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The Integrated Approaches to the Productivity Management of the Grape Plantations of Different Ages

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Abstract. The article highlights the generalized research data of the Department of Horticulture, Viticulture, Biology and Chemistry of Odessa State University. The main direction of its work is to maintain the productivity of existing plantations and the formation of high-yielding plantations of grapes of technical varieties in the Northern Black Sea region of Ukraine. Based on many years of research, the productivity of vineyards of Aligote, Traminer pink, White fetish, Chardonnay, Pinot Noir, Cabernet Sauvignon and many others has been established, as well as complex schemes of impact on young grape bushes and plantations older than 25 years. As a result of researches, the basic optimum terms for conditions of the South of Ukraine in which it is necessary to carry out processing by growth stimulators and root and foliar feeding are established. These terms are: the first treatment before flowering, the second when the berries reach the size of a pea and the third at the beginning of ripening berries. It is proved that the after-effect of application of fertilizing elements is intensified on old plantations after the renewal of the plantation and can last up to three years, depending on the wet supply of the territory. The main conclusions and proposals for the use of complexes of agricultural technology elements based on root and foliar nutrition with different substances, irrigation, periodic deep tillage is given. Based on the obtained results, a mathematical model of quality management of grape products and products of its processing is developed

Keywords: grape plants, productivity increase, replantation, local nutrition, phenylalanine, microelements

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INTRODUCTION

The grape plantations in Ukraine are very different in quality both in the condition and age. In a number of obvious economic, technological and other advantages obtained from growing grapes, this industry in Ukraine began to revive. At the same time, we are confronted with such a problem as resuscitation of existing plantings that were launched during the transition period of management. For the revival of viticulture, along with the laying of new highly productive plantings, it is necessary to prolong the life of existing ones and improve their productivity and ensure the quality of the obtained products. At this stage, it is possible to resuscitate the existing grape plantations only through the combined effect on the above-ground and below-ground parts of the grape plant. In our point of view, such tools of influence are the replantation of the grape plants with fertilization to a considerable depth and also foliar and root nutrition (using a hydroborer) of grape plants with biologically active exo- and endogenic substances with a strict interpretation of varietal agriculture.

Our assumptions are confirmed by the work of various scientists, but all of them studied the above-mentioned techniques separately. That's why a number of scientists [1-9] confirm the positive effect of the replantation with simultaneous fertilization, while the staff of the Department of horticulture and viticulture (until 2009, the Department of viticulture and winemaking) at Odesa State Agrarian University suggests the feasibility of using in foliar and root nutrition the biologically active substances and also using of specific agricultural techniques for each of the varieties [10-30].

In the literature, there is no data concerning the combined effect of foliar and root nutrition on young and bearing bushes with different substances on the productivity of the grape plant, and even less so on the quality of table and sparkling wines. Therefore, the chosen research direction is quite relevant and timely. Based on the above-mentioned information, the purpose of these studies was to establish the influence of agricultural combinations on the development and productivity of different technical varieties and age categories of grape plants. The main limiting factor in the development of the grape and wine industry in the steppe regions of the Odessa, Mykolaiv, Kherson and the Autonomous Republic of Crimea is the lack of sugar accumulation, that is why it is impossible to get a desired annual harvest for preparing different types of wines [31; 32].

Since the industrial vineyards in these areas are located in the zone of hazardous agriculture, new ways of the exposure routs for the grape plant are needed that could reveal its potential. It is necessary to create favorable conditions for more intensive life processes in the plant, namely to better take place photosynthesis, respiration, transpiration and better work the root system in the conditions in which plants are located during the year. Thus, it is necessary to influence on the foliar apparatus and root system of the grape plant during the vegetation. There are some decisions, namely the foliar and root nutrition, regulation of the narrow habit of the plant, the point-of-care effects on a bush green part.

Foliar nutrition should be combined with a pest and disease protection system in order to protect the plant from diseases and pests simultaneously at no additional cost and carry out foliar nutrition. It is more difficult to carry out root nutrition, because it's effective only if it gets into the optimal soil horizon, i.e. to a depth of 45-50 cm. This task can be solved by the deep tillage at a specified depth and by the local nutrition using a hydroborer. The replantation should be carried out in the autumn, when the second wave of root growth is observed and in the spring before the beginning of vegetation when the first wave of root growth is. Local nutrition using a hydroborer can be carried out several times during the vegetation.

