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Impact of Organic and Inorganic Fertilization on The Growth Characteristics of Superior Grape Vines

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ABSTRACT

This investigation was carried out over two successive growing periods (2020/2021 and 2021/2022) on Superior seedless grapevines to examine the impact of organic, mineral, and biofertilization methods on the growth of Superior seedless grapevines.
It was evident that the compost and/or compost tea treatment produced good superior seedless grapevines vegetative growth traits (average shoot length, leaf area, cane thickness, and pruning weight) with the best values when they applied together (compost + compost tea).
All vegetative growth traits were affected by mineral and bio fertilization in both seasons. The treatment of (Min-NK + bio- P) produced the tallest shoots, biggest leaf area, thickest cane thickness, and heaviest pruning weight.
It could be concluded that the treatments of (compost + compost tea) plus (Min- NK + bio-P) recorded the best results for growth development of Superior seedless grapevines.

KEYWORDS: Superior, compost, Mineral NPK, Minia Azotein, Phosphorene, Potassene.

1. INTRODUCTION

Grapes are widely consumed locally and exported outside to a large number of temperate and tropical nations worldwide. *Vitis vinifera* L., the grape, is one of the most important and nutritious fruit crops. Grapes, the second most produced fruit, are becoming more and more well-liked due to its medicinal and nutritional properties. One of the primary applications of grapes is the creation of wine. Its variations have been altered to flourish in a range of climates around the world. Many cultivars are used in a variety of products, including as fresh fruit, juice, wine, preserves, and raisins, and are developed for use on tables and in wine drinking (Creasy and Creasy, 2009 and Zhu *et al*., 2022).

Superior grapevine cv. is regarded as one of the best and most popular grape varieties that can be produced in Egypt. Because the ripening season is still early (from the first until mid-June), its export potential to overseas markets is higher. A solid way to improve export performance and prevent contamination of our environment is to modify the amount of mineral fertilizer used (Ahmed *et al*., 2017).

Rational fertilization is a win-win strategy for agricultural income and environmental preservation in ecologically sensitive places. When organic and natural sources were combined with inorganic sources for grapevine variety fertilization, there was an increase in vegetative development, leaf mineral content, yield, and quality compared to when inorganic sources were used alone (Shaheen, *et al.* 2013 and Hegazi *et al.* 2014).

In addition to their high cost and detrimental effects on humans, soil, and water, mineral fertilizers used in agricultural production can alter the composition of fruits, vegetables, and root crops as well as lower their vitamin, mineral, and other useful chemical contents (Bogatyre, 2000). Large volumes of chemical fertilizers are produced with preset predetermined amounts of N, P, and K concentrations. The use of chemical fertilizers causes eutrophication of water streams and pollution of the air and ground water (Youssef and Eissa, 2014).

Using biofertilizers and organic fertilizers can be a beneficial substitute for chemical fertilizers. In addition to raising the amount of organic matter in the soil, organic fertilizer also makes more P, K, Ca, and Mg available. Fruit grapevines' vegetative development and nutritional quality were enhanced by organic fertilizer (Kassem and Marzouk, 2002).

Applications of beneficial microorganism-based biofertilizers, as opposed to synthetic chemicals, are known to improve plant development by giving plants more nutrients. They may also assist preserve soil fertility and environmental health. By utilizing bacteria that fix nitrogen along with those that release phosphate and potassium, one may boost fertilizer efficiency, productivity, and soil fertility. In soil contaminated with toxic, xenobiotic, and resistant substances, they have been demonstrated to improve rhizosphere nutrient fixation, produce plant growth stimulants, improve soil stability, provide biological control, decompose materials, recycle nutrients, and initiate a bioremediation process. Using bio-fertilizers can lower energy usage, improve soil fertility, decrease soil and water pollution, increase output per unit area quickly, and promote biological control and antagonistic interactions with phytopathogenic organisms (El-Salhy *et al*., 2006, Itelima *et al*., 2018 and El-Salhy *et al*., 2021).

In order to better understand how organic and/or biological fertilizers may complement mineral fertilizers, this study focused on the development of superior seedless grapevines.

2. MATERIALS AND METHODS

This study was carried out over the course of two successive growing seasons (2020/2021 and 2021/2022) to examine the impact of mineral, organic, and biofertilization treatments on grapevine growth of Superior grapevines.

