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OPINION

on the dissertation for obtaining the educational and scientific degree "Doctor" in: Professional field "5.7. Architecture, Construction and Geodesy" and scientific specialty, Land Management and Protection of Agricultural Land (incl. Property Management).

Author of the dissertation: ENG. LYUBOMIR LYUDMILOV STOYANOV, PhD student in independent study at the Department of Sustainable Land Use and Property Management, Faculty of Geodesy at the University of Architecture, Civil Engineering and Geodesy, Sofia.

Topic of the dissertation: "Soil-climatic assessment when establishing vineyards for white table wines".

Reviewer: Prof. Dr. Veneta Naydenova Krasteva-Penkova, IPAZR – Sofia, Professional field code 6.1. "Plant production", Scientific specialty "Soil science".

1. Evaluation of the results obtained

Viticulture is one of the important and profitable sub-sectors of agriculture in Bulgaria. This importance over time is due to the specificity and peculiarities in the production and processing of grapes, related to the history, religion, traditions, legislation, geographical location and soil-climatic conditions of the country and the region, as well as the dietary and medicinal qualities of grapes and wine. The climate, relief and variety of soils offer very good opportunities for viticulture and winemaking in the country.

In the presented dissertation work, the main soil-climatic indicators for zoning of vineyard plantations for the production of white table wines are described and parameterized. A multi-level soil-climatic assessment model has been developed and presented, which is objective for the suitability of specific territories for the creation of highly productive vineyards. Through this assessment, the risks associated with yields, quality and soil degradation are minimal.

The tasks through which the set goal is achieved are precisely selected and presented in a logical sequence.

The literature review notes the developments of leading specialists in the field of viticulture and winemaking. The professional experience of many researchers is presented, which helps to determine the optimal, minimum and maximum limits of selected indicators assessing the suitability of a given territory for growing vineyards. The meaning of the concept of "terroir" is described - which is defined as a "growing environment" or the basis for the formation of a characteristic and quality wine. The word "terroir" includes the interaction between the natural environment and the vine, which has a strong influence on the "development of the plant, the ripening of the grapes and the taste characteristics of the wine".

The main soil characteristics that directly influence the development of the grapevine crop are indicated - soil strength, mechanical composition, total porosity, humus content, total carbonate content, soil reaction, groundwater level. Each of the soil indicators is justified and supported by the research of Bulgarian and international scientists. After the description of each soil indicator, tables and "more important conclusions" are presented, which briefly and accurately formulate the positive or negative influences of the individual soil indicator.

The most important meteorological elements forming the assessment of climatic conditions are also described in detail, and again the material is supported by a review of the research of scientists dealing with grape plantations. The main factors considered are air temperature, temperature sum, annual precipitation sum and amount of precipitation in the months of September and October. The indicators forming the assessment of climatic conditions are clearly presented in tabular form, and for each indicator "more important conclusions" are drawn. This makes it easier for the reader and is an easy reference point whether the climatic conditions in the area are suitable for the specified grape variety.

The literature review describes the influence of geomorphological conditions, as the topography of a given location plays an important role in the growth and quality of vineyards. The influence of altitude and slope exposure on certain climatic elements is indicated.

The main varieties of white wine grapes and the areas occupied by them in the 6 wine-producing regions of the country are presented.

After a description of the main indicators (soil, climatic, topographic) that have a direct impact on the development of grapevine crops, the methodology for assessing soil and climatic conditions is presented. An "adapted and supplemented model" for soil and climatic assessment of geographical territories is applied, which shows the degree of suitability for growing highly productive vineyards for white table wines.

The methodology and basic principles of risk assessment (identifying risks, analyzing their probability and impact, and assessing whether the risks are acceptable against previously established criteria) are used as a basis. The purpose of the assessment is to support informed decision-making regarding the need to treat the risk and the priorities in its management. As a result of the assessment, the risks are categorized as high, medium and low.

The basic principles of the above-mentioned model are used in the considered dissertation work, but there is an upgrade, which consists in the following: it applies a parametric assessment of the main indicators of soil and climatic conditions that determine the suitability of the territory for growing vineyards. The presented model reflects the influence and evaluates the interaction of the main factors characterizing the terroir. The dissertation work defines.

1. Basic soil and climatic indicators; scales have been developed for assessing each indicator; 2. Assessment of conditions (soil indicators and correction coefficients) and (climatic indicators and correction coefficients). 3. An assessment of soil conditions and an assessment of climatic conditions are obtained. 4. A general assessment of soil and climatic conditions is formed from these two assessments. A scale from 1 to 5 has been developed for each of the indicators (presented in tables).

The optimal conditions for the development of the plant according to its biological requirements (for each indicator) receive the highest score - 5, and those conditions that lead to significant violations and difficulties in the normal development of the plant receive the lowest score -1. The assessment of the suitability of the soil type is maximum - 35 points, minimum - 7 points). It is formed from the sum of the scores obtained for each of the selected indicators (in this case 7 soil indicators).

