

## Effect of girdling and foliar spraying of phosphorus on vegetative growth and yield's quality of two grapevine (*Vitis vinifera* L.) cultivars Zark and Kamali

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<https://doi.org/10.36077/kjas/2020/120204>

\*Received: 5/10/2020, Accepted: 6/11/2020

### Abstract

This study was conducted during the growing season of 2019-2020 in the vineyard of College of Agricultural Engineering Sciences, University of Duhok, Kurdistan, Iraq to investigate the effect of girdling (girdling and Non-girdling) and spraying of Phosphorus (0, 5, 10 g.L<sup>-1</sup>) on two grapevine cultivars Zark and Kamali. The results indicated that the girdling led to improve all studied parameters compared with non-girdling one. Girdling of Zark cultivar had a significant effect on number of clusters, shoot length, number of leaves per shoot, number of berries per cluster, total sugar and TSS in berries. Also, the girdling of Kamali cultivar enhanced number of clusters, shoot length, number of shoots per vine, number of leaves per shoot and size of berries. Spraying of phosphorus, especially at 10g.L<sup>-1</sup> caused a significant increase in most studied parameters compared to the control. The combination of girdling + 10 g.L<sup>-1</sup> of phosphorus with either cultivar was superior treatment for most parameters compared with control of both cultivars.

**Keyword:** Grapevine, Zark, Kamali, Girdling, Phosphorus, *Vitis vinifera* L.

## Introduction

Grapevine (*Vitis vinifera* L.) is considered one of the most important fruit crops in the world in terms of cultivation and economic value. It is used for production of fresh fruit, dried fruit, wine and juice (3 and 19). Cultivation of grapevine is believed to be originated in Armenia near the Caspian Sea then moved to Europe and Asia. Grape is one of the most delicious and nourishing sub-tropical fruit with the ability for adaptation under temperate, subtropical

Arms girdling of Vines (the removal of a ring of phloem) was preferred exactly after vine growth began to increase the size, weight, sugar content in berries. In addition, girdling of grapevines results in an increase in carbohydrate concentration in the upper part of vine and an increase in weight per unit leaf area (15). The size of berries and yield quality was increased by cane girdling of seedless Grapevines (8 and 20). The Thompson seedless grapevine berries got improved as compared with non-girdle treated arms (1).

The effective method for avoiding nutrient deficiency was foliar spraying method so that the grapevines spraying with phosphorus will boost vine P status in vineyard, because it will be grown on red-hill soils (17). Usually P present in the form of phosphate ( $PO_4$ ), Phosphate (PO), that come from phosphoric acid, Phosphate is taken up by the same transporters as phosphate, is both phloem- and xylem-mobile, and appears to be sensed as phosphate by plants (18). This usually will improve leaf area, total sugar, number of clusters, number of berries/plant and total soluble solids of grapevine (13).

and tropical conditions. The berries contain adequate minerals, Ascorbic acid and vitamin (B1 and B2) (14). According to the Food and Agriculture Organization (FAO) (7), good commercial yields were 15 to 20 Kg grapes per vine or 15 to 30 (or more) tons/ha (80 to 85% moisture). It is possible to increase yield and improve quality parameters of grape by using some canopy practices like girdling, topping, tipping, removal of lateral shoots, remove the leaves and follow the correct fertilization program.

The Zark grape variety is the most widely cultivated variety in Duhok, where it is mostly planted in rain-fed areas, there are several villages specialized in its cultivation including: Besefki, Darkechnik, Swaratuka, Ashawi and some others, beside fresh consumption, Zark is used for juice, wine and raisin production. The inflorescence of this variety is hermaphroditic and it is a good pollinator for the pistillate varieties (2 and 3).

Kamali is the other grape variety which is considered to be a local Iraqi grape variety, come from a natural selection from the Taifi-red variety, it is widely planted in central Iraq and in irrigated vineyards in Duhok, as well as in some vineyards of Erbil and Sulaymaniyah. Kamali is favorable and one of the best table grapes, with excellent commercial properties (3).

This study was aimed to evaluate the effect of girdling and foliar spraying of phosphorus on vegetative growth, yield and quality of two grapevine cultivars (*Vitis vinifera* L.) Zark and Kamali.