In order to achieve the previous goal of 96 superior grapevines, an orchard in Talla village, Minia district, Minia governorate was utilized. The grapevines, which were 6 years old, were spaced two by three meters apart and were irrigated using Nile water through a surface irrigation system. Pruning was conducted annually in the first week of January, leaving 72 buds per vine (6 fruiting canes x 10 buds, plus 6 renewal spurs x 2 buds). Prior to the trials, the soil used was analyzed mechanically, physically, and chemically at a depth of 0.0 to 90 cm, following the method outlined by Wilde *et al.* (1985). The results of these analyses were presented in Table (1).

The experiment included 32 treatments (four different types of organic fertilization X eight mineral and/or biofertilization treatments). Using a split-plot manner with three replicates, one vine per each. A total of 96 vines were utilized, divided into 4 factor A treatments and 8 factor B treatments, each with three duplicates. The eight mineral and/or biofertilization treatments were divided among the sub-plots (factor B), whereas the four compost treatments were divided among the main plots (factor A).

Table 1. Physical and chemical analysis of the used soil in the study.

Character	Values
Particle size distribution	
Sand (%)	5.2
Silt (%)	23.8
Clay (%)	71.0
Texture	Clay
pH (1:2.5 ratio extract)	7.7
EC (1:2.5 extract) mmhos/l cm 25ºC	0.79
Total $CaCO_3$ (%)	1.96
O.M. (%)	1.72
Total N (%)	0.07
P ppm (Olsen)	4.2
K ppm (ammonium acetate)	605.0
Mg (ppm)	6.0
Available micronutrients (EDTA)	
Fe (ppm)	3.8
Zn (ppm)	3.0
Mn (ppm)	5.3
Cu (ppm)	1.0

The present treatments could be illustrated as follows:

The organic fertilization treatments occupied the main plot (A) as follows:

1. A_0, control (without compost addition).
2. A_1. 2.5 kg compost/vine.
3. A_2. 2.5 l compost tea/vine.
4. A_3. 1.25 kg compost + 1.25 l compost tea/vine.

Mineral and/or biofertilization treatments (sub-plots, B):

1. B_0- Control (mineral NPK fertilization).
2. B_1- Min PK + bio-N.
3. B_2- Min NK + bio-P.
4. B_3- Min NP + bio-K.
5. B_4- Min N + bio-P and K.
6. B_5- Min P + bio-N and K.
7. B_6- Min K + bio-N and P.
8. B_7- Bio- NPK.

The Egyptian Corporation for Solid Waste Recycling is the source of the used compost under the trade name Obour compost. In order to make compost tea, 1000 kg of compost and 1000 liters of fresh water were combined, and the compost solution was then allowed to sit at room temperature for 48 hours. Following that, 200 liters of fresh tap water were diluted with 1.0 liter of compost tea after the tea was filtered. Table 2 displays the results of physio-chemical properties of compost using the methodology outlined by Wilde *et al*. (1985).

Table 2. Physio-chemical properties of the used compost in both seasons of 2020/2021 and 2021/2022.

Character	Value	Character	Value
Organic carbon (%)	16	**Wet cubic meter weight (kg)**	790
Total N (%)	1.3	**Dry cubic meter weight (kg)**	580
C/N ratio	12.31	**Density (g/cm)**	1.33
Organic matter (%)	26	**Saturated with water (%)**	180
Humidity (%)	28	**Fe (ppm)**	1170
pH (1:2.5)	7.7	**Zn (ppm)**	45
E.C. (mmhos/cm)	3.5	**Mn (ppm)**	110
Total P (%)	0.5	**Cu (ppm)**	160
Total K (%)	0.7		

During the two seasons, the designated amounts of compost and/or compost tea were added once during the first week of March. The mineral fertilizers that were utilized were ammonium nitrate (33.5% N), calcium super-phosphate (15.5% P_2O_5), and potassium sulfate (48% K_2O) at a rate of 300:300:300. Nitrogen application was divided into three doses: 25% during the first week of April, 50% at the first week of May, and the last 25% at the first week of June. Also, phosphorus was divided into two equal batches, applied during the second week of January and again right after berry setting (first week of May). Similarly, potassium was divided into two equal batches during the first bloom (last week of March) and again right after berry setting (first week of May). Everything else in agriculture was done as normal.

