Assiut University Center for Environmental Studies-Egypt

The 9th Int. Conf. for Develop. and the Env . in the Arab world, April, 15-17, 2018

VERMICOMPOST AS AN ALTERNATIVE TO MINERAL NITROGEN FERTILIZATION AND IMPACT ON YIELD, FRUIT QUALITY AND STORABILITY OF FLAME SEEDLESS GRAPES UNDER SANDY SOIL

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ABSTRACT

This experiment was carried out during 2015 and 2016 seasons on Flame Seedless grapevines grown in sandy soil under drip irrigation system at Khatatba district, in Menofia Governorate, Egypt. The aim of this research is reducing of the conventional fertilization (full mineral N source) by using vermicompost and its impact on yield, fruit quality and storability. Six treatments fertilization were employed as follows: T1 (100% vermicompost -5 kg/vine + 0%mineral nitrogen), T2 (80%vermicompos- 4 kg/ vine t+20% mineral nitrogen), T3 (60% vermicompost -3 kg/ vine +40%mineral nitrogen), T4 (40%vermicompost - 2 kg/ vine + 60% mineral nitrogen), T5 (20% vermicompost - 1kg/ vine + 80% mineral nitrogen) and T6 (0 vermicompost + 100% mineral nitrogen - 291g ammonium sulphate 20.6 %/ vine) (control). The grapes was picked and cold stored at 0 OC & 90-95 % RH for 0, 15, and 30-day periods. T3 induced the highest yield/vine with better cluster weight and improved berry physical and chemical characteristics. T3 and T4 gave the highest number of cluster and decreased nitrite, nitrate and titratable acidity in berry juice compare to completed N mineral fertilizer. During cold storage, T3 and T4 reduced the cluster weight loss, cluster berry shattering and cluster berry decay. In addition, T3 induced the highest firmness, SSC, SSC: acid ratio, total sugar, reducing sugar, non-reducing sugar and decreased titratable acidity in berry juice as compared with the conventional fertilization (full mineral N source). It is recommended to use 60% vermicompost+40%mineral nitrogen for the highest yield and fruit quality and 40% vermicompost+ 60% mineral nitrogen for the best storability of Flame Seedless grapes under sandy soil.

Keywords: *Grapevine, vermicompost, yield, quality, storability*

INTRODUCTION

Grapes (*Vitis vinefera*, L) considered one of the most popular and favorite fruit crops in the world. In Egypt, grapes rank the second fruit crop after citrus. Flame seedless is one of the most important grape cultivars, since it produces large clusters and sweet flavor. Mineral Fertilization is considered as an important practice during the growing season of fruit trees, especially nitrogen, phosphorus and potassium fertilization. Organic fertilization is another option for supplying macro and micro nutrients necessary for plant growth (El-Haggar *et al*., 2004). Also, improve soil conditions such as structure, aeration and retention of moisture and reduce soil pH (Nasser, 1998). Vermicomposts are finely-divided

mature peat-like materials with a high porosity, aeration, drainage and water-holding capacity and microbial activity which are stabilized by interactions between earthworms and microorganisms in a non-thermophilic process (Edwards & Burrows, 1988). Vermicompost contains most essential nutrients for plant iv available form such as nitrates, phosphates and exchangeable calcium, soluble potassium, high levels of total and available nitrogen, phosphorous, potassium (NPK) and micro nutrients (Parthasarathi & Ranganathan, 1999). Vermicompost improving soil aggregation, structure and fertility, increasing microbial diversity and populations, improving the moisture-holding capacity of soils, increasing the soil cation exchange capacity and increasing crop yields (Zink & Allen, 1998). Grapes are a non-climacteric fruit with a relatively low physiological activity. However, perishable nature of the berry, as indicated by weight loss, increased berry shatters and decay development, impair its long term storability (Mahajan *et al*., 2010). However, the crop would fetch premium prices, if the storage period could be extended further. For that, there is a need to down regulate accelerated senescence of berries by suppressing ripening related changes such as berry softening and development of off flavors during postharvest storage alongside aforesaid drawbacks.

The objective of this study is investigate the effect of using vermicompost as N organic source and its partially substitute of completed N mineral fertilizer on yield, fruit quality and storability of Flame Seedless grapes under sandy soil.

