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Effect of Nitrogen and Diphenylamine on *Gladiolus hybrida* cv. Sancerre Production

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Abstract: This investigation was carried out during 2010 and 2011 seasons on *Gladiolus hybrida* cv." Sancerre" grown in 25 cm diameter clay pots at a commercial nursery, in Damanhour city, El-Beheira governorate, Egypt. The aim of this work was to study the effects of different levels of ammonium nitrate (33.5% N) at rates of (zero, 2, 4, 6 g/ plant) as a source of nitrogen and diphenylamine (98%) at rates of (zero, 100, 150, 200 ppm) as a source of amino acid on the vegetative growth, flowering, corms production and chlorophyll contents of Gladiolus (*Gladiolus hybrida* cv. "Sancerre"). From the obtained results it was concluded that treating gladiolus plants with ammonium nitrate at 6gm/plant and diphenylamine at 150 ppm improve the vegetative growth, flowering characteristics, corms production and total chlorophyll contents in the leaves of *Gladiolus* plants.

Key words: *Gladiolus hybrida* cv. "Sancerre" · Diphenylamine · Nitrogen · Vegetative growth · Flowering characteristics · Corms production

INTRODUCTION

Gladiolus is derived from the native plants of south and central Africa as well as the Mediterranean region. *Gladiolus* family *Iridaceae* is a valuable and economic flowering bulb used as a landscape plant in the home gardens, as specimen for exhibition and used in decoration as a lovely and rich colored cut flower spike with relatively long vase life. *Gladiolus* is represented by 180 species and 10000 cultivars including almost all colors [1]. In this study corms of *Gladiolus hybrida* cultivar "Sancerre" was chosen for its popularity and adaptability to the Egyptian environmental conditions. Also," Sancerre" has some important characters such as its favorable height (120 to 130 cm), sturdiness of stem is good with large flower size which is white (11.5 to 14.5 cm). Besides it can be bloomed in spring to early summer, summer and autumn consequently, the possibility of exporting of its flowers could be increased. Nutritional requirements are considered as limiting factor for gladiolus plant growth, flowering and corms production. Nitrogen is an essential element in many important metabolic compounds such amino acids, enzymes, nucleic acids and chlorophyll also essential for carbohydrate use within plant. Supplying the plant with adequate quantities of nitrogen at the right time tends to increase cell number and size on overall increase in vegetative growth production [2]. The regulation of plant growth and biosynthesis of important economic chemical constituents could be achieved through the use of different growth regulating substances. There has been a recent trend to use naturally-occurring compounds (including amino acids) to achieve such regulation. Davis [3] reported that amino acid as organic nitrogenous compounds are the building blocks in the synthesis of proteins, which are formed by a process in which ribosome's catalyze the polymerization of amino acids. Diphenylamine $[(C_6H_5)_2NH]$ is an aromatic antioxidant amine, a plant growth regulator and a fungicide, beside, it has been used in a test for nitrates and for scald control on apples [4]. Abou Dahab and Abd El-Aziz [5] reported that the foliar spraying of diphenylamine at 50 or 100 ppm significantly increased plant growth of *Philodendron erubescens* plants (in terms of plant height, number of leaves/plant, stem diameter, root length, leaf area, as well as fresh and dry weights of the different plants parts).

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The objective of this work was to study the effect of different levels of nitrogen and diphenylamine and their combinations on the vegetative growth, flowering, corms and cormels production and some chemical analysis of *Gladiolus hybrida* cv. "Sancerre".

MATERIALS AND METHODS

The present study was carried out in two successive seasons; 2010 and 2011 at a commercial nursery in Damanhour city, El Beheira governorate, Egypt. Gladiolus (*Gladiolus hybrida* cv. "Sancerre") corms were planted in clay pots of 25 cm diameter at a depth of 10 cm from the soil surface, in October 15th, 2010 in the first season and repeated during the same date in the second season. The averages diameter and fresh weight of the chosen corms were 2.3 cm and 8.16 gm, respectively in both seasons. The pots were filled with a mixture of sand and fine manure at the ratio of 3:1 by volume [1]. The analysis of the used medium is presented in Table (1) was carried out in the soil testing laboratory, Desert Development Center, American University in Cairo.