As N-fertilizer, Minia Azotein, a commercial biofertilizer, includes N-fixing bacteria (*Azotobacter chroococcum*) at concentration of 10^7 bacterial cells. As a source of bio-P, a specific strain of *Bacillus megatherium* var phosphoticum bacteria with a cell density of around 10^7 makes up Minia Phosphorene, a commercial biofertilizer that uses phosphate-dissolving bacteria. While, for bio-K, Minia Potassein, a commercial biofertilizer that comprises actinomestat bacteria have a cell density of around 10^7. The Laboratory of Biofertilizers at Minia University in Egypt was the source of all biofertilizers, which were applied at a rate of 10 milliliters per vine. After applying mineral fertilizer for a week, the appropriate biofertilizers were added, and irrigation was started right away.

2.1. Data recorded

Both leaf area (cm^2) and main shoot length (cm), were measured in the middle of June in both growing seasons. After calculating the length of each of the 10 main shoots of a vine (in centimeters), the average main shoot length was determined. By selecting twenty mature leaves from those across from the basal clusters, the average leaf area (cm^2) was calculated using the equation given by Ahmed and Morsy (1999):

Leaf area (cm^2) = 0.45 (0.79 x maximum diameter^2) + 17.77 then average leaf area was registered.

1. Average shoot length (cm).
2. Leaf area (cm^2).
3. Cane thickness (cm) was measured according to Samra (2008).
4. Pruning weight (kg).

2.2. Statistical analysis

According to Snedecor and Cochran (1967) and Mead *et al*. (1993), all of the collected data were tabulated and statistically evaluated using New L.S.D. at 5% for all comparisons among the studied treatment means.

3. RESULTS AND DISCUSSION

3.1. Vegetative growth traits

Data shown in Tables (7 to 10) observed the response of Superior seedless grape growth (main shoot length, leaf area, cane thickness, and pruning weight) to organic, mineral and biofertilization in both seasons.

As can be seen from the mentioned Tables, by providing compost treatments to the vines in both seasons, the tested vegetative characteristics of Superior seedless grapevines, such as main shoot length, leaf area, cane thickness, and pruning weight were markedly augmented. In this case, the use of (compost + compost tea) proved to be a more successful treatment as gave the tallest shoot (156 and 211 cm), the largest areas (145.06 and 144.65 cm^2), the thickest canes (1.11 and 1.33 cm), and the heaviest pruning weight (2.95 and 3.69 kg) in the first and second season, respectively. On contrast, the control treatment recorded the lowest values, while, compost or compost tea alone take intermediate values.

The positive impacts of organic fertilization on improvement of vegetative traits were proved by Abd-Elaal *et al*. (2007) and Ahmed and Mohamed (2018) on Superior seedless grapevine; Bondok *et al*. (2007) and El-Salhy *et al*. (2021) on Flame seedless grapevine; and Seleem and Abd El-Hameed (2009), and Al-Hawezy and Ibrahim (2018) on Thompson seedless grapevine.

The beneficial impact of organic fertilization may be explained by the fact that over time, organic materials created regulatory substances that support plant growth and production, such as gibberellic acid, cytokinins, and indole acetic acid. Furthermore, organic materials are significant because they can cause the oxidation of certain molecules,

Table 3. Effect of compost, mineral NPK and bio-fertilizers combination treatments on shoot length (cm) of Superior Seedless grapevines in the two growing seasons (2020/2021 and 2021/2022).

Mineral and/or bio-fertilizers (B)	Compost treatments (A)				
	Control	Compost	Compost tea	Compost + Compost tea	Mean (B)
			The 1st season (2020/2021)		
Control (Mineral NPK)	158	157	156	169	160
Min- PK + bio- N	153	148	142	160	151
Min- NK + bio- P	151	153	175	158	159
Min- NP + bio- K	155	156	156	163	158
Min- N + bio- PK	157	150	154	162	156
Min- P + bio- NK	141	151	152	148	148
Min- K + bio- NP	157	149	148	165	155
Bio- NPK	115	128	137	120	125
Mean (A)	148	149	153	156	
L.S.D. at 5 %	A: 2.94		B: 0.99		AB: 1.71
			The 2nd season (2021/2022)		
Control (Mineral NPK)	215	208	228	229	220
Min- PK + bio- N	193	189	216	205	201
Min- NK + bio- P	213	230	198	235	219
Min- NP + bio- K	210	217	199	224	213
Min- N + bio- PK	217	212	197	219	211
Min- P + bio- NK	177	185	208	203	193
Min- K + bio- NP	221	189	198	212	205
Bio- NPK	174	212	215	159	190
Mean (A)	203	205	207	211	
L.S.D. at 5 %	A: 3.12		B: 1.05		AB: 1.82