MATERIALS AND METHODS

This study was conducted during two successive seasons of 2015 and 2016 at private vine yard at EL-Khatatba (desert region), EL Menofia Governorate, Egypt. This study included 54 vines, six treatments were carried out, and each with three replicates (3 vines / replicate).The selected vines were uniform in vigor as possible (7 years old), planted in sandy soil at 1.5x3 meters (vine x row) under drip irrigation system (ground water salinity = 1.33 ds/m). The vines trained according to the double cordon system. Pruning was carried out at the first week of January by leaving 45-55 buds per vine (20 fruiting spurs * 2-3 buds / spur). Mineral nitrogen fertilizer was added by 0, 20,40, 60, 80, 100% of the recommended rate [60 unit nitrogen ammonium sulphate (20.6 %)] and placed at 10 cm under the soil surface on both sides of the vine row (50 cm from the trunk), at three intervals; 15% at first week of March (after bud burst and before flowering), 50% at late May (after fruit set and before harvest date) and 35% at mid-August (after harvest) (El-Sabagh *et al.*, 2011). All the vines were inoculated with 30 ml/vine (*Azotobacter chroococcum, Bacillus megaterium,* and *Bacillus circulans)*. Get a cell suspension 2 * 10^4, 4 * $l0^4$ and 3* $l0^5$ cell /g soil) respectively. The suspension was applied three times: at first week of February, March and April. In addition, 40 unit of Phosphorus as calcium super phosphate (15.5% P_2O_5) was added to all vines during first week of February and 100 unit of potassium as potassium sulphate (48 % K_2O) was added to all vines as follows: 50% during first week of March and 50% during the growing seasons (late May). The organic fertilization (vermicompost) was added once at the first week of February as side dressed in a band of 50 cm wide on both sides of the vine row and mixed with the surface of 10 cm of soil.

Some physical and chemical properties of the experimental orchard soil:

Particle size distribution*			Texture	Ec**		(Soluble cation***				Soluble Anions@)			
Sand	Silt	Clay	Soil		pH	Ca^{++}	Mg^{++}	Na^{++}	K^{+}	CO_3	HCO_3	Cl^-	SO_4
91.72	6.15	2.13	Sandy	1.99	7.87	6.65	3.40	9.18	0.57	--	3.85	8.30	7.85

*** %, ** ds/m, *** meq/l, @ meq/l**

Vermicompost analysis:

N %	P %	K %	Ca %	Mg %	Fe ppm	Mn ppm	Zn ppm	Cu ppm	Ni ppm	Co ppm	Cd ppm	Moisture %
1.64	0.64	1.32	1.48	1.34	124.0	194.0	111.0	25.16	7.14	4.39	2.23	30

The treatments were arranged as follows:

1-**T1: 100% of the N from organic source (vermicompost) (5 kg/vine).**

2-T2: 80% from organic N (4 kg/ vine) +20% inorganic N (58 g ammonium sulphate /vine).

3-T3: 60 % organic N (3 kg/ vine) +40 % inorganic N (117 g ammonium sulphate /vine).

4-T4: 40 % organic N (2 kg/ vine) +60 % inorganic N (175 g ammonium sulphate /vine.

5- T5: 20 % organic N (1kg/ vine) + 80 % inorganic N (233 g ammonium sulphate /vine.

6- T6: control 100% nitrogen fertilizers (291 g ammonium sulphate / vine).

The following parameters were measured

1-Yield and cluster characteristics at picking date

Number of cluster foe every vine

Cluster weight (g):- Cluster weight was recorded in gram.

Yield (kg/vine):- The average weight of cluster at harvest date (commercial maturity TSS $\geq$ 16^o brix) (Champa, 2013) was determined using 10 clusters per replicate, weighed and divided by its number, and the yield /vine was expressed as follows:

Vine yield (kg) =average weight of cluster (g) x number of cluster per vine.

2 -Cluster length and width (cm): **At harvest time, two clusters were taken at random from each vine to determine cluster traits such as cluster length and width according to Winkler *et al.* (1974).**

3-Physical properties of berry

Berry dimensions (mm):- Berry length and diameter were measured (mm) in 10 berries by using vernal clipper; the average length and diameter of berries were calculated.

Berry firmness (Newton):- was measured in ten berries per cluster (gram force) using hand dynamometer model FDP1000 with a thump 1mm. Data of berry firmness was transformed into Newton units using standard factor (1 gram Force =0.00980665 Newton).

Weight of 100 berries (g) was determined using digital balance; the volume (ml) of the same berries was determined by the water displacement method. Berry juice was extracted and filtered through two layers of cheese cloth to determine berry juice % related to berries weight (v/w)

4-Chemical properties of berries

Soluble solids content (SSC): was determined as percentage in juice by means of hand refractometer apparatus according to A.O.A.C. (1990).