Unconventional physiologically active substances, namely organic acids of the Krebs cycle, amino acids, pyridine compounds have been proposed in order to achieve these objectives at the Department of Viticulture and Winemaking of the OSAU [21]. For solving this problem, firstly, we should grow high-quality grafted planting material, so that the plants have the same vigor and productivity after planting the vineyard. The quality of the grafted planting material depends on the choice of rootstock and scion stalks. It is currently necessary to use clones of rootstock and scion varieties. Clones of rootstock varieties must be grown on a mother plantation of rootstock vines with a management system that would ensure good stalks ripening with a diameter of 7 to 12 mm with a high carbohydrate content, for example, a T-shaped horizontal trellis.

Clones of scion varieties must be grown on a mother plantation of intensive scion vines with a management system that would ensure good stalks ripening with a diameter of 7 to 12 mm with a high carbohydrate content. It is possible to improve the quality of wine materials in the process of their production via selecting yeast strains by various technological methods before, during and after fermentation (Fig. 1).

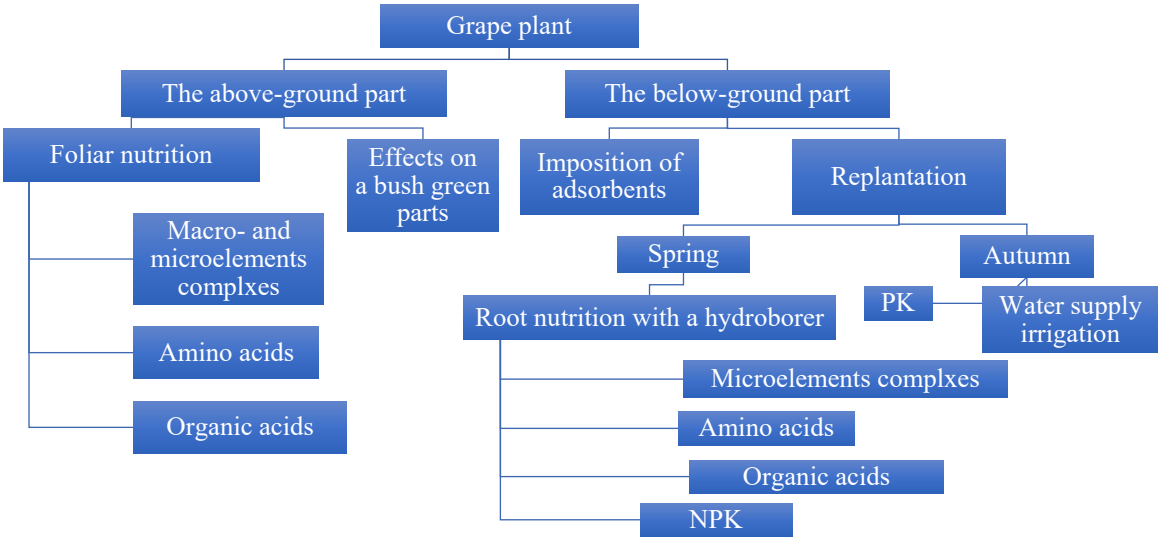

Figure 1. *Modification techniques for a grape plant*

MATERIALS AND METHODS

Since 2001, the Department of Viticulture and Winemaking (now the Department of Horticulture, Viticulture, Biology and Chemistry) in various farm types of the Odesa and Mykolaiv Region (Southern Ukraine) has laid a number of experiments:

1. During 2001-2005, in the agricultural production cooperative "Limanskii", Ochakovskii Region, Mykolaev Oblast carried out Experiments on the productivity of grape plants influenced by the microelements complex nutrition (Ni, Cr, Mn, Ti) on Chardonnay and Pinot noir on the plantations starting between 3 and 7 years. Planting scheme 3x1 m, the grape plant shape – double Guyot. Experiments were conducted using two schemes.

Experiment 1. The influence of root and foliar nutrition of grape plants with a microelements complex on the productivity of Chardonnay and Pinot noir. Option 1 – control – without nutrition. Option 2 – foliar nutrition of grape plant with a microelements complex 0.03% (Ni, Cr, Mn, Ti). Option 3 – root grape plants nutrition with a microelements complex 0.03% (Ni, Cr, Mn, Ti) using a hydroborer. Option 4 – foliar and root nutrition of grape plant with a microelements complex 0.03% (Ni, Cr, Mn, Ti). The establishment scheme of the experiment on the land plot: 2001 – vineyard 3 years of vegetation; 2002 – vineyard 4 years of vegetation; 2003 – vineyard 5 years of vegetation; 2004 – vineyard 6 years of vegetation. In each of the named years, in separate land plots, the experiment was conducted according to the indicated experimental scheme, the microelements complex was studied. The aftereffect was studied at the same land plots in 2002-2005.

