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RESEARCH ARTICLE

Efficiency of organic and bio-fertilization on reducing the rates of mineral fertilizers in flame seedless vineyards

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Abstract

This study was conducted during 2018, 2019 and 2020 seasons, on 10 years old Flame Seedless grapevines, grown on the experimental vineyard of Research Station Agriculture, EL-Matana, Esna, Luxor, Egypt to study the effect of organic and bio-fertilization on vegetative growth, nutrient status, and fruiting of Flame Seedless grapevines. The experiment was arranged in a complete randomized block design with seven treatments and three replications two vine per each. The obtained results could be summarized as follow: Using the recommended dose of nitrogen (RDN) via 50 or 25% mineral plus 50 or 75% or 50% organic and bio-form significantly increased, pruning wood weight, number of leaves/shoot and leaf area as well as leaf total chlorophyll and leaf nutrient composition compared to use RDN via mineral N fertilizer alone. No significant differences on these traits due to use RDN via 50% mineral plus 50 organic or bio, double form or 25% N plus 75 bio-form and triple born. All combined fertilization treatments significantly increased the yield and improved the cluster and berry traits compared to use RDN via mineral source only. It is evident from the foregoing results that double form 50% mineral plus 50% either organic or bio or triple form (25% N plus, 75 organic and bio.) improved the vegetative growth, yield and berry quality. In addition, it minimized the production costs and reduced environmental pollution.

Keywords: Bio-fertilization; Fruiting; Berry quality; Grapevines; pollution.

1. Introduction

Grapes (*Vitis vinifera L.*) are considered as one of the most popular and favorite fruit crops in the world for being of an excellent flavor, nice taste and high nutritional value. It reached about 221709 feddans, with a total annual production of 1626259 tons according to the statistics of M.A.L.R. (2019). Flame Seedless is one of the most important cultivars grown in the Egyptian vineyards for both exportation and local market El-Salhy *et al*., (2017a).

Fertilization is one of the important managements for increasing the yield. The optimum nitrogen rate applied to table grapes usually ranges between 40 to 100 g/vine/year, depending on the soil type, climate and cultivar Khalil *et al*., (1989). The efficiency of nitrogen fertilizer under field conditions and flood irrigation rarely exceeds 50% Sahrawat, (1979). Use of the

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chemical fertilizers to overcome the low fertility of soils become more expensive item for orchard management and causes environmental pollution. Controlling chemical fertilization, especially N fertilizer is very important for reducing environmental pollution and obtaining safe produce. Using organic and bio-fertilizers could relatively good method in this respect (El-Haddad *et al*., (1993); Verna, (1999); Ram Rao *et al*., (2007) and El-Salhy *et al*., (2011).

Organic fertilization improves the soil structure, helps retention of moisture and reduces the soil pH. Also, it promotes plant growth, increases nutrient content, crop productivity, facilitates the implementation of different types of soil, and adds economic benefits for farmers. In addition, it could reduce the application of industrial fertilizers in the long term (Rasmussen & Parton, 1994 and Sala & Blidariu, (2012).

Biological fertilization relies on the application of natural fertilizers, decaying remains of organic matter, animal manure, and microorganisms such as fungi and bacteria Bejan and Vișoiu, (2010). The application of biofertilizers has many advantages. This includes reducing plant requirements of nitrogen by 25% and environmental pollution while improving the availability and uptake of various nutrients for the plant absorption and productivity of the trees Chirions *et al*., (2006).