Titratable acidity (%): berries Juice titratable acidity was determined by using 5 ml juice and titrated against 0.1N sodium hydroxide, using phenol phethalein as indicator according to A.O.A.C. (1990) and expressed as mg tartaric acid per 100 ml juice.

SSC/ Acid ratio: From data of SSC and that of titratable acidity, the SSC/acid ratio was calculated.

Sugar contents (total, reducing and non-reducing sugars %) in berries Juice:- The total and reducing sugars were determined according to Bernfeld (1955) and Miller (1959), respectively. The non-reducing sugars were calculated by the difference between total sugars and reducing sugars.

Nitrite and nitrate content in berries juice (ppm):

were determined according to Ridnour–Lisa *et al*. (2000).

At picking date (in July) in both seasons, clusters were picked and transported (at ambient temperature ≈ 25 oC) to laboratory of Faculty of Agriculture, Tanta University, Egypt. The clusters were packed in proliferated polyethylene bags and arranged in plastic boxes (50*35*15 cm). All plastic boxes were stored at 0oC and 90-95% RH. Every treatment was represented by three proliferated polyethylene bags for every storage period (0, 15 and 30 days). Each polyethylene page contained one cluster which was weight and labeled at picking time to determine the cluster weight loss during the deferent cold storage periods. At the picking date (zero time) and after every 15 days, samples of 3 polyethylene bags per treatment were taken out for evaluating the storability of Flame Seedless grapes as affected by pre-harvest treatments (vermicompost) and storage periods.

5- Fruits storability

Fruit physical properties

Weight loss (%): Every two weeks of cold storage period up to four weeks, the clusters were reweighed after storage and the clusters weight loss was calculated as percent related to the weight of the same clusters before cold storage.

Berry shattering (%):-Shattering was determined by given two light shakes by hand for every cluster in sample. The shattering was calculated by dividing the shattered berries weight by cluster weight before the shaking and expressed as percentage.

Berry decay (%):-It was calculated according to weight of decayed berries by initial cluster weight and expressed as percentage.

Berry firmness (Newton):- Ten berries per cluster were used; berry firmness was measured in gram force (gf) using hand dynamometer model FDp1000 with a thump (1mm). Data of berry firmness was transformed in to Newton units using standard factor (1 gram force =0.00980665 Newton).

5.2-Fruit chemical properties: Soluble solids content (SSC), titratable acidity (TA), SSC: TA ratio and sugar contents (total, reducing and non-reducing sugars) were determined as described before.

6- Statistical analysis

Analysis of variance method as randomized complete block design for field data and split plot design as for postharvest data was used, since treatments were allocated as main plot and cold storage period as sub plot according to Snedecor and Cochran (1972), and means were compared according to Duncan multiple range test (DMRT) (Duncan, 1955).

RESULT AND DISCUSSION

1-Number of cluster, cluster weight and yield/ vine

Data in Table 1 show that organic treatments were significantly effective on cluster number, cluster weight and total vine yield. T3 produced the highest cluster weight (550 g and 553.3 g) and yield / vine (19.4 kg and 19.6 kg), while the conventional mineral N fertilization recorded the lowest cluster weight (400.6 and 396.6 g) and yield / vine (13.4 and 13..3 kg) in the two seasons, respectively. T4 gave the highest number of cluster in both seasons. The effect of organic-N and bio-fertilizer on activating the synthesis of total carbohydrates and proteins which enhances cell division and enlargement leading to improving the vine growth and nutritional status and maintaining a good balance between total carbohydrates and nitrogen in favor improving bud burst that lead to an increase of cluster number per vine, hence the yield was increased Masoud (2012). Our data go in line with Abd El-Migeed *et al.* (2006) on Thompson Seedless grapevines who indicated that number of cluster, yield and cluster weight improved due to application of 50% mineral N + 50% organic fertilizer. In addition, Venkatesh (1995) observed that, the number of cluster and yield in Thompson Seedless grapes were increased by application of vermicompost (2.0 tons /feddan) and Athani *et al.* (2007) found that maximum yield on Guava tress was recorded by 75% recommended does Fertilize +10 kg vermicompost/vine.