Experiment 2. The influence of different yeast strains against the implementation of root and foliar nutrition of grape plants of Chardonnay and Pinot noir on the quality of sparkling wines. Option 1 – control. Option 2 – foliar grape plants nutrition with a microelements complex 0.03% (Ni, Cr, Mn, Ti) + yeast strain 1. Option 3 – foliar grape plants nutrition with a microelements complex 0.03% (Ni, Cr, Mn, Ti) + yeast strain 2. Option 4 – root grape plants nutrition with a microelements complex 0.03% (Ni, Cr, Mn, Ti) using a hydroborer + yeast strain 1. Option 5 – root grape plants nutrition with a microelements complex 0.03% (Ni, Cr, Mn, Ti) using a hydroborer + yeast strain 2. Option 6 – foliar and root grape plants nutrition with a microelements complex 0.03% (Ni, Cr, Mn, Ti) + yeast strain 1. Option 7 – foliar and root grape plants nutrition with a microelements complex 0.03% (Ni, Cr, Mn, Ti) + yeast strain 2.

Foliar grape plants nutrition with a microelements complex is conducted in 3 terms: at the beginning of a blossom time, when the size of a berry is about a pea and at the beginning of berries ripening. Root grape plant nutrition with a microelements complex is carried out using a hydroborer in 3 terms: at the beginning of a sap flow, at the beginning of a blossom time and when the size of a berry is about a pea. Two wells are made 50 cm from the grape plant on both sides along the row using a hydroborer. The microelements complex included salts of Ni, Cr, Mn and Ti, namely: nickel chloride, manganese chloride, ammonium chromate and titanium 4-chloride. The spray material is prepared as follows: nickel chloride – 24 g, ammonium chromate – 27 g, manganese chloride – 20 g are dissolved in 10 liters of water, well mixed, and then it is added 16 g of titanium 4-chloride, well mixed again and then the volume is brought to 100 liters of water.

In the second experiment, different yeast strains are added to the wine material in 0.75-liter bottles during the fermentation. For each variant and variety, wine material is made using the micro-winemaking method, and then sparkling wines are made in bottles of 0.75 liter by the bottle method.

2. In the agricultural production cooperative "Kristo Botev", Artsyzsky Region, Odesa Oblast carried

out experiments on Sukholimansky white and Cabernet Sauvignon. Experiments were conducted using 3 schemes.

Experiment 1. The using of phenylalanine against the implementation of different soil cultivation with local introducing of phenylalanine using a hydroborer. Option 1 – the plowing to a depth of 25-30 cm in the autumn – control; Option 2 – the implantation to a depth of 45-50 cm in the spring; Option 3 – the introducing of phenylalanine for the plowing using a hydroborer; Option 4 – the introducing of phenylalanine using a hydroborer after the replantation.

Experiment 2. The use of mineral fertilizers and Super Humisol separately and jointly while the top-dressing using a hydroborer during the plowing. Option 1 – the plowing to a depth of 25-30 cm – control; Option 2 – the introducing of 80 gr. p.n. (primary nutrients) mineral fertilizers (NPK) per 100 liters of water using a hydroborer; Option 3 – the introducing of 160 gr. p.n. NPK per 100 liters of water using a hydroborer; Option 4 – the introducing of Super Humisol in a dilution of 1:10 liter of water using a hydroborer; Variant 5 – the introducing of 80 gr. p.n. NPK per 100 liters of water with Super Humisol using a hydroborer; Option 6 – the introducing of 160 gr. p.n. NRK per 100 liters of water with Super Humisol using a hydroborer.

Experiment 3. The introducing of mineral fertilizers, Super Humisol separately and jointly using a hydroborer after the replantation. Option 1 – the replantation to a depth of 45-50 cm using a root plow RFG-2 in the spring – control; Options 2-6 are the same as in the experiment 2, only when the replantation. According to the adopted method, phenylalanine, NPK and Super Humisol were introduced three times during the vegetation using a hydroborer: at the beginning of bud opening, before a blossom time and when the size of a berry is about a pea. Phenylalanine concentration was 0.003%, Super Humisol was in a dilution of 1:10. The replantation was carried out one row over to a depth of 45-50 cm, 50 cm from the grape plant using a root plow RFG-2 in the spring.

