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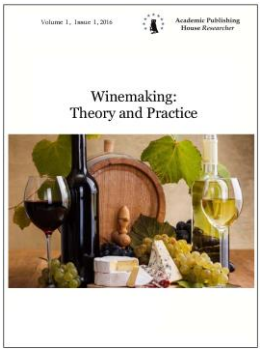

Articles

Production of Red Table Wines as the Sorts of Local Grapes

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Abstract

The study of the mechanical and chemical composition of local and locally adapted red grape varieties chosen for the preparation of high-quality red table wines has shown that, depending on agrotechnical activities, territory, climate variability and other conditions, even in the technically maturing phase, small and large values of such parameters are possible, As titratable acidity and sugar content. In view of this, it becomes necessary to regulate the chemical composition of the grape must obtained in these conditions in accordance with the chosen technology.

Scientifically substantiated and defined the direction of improving the technology of cooking natural red wine using Mattress, as the main variety. The possibility of using other grape with red berries grown in Azerbaijan along with the grape of Matras is also indicated. A model has been developed that reflects the dynamics of the anthocyanin complex and the intensity of the color of the wine that is subject to prolonged heat treatment in the presence of atmospheric air.

Keywords: wine, red wine, grape, hybrid, quality, physico-chemical and sensor analysis.

1. Introduction

The richness of various grape genotypes of Azerbaijan Republic, the favorable condition of the country's soil-climate for vineyard, as well as, the variety of physical-chemical composition of grapes grown in this country create a suitable basis and possibility for production of high quality wines of all kinds with a wide range of high-consumption properties, rich bouquet, delicate flavor, full color, and harmonic properties (Guseinov et al., 2018; Laura et al., 2014; Lorenzis et al., 2015; Maghradze et al., 2015; Maul et al., 2015).

The Viticulture has the wide industrial characteristic posessing special weight among the spheres of agriculture yet from ancient times in Azerbaijan, the grape were grown and wine were produced here always. Today the Viticulture is also considered on the priority spheres by the point of increasing the country's economy. In recent years, the numbers of local selection sorts have increased in the volume of total product's growing. That is why, their technological compliance is required in preparing of the table wines from these sorts. In other words, conduction of research towards the investigation of grape, material of wine and chemical composition of wine, selection of sorts creating the opportunity for getting the product which is more qualitative and sustainable for the competition, improvement of processing technology of grape are required. In relations with

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this, red table wines require special attention which is rich for its natural substances, especially with different prosianid substances, vitamins, minerals and posessing functional importance with other components. From this point of view, one of the problem sis extraction color and phenol substances in an optimal amount from the grape in processing the wine by red method. The phenol compounds in grape actually combine on the cover of the nipple, in sees and in other hard structure elements of cluster. There are some issues which were not settled in this sphere though different methods were applied for strenghtening of extraction of these unites in practice.

2. Material and methods

The main purpose in reasearch work is improvement of technological parameters of preparation of high-quality red table wines from grape sorts grown in Azerbaijan (Perez-Magarino, Gonzalez-Sandoze, 2006; Panahov, 2015; Salimov et al., 2018; Salimov et al., 2020).

Local, intoducted and hybrid grape sorts grown in Azerbaijan (Matrasa, Tavkveri, Khindogni, Kaverne-Sovninyon, Izabella, Saperavi), the wine material prepared from them and wines were taken as the object of research.

Local red grape sorts providing to obtain juices and wine blending material posessing any color of intensivity in the result of researhc were chosen. It was defined that the dependence of temprature of the quantity of anthocyaninsin wine in affect of air is expressed with the cynetic model of reaction at first. The parameters of antosian composition of local Matrasa grape sort were studies, the chemical structure formula of pigment in the form of 3-o-P-O gluczyloxy – 4, 5, 7-trihydroxy – 3, 5-dimethoxy flavilium chloride was defined. The improved alternative of production technology of natural red table wine by using local technical red grape sorts grown in soil-climate condition of Azerbaijan were worked out, its physico-chemical properties, technological pecularities were studied and its quality was assessed by degustation. The maxomum term of working with heat wihtout loosing the color of wine's material obtained in the result of research was defined. The pasterization of bruise and positive effect of fermenting within 8 days were defined experimentally.

