IMPACT OF CANE ARCHING ON VEGETATIVE AND PRODUCTIVITY INDICATORS OF WINE GRAPE CULTIVAR MERLOT

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Abstract: *In specific conditions of Albania, the grape cultivar "Merlot", has replaced the autochthonous cultivars such as Kallmet and Shesh i Zi in the structure of red wine cultivars because of its resistance against diseases like Plasmopara viticola and Uncinula necator, earlier maturity time, high levels of anthocians on the berry peel, and low levels of tannins. Grape cultivar Merlot differs one or two inflorescenes for each fruitbearing shoots in the base and middle part buds of the cane. In vineyards without irrigation there is beeing applied short prunning system with two-three buds for cane or ten to twelve buds for each vine. The paper presents the impact of productive cane arching (bending) on vegetative and productivity indicators of grape cultivar Merlot. The study was carried out during 2008-2010 in vineyards of Zagora village in Malësia e Madhe, where was applied double Gyot training and mixed pruning system. There were studied two variants of productive canes fixing: V_1 – horizontal canes – traditional Gyot. V_2 – arched canes (bending canes). The experimental data show that cane arching do affect on vegetative and productive indicators of grape cultivar Merlot. So, in V_2, with arched canes, shoot length was 76.25 cm versus 86.25 cm of V_1; mean shoot diameters in V_2 was 7.97 mm versus 6.48 mm of V_1, and relative productive coefficients (RPC) were 1.46 bunches/shoot for V_2 versus 1.5 bunches/shoot for V_1. The increase of yield of V_2 was 13.2 kv/ha or 10.9% higher than the yield of V_1. The specific gravity of must of V_2 (arched canes) was 1088 versus 1086 of V_1, and sugar content of must was 20.4% for V_2 versus 19.9% for V_1. The wine produced with grape of V_2 had an alcoholic grade 12% versus 11.7% of the wine produced with grape of V_1. At the crown form double Gyot, arching of productive canes do affect positively on reducing of polarity phenomenon and increase of productivity because of a better assimilates distribution to product indicators benefit, and improvement of chemical and technical must and wine indicators.*

Key words: *arching, cane, double Gyot, indicator, productivity, vegetation.*

INTRODUCTION

The grapevine cultivar Merlot is extensively used for red wine production, which because of its good adaptability, is one the most disseminated cultivar on the region of Shkodra and Malësia e Madhe (ÇAKALLI, D. & L. SUSAJ, 2004). The crown form double Gyot can be formed and maintained using mixed pruning system. This form is the most used form to wine grape cultivars, which consists on two productive canes with twelve buds, and two replacement jets with two buds, with a total number of twenty eight buds (SUSAJ, L., 2009).

In traditional (common) double Gyot method, the productive canes are fixed in the first wire of vertical espalier on horizontal position, while the last ten years, is being used, even not widely, the double Gyot with arched (bending) canes (JAMES, D., 2009), which can be realized fixing the middle of productive canes in the second wire, while the top arched end fix in the first wire of the vertical espalier. Canes arching to the double Gyot form have been successful at reducing the polarity phenomenon known as End Point Principle (EPP) (DODSON, J., 2009). EPP identifies shoots at the distal end of long canes which can exhibit a vigorous development, compare to other shoots on a cane (JACKSON, D., 2001). Some evidences suggest that shoot growth has a phenological relationship, because it is affected by climatic factors

(GALET, P., 2000), while the specific problem EPP, shoot growth in different positions on the cane length and polarity phenomenon occurrence have more likely physiological nature (MULLINS, M., et alt., 1992). Jackson has suggested that these conditions are probably related to apical dominance.

In the case of arching canes, the vegetative and productivity indicators can be improved because of a better assimilates distribution. In this case, the assimilates movement forward to the distal end buds of the cane is reduced, so the distal end shoot vigorous is reduced (JACKSON, D. & D. SCHUSTER, 2001).

The impact of grapevine arched canes is similar to arched shoots of fruit trees, a culture system used intensively in Germany and Eastern North (SLIGERLAND, K., 2003). This method was primarily adopted to increase available cane surface (area by arching the cane) creating a higher bud/meter ratio between closely planted vines (MULLER, 2000).

Uneven shoot growth can lead to underdeveloped shoots in the middle of the cane and can result on poor bunch quality, decreased bunch number, and overcrowding of shoots and foliage of crown of closed vines (DODSON, J., 2009).