Table 1: Effect of partial substitution of vermicompost on number of cluster, cluster weight and yield /vine on Flame Seedless grapevines at 2015 & 2016 seasons

Treatments	Number of cluster		Cluster weight (g)		Yield (kg/vine)	
	2015	2016	**2015**	**2016**	**2015**	**2016**
T1	34.4 abc	34.4 abc	446.6 bc	460.0 c	15.4 d	15.8 c
T2	35.4 a	34.1 bc	466.7 c	453.3 c	16.5 c	15.5 c
T3	35.2 ab	35.4 abc	550.0 a	553.3 a	19.4 a	19.6 a
T4	35.5 a	36.3 a	506.7 b	510.0 b	18.0 b	18.5 b
T5	32.4 c	35.8 ab	423.3 de	426.6 c	13.7 e	15.3 c
T6	33.0 bc	33.5 c	400.6 e	396.6 d	13.4 e	13.3 d

Means having the same letter (s) in each column are not significantly different at 5% level with DMRT. *T1:100% vermicompost+0% mineral nitrogen, T2:80%vermicompost+20% mineral nitrogen, T3:60%vermicompost+40% mineral nitrogen, T4:40%vermicompost+60% mineral nitrogen, T5:20%vermicompost+80% mineral nitrogen and T6:100% mineral nitrogen (control).

2- CLUSTER AND BERRY CHARACTERS

2-1: CLUSTER LENGTH, WIDTH AND BERRY DIAMETER

Data in Table 2 reveal that cluster length, width and berry diameter of Flame Seedless grapes were significantly affected by vermicompost treatments in both seasons. T3 induced the best cluster characters,

while the conventional mineral N fertilization induced the lowest one in this sphere. This result could be due to vermicompost encouraged the biosynthesis of plant growth promoters and caused the clear increase of cluster length, width and berry dimension through better absorption of micro nutrient from the soil (Hegazi *et al*., 2014). These results are parallel with Abd El-Wahab (2011) found that application of 50% organic manure combined with application of 50% mineral nitrogen fertilizer improved the physical characteristics of berries of Red Globe grapevines and Barve (1992) reported that, incorporation of vermicompost has improved the berry diameter in grapes.

Table 2: Effect of partial substitution of vermicompost on cluster length, cluster width, berry length and berry width on Flame Seedless grapes at 2015 & 2016 seasons

Treatments	Cluster length (cm)		Cluster width (cm)		Berry length (cm)		Berry width (cm)	
	2015	2016	2015	2016	2015	2016	2015	2016
T1	23.6 bc	24.3cd	12.6 cd	13.2 c	1.7bc	1.7b	1.4cd	1.5 c
T2	24.0abc	25.3 bc	14.0 bc	14.0 b	1.7bc	1.7 b	1.5 bc	1.5c
T3	25.0 a	26.6 a	16.3 a	16.0 a	1.9 a	1.9 a	1.7 a	1.7 a
T4	24.6 ab	26.3 ab	14.6 ab	14.7 b	1.8 ab	1.7 b	1.6 ab	1.6 b
T5	23.3 c	24.3 cd	12.3 cd	12.7 c	1.6 c	1.6 b	1.4 cd	1.5 c
T6	23.0 c	24.0 d	12.0 d	10.5 d	1.6 c	1.6 b	1.3 d	1.5 c

Means having the same letter (s) in each column are not significantly different at 5% level with DMRT. *T1:100% vermicompost+0% mineral nitrogen, T2:80%vermicompost+20% mineral nitrogen, T3:60%vermicompost+40% mineral nitrogen, T4:40%vermicompost+60% mineral nitrogen, T5:20%vermicompost+80% mineral nitrogen and T6:100% mineral nitrogen (control).

2-2:WEIGHT, VOLUME JUICE OF 100 BERRY AND BERRY FIRMNESS

Data in Tables 3 reveal that weight, volume, juice berry and berry firmness of Flame Seedless grapevine was significantly increased with application of vermicompost compared to the conventional fertilization with full mineral N source. T3 gave the highest weight, volume, juice volume of 100 berry and berry firmness. Conventional fertilization with full mineral N source (T6) gave the lowest one of this parameters. The positive effect of this results may be due to vermicompost increased the number of the soil microflora, (total fungi, total bacteria, total actinomycetes , some macro and micro elements (i.e. N,P, K, Fe, Zn, and Mn) in soil. However, biofertilizers might contain different strains of a symbiotic associative diazotrophes, phosphate solublizing microorganisms and silicate dissolving microorganisms (Saber, 1993). This increased in berry firmness might be due to the optimum level of potassium availability through vermicompost. These results are parallel with Abd El-Migeed *et al.* (2006) found that application of 50% mineral N+ 50% organic fertilizer improve berry weight and berry size on Thompson Seedless grapevines. Bondok *et al.* (2007) found that application 75% organic nitrogen Fertilizer +25% mineral nitrogen fertilizers on Flame Seedless grapevine increased berry weight, size and juice volume compare than mineral nitrogen Fertilizer alone. Abd El-Razek *et al.* (2011) found that berry firmness decreased in the high N-variants when supplied Crimson Seedless with three nitrogen rates.