There are 16 treatments which are all the possible combinations of four levels concentration of ammonium nitrate (zero, 2, 4, 6 gm/ plant) and diphenylamine (zero, 100, 150, 200 ppm). Diphenylamine [$(C_6H_5)_2NH$] was bought from a commercial laboratory for chemicals in Alexandria as a powder product with a purity of 98%. Ammonium nitrate (33.5% N) was used as a source of nitrogen fertilizer. The amount of nitrogen were divided into four equal doses, where the first one was added to the pot soil one week after planting, the other doses were applied as a top dressing at 25, 50, 75 days from planting time. The concentrations of the diphenylamine were sprayed early in the morning four times (at 30, 45, 60 and 75 days from the sprouting) on the plant foliage until the run off point. Monocalcium superphosphate (16 % P_2O_5) at a rate of 25 ppm/plant and potassium sulfate (48% K_2O) at a rate of 12 ppm/ plant were mixed with the used medium for all plants just before planting, to cover the plant requirements for phosphorus and potassium [1]. Besides, Mg and Fe fertilizers were sprayed three times at three weekly intervals on the plant foliage until the run off point at 150 and 75 ppm for Mg and Fe; respectively [6].

The following data were recorded; plant height, leaves number, leaf area according to Zidan [7], dry weight of leaves, flowering time, length of the cut spike, number of florets, florets diameter, inflorescences duration, florets dry weight, corms and cormels dry weight and total chlorophyll contents according to Rami and Porath [8].

The experimental design was a complete randomized block design in a factorial experiment with three replicates; each replicate contained three plants. Data were subjected to analysis of variance (ANOVA) using the SAS program, SAS Institute [9] and the mean values were compared using Tukey's test at $L.S.D_{0.05}$ level [10].

RESULTS AND DISCUSSION

Vegetative Growth

Plant Height (cm): The analysis of variance showed that, only the F-values of nitrogen, diphenylamine and interactions between them were significant in first season while the F-values of nitrogen and diphenylamine were significant but the interactions between them were not significant in the second season. Generally, data on means of plant height of two seasons in Table 2 showed that, using nitrogen, diphenylamine and interactions between them led to increase the plant height of gladiolus plants compared with control. The tallest plants (123.71 cm = means of the two seasons) was found by using nitrogen at 6gm / plant combined with diphenylamine at 150 ppm. These results may be due to the increasing amount of the added nitrogen which led to increase the amount of absorbed and translocated nitrogen within the plants. Besides, nitrogen is an important element in increasing many biological processes [11]. Also, the role of the amino acids such as diphenylamine in stimulating growth of several plant species, Phillips [12] indicated that several alternative routes of indole acetic acid (IAA) synthesis exist in plants, all starting from amino acids. Russell [13] indicated that the increase in growth as a result of application of amino acids may be due to their conversion into IAA.

Table 1: Mechanical analysis and some chemical properties of the used growth medium.

Mechanical analysis				Chemical properties				
Clay%	Silt%	Sand%	Soil texture	pH	EC (ds/m)	N (ppm)	P (ppm)	K (ppm)
3.6	2.8	93.5	Sandy soil	7.6	1.68	96	20.37	153.9

Table 2: Means of the plant height (cm) leaves area per plant (cm^2) and leaves dry weight (gm) of *Gladiolus hybrida*, cv. "Sancerre" as influenced by the different levels of ammonium nitrate (AN), diphenylamine (D) and their interactions (ANXD) in the two seasons of 2010 and 2011

