Uluslararası Tarım Araştırmalarında Yenilikçi Yaklaşımlar Dergisi
International Journal of Innovative Approaches in Agricultural Research 2019, Vol. 3 (1), 8-15
https://doi.org/10.29329/ijiaar.2019.188.2

Original article

Cuttings Viability after Treatment of the Mother Vineyard with Herbicides [1]

Neli Prodanova-Marinova *

Institute of Viticulture and Enology, 1 Kala Tepe Str., 5800 Pleven, Bulgari.

Abstract

During the period 2014–2016 at the Institute of Viticulture and Enology a trial was carried out to study the impact of the herbicides Gardoprim plus Gold (312.5 g/l s-metolachlor + 187.5 g/l terbuthylazine), Lumax 538 SC (375 g/l s-metolachlor + 125 g/l terbuthylazine + 337.5 g/l mesotrione) and Wing P (pendimethalin 250 g/l + dimethenamid P 212.5 g/l) on the yield of high-quality cuttings for production of vine propagation material. The treatments in the mother vineyard of Cabernet Sauvignon variety (clone D-1) were performed in the spring before the buds germination. The obtained cuttings were grafted in 2015, 2016 and 2017 on Berlandieri X Riparia SO4 rootstock. After the stratification, the grafted cuttings were planted in the nursery and their vegetative manifestations were monitored.

The cuttings from the herbicide-treated variants showed viability similar to the control, and their buds germinated with the same intensity. The yield of rooted vines did not differ significantly from the cuttings grown without herbicides, as the highest rate of standard propagation material was obtained with Gardoprim plus Gold (55.45%). The vine biometric indicators exceeded those of the control variant. The application of the herbicides Gardoprim plus Gold, Lumax 538 SC and Wing P for keeping the soil surface free from weeds did not adversely affect the cuttings quality and was a suitable method for improving the agro-technology in the mother vineyards.

Keywords: vine, cuttings, grafting, mother vineyard, nursery, herbicides.

Received: 31 August 2018 * **Accepted:** 19 January 2019 * **DOI:** https://doi.org/10.29329/ijiaar.2019.188.2

* **Corresponding author:**

Neli Prodanova-Marinova, Institute of Viticulture and Enology, 1 Kala Tepe Str., 5800 Pleven, Bulgari.
Email: neli_npm@abv.bg

[1] A part of this study was presented at the International Agricultural, Biological and Life Science Conference, Edirne, Turkey, September 2-5, 2018.

INTRODUCTION

A basic requirement for mother vineyard growing has been its guaranteed health and physiological status. The high weeds incidence has been a prerequisite for worse microclimate, creating conditions for inhibiting vine growth, spread of diseases and facilitating the attacks by enemies. The weed infestation made them a source of inoculum for infecting the vines in the mother vineyard and pathogens spreading through the propagation material (Duffus, 1971, Adlerz and Hopkins, 1979, Wistrom and Purcell, 2005; Agustí-Brisach et al., 2011).

Greater competitivity of weeds in absorbing nutrients from the environment resulted in reduction of the yields of all vineyard-related productions (Vitis vinifera) – grapes, cuttings, rootstock, propagation material (Moulis, 1992, Prodanova-Marinova, 2012; Muganu, et al., 2013). It has been found that bindweed species (*Convolvulus arvensis* L.), mustard (*Sinapis arvensis* L.), amaranth (*Amaranthus retroflexus* L.) and twitch (*Cynodon dactylon* Pers.) transpire much more intensively than vine. In addition to more water, weeds absorb from the soil greater quantities of nutrients (Boychev, 1980; Smirnov et al., 1987; Steenwerth et al., 2016).

The application of herbicides leads to a reduction or complete destruction of harmful plants in the vineyard and the proper selection of the active substances have a positive effect on vine growth. It has been shown that after prolonged use of herbicides (e.g., triazine group), vine growth is enhanced. The plants have better developed shoots and their annual growth is higher compared to the traditionally cultivated vineyards (Nikov et al., 1972; Magriso et al., 1979; Patil, 2006).

