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Enhancing Yield and Quality of Red Roomy Vines by Paclobutrazol

Wassel, A. M.[1]; H. A. Abd El-Hameed[2] and Sara M. A. Hassan[1*]

[1]Pomology, Horticulture Department, Faculty of Agriculture, Minia University, El-Minia, 61517, Egypt.
[2]Grapes Institute, ARC, Egypt.

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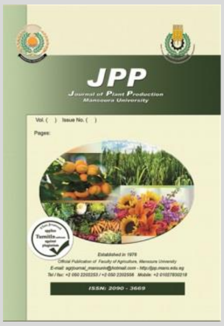

ABSTRACT

In a private orchard of grapevine located in Tow village, Minia district, Minia Governorate, Egypt, the current research was conducted during twice growing seasons (2021/2022 and 2022/2023) to examine the influence of paclobutrazol treatments (0, 500, 750, and 1000 ppm) on the yield and berry quality of Red Roomy grapevines. All paclobutrazol treatments exceeded berry set percentage, cluster weight, number of clusters per vine, cluster dimension, yield per vine, berry weight, berry equatorial and longitudinal, TSS (%), TSS/A ratio, total anthocyanins and reducing sugar (%) compared to the control. The use of paclobutrazol led to a significant decline in shot berries (%) and titratable acidity (%) through both experimental seasons facing the control. Remarkably, there were no marked differences between the highest concentrations of PBZ at 1000 or 750 ppm. The application of PBZ two weeks prior to flowering yielded the most favorable results. Our research indicated that for optimal regulated high yield and quality of Red Roomy grapevine within environmental context of Minia Governorate, it is recommended to administer paclobutrazol at concentration of 750 ppm two weeks before bud opening stage.

Keywords: Grape – Retardants – Paclobutrazol – yield – Berry quality.

INTRODUCTION

Grape is one of the most significant fruit crops globally, cultivated widely across Europe and various other regions including Egypt due to their exceptional flavor, pleasant taste, and substantial nutritional benefits (El-salhy *et al*., 2011). In Egypt, grapes hold the second rank in fruit production, following citrus fruits. As reported by the Ministry of Agricultural Statistics (2022), the total area of grape cultivation reached 186,404 Feddans, yielding an annual production of 1,790,734 metric tons of fruit.

Paclobutrazol (PBZ), [2RS, 3RS]-1-[4-chlorophenyl]-4,4-dimethyl-2-(1H-1,2,4-triazol-1-yl) pentan-3-ol, the structure comprises a triazole ring and a benzene ring that is chlorinated and connected to an open carbon chain. This substance serves as a plant growth regulator that is extensively utilized across various crops to facilitate year-round fruit production by suppressing the synthesis of gibberellin, a hormone that plays a crucial role in promoting vegetative growth in plants. The utilization of paclobutrazol has been extensively researched due to its significant capability to regulate the growth and development of fruit crops. Typically, it functions by inhibiting the biosynthesis of gibberellins at the kaurene stage, resulting in a reduction of vegetative growth. This characteristic is particularly advantageous for promoting flower initiation in shoot buds, leading to early and abundant flowering. Furthermore, paclobutrazol has been shown to enhance fruit yield and consistently improve the quality of crops. The properties of paclobutrazol that regulate growth are influenced by modifications in the concentrations of key plant hormones, such as gibberellins, abscisic acid, and cytokinins. Paclobutrazol impacts the isoprenoid pathway, leading to a reduction in gibberellin production while simultaneously elevating the levels of cytokinins. The inhibition of gibberellin synthesis leads to an accumulation of precursors within the terpenoid pathway, which subsequently results in the production of abscisic acid. Additionally, PBZ has been employed to safeguard plants from various abiotic stresses, including chilling, water deficit, flooding, and salinity. The agronomic management of this technology positions it as an innovative approach aimed at diminishing vigor while enhancing both flower induction and development in fruit trees, ultimately leading to improved economic returns (Gollagi *et al*., 2019; Kumar *et al*., 2023 and Gul *et al*., 2024).

This research aimed to investigate the influence of paclobutrazol on the yield and quality of Red Roomy grapevines under Minia Governorate conditions.