Applications of bio-fertilizers containing beneficial micro-organisms instead of synthetic chemicals are known to improve plant growth through the supply of plant nutrients. May help to sustain environmental health and soil productivity. Nitrogen fixing cyanobacteria and effective microorganisms (EM) are used in order to improve the soil fertility, fertilizer efficiency and productivity of trees Myint, (1999); Kannaiyan, (2002) and Ahmed *et al*., (2015). They are known to improve fixation of nutrients in the rhizosphere, produce growth stimulants for plants, improve soil stability, provide biological control, biodegrade substance, recycle nutrients, promote mycorrhiza symbiosis and develop bioremediation process in soil contaminated with toxic, xenobiotic and recalcitrant substances. Additionally, the use of bio-fertilizers can improve productivity per unit area in a relatively short time, consume smaller amounts of energy, mitigate contamination of soil and water, increase soil fertility, and promote antagonism and biological control of phytopathogenic organisms Shimbio *et al*., (2001); Abdel-Hamid, (2002); Chirinos *et al*., (2006) and El-Salhy *et al*., (2006). Algae extracts are regarded as natural fertilizers which containing macronutrients - micronutrients, amino acids, and vitamins that stimulate vegetative growth, yield and fruit quality Craigie, (2010). Also, it is containing various natural plants hormones like IAA, GA3 and cytokines that role in many biological processes leading to enhances growth and yield Stirck *et al*., (2003). Supplying the various grapevine cultivar with organic or bio-fertilizers beside mineral-N source caused a pronounced increase in vegetative growth and nutritional status of vines, as well as in yield components, cluster traits and berry quality Abdel-Hady, (2003); El-Shenawy and Fayed, (2005); Abbas *et al*., (2006); Mostafa, (2008); Abdel-Monem *et al*., (2008); Abada, (2009); El-Sabagh *et al*, (2011); El-Salhy *et al*., (2011); Masoud, (2012); El-Salhy *et al*., (2017a) and El-Salhy *et al*., (2017b).

The aim of this study was to investigate the possibility of using organic and bio-fertilization partially instead of completed mineral fertilizers on growth and fruiting of Flame Seedless grapevines.

2. Materials and Methods

The present investigation was carried out in three successive seasons of 2018, 2019 and 2020 on Flame Seedless grapevines. The vines were grown in the experimental vineyard of Research Station Agriculture, EL-Matana, Esna, Luxor, Egypt, where the soil is clay. Some properties of the orchard soil were determined according to Wilde *et al*. (1985) and are present in Table (1).

Table 1. Some physical and chemical properties of the soil of the experiment site.

Soil properties	Values	Soil properties	Values
Sand %	7.5	Total N (%)	0.13
Silt %	13.5	Total K (%)	0.17
Clay %	79.0	$NaHCO_3$ extractable P (ppm)	7.8
Texture	Clay	NH_4OAC-extractable K (ppm)	463
$CaCO_3$ (%)	1.21	DTPA extractable Fe (ppm)	10.75
Organic matter (%)	1.35	DTPA extractable Mn (ppm)	12.39
pH (1:1 suspension)	7.98	DTPA extractable Zn (ppm)	1.82
ECe (dS/m^{-1})	0.97	DTPA extractable Cu (ppm)	1.63

The vines were 10 years old at the starting of this experiment and spaced at 2x3 meters apart. Forty-two vines of healthy with no visual nutrients deficiency symptoms, nearly uniform in shape, size and productivity were chosen and devoted to achieve this study. The chosen vines were received the usual agriculture practices that are used in the vineyard including irrigation and pest control. The vines were trained according to the T. shape and pruned during the second week of December by leaving 15 fruiting spurs with 4 buds each plus six replacement spurs with 2 buds each.

The experiment included the following seven treatments:

1- Application of the recommended dose of nitrogen (RDN), 80 g N/vine/year (240 g ammonium nitrate) as 100% mineral N form (controlT_1).
2- Application of the RDN as 50% mineral and 50% yeast as bio-fertilizers (T_2).
3- Application of the RDN as 50% mineral and 50% nitrobine (T_3).
4- Application of the RDN as 50% mineral and 50% algae extracts as natural fertilizers (T_4).
5- Application of the RDN as 25% mineral plus 25% organic and 50% yeast (T_5).
6- Application of the RDN as 25% mineral plus 25% organic and 50 nitrobine (T_6).
7- Application of the RDN as 25% mineral plus 25% organic and 50% algae extracts as natural fertilizer (T_7).

The experiment was set up as a complete randomized block design. Each treatment was replicated three times, two vines per each. The organic fertilizer (compost 4.9% N) was added once at first week of February. The mineral nitrogen source was ammonium nitrate (33.5% N) and it was applied at three times: growth start, immediately after berry set and at two month later. Nitrobine and yeast as bio-fertilizers and algae extracts were added in two equal batches at the growth start and one month later. Nitrobine is a bio-fertilizer which contains nitrogen fixing bacteria. Algae extracts which contents macronutrients, micronutrients, amino acids, vitamins and plants hormones, whereas yeast contains a large amount of mineral, proteins, vitamin B and cytokinins.

The following parameters were determined to evaluate the effects of different fertilization treatments on growth, nutrient status, yield and berry quality.

2.1. Vegetative growth Parameters

All vegetative growth traits i.e. main shoot length (cm), leaf area and total chlorophyll were measured in the middle of July.

