A comparative study on N-use efficiency of Crimson Seedless, Superior and Thompson Seedless grapevine varieties

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Abstract

A pot experiment was carried out to evaluate the growth and N-use efficiency of three grapevine varieties (Crimson Seedless, Superior and Thompson seedless). Nitrogen was added at five rates: 0, 10, 40, 80 and 120 ppm-N by using ammonium nitrate (33.5 % N) as a source of nitrogen. Plant samples were collected after two and sex weeks from the ending of nitrogen application treatments. The obtained results showed that, irrespective of varieties, increasing N-rates increased root, shoot growth and N-content but decreased N-use efficiency. However, Crimson recorded the highest values of all root, shoot growth parameters, N-content and N-use efficiency compared with the other two varieties. On the other hand, the interaction effect of N-rates and grapevine varieties showed that Crimson had the highest root length, root fineness values, root and shoot dry weight, shoot length, leaf area, N-content. Crimson recorded the highest nitrogen use efficiency at all N-rates compared with the two other grapevine varieties. Based on the result of the present study, Crimson variety can produce well under low N level and responded well to N-application.

Keywords: grapevine, fertilization, nitrogen, N-use efficiency, Crimson Seedless, Superior and Thompson Seedless

Introduction

Nitrogen (N) plays a major role in the growth and development of all parts of the grapevine. A significant amount of nitrogen is essential for normal vine growth (Bill et al., 1998). In other hand, loss of nitrogen from the vineyard can occur in several ways. Nitrogen may be lost through leaching of nitrate, since it has a negative charge and is not tightly held by the negatively charged clay and organic matter. Nitrate thus moves readily downward with deep irrigation and rainfall. In waterlogged soils, oxygen concentration is low, causing some nitrate to be reduced to gaseous nitrogen by anaerobic bacteria and lost to the atmosphere. Some ammonium may be fixed by soil mineral complexes and become unavailable to plants and microbes. Erosion of surface soils may also remove nitrogen from the vineyard (Donna, 2004).

Therefore, the potential for increasing N fertilizer efficiency in vineyards has greatly improved in recent years with new informations on N fertilizer timing, the grapevine's N demand, maximizing irrigation efficiency (Bill et al., 1998) and by identifying individual components that explained both uptake and utilization efficiency (Moll et al., 1982).

Thus, this study was outlined to evaluate the growth and N-use efficiency of Crimson seedless, Superior and Thompson seedless grape cultivars.

Materials and methods

A pot experiment was carried out during 2006 season in Pomology department nursery, Faculty of Agriculture, Cairo University, to evaluate the growth and N-use efficiency of three grapevine varieties. These varieties were Crimson Seedless, Superior and Thompson seedless. 150 uniform wood cuttings of each of Crimson, Superior and Thompson were planted in plastic pots filled with 7 kg washed sand. One month ago after planting, 60 seedlings (rooted cutting) of each variety were chosen and equally shared between five treatments, each was replicated three times and every replicate was represented by four plants. Both phosphorus and potassium were added as basal dose at the rate of 40 ppm P_2O_5 and 40 ppm K_2O / kg washed sand before planting using supper phosphate (15 % P_2O_5) and potassium sulphate (50 % K_2O) as a source of P and K, respectively.

Nitrogen added at five rates: 0, 10, 40, 80 and 120 ppm by using ammonium nitrate (33.5 % N) as a source of nitrogen. The estimated amount of nitrogen fertilizer needed per pot at each rate was fractioned into equal 4 does added weekly. These treatments were arranged in a split plot design with three replicates in each treatment. The seedlings were then irrigated with tap water three times a week during experimental periods. Plant samples (leaves, stems and roots) were collected after two (first sampling time) and sex weeks (second sampling time) from the ending of nitrogen application treatments.

Evaluation of the tested varieties and treatments was carried out through following parameters:

1- Morphological parameters:

1-1 Root parameters:

1-1-1 Number of roots per plant

1-1-2 Root dry weight (g)

1-1-3 Total root length (estimated according to Neuman, 1966)

1-1-4 Root fineness {root length (m) / root fresh weight (g), according to Ryser and lambers (1995)}.