MATERIALS AND METHODS

This study was carried out in a vineyard situated in Tow village, within the Minia District of Minia Governorate in Egypt, throughout the two growing seasons (2021/2022 and 2022/2023). The primary objective of the study was to examine how paclobutrazol treatments influenced the yield and berry quality of Red Roomy grapevines. For this research, a total of thirty uniform grapevines, each nine years old, were chosen. The spacing between the vines was set at 2 x 2 meters. Winter pruning took place during the first week of January for both growing seasons, utilizing Gable trellise systems for along with cane-pruning methods. Every vine was specifically engineered to bear a total of 72 buds, consisting of six fruiting canes that each feature ten buds and six renewal spurs that contain two buds. At the beginning of the trials, the soil underwent a series of mechanical, physical, and chemical analyses to a depth ranging from 0.0 to 90 cm, adhering to the methodologies established by Wilde *et al.* (1985), with the findings detailed in Table (a). The experimental framework comprised ten treatments, including three varying

*** Corresponding author.**
E-mail address: saralojy2021@gmail.com
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concentrations of paclobutrazol, (500, 750, and 1000 ppm), in addition to a control group. Each concentration was administered across three separate intervals (3, 2 and 1 week before bud opening), and the arrangements of the treatments were structured according to a complete randomized block design, with three replicates. Therefore, the total number of vines was thirty represented 10 treatments X 3 replications.

Table a. Physical and chemical analysis of the used soil in the study.

Character			Values
Particle size distribution			
Sand: 5.89%	Silt: 25.60%	Clay: 68.51%	Texture: Clay
Chemical analysis			
pH	7.9	Total N (%)	0.06
EC (dS/m)	0.81	P ppm (Olsen)	9.4
Total $CaCO_3$ (%)	1.37	K (ppm)	637.0
O.M. (%)	0.69	Mg (ppm)	58.0
Available micronutrients (EDTA)			
Fe (ppm)	4.1	Mn (ppm)	4.5
Zn (ppm)	3.4	Cu (ppm)	1.6

The treatments could be listed as follows:

1. Control (sprayed with tap water PBZ addition).
2. Spraying PBZ 500 ppm 3 weeks before bud opening.
3. Spraying PBZ 500 ppm 2 weeks before bud opening.
4. Spraying PBZ 500 ppm 1 week before bud opening.
5. Spraying PBZ 750 ppm 3 weeks before bud opening.
6. Spraying PBZ 750 ppm 2 weeks before bud opening.
7. Spraying PBZ 750 ppm 1 week before bud opening.
8. Spraying PBZ 1000 ppm 3 weeks before bud opening.
9. Spraying PBZ 1000 ppm 2 weeks before bud opening.
10. Spraying PBZ 1000 ppm 1 week before bud opening.

Data measurements:

1. Yield and its components:

The harvesting procedure began when the TSS/acid ratio in the berries of the control reached about 25:1, as established by Weaver (1976). The yield from each vine was recorded by assessing both the weight (kg) and the total number of clusters produced per vine, after which the average weight of each cluster was calculated in (g). Furthermore, the assessment of berry quality involved the random selection of five clusters from each vine to analyze their physical and chemical characteristics. This evaluation encompassed measurements of cluster size, average berry weight, total soluble solids, titratable acidity in the juice, and total anthocyanins expressed in milligrams per 100 grams of fresh weight.

The obtained results were as follows:

1. **Yield and its components:** berry set (%), clusters number/vine, cluster weight (g), cluster length (cm), cluster width (cm), and yield/vine (kg).
2. **Berry physical characteristics: s**hot berries (%), average berry weight (g), berry longitudinal (cm), and berry equatorial (cm).
3. **Berry chemical characteristics:** total soluble solids percentage (TSS%) in berry juice was determined using hand refractometer, titratable acidity % was determined according to A.O.A.C. (2000), TSS/A ratio was calculated, total anthocyanins (mg/100 g FW) and reducing sugars (%) were performed using volumetric method (Lane and Eynon, 1965) as described by A.O.A.C. (2000).

Statistical analysis

The data were systematically arranged into tables and analyzed statistically using New L.S.D at a significance threshold of 5%, enabling comparisons among the treatment means being studied, as described by Snedecor and Cochran (1967) and Mead *et al*. (1993).

RESULTS AND DISCUSSION

1. Yield and its components:

The yield of the Red Roomy, along with its various components, including berry set percentage, the number of clusters per vine, cluster weight in grams, cluster dimensions in centimeters (length and width), and yield per vine in kilograms, over the course of two growing seasons, as influenced by the application of paclobutrazol, is presented in Tables (1 to 3).