According to the best options and control, wine materials were made of Sukholimansky White based on the "white" method and Cabernet Sauvignon according to the "red" method. Wine materials were analyzed after 3 months annually. In the conditions of public corporation "Koblevo", the third block of studies was started to develop a set of methods for increasing the productivity of bearing grape plantations based on the replantation in the south of Ukraine. The experiments were carried out for four years on grape kinds Traminer rosso and Feteaska white grafted on the Kober 5BB rootstock, with a planting scheme of 4x2 m, forming a double-sided horizontal cordon. The experiments were carried out according to three schemes:

Experiment 1. "The replantation effect and the use of phenylalanine with 4-titanium chloride on biometric indicators, yield and quality of berries of the grape kinds Feteaska white and Traminer rosso". The experiment included options: 1. Control-plowing to a depth of 25-30 cm; 2. Replantation to a depth of 50-60 cm; 3. Plowing to a depth of 25-30 cm + phenylalanine in combination with 4-titanium chloride; 4. Replantation to a depth of 50-60 cm + phenylalanine in combination with 4-titanium chloride.

Experiment 2. "The phenylalanine effect in combination with titanium during the foliar nutrition and introducing of Ammoium Nitrate Phosphate (ANP) fertilizer against the replantation on biometric indicators, yield and quality of grape kinds Traminer rosso and Feteaska white". Options: 1. Control – plowing with the introducing of NPK; 2. Fertilizing with NPK when the replantation to a depth of 50-60 cm; 3. The grape plants processing with a phenylalanine in the complex with 4-chloride titanium + root fertilizing with NPK when the replantation to a depth of 50-60 cm.

Experiment 3. "The influence of load of grape plants with eyes on biometric indicators, yield and quality of grape kinds Feteaska white and Traminer rosso against the different tillage methods". Options: 1. The load is 60-70 buds the length of vines is 8-10 buds when the plowing (control); 2. The load is 60-70 buds; the length of vines is 8-10 buds when the replantation using a rootplow. 3. The load is 80 buds, the length of vines is 8-10 buds when the plowing; 4. The load is 80 buds, the length of vines is 8-10 buds when the replantation; 5. The load is 90 buds the length of vines is 8-10 buds when the plowing; 6. The load is 90 buds, the length of vines is 8-10 buds when the replantation.

The replantation was carried out in the spring before budding at the distance of 50 cm from the grape plant. At the same time, nitroammofoska fertilizer was added at the rate of 500 kg per hectare. The replantation was carried out one row over to a depth of 50-60 cm using a rootplow. Grape plants were sprayed with phenylalanine with 4-titanium chloride (at a concentration of 0.003%): the first – before blossom time; the second – when the size of a berry is about a pea; the third – at the beginning of berry maturation.

3. The fourth block of tests was carried out during 2003-2008 on the theme "Complex of agro-farms for increasing the productivity and quality of technical grape varieties in the South of Ukraine" in public corporation "Champagne of Ukraine" Artsizsky Region, Odesa Oblast. For experiments, the following grape kinds were taken: Aligote, Feteaska white, Chardonnay, Sauvignon green grafted on rootstock Riparia x Rupestris 101-14, the planting scheme 3.0x1.5 m and 4.0x2.0 m, a grape plant forming – two-sided horizontal cordon. The experiments were carried out according to two schemes:

Experiment 1. Study of the influence of NPK fertilizer and irrigation against the different methods of tillage and nutrition areas on the growth and productivity of technical grape kinds. Option 1 – control-plowing to a depth of 25-30 cm. Option 2 – the replantation using a rootplow to a depth of 45-50 cm in a row in the spring.

Option 3 – deep tilling in two rows to a depth of 45-50 cm one row over in the spring. Option 4 – the replantation using a rootplow to a depth of 45-50 cm one row over in the spring with the introducing of nitroammophoska fertilizer 500 kg/ha. Option 5 – deep tilling in two lines to a depth of 45-50 cm one row over in the spring with the introducing of nitroammophoska fertilizer 500 kg/ha. Option 6 – the replantation using a rootplow to a depth of 45-50 cm one row over in the spring with the introducing of nitroammophoska fertilizer 500 kg/ha and irrigation along the furrows three times during the growing season of 500 m^3/ha. Option 7 – deep tilling in two lines to a depth of 45-50 cm one row over in the spring with the introducing of nitroammophoska fertilizer 500 kg/ha and irrigation along furrows three times during the growing season of 500 m^3/ha. This scheme was used in vineyards with a planting scheme of 3.0x1.5 and 4.0x2.0 m. The effect of techniques was studied in 2003-2006, the aftereffect was studied in 2004-2007. This scheme was used on Aligote and Chardonnay kinds.