The leaf area (cm^2): Twenty leaves from those opposite to basal clusters were measured according to the following equation that was reported by Ahmed and Morsy (1999)

Leaf area = 0.56 (0.79 x w2) + 20.01, where, w = the maximum leaf width.

Weight of pruning wood (kg) was estimated by weighing the removal one year old wood after pruning..

2.2. Leaf nutritional status

Samples of 30 leaves for each replication were collected from the first full mature leaves from shoots top in mid of July and leaf petioles were separated from the blades. The petioles were washed with tap water, distilled water, air-dried, oven-dried at 70°C to constant weight, then ground in a stainless steel mill. Wet digestion was done by using concentrated sulphoric acid and hydrogen peroxide for overnight. Percentages of N, P and K (on dry weight basis) were determined in the digestion according to Wilde *et al*. (1985). In addition, total chlorophylls were determined in leaves according to Von Wettstein (1957).

2.3. Yield

At harvest date (mid of June), the yield per vine in terms of weight (kg) and number of clusters per vine was recorded.

2.4. Cluster and berry characteristic

Two clusters were randomly taken from each vine to determine the cluster and berry traits such as cluster weight and cluster compactness coefficient. Berry quality such as berry weight and dimension as well as reducing sugar percentages, total soluble solids and total acidity (expressed as gm tartaric acid per 100 ml juice), berry properties were as outlined in A.O.A.C. (1985). Total anthocyanin content of berry skin was determined according to Rabino and Mancinelli, (1986). All the obtained data were tabulated and analyzed according to Gomez and Gomez, (1984) using new L.S.D. test for distinguishing the significance differences between various treatment means according to Steel and Torrie (1980).

3. Results

3.1. Growth vegetative characteristics

It can be stated from the obtained data in Tables (2 and 3) that using different sources of nitrogen fertilization on leaf area, pruning wood weight, leaf chlorophyll content and leaf mineral contents (N, P & K) of Flame Seedless grapevines in 2018, 2019 and 2020 seasons. Obtained data clarified that the results took similar trend during the three studied seasons.

In a general view, data in prementioned tables showed that the application of the required N through using 50 or 25% of the recommended dose of nitrogen (RDN) as mineral N along with 50% of organic or bio (double form), as well as 25% mineral combined 25% organic and 50% bio (triple form) significantly increased such traits compared to using RDN only as a mineral N fertilizer.

The maximum values of leaf area, pruning wood weight, leaf chlorophyll content and leaf mineral contents were recorded on the vines that were fertilized with triple form either, (25% mineral-N plus 25% organic and 50% bio-form). On other hand, the lowest values of the growth traits were recorded on the vines that were treated with 100% mineral-N (check treatment). The highest leaf area (132.6 & 130.6 cm^2), pruning wood weight (1.63 & 1.62 kg/vine), total chlorophyll (5.17 & 5.17%), leaf N (2.09 & 1.95%), leaf P (0.13 & 0.14) and leaf K (1.24 & 1.28% as an av. of the three studied seasons) were obtained due to use either double form (50% N and 50% algae extract) or triple form, (25% N + 25% organic + 50% algae extract), respectively. On other hand, the lowest values of these traits were recorded on the vines treated with 100% mineral N (control). Then, the corresponding increment percentage of leaf area, pruning wood weight, total chlorophyll and leaf NPK% were (10.96 & 9.28), (11.64 & 10.96), (11.66 & 11.66), (11.11 & 8.33), (17.95 & 21.37) and (11.71& 15.31%) as an av. the three studied season) compared to the check treatment, respectively. No significant differences were found due to fertilize by double or triple forms. Therefore, N fertilization with organic or bio-form, as well as organic plus bio-form as a partial substitute for mineral ones significantly increased the total leaf surface area, nutritional status and vegetative growth of vines.

3.2. Yield and cluster characteristics

Data presented in Tables (4 & 5) showed that using different sources of nitrogen fertilization application on yield/vine, cluster weight, berry weight, and compactness coefficient of Flame Seedless grapevines in 2018, 2019 and 2020 seasons. Using nitrogen fertilization as combination form (mineral-plus, either compost or bio-form) significantly increased the yield/vine and cluster weight and decreased compactness coefficient of cluster compared to application of N as 100% mineral fertilization. Moreover, fertilized by combined forms gave the highest values of these traits and least values of compactness coefficient comparing checked treatment. The heaviest yield and cluster weight as well as berry weight and least values of cluster compactness coefficient were detected due to fertilize by double form (50% N + 50% algae extract) or triple form (25% N + 25% compost + 50% bio-form).