It has been observed that all aforementioned mentioned parameters exhibited a significant improvement during both growing seasons as a result of the application of PBZ at concentrations of 500, 750, and 1000 ppm when compared to the control treatment. The highest concentration of PBZ, along with the intermediate level of 750 ppm, yielded the most substantial values, with no notable differences between these two concentrations. The observed enhancement in yield per vine attributed to the three concentrations was recorded at 4.71%, 11.76%, and 14.12%, translating to increases of 28.75%, 46.25%, and 55.00% compared to the control in the first and second seasons, respectively. Additionally, the other yield components and characteristics of the clusters exhibited a similar trend.

The enhanced yield could be attributed to a well-balanced leaf area that allowed the vine to generate a sufficient quantity of photo-assimilates. Consequently, this likely led to a greater proportion of fruitful canes, along with improvements in various metrics such as bunch length, bunch weight, berry length, average berry weight, and berry diameter, ultimately resulting in a superior overall yield, as noted by Hunter and Proctor (1992). The impact of the paclobutrazol can be ascribed to its capacity to impede both cell elongation and cell division, a process that takes place due to its disruption of gibberellin biosynthesis (Ghosh *et al*., 2022).

Table 1. Effect of different concentrations of paclobutrazol on berry set (%) and number of clusters per vine of Red Roomy grapevines during 2021 and 2022.

Treatments	Percentage of berry set (%)		Number of clusters per vines	
	2021/ 2022	2022/ 2023	2021/ 2022	2022/ 2023
Control	5.7	5.8	26.0	25.0
PBZ (500 ppm) 3 weeks	7.0	7.1	25.0	28.0
PBZ (500 ppm) 2 weeks	9.0	8.0	26.0	31.0
PBZ (500 ppm) 1 weeks	8.1	7.8	26.0	30.0
PBZ (750 ppm) 3 weeks	8.1	8.1	26.0	31.0
PBZ (750 ppm) 2 weeks	10.1	9.8	26.0	35.0
PBZ (750 ppm) 1 weeks	9.3	9.1	25.0	34.0
PBZ (1000 ppm) 3 weeks	9.0	8.9	25.0	32.0
PBZ (1000 ppm) 2 weeks	11.0	10.6	26.0	36.0
PBZ (1000 ppm) 1 weeks	10.2	9.8	26.0	35.0
New LSD at 5%	1.0	0.9	NS	2.0

Our data were in the line to those obtained by Reynolds (1988), Shaltout *et al*. (1988), Williams *et al*. (1989) and Sable *et al*. (2016), Reynolds and Wardle (1990), Kim (1991), Hunter and Proctor (1992), Basiouny (1994), Agüero *et al*. (1995), Christov *et al*. (1995), Carreno *et al*. (2005), Baninasab and Shahgholi (2012), Todić *et al*. (2012) and Wassel *et al*. (2023) on *Vitis spp*.

The timing of paclobutrazol application plays a crucial role in influencing the yields and their associated components in Red Roomy grapevines. The findings of our research distinctly demonstrated that the administration of PBZ two weeks before bud opening resulted in the most substantial grape yield and its associated characteristics throughout both seasons; this outcome did not show a significant difference when compared to the application of PBZ two weeks before flowering, as illustrated in Tables (1 to 3).

Table 2. Effect of different concentrations of paclobutrazol on cluster weight (g) and yield per vine (kg) of Red Roomy grapevines cv. during 2021/2022 and 2022/2023.

Treatments	Cluster weight (g)		Yield per vine (kg)	
	2021/ 2022	2022/ 2023	2021/ 2022	2022/ 2023
Control	325.0	322.0	8.5	8.0
PBZ (500 ppm) 3 weeks	339.0	337.0	7.8	9.4
PBZ (500 ppm) 2 weeks	360.0	358.0	9.9	11.1
PBZ (500 ppm) 1 weeks	350.0	349.0	9.1	10.5
PBZ (750 ppm) 3 weeks	352.0	348.0	9.3	10.8
PBZ (750 ppm) 2 weeks	375.0	358.0	9.7	12.5
PBZ (750 ppm) 1 weeks	364.0	350.0	9.4	11.9
PBZ (1000 ppm) 3 weeks	361.0	357.0	9.4	11.4
PBZ (1000 ppm) 2 weeks	383.0	367.0	9.9	13.2
PBZ (1000 ppm) 1 weeks	373.0	359.0	9.7	12.6
New LSD at 5%	10.5	10.0	0.3	0.8

Table 3. Effect of different concentrations of paclobutrazol on cluster length and cluster width (cm) of Red Roomy grapevines cv. during 2021/2022 and 2022/2023.