Experiment 2. The identification of the optimal load against the nitroammophoska fertilizer application, irrigation and deep row tilling spacing for technical grape kinds. Option 1 – control-load is 40-50 buds, length of vines is 3-4 buds, deep tilling in two rows to a depth of 45-50 cm one row over. Option 2 – load is 40-50 buds and trimming vines for 5-6 buds. Option 3-load is 60-70 buds and trimming are 3-4 buds. Option 4 – load is 60-70 buds, trimming is 5-6 buds. Option 5 – load is 80-90 buds; trimming is to 3-4 buds. Option 6 – load is 80-90 buds, trimming is 5-6 buds. Option 7 – load is 40-50 buds; trimming is 3-4 buds tilling in two rows to a depth of 45-50 cm one row over with the introducing of NPK fertilizer 500 kg/ha and irrigation three times during the growing season of 500 m^3/ha. Options 8, 9, 10, 11, 12 repeat options 2, 3, 4, 5, 6, respectively, similarly to option 7. This scheme was used in vineyards with a planting scheme of 4.0x2.0 m., the effect was studied on Aligote and Fetyaska white kinds in 2003-2006, and the aftereffect was studied on Aligote and Fetyaska white kinds in 2004-2007.

From 2012 to date, the study of the influence of these techniques on various grape kinds growing in different relief conditions (plains, slopes, terraces) is being carried out. Many substances pass from the introduced kinds. Generalizing experiments are carried out by the staff of the department from 2001 to 2020, and will be used to build mathematical models for managing the quality of grapes.

All experiments in all studies were performed in triple analyses by the method of randomization. In each replication was 15 accounting grape plants in a row. Two protective rows were left between the experimental rows. Separately, according to varieties and variants we carried out counts, analyzes and observations generally accepted in viticulture [7].

RESULTS AND DISCUSSION

As a result of the experiments carried out to study the effect and aftereffect of a microelements complex consisting of Ni, Cr, Mn, Ti during the foliar and root nutrition of young grape plants and bearing vineyards and the subsequent use of different yeast strains during the production of sparkling wines of Chardonnay and Pinot noir kinds, it is possible to make the following conclusions.

In young vineyards the root and foliar grape plants nutrition with a microelements complex should be carried out before full bearing. At the same time, the foliage surface area during the year increases by 0.114 m^2, and in the aftereffect year increases by 1.098 m^2 in Chardonnay on average over two years compared with the control. The volume of one-year growth also increases during the year by 25.2 cm^3, and in the aftereffect year by 568.3 cm^3. For Pinot noir, such increases were recorded in foliage surface area, respectively, by 0.244 m^2 and 1.074 m^2, in terms of annual growth, respectively, by 78.5 cm^3 and 443.6 cm^3. Under the influence of a microelements complex, the following increases: the mass of the bunch, the yield from 1 grape plant until full bearing during the year and especially in the aftereffect year, respectively, for Chardonnay by 10.4 g; 0.08 kg and 12.5 g; 0.48 kg, for Pinot, respectively, during the year by 15.7 g 0.23 kg, in the aftereffect year by 11.3 g; 0.55 kg.

In bearing vineyards, the best option is the combined use of foliar and root grape plants nutrition with a microelements complex. In comparison with the control, on average, for two years, during the year of operation on the Chardonnay, the foliar area was increased by 0.625 m^2, in the aftereffect year by 1.144 m^2; the volume of one-year growth was increased in the year of operation by 280.0 cm^3, in the aftereffect year by 375.0 cm^3. For the Pinot noir, in the year of operation, the foliar surface area was increased by 1.205 m^2 and the aftereffect year was increased by 1.583 m^2; the volume of one-year was increased in the year of operation by 380,2 cm^3 and the aftereffect year 439.6 cm^3. The microelements complex, with joint use, provides a yield increase in bearing vineyards for the Chardonnay by 36.7% per year of operation and by 35.9% per year of aftereffect and for Pinot noir, respectively, by 30.7% and 24.2% compared to control. At the same time, the highest quality indicators are observed such as the berries sugar level in the year of operation on young plantations was in the range of 17.6-17.9 g/100, and within 18.0-18.1 g/100 cm^3 on bearing plantations.

