



REVIEW

regarding the competition for occupying the academic position of *Professor* in professional area: 4.5 Mathematics; scientific specialty: *Mathematical Modelling and Application of Mathematics*, announced in the State Gazette, issue №65/08.08.2025, with a candidate Velika Nikolaeva Kuneva – Agricultural University – Plovdiv

Reviewer: Prof. Todor Zhelyazkov Mollov, DSc, *Paisii Hilendarski* Plovdiv University, field of higher education: 4. Natural Sciences, Mathematics and Informatics; professional area: 4.5 Mathematics; scientific specialty: *Algebra and Theory of Numbers*, assigned a member of the scientific jury with Order № РД-16-1018/ 08.10. 2025 of the Rector of the Agricultural University – Plovdiv.

1. General data regarding the candidate's career and professional development.

Associate Professor Velika Kuneva was born on 01.07.1977 in Plovdiv. In 2001 she graduated from *Paisii Hilendarski* Plovdiv University obtaining a master's degree in mathematics and informatics. In 2008, after a successful competition, she was appointed as an assistant professor in the Department of Mathematics and Physics at the Faculty of Economics. On 10.01.2013 she successfully defended her doctoral dissertation and obtained the educational and scientific degree of *Doctor* in the scientific specialty *Algebra and Number Theory*. She was habilitated as an associate professor in 2016 in the scientific specialty *Mathematical Modelling and Applications of Mathematics*.

The candidate's research development covers a wide range of publication activities.

Assoc. Prof. Velika Kuneva has trained and led to the successful defence two doctoral students.

Her professional career at the Faculty of Economics also includes several administrative positions. During the periods 2017-2018 and 2020-2024 she was the Deputy Dean of the Faculty, and since April 2024 to the present she has been the Dean of the Faculty of Economics.

Assoc. Prof. Kuneva actively participates in the activities of the Agricultural University and the Faculty of Economics. Over the years she has been elected as a member of the Academic Council, a member of the Faculty Council and Faculty Erasmus Coordinator.

The total work experience of Assoc. Prof. Velika Kuneva is 23 years, including 16 years and 11 months at the Agricultural University - Plovdiv.

She is fluent in English and Russian. This provides her with an excellent opportunity to teach foreign students under the Erasmus + program.

2. General description of the submitted materials.

Assoc. Prof. Velika Kuneva has submitted summarized information with relation to the science-metric indicators covering the minimum national requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its application of the Agricultural University:

- **Indicator A** – 50 points out of minimum 50;
- **Indicator B** – 222 points out of minimum 100;
- **Indicator Г** – 738 points out of minimum 200;
- **Indicator Д** – 208 points out of minimum 100;
- **Indicator E** – 191,67 points out of minimum 100;
- **Total number** - 1409.7 points out of minimum 550.

It is evident that Assoc. Prof. Kuneva's scientific works fully meet and significantly exceed the requirements for the occupation of the academic position of Professor.

Assoc. Prof. Kuneva has presented a common list of scientific publications – **110** in number, of which:

- Publications related to the doctoral dissertation – **6**;
- Publications related to the competition for Associate Professor and the verification in the National Agency for Information and Documentation (NACID) – **46**;
- Publications in conference proceedings – **25**;

In the present competition Assoc. Prof. Kuneva participates with a production of **33** scientific works in the nomenclature specialty. They are subjects of review regarding the present competition grouped as follows:

- Scientific publications referenced and indexed in world-renowned databases of scientific information **Web of Science** or **Scopus** – **33**;
- Publications in **Web of Science** with impact factor and quartile – **10**;
- Publications in **Scopus** with impact factor and quartile – **8**;
- Publications in **Web of Science** without impact factor and quartile – **14**;
- Publication in **Web of Science** and **Scopus** with **SGR**- **1**;

31 (94%) of the 33 mentioned works are published in English language and 2 (6%) - in Bulgarian.

- ❖ Textbooks – **1**;
- ❖ Handbooks – **2**.

3. Main directions of the candidate`s research work.

After defending her doctoral dissertation related to the field of algebra, the candidate has directed her research interest to the application of mathematics in agronomy, which most corresponds with the profile of the Agricultural University. Generally she participates in interdisciplinary research teams using various mathematical and statistical approaches in her work to analyse experimental data from different areas of agronomic science; to establish the relationship between the studied factors and their influence on the studied processes, as well as their subsequent modelling using variation and dispersion analysis, regression analysis, cluster and factor analysis.