Appropriate technological documents were compiled by us and the production of high-quality red table wine by industrial method in "ASPİ AGRO" LLC company situated in Gabala city on the basis of suggestions and recomendations submitted to the production was organized.

Short description of selected grape sorts (Amanov et al., 2012; Pipia et al., 2012; Salimov et al., 2015).

Matrasa sort. It is most ancient, most precious sorst of Azerbaijan. The size of leaves is average (length is 17...21 cm, width is 16...20 cm), it has round form and it is 5 slices. The thickness of its peel is average, its surface is covered with the layer of wax. The flesh is juicy. It has 1-2 seed in its nipple. It grows up in the middle period. Vegetation period is 145 days. It is selected with its tolerancy (3-3,5 points) against oidium and anthracnose disease in Absheron condition, its sustainability against brown rot disease (2 points). It is high productive sort.

Sugariness in its nipples is 19,0 q/100 cm^3, the titratable acidity is 4,8 g/dm^3. The product of Matrasa sort is fully available for obtaining high-quality red table wines and wines of desset type (cagor). It is grown up in most regions of the Republic by regionizing (Irrigated lowlands along Kur, Shirvan–Garabagh irrigated lowlands, Foothill steppe, Low mountainous and shaki – Zagatala regions).

Khındognı sort is ancient local technical grape sort of Azerbaijan. Its leaves i sin round form with 5 slices. Its flower is bisexual. The color of nipple is dark blue, or black, and its form is circular. Its peel is thin, the flesh is juicy. Its wine is red. There are 2-4 pieces of seed in its neeple. Its sort ripens tardy. The vegetation period continues 155 days. The leaves of sort are tolerance (3-3,5 points) against oidium disease and its clusters are very unstable (5 points). The sort is unstable against anthracnose disease (4-4,5 points) and it is tolerance against brown rot disease (3-3,5 points). It has18,7 g/100 sm^3 sugariness in its nipples, the titratable acidity is 5,27 g/dm^3. The sort is precious source for obtaining high-quality red table wines.

The country of Izabella sort is North America. It is considered natural hybrid of V.Labruska L. and V.vinifera L. types. This sort is included to the sort standards of Azerbaijan. Its leaves are in round form, with 3 slices. Its niplles are circular, thy are black or dark brown (brown). Its peel thick and strong, its surface is covered with with the layer of wax. The flesh is juicy. Its nipple has 1-4 seeds. Its sort ripens tardy the vegetation period continues 172 days. The sort is selected for its

sustainability against oidium, anthracnose and brown rot disease (2-2,5 points). It is high productive sort. The sugariness in its nipple is 18,3 q/100 cm^3, its titratable acidity is 5,6 g/dm^3. The sort is a precious material for the production of wines selected for their special taste and smell.

The country of Kaberne-Sovinyon sort is France and it was grown u pin Azerbaijan since the end of 19th century. Its flower is bisexual. Its clusters i sin average size (length 12...16 cm, width 7...9 cm), cylindrical-conical, in middle density. Its nipples is in average size (length 13...16 mm, width 12...16 mm), form is round, its color is dark-blue. Its surface is covered with the layer of wax. The peel is thick, the felsh is juicy. The sort is middle and ripens tardy. Its vegetation period continues 155-160 days in the condition of Absheron. It shows tolerancy against oidium and brown rot disease (3-3,5 points). The cluster wealy spreads with its list. It is high productive sort. The sugariness in its nipple is 19,2-21,2 q/100 cm^3, its titratable acidity changes between 5,6-7,2 g/dm^3. The sort is a precious source for obtaining high-quality wines, champagne materials. Wide spreading is observed in layout and foothills of our Republic.

Saperavi is local grape sort of Georgia and it is grown up in our Republic for a long years. The sort belongs to the group of Black Sea basin (convar pontica Negr.). its flower is bisexual. Its clusters are in average size, are conical. Its nipples are oval, dark-blue, it is covered with the layer of wax. Its peel is relatively mild. Its juice is weak pink. Its sort ripens tardy. The vegetation period continues among 155-162 days. It is high productive sort. The sugariness in its nipples 18,2-22,6 g/100 cm^3, the titratable acidity changes among 5,26-7,46 g/dm^3. The product of sort is precious material for obtaining high-quality table, desert and dark wines.