<u>Method of measuring root length:</u>

The method is based on the assumption that if a root is laid within an area, the longer the root the more intersections it will make, an average, with the number of intersections can be used to estimate the length of root by the following equation:

$L = (\pi R N) 2H$

Where L = root length (cm) of the counted sample.

R = area of screen cm^2

N = number of intersection

H = length of hair line in the plain where the root are counted.

The N is calculated as (Sum of intersection / sum filed examined).

Root length per g of counted sample = L / C

Where C = dry weight of the counted sample.

Then: Total length of the root = (L / C) x total dry weight of the root.

1-2 Shoot parameters:

1-2-1Shoot length (cm)

1-2-2 Shoot dry weight (g)

1-2-3 Average leaf area (cm^2) using leaf area meter (model LI-3000)

Dry weight of roots and shoots (leaves and stems), were taken after drying at 70 °C

3- Chemical Measurements

3-1 Root and shoot nitrogen content

N-content was determined in the dry samples according to modified Microkeldhal method as described by Jackson (1967).

3-2 Nitrogen use efficiency

Nitrogen use efficiency was calculated as fallows::

Nitrogen use efficiency =

{Whole plant dry mater in N-fertilized soil - whole plant dry mater in zero- N soil} / rate of applied nitrogen

Statistical analysis:

The obtained data were subjected to analysis of variance according to Snedecor and Cochran (1990) and means were separated by LSD at 5 % level.

Results and Discussion

1- Effect of different nitrogen rates on the seedling growth of various grapevine varieties:

1-1 Number of roots:

In general, number of roots per seedling was significantly affected by nitrogen rates at both two samplings times (Table 1), the higher root number was obtained with 120 ppm-N at both two sampling times. Also, root number was significantly affected by grapevine varieties at the first sampling time, while this effect was insignificant at the second sampling time, Crimson recorded the highest root number at both two sampling times (Table 1).

The interaction between nitrogen rates and grapevine varieties significantly affected root number per seedling. The highest root number was obtained with Crimson seedling at 80 ppm nitrogen through the two sampling times, while Superior and Thompson varieties recorded the highest root number at 120 ppm nitrogen. This mean that Crimson variety had a lower nitrogen requirement for the maximum root number compared with Superior and Thompson varieties. Similar results were obtained by Abou Sayed-Ahmed et al. (2000), Sourial et al. (2004) and El-Shahat et al. (2006).

Table (1) Effect of different nitrogen rates on number of root / seedling of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	19.67	bc	15.33	e	14.33	e	**16.44**	B
10	20.00	bc	16.00	e	15.00	e	**17.00**	B
40	20.67	bc	16.00	e	16.67	de	**17.78**	AB
80	23.67	a	19.00	cd	16.67	de	**19.78**	A
120	21.67	ab	19.60	cd	20.33	bc	**20.53**	A
Mean	**21.13**	**A**	**17.17**	**B**	**16.60**	**B**		
Second sampling time								
0	20.67	bcd	18.33	d	18.33	d	**19.11**	B
10	21.00	bcd	20.00	cd	19.67	cd	**20.22**	AB
40	22.00	abc	20.33	cd	20.00	cd	**20.78**	AB
80	24.33	a	22.00	abc	21.33	bc	**22.56**	A
120	23.33	ab	22.33	abc	23.33	ab	**23.00**	A
Mean	**22.27**	**A**	**20.60**	**A**	**20.53**	**A**		

1-2 Root dry weight:

Generally, the data in Table (2) showed a significant differences in root dry weight as a result of increasing N-rates during both two sampling times. The highest root dry weight recorded under N application at 120 ppm-N through both sampling times with net increased about 102% and 76% in 1st and 2nd sampling time respectively compared 0 ppm-N treatment. This result came in line with the finding of Ali el al. (1999) who reported that root weight was increased by increasing N application rate from 0 to 150 mg/pot.