As a teacher and researcher with an educational background in mathematics, Assoc. Prof. Kuneva applies mathematical methods to study and analyse various processes in agricultural science. Her scientific interests in the presented publications are related to the use of mathematical-statistical processing based on the analytical and logical approach.

The main directions are as follows: 1) application of mathematical and statistical methods in research in the agricultural sphere, 2) applied solution of transport problems and Leontiev's mathematical and economic balance model using MS Excel (Solver) software, 3) application of differential equations for analysis of a kinetic model describing the development of autoimmune diseases.

The candidate participates in three scientific and educational projects, in one of which she is the leader of a work package.

4. Evaluation of the candidate's teaching work. Her role in the training of young scientists.

Assoc. Prof. Velika Kuneva is distinguished via her extremely active teaching work. She has gained 17 years of teaching experience - training undergraduate students and doctoral students.

According to the submitted certificate (NOF 5-17/23.09.2025) from the agricultural University - Plovdiv, the teaching workload of Assoc. Prof. Kuneva for the period 2020-2025 is 4498.3 hours - lectures, practical classes and extracurricular activities. The average annual workload over the last five years has been 900 hours.

I pay special attention to her participation in the training of students under the Erasmus+ program. She has read lectures in English in the disciplines Higher Mathematics, Applied Mathematics, Mathematical Programming and Optimization Methods.

Proof of her high teaching qualification is the interest in these disciplines shown by foreign students from different countries, which has multiplied over time.

Assoc. Prof. Velika Kuneva has developed curricula in the disciplines: Higher Mathematics, Applied Mathematics, Optimization Methods, Linear Algebra and Analytical Geometry for Bachelors and Masters in full-time and part-time studies.

To facilitate the students' training, Assoc. Prof. Kuneva has participated as a co-author of two handbooks and the independent author of one textbook in Higher Mathematics.

After being elected to the academic position of *Associate Professor*, she has supervised 5 graduates who defended their diploma theses.

Assoc. Prof. Velika Kuneva is the supervisor of 4 doctoral students, two of whom have successfully defended their dissertations. The candidate's teaching activities to date prove that she is a well-established and successful teacher and scientific supervisor in the field of this competition - mathematical modelling and application of mathematics.

5. Significance of the obtained results, proved by citations and publications.

A review of the scientific publications presented by Assoc. Prof. Velika Kuneva shows that the indicated 26 citations cover and even exceed the required number of points according to the requirements of this criterion. There are no self-citations.

6. Contributions and their significance for science and practice. Evaluation of the candidate's research profile.

The publications and their scientific conclusions based on mathematical analysis performed with various mathematical and statistical methods allow for more effective planning of experiments, a significant reduction in experimental work and an objective assessment of the obtained results. It represents a significant contribution to practice.

The candidate Assoc. Prof. Velika Kuneva has a clearly outlined profile of research work related to mathematical modelling and application of mathematical methods in agronomic research studies.

I. SCIENTIFIC AND APPLIED CONTRIBUTIONS

General description of the research work

In her scientific works the candidate uses methods of applied mathematics, applied solution of transport problems and kinetic model of nonlinear systems of differential equations. Classical methods are applied, such as a two-factor analysis of variance (Anova), a correlation analysis for calculating Pearson correlation coefficients, a factor analysis, which is a branch of applied mathematics (created by Charles Spearman), and a cluster analysis from informatics and mathematical modelling used for grouping objects into clusters. An applied solution of transport problems and an applied solution of the Leontiev model using MS Excel software (Solver), as well as an analysis of the kinetic model of autoimmune diseases, which is a model of nonlinear systems of differential equations, has been performed by the candidate.

I will note that the theoretical justifications and graphical interpretations in Kuneva's co-authoring works have been conducted by her.

The scientific works are in sections B and Γ.

Publications in group B

In Publication [1] a two-factor analysis of variance (Anova) from statistical modelling is performed to determine the effect of one preparation on a coriander variety.

In Publication [2] a model with nonlinear systems of differential equations with numerical results for autoimmune diseases is presented.

In Publications [3,4,5] a solution to transport mathematical problems and a Leontief model is given using the MS Excel software (Solver).