Tavkveri sort is local grape sort of Georgia and it has been grown u pin Azerbaijan for a long years. It belongs to Eastern technical sorts subgropus (convar orientalis subconvar caspica Negr.). Its nipples are in middle size (length 14...16mm, width 13...15mm), round form. It is dark blue. The nipple has 2-3 seeds. Its sort ripens tardy. The vegetation period continues 160 days. It is high productive sort. The juisce extraction is 85,7 %, sugariness is 17,9 g/100 cm^3, titratable acidity is 4,87 g/dm^3, the general humidity is 74,8 %, dry substance 25,2 %, ashes is 5,56 % for total mass of its clusters. The sort is a precious materials for table, desert wines and for the production of grape juice.

The most important indicators for preparation of wine in studying the chemical composition of juice obtained from grape, also, titratable acidity with the account of wine acid, the mass concentration of sugar were defined (Tables 1, 2).

It was defined in the result of research that there is need to regulate of this indicator to prepare high-quality wine because of the average price of mass concentration of sugar is low in juice obtained from quickly ripened red sorts. The blend with other red grape sorts (specially with Khındognı) of “Matrasa” juice in recomended regulation alternative of titratable acidity is not considered.

Table 1. Mass concentration of sugar (g/dm^3)

Years	Grape					
	Mədrəsə	Khındognı	Izabella	Kaberne-Sovinyon	Saperavi	Tavkveri
2016	146,7±2,3	150,5±1,5	186,8±1,8	158,3±1,6	119,8±0,6	120,8±1,5
2017	132,7±0,8	114,9±0,4	204,1±0,7	175,7±2,4	-	147,3±1,4
2018	130,1±1,5	106,3±0,8	146,1±0,6	-	-	141,2±1,4
2019	118,1±0,5	148,1±1,5	-	-	-	-
Average price	130,0±1,5	135,2±0,8	158,2±0,8	152,3±1,6	122,7±0,7	123,2±1,4

Table 2. Mass concentration of acids (g/dm³)

Years	Grape					
	Mədrəsə	Khındognı	Izabella	Kaberne-Sovinyon	Saperavi	Tavkveri
2016	4,2±0,1	9,2±0,1	12,2±0,1	13,5±0,2	16,6±0,1	10,9±0,2
2017	4,0±0,2	10,9±0,1	10,7±0,1	13,6±0,4	-	10,1±0,2
2018	6,6±0,3	12,7±0,1	14,7±0,2	-	-	9,1±0,3
2019	4,7±0,2	8,1±0,1	-	-	-	-
Average price	5,1±0,2	9,1±0,1	13,1±0,2	14,2±0,3	16,6±0,2	11,0±0,2

The indicator is glucosidometric indicator representing more effectivity of the juice to prepare the wine. This indicator has more optimal price in "Matrasa" sort. That is why, this sort was preferred as main raw material in the research.

The improved technology of preparation of high-quality red table wine by using "Matrasa" grape and "Khindogni" grape to regulate the titratable acidity was suggested. The description of technological process is as following.

New collected grape is poured to the dosage-nourishing spiral conveyor receiving bunker in required relation of sorts from transport. The raw material is transferred to plunger thinner-dumping from here. Obtained crunch is issued to pasterizator by pump, it worked-out with heat. It worked out here with pectolytic enzyme preparation or ultra-sound if required. Pasterizator was supplied with steam shirts and mixers. Prepared crunch is kept for 1 hour by heating up to 65±2°C. Cooled crunch is issued to vertical vinifier by pump (fermentation by swimming "shapka" method). At the same time, the yeast is issued to vinifier in a calculated amount. The fermentation period is carried out by active mixing (by pump) of fermented environment on periodical scheme. Fermented juice is divided from crunch, two fractions – the wine material and moonshine are obtained. Moonshine is extracted from technological line and it is used for obtaining alcohol. The juice divided from crunch is issued to tank for fermentation up to the end. Stored and partially luminious wine material is transfrred to luminiating device with bentonit (by ultra-sound effect if required). The fluid on the sediments are decantatiated, but the sediment is transferred to centrifuge, remaining wine material is divided from sediment. Luminated wine material is filtered from filter-cardboard and it is issued to filter-press. The product is kept in the tank with termostat provided that not being more than 5±2°C. It is used with the purpose of blend if required. The main anthocyaninsof grape contain monoglycosides of malvidin, petunidin, delfinid, petunidine, in small quantities of acidized monoglycosides of petunidin and malvidin, cyanidine. The composition of anthocyanins depends on the types of grape, of its growing condition. Its color diversity is explained with structural specifications of anthocyanins, creation of complexes posessing K (dark red), Mg, Ca (blue), Ni and Cu (white) and existence of pH environment (Panahov 2015; Panahov 2016).