Table (2) Effect of different nitrogen rates on root dry weight (g / pot) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	0.80	bc	0.35	f	0.25	g	**0.47**	C
10	0.82	bc	0.49	e	0.31	fg	**0.54**	C
40	0.90	b	0.57	de	0.50	e	**0.66**	B
80	1.37	a	0.65	d	0.56	e	**0.87**	A
120	1.39	a	0.79	c	0.63	d	**0.94**	A
Mean	**1.06**	**A**	**0.57**	**B**	**0.45**	**B**		
Second sampling time								
0	1.81	d	1.42	f	0.99	g	**1.407**	B
10	2.41	b	1.59	e	1.25	f	**1.75**	B
40	2.50	b	1.94	c	1.36	f	**1.94**	AB
80	3.13	a	2.24	b	1.77	de	**2.38**	A
120	3.13	a	2.44	b	1.90	c	**2.49**	A
Mean	**2.60**	**A**	**1.93**	**B**	**1.46**	**B**		

Irrespective of N-rates, root dry weight was affected significantly by grapevine varieties. Crimson recorded significant highest root dry weight through the 1st and 2nd sampling time compared with the other grape varieties. These results are in harmony with those reported by Sourial et al. (2004) and El-Shahat et al. (2006). They showed that both root fresh and dry weight of ARG1 were increased than other grape rootstocks evaluated.

In addition such increment was pronounced when the interaction between N-rate X grape varieties was considered, through the first sampling time the highest root dry weight was observed with Crimson under 80 ppm-N while it was continued up to 120 ppm with respect Superior and Thompson . Through the second sampling time the highest root dry weight was observed with Crimson and Superior under 80 ppm-N while with Thompson it was observed under 120 ppm-N. This mean that Crimson variety had a lower nitrogen requirement for the maximum root dry weight compared with Superior and Thompson varieties This result was in harmony with El-Kassas (1976) who noted that Red Roomy had the highest increment in root weight than Thompson seedless, and the highest weight observed with high N level.

1-3 Root length:

Length of roots per plant was significantly affected by increasing N-rate from 0 to 120 ppm-N (Table 3). The longest root length was recorded with N application at 120 and 80 ppm-N though 1st and 2nd sampling time respectively. This result came in line with the finding of Stevanovic and Dzamic (1998). They reported that increased root length enhancement by nitrogen application. Also, Irrespective of N-rates, total root length was affected significantly by grapevine varieties. Crimson recorded the highest total root length in both sampling times (94.93 and 342.1 m respectively). These results are in conformity with the findings of Sourial et al. (2004). They reported a significant difference in total root length between tested grapevine varieties in both season of study. Dogridge grape vine rootstock revealed higher total length of roots / plant than Thompson seedless grapevine variety.

Regarding to the interaction effect between grapevine varieties and N-rates the data disclosed that Crimson had significantly the highest total root length compared with other grapevine varieties under all N-rates, and the highest total root length was observed with Crimson under 80 ppm-N through first and second sampling time. This mean that Crimson variety had more ability for produce longest root under different nitrogen rates compared with Superior and Thompson varieties. This result was in harmony with El-Kassas (1976) who noted that Red Roomy had the highest increment in root lenght than Thompson seedless, and the highest lenght observed with high N level.

Table (3) Effect of different nitrogen rates on total root length (m / seedling) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	82.83	b	33.13	de	15.40	f	**43.79**	C
10	78.35	b	42.26	de	17.57	f	**46.06**	C
40	85.26	b	42.26	de	28.02	ef	**51.84**	BC
80	111.30	a	45.64	d	33.42	de	**63.44**	AB
120	117.00	a	62.37	c	35.99	de	**71.78**	A
Mean	**94.93**	**A**	**45.93**	**B**	**26.08**	**C**		
Second sampling time								
0	232.9	de	187.7	f	120.2	g	**180.3**	D
10	317.1	c	203.6	ef	136.2	g	**219.0**	C
40	360.5	b	212.0	ef	147.2	g	**239.9**	B
80	431.8	a	259.1	d	198.4	ef	**296.4**	A
120	368.5	b	263.2	d	211.7	ef	**281.1**	AB
Mean	**342.1**	**A**	**225.12**	**B**	**162.7**	**B**		

1-4 Root fineness:

In general, root fineness was significantly affected by nitrogen rates at both two sampling times (Table 4), root fineness was significantly reduced by increasing N-rate to 120 ppm. In this regard data cleared that, the highest root fineness was obtained with 0 ppm-N at both two sampling times. In addition, root fineness was significantly affected by grapevine varieties at both two sampling times, Crimson recorded the highest root fineness at both two sampling time while Thompson recoded the lowest values. In other word, root fineness of Crimson exceeded that of Thomson by about 77% and 29% in 1st and 2nd sampling time respectively.