The option can be distinguished with the combined use of a microelements complex based on the chemical and organoleptic analyzes of wine materials made from Chardonnay and Pinot noir. The mass fraction of alcohol for Chardonnay was increased in the year of operation by 0.38%, and in the aftereffect year by 0.57%; the mass fraction of alcohol for Pinot noir was increased, respectively, by 0.37% and 0.27%. The

degustation evaluation was increased in the year of operation and aftereffect year for Chardonnay by 0.3-0.4 points, and for Pinot Noir, respectively, by 0.4-0.2 points. Foliar and root nutrition of grape plants Chardonnay and Pinot Noir with a microelements complex and the use of yeast of different strains helps to improve the foamy, sparkling wine properties, increases the taste and degustation evaluation. For both kinds, the best yeast is the Abrau-Durso strain.

The tested techniques are economically proved in bearing vineyards. In the best option (combined use of a microelements complex), the profit was increased by UAH 4312.5 per year of operation, and by UAH 3372.8 per aftereffect year for the Chardonnay and the profit was increased by UAH 3855.7 and UAH 2507.4, respectively, for the Pinot Noir compared to the control.

As a result of the experiments carried out to study the effect of phenylalanine, NPK, Super Humisol against the different tillage during root nutrition using a hydroborer on low-yielding bearing vineyards of Sukholimansky White and Cabernet Sauvignon kinds, the following results were obtained:

– local introducing of biologically active substances and mineral fertilizers using a hydroborer provides a significant increase in the foliage surface area and volume of annual growth of grape plants in the year of operation and especially the next year in both kinds, the reaction of Sukholimansky white is more constant; local introducing of phenylalanine using a hydroborer after the replantation contributes to an increase in the number of roots in the soil layer 40-60 cm, both in the year of operation and in the aftereffect year; under the influence of phenylalanine, the yield increases by 6.3% against the plowing and replantation – 16.1%. In this case, the sugar level increases (by 0.3 g/100 cm^3 – 1.0 g/100 cm^3). The next year, after the introducing of phenylalanine against the replantation, the yield increases by 36.2%, and the sugar level increases by 0.8 g/100 cm^3;

– in a series of experiments on the use of mineral fertilizers (NPK) and Super Humisol (jointly and separately), an increase in the foliar surface area, the volume of annual plant growth, both in the year of operation and in the second and third years after the introducing of NPK separately or jointly with Super Humisol was experimentally proved; in the year of operation of mineral fertilizers and Super Humisol in the eyes, especially in the central buds, there is a deeper differentiation according to well-formed acrospires and the amount of a acrospires up to the eighth eye, which subsequently shows itself in an increase in the number of bunches and yield; root nutrition with mineral fertilizers (NPK) jointly with Super Humisol using a hydroborer against the replantation has a positive effect on the development nature of the root system in the optimal soil horizon from 20 to 60 cm. At the same time, the tendency of wine materials quality improvement is noted. The techniques that have been studied are economically proved. In the option where the replantation was held in the spring and phenylalanine was added three times during the growing season, the profit was increased for Cabernet Sauvignon in the year of operation by UAH 932 and in the aftereffect year by UAH 2335. In a series of experiments, where the root nutrition of NPK 160 g per 100 liters of water jointly with Super Humisol using a hydroborer was used against the replantation, the profit was increased by UAH 1,649.5. from 1 ha per year of operation and by UAH 649.8. from 1 ha per year of aftereffect for Sukholimansky white.

As a result of the experiments carried out to study the effect of a set of methods: foliar nutrition with phenylalanine with 4-titanium chloride, introducing nitroammofoska fertilizer for plowing in the autumn or replantation in the spring, different loads of grape plants on old bearing vineyards of Traminer rosso and Feteasca white, we can make the following conclusions:

– the techniques that were studied separately and in combination affect the biometric indicators in the year of operation: the foliar surface area and the volume of one-year growth decrease while the replantation separately or jointly with nitroammofoska fertilization; he foliar surface area and the volume of one-year growth increase with the use of phenylalanine with titanium 4-chloride, both against the plowing and the replantation in both kinds, especially with the use of nitroammofoska fertilizer against the replantation in the year of aftereffect, the foliar surface area and the volume of one-year growth increase in all experimental variants;