	Main effect of Ammonium Nitrate (AN)					
	Plant height (cm)		Leaves area (cm2)		Leaves dry weight (gm)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (AN)	73.48	73.66	255.23	255.06	3.17	3.15
2 gm/plant (AN)	100.96	101.12	318.70	318.28	4.84	4.88
4 gm/plant (AN)	113.02	113.03	356.55	356.51	5.56	5.60
6 gm/plant (AN)	118.95	121.70	381.69	381.80	5.99	6.01
L.S.D $_{0.05}$	0.973	1.453	1.481	2.412	0.525	0.826
	Main effect of Diphenylamine (D)					
	Plant height (cm)		Leaves area (cm^2)		Leaves dry weight (gm)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (D)	95.83	98.68	299.98	299.71	4.19	4.19
100 ppm (D)	101.18	101.16	324.90	325.02	4.86	4.88
150 ppm (D)	104.59	104.58	337.99	337.73	5.23	5.26
200 ppm (D)	104.81	105.09	349.30	349.19	5.28	5.30
L.S.D $_{0.05}$	0.973	1.453	1.481	2.412	0.525	0.826

Main effect of interaction between (ANXD) ammonium nitrate and diphenylamine

		Plant height (cm)		Leaves area (cm^2)		Leaves dry weight (gm)	
Ammonium nitrate	Diphenylamine						
(gm/plant)	(ppm)	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
0	0	69.53	70	211.17	211.34	2.35	2.31
	100	72.63	72.7	244.83	244.93	2.95	2.81
	150	75.83	75.5	270.06	269.01	3.55	3.62
	200	75.93	76.45	294.84	294.96	3.84	3.85
2	0	97.47	97.8	299.03	297.97	4.61	4.64
	100	98.77	98.75	310.25	310.17	4.73	4.89
	150	103.17	103.1	329.37	329.4	4.96	4.94
	200	104.43	104.8	336.12	335.58	5.04	5.04
4	0	108.37	108.5	347.87	347.61	5.11	5.15
	100	111.26	110.95	350.24	350.51	5.45	5.59
	150	115.8	115.85	353.96	353.8	5.75	5.77
	200	116.63	116.81	374.15	374.13	5.89	5.92
6	0	117.93	118.41	341.86	341.93	4.72	4.69
	100	122.07	122.25	394.28	394.47	6.29	6.24
	150	123.57	123.85	398.56	398.69	6.62	6.73
	200	122.23	122.3	392.07	392.11	6.35	6.4
L.S.D$_{0.05}$ for (ANXD)		1.47	2.15	2.44	6.03	0.31	1.23

L.S.D$_{0.05}$= least significant differences at 0.05 probability.

Ammonium Nitrate (AN), Diphenylamine (D)

Leaf Area per Plant (cm^2): Data presented in Table 2 showed that, the highest significant increase in leaf area per plant was obtained by using the highest level of nitrogen (6 gm/ plant) combined with diphenylamine at 150 ppm during the two seasons, these results may be due to the increase in leaves expansion and size or both as a result the leaves area could be increased [2, 14]. Besides, Luwe [15] reported that the diphenylamine as antioxidants have the ability to prevent the environmental stress damage on plant growth and to increase the leaves area by increasing cell elongation and expansion.

Leaves Dry Weight (gm): The data recorded in two seasons showed that the nitrogen and diphenylamine increased the dry weights of the leaves compared with the control (Table, 2). The most effective treatment was the application of diphenylamine at 150 ppm and nitrogen at (6 gm/plant) this may be attributed to the role of each used factor on activation the vegetative growth. Nitrogen lead to increase the photosynthesis efficiency and thus the biosynthesis of proteins and carbohydrates could be increased, leading to increase the leaves number and size thus the accumulation of dry matter in the leaves could be

Table 3: Means of flowering time (days), number of florets and flowering duration (days) of *Gladiolus hybrid*a, cv. Sancerre as influenced by the different levels of ammonium nitrate (AN), diphenylamine (D) and their interactions (ANXD) in the two seasons of 2010 and 2011