The interaction between nitrogen rates and grapevine varieties significantly affected root fineness. The highest value of root fineness was obtained with Crimson seedling at 0 ppm nitrogen, while the lowest value was obtained by Thompson under 120 ppm-N through the two sampling times. Fine roots are the main components of the root system through which plants absorb water and nutrients (De Silva, 1999), so this mean that Crimson variety had more ability for absorb nutrients such as nitrogen compared with Superior and Thompson varieties.

Table (4) Effect of different nitrogen rates on root fineness (m/g) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	20.19	a	18.41	ab	11.64	d	**16.75**	A
10	18.59	ab	16.48	bc	10.70	d	**15.26**	AB
40	18.59	ab	16.24	bc	10.61	d	**15.15**	AB
80	18.65	ab	15.21	c	10.14	d	**14.67**	AB
120	15.35	c	15.21	c	10.32	d	**13.62**	B
Mean	**18.27**	**A**	**16.31**	**A**	**10.68**	**B**		
Second sampling time								
0	33.88	a	24.62	b-e	23.73	c-f	**27.41**	A
10	26.99	bc	24.85	bcd	21.45	ef	**24.43**	AB
40	27.00	bc	20.73	f	20.75	f	**22.82**	B
80	27.22	b	22.86	def	20.51	f	**23.53**	B
120	22.91	def	21.15	f	20.47	f	**21.51**	B
Mean	**27.60**	**A**	**22.84**	**AB**	**21.38**	**B**		

1-5 Shoot length:

Results presented in Table (5) illustrate the averages shoot length as affected by different nitrogen rates. Generally, Irrespective of grapevine varieties, the obtained results showed an obvious increase in shoot length due to N application rate. In this regard, shoot gained from seedling supplied with 120 ppm-N were the longest, such trend was true in both sampling time. The matched increase values of shoot under 120 ppm-N comparing with 0 N-rate was 88.99 % in the 1st sampling time and 83.43 % in the 2nd ones. These results are in conformity, with the finding of Bavaresco et al. (2001) noted that shoot growth was increased by increasing N application rate to 16 g / pot / year. In addition, Shawky et al. (2004) on Thompson seedless grape transplants noted that, increased N from 0 to 5 g per plant resulted in the greatest shoot length.

Table (5) Effect of different nitrogen rates on shoot length (cm) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	7.50	de	5.00	fg	4.67	g	**5.72**	C
10	7.83	d	5.50	efg	5.37	fg	**6.23**	C
40	11.17	bc	5.52	efg	5.47	efg	**7.38**	BC
80	13.10	ab	8.03	d	6.10	ef	**9.08**	AB
120	13.60	a	10.57	c	8.25	d	**10.81**	A
Mean	**10.64**	**A**	**6.92**	**B**	**5.97**	**B**		
Second sampling time								
0	9.67	ef	8.57	fg	7.67	g	**8.63**	D
10	11.67	d	9.00	fg	10.73	de	**10.47**	C
40	14.67	abc	13.67	c	11.20	de	**13.18**	B
80	16.33	a	14.67	abc	14.00	c	**15.00**	A
120	15.83	a	16.00	a	15.67	ab	**15.83**	A
Mean	**13.63**	**A**	**12.38**	**A**	**11.85**	**A**		

Irrespective of N-rate, Crimson seedless had the highest shoot length compared with other two varieties at both sampling times. In this respect Crimson recorded the highest shoot length (10.64 and 13.63 cm in both sampling times respectively). Moatamed (1993), Fawzy (1998) and Sourial et al. (2004), cleared that Dograide grape transplant were always had higher shoot length than Thompson grape transplant.