## Material and Methods

This study was carried out in the vineyard of the college of Agricultural engineering

sciences, University of Duhok, Kurdistan /Iraq, in order to study the effect of girdling and three level of spraying with phosphorus (0, 5 or 10 g.L<sup>-1</sup>) on two grapevine cultivars (Zark and Kamali).

The vines were selected to be uniform in vigor as possible; it was 8-year-old planted in clay soil at 2.5 m plant spacing. Vines were trained of T-Trellis training, system irrigated with drip system. Pruning was done to the both varieties by leaving 7 canes each with 9 eyes for Kamali and 6 canes each with 5 eyes for Zark, in addition to leaving renewal spurs equal to number of canes each with two eyes.

Therefore, the factorial experiment consisted of twelve treatments (Girdling and Non-girdling, three concentrations of Phosphorus and two cultivar of grapevine “Zark” and Kamali”). The girdling was done on the two arms of vines, two weeks after first growth, and the spraying of phosphorus (Rootex fertilizer: N 7%, P<sub>2</sub>O<sub>5</sub> 47% and K<sub>2</sub>O 6%) was done at the end of April. The experiment was arranged as R.C.B.D with three replications and four vines for each experimental unit. For data analyzing the SAS program was used for detecting the signification as SAS Institute (16). The means among treatments were compared using Duncan’s multiple range tests (5).

The following Parameters were measured: all studied characteristics were measured from the girdled parts of the vine (two arms) including shoot length (cm), number of shoots per vine, number of leaves per shoot, number of clusters per vine, number of berries per cluster, size of berries by using a graduated cylinder contained water to determine the berries volume, and berries total contents of sugar (%): Taking

1ml from pure juice, add 1ml of phenol 5% then 18ml of distilled water and then 5ml of H<sub>2</sub>SO<sub>4</sub> 30 min in boiling water at 60 °C then 15 min in centrifuge at 3000 rotate/min and putting sample in spectrophotometer at (490 nanometer). The standard sugar solution and standard curve were prepared (Lane and Eynon method) (10). and total soluble solids (%): The total soluble solids measured with 30 fruits by using Carolzeiss hand Refractometer (11).

## Results and Discussion

### Shoot length (cm)

Results in table (1) showed that Zark cultivar had a significant effect on shoot length (225.78cm). The same table clearly shows that girdling process and spraying cultivars with 10 g.L<sup>-1</sup> of phosphorus significantly affected shoot length where the highest values were 242.89 and 272.75 cm, respectively. The interaction of Zark cultivar + girdling and Kamali cultivar + girdling significantly differed in shoot length from either cultivar+Non-girdling. Kamali cultivar treated with 10g.L<sup>-1</sup> Phosphorus gave the highest value which surpassed significantly to the lowest value (Table1). The combination of girdling/Phosphorus also showed significant effect on shoot length of grapevine, since the maximum value was obtained from combination treatment of girdling/10g.L<sup>-1</sup> Phosphorus. Results also showed that the interactions of the three factors differed significantly; the maximum shoot length value (308.33 cm) was recorded from interaction of Kamali cultivar/ girdling/10 g.L<sup>-1</sup> Phosphorus compared with the minimum value (150 cm) resulted from Kamali cultivar/ Non-girdling/0 g.L<sup>-1</sup> Phosphorus.

**Table 1. Effect of girdling and foliar spraying of phosphorus on shoot length (cm) of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	180.67 fg	197.67 ef	222.67 de	200.33 b	225.78
	Girdling	242.00 cd	245.00 cd	266.67 bc	251.22 a	a
Kamali	Non-girdling	150.00 h	159.67 gh	293.33 ab	201.00 b	217.78
	Girdling	201.33 ef	194.00 ef	308.33 a	234.56 a	b
Phosphorus		193.50 b	199.08 b	272.75 a	Girdling	
Cultivar *Phosphorus	Zark	211.33 d	221.33 c	244.67 b	Non-girdling	200.67 b
	Kamali	175.67 d	176.83 c	300.83 a	Girdling	242.89 a
Girdling *	Non-girdling	165.33 d	178.67 d	258.00 b		
phosphorus	Girdling	221.67 c	219.50 c	287.50 a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan multiple ranges test at significant level of 5%.