The existence of anthocyanins in grape depends on the process of photosynthesis. Ths is defined by the illumination of leaves intensively. That is why, collection of anthocyanins in grape are not in the same order in different sorts, it depends on sort and growing condition. The quantity of coloring substances always increase as grape grows (Perez-Magarino, Gonzalez-Sandoze, 2006; Salimov et al., 2017), it is 2,5...2,8 % compared to the mass of peel of dry nipple with Kaberne-Sovinyon sort. This number is 5-6 % in the peel of Saperavi sort, it is 250...260 mg/dm³ in the juice of crunch. It should be noted that the dependence between collection of tan in peel and the sugariness of juice were not observed. But the quantity of coloring subtances increses by increasing the sugariness. The quantity of anthocyanins decreases in an important degree when the grape grown up fully. Selection of grape sort for the production of natural red sour wine is implemented for their technological composition of colored substances. This becomes 450 mg in 1 kg grape in good sorts. Kaberne-Sovinyon, Saperavi, Merlot, Matrasa, Khındognı, Murverd, Rara Neagra, Magarach lalai and other meet this requirement.

There are phenol compounds with names from 15 to 60 in red wines and these directly effect to the formation of smell and color of wine. The degustation price increases with the increase of concentration of phenol compounds (Perez-Magarino, Gonzalez-Sandoze, 2006). Wine possesses

empty and water taste if these are missing, they possess rough and shocking taste in case if they are over (Salimov, Musayev, 2012).

3. Discussion

The expertise was carried out with the modern research methods on wine examples prepared in the result of conducted scientific-research works.

The physco-chemical (Table 5) and sensor analysis of prepared wine materials was conducted on the basis of approved metodology and modern research methods.

The transparency, color, taste, smell (bucket) and typicality of wines by organileptic methods (Tables 3, 4).

Researched wine materials possessed normal dynamic (from 1105 to 1890 mg/dm^3) in decreasing of total quantity of phenol compounds. Phenol composition indicators and chromatic characteristics of wine materialsa are issued in Table 6.

Following methods were applied in increasion of titratable acidity of wine material: adding oxidizing (wine acid E334, citric acid E330, apple acid E296, milk acid E270), blending with wine material obtained from the grape with high acidity. The organoleptic assessment of the effect of acids (wine acid E334, citric acid E330, apple acid E296, milk acid E270) to the taste and color of wine material to define the oxidizing agent for optimal acidity of acidic wine material was conducted (Panahov, 2014; Panahov, 2016). That is why, the certain acids were added to wine material until the acidity will be 7 q/dm^3. Organoleptic assessment, control and pH of acid added examples are issued in Table 6.

Table 3. Organileptic essence of Wine

№	Indicator	Essence
1	Transparency	Transparent, without sediment and additional impurities
2	Color	From dark red to dark pomegranate color
3	Smell	According to sort, without outside shade and acetic acid
4	Taste	Clear, light, fresh, harmonic, according to sort

Table 4. Physico-chemical indicators of Matrasa wine materials

Years	Indicator				
	Mass concentration of sugar, g/dm^3	Mass concentration of acids g /dm^3	pH	Mass concentration of volatile acids, g /dm^3	Volume share of Ethyl alcohol, h%
2016	0,9±0,2	3,4±0,1	4,00±0,05	0,6±0,1	10,7±0,2
2017	1,2±0,1	3,8±0,1	4,00±0,05	0,5±0,1	12,0±0,3
2018	1,2±0,2	3,5±0,1	3,95±0,05	0,3±0,1	11,0±0,4
2019	1,1±0,2	3,6±0,1	3,75±0,05	0,4±0,1	13,0±0,4