The obtained highest values of yield/vine (11.88 & 11.71 kg), cluster weight (416.4 & 410.9 g), berry weight (2.80 & 2.78 g) and least cluster compactness coefficient (6.29 & 6.27) as an av. the three studied seasons due to fertilize with double form (50% N + 50% algae) or triple form (25% N + 25% compost + 50% algae), respectively. Contrarily, these values on checked vines were (10.12 kg), (371.4 g), (2.48) and (6.71), respectively. Hence, the corresponding increment percentages for these traits over check treatment were (17.39 & 15.71%), (12.12 & 10.63%) and (12.90 & 12.09%) as well as the decrement percentage of cluster compactness coefficient was (6.26 & 6.56%) as an av. the three studied seasons, respectively. No significant differences were recorded due to use double or triple form fertilization. In general, it could be concluded that combined compost and bio-form with mineral-N fertilization had positive effects on productivity of Flame Seedless grapevines.

Table 2. Effect of organic and bio-fertilization on some growth traits of Flame Seedless grapevines during 2018, 2019 and 2020 seasons.

Property	Leaf area (cm^2)				Wood pruning weight (kg)				Total chlorophyll (mg/g F.W)			
Treat.	2018	2019	2020	Mean	2018	2019	2020	Mean	2018	2019	2020	Mean
100 m.(Cont.)	120.3B	118.1B	120.2B	119.5	1.42B	1.44B	1.51B	1.46	4.58B	4.65B	4.66B	4.63
50 m. + 50 yeast	127.8A	130.2A	132.3A	130.1	1.53A	1.55A	1.62A	1.57	4.95A	5.03A	5.05A	5.01
50 m. + 50 nitrobin	129.5A	132.1A	134.5A	132.0	1.58A	1.61A	1.68A	1.62	5.14A	5.23A	5.25A	5.21
50 m. + Algae	129.7A	132.9A	135.2A	132.6	1.59A	1.62A	1.69A	1.63	5.10A	5.19A	5.21A	5.17
25 m. + 25 org. + 50 yeast	128.6A	131.1A	133.3A	131.0	1.53A	1.55A	1.62A	1.57	4.93A	5.01A	5.13A	5.02
25 m. + 25 org. + 50 nit.	127.8A	130.3A	132.5A	130.2	1.56A	1.58A	1.65A	1.60	5.00A	5.08A	5.11A	5.06
25 m. + 25 org. + 50 algae	128.3A	130.7A	132.9A	130.6	1.59A	1.61A	1.67A	1.62	5.11A	5.19A	5.22A	5.17
LSD 5%	5.33	5.16	6.10		0.08	0.08	0.08		0.23	0.22	0.22	

Table 3. Effect of organic and bio-fertilization on leaf percentage of Flame Seedless grapevines during 2018, 2019 and 2020 seasons.

Property	Leaf N %				Leaf P %				Leaf K %			
Treat.	2018	2019	2020	Mean	2018	2019	2020	Mean	2018	2019	2020	Mean
100 m. (Cont.)	1.76B	1.82B	1.82B	1.80	0.118B	0.116B	0.118B	0.117	1.11B	1.10B	1.11B	1.11
50 m. + 50 yeast	1.94A	1.98A	2.00A	1.97	0.138A	0.135A	0.136A	0.136	1.24A	1.23A	1.25A	1.24
50 m. + 50 nitrobin	1.96A	1.99A	1.99A	1.98	0.136A	0.132A	0.134A	0.134	1.29A	1.28A	1.28A	1.28
50 m. + Algae	1.98A	2.00A	2.01A	2.00	0.139A	0.137A	0.137A	0.138	1.25A	1.24A	1.24A	1.24
25 m. + 25 org. + 50 yeast	1.93A	1.97A	1.96A	1.95	0.142A	0.139A	0.140A	0.140	1.23A	1.23A	1.25A	1.24
25 m. + 25 org. + 50 nit.	1.92A	1.95A	1.97A	1.95	0.141A	0.139A	0.139A	0.140	1.23A	1.22A	1.23A	1.23
25 m. + 25 org. + 50 algae	1.93A	1.95A	1.96A	1.95	0.144A	0.140A	0.142A	0.142	1.28A	1.27A	1.28A	1.28
LSD 5 %	0.05	0.05	0.05		0.010	0.008	0.010		0.08	0.09	0.09	

Table 4. Effect of organic and bio-fertilization on yield/vine, cluster weight and cluster compactness of Flame Seedless grapevines during 2018, 2019 and 2020 seasons.