Number of leaves per shoot:

It's clear from the results (Table 2) that number of leaves per shoot did not differ between the two cultivars. Girdling process in both cultivars gave highest number of leaves per shoot compared to Non-girdling. Same table showed that the Phosphorus was dominated where sprayed at 10g.L<sup>-1</sup>. The interaction of either cultivar with girdling showed significant effect on number of leaves per shoot, compare to

interaction of cultivars and non-girdling that gave lowest value. Although cultivars did not differ from each other, results indicated that interactions of cultivar and Phosphorus significantly differed especially where spraying at 10g.L<sup>-1</sup>. The interaction of girdling and 10g.L<sup>-1</sup> phosphorus had significant effect on number of leaves per shoot. Concerning the interactions of studied factors, results indicated that the maximum value of number of leaves per shoot (122) was recorded from the interactions of Zark cultivar + girdling + 10 g.L<sup>-1</sup> Phosphorus compared to the interaction of Kamali cultivar + Non-girdling and 0 g.L<sup>-1</sup> Phosphorus that recorded the lowest value (76).

**Table 2. Effect of girdling and foliar spraying of phosphorus on Number of leaves per shoot of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	84.33 de	103.33 bc	108.33 ab	98.67 b	107.72
	Girdling	109.00 ab	119.33 a	122.00 a	116.78 a	a
Kamali	Non-girdling	76.00 e	94.00 cd	120.00 a	96.67 b	104.28
	Girdling	103.33 bc	112.33 ab	120.00 a	111.89 a	a
Phosphorus		93.17 c	107.25 b	117.58 a	Girdling	
Cultivar	Zark	96.67 cd	111.33 ab	115.17 a	Non-girdling	97.67 b
*Phosphorus	Kamali	89.67 d	103.17 bc	120.00 a	Girdling	114.33 a
Girdling *	Non-girdling	80.17 d	98.67 c	114.17 ab		
phosphorus	Girdling	106.17 bc	115.83 ab	121.00 a		

Means within a column, row and their interactions followed by the same letter(s) are not significantly different according to Duncan's multiple ranges tests ( $P \leq 0.05$ )

Number of shoots per vine

Table (3) showed that the Kamali cultivar had higher (50.06 shoot.vine<sup>-1</sup>) number of shoots per vine and significantly differed from Zark cultivar (33.92 shoot.vine<sup>-1</sup>). The results showed that number of shoots per vine significantly increased especially at girdling process (45.39 shoot.vine<sup>-1</sup>). It's also clear that spraying phosphorus with 10g.L<sup>-1</sup> had number of shoots per vine that did not differ from that of spraying 5g.L<sup>-1</sup>

Phosphorus, but significantly differed compared to the control. Regarding the interactions(cultivar/girdling, cultivar/phosphorus and girdling/phosphorus), maximum values were 54.67, 52.92 and 47.50 shoot.vine<sup>-1</sup> resulted from the interaction of Kamali cultivar/girdling, Kamali cultivar/5 g.L<sup>-1</sup> phosphorus and girdling/10g.L<sup>-1</sup> phosphorus, respectively. In respect, the interaction of the three studied factors especially Kamali cultivar/girdling/5 g.L<sup>-1</sup> phosphorus gave the highest value (55.83 shoot.vine<sup>-1</sup>) compared to lowest value (30.33 shoot.vine<sup>-1</sup>) from the interaction among Zark cultivar/non-girdling/ 0g.L<sup>-1</sup> phosphorus.

**Table 3. Effect of girdling and foliar spraying of phosphorus on Number of shoots per vine of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	30.33 f	33.33 ef	31.50 f	31.72 d	33.92 b
	Girdling	31.00 f	37.33 d-f	40.00 c-e	36.11 c	
Kamali	Non-girdling	40.83 cd	50.00 ab	45.50 bc	45.44 b	50.06 a
	Girdling	53.17 a	55.83 a	55.00 a	54.67 a	
Phosphorus		38.83 b	44.13 a	43.00 a	Girdling	
Cultivar	Zark	30.67 c	35.35 c	35.75 c	Non-girdling	38.58 b
*Phosphorus	Kamali	47.00 b	52.92 a	50.25 ab	Girdling	45.39 a
Girdling	Non-girdling	35.58 d	41.67 bc	38.50 cd		
*	Girdling	42.08 bc	46.58 ab	47.50 a		
phosphorus						

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan multiple ranges test at significant level of 5%.