Also, the statistical analysis disclosed that Crimson in the 1st sampling time recorded the highest shoot length under N rate at 80 ppm, while Superior and Thompson gaved the highest at 120 ppm-N through 1st sampling time. However, through 2nd sampling time Crimson recorded the highest shoot length at 40 ppm-N, while the other two varieties recorded the highest shoot length at 80 ppm-N.

1-6 Shoot dry weight:

Irrespective of grapevine varieties (Table 6), increasing N-rate resulted in an obvious increase in shoot dry weight associated with higher N-rate (120 ppm-N) compared to the lower one (0 ppm-N). In this regard Mitra (1988) reported that shoot dry weight recorded with the higher N does. Also, similar results were recorded with Shawky et al. (2004).

Table (6) Effect of different nitrogen rates on shoot dry weight (g / pot) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	1.26	cd	0.83	f	0.67	g	**0.92**	CD
10	1.54	c	0.86	f	0.77	fg	**1.06**	CD
40	1.79	b	0.93	def	0.85	f	**1.19**	BC
80	1.92	b	1.08	de	0.88	ef	**1.29**	B
120	2.55	a	1.33	c	1.10	d	**1.66**	A
Mean	**1.81**	**A**	**1.01**	**B**	**0.85**	**B**		
Second sampling time								
0	1.90	efg	1.48	ghi	1.21	i	**1.53**	C
10	2.20	de	1.85	e-h	1.40	hi	**1.82**	BC
40	2.79	bc	2.00	ef	1.62	f-i	**2.14**	B
80	4.10	a	2.56	cd	2.31	de	**2.99**	A
120	3.70	a	3.12	b	2.88	bC	**3.23**	A
Mean	**2.94**	**A**	**2.20**	**B**	**1.88**	**C**		

Irrespective of N-rates, Crimson grapevine had the highest shootdry weight through both two sampling times. Similar results were obtained by Sourial et al. (2004). At the first sampling time, all grape varieties recorded the highest shoot dry weight at 120 pm-N, while through second sampling time the highest weight of shoot was obtained with Crimson seedling at 80 ppm nitrogen, while Superior and Thompson varieties recorded the highest shoot weight at 120 ppm nitrogen. This mean that Crimson variety had a lower nitrogen requirement for the maximum shoot dry weight compared with Superior and Thompson varieties. This results were in line with those reported by El-Kassas (1976) who found that top fresh and dry weight were increased significantly by increased N-rate, and Red Roomy had the highest top fresh and dry weight.

1-7 Average leaf area:

In general, average leaf area per seedling was significantly affected by nitrogen rates at both two sampling time (Table 7), Irrespective of grape varieties, the highest leaf area was obtained with 120 ppm-N at both sampling times with net increase in leaf area about 56% and 49% with N applied at 120 ppm compare with control (0 ppm-N) through two sampling times respectively.

The results presented in Table (7) indicated that Crimson Seedless grapes have a highest leaf area compare with superior and Thompson. This data are in harmony with that reported by Fawzy (1998), Nikos et al. (2004) and Fallahi et al. (2005). They found that differences of leaf area between grape genotype could be attributed to the deferent of vigoration between cultivars.

The interaction between nitrogen rates and grape varieties significantly affected average leaf area per seedling. The highest average leaf area was obtained with Crimson seedling at 80 ppm nitrogen through the two sampling times, while Superior and Thompson varieties recorded the highest average leaf area at 120 ppm nitrogen. This mean that

Crimson variety had a lower nitrogen requirement for the maximum leaf area compared with Superior and Thompson varieties.