Table 5. Phenol and color composition indicators of wine materials prepared from Matrasa grape sort

Years	Idicators									
	Mass concentration of phenol compounds,mg/dm³	Quantity of monomer anthocyanins , mg/dm³	Mass concentration of colored substances , mg/dm³	Maximum of visible area of spectrum (pH 1,0) nm	Color caused by polymers , %	Intensity of color, (i_{520})	Intensity of color, (i_s)	Total quantity of flavans, mg/dm³	Total quantity of flavans, mq/dm³	Mass concentration of leuco-anthocyanins, mq/dm³
2016	1105±16	18±2	28±2	512±1	63,3±1,2	2,89±0,12	1,83±0,08	-	78±3	124±8
2017	1510±21	50±2	52±3	521±3	47,0±0,4	2,92±0,21	1,37±0,12	-	69±3	360±11
2018	1890±25	173±9	120±8	521±1	43,1±0,5	2,17±0,17	0,98±0,06	-	61±4	315±12
2019	1990±23	170±7	123±6	541±1	42,1±0,5	2,19±0,19	0,99±0,05	-	64±8	365±16

Table 6. Orqanoleptic assessment and pH by adding different acids to Matrasa wine until the acidity will reach to 7 g/dm³ (by considering wine acid)

№	Examples	Color	Taste	pH
1	Control (without adding acid)	Light brown shade wirh red differ from acid added examples	Not known, empty, pleasant bitterness, acidity is not felt	4,00±0,05
2	By adding citric acid	Red with pink shade	sour, sharp, pleasant bitterness, full	3,65±0,05
3	By adding apple acid	Red with dark pink shade	sharp strong sour, not clear known, no bitterness	3,65±0,05
4	By adding wine acid	Red with pink shade, full	pleasant, sour, full	3,50±0,05
5	By adding milk acid	Red with dark pink shade	Not known, empty, no bitterness, is not sour	3,50±0,05

Following methods were studied while increasing the acidity of juice: adding citric acid, adding grape juice with high acidity, working with heating, fermentative working and working with physical affect (ultra sound) (Figure 1).

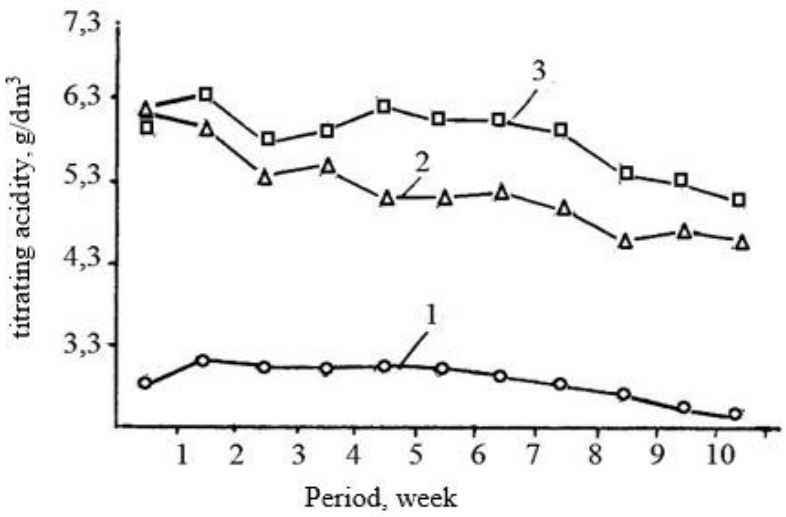

Fig. 1. Changing of titratable acidity in wine material 1 – control; 2 – blend; 3 – Citric acid, in case of usage