Min- NPK: mineral N, P and K.
Min N + bio-P&K: mineral N plus biofertilizer P and K.
Min P + bio-N&K: mineral P plus biofertilizer N and K.
Min K + bio-N&P: mineral K plus biofertilizer N and P.
Min PK + bio-N: mineral P and K plus biofertilizer N.
Min NK + bio-P: mineral N and K plus biofertilizer P.
Min NP + bio-K: mineral N and P plus biofertilizer K.
Bio- NPK: biofertilizer N, P and K.

such as sulfur, acidify the soil, and increase the soil's capacity to store water. Certain minerals in the soil become soluble under these circumstances, improving the soil's composition and qualities (Ram and Pathak, 2007 and Sabry *et al*., 2016 and Brar *et al*., 2019).

Concerning the influence of mineral and/or biofertilization on vegetative growth of Superior seedless grapevines, it could be seen from the same tables that when comparing with the control treatment (Min- NPK), the treatments of (Min- N + bio-PK), (Min- NP + bio-K) (Min- PK + bio-N), and (Bio- NPK) reduced shoot length, leaf area and thickest canes. The treatment of (Min-NPK), followed by (Min-NK + bio-P) produced the tallest plants which gave (160 and 220 cm) and (159 and 219 cm), the largest areas (143.71 and 150.29 cm^2) and (142.27 and 143.96 cm^2), and the thickest canes (1.05 and 1.35 cm) and (1.00 and 1.35 cm) However, the heaviest pruning weight (3.16 and 3.97 kg) and (2.93 and 3.96 kg) were recorded with (Min- K + bio- NP) and (Min-N + bio-PK) in the first and second seasons, respectively. However, the lowest values in both seasons were recorded for plants treated with Bio-NPK.

The distinguished effects of NPK types on vegetative growth of grapevines were denoted by Akl et al. (2017) and El-Salhy et al. (2023) on Superior seedless grapevine; Dosoky et al. (2021) on Crimson seedless grapevine; Mostafa et al. (2008) on Thompson seedless and Dosoky et al. (2021) on Mid night beauty grapevine transplants.

Table 4. Effect of compost, mineral NPK and bio-fertilizers combination treatments on leaf area (cm2) of Superior Seedless grapevines in the two growing seasons (2020/2021 and 2021/2022).

Mineral and/or bio-fertilizers (B)	Compost treatments (A)				
	Control	Compost	Compost tea	Compost + Compost tea	Mean (B)
The 1st season (2020/2021)					
Control (Mineral NPK)	145.90	144.32	142.34	142.27	143.71
Min- PK + bio- N	135.18	116.31	138.65	135.07	131.30
Min- NK + bio- P	133.83	149.82	127.61	157.83	142.27
Min- NP + bio- K	112.44	147.09	147.48	153.70	140.18
Min- N + bio- PK	124.85	121.35	146.70	154.80	136.93
Min- P + bio- NK	116.06	122.30	127.24	145.03	127.66
Min- K + bio- NP	116.38	126.92	143.91	149.03	134.06
Bio- NPK	109.52	112.40	115.21	122.77	114.98
Mean (A)	124.27	130.06	136.14	145.06	
L.S.D. at 5 %	A: 4.53		B: 2.18	AB: 3.78	
The 2nd season (2021/2022)					
Control (Mineral NPK)	146.76	145.89	152.82	155.68	150.29
Min- PK + bio- N	135.05	120.27	136.93	131.19	130.86
Min- NK + bio- P	137.78	150.51	123.58	163.95	143.96
Min- NP + bio- K	119.18	140.31	149.22	150.04	139.69
Min- N + bio- PK	89.81	150.64	154.75	158.79	138.50
Min- P + bio- NK	116.75	123.25	127.50	133.98	125.37
Min- K + bio- NP	119.83	126.74	148.54	135.00	132.53
Bio- NPK	111.86	122.37	118.38	128.60	120.30
Mean (A)	122.13	135.00	138.97	144.65	
L.S.D. at 5 %	A: 4.68		B: 2.71	AB: 4.69	

Min- NPK: mineral N, P and K.
Min N + bio-P&K: mineral N plus biofertilizer P and K.
Min P + bio-N&K: mineral P plus biofertilizer N and K.
Min K + bio-N&P: mineral K plus biofertilizer N and P.
Min PK + bio-N: mineral P and K plus biofertilizer N.
Min NK + bio-P: mineral N and K plus biofertilizer P.
Min NP + bio-K: mineral N and P plus biofertilizer K.
Bio- NPK: biofertilizer N, P and K.