MATERIAL AND METHODS

Study was carried out during 2008-2010 in the vineyards of Zagora village, at Northern west part of Malësia e Madhe, 210 m above sea level, planted with grape cultivar Merlot. Vines were fourteen years on age (they were planted in 1996), they are maintained at double Gyot form through mixed pruning system, with a total load of 28 buds/pant. Trunk height was 80 cm, and the supporting system was vertical espalier 2 m above the ground surface, with four wires in 40 cm distance from each-other. There were studied two variants with thirty vines/variant, V_1 and V_2. The difference between variants consists only on the way of fixing of productive canes on the vertical espalier. So,

Variant V_1: canes were fixed horizontally (traditional Gyot). Productive canes with twelve buds were fixed on the first wire of the vertical espalier, in horizontal manner.

Variant V_2: canes were arched. In this variant, the middle of the productive canes with twelve buds were fixed on the second wire of vertical espalier, while the top ends were arched and fixed on the first wire.

During the vegetative period were measured, observed and estimated some vegetative and productivity indicators, as:

- Shoots length (cm). It was measured in the period June, 20-25.
- Shoots diameter (mm). It was measured in the middle of second internodes with a micrometer in the period June, 20-25.
- Number of bunches for shoot (Relative Productivity Coefficient - RPC) and mean bunch's weight, which were measured and estimated at the maturity period of the grape, in September, 12-15.
- Yield (kg/plant and kv/ha) were measured and evaluated during the maturity (harvesting) period, September, 12-15, based on the mean productivity of 30 vines for each variant.
- Chemical and technological indicators: must content, specific gravity of the must, pH, sugar content of the must, etc, were measured and evaluated at the Lab of Winery "Miqësia", Koplik, during the period September, 12-16.

RESULTS AND DISCUSSIONS

Shoot length (cm)

Results show that cane arching do affect at developed shoot length. The mean value of shoot length of V_2 with arched canes was 76.25 cm, while the mean value of shoot length of V_1

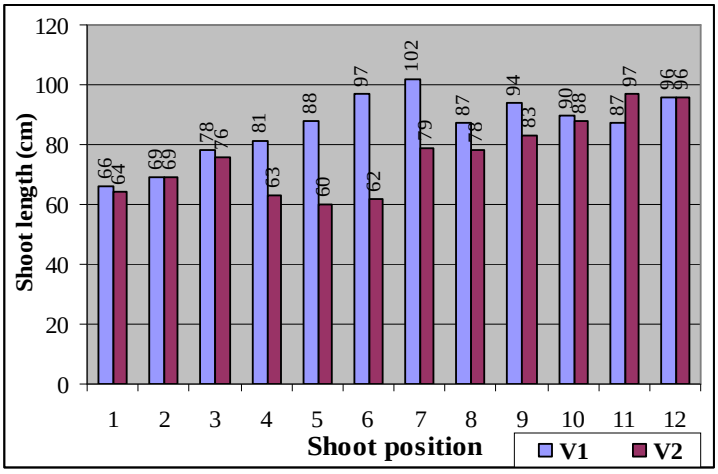
with horizontal canes was 86.25 cm or 10 cm longer. Mean shoot length of V_1 vines with horizontal canes increases from base to distal end. More vigorous were shoots on the positions 6, 7, 9 and 12, while the shortest shoots were them in the positions 1, 2 and 3. To the variant 2, arched canes, the shortest shoots were them which came from buds in the positions 4, 5 and 6 (Table 1 and Graph 1).

Table 1

Shoot length (cm), according to variants

Shoot position	Shoot length (cm)	
	V_1	V_2
1	66	64
2	69	69
3	78	76
4	81	63
5	88	60
6	97	62
7	102	79
8	87	78
9	94	83
10	90	88
11	87	97
12	96	96
Mean	**86.25**	**76.25**

At variant 2, with arched canes, shoot length was more uniform. This was suggested by Smart and Robinson (1991) which show that light intensity for interior clusters of vines with arched canes was 40% of direct sunlight versus 26% of horizontal canes (14% lower).



Graph 1. Shoot length (cm), according to variants

Shoots diameter (shoot thickness) (mm)

Shoot diameter (thickness) varies according to its position on the cane length. Shoots developed on horizontal canes (V_1) were thinner than shoots developed on arched canes (V_2). Mean value of shoot diameter for V_1 was 6.48 mm, while mean value of shoot diameter for V_2 was 7.97 mm, and the difference between two variants was 1.49 mm. Shoots in the middle of canes (in the 5 and 6 position on cane) were thinner than those in both extreme ends, in both

variants, suggesting an uneven distribution of growth (DODSON, J., 2009), but the difference was higher for V_2 (arched canes) (Table 2 and Graph 2).

