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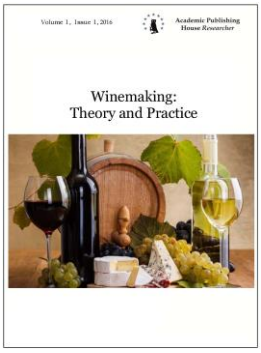

Develop Efficient Rational Methods to Manage Missing Plants in Vineyards Giving Full Crop

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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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