	Main effect of Ammonium Nitrate (AN)					
	Flowering time (days)		Number of florets		Flowering duration (days)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (AN)	110.92	111	8.58	9.13	8.67	8.88
2 gm/plant (AN)	102.83	102.75	12.92	12.88	11.17	11.38
4 gm/plant (AN)	94.17	94.25	14.83	14.88	12.25	12.38
6 gm/plant (AN)	93.33	93.25	15.83	16	13.92	13.88
L.S.D $_{0.05}$	2.895	3.901	2.26	1.34	2.49	2.26
	Main effect of Diphenylamine (D)					
	Flowering time (days)		Number of florets		Flowering duration (days)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (D)	104.33	104.38	11.58	12	10.17	10.38
100 ppm (D)	100.75	100.75	13	13	11.58	11.75
150 ppm (D)	98.67	98.63	13.75	13.88	12	12.38
200 ppm (D)	97.5	97.5	13.83	14	12.25	12
L.S.D $_{0.05}$	2.895	3.901	2.26	1.34	2.49	2.26

Main effect of interaction between (ANXD) ammonium nitrate and diphenylamine

		Flowering time (days)		Number of florets		Flowering duration (days)	
Nitrogen (gm/plant)	Diphenylamine (ppm)	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
0	0	113.33	113.5	7.33	7.5	6.33	7.5
	100	112.67	112.5	8.67	9	8.67	9
	150	110.33	110.5	9	9.5	9.33	9.5
	200	107.33	107.5	9.5	9.5	10	10.5
2	0	106.67	106.5	10.67	11	11.67	11
	100	104.33	104.5	11	11.5	12.67	13
	150	101	101.5	11.33	11.5	13.33	13.5
	200	99.33	98.5	11.67	11.5	14	14
4	0	96.67	97	11.67	11.5	14.33	14.5
	100	95.33	95.5	12	12.5	14.67	14.5
	150	93.67	93	12.33	13	15	15
	200	91	91.5	13	12.5	15.33	15.5
6	0	100.67	100.5	11	11.5	14	15
	100	90.67	90.5	14.67	14	16	15.5
	150	89.67	89.5	15.33	15.5	17.33	17.5
	200	92.33	92.5	14.67	14.5	16	16
L.S.D $_{0.05}$ for (NXD)		4.37	5.78	2.01	3.7	2.35	3.35

L.S.D $_{0.05}$= least significant differences at 0.05 probability.
Ammonium Nitrate (AN), Diphenylamine (D)

increased. The diphenylamine may stimulate growth by increasing the leaves development and the size of photosynthesizing surface. These results are agreement with those obtained by Gomaa [16], Talaat *et al*. [17] and Abou Dahab and Abd El-Aziz [5].

Flowering Characteristics

Flowering Time (days): Generally, data presented in Table 3 showed that, using any level of the diphenylamine or nitrogen alone led to a significant reduction in the number of days needed for flowering, compared with the control treatment. Furthermore, the application of diphenylamine at 150 ppm and nitrogen (6 gm / plant) gave the minimum time need for flowering of gladiolus compared with other treatments in the two seasons. These results may be due to that presence of any of the used amino acids can serve as a source of energy and enhance the synthesis of auxins, organic materials and nitrogen which are essential for increasing the vegetative growth rate and accumulation of flowering materials, consequently the flowering could be hasten [18, 19].

Table 4: Means of florets diameter (cm), florets dry weight (gm) and spike length (cm) of *Gladiolus hybrid*a, cv. Sancerre as influenced by the different levels of ammonium nitrate (AN), diphenylamine (D) and their interactions (ANXD) in the two seasons of 2010 and 2011

	Main effect of Ammonium Nitrate (AN)					
	Florets diameter (cm)		Florets dry weight (gm)		Spike length (cm)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (AN)	6.16	6.06	1.31	1.34	53.85	53.74
2 gm/plant (AN)	7.53	7.58	1.7	1.71	76.03	76.04
4 gm/plant (AN)	8.77	8.76	1.99	2.01	88.04	88.16
6 gm/plant (AN)	9.33	9.34	2.94	2.28	92.91	92.89
L.S.D $_{0.05}$	0.540	0.884	0.22	0.175	1.725	3.302
	Main effect of Diphenylamine (D)					
	Florets diameter (cm)		Florets dry weight (gm)		Spike length (cm)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (D)	7.16	7.18	1.55	1.59	70.19	70.34
100 ppm (D)	7.89	7.88	1.84	1.86	77.83	77.81
150 ppm (D)	8.33	8.36	1.96	1.91	80.6	80.51
200 ppm (D)	8.41	8.33	1.97	1.97	82.21	82.16
L.S.D $_{0.05}$	0.540	0.884	0.22	0.175	1.725	3.302