#### Number of clusters per vine

Table (4) obviously indicates that there is no significant differences between Zark and Kamali cultivars in number of clusters per vine. However, both cultivars with girdling proportionally enhanced the number of clusters to significance. Generally, the highest number of clusters were in accompany with girdling and the lowest number of clusters were in the control. It is obvious from the same table that there was significant effect of spraying phosphorus on the number of clusters particularly at 10g.L<sup>-1</sup> phosphorus which gave the highest number of clusters (49.42

cluster.vine<sup>-1</sup>). Regarding the combination between cultivars and girdling (table 4), interaction of girdling/Kamali cultivar had the highest number of clusters (51.56 cluster.vine<sup>-1</sup>). Similarly, interaction of cultivars/phosphorus and girdling/phosphorus resulted in significantly higher number of clusters especially in case of value Zark cultivar/10g.L<sup>-1</sup> phosphorus. Interactions (table 4) of the three factors resulted in the highest value which was recorded in the interaction of Zark cultivar/girdling/10 g.L<sup>-1</sup> phosphorus compared with the minimum value from Kamali cultivar/Non-girdling /0 g.L<sup>-1</sup> phosphorus.

**Table 4 Effect of girdling and foliar spraying of phosphorus on Number of clusters per arm of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	37.67 cd	41.33 bc	42.00 bc	40.33 b	44.89 a
	Girdling	44.33 b	46.00 b	58.00 a	49.44 a	
Kamali	Non-girdling	34.67 d	38.00 cd	43.67 b	38.78 b	45.17 a
	Girdling	54.33 a	46.33 b	54.00 a	51.56 a	
Phosphorus		42.75 b	42.92 b	49.42 a	Girdling	
Cultivar	Zark	41.00 b	43.67 b	50.00 a	Non-girdling	39.56 b
*Phosphorus	Kamali	44.50 b	42.17 b	48.83 a	Girdling	50.50 a
Girdling	Non-girdling	36.17 e	39.67 de	42.83 cd		
*	Girdling	49.33 b	46.17 bc	56.0 A		
phosphorus						

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan multiple ranges test at significant level of 5%.

#### Number of berries per cluster:

The number of berries per cluster was significantly higher in Zark cultivar recording 135 berries.cluster<sup>-1</sup> compared to Kamali cultivar that of 84.94 berries.cluster<sup>-1</sup> (Table 5). Results of the same table showed that girdling of Zark and Kamali cultivars gave the highest value of number of berries per cluster compared to Non-girdling. Spraying of phosphorus at both concentrations had significant effect on the number of berries per cluster compared to control. The results indicated significant effect for interaction between cultivars and girdling on the number of berries per cluster,

interaction between Zark cultivar and girdling recorded the highest number of berries per cluster and the cultivar was also interacted with phosphorus in similar manner. The highest values, 143.33 and 125.67 berries.cluster<sup>-1</sup>, were resulted from the interaction of Zark cultivar/5 g.L<sup>-1</sup> Phosphorus and girdling/5 g.L<sup>-1</sup> Phosphorus, respectively. Table (5) also shows that the complete interaction of cultivars, girdling and Phosphorus, had significant effect on the number of berries per cluster. The interaction treatment of Zark cultivar/ girdling/5g.L<sup>-1</sup> phosphorus gave the maximum number of berries per cluster which significantly differed from other interaction treatments.

**Table 5. Effect of girdling and foliar spraying of phosphorus on Number of berries per clusters of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	93.33 cd	130.00 b	130.00 b	117.78 b	135.00 a
	Girdling	150.00 a	156.67 a	150.00 a	152.22 a	
Kamali	Non-girdling	66.67 e	72.33 e	90.00 cd	76.33 d	84.94 b
	Girdling	86.00 d	94.67 cd	100.00 c	93.56 c	
Phosphorus		99.00 b	113.42 a	117.50 a	Girdling	
Cultivar	Zark	121.67 b	143.33 a	140.00 a	Non-girdling	97.06 b
*Phosphorus	Kamali	76.33 d	83.50 d	95.00 c	Girdling	122.89 a
Girdling *	Non-girdling	80.00 d	101.17 c	110.00 b		
phosphorus	Girdling	118.00 a	125.67 a	125.00 a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan multiple ranges test at significant level of 5%.