– under the influence of phenylalanine with titanium 4-chloride against the plowing in the year of operation, the yield increases by 16% for Traminer rosso and by 8.5% for Feteaska white; against the replantation by 23.1% for the Traminer rosso and by 6.1% for the Fetyaska. In the year of aftereffect, the yield increases, respectively, by 68.2 and 75.8% for Traminer rosso and by 20.9 and 41.0% for Fetyaska white;

– under the influence of phenylalanine jointly with titanium 4-chloride and the introducing of nitroammofoska fertilizer during the replantation compared to plowing and the introducing of nitroammofoska fertilizer in the year of operation, the yield increases by 6.5% for Traminer rosso and by 7.5% for Feteaska white. In the aftereffect year Traminer rosso increases the yield by 16.4%, and Feteaska white by 29.1%. The yield rising trend persists in the second year of aftereffect in both kinds;

– the sugar level of berry juice is always higher both in the year of operation and in the year of aftereffect in the options where foliar nutrition with phenylalanine with 4-titanium chloride was carried out separately or jointly with root nutrition with nitroammofoska fertilizer, with the load increase in both kinds;

– the use of replantation in combination with spraying the grape plants with phenylalanine jointly with titanium 4-chloride, or replantation with the introducing of ANP fertilizer and spraying the grape plants three times

with phenylalanine jointly with titanium 4-chloride provides a deeper differentiation of inflorescences, especially along the acrospires of the buds and it was also found that there is an increase in the root mass (number, length, weight) under the influence of replantation when NPK(16:16:16) fertilizer is introduced jointly with phenylalanine in combination with titanium 4-chloride and during the increase in eye load in both experimental kinds. At the same time, there is a close correlation between the development of the root system and the foliar surface area. In the year of action, the correlation coefficients are 0.78, and in the year of aftereffect – 0.94, which is expressed by the equation *y=485.96+39.13x*;

– calculations of energy efficiency confirm the feasibility of using phenylalanine in combination with 4-titanium chloride and the combined use of phenylalanine with 4-titanium chloride with the introducing of nitroammofoska fertilizer against the replantation, since the total energy consumption with the highest energy efficiency for three years here was lower compared to options where the specified substances were used for plowing, but more than in the control, but high energy costs are compensated by the high productivity of the plantings in the named options. Thus, higher energy costs in viticulture are more efficient. In addition, the marked options have a level of economic profitability according to Traminer rosso when using phenylalanine in combination with 4-titanium chloride in the year of operation by 149.8%, and in the year of aftereffect by 201.8%; when phenylalanine is used jointly with titanium 4-chloride, and nitroammofoska fertilizer is added against the replantation by 134.8 and 180.1%, respectively, over the years.

As a result of the experiments carried out to study the effect of an agricultural practices complex, namely: the replantation using different devices, root nutrition with ANP fertilizer, tilling and foliar with crystalon due to the different planting schemes on the industrial varieties productivity, the following results were obtained:

– the complex of agricultural practices and individual fragments significantly affect the biometric indicators of grape plants in the year of application and especially in the year of aftereffect, and the reaction of the studied kinds is different;

– the use of a rotter or rootplow for replantation provides approximately the same increments in a number of growth and development indicators of grape plants;

– the individual agricultural practices provide a certain yield increase in the year of their application and in the year of aftereffect, regardless of the planting patterns of grape plants, devices used for the replantation, grape kinds. For Chardonnay, in the year of operation, the yield was increased within 0.83-4.00 t/ha, and in the year of aftereffect in the range of 1.78-3.53 t/ha; for Aligote within 0.7-0.83 t/ha and 1.91-1.53 t/ha, respectively;

– the complex of agricultural practices both in the year of application and in the year of aftereffect provides a significant increase in yield, regardless of the planting schemes, studied kinds. For Chardonnay, in the year of operation, the yield increased within 2.57-3.54 t/ha, and in the aftereffect year within 3.58-5.72 t/ha; for Aligote within 1.56-2.13 t/ha and 2.05-3.1 t/ha, respectively;

– depending on the joint application of a number of agricultural practices or a whole complex, the load and length of trimming of bearing vines are changed. For Fetyaska white, the best growth and bearing indicators were established at a load is 80-90 eyes and a length of bearing vines is 5-6 eyes against the replantation: the foliar surface area was increased by 3.33 cm^2, the volume of annual growth by 1675.98 cm^3, the yield by 6.31 t/ha per year of operation, and in the year of aftereffect these increases are: 6.57 m^2, 2451.36 cm^3, 69.3 t/ha. The optimal load is 80-90 eyes with the length of bearing vines 5-6 eyes against the agricultural practices complex per year of their application provided an increase in the foliar surface area by 6.8 m^2, the volume of annual growth by 3347.9 cm^3, and the yield by 7.13 t/ha, and in the year of aftereffect by 7.56 cm^2, 3556.89 cm^3, 7.53 t/ha, respectively;