Table (7) Effect of different nitrogen rates on average leaf area (cm^2) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	54.78	de	34.33	g	33.85	g	**40.99**	C
10	56.82	de	35.67	g	34.67	g	**42.38**	C
40	69.17	b	39.67	fg	36.97	g	**48.60**	B
80	79.50	a	59.67	cd	45.48	f	**61.33**	A
120	76.00	a	64.12	bc	51.76	e	**63.96**	A
Mean	**67.25**	**A**	**46.56**	**B**	**40.54**	**B**		
Second sampling time								
0	58.50	fgh	51.33	h	39.83	i	**49.89**	C
10	61.83	d-g	54.33	gh	51.34	h	**55.84**	C
40	75.67	b	64.83	c-f	60.50	efg	**67.00**	B
80	86.67	a	65.28	c-f	69.33	bcd	**73.76**	AB
120	85.67	a	67.17	cde	71.00	bc	**74.61**	A
Mean	**73.67**	**A**	**60.59**	**B**	**58.40**	**B**		

2- Effect of different nitrogen rates on N-content of various grapevine varieties:

2-1 Root N-content

In general, root N-content was significantly affected by nitrogen rates at both two sampling times (Table 8), the highest root N-content was obtained with 120 ppm-N at both two sampling times. Also, root N-content was significantly affected by grapevine varieties at the both sampling times, where Crimson recorded the highest roots N-content at both two sampling times (Table 8).

The interaction between nitrogen rates and grapevine varieties significantly affected roots N-content. The highest values of roots N-content was obtained at 120 ppm nitrogen with Crimson only through the both two sampling times.

Table (8) Effect of different nitrogen rates on root N-content (mg/pot) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	5.47	i	2.45	j	1.79	j	**3.24**	E
10	7.79	h	5.34	i	3.58	ij	**5.58**	D
40	15.63	d	10.30	fg	9.88	gh	**11.94**	C
80	25.83	b	12.85	e	12.11	ef	**16.93**	B
120	31.86	a	19.56	c	15.87	d	**22.43**	A
Mean	**17.32**	**A**	**10.11**	**B**	**8.65**	**B**		
Second sampling time								
0	8.32	fh	7.43	h	5.00	h	**6.92**	D
10	13.88	ef	9.15	fh	8.11	gh	**10.38**	D
40	20.61	cd	17.49	de	12.14	ef	**16.75**	C
80	28.04	b	23.14	c	19.64	cd	**23.61**	B
120	39.67	a	39.6	a	29.18	b	**36.15**	A
Mean	**22.10**	**A**	**19.36**	**AB**	**14.81**	**B**		

2-2 Shoot N-content

Nitrogen content per shoot was significantly affected by increasing N-rate from 0 to 120 ppm-N (Table 9), the highest shoot N-content was obtained with 120 ppm-N at both two sampling time. This in agreement with Shawky et al. (2004). Also, shoot N-content was significantly affected by grape varieties at both two sampling time, Crimson recorded the highest significantly shoot N-content (22.78 and 40.53 mg/plant at both two sampling time respectively). This data are in line with that reported by Grant and Matthews (1996) and Keller et al. (2001).

The interaction between nitrogen rates and grape varieties significantly affected shoot N-content per seedling. The highest shoot N-content was obtained with Crimson seedling at 120 ppm nitrogen through the 1st sampling time and with 80 ppm nitrogen through the 2nd sampling time. Also, the data presented that crimson recorded the highest shoot N-content under any N-rate than Superior or Thompson. This mean that

Crimson grapevines variety had the highest ability uptake nitrogen content compared with Superior and Thompson grapevines varieties.

Crimson had a higher root dry weight, root number, root length and root fineness. This vigor root growth resulted in higher N-content compared with the other varieties (Superior and Thompson). This in agreement with Nakamura et al. (2002), Mingtan et al. (2003) and Becker et al. (2006).

Table (9) Effect of different nitrogen rates on shoot N-content (mg/pot) of various grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
0	10.01	fg	5.83	hi	5.41	i	**7.08**	D
10	13.31	ef	9.18	gh	8.80	ghi	**10.43**	D
40	17.76	cd	12.81	ef	12.15	fg	**14.24**	C
80	27.01	b	17.65	d	16.20	de	**20.29**	B
120	42.41	a	25.59	b	21.09	c	**29.70**	A
Mean	**22.10**	**A**	**14.21**	**AB**	**12.73**	**B**		
Second sampling time								
0	12.67	fgh	10.09	gh	9.12	h	**10.63**	C
10	20.14	e	19.28	ef	16.86	efg	**18.76**	B
40	30.72	d	23.01	e	20.83	e	**24.85**	B
80	71.29	a	46.58	c	44.57	c	**54.15**	A
120	67.83	a	58.44	b	56.64	b	**60.97**	A
Mean	**40.53**	**A**	**31.48**	**B**	**29.60**	**B**		