Table 3: **Effect of partial substitution of vermicompost on weight, volume and volume juice of 100 berries of Flame Seedless grapes at 2015 & 2016 seasons**

Treatments	**100 Beery weight (g)**		**100 Beery volume (ml)**		**100 Beery Juice volume (ml)**		**Berry Firmness (Newton)**	
.	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
T1	262.2cd	281.67bc	236.7cd	253.3c	158.3cd	166.7c	2.58c	2.51d
T2	269.0bc	286.67b	243.3c	253.3c	163.3c	163.3c	2.58c	2.61c
T3	309.6 a	330.00a	276.7a	290.0a	180.0a	196.7a	2.84a	3.04a
T4	273.3 b	286.67b	256.7b	273.3b	170.0b	180.0b	2.71b	2.74b
T5	256.7d	266.67d	226.6de	240.0d	156.7de	153.3d	2.42d	2.45d
T6	247.0e	271.67cd	223.3e	220.0d	151.6e	153.3d	2.25e	2.3e

Means having the same letter (s) in each column are not significantly different at 5% level with DMRT. *T1:100% vermicompost+0% mineral nitrogen, T2:80%vermicompost+20% mineral nitrogen, T3:60%vermicompost+40% mineral nitrogen, T4:40%vermicompost+60% mineral nitrogen, T5:20%vermicompost+80% mineral nitrogen and T6:100% mineral nitrogen (control).

2-3: Nitrite and Nitrate fruit content (ppm)

Data in Tables 4 reveal that nitrite and nitrate content of Flame Seedless grapes juice were significantly decreased with application of vermicompost compared to the conventional fertilization with full mineral N source. However, T3 and T4 gave the lowest nitrite and nitrate contents, while, the highest one were presented in the conventional fertilization treatment with full mineral N source (T6) in the both seasons. This may be due to that using organic manure fertilizer is often considered as a desirable nitrogen source because the nitrogen is in the mineralization immobilization cycle longer and thus is more slowly available (Hallberg & Keeney, 1993). Moreover, the use of organic manure (as slow release for nitrogen) induced a further reduction in $N0_3$ -N accumulation in the plant compared with mineral nitrogen (as fast release for nitrogen) El-Sisy (2000). The obtained results are in agreement with those obtained by Belal (2006) and Farag (2006) reported that the interactions of all combinations between organic nitrogen and mineral nitrogen doses gave a significant decrease in nitrate and nitrite content in the juice of berries as compared with mineral nitrogen alone for Thompson Seedless grapevines.

Table 4: **Effect of partial substitution of vermicompost on nitrite and nitrate content of Flame Seedless grapes at 2015 & 2016 seasons**

	NO_2 (ppm)		**NO_3 (ppm)**	
Treatments	2015	2016	**2015**	**2016**
T1(100% V)	0.26 c	0.21 c	8.25 c	6.25 c
T2(80% V*+20% MN)**	0.23 d	0.20 c	8.40 c	7.06 c
T3(60% V+40% MN)	0.18 e	0.14 d	5.58 d	3.58 d
T4(40% V+60% MN)	0.23 d	0.15 d	6.51 d	4.51d
T5(20% V+80% MN)	0.41 b	0.37 b	11.31 b	9.16 b
T6(100% MN)	0.78 a	0.72 a	19.25 a	18.25 a

Means having the same letter (s) in each column are not significantly different at 5% level with DMRT. *V: Vermicompost , ** MN: mineral nitrogen.

3-Cluster physical, chemical quality parameters and cold storage

3-1: Fruit weight loss, berry shattering, berry decay and berry firmness.