4. Conclusion

1. Studying the mechanical and chemical composition of red grape sorts adapted to local and local soil climate condition selected for the preparation of high- quality red table wines howed that the titratable acidity, sugariness percentage can be more or less in the phase of technical growing depending on agrotechnical measures, territory, chaning cimate and etc. According to selected technology the chemical composition of juice obtained from these should be regulated.
2. Heating, fermentative physical working regimes are defined experimentally in preparation of wine, their affect to the chemical composition of wine were clarified. It was defined that *Rapidase CR* drug accelerates in an important degree the fermentation in 30°C temprature within four hours, the titratable acidity and color intensivity of wine prepared from matrasa grape increase.
3. It was revealed that the working with ultra sound (more than 10W/sm²) with 22±1,65 Hs frequency as physical effect supports to the collection of polyphenol and anthocyanins. Also, it was approved that the processing of bruise in 60°C temprature supports to enrichement of juice with extractiv substances. The fermentation period for bruise was defined for eight days optimally by experimental method.
4. Organoleptic analysis of prepared wines were carried out, the relations of its main cimponents were defined preciesely. Here the blend scheme fot Matrasa and Khindogni sorts are considered superior for production technology by being 1:1.
5. It was defined that if the investigation put for new product cannot be able to prove its value economically, it provides taking 172410 AZN income from realization of 100000 bottles of wine during the season.
6. Appropriate technological documents were worked out by us and the production of high qulitative red table wine was organized by industrial method at "ASPI AGRO" LLC enterprise situated at Gabala city o the basis of suggestions and recomendations submitted to the production by us.

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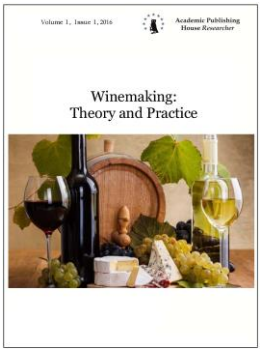

Develop Efficient Rational Methods to Manage Missing Plants in Vineyards Giving Full Crop

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Abstract

Viticulture is an important field of agriculture. The development of viticulture is necessary to improve the quality of the production product – wine, so much attention is paid to studies aimed at developing agro-technologies in viticulture.

An article discusses the efficient methods to manage the missing plants in the vineyards (already giving full crop). The negative effect of missing plants is revealed especially in the old vineyards, causing the decrease of the yield and increase in financial expenses due to costly operations. We have manipulated five types of methods against missing plants – I version – replacement using the method of bending the matured shoot (control); II version – replacement by one year old vine plant head covered with soil; III version – replacement by one year old vine paraffined plant; IV version – replacement by green fertile pot vine plant; V version – replacement by newly stratified vine plant.

The results have been recorded according to vine plant success, and to their vegetative growth. Preliminary results have been processed and results have been concluded accordingly.

Keywords: vine, missing plants in the vineyards, vine plant, vine replacement, rational technology.

1. Introduction

Viticulture and Winemaking plays important role among other agriculture industries in Georgia. Diverse soil and climate conditions creates potential for high quality viticulture development, that is strengthened by diverse, local indigenous vine varieties.

According to Wine Agency in 2018 year about 86,2 mln bottles (0,75 liter) have been exported to 53 countries, that is the record number in the last 30 years. There was 13 % increase compared to 2017 year. The value of exported wines was 203 mln dollars (Georgian wine). The above-mentioned data indicates that industry has high potential and should be used for the future development strategy.

In viticulture and winemaking industry agrotechnological processes play great role due to different challenges, like impact of climate change, meeting the market demands by producing high quality products and etc. The most important part of the agrotechnology is selection of planting material, vine plantation according to modern agrotechnological regulations and etc. Among those challenges missing plants has high importance.

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The missing plants decrease the grape quality and have negative impact on the self-cost of the grape. Each year some number of vine plantation decease, the reason for this can be:

- Poorly prepared soil for vine plantation;
- Poor vine treatment operations;
- Bad climate conditions (frost, hail, drought and etc.);
- Pest and Disease;
- Mechanical injury – by tractors, plough, cultivator and etc.

The above-mentioned reasons cause the missing plants, that has bad impact on overall grape quality. Also, the expenses increase by chemical treatments and soil preparation work.

2. Materials and methods

According to literature review the methods against missing plants are the following activities – replacement by new vine plants or by bending the existing ones for propagation.