Publications in group Γ

1. In Publications [1 and 3] a correlation analysis is applied for the main biometric indicators of rapeseed and corn for silage and grain. This increases the objectivity in the assessment of the complex effect of *Reni* preparations with *Mnogolistna 1* alfalfa variety. This analysis shows correlations between the relevant indicators 14, 22.
2. In Publication [2] the effects of individual cultural dimensions and motivations on the behaviour economy of Turkish and Bulgarian participants are studied using mathematical methods. Bulgarians are more affected by the motivation for pleasure compared to the participation in the sharing economy, while Turkish participants are more affected by the motivation for sustainability.
3. In Publication [4] eight common wheat varieties are compared using cluster analysis and factor analysis.
4. In Publication [5] real data regarding the coriander production process are presented using the analysis of variance model. The technology is evaluated using a T-test. The obtained results are valid only under specific conditions.
5. In publication [7] a mathematical approach is used - cluster, correlation and factor analysis to analyse pea crop.
6. Mathematical models describing the parameters of the relationship between transpiration yield according to the FAO linear formula and the Davidov degree for common beans are calibrated [9 and 12].
7. In Publication [10] a correlation and factor analysis is applied to assess the similarity and remoteness of the impact of climatic indicators on some clones of Syra variety. As a result, correlations between phenological indicators are established.
8. By applying a cluster, correlation and factor analysis, it is conducted an assessment of the similarity and remoteness of the impact of different fertilization regimes and their grouping based on main morphological and generative indicators on *Tushon* carrot variety [13].
9. In Publication [8] an option for reducing the costs in delivering ornamental plants to nurseries is presented. In Publication [17] an option for reducing the costs of fertilization is studied. The transportation costs are optimized by solving a transportation problem under certain conditions. The proposed algorithm for describing a transportation problem and its subsequent solution using MS Excel (Solver) helps to reduce the costs of performing the technological operation of fertilization.
10. In Publication [19] seasonal changes of dominant algae in shallow fishponds are analysed for the first time in the country applying the concept of functional groups. One hundred and seventy-two taxa are identified, classified into 22 functional groups. The results of the applied cluster analysis show that the algae are grouped into four clusters. The obtained data indicate that this ecological approach would be suitable for studying the ecology and seasonal changes of dominant algae species.
11. In Publication [21] the effect of nutrition and irrigation on the productivity of the oil-bearing rose (*Rosa Damascena Mill*) is studied and linear regression models are derived that express the influence of the yield indicator. The obtained correlation relationships show the degree of influence of each indicator on the formation of yields in the oil-bearing rose.

12. A correlation analysis is used to assess the relationship between the main biometric indicators for three cotton varieties. Correlation relationships with a high degree of correlation are established between the structural elements: mass of one seed and bud formation ($r = 0.989$), mass of one seed and number of seeds per plant ($r = 0.988$) under irrigated conditions - Publication [23].

13. Using a correlation and cluster analysis, the similarity and dissimilarity of different irrigation regimes for tomatoes are assessed - Publication [26]. The cluster analysis has separated the similarity into two main cluster options. The strongest positive correlation is found between total pigment and lycopene yield, beta-carotene.

14. In Publication [27] 54 rye samples are studied. 54 local and introduced rye samples were studied based on some basic biochemical parameters – crude protein, %; lysine, % and lysine in protein, %, as well as their grouping using hierarchical cluster analysis.

15. Using cluster analysis and factor analysis, the similarity and remoteness of the impact of different irrigation regimes on tomatoes (*Vitelio* variety) and their grouping by basic biochemical indicators are assessed. The strongest positive correlation is observed between the indicators total dyes and lycopene for the two experimental years (Publication [28]).

II. METHODOLOGICAL CONTRIBUTIONS

These contributions include the candidate's participation as a co-author in 2 handbooks: *Handbook of Applied Mathematics* (2011) and *Handbook of Optimization Methods* (2018), as well as an individual author of the *Textbook of Higher Mathematics* (2024). They are adapted for undergraduate students of the Agricultural University and specialists interested in the application of modern mathematical methods in various fields of science.

7. Critical notes and recommendations.

I have no critical notes.

8. Personal impressions and reviewer's opinion.

In my opinion, Velika Kuneva is an ambitious lecturer and a completed scientist.

CONCLUSION

Taking into account the candidate's teaching, scientific and scientific-applied work, I believe that Assoc. Prof. Velika Kuneva, PhD, meets the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for its application, as well as the Regulations for its application of the Agricultural University. She is distinguished by her excellent teaching activities and the efficient use of applied mathematics to create numerous agricultural models.

All this gives me ground to evaluate **POSITIVELY** her overall work.

I would like to propose the esteemed Scientific Jury to also vote positively, and the Faculty Council of the Faculty of Economics at the Agricultural University - Plovdiv to elect **Velika Nikolaeva Kuneva** to occupy the academic position of **Professor** in the scientific specialty ***Mathematical Modelling and Application of Mathematics***.

04th November, 2025
Plovdiv

REVIEWER: 
(Prof. Todor Zhelyazkov Mollov, DSc)