Treatments	Cluster length (cm)		Cluster width (cm)	
	2021/ 2022	2022/ 2023	2021/ 2022	2022/ 2023
Control	19.1	19.0	12.1	12.0
PBZ (500 ppm) 3 weeks	19.9	19.7	12.8	12.9
PBZ (500 ppm) 2 weeks	20.6	20.8	13.5	13.5
PBZ (500 ppm) 1 weeks	20.3	20.4	13.2	13.3
PBZ (750 ppm) 3 weeks	20.4	20.3	13.3	12.4
PBZ (750 ppm) 2 weeks	21.2	21.5	13.9	14.0
PBZ (750 ppm) 1 weeks	21.0	20.9	13.7	13.8
PBZ (1000 ppm) 3 weeks	20.1	20.7	13.6	13.5
PBZ (1000 ppm) 2 weeks	21.5	21.6	14.2	14.1
PBZ (1000 ppm) 1 weeks	21.2	21.2	14.0	13.9
New LSD at 5%	0.4	0.5	0.4	0.3

2. Berry physical characteristics:

Data presented in Tables 4 and 5 illustrated the impact of paclobutrazol treatment on the physical and morphological characteristics of Red Roomy grapes, namely, the percentage of shot berries, berry weight, along with the longitudinal and equatorial dimensions measured in centimeters, throughout two growing seasons.

The findings from our study indicate that the parameters exhibited significant improvement during both experimental seasons as a result of the application of PBZ at concentrations of 500, 750, and 1000 ppm, when compared to the untreated vines; however, it is noteworthy that the percentage of shot berries experienced a decline. The rise in berry weight, both equatorially and longitudinally, was directly correlated with the increase in PBZ concentration. Consequently, the medium concentration of PBZ (750 ppm), along with the high level (1000 ppm), yielded the greatest measurements, without significant differences between them. Conversely, the application of PBZ on the vines resulted in a reduction of shot berries during both seasons, which is advantageous for the quality of the grapes and their marketability. The enhancement of the morphological characteristics of the berries was observed to be 11.31% and 9.61% for berry weight, along with increases of 8.62% and 12.38% for berry length, and 9.44% and 13.56% for berry width concerning to PBZ at 1000 ppm when compared to the control group during the two experimental seasons, respectively.

The efficacy of paclobutrazol (PBZ) is associated with its ability to inhibit the processes of cell division and elongation, a function that is achieved through the interference with gibberellin biosynthesis. The enhancement in the quality of berries can be linked to an appropriately balanced leaf area, which enabled the vine to produce an adequate amount of photo-assimilates. As a result, this probably contributed to a higher percentage of productive canes, accompanied by improvements in several parameters including bunch weight, bunch length, average berry weight, berry length, and berry diameter, which ultimately led to an overall enhancement in quality (Hunter and Proctor, 1992 and Ghosh *et al*., 2022).

Similar findings were emphasized by Reynolds (1988), Shaltout *et al*. (1988), Williams *et al*. (1989), Nir (1991), Reynolds *et al*. (1992), Agüero *et al*. (1995), Carreno *et al*. (2005), Samaan and Nasser (2020) and Wassel *et al*. (2023) on grape spp.

The time of application with paclobutrazol is an important factor impacting the morphological characteristics of berry of Red Roomy grape. The findings of our research clearly indicated that the most advantageous berry morphological characteristics were achieved with the application of PBZ at a concentration of 750 ppm two weeks before bud opening throughout both growing seasons, as depicted in Tables 4 and 5.

Table 4. Effect of different concentrations of paclobutrazol on shot berries (%) and berry weight (g) of Red Roomy grapevines cv. during 2021/2022 and 2022/2023.

Treatments	Shot berries (%)		Berry weight (g)	
	2021/ 2022	2022/ 2023	2021/ 2022	2022/ 2023
Control	9.2	9.5	4.95	5.10
PBZ (500 ppm) 3 weeks	8.2	8.4	5.15	5.25
PBZ (500 ppm) 2 weeks	7.4	7.6	5.40	5.47
PBZ (500 ppm) 1 weeks	6.8	6.9	5.29	5.37
PBZ (750 ppm) 3 weeks	7.3	7.5	5.28	5.38
PBZ (750 ppm) 2 weeks	6.5	6.7	5.52	5.60
PBZ (750 ppm) 1 weeks	6.0	6.0	5.42	5.50
PBZ (1000 ppm) 3 weeks	6.7	6.8	5.38	5.47
PBZ (1000 ppm) 2 weeks	6.0	6.0	5.63	5.69
PBZ (1000 ppm) 1 weeks	5.4	5.3	5.53	5.60
New LSD at 5%	0.7	0.8	0.12	0.11

Table 5. Effect of different concentrations of paclobutrazol on berry longitudinal (cm) and berry equatorial (cm) of Red Roomy grapevines cv. during 2021/2022 and 2022/2023.