An assessment of soil conditions in a certain territory is formed from the average assessment of all soil types in the selected area. Determination of the final (corrected) assessment of soil conditions (maximum – 5, minimum – 1) is obtained after applying correction coefficients (for each indicator separately).

When assessing climatic conditions (for the indicators -t° min, t° max, T, annual precipitation amount, precipitation amount in IX and X). Assessment of climatic conditions (maximum – 25 points, minimum – 5 points) (in this case 5 climatic indicators). It is formed from the sum of the assessments obtained for each of the selected indicators. The assessments of the

climatic indicators are multiplied by the corresponding correction coefficients and the final assessment of the climate in the specified region is obtained.

The application of correction coefficients takes into account the importance of a given indicator. The one that has the most significant impact on the development of the plant and cannot be changed by man (for example, mechanical composition) receives a higher weight. The score obtained for the respective indicator is multiplied by the correction coefficient. The sum of all weight (correction) coefficients is 1 (unit). When determining the weight (correction) coefficients used to calculate the final assessments of soil and climatic conditions, the Analytical Hierarchy Process (AHP) method developed by Thomas Saaty (Saaty, 2012) was applied. The scale was developed in 9 levels, with the lowest - first level - the two indicators having equal importance for the assessment, and at the 9th level there is dominance of one of the indicators over the others. When calculating the overall assessment of soil and climatic conditions, this is reflected in the values.

The newly developed methodology has been applied to assess the soil and climatic conditions of the municipalities of Karlovo, Ruse, Varna and Kavarna (traditional wine-growing regions) for the establishment of vineyards for white table wines, based on the biological characteristics and requirements of certain grape varieties.

The main soil differences in the municipalities are described with values of their physico-chemical properties. Each soil and climatic indicator receives a score ranging from 1 to 5 points. An average score of all soil differences in the specific municipality is calculated.

According to the values of the obtained complex soil-climatic assessment, the lands are classified as unsuitable, satisfactory, good, very good, excellent.

The developed methodology for assessing soil and climatic conditions for the production of white wines is practical, written in a comprehensible manner and easily applicable in practice. The selected indicators are presented in tables and diagrams, so that the reader can understand the sequence in which they were carried out. The development can be successfully applied for zoning of vineyard plantations by the Ministry of Agriculture, Regional Directorates and Municipal Agricultural Services, by agronomists and even non-professionals, as long as they have up-to-date data on the specified indicators.

2. Contributions and recommendations for implementation

In the last part of the dissertation, the author has formulated 6 contributions. I accept the contributions as the personal work of the doctoral student, and as the main conclusions of the dissertation. As a significant contribution, I consider the proposed «Adapted and supplemented model for soil-climatic assessment» consistent with the biological characteristics and requirements of grape varieties for the production of white table wines; Based on the biological requirements of the grape crop, the most significant soil and climatic indicators are presented, which have a direct impact on its development.

Optimal and limit values have been determined for each of the indicators; Criteria for the analysis of terroir conditions are presented, which take into account the complex interaction between climate, soil, relief and varietal characteristics of the vines. This approach allows for a more precise assessment of the suitability of territories for high-quality viticulture. The developed methodology can be applied in sustainable land use planning, focusing on the effective and environmentally friendly zoning of territories for viticulture purposes. This contributes to minimizing agro-ecological risks and protecting soil resources. Last but not least, contribution No.

1 - which presents the requirements of the vine to soil and climatic conditions based on modern scientific research in a wide range of world-famous regions for viticulture, including in Bulgaria.

3. Critical notes and questions

As a remark, I can point out that the dissertation does not explain very clearly the method of obtaining the correction coefficients for the individual indicators. There are minor typos in the dissertation, but they are not many. On page 94, table 30, the heading indicates minimum temperatures instead of the amount of precipitation in September-October. On page 122, it is stated that the Rendzins suffer from a low content of carbonates, but it is exactly the opposite. I agree that this methodology is very applicable in the development of territories.

Question: What is meant by "developing a model for adapting viticulture to climate risks - drought, frost, extreme precipitation"? I recommend that the doctoral student continue to apply the model to the territory and other municipalities.
It will be very useful to study the influence of soil and climatic conditions in the country's vineyard areas, related to the yield of production that went into the production of wines that have won awards at world competitions. These areas can serve as a benchmark for the production of vine plantations for the production of white table wines.

4. Published articles and citations

The documentation for the procedure indicates two independent publications related to the dissertation work and one in co-authorship, published in the Yearbooks of UACEG.

Conclusion:

Based on the various methods studied and applied by the doctoral student, the purposefully and correctly conducted research and interpretations, the generalizations and conclusions made, I believe that the presented dissertation meets the requirements of the ZRASRB and PPZRASRB, which gives me reason to evaluate it POSITIVELY.

I would like to propose to the esteemed Scientific Jury to also vote positively and award Eng. Lyubomir Lyudmilov Stoyanov the educational and scientific degree "Doctor" in the Professional Field "5.7. Architecture, Construction and Geodesy" and the scientific specialty, Land Management and Protection of Agricultural Lands (including Property Management).

08. 2025 year.

PREPARED THE OPINION:

Sofia

Prof.dr. V.Krasteva