It has been found that the herbicides Lumax 538 SC, Gardoprim Plus Gold and Wing P, introduced immediately after hilling down of the vines did not damage the vine buds and did not reduce the shoots developed from them. Lumax 538 SC at a dose of 0.6 l/da has created conditions for obtaining a greater number of cuttings from the vines in the technological control (Prodanova – Marinova, 2016).

The objective of this study was to determine the viability of the cuttings obtained after treatment of the mother vineyard with herbicides in field conditions.

Material and Method

The trial was carried out in 2014 – 2016 at the Institute of Viticulture and Enology, Pleven, Bulgaria. The soil type in the plantations was leached chernozem, formed on clayed loess, a heavy sandy-clay in mechanical structure. Three herbicides in two doses were tested to control the weed vegetation in the mother vineyard. The cuttings from the plots with the higher dose of application were chosen for the viability check, which had also determined the variants of the present study (Table 1).

Table 1. Variants of the trial depending on the treatment of the mother plantations with herbicides

Variant	Herbicide	Active substance	Dose (l/da)
K	-	-	-
V1	Lumax 538 SC	*375 g/l s-metolachlor + 125 g / l terbuthylazine + 337.5 g / l mesotrione*	0.6
V2	Gardoprim Plus Gold	*312.5 g/l s-metolachlor + 187.5 g/l terbuthylazine*	0.6
V3	Wing P	*pendimethalin 250 g/l + dimethenamid 250 g/l P 212.5 g/l*	0.6

The treatments in the mother vineyard of Cabernet Sauvignon variety (clone D-1) were carried out in the spring of 2014, 2015 and 2016 before buds germination with a backpack sprayer at consumption rate 40 l/da working solution (Pmax 300 kPa). The cuttings were grafted in 2015, 2016 and 2017 to Berlandieri X Riparia SO4 rootstock. After the stratification process, the grafted cuttings were planted in the nursery and cultivated according to the technology adopted by IVE, Pleven, without polyurethane mulch (Dimitrova et al., 2007).

The trial was set in four repetitions by the long plots method. The following indicators were recorded: bud germination dynamics (%); yield of standard rooted vines (% compared to the planted cuttings in the nursery); length (cm) and mass (g) of the annual mature growth; the second internode diameter of the main shoot (mm) and the number of roots (> 2 mm and < 2 mm) on the average per vine. The data were processed by analysis of variance (Dimova and Marinkov, 1999).

Results and Discussion

The grafted cuttings from the herbicide-treated vines grew evenly, with an intensity similar to that of the control. The data for the three years were analogous. The average rates for this indicator for the period of the study are given in Table 2. No inhibition of bud development was detected in any of the five records during the vegetation. In all variants with herbicides, they exhibited a higher viability compared to the control. In the first and second ten days after the cuttings were planted in the nursery their germination was most intense, as only at the end of the first ten-day period there were more significant differences between the treated variants and the control, however the analysis of variance did not prove them. The equal results at the end of the fifth ten-day period confirmed the assumption that there was no negative effect of Lumax 538 SC, Gardoprim Plus Gold and Wing P applied in the mother vineyard on the viability of the cuttings. The differences compared to the control varied from 3.01% (V1) to 1.43% (V3) and were insignificant.

Table 2. Buds germination dynamics of the grafted cuttings after their planting in the nursery (on the average for the period)

variant	Germinated cuttings						
	I ten days		II ten days	III ten days	IV ten days	V ten days	
	%	Significance	%	%	%	%	Significance
K	71.28	*	88.35	93.54	92.75	90.60	*
V1	86.28	ns	95.63	96.07	94.55	93.61	ns
V2	81.15	ns	91.98	93.83	92.36	92.05	ns
V3	85.45	ns	92.74	94.64	92.68	92.03	ns
	GD(5.0%) = 16.246 GD(1.0%) = 24.611 GD(0.1%) = 39.563					GD(5.0%) = 9.340 GD(1.0%) = 14.150 GD(0.1%) = 22.746	