According to Abd El-Aal *et al.* (2013) and Abd El-Rahman and Bakr (2022) on Superior seedless grapevines; Abbas *et al.* (2006) on Ruby seedless grapevine; Mostafa (2008) and Masoud (2012) on Flame Seedless grapevine; El-Abbasy *et al.* (2013) on Thompson Seedless grape and Refaai and Soltan (2023) on Early sweet vineyards, bio-fertilization also had a favorable impact on vegetative growth parameters.

According to Murrell and Munson (1999), mineral phosphorus is known to enhance biological nitrogen fixation, water usage efficiency, root growth, quick plant maturity, and seed production. It also increases plant resistance to disease. Also, the high nutritional availability of mineral fertilizers, which promotes cell division and expansion (Nijjar, 1985).

Fertilizer efficiency, production, and soil fertility may all be increased by using bacteria that fix nitrogen as well as bacteria that release phosphorus and potassium. They have been shown to enhance rhizosphere nutrient fixation, generate plant growth stimulants, enhance soil stability, offer biological control, decompose materials, recycle nutrients, encourage mycorrhizal symbiosis, and create a bioremediation process in soil tainted with toxic, xenobiotic, and resistant substances. Applying bio-fertilizers can reduce energy consumption, lessen water and soil pollution, enhance soil fertility, boost production per unit area in a short time (El-Salhy et al., 2006 and El-Salhy et al., 2021).

The impact of the combinations between organic, mineral and/or bio fertilization was substantial for grape growth (shoot length, leaf area, cane thickness and pruning weight) in both

Table 5. Effect of compost, mineral NPK and bio-fertilizers combination treatments on cane thickness (cm) of Superior Seedless grapevines in the two growing seasons (2020/2021 and 2021/2022).

Mineral and/or bio-fertilizers (B)	Compost treatments (A)				
	Control	Compost	Compost tea	Compost + Compost tea	Mean (B)
The 1st season (2020/2021)					
Control (Mineral NPK)	0.90	1.10	1.00	1.20	1.05
Min- PK + bio- N	0.90	0.80	1.00	1.10	0.95
Min- NK + bio- P	0.90	0.90	1.00	1.20	1.00
Min- NP + bio- K	0.90	1.00	0.90	1.10	0.98
Min- N + bio- PK	0.90	0.90	0.90	1.10	0.95
Min- P + bio- NK	0.80	0.80	0.90	1.10	0.90
Min- K + bio- NP	0.90	0.90	0.90	1.10	0.95
Bio- NPK	0.80	0.80	0.90	1.00	0.88
Mean (A)	0.88	0.90	0.94	1.11	
L.S.D. at 5 %	A: 0.26		B: 0.14		AB: 0.24
The 2nd season (2021/2022)					
Control (Mineral NPK)	1.30	1.30	1.40	1.40	1.35
Min- PK + bio- N	1.30	1.10	1.20	1.40	1.25
Min- NK + bio- P	1.30	1.30	1.40	1.40	1.35
Min- NP + bio- K	1.20	1.30	1.30	1.30	1.28
Min- N + bio- PK	1.20	1.30	1.20	1.30	1.25
Min- P + bio- NK	1.20	1.30	1.20	1.30	1.25
Min- K + bio- NP	1.20	1.20	1.20	1.30	1.23
Bio- NPK	1.00	1.10	1.10	1.20	1.10
Mean (A)	1.21	1.24	1.25	1.33	
L.S.D. at 5 %	A: 0.28		B: 0.19		AB: 0.33

Min- NPK: mineral N, P and K.
Min N + bio-P&K: mineral N plus biofertilizer P and K.
Min P + bio-N&K: mineral P plus biofertilizer N and K.
Min K + bio-N&P: mineral K plus biofertilizer N and P.
Min PK + bio-N: mineral P and K plus biofertilizer N.
Min NK + bio-P: mineral N and K plus biofertilizer P.
Min NP + bio-K: mineral N and P plus biofertilizer K.
Bio- NPK: biofertilizer N, P and K.

seasons, relative to check treatment. In most cases, the best values were recorded for the interaction treatment [(compost + compost tea) + (Min- NK + bio-P)].