Data in Table 5 show that organic N treatments were significantly effective on cluster weight loss, berry shattering, berry decay and berry firmness during cold storage. T3 and T4 gave the lowest weight loss, berry shattering and berry decay in both seasons, while T5 and T6 gave the highest value in this sphere. T3 showed the highest value of berry firmness compared with the conventional fertilization treatment with full mineral

N source (T6). Data also revealed that the lowest shattering percentage was obtained from the lowest level of N units treatments on Flame Seedless grapevine. As for cold storage period. the lowest weight loss, berry shattering and berry decay in proportionally increased, while berry firmness decreased with the storage period advanced. In addition, data emphasized these result, hence cluster weight loss, berry shattering, berry decay percentage and berry firmness recorded (4.31 & 4.85%), (4.52 & 4.15 %) & (3.79 & 3.92%) & (2.47 & 2.49 Newton) in the two seasons, respectively after 30 days of cold storage period. The decrease in cluster weight loss may due to respiration and transpiration (Wolucka *et al*., 2005).The decrease in berry firmness may be due to breakdown of insoluble proto-pectins into soluble pectin (Matto, 1975), or by increased membrane permeability caused by cellular disintegration (Oogaki *et al.*, 1990). The loss of pectic substances in the middle lamellae of the cell wall is perhaps the key step in ripening process that leads to the loss of cell integrity or firmness (Solomes & Latics, 1973). Our results go in line with those obtained by Abdel-Hamid (2000) and Abdel Wahab & El-Shinawy (2004) they found that weight loss and berry decay percentage of grapes were increased and berry firmness was decreased with advancing storage period. In addition, Bondok *et al.* (2007) indicated that shattering percentage was increased with the advance of storage period.

3-2: Soluble solids content (SSC), titratable acidity (TA) and SSC: TA ratio

Data in Table 6 show that SSC, TA and SSC: TA of Flame Seedless grapes were significantly increased with application of vermicompost compared to the conventional fertilization with full mineral N source during cold storage. T3 induced the highest SSC (19.6 & 19.8 %), the lowest acidity (0.51 & 0.50 %) and the highest SSC: TA (38.5 and 39.9) in the two seasons, respectively. While, the conventional fertilization with full mineral N source (T6) showed reverse results in this sphere. The effect of cold storage periods, data clears that SSC and SSC: TA was increased with the storage period advanced, while AT was decreased with the storage period advanced. This increase in SSC and SSC/Acid ratio may be due to increased TSS percentages throughout the storage period are presumably due to increased activity of enzymes responsible for starch hydrolysis to soluble sugars and can be caused by the decline in the amount of carbohydrates, pectines, partial hydrolysis of protein and decomposition of glycosides into subunits during respiration (Gayed *et al.*, 2017). Also, the reduction in acidity could be attributed to consumption of acids in respiration (El-Sayed, 2013). Our results go in line with those obtained by Al-Wasfy *et al.* (2006) and El-Morsy (1997) recorded that using 50% (compost) + 50% of the NPK mineral recommended fertilizers improving the chemical characteristics of berries as total soluble solids, total acidity and TSS/acid ratio. Also, Athani *et al.* (2007) found that 75% RDF + 10 kg vermicompost per plant of guava trees gave the higher value of TSS. These results are agree with Abdel-Wahab & El-Shinawy (2004) reported that TSS and TSS/acidity were increased and total acidity of grapes of cold storage was decreased with advancing storage period. In addition, Mahajan *et al.* (2010) found that TSS content was increased and acidity was decreased in berry juice during cold storage of Flame Seedless grapes.

Table 5: **Effect of partial substitution of vermicompost and cold storage (0°C &90- 95% RH) periods on Flame Seedless grapes at 2015 & 2016 seasons**

Treatments	Cluster weight loss (%)		Berry shattering (%)		Berry decay (%)		Berry Firmness (N)	
	2015	2016	2015	2016	2015	2016	2015	2016
Treatments (T)								
T1 (100 % V)	2.49 b	2.84ab	2.07c	2.36bc	1.58 b	2.10 a	2.54 c	2.47 d
T2 (80% V*+ 20% MN)**	2.35 b	2.54bc	2.60b	2.07c	1.73 b	2.09 a	2.55 c	2.57 c
T3 (60% V+ 40% MN)	1.48 c	2.05d	1.70d	1.48d	1.48 b	1.31b	2.78 a	2.94 a
T4 (40% V+ 60% MN)	1.57 c	2.28cd	1.53d	1.23d	1.60 b	1.14b	2.68b	2.70 b
T5 (20% V+ 80% MN)	2.91 a	3.00a	3.02a	2.70ab	2.16 a	2.26 a	2.36d	2.40 e
T6 (100% MN)	3.19 a	3.15a	2.94a	3.05a	2.27 a	2.27 a	2.20 e	2.26 f
Storage periods (S) in day								
0	0.00 c	0.00c	0.00c	0.00c	0.00c	0.00c	2.5a	2.61 a
15	2.68 b	3.08b	2.42b	2.30 b	1.61 b	1.66b	2.5b	2.56 b
30	4.31 a	4.85 a	4.52a	4.15a	3.70a	3.92a	2.4c	2.49 c
T*S significant	**	NS	**	**	**	**	NS	NS