Vine replacement should be used when one can find several missing plants in a row. In this case the missing space should be sowed along a row line. The hole should be dig at 50-60 cm, on the surface at about 20-30 cm height fertilized soil fraction should be distributed. 1-2 years old paraffined vine plant, with normalized root at 10-12 cm should be placed in the soil according to natural developed root system (Primicerio, 2017). The fine structured soil should be distributed on the upper layer and properly flattened. After planting the vine should be irrigated properly. (Chkhartishvili, 2016; Kantaria, Ramishvili, 1983; Proffit et al., 2006).

The best result is shown by planting the vines during the vegetative cycle, when green vine plants in the fertile pots with peat compost was used. Newly replaced vine plants should be attached to the single stake. The great attention should be paid to vine pest and disease management and weed control and other necessary vine treatment operations (Chkhartishvili, 2016).

In the fully cropped vine plantation, it is recommended to use the vine bending operation – using the green shoots; or using matured shoots or whole vine bending technique to fill the missing plants, or elongating the vine arm or training the vines otherwise (Chkhartishvili, 2016).

Object, subject, and methods of research

Research Method: our goal was to study and reveal the best version to replace the missing plant vineyard by rational agrotechnological operations.

The study was conducted at Rkatsiteli Vine vineyards with missing plants.

I version – replacement using the method of bending the matured shoot (control)

II version – replacement by one year old vine plant head covered with soil

III version – replacement by one year old vine paraffined plant

IV version – replacement by green fertile pot vine plant

V version – replacement by newly stratified vine plant

During each method 20 units have been planted, from where 3 of them have been recorded, according to developed vine plant vegetative vigor.

Recording elements: in each version it was recorded:

- total amount of successful vine plant
- the growth dynamic of successful plant, length (cm) during vegetative cycle
- total vegetative growth length, width after the end of vegetation cycle;

The experiment was conducted in Kakheti – in the biggest viticulture-winemaking region at Telavi municipality, village Ruispiri. The soil in the given region is characterized as brown fertile clayey soil, this type of soil is common for this region and has high clay content. The wines from the given soil are characterized by velvety perception at the palate.

Brown clay structure soils have high Ampelo-Ecological factors, that is characterized by dense structure and high air-water potential capacity. This soil type is rich by calcium, nitrogen, potassium and phosphorus (Talakhadze, Anjaparidze, 1980).

Each experimental plot has undergone the common soil preparation, weed management operations, pest and disease control and green operations.

In 2019 the weed management was conducted by integrated mechanical and chemical operations. After that the plot was cultivated by tractor at 25-30 cm depth. The soil among the vines which could not be cultivated mechanically was manipulitaed manually by workers.

The root of weeds was taken out from the vineyards. In the middle of February, during non-frost period the soil surface was cultivated.

At the experimental object:

Version I, that was the control version, the vine matured shoot by quantity of 20 unit was bent in the middle of February. The single vine stake was used directly during plantation. Vine shoot bending according to literature review is the main operation used against missing plants, though the main disadvantage is that the vine plant is developed on its own root system, so that it is not a grafted vine and is not resistant to phylloxera, meaning that longevity is restricted.

Version II 20 unit of one year old vine plant was planted in March covered with soil. Agrotechnological method means covering the vine plant head by fine structured soil, protecting if from drying out and low temperature impact.

Version III 20 unit of vine plants paraffined planted in the end of April. The main advantage is that vine plant does not need the soil coverage as the vines are planted during non-frost period, and the paraffin protects them from drying out.

Version IV the vine was planted in the end of May, using green fertile pot vine plants by quantity of 20. Green fertile pot vine plant used as replacement method is the most interesting technique, as the success of this kind of vine plant is very high. The vine is planted during the vegetative cycle, when the vine has already developed 4-5 leaves.

Version V in the beginning of May newly stratified paraffined vine plant, covered with fine soil. The vine plant has no significant vegetative organs developed, it is not like standard one-year vine plant, though it has well developed callus. This kind of vine plant planted in the static place has potential to adapt easily and has potential to grow well.

3. Results

The results of the experiment are shown in the given tables and processed using math – calculated the average number.