Table 2

Mean shoot diameter (mm), according to variants

Shoot position	Shoot diameter (mm)	
	V_1	V_2
1	6.8	8.8
2	6.4	8.6
3	6.1	7.8
4	6.2	7.3
5	5.8	6.6
6	6.2	6.9
7	6.4	8.3
8	6.1	8.7
9	6.6	8.2
10	7.4	8.1
11	7	7.8
12	6.8	8.6
Mean	**6.48**	**7.97**

Graph 2. Mean shoot diameter (mm), according to variants

Graph 2 shows that shoots developed on arched canes are thicker than those developed on horizontal canes. At the same time, the difference between shoots on the cane length was higher for V_2.

Productivity indicators

Results of study show that arching of the canes do affect on productivity indicators as the number of bunches/shoot, mean bunch weight, and yield. Culture system at grape cultivar Merlot do affect on vegetative (density and distribution) and productivity indicators (sugar content, etc) through microclimate effect inside vine crown (BAIGORRI, H., et alt., 2001).

Number of bunches for shoot (Relative Productivity Coefficient - RPC)

At variant 2, with arched canes, the mean value of number of bunches/shoot, or so known, Relative Productivity Coefficient, was 1.46, versus 1.5 for variant 1, with horizontal canes.

Mean bunch weight (gr)

Mean bunch weight (gr) of V_2, with arched canes, was 127.6 gr, versus 112.3 gr for V_1, with horizontal canes, with a difference of 15.3 gr.

Yield (kg/vine and kv/ha)

Mean yield (kg/vine), realized at variant 1, with horizontal canes, was 3.63 kg/vine, while mean yield for variant 2, with arched canes was 4.03 kg/vine or 0.4 kg/vine higher.

Mean yield (kv/ha), realized at V_2, with horizontal canes, was 119.8 kv/ha, while mean yield for V_2, with arched canes was 133 kv/ha, with a difference of 13.2 kv/ha or 10.9% higher. Arching the canes did affected the increase of yield (kg/vine) and total yield (kv/ha) (Table 3).

Tabela 3

Productivity indicators, according to variants

Indicators	Years						Mean	
	2008		2009		2010			
	V_1	V_2	V_1	V_2	V_1	V_2	V_1	V_2
Number of bunches/shoots	1.48	1.45	1.46	1.48	1.56	1.45	1.5	1.46
Bunch weight (gr)	113	125	104	120	120	126	112.3	127.6
Productivity (kg/plant)	3.7	4.3	3.1	3.7	3.9	4.1	3.63	4.03
Yield (kv/ha)	122.1	141.9	102.3	122.1	128.7	135.3	119.8	133

Chemical and technological indicators

The product was tested for chemical end technological indicators which affect directly the wine quality. Tests for must content, sugar content of the must, pH, and alcoholic grade of wine were done at Lab of Winery "Miqësia", Koplik, during the period September, 12-16.

Results of mechanical-chemical tests showed that cane arching do not affect must content (%) and pH. So, for both variants, must content was 65% and pH = 3.4.

Cane arching affected slightly the specific gravity (must weight), sugar content, and, consequently, a slightly increase of alcoholic grade of the produced wine. This is because of a better exposure to sunlight of vines with arched canes inside the vine crown, as a result the peel of the berry is more colored and the pulp accumulates more sugar (Smart and Robinson, 1991). Specific gravity of must from variant 2 (with arched canes) was 1088 versus 1086 for variant 1 (horizontal canes), sugar content of must was 20.4% for V_2 versus 19.9% for V_1. These two indicators affected the alcoholic grade of the produced wine from both variants, which were 12% for V_2 and 11.7 % for V_1 (Table 5).

Table 5

Chemical and technological indicators of must, according to variants

Variants	Must content (%)	Must characteristics			Alcoholic grade of wine (%/Vol)
		Specific gravity	Sugar content (%)	pH	
V1	65	1088	20.4	3.4	12
V2	65	1086	19.9	3.4	11.7

CONCLUSIONS

Cane arching do affect on improving of some productivity indicators of grape cultivar Merlot, such as mean bunch weight and yield (kg/vine or kv/ha). This occurs because of a better distribution of assimilates toward bunches. Yield (kv/ha) of the arched cane variant was

13.2 kv/ha or 10.9% higher.

Cane arching do affect on improving of chemical and technological indicators of must, where the specific gravity and sugar content were slightly increased, which affects the wine quality (alcoholic grade of produced wine).

Cane arching do not affect on must content and pH of must.

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