Means having the same letter (s) in each column for every factor are not significantly different at 5% level with DMRT.
***V : Vermicompost , ** MN: mineral nitrogen.**

Table 6: **Effect of partial substitution of vermicompost cold storage (0 °C &90- 95% RH) periods on SSC, TA and SSC: TA ratio of Flame Seedless grapes at 2015 & 2016 seasons**

Treatments	SSC (%)		@TA (%)		SSC:TA ratio	
	2015	2016	2015	2016	2015	2016
Treatments (T)						
T1 (100 % V)	17.9 cd	18.0 cd	0.61 b	0.59 b	29.1d	30.4d
T2 (80% V+ 20% MN)	18.2 c	18.2 c	0.59 c	0.55 d	30.8 c	32.7 c
T3 (60% V+ 40% MN)	19.6 a	19.8 a	0.51 e	0.50 f	38.5 a	39.9 a
T4 (40% V+ 60% MN)	18.7 b	18.9 b	0.55 d	0.51 d	34.0b	37.2b
T5 (20% V+ 80% MN)	17.6 de	17.6 de	0.59 c	0.57 c	29.4d	30.7d
T6 (100% MN)	17.3 e	17.3 e	0.67 a	0.62 a	25.8 e	28.0 e
Storage periods (S) day						
0	17.9 c	18.0 c	0.59 a	0.57 a	30.5 c	31.5 c
15	15.2 b	18.3 b	0.55 a	0.55 b	31.5b	33.3b
30	18.5 a	18.7 a	0.55 a	0.54 c	32.1 a	34.7 a
T*S significant	NS	NS	**	NS	NS	NS

Means having the same letter (s) in each column are not significantly different at 5% level with DMRT
@ calculated as tartaric acid, *T1:100% vermicompost+0% mineral nitrogen, T2:80%vermicompost+20% mineral nitrogen, T3:60%vermicompost+40% mineral nitrogen, T4:40%vermicompost+60% mineral nitrogen, T5:20%vermicompost+80% mineral nitrogen and T6:100% mineral nitrogen (control).

3-3: Total sugar, reducing sugar and non-reducing sugar (%).

Data in Table 7 reveal that total, reducing and non- reducing sugar of Flame Seedless grapes were significantly affected by vermicompost treatments in both seasons. T3 gave the highest values of total sugar, reducing sugar and non-reducing sugar (18.6% and 18.9%), (15.8% and 15.9%) & (2.7% and 2.9%) in the two seasons, respectively. Also, results cleared that T6 showed the lowest results in this sphere. Data clear that the total sugar, reducing sugar and non-reducing sugar increased with advancing the storage period. Total sugar, reducing sugar and non-reducing sugar recorded lowest value before cold storage (zero time cold storage) against the highest value for those stored for 30 days. This result may be attributed to the reduction in moisture content, degradation of complex insoluble compounds to simple soluble compounds and accumulation of sugars in fruit Juice Morga *et al.* (1979). Our data go in line with Mohit & Rajesh (2014), treated mango trees with different organic fertilizer (farm yard manure, vermicompost, poultry manure and

neem cake). The result showed the maximum total sugar, reducing sugar and non-reducing sugar content from the 2 days of storage to 8 days of storage was found maximum in 75 kg poultry manure per tree during both the years. These results agreed with those obtained by Rai *et al.* (2009) showed that, application of 40 kg vermicompost per tree significantly increased the quality parameters total sugar and reducing sugars content of pear cultivar.