Table 1. Success of vine plants

Version	Planted	Success
I	20	20
II	20	20
III	20	18
IV	20	16
V	20	17

According to the given data, the best success is achieved by first version (control – vine shoot bend) and second version (one year vine plant with soil cover), in the given cases the vine plant has 100 % success. Third version (one year vine plant paraffined) was characterized by 90 % success, fifth version (newly stratified vine plant) was characterized by 85 % success and forth version was characterized by 80 % (green fertile pot vine plant).

The vegetative growth cycle of newly planted vines is shown in II and III tables (according to the versions), II table shows the growth density by diameter, grouped as: 2-3 mm, 4-5 mm and 6-10 mm. Table 3 shows the growth length dynamic, grouped as following: 0-50 cm, 50-100 cm, 101-200 cm; > 200 cm length.

Table 2. Vine plant width during vegetation

	2-3 mm			4-5 mm			6-10 mm		
version	June	July	August	June	July	August	June	July	August
I	0	0	0	7	0	0	13	20	20
II	0	0	0	5	0	0	15	20	20
III	4	0	0	14	14	14	0	4	4
IV	16	3	3	0	13	13	0	0	0
V	17	15	14	0	2	2	0	0	1

According to the data table, 6-10 cm width is characterized by version I (control – bend vine shoot) and version II (one year vine plant covered with soil); 4-5 mm width has version III (vine plant paraffined) and in July and August version IV (fertile pot vine plant), and 2-3 mm width was the success of version V (newly stratified vine plant).

Table 3. Vine plant length during vegetation

	0-50 cm			51-100 cm			101-200 cm			> 201 cm		
	June	July	August	June	July	August	June	July	August	June	July	August
I	0	0	0	7	0	0	0	0	0	13	20	20
II	0	0	0	0	2	2	17	16	14	1	2	4
III	3	2	0	12	9	11	2	7	6	0	0	1
IV	9	8	8	7	8	8	0	0	0	0	0	0
V	13	10	8	4	7	9	0	0	0	0	0	0

According to the length of growth, the vine shoots of 201 cm, the longest has version I (control – bend vine shoot); 101-200 cm shoot length has version II (one year plant head covered by soil); 51-100 cm growth length has version III (paraffined vine plant without head covering by soil) and version IV (green vine plant); 0-50 cm length of growth has version V (newly stratified vine plantation).

The vigor of young vine after the end of vegetation cycle was studied by each version. The length and width (diameter) were registered. The result data are shown in Table 4 and 5.

Table 4. The growth width after the end of vegetation

Version/ Diameter	I	II	III	IV	V
2-3 mm	0	0	1	0	0
4–5 mm	0	4	4	16	6
6–10 mm	20	16	14	0	11

According to the data of the table it is shown that, 2-3 mm vine shoot growth has version III (paraffined one year vine plant without soil cover) 5 %; 4-5 growth has been reached in version IV (green fertile pot vine plant) by 100 %; version II, III, V by 35 %; 6-10 cm growth was reached by version I 100 %; version II 80 %, version III 78 %; version V 65 %.

Table 5. Growth length after the vegetation

Version/length	I	II	III	IV	V
50–100 cm	0	2	2	16	15
100–200 cm	0	15	13	0	2
> 200 cm	20	3	2	0	0

According to the Table 5, growth of 50-100 cm was reached by version IV and V; 100-200 cm length growth was reached by version II and III; and 200 cm growth was reached by version I.

4. Conclusion

1. The best results by vine success have been reached in version I and II; the vine plants have 100 % success. Version I is not an independent plant and takes the nutrition from mother plant, which gives the highest vigor and potential to succeed. Version II one year old vine plant covered with soil showed the best results in the given experiment;

2. According to vegetative growth the best result was reached in Version I; also version II and III are characterized by high growth. Version I result is based again on the mother plant available nutrient supply. Though the priority can be given to version II and III that were planted during spring time, as they have been characterized by sufficient vegetative growth in total.

3. The study is continued to conclude which version can give the yield earliest; According to the result data version II and III are in the best conditions, as their growth is sufficient, that gives them the priority after the first pruning to have well-developed vine trunk, which enables to have the earliest period to give yield.

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