#### Size of 100 berries

Table (6) indicated that size of berries differed between cultivars where Kamali had significantly the highest value (833.33mm). Girdling also significantly affected size of berries compared to non-girdling. Spraying of phosphorus, on the other hand, at 5 and 10 g.L<sup>-1</sup> had significant effect on size of berries in the two cultivars compared to control. Regarding the combination between cultivars and girdling, Kamali cultivar/girdling had the highest value of

size of berries (1033.33 mm). Also, the same table indicated that the interaction of cultivars/ phosphorus and girdling/phosphorus positively affected size of berries, the highest values were recorded in interaction of Kamali cultivar/10 g.L<sup>-1</sup>phosphorus and girdling/10g.L<sup>-1</sup> phosphorus. Relative to interactions of the three factors, the highest size of berries was recorded from the interaction of Kamali cultivar/girdling/10 g.L<sup>-1</sup> phosphorus compared with the minimum value in Zark cultivar/non-girdling/0g.L<sup>-1</sup> phosphorus.



**Table 6. Effect of girdling and foliar spraying of phosphorus on size of 100 berries of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	300.00 g	400.00 fg	466.67 ef	388.89 c	505.56 b
	Girdling	500.00 ef	633.33 cd	733.33 c	622.22 b	
Kamali	Non-girdling	533.33 de	666.67 c	700.00 c	633.33 b	833.33 a
	Girdling	866.67 b	1100.00 a	1133.33 a	1033.33 a	
Phosphorus		550.00 b	700.00 a	758.33 a	Girdling	
Cultivar	Zark	400.00 d	516.67 c	600.00 c	Non-girdling	511.11 b
*Phosphorus	Kamali	700.00 b	883.33 a	916.67 a	Girdling	827.78 a
Girdling	Non-girdling	416.67 d	533.33 c	583.33 c		
*phosphorus	Girdling	683.33 b	866.67 a	933.33 a		

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan multiple ranges test at significant level of 5%.

#### Total sugar (%)

Regardless of treatment type, results (Table 7) showed that Zark cultivar had higher berries content of total sugar and significantly differed from Kamali cultivar. It is obvious from this table that there was significant effect of girdling on the total sugar, (18.25%) it's the highest value. Both cultivars sprayed with phosphorus resulted in partial improvement in total sugar content with obtained significant effect. Sprays with 10 g phosphorus gave the highest value where the lowest was in the control. Table (7) also indicated that the interactions of Zark cultivar/girdling resulted in higher total sugar which significantly differed from Kamali

cultivar/non-girdling interaction. Regarding the cultivars/phosphorus interaction, findings showed that Zark cultivar/10 g.L<sup>-1</sup> phosphorus had the highest value of total sugar (20.17%) as compared to the interactions of Kamali cultivar/0 g.L<sup>-1</sup> phosphorus which recorded the minimum value (11.67%). Significant increase in total sugar was recorded in girdling/5 and 10g.L<sup>-1</sup> phosphorus compared to the control. However, total interaction of the three factors resulted in the highest total sugar content, Zark cultivar/girdling/10 g.L<sup>-1</sup> phosphorus recorded the maximum compared to the minimum from Kamali cultivar/non-girdling/0 g.L<sup>-1</sup> phosphorus.

**Table 7. Effect of girdling and foliar spraying of phosphorus on Total sugar percentage in berries of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	13.00 fg	14.50 de	16.00 c	14.50 b	17.89 a
	Girdling	19.17 b	20.33 b	24.33 a	21.28 a	
Kamali	Non-girdling	10.00 i	10.83 hi	11.83 gh	10.89 c	13.06 b
	Girdling	13.33 ef	15.67 cd	16.67 c	15.22 b	
Phosphorus		13.88 c	15.33 b	17.21 a	Girdling	
Cultivar	Zark	16.08 c	17.42 b	20.17 a	Non-girdling	12.69 b
*Phosphorus	Kamali	11.67 f	13.25 e	14.25 d	Girdling	18.25 a
Girdling	Non-girdling	11.50 f	12.67 e	13.92 d		
*	Girdling	16.25 c	18.00 b	20.50 a		
phosphorus						

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan multiple ranges test at significant level of 5%.