Property	Yield/vine (kg)				Cluster weight (g)				Cluster compactness coefficient			
Treat.	2018	2019	2020	Mean	2018	2019	2020	Mean	2018	2019	2020	Mean
100 m. (Cont.)	8.71B	10.65B	11.00B	10.12	362.8B	373.0B	378.3B	371.4	6.72A	6.67A	6.73A	6.71
50 m. + 50 yeast	9.80A	12.05A	12.47A	11.44	403.3A	412.8A	417.1A	411.1	6.38B	6.35B	6.32B	6.35
50 m. + 50 nitrobin	9.76A	12.72A	13.16A	11.88	401.6A	411.6A	415.0A	409.4	6.43B	6.31B	6.36B	6.37
50 m. + Algae	9.78A	12.68A	13.18A	11.88	407.5A	418.3A	423.5A	416.4	6.28B	6.27B	6.31B	6.29
25 m. + 25 org. + 50 yeast	9.61AB	12.25A	12.65A	11.50	400.4A	410.0A	413.8A	408.1	6.43B	6.39B	6.45B	6.42
25 m. + 25 org. + 50 nit.	9.90A	12.31A	12.73A	11.65	401.0A	413.0A	417.5A	410.5	6.39B	6.28B	6.31B	6.33
25 m. + 25 org. + 50 algae	9.82A	12.46A	12.85A	11.71	404.3A	412.5A	416.0A	410.9	6.33B	6.19B	6.29B	6.27
LSD 5 %	0.48	0.68	0.71		16.58	18.93	18.35		0.22	0.23	0.20	

Table 5. Effect of organic and bio-fertilization on TSS, total acidity and berry weight of Flame Seedless grapevines during 2018, 2019 and 2020 seasons.

Property	TSS%				Total acidity				Berry weight (g)			
Treat.	2018	2019	2020	Mean	2018	2019	2020	Mean	2018	2019	2020	Mean
100 m. (Cont.)	15.5B	15.8B	15.5B	15.6	0.612B	0.553B	0.589B	0.585	2.44B	2.50B	2.50B	2.48
50 m. + 50 yeast	17.2A	17.4A	17.1A	17.2	0.581A	0.528B	0.565A	0.558	2.68A	2.75A	2.78A	2.74
50 m. + 50 nitrobin	17.1A	17.3A	16.9A	17.1	0.560A	0.500B	0.533A	0.531	2.67A	2.75A	2.77A	2.73
50 m. + Algae	17.4A	17.6A	17.3A	17.4	0.558A	0.502B	0.540A	0.533	2.75A	2.82A	2.83A	2.80
25 m. + 25 org. + 50 yeast	17.1A	17.2A	17.0A	17.1	0.587A	0.534B	0.560A	0.560	2.67A	2.74A	2.76A	2.72
25 m. + 25 org. + 50 nit.	16.9A	17.1A	16.7A	16.9	0.568A	0.507B	0.550A	0.542	2.68A	2.75A	2.76A	2.73
25 m. + 25 org. + 50 algae	17.3A	17.5A	17.2A	17.3	0.564A	0.500A	0.540A	0.535	2.73A	2.80A	2.81A	2.78
LSD 5 %	0.51	0.53	0.61		0.023	0.018	0.026		0.11	0.13	0.10	

Table 6. Effect of organic and bio-fertilization on reducing sugar and anthocyanin of Flame Seedless grapevines during 2018, 2019 and 2020 seasons.