The lack of visible damage to the buds and the cuttings and impairment of their viability affected the yield of quality vine propagation material. The ratio of standard rooted vines differed significantly during the individual years of the study, however the herbicidal action in the mother vineyard in the preceding year was not the main factor causing these differences (Table 3). The variance of the results compared to the control indicated the impact of side factors (climatic, technological, etc.) rather than a negative herbicidal effect. In 2015, the highest yield (48.94% at 47.33% in the control) was recorded in the variant of the vines treated with Wing P (V2) and the lowest in 2017 (64.32) % at 74.93% in the control). In 2016, the ratio of standard rooted vines exceeded the control with a good statistical probability of the difference. The results for V3 (Gardoprim Plus Gold) were not analogous either – in 2015 it was recorded the lowest yield (44.35% at 47.33% in the control) while in 2016 it surpassed the control with a very good probability of the difference of 23.85%.

Table 3. Yield of standard propagation material on the average for the period 2015 – 2017

Variant	Standard rooted vines					
	2015		2016		2017	
	%	Significance	%	Significance	%	Significance
K	47.33	*	25.00	*	74.93	*
V1	46.28	ns	24.03	ns	72.22	ns
V2	48.94	ns	34.27	++	64.32	ns
V3	44.35	ns	48.85	+++	73.15	ns
	GD(5.0%) = 18.875 GD(1.0%) = 28.594 GD(0.1%) = 45.965		GD(5.0%) = 5.260 GD(1.0%) = 7.969 GD(0.1%) = 12.810		GD(5.0%) = 11.827 GD(1.0%) = 21.710 GD(0.1%) = 48.100	

The average yield of standard propagation material for the period 2015-2017 from the variants of Wing P (V2) and Gardoprim Plus Gold (V3) exceeded that of the control (more significant for V3 – by

6.36%) – figure 1. For Lumax 538 SC, the average result for the three years was smaller than that of the control by 1.58%. The differences were insignificant (at GD(5.0%) = 15.532; GD(1.0%) = 23.530; GD(0.1%) = 37.825) and did not demonstrate convincingly the effect of the herbicidal action in the mother vineyard on the yield of standard rooted vines obtained from the cuttings produced in it.

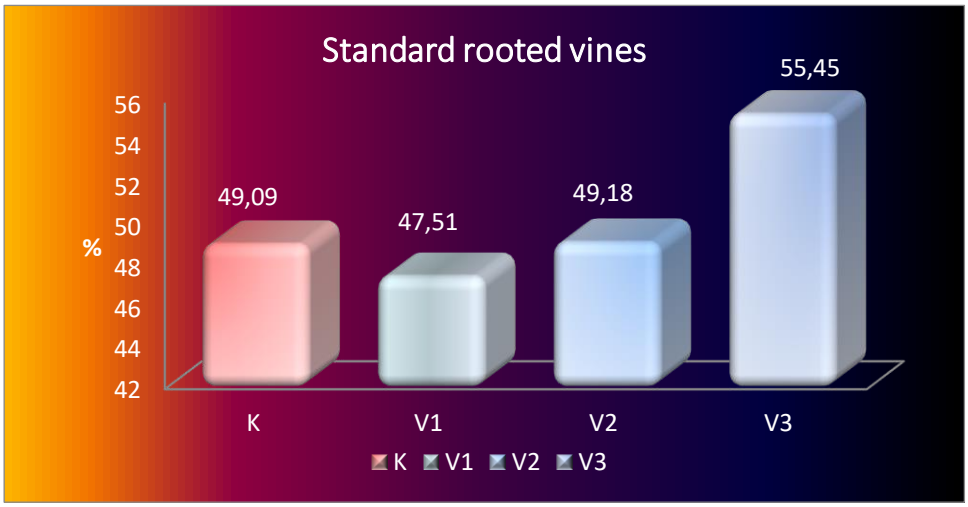

Figure 1. Yield of standard rooted vines on the average for the period 2015 – 2017

The biometric characteristics of the vines presented their overall habitus at the end of the vegetation season and their removal from the nursery. Greater lengths and mass of the mature annual growth were measured in the treated variants, but the differences were not proven by the analysis of variance (Table 4). The results showing the diameter at the base of the main shoots were similar. The application of herbicides in the mother vineyard did not adversely affect the growth of the shoots and the ripening of the wood of the vines obtained from the cuttings produced in it.