#### Total Soluble Solids (%)

It is illustrated from the results (table 8) that the Zark cultivar had higher TSS % that of 20.44% with significant difference from Kamali cultivar which gave lower value (14.50%). The TSS% was significantly affected by the presence of both girdling and phosphorus applications especially at 10 g.L<sup>-1</sup> phosphorus. Significant increase in TSS% was also recorded due to interaction of cultivars/girdling. The interaction Zark cultivar/girdling appeared to be the most effective, as it recorded the maximum

TSS%. Similarly, Zark cultivar/10g.L<sup>-1</sup> phosphorus had higher value than Kamali cultivar/0 g.L<sup>-1</sup> phosphorus. For the interactions between girdling and phosphorus the highest value recorded with girdling and 10 g.L<sup>-1</sup> phosphorus (23.17%). Table (8) also showed that interactions of the three studied factors (cultivars, girdling and phosphorus) had significant effect in TSS%. The interaction of Zark cultivar/girdling/10g.L<sup>-1</sup> phosphorus had the maximum TSS (27.33 %), which significantly differed from the other treatments especially the lowest value (8.67 %).

**Table 8. Effect of girdling and foliar spraying of phosphorus on TSS (%) in berries of two grapevine (*Vitis vinifera* L.) cultivars, Zark and Kamali**

Cultivars	Girdling	Phosphorus 0	phosphorus 5 g.L <sup>-1</sup>	phosphorus 10 g.L <sup>-1</sup>	Cultivar* Girdling	Cultivar
Zark	Non-girdling	15.67 c	17.00 bc	18.00 bc	16.89 b	20.44 a
	Girdling	19.00 b	25.67 a	27.33 a	24.00 a	
Kamali	Non-girdling	8.67 e	10.67 e	13.33 d	10.89 c	14.50 b
	Girdling	17.33 bc	18.00 bc	19.00 b	18.11 b	
Phosphorus		15.17 c	17.83 b	19.42 a	Girdling	
Cultivar	Zark	17.33 b	21.33 a	22.67 a	Non-girdling	13.89 b
*Phosphorus	Kamali	13.00 c	14.33 c	16.17 b	Girdling	21.06 a
Girdling	Non-girdling	12.17 e	13.83 d	15.67 c		
*	Girdling	18.17 b	21.83 a	23.17 a		
phosphorus						

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan multiple ranges test at significant level of 5%.

Findings showed that the two grapevine cultivars Zark and Kamali differed in their performance regardless the type of treatment. The reason for such difference is mostly attributed to genetic factors. Girdling had visible enhance on the studied characteristics, it promotes shoot length, number of leave/shoot, number of shoot/vine, number of cluster/vine, number of berries/clusters, size of berries, Total sugar content in berries and TSS. Mainly, this may due to accumulation of synthetic carbohydrate CHO in upper part of girdle area of arms especially in leaves. This CHO accumulation encourages producing new vegetative parts and increases the vegetative and reproductive parameters. This is because the girdle area prevents the sap from flowing to the lower part (roots) through the phloem. This in came agreement with findings of previous

studies (6. 4 and 12). The phosphorus has a great role in increasing the main functions in plants particularly for the synthesis of nucleic acids, Ribose nucleic acid and protein. Moreover, phosphorus is a major nutrient required for vine in cellular membranes, enzymes and ATP. In the present study, the phosphorus might have played key role to increase the number of clusters, shoot length, number of leaves, shoots and berries, sizes of berries, Total sugar and TSS of grapevine (9 and 13).

### Conclusion

According to obtained results the girdling lead to improve all studied parameters compared with non-girdle one. Girdling of Zark cultivar have a significant effect on number of clusters, shoot length, number of leaves per shoots, number of berries per clusters, Total sugar in berries and TSS in

berries. Also, the girdling of Kamali cultivar led to enhancement in number of clusters, shoot length, number of shoots per vine, number of leaves per shoots and size of berries. Spraying of phosphorus especially at  $10\text{g.L}^{-1}$  had a significant effect on all studied parameters compared with control.

The interaction of phosphorus spraying mainly at  $10\text{g.L}^{-1}$  with both cultivars significantly increased all the studies parameters except the number of shoots per vine, where  $5\text{g.L}^{-1}$  was the best treatment compared to the control. Also, the interaction of girdling with  $10\text{g.L}^{-1}$  phosphorus spraying had a significant difference in enhancing all studied parameters compared with the control.

The combination of girdling and  $10\text{g.L}^{-1}$  with either cultivar was superior treatment with most of parameters compared to the control of both cultivars.

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