Property	Reducing sugar %				Anthocyanin (mg/100 g)			
Treat.	2018	2019	2020	Mean	2018	2019	2020	Mean
100 m. (Cont.)	14.10B	13.81B	14.45B	14.12	1.16B	1.18B	1.15B	1.16
50 m. + 50 yeast	15.31A	15.08A	15.50A	15.30	1.31A	1.33A	1.28A	1.31
50 m. + 50 nitrobin	15.41A	15.15A	15.63A	15.40	1.29A	1.32A	1.27A	1.29
50 m. + Algae	15.68A	15.43A	15.91A	15.67	1.33A	1.35A	1.32A	1.33
25 m. + 25 org. + 50 yeast	15.21A	14.94A	15.43A	15.19	1.32A	1.34A	1.30A	1.32
25 m. + 25 org. + 50 nit.	15.23A	14.98A	15.45A	15.22	1.30A	1.32A	1.29A	1.30
25 m. + 25 org. + 50 algae	15.55A	15.29A	15.78A	15.54	1.33A	1.35A	1.31A	1.33
LSD 5 %	0.48	0.62	0.59		0.05	0.05	0.06	

3.3. Chemical constituents of berry juice

Data of various berry characteristics as affected by different studied treatments during 2018, 2019 and 2020 seasons are presented in Tables (5 & 6).

The data indicated that using double or triple form of fertilization significantly improved the Flame Seedless grapes quality in terms of increasing total soluble solids, reducing sugars and anthocyanin contents and decreasing total acidity compared to checked treatment (100% mineral N).

The highest total soluble solids, reducing sugars and anthocyanin contents were (17.4%), (15.67%) and (1.33 mg/100g) as an av. of the three studied seasons obtained on vines fertilized with double form (50% N and 50% algae extract). Contrary, the least values of these traits were recorded on vines that fertilization by (100% mineral N checked treatment) which gave (15.6%), (14.12%) and (1.16) as an av. of the three studied seasons, respectively. Hence, the increment percentage of the attributers due to using fertilization via double form over the check treatment attained (11.54, 8.89 & 14.66%), respectively. The least values of acidity was recorded on vines that fertilization by double form (50% plus 50% nitrobin) was (0.531%) compared to 0.585% as an av. three studied seasons on checked vines. Hence, such amending induces decrement percentage in total acidity attained (9.23%) as an av. of the three studied seasons. No significant differences were found due to fertilize by double or triple forms.

4. Discussion

Nitrogen fertilization is one of the important tools in increasing crop yield. Nitrogen plays a key role in the nutrition of fruit trees. It is a necessary element for chlorophyll, protoplasm and nucleic acids (Nijjar, 1985).

Using the organic and bio-fertilizer as well as algae extract improve the growth and berry characteristics due to the reliable role of then on enhancing the water-holding capacity, soil structure aggregation, soil organic matter and humid substances may increase the availability of nutrients and reduce soil pH and salinity Nijjar, (1985) and Darwish *et al*., (1995). Moreover, they activate the availability uptake and translocation of most nutrients, that accelerating carbohydrate and protein synthesis and nutrient movement, encouraging cell division and development of meristematic tissues.

Bio-fertilization has an important impact on biological, physical and chemical soil properties Kannaiyan, (2002) and El-Salhy *et al*., (2006). The role of bio-fertilization on facilitating the fixation of atmospheric N as well as activating the availability uptake and translocation of most nutrients, that accelerating carbohydrate and protein synthesis and movement which aid to encouraging cell division and the development of meristematic tissues. Moreover, it is enhancing the resistance of plants to root diseases and controlling vegetative growth of trees, then, improving its productivity Gaur *et al*., (1980) and Subba Rao, (1984). In addition, the effect of 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 of improving bud burst and fertility coefficient that lead to an increase of cluster number per vine, hence the yield was increased and hastened the maturation and improved berry quality. These results of the present investigation agree with those of Abdel-Hamid (2002), Abdel-Hady (2003), El-Shenawy and Fayed (2005), Abbas *et al*. (2006), El-Salhy *et al*. (2006), Mostafa (2008), Abdel-Monem *et al*. (2008), Hegab *et al*. (2010), El-Sabagh *et al*. (2011), El-Salhy *et al*. (2011), Masoud (2012), El-Salhy *et al*. (2013), Ahmed *et al*. (2015); El-Salhy *et al*. (2017a) and El-Salhy *et al*. (2017b) concluded that application N via mineral plus organic and bio forms was improved the growth aspects, yield and berry quality of grapevines.

The fertilization applied could be improve the growth aspects and fruiting, which increased the leaf area about 11%, total chlorophyll 12%, N 11% and K 12%, as well as yield 17%, berry weight 13%, TSS 11% and anthocyanin 15%.

5. Conclusion

Therefore, it could be concluded that using 25 to 50% of nitrogen requirements plus organic and bio-form improve the vine nutrient status, yield and fruit quality leading to an increase of the packable yield. In addition, it minimizes the production costs and environmental pollution which could be occurred by excess of chemical fertilizers.

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