Treatments	Berry longitudinal (cm)		Berry equatorial (cm)	
	2021/ 2022	2022/ 2023	2021/ 2022	2022/ 2023
Control	2.12	2.10	1.80	1.77
PBZ (500 ppm) 3 weeks	2.11	2.16	1.86	1.85
PBZ (500 ppm) 2 weeks	2.27	2.29	1.93	1.95
PBZ (500 ppm) 1 weeks	2.23	2.24	1.90	1.91
PBZ (750 ppm) 3 weeks	2.24	2.25	1.91	1.92
PBZ (750 ppm) 2 weeks	2.34	2.36	1.98	2.02
PBZ (750 ppm) 1 weeks	2.30	2.32	1.95	1.98
PBZ (1000 ppm) 3 weeks	2.27	2.30	1.93	1.96
PBZ (1000 ppm) 2 weeks	2.37	2.41	2.01	2.05
PBZ (1000 ppm) 1 weeks	2.36	2.36	1.98	2.02
New LSD at 5%	0.05	0.06	0.04	0.05

2. Berry chemical characteristics:

The impact of paclobutrazol application on the chemical characteristics of berry quality, namely, total soluble solids (TSS %), titratable acidity (TA%), TSS/A ratio, total anthocyanins as mg/100g and reducing sugars (%) fresh weight, in Red Roomy grapes over two growing seasons is presented in Tables 6 and 7.

Our findings clearly indicate that all the parameters mentioned above experienced a notable increase during both experimental seasons because of the various PBZ treatments when compared to the control vines, except for titratable acidity (%), which showed a decrease. Furthermore, the rise in total soluble solids (%) TSS/A ratio, total anthocyanins and reducing sugars (%) was directly correlated with the increasing levels of PBZ. In the meantime, the application of a medium concentration of PBZ at 750 ppm yielded the highest values. Conversely, the use of PBZ on the vines resulted in a reduction of titratable acidity (%) across both seasons, which is advantageous for the quality of the grapes and their marketability. The enhancement of chemical characteristics of Red Roomy berries (in berry juice) was observed, with total soluble solids rising by 23.33% and 23.23%, TSS/TA ratio by 69.80 and 70.58%, total anthocyanins increasing by 16.19% and 16.74% and reducing sugars by 110.83 and 112.82% over the control group during the first and second seasons, respectively, attributed to the elevated concentration of PBZ.

The total concentration of soluble solids showed an upward trend, which may be linked to the conversion of starch and various photosynthetic byproducts into sugars, as noted by Stern *et al.* (2007).

Our results are agreeing with those reported by Reynolds (1988), Shaltout *et al.* (1988), Reynolds *et al.* (1992), Agüero *et al.* (1995), Ban *et al.* (2003), Carreno *et al.* (2005), Baninasab and Shahgholi (2012), Todić *et al.* (2012), Samaan and Nasser (2020) and Wassel *et al.* (2023) on grape spp.

The timing of applying paclobutrazol significantly influences the chemical characteristics related to the quality of berries in Red Roomy grapevines. Based on our results, providing vines with PBZ at a concentration of 750 ppm two weeks before bud opening led to the best berry quality observed in both growing seasons (Tables 6 and 7).

Table 6. Effect of different concentrations of paclobutrazol on TSS (%) and titratable acidity (%) in berry juice of Red Roomy grapevines cv. during 2021/2022 and 2022/2023.