Our results declared that treatment including (compost + compost tea) in presence of miner NK and bio-P gave the best vegetative characters (shoot length, leaf area, cane thickness and pruning weight) for Superior grapevines.

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Table 6. Effect of compost, mineral NPK and bio-fertilizers combination treatments on pruning weight (kg) of Superior Seedless grapevines in the two growing seasons (2020/2021 and 2021/2022).

Mineral and/or bio-fertilizers (B)	Compost treatments (A)				
	Control	Compost	Compost tea	Compost + Compost tea	Mean (B)
			The 1st season (2020/2021)		
Control (Mineral NPK)	2.86	3.07	3.37	3.32	3.16
Min- PK + bio- N	2.37	2.65	2.72	3.01	2.69
Min- NK + bio- P	2.77	2.82	2.90	3.23	2.93
Min- NP + bio- K	2.72	2.62	2.99	3.12	2.86
Min- N + bio- PK	2.67	2.70	2.83	3.17	2.84
Min- P + bio- NK	2.76	2.43	2.50	2.67	2.59
Min- K + bio- NP	2.50	2.88	2.52	2.88	2.70
Bio- NPK	2.10	2.10	1.88	2.16	2.06
Mean (A)	2.59	2.66	2.71	2.95	
L.S.D. at 5 %	A: 0.21		B: 0.17		AB: 0.29
			The 2nd season (2021/2022)		
Control (Mineral NPK)	4.08	3.88	3.92	3.99	3.97
Min- PK + bio- N	3.53	3.46	3.56	3.72	3.57
Min- NK + bio- P	3.55	4.10	4.21	3.97	3.96
Min- NP + bio- K	3.66	3.69	3.74	3.98	3.77
Min- N + bio- PK	3.38	3.77	3.89	4.00	3.76
Min- P + bio- NK	3.26	3.19	3.01	3.30	3.19
Min- K + bio- NP	3.54	3.73	3.83	3.76	3.72
Bio- NPK	2.31	2.57	2.61	2.79	2.57
Mean (A)	3.41	3.55	3.60	3.69	
L.S.D. at 5 %	A: 0.28		B: 0.26		AB: 0.45

Min- NPK: mineral N, P and K.
Min N + bio-P&K: mineral N plus biofertilizer P and K.
Min P + bio-N&K: mineral P plus biofertilizer N and K.
Min K + bio-N&P: mineral K plus biofertilizer N and P.
Min PK + bio-N: mineral P and K plus biofertilizer N.
Min NK + bio-P: mineral N and K plus biofertilizer P.
Min NP + bio-K: mineral N and P plus biofertilizer K.
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الملخص العربي

تأثير التسميد العضوي وغير العضوي على صفات النمو لكرمات العنب صنف سوبيريور

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في هذه الدراسة، تم اختبار كرمات عنب عديم البذور عمرها ستة سنوات ومنزرعة في مزرعة خاصة بقرية تلا، مركز المنيا، محافظة المنيا، مصر، لموسمين نمو متتاليين (٢٠٢٠/٢٠٢١ و٢٠٢١/٢٠٢٢) لتقييم تأثير عدة أنواع من معاملات التسميد وهي التسميد العضوي (الكمبوست وشاي الكمبوست) والتسميد المعدني و/ أو التسميد الحيوي من NPK على خصائص النمو لكرمات العنب صنف سوبيريور.

أوضحت النتائج أن معاملات الكمبوست و/أو شاي الكمبوست أنتجت صفات نمو خضري جيد (متوسط طول الفرع، مساحة الورقة، سُمك الساق، ووزن خشب التقليم) وكانت أفضل النتائج مع معاملة (الكمبوست + شاي الكمبوست).

كذلك، تأثرت جميع صفات النمو الخضري المدروسة بالتسميد المعدني و/أو الحيوي في كلا موسمي النمو. أنتجت المعاملة (Min– NK + bio–P) أطول الفروع وأكبر مساحة ورقة وسُمك الساق سميك وأثقل وزن لخشب التقليم.

يمكن الاستنتاج أن معاملات (الكمبوست + شاي الكمبوست) بالإضافة إلى (Min– NK + bio–P) سجلت أفضل النتائج في نمو ومحصول العنب عديم البذور، صنف سوبيريور.

كلمات افتتاحية: سوبيريور، الكمبوست، NPK المعدني، منيا الآزوتين، فوسفورين، بوتاسين.