Table 4. Biometric characteristics of the grafted rooted vines obtained by grafting of cuttings from the mother plantation treated with herbicides (average for the period 2015-2017).

Variant	Length		Mass		Diameter	
	cm	Significance	g	Significance	mm	Significance
K	78.50	*	14.06	*	5.9	*
V1	80.88	ns	15.60	ns	6.3	ns
V2	91.71	ns	16.86	ns	6.4	ns
V3	78.53	ns	16.56	ns	6.7	ns
	GD(5.0%) = 15.936 GD(1.0%) = 24.141 GD(0.1%) = 38.807		GD(5.0%) = 5.844 GD(1.0%) = 8.854 GD(0.1%) = 14.232		GD(5.0%) = 2.420 GD(1.0%) = 3.667 GD(0.1%) = 5.894	

The root system development in the production of vine propagation material was largely determined by the rootstock. After grafting, the live bond between the rootstock and the cutting had formed a single organism and allowed the cutting to influence the rootstock and the rooting process. The

measurements made after the removal of the vines from the nursery did not establish any differences in the number of roots between the control and the variants of cuttings from the treated mother vineyard, caused by a negative herbicidal effect (Figure 2). The number of roots with a diameter greater than 2 mm was approximately the same – the differences were minimal (0.2 – 0.3 compared to the control) and unproven both between the control and the treated variants, and between them (GD (5.0 %) = 1.787; GD (1.0%) = 2.707; GD (0.1%) = 4.351). A more significant difference was recorded in the roots less than 2 mm diameter in the variant treated with Lumax 538 SC – the vines from this variant had a significantly greater number than those in the control and the other variants (the probability of the difference was good at GD (5.0 %) = 2.092; GD (1.0%) = 3.169; GD (0.1%) = 5.095). That affected, respectively, the average total number of roots per vine – the highest rate of the indicator (15.5) was recorded in this variant (the difference was significant at GD (5.0%) = 3.019; GD (1.0%) = 4.574; GD (0.1%) = 7.352). The other variants and the control did not differ significantly, both in the number of roots below 2 mm in diameter and the total number.

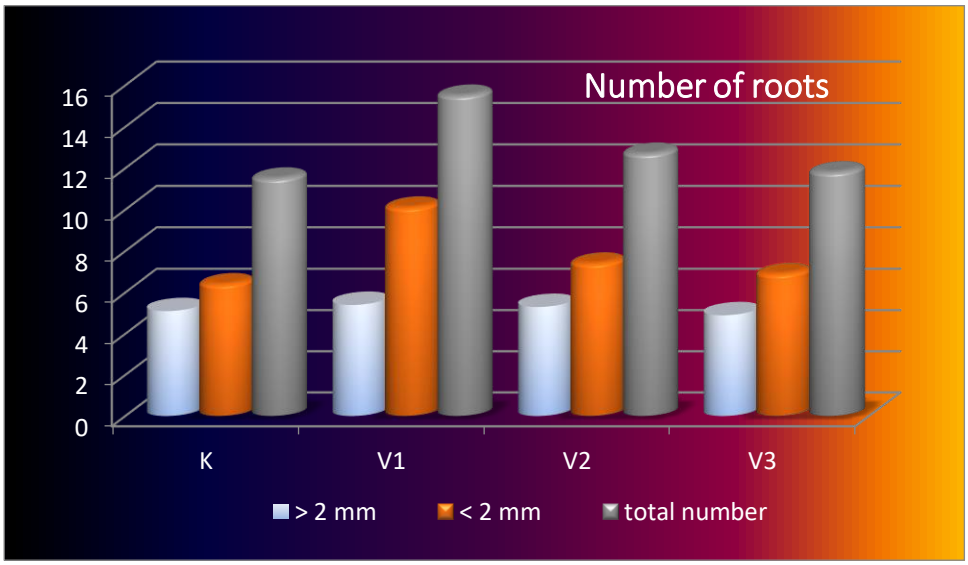

Figure 2. Number of roots per vine on the average for the period 2015 – 2017 after removal from the nursery

Conclusions

The cuttings, treated with Gardoprim Plus Gold, Lumax 538 SC and Wing P showed a viability similar to that of the control, and their buds germinated with the same intensity.