Table 7: Effect of partial substitution of vermicompost and cold storage (0 °C & 90-95% RH) periods on total sugar, reducing sugar and non-reducing sugar of Flame Seedless grapes at 2015 & 2016 seasons

Treatments	Total sugar (%)		Reducing sugar (%)		Non Reducing sugar (%)	
	2015	2016	2015	2016	2015	2016
Treatments (T)						
T1 (100 % V)	16.1 d	16.6 c	14.2 d	14.6 d	1.8 d	2.0 c
T2 (80% V*+ 20% MN)**	16.5 c	16.6 c	14.9 c	14.9 c	1.5 e	1.6 d
T3 (60% V+ 40% MN)	18.6 a	18.9 a	15.8 a	15.9 a	2.7 a	2.9 a
T4 (40% V+ 60% MN)	17.8 b	17.8 b	15.3 b	15.4 b	2.4 b	2.4 b
T5 (20% V+ 80% MN)	16.4 c	16.7 c	14.3 d	14.7 d	2.1 c	2.0 c
T6 (100% MN)	15.8 e	16.1 d	14.1 e	14.4 e	1.7 de	1.6 d
Storage periods (S) in day						
0	16.7 c	16.8 c	14.6 c	14.8 c	2.1 a	2.0 b
15	16.9 d	17.2 b	14.8 b	15.0 b	2.1 a	2.1 ab
30	17.0 a	17.4 a	14.9 a	15.2 a	2.2 a	2.1 a
T*S significant	**NS**	**NS**	**NS**	**NS**	**NS**	*

Means having the same letter (s) in each column for every factor are not significantly different at 5% level with DMRT .
***V : Vermicompost , ** MN: mineral nitrogen.**

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الفيرمي كومبوست كبديل للتسميد النيتروجيني المعدني وتأثيرة على المحصول وجودة الثمار والقدرة التخزينية لثمار العنب الفليم سيدلس حت ظروف الاراضي الرملية

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الملخص :

أجريت هذه الدراسة خلال موسمي ٢٠١٥-٢٠١٦ بمزرعة خاصة بطريق الخطاطبة الصحراوي محافظة المنوفية وذلك علي كرمات العنب الفليم سيدلس والتي تبلغ من العمر ٧ سنوات والمنزرعة في تربه رمليه وتروي بالتنقيط. الهدف من التجربة هو ترشيد استخدام الأسمدة النيتروجينية المعدنية بأستخدام الخلط بين الأسمدة النيتروجينية المعدنية والسماد العضوي الفيرمي كمبوست ودراسة تأثيرها علي صفات الجودة والمحصول والقدرة التخزينية للثمار. وتم إضافة سماد الفيرمي كمبوست مع السماد النيتروجيني المعدني بنسب مختلفة ١٠٠,٨٠,٦٠,٤٠,٢٠,٠ %. وخزنت الثمار في كليه الزراعة جامعة طنطا علي درجه حرارة صفر مئوي ورطوبة نسبية ٩٠-٩٥% . أظهرت النتائج أن استخدام مخلوط مكون من ٦٠% من السماد العضوي الفيرمي كمبوست مع ٤٠% من السماد النيتروجيني المعدني حقق اعلي محصول واعلي سكريات وانخفض محتوي العصير من الحموضة والنيتريت والنترات مقارنه بالكرمات التي سمدت ب ١٠٠% سماد نيتروجيني معدني. كذلك أظهرت النتائج وأن استخدام ٤٠% من السماد العضوي الفيرمي كمبوست مع ٦٠% من السماد النيتروجيني المعدني قد حققوا أقل نسبة فقد في الوزن ونسبة تالف للحبات وأقل نسبة فرط للعناقيد اثناء التخزين المبرد مقارنه بالكرمات التي سمدت ب ١٠٠% سماد نيتروجيني معدني. كذلك أظهرت النتائج أن استخدام مخلوط مكون من ٦٠% من السماد العضوي الفيرمي كمبوست مع ٤٠% من السماد النيتروجيني المعدني أظهرت أعلي صلابة للحبات وأعلى نسبة للمواد الصلبه الكليه الذائبة وأعلى نسبة بين المواد الصلبة الكلية الذائبة والحموضة وكذلك أعلي نسبة سكريات في العصير (كلية – مختزلة – غير مختزلة).وعلي الجانب الأخر فقد انخفض محتوي العصير من الحموضة عند التخزين المبرد مقارنه بالكرمات التي سمدت ب ١٠٠% سماد نيتروجيني معدني.

وعلية يوصى باستخدام مخلوط مكون من ٦٠% من السماد العضوي الفيرمي كمبوست مع ٤٠% من السماد النيتروجيني المعدني للحصول على أعلى محصول وافضل جودة بينما يتم استخدام مخلوط ٤٠% من السماد العضوي الفيرمي كمبوست مع ٦٠% من السماد النيتروجيني المعدني لتحقيق افضل قدرة تخزينية لثمار العنب "الفليم سيدلس"