– the use of replantation, root nutrition with ANP fertilizer and tilling along furrows, regardless of planting schemes, especially in the year of aftereffect provides a deeper differentiation of inflorescences, bearing rates of central buds by the sum of inflorescence acrospires are increased in all junctures;

– as a result of long-term experiments in studying the development of the root system, it was found that the use of the studied agricultural practices, separately and especially in combination, provide a significant increase in the number of roots in the year of application and year of aftereffect in the soil horizon from 20 to 80 cm, regardless of the planting patterns;

– the proposed agricultural methods, separately and in a certain combination provide an increase in the quality indicators of the studied technical kinds with a high yield both in the year of their application and in the year of aftereffect;

– the developed complex allows to change the quality indicators of wine materials for the better. To obtain wine materials with a mass fraction of alcohol 10.45% and degustation evaluation 7.6 points for the production of ordinary wines, it is necessary to use the whole complex of agricultural practices. To obtain wine materials with a volume fraction of alcohol 11.54% and degustation evaluation 7.7-7.8 points, suitable for the production of vintage wines, against the developed complex, carry out foliar nutrition with special crystalon;

– calculations of economic efficiency confirm the feasibility of using such expensive techniques as replantation, root nutrition with ANP fertilizer, tilling. In the year of application, the level of profitability is ensured at the control level, although energy costs increase almost twice, and in the year of aftereffect with a planting pattern of 3.0x1.5 m for Chardonnay, the level of

profitability increases by 77%, and for Aligote by 59.2%; with a planting pattern of 4.0x2.0 m, 135.5% for Chardonnay and 40.17% for Aligote. At the same time, the efficiency of additional energy cost was greater than one – 1.17-1.31.

CONCLUSIONS

Based on the above-mentioned information, we offer a quality management system for grape and wine products of the specified conditions: cultivation of high-quality grafted planting material based on the use of clones of rootstock and scion varieties; use of physiologically active substances for the root nutrition using a hydroborer against the replantation; use of these substances for foliar nutrition separately or jointly with a pest and disease protection system; use of root and foliar fertilizing simultaneously on young vineyards before starting bearing and on already bearing implantations; development of differentiated agricultural equipment for grape varieties in a separate agrocenosis (area); improving the wine materials quality in the process of their production via selecting yeast strains by various technological methods before, during and after fermentation.

Thus, in order to increase the productivity of plantings of different ages, it is necessary to use a set of techniques that are most appropriate in relation to the age and condition of the plantings, as well as the available material and technological capabilities. And this is possible thanks to a large selection of complexes of techniques mentioned in this article.

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Комплексні підходи до управління продуктивністю виноградних насаджень різного віку

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Анотація. У статті висвітлено узагальнені дані дослідження кафедри садівництва, виноградарства, біології та хімії Одеського державного університету. Основним напрямом її роботи є підтримка продуктивності наявних насаджень та формування високопродуктивних насаджень винограду технічних сортів у Північному Причорномор'ї України. На основі багаторічних досліджень було встановлено врожайність виноградників Aligote, Traminer pink, White fetish, Chardonnay, Pinot Noir, Cabernet Sauvignon та багато інших, а також складні схеми впливу на молоді кущі винограду та насадження віком від 25 років. Унаслідок досліджень встановлено базові оптимальні умови для умов Півдня України, в яких необхідно проводити обробку стимуляторами росту та кореневе, позакореневе підживлення. Такими термінами є: перша обробка перед цвітінням, друга, коли ягоди досягають розміру горошини, і третя – на початку дозрівання ягід. Доведено, що ефект від внесення добрив посилюється на старих насадженнях після оновлення насадження і може тривати до трьох років, залежно від вологості території. Наведено основні висновки та пропозиції щодо використання комплексів елементів агротехніки на основі кореневого та позакореневого живлення різними речовинами, зрошення, періодичного глибокого обробітку ґрунту. На основі отриманих результатів розроблено математичну модель управління якістю виноградної продукції та продуктів її переробки

Ключові слова: виноградні рослини, підвищення продуктивності, пересадка, місцеве живлення, фенілаланін, мікроелементи