2- Nitrogen use efficiency in response to nitrogen rates and grapevine varieties:

In general, nitrogen use efficiency decreased significantly with increasing nitrogen rates and it was differed significantly among grapevine varieties (Table 10), while it was greater at lower than higher nitrogen rates through both sampling times, Crimson had the highest nitrogen use efficiency compared with tow other varieties. Results in Table (10) show that the interaction between N-rates and grapevine varieties significantly affected nitrogen use efficiency. The highest value was obtained with Crimson at lower N- rate during both sampling times.

Table (10) Nitrogen use efficiency in response to nitrogen rates and grapevine varieties.

N- rates ppm	Crimson		Superior		Thompson		Mean	
First sampling time								
10	3.43	a	3.24	a	2.33	b	**3.0**	A
40	2.24	b	1.13	cd	1.54	c	**1.64**	B
80	2.19	b	1.0	d	0.98	d	**1.39**	B
120	2.23	b	1.12	cd	1.00	d	**1.45**	B
Mean	**2.52**	**A**	**1.62**	**B**	**1.46**	**B**		
Second sampling time								
10	12.86	a	7.76	b	6.33	b	**8.98**	A
40	5.63	bc	3.73	cd	2.76	d	**4.04**	B
80	6.27	b	3.38	d	3.51	cd	**4.39**	B
120	3.71	cd	3.16	d	3.07	d	**3.31**	B
Mean	**7.12**	**A**	**4.51**	**AB**	**3.92**	**B**		

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دراسة مقارنه علىكفاءة استخدام النيتروجين فى أصناف العنب, كريمسون سيدلس و سوبيريور و طومسون سيدلس

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الملخص

نفذت تجربة أصص لتقييم النمو وكفاءة استخدام النيتروجين لثلاثة أصناف من العنب وهى كريمسون سيدلس وسبيريور وطومسون سيدلس. أضيف النيتروجين بخمسة معدلات (صفر، 10, 40, 80، 120 جزء فى المليون) باستخدام سماد نترات الأمونيوم (33.5 % نيتروجين) كمصدر للنيتروجين ولقد تم أخذ عينات النبات بعد أسبوعين وستة أسابيع من نهاية إضافة معاملات النيتروجين. وقد دلت النتائج المتحصل عليها على انه بصرف النظر عن تأثير أصناف العنب، فقد أدت زيادة معدلات النيتروجين إلى زيادة نمو كل من الجذور والأجزاء الخضرية والمحتوى النيتروجينى وقللت من كفاءة استخدام النيتروجين. علاوة على ذلك فقد أظهرت النتائج أن صنف العنب كريمسون سيدلس سجل أعلى القيم لقياسات كل من الجذور والأجزاء الخضرية والمحتوى النيتروجينى وكذلك كفاءة استخدام النيتروجين مقارنة بالصنفين الأخريين. ومن ناحية أخرى فقد دل التأثير المشترك لكل من معدلات النيتروجين وأصناف العنب على أن صنف العنب كريمسون سيدلس حقق أعلى طول للجذور وأعلى القيم لدرجة نعومة الجذر وكذلك الوزن الجاف لكل من الجذور والأجزاء الخضرية مع تحقيق أعلى طول للفرع ومساحة الورقة والمحتوى النيتروجينى. كما سجل صنف العنب كريمسون أعلى كفاءة فى استخدام النيتروجين عند كل مستويات النيتروجين بالمقارنة بالصنفين الأخريين وأنه بناء عل نتائج البحث الحالى، فان صنف العنب كريمسون سيدلس يمكن أن ينجح بدرجة جيدة فى الأراضى المنخفضة فى محتواها من النيتروجين وكذلك فأنه يستجيب بصورة أفضل لإضافة النيتروجين.