The yield of rooted vines did not differ significantly from that of the cuttings grown without the application of herbicides, as the highest ratio of standard propagation material was obtained from Gardoprim Plus Gold variant (55.45%).

The use of cuttings from mother vineyard treated with Gardoprim Plus Gold, Lumax 538 SC and Wing P for the production of Cabernet Sauvignon (clone D-1) propagation material did not inhibit the root system and shoots development and did not reduce the mature annual growth of the vines.

The application of the tested herbicides to maintain the weed-free soil surface did not adversely affect the quality of the cuttings and was a suitable method for improving the agricultural and technical practices in the mother vineyards.

REFERENCES

Adlerz, W. C. and D. L. Hopkins (1979). Natural infectivity of two sharpshooter vectors of Pierce's disease of grape in Florida. J. Econ. Entomol., 72(6), 916-919.

Agustí-Brisach, C., D. Gramaje, M. León, J. García-Jiménez and J. Armengol (2011). Evaluation of vineyard weeds as potentialhosts of black-foot and Petri disease pathogens. Plant Dis., 95, 803-810

Boychev, A. (1980). Studies on water and nutrition regimen of weeds in the vineyards. Gradinarska i Lozarska Nauka, 2, 98 – 103.

Dimitrova, V., V. Peykov, E. Tsvetanov, H. Encheva and M. Chelebiev (2007). Optimization of the technology for the production of grafted rooted vines. Proceed. of scientific conference with international participation "Sustainable development of viticulture and enology, knowledge-based", Pleven, 29-30 August 2007. pp. 99-106.

Dimova, D. and E. Marinkov (1999). Experimental Works and Biometry. Academic publishing house of HAI, Plovdiv, 263.

Duffus, J. E. (1971). Role of weeds in the incidence of virus diseases. Annu. Rev. Phytopathol., 9(1), 319-340.

Magrisso, Y., S. Yonev, T. Cholakov, M. Nikov, B. Danailov, E. Raykov, A. Georgiev, V. Dimchev and D. Babrikov D. (1979). Commercial technologies in viticulture. Sofia. Zemizdat. 322.

Moulis, I. (1992). Etude de la concurrence herbe – vigne. Consequences écophysiologiques sur la vigne de l'enherbement de vignoble en region Mediterranéenne. Comptes rendues du IV simposium international de physiologie de la vigne, 11 – 15 mai, Torino, 93 – 97

Muganu, M., M. Paolocci, D. Gnisci, F. E. Barnaba, A. Bellincontro, F. Mencarelli and I. Grosu (2013). Effect of Different Soil Management Practices on Grapevine Growth and on Berry Quality Assessed by NIR-AOTF Spectroscopy Acta Hortic., 978, 117 – 125.

Nikov, M. (1972). Growth and fruit-bearing of vines with prolonged use of herbicides without tillage. Gradinarska i Lozarska Nauka, IX, 7, 137 – 146.

Patil, D., G. Sulikeri and H. Patil (2008). Studies on the weed management practices in Thompson seedless grape vineyard. Acta Hortic., 785, 321 - 326.

Prodanova – Marinova, N. (2016). Effect of some herbicides on weeds and vines in mother plantation of Cabernet sauvignon. Agric. Sci. Technol., 8 (3), 227 – 231.

Prodanova-Marinova, N. (2012). Study on the Efficiency and Selectivity of Soil Herbicides in Vine Nursery. Dissertation Thesis for PhD Degree, 161.

Smirnov, K., F. Kalmykov and G. Morozov (1987). Viticulture. Agropromizdat, 877.

Steenwerth, K., A. Orellana-Calderón, R. Hanifin, C. Storm and A. McElrone (2016). Effects of Various Vineyard Floor Management Techniques on Weed Community Shifts and Grapevine Water Relations. American journal of enology and viticulture, 67, 2, 153 – 162.

Wistrom, C. and A. H. Purcell (2005). The fate of Xylella fastidiosa in vineyard weeds and other alternate hosts in California. Plant Dis., 89(9), 994-999.