient and swift.

EXPERIMENTS AND RESULTS

Test regulation and definition: Rest regulation must be defined first before the test data entry. At present, it supported two types of test, regional test and production test. The main definition parameters of test regulations were.

Disposition amount: Refer to the number of the variety samples.

The number of experimental plot and experimental group: Refer to the repetition number of test plots.

Standard area: Refer to the area of standard test plot regulated by official and the general area of regional standard test plot was 25.4 m^2.

Actual area: Refer to the actual area being planted in the implementation process of the test and the actual yield of the planting plot can be converted automatically into the yield of standard plot area during experimental statistics. If the line number, the number of columns and plant spacing were defined, the actual area OD planting region would equal to line number times column number times planting distance times line spacing.

Line number, the number of columns and regional cluster number: Regional cluster number equals to line number times column number. These parameters are used for calculating the actual area of planting plot and planting-absent rate converted from plot yield.

Row spacing and line spacing: They are used for calculating the area of actual planting plot and the statistics of various economic characters.

Character in growth period: This module was used for setting the character of growth period of variety of maize participating the test and the regional test only needed to set uniform seeding time and transplanting period in the definition list of test regulation. The system shall automatically calculate the seedling age, total growth period, ranking positions of total growth period, as well as the varied number of days compared with the control variety, of the variety samples.

Test observation data: This module was used for recording various observation projects of maize samples, such as agronomic characters and resistance, etc. It was also used for adding or deleting the variety of test observation projects and defining the test observation standard (Liyuan and Yan, 2013).

Economic character: This module was used for recording field sampling survey data and indoor maize test data of maize attending test in different growth stages. And finally it shall calculate and generate various economic character data.

According to field sampling survey data and indoor maize test data, the main assessment index would be maize grade and maize moisture content:

- Maize grade was divided in accordance with the weight of maize with standard moisture content in unit volume and there was special instrument for testing the volume-weight of maize-volume-weight instrument whose capacity was one liter (Peilong

et al., 2013). The volume-weight of maize can be measured in accordance with the operational approach required by Chinese National Standards (GB1353-2009). The existing national standard can be divided into five grades and the specific grades were: first-grade volume-weight shall be greater than or equal to 720 g/L, the second-grade volume-weight shall be greater than or equal to 685 g/L and less than 720 g/L, the third-grade volume-weight shall be greater than or equal to 650 g/L and less than 685 g/L, the fourth-grade volume-weight shall be greater than or equal to 620 g/L and less than 650 g/L, the fifth-grade volume-weight shall be greater than or equal to 590 g/L and less than 620 g/L and as for those less than 590 g/L shall be off-grade.

- The maize moisture content can be divided on the basis of the ratio of water content of unit maize weight to total weight and most of it would be calculated on the basis of 0.5%. Generally, the safe moisture content of maize in northeast shall be 14.0% (available for meeting the safe storage of grain) and different regions were with different maize safe moisture. The simple method of measuring moisture was to use rapid moisture meter, whose speed was fast, but with certain error. Relative accurate method was to take maize to the examine room of grain department, use pulverizer to smash the maize and weigh it and then place it into constant temperature oven to bake for scheduled time and weigh after it cooled down to indoor temperature, after that, the ratio of weight difference to weight before baking was the moisture content of maize. In the past, most of the inspection personnel in grain department can determine the moisture content of maize by depending on perception. However, in order to protect farmers' interests and fair dealing, country has forbid inspection personnel to examine the moisture content of maize in accordance with perception. Generally, the moisture content of new reaping maize in northeast can be around 27% and about 14% in south area of southern central plains. While, the moisture content of new reaping maize was related with the weather of mature period and the maturity of maize.

Yield computation: This module was mainly used for regional yield record of maize samples, calculation of yield per unit area and ranking. The specific functions were as follows.

Dry rate can be calculated in accordance with the raw weight and weight after drying of the actual reaping maize of the plot.

Yield-discount calculation can be made on the basis of the actual planting-absent rate of the plot.

Convert the actual planting yield into yield of regional area.

Calculate the general comparison of theoretical yield per unit area and actual reaping.

Make contrast calculation of actual reaping with control variety, meanwhile, make difference significant T detection.

Carry out new multiple range method test among varieties of maize samples and show them by letters.

Biostatistics: This module was used for biostatistics analysis of maize variety test and supported T detection, F detection and new multiple range method tests and can generate automatically: comparison table, analysis of variance table, yield differences ladder table, yield difference letters mark table, the minimum differential and yield comprehensive table.

Comprehensive assessment: This module was used for adding evaluation index projects in comprehensive evaluation table and then accomplishes comprehensive evaluation of maize samples by comparing the index and precedence. Users can also predefine project evaluation, evaluation criteria and evaluation, so as to allow the system to complete the comprehensive evaluation of maize varieties samples intelligently in accordance with the predefinition, at last, manual amendment and repletion shall be done.

Other functions: This system can also be applied in the following aspects.

Across-table custom query: Select data projects in different statistical data tables to one same data table.

Across-rent custom query: Select same data in different experimental group's across-group into one data table.

All data tables can be customized into spreadsheet and also can be printed.

Data printout: It can be used to allow experimental statistical data to be filled in the testing record table directly; in addition, the testing statistical data shall be customized by experimental record before it was filled in the testing record table. Successively fill in data projects can be set.

CONCLUSION

This research developed a set of statistical analysis software system for maize seedling experiment by software engineering approach. It can be proved through the experiment that this system can accomplish experiment instructions definition, data automatic record and calculation, biostatistics, comprehensive

evaluation of experimental samples, printout and experimental materials archiving, etc. It was very suitable for the screening tests and production experiments of maize seedling. But it should be improved if the following problems appeared. Firstly, user interface still needs to be perfected, so as to make it proper to various tablet computer and allow users to use the software timely and conveniently in experimental plot; secondly, on account of the increase of experimental data, more efficient cloud computing supporting platform can be used in the future, so as to expand the operational capability of the software.

REFERENCES

Boomsma, C.R., J.B. Santini, T.D. West, C. Brewer Jason, L.M. McIntyre and T.J. Vyn, 2010. Maize grain yield responses to plant height variability resulting from crop rotation and tillage system in a long-term experiment. Soil Tillage Res., 106(2): 227-240.

Chen, L.J., X.W. Bai and W.T. Ren, 2010. Identification and location of corn seedling based on computer vision. Proceedings of the International Conference on Signal Processing, pp: 1240-1243.

Febri, D., K.N.A.S. Najeeb, M.T. El Mubarak, N.A. Nawal, I. Anizan, C.M.Z. Che Radziah and W.Y. Wan Mohtar, 2013. Microbial involvement in growth of paddy. Curr. Res. J. Biol. Sci., 5(6): 285-290.

Gido, O.E., K.L. Job, K.I. Gicuru, K.M. Benjamin, W.K. Sibiko and K.J. Mwangi, 2013. Maize farmers perceptions towards organic soil management practices in Bungoma County, Kenya. Res. J. Environ. Earth Sci., 5(2): 41-48.

Liyuan, Y. and S. Yan, 2013. Effects of super absorbent resin on leaf water use efficiency and yield in dry-land wheat. Adv. J. Food Sci. Technol., 5(6): 661-664.

Peilong, X., S. Yipeng and N. Na, 2013. Effect of grape procyanidins on vascular endothelial cell apoptosis by flow cytometry analysis. Adv. J. Food Sci. Technol., 5(4): 449-452.

Yamada, S. and A. Kawahara, 2009. Statistical analysis of process monitoring data for software process improvement. Int. J. Reliab. Qual. Safe. Eng., 16(5): 435-451.