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ABSTRACT

Keywords: *biostimulating substances, table grapes, productivity, Iasi vineyard.*

The doctoral thesis with title „*Research regarding the influence of some treatments with biostimulating substances on the production and quality of grapes at some table varieties grown in the conditions of Iasi vineyard*” is included in the assembly of research carried out worldwide regarding the development of the viticultural sector by obtaining higher production of table grapes quantitative and qualitative, that would satisfy the requirements of consumers, by improving actual cultivation technologies along with minimizing costs and maximizing the profit.

This paper aims to study the influences of treatments with biostimulating substances on table grape varieties, both indigenous and cosmopolitan, or romanian new creations, growing in Iasi vineyard area, Copou viticultural center.

The doctoral thesis is structured in two parts and contains 258 pages, which includes 141 tables, 102 figures and color pictures and bibliography containing 209 titles. The first part of the paper, regarding *the current state of knowledge* on the issues approached, include the introduction and three chapters, and the second part represents *personal researches*, presented in eight chapters, including the final conclusions and recommendations.

In **Chapter I**, with title *Present state of research regarding growth stimulators plant hormones*, is presented a summary of the bibliographic data concerning the use of bioastimulating substances history, definition, classification and plant hormone biosynthesis, and also the major influences that main phytohormones (auxins, gibberellins, cytokinins) exerted on plants.

Chapter II, entitled *Present state of research regarding the use of biostimulating substances within vines growing technology*, presents information on grape morphology, physico-structural and biochemical features of table grapes, determining the optimal concentration and timing of application of biostimulating substances used in the growing technology of the vine. Also, this chapter summarizes data on the influence of treatments with bioactive substances on physical and chemical properties of table grapes.

The natural framework of research is presented in **Chapter III**, both from climatological and geomorphological point of view, and also from the perspective of geographical location.



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Part of personal research begins with **Chapter IV**, *Scope and objectives of the research*, which presents general considerations concerning the scope of present work, complemented by the activities undertaken in each objective.

Organizational framework, the biological material used in the study, the substances used for the biostimulating treatments and methods of research are presented in **Chapter V**.

Experience has been located in the ampelographic collection of „Vasile Adamachi” farm, situated in Copou viticultural area, belonging to the University of Agricultural Sciences and Veterinary Medicine (U.A.S.V.M) „Ion Ionescu de la Brad” Iasi. The most important instrumental measurements was conducted in the Laboratory of Viticulture from U.A.S.V.M Iasi.

The biological material was represented by seven varieties of vine grapes: Gelu, Chasselas doré, Muscat de Hamburg, Coarnă neagră, Coarnă neagră selecționată, Xenia and resistant variety Moldova.

During the two years of study (2011 and 2012), the experience was organized in three repetitions. Biostimulating substances: Cropmax[®], in concentration of 10 mL/10 L H₂O, 25 mL/10 L H₂O and 50 mL/10 L H₂O and Kelpak[®] in concentration of 50 mL/10 L H₂O, 100 mL/10 L H₂O and 150 mL/10 L H₂O were applied foliarly, at three phenophases: before flowering, after falling of flowers and at the formation of berries, at varieties: Gelu, Chasselas doré and Moldova. The application of gibberellic acid (GA₃) was carried out by direct spraying of inflorescences, in the flowering phenological phase, where 70% of the corollas were fallen, at all varieties selected for the study, in a concentration of 25 ppm, 50 ppm and 100 ppm.

Physico-structural determinations (average weight of the cluster, weight of 100 berries, the average weight of a berry, the average number of bunches per vine stock, average number of berries per cluster, number of seeds in berry, seeds weight, the average yield per vine stock, the average yield per hectare, the percentage of marketed production) were performed biometrically, based on them being determined a series of factors and indices of structure, composition, fertility and productivity of the varieties.

Regarding the chemical determinations carried out on samples at harvest, were determined soluble dry matter content of the grapes (refractometric method), equated to the amount of sugars (according to Ribereau-Gayón, 2004) and the titratable acidity (according to O.I.V.).

The quantification of the total content of anthocyanins (pH variational spectrophotometric method) and the total content of phenolic compounds (Folin-Ciocalteu method), completed the chemical determinations carried out on grapes obtained after the bioactive treatments.



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Also was performed the measurement of photosynthesis intensity in leaves and additional parameters (photosynthetic active radiation, intracellular CO₂, evapotranspiration, stomatal conductance and photosynthesis rate), using the gas meter Lci 600 (ADC BioScientific Ltd.).

Results and discussions regarding the influence that treatments with biostimulating substances have on the analyzed varieties are presented in **Chapters VI, VII and VIII**, their exposure being accompanied by the presentation of statistical significance through the calculation of limit differences.

Unlike the year 2011, in 2012 were registered variations in the characteristics of productivity, due to low temperatures recorded in the winter 2011-2012 and the uneven distribution of precipitations during the growing season.

Once with the application of Cropmax[®] treatments, was found that the variety Chasselas doré reported the best results in terms of grape quality and yield per hectare that registering the maximum values of 28.91 t/ha in 2011, respectively 20.28 t/ha in 2012, at low levels of stimulator product (10 ml/10 L H₂O). Increasing the concentrations of bioactive product affected negatively the fertility and productivity characteristics of the variety, the average yield per hectare being reduced to 16.78 t / ha, in 2012.