Treatments	TSS (%)		Titratable acidity (%)		TSS/A ratio	
	2021/2022	2022/2023	2021/2022	2022/2023	2021/2022	2022/2023
Control	24.90	25.10	0.64	0.67	38.91	37.46
PBZ (500 ppm) 3 weeks	26.67	26.70	0.56	0.57	47.63	46.84
PBZ (500 ppm) 2 weeks	29.22	29.33	0.53	0.55	55.13	53.33
PBZ (500 ppm) 1 weeks	28.13	28.19	0.52	0.56	54.10	50.34
PBZ (750 ppm) 3 weeks	28.24	28.50	0.48	0.50	58.83	57.00
PBZ (750 ppm) 2 weeks	30.94	31.09	0.46	0.48	67.26	64.77
PBZ (750 ppm) 1 weeks	29.75	29.99	0.47	0.50	63.30	59.98
PBZ (1000 ppm) 3 weeks	29.33	29.53	0.47	0.49	62.40	60.27
PBZ (1000 ppm) 2 weeks	31.90	32.16	0.44	0.45	72.50	71.47
PBZ (1000 ppm) 1 weeks	30.89	31.09	0.46	0.46	67.15	67.59
New LSD at 5%	1.07	1.08	0.02	0.03	4.29	3.74

Table 7. Effect of different concentrations of paclobutrazol on total anthocyanins (mg/100 g FW) of Red Roomy grapevines cv. during 2021/2022 and 2022/2023.

Treatments	Total anthocyanins (mg/100 g FW)		Reducing sugars (%)	
	2021/2022	2022/2023	2021/2022	2022/2023
Control	2.10	2.15	12.46	12.56
PBZ (500 ppm) 3 weeks	2.20	2.24	20.02	20.47
PBZ (500 ppm) 2 weeks	2.36	2.41	21.34	21.71
PBZ (500 ppm) 1 weeks	2.29	2.33	20.86	20.79
PBZ (750 ppm) 3 weeks	2.29	2.34	22.19	23.14
PBZ (750 ppm) 2 weeks	2.45	2.61	24.16	24.65
PBZ (750 ppm) 1 weeks	2.39	2.54	22.27	22.63
PBZ (1000 ppm) 3 weeks	2.36	2.42	27.08	27.77
PBZ (1000 ppm) 2 weeks	2.51	2.59	29.45	29.78
PBZ (1000 ppm) 1 weeks	2.45	2.51	28.24	28.86
New LSD at 5%	0.08	0.09	4.29	3.74

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تحسين إنتاجية وجودة العنب الرومى الأحمر باستخدام الباكلوبوترازول

عبد الحميد محمد مرسي واصل[1] ، حسن محمد عبد الحميد[2] و سارة مخلوف أحمد حسن[1]

[1]قسم البساتين– كلية الزراعة – جامعة المنيا.
[2]معهد بحوث العنب - مركز البحوث الزراعية.

الملخص

في بستان خاص لكروم العنب يقع في قرية طوه، مركز المنيا، محافظة المنيا، مصر، تم إجراء البحث خلال موسمين متتاليين (2022/2021 و2023/2022) لدراسة تأثير معاملات الباكلوبوترازول (0، 500، 750، و1000 جزء في المليون) على محصول وجودة كروم العنب الرومي الأحمر. أظهرت جميع معاملات الباكلوبوترازول لكروم العنب الرومي الأحمر في ارتفاع ملحوظ في نسبة عقد الحبات ووزن العنقود وعدد العناقيد لكل كرمة وطول وعرض العنقود والمحصول لكل كرمة ووزن الحبة واستدارتها وطولها ومحتوى العصير من المواد الكلية الصلبة الذائبة ونسبة المواد الكلية الصلبة الذائبة إلي الحموضة المعايرة وتركيز صبغة الأنثوسيانين والسكريات الكلية المختزلة مقارنة بمعاملة الكنترول. وعلى العكس من ذلك، أدى استخدام الباكلوبوترازول إلى انخفاض كبير في النسبة المئوية للحبات الصغيرة والحموضة الكلية القابلة للقياس خلال كلا الموسمين التجريبيين مقارنة بمعاملة الكنترول. ومن الجدير بالذكر أنه لم تكن هناك فروق ملحوظة بين تركيزات 1000 أو 750 جزء في المليون من الباكلوبوترازول. وقد أدت إضافة الباكلوبوترازول قبل أسبوعين من تفتح البراعم للحصول على أفضل النتائج. تشير النتائج المتحصل عليها إلى أنه للحصول على إنتاجية عالية وجودة مثالية لكروم العنب الرومي الأحمر تحت ظروف محافظة المنيا، يوصَى بإضافة الباكلوبوترازول بتركيز 750 جزء في المليون قبل أسبوعين من مرحلة تفتح البراعم.

الكلمات المفتاحية: العنب الرومي الأحمر - مثبطات النمو - الباكلوبوترازول – المحصول - جودة حبات العنب.