At the variety Moldova, the application of low concentrations of Cropmax[®] (10 mL/ 10 L H₂O) contributed to the increase of berries size and quality expressed through a balanced ratio between sugars and acidity (26.58), with a trend of additional accumulation of phenolic compounds (1.411 g GAE/100 g, in 2011 and 1.693 g GAE/100 g, in 2012), but without a positive influence on average yield per hectare, which was about 10% lower than the control variant.

Treatment with Kelpak[®] had a positive influence only in the case of Moldova resistant variety, at which were registered yield increases of above 40% (2012), with an average of 28.71 t/ha, in the case of concentration 100 mL/10 L H₂O, with a significant percentage of marketed production that exceeded 90%.

Variety Gelu responded best to treatment with gibberellic acid (GA₃), the concentration of 50 ppm being the optimal in terms of quality indices and productivity. Were registered highly significant positive statistical differences compared to the control regarding the average production per hectare (24.67 t/ha, in 2011 and 17.38 t/ha, in 2012).

Treatments carried out with 50 ppm of gibberellic acid at the variety Xenia were transposed through outstanding yield increases of above 45%, with an average production of 16.17 t/ha compared to the control variant (11.25 t/ha). Higher doses of GA₃ contributed to the



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increase of production quality, through a superior accumulation of soluble sugars (175.50 g/L) and phenolic compounds (0.639 g GAE/100 g, 2012), in the detriment of the average production per hectare, which not exceed 15.00 tons. At this variety, can be observed the positive relationship between the concentration of GA₃ applied and the sugar content ($R^2 > 0.89$), titratable acidity being inversely correlated with the dose of stimulator applied.

At Moldova variety, performing the GA₃ treatments in high concentrations (100 ppm) has resulted in obtaining an increase of production of approximately 30%, reaching an average up to 28.35 t/ha compared to the non-treated variant (21.56 t/ha).

At Muscat of Hamburg variety, gibberellin concentration that can be successfully applied to obtain a high yield of grape production, with a significant improvement in their quality parameters, was 25 ppm GA₃, ensuring a increase in production of over 18% and an increase in marketed production of 72%. At these concentrations glucoacidimetric index held equilibrated values (34.17) and the anthocyanin content was significantly improved (1140.46 mg/100 g skin). The number of seeds in berry remained constant (two) and the concentration of anthocyanins was over 30% higher compared to the untreated variant.

Low concentrations of gibberellic acid (25 ppm GA₃) applied on the inflorescences of the variety Coarnă neagră influenced positively the average weight of a grape (332.30 g), the average yield per hectare increasing from 12.43 t/ha (untreated variant) up to 17.08 t/ha, the production growth compared to the control being statistically significant positive, reaching 40%. With the increasing of gibberellins concentration (up to 50 ppm), sugars and phenolic compounds of Coarnă neagră grapes had a positive evolution, exceeding 0.70 g GAE/100g, but with a reduction in average yield per hectare.

The variety Coarnă neagră selecționată, in contrast to the variety of origin, presented increased yields of about 20% compared to untreated variant, at an average concentration of gibberellic acid (50 ppm GA₃), that also led to a further accumulation of anthocyanin (606.34 mg/100 g skin), grapes appearance being enhanced by obtaining higher and uniform colored berries.

In the **Chapter IX** is presented the *statistical analysis of variance (ANOVA)* applied to the values of the main physical and chemical characteristics studied, indicating that at most of varieties, the recorded data were slightly influenced by the year of harvest.

Concerning the influences of the biostimulator concentration applied, on the average production per hectare, these were significant for varieties Gelu (GA₃), Chasselas doré (Cropmax[®] and GA₃) and Xenia (GA₃). Regarding grapes weight, statistical influence of the



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concentration of the substance applied to this parameter was highly significant for the variety Moldova (GA₃) and distinctly significant for the varieties Gelu (Kelpak[®]) and Moldova (Cropmax[®]).

Aspects of economic efficiency regarding the introduction of treatments with biostimulating products in the growing technology of the vine are presented in **Chapter X**. The most important values of the profit rate, net profit obtained after the application of biostimulating treatments, were observed for gibberellic acid, at the varieties: Moldova (100 ppm GA₃, 15785 lei/ha), Coarnă neagră (25 ppm GA₃, 9878 lei/ha), Xenia (25 ppm GA₃, 7554 lei/ha), Coarnă neagră selecționată (50 ppm GA₃, 5520 lei/ha), Muscat de Hamburg (25 ppm GA₃, 4753 lei/ha) and Gelu (50 ppm GA₃, 2123 lei/ha).

The thesis ends with **Chapter XI**, in which are exposed the conclusions and recommendations that have emerged from the analysis of experimental data.

Vine varieties of table grapes had a proper response under the influence of hormonal treatments. Establishing the concentrations of biostimulating substance and the phenophase for their application are considered „key” factors in the introduction of these treatments in the current growing technologies of vine.

Biostimulating treatments applied to the vine varieties for table grapes led, in generally, to an increase in sugar content of berries, along with a decrease in total acidity, equilibrating the ratio between these classes of compounds. Appearance of grapes was also improved by obtaining higher and uniform colored berries. There were significant changes in the weight of the rachis and less important on the weight and number of seeds in berries.

Recorded experimental data justifies the use of substances with biostimulating role on vine varieties for table grapes grown in Iasi vineyard areal, in order to improve their productivity and quality features, considering the particularities and restrictions mentioned in this paper.