Main effect of interaction between (ANXD) ammonium nitrate and diphenylamine

		Florets diameter (cm)		Florets dry weight (gm)		Spike length (cm)	
Nitrogen (gm/plant)	Diphenylamine (ppm)	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
0	0	5.03	5	1.04	1.07	46.27	46.25
	100	5.93	5.85	1.33	1.37	53.87	53.95
	150	6.73	6.8	1.39	1.43	56.33	56.1
	200	6.93	6.6	1.46	1.48	58.93	58.65
2	0	7.13	7.15	1.54	1.58	67.83	67.9
	100	7.23	7.35	1.67	1.73	74.27	74.4
	150	7.85	7.85	1.77	1.8	79.87	79.6
	200	7.93	7.95	1.81	1.95	82.17	82.25
4	0	8.47	8.45	1.93	1.95	84.5	84.85
	100	8.67	8.65	1.97	1.97	87.63	87.55
	150	8.8	8.85	2	1.99	89.03	89.1
	200	9.13	9.10	2.09	2.12	91	91.15
6	0	8	8.1	1.71	1.76	82.17	82.35
	100	9.73	9.65	2.38	2.36	95.56	95.35
	150	9.96	9.95	2.58	2.51	97.17	97.25
	200	9.63	9.65	2.51	2.48	96.73	96.6
L.S.D $_{0.05}$ for (NXD)		0.81	1.31	0.33	0.26	2.6	4.9

L.S.D0.05= least significant differences at 0.05 probability. Ammonium Nitrate (AN), Diphenylamine (D)

Number of Florets: Data in Table 3 indicated that using nitrogen at 6 gm/plant combined with diphenylamine at 150 ppm gave the highest increase in the number of florets per spike during the two seasons. These results may be due to the effect of the used factors on improving the vegetative growth and accumulation of the row materials which needed for the formation of good spikes which had many florets, these results are in harmony with those obtained by Naglaa *et al*. [14].

Flowering Duration (days): The data recorded in the two seasons showed that using any level of nitrogen combined with any level of the diphenylamine led to an increase in the flowering duration compared with the control (Table 3). These results may be due to the use of nitrogen at a suitable concentration could improve the vegetative growth of gladiolus plants, consequently the flowering quality could be increased, these results are in harmony with those obtained by Jhon *et al*. [20] and Sehrawat *et al*. [21]. Furthermore using the diphenylamine at suitable concentrations act as scavengers, helping to prevent cells and tissues damage and delay the flowering senescence as reported by Naglaa *et al*. [14].

Florets Diameter (cm): Generally, data of florets diameter of the two seasons in Table 4 indicated that using nitrogen at 6 gm per plant combined with 150 ppm of the diphenylamine gave the highest increase in florets

diameter compared with other treatments. These results may be related to effect of nitrogen and diphenylamine on improving the vegetative growth which led to an increase in the florets number and their diameter, similar trend was found by Bose *et al*. [22] and Wahba *et al*. [23].

Florets Dry Weight (gm): Data presented in Table 4 indicated that, using the highest levels of nitrogen (6 gm/plant) combined with diphenylamine at 150ppm gave the maximum dry weight of Gladiolus florets, compared with the other treatments during the two seasons. These results may be due to the effect of nitrogen and diphenylamine on improving the vegetative growth which led to the increase in florets number and florets diameter, consequently the florets dry weight per spike could be increased. These results are in harmony with those obtained by Haikal [24], Wahba *et al*. [23] and Khan and Ahmed [25].

Spike Length (cm): Data of the two seasons in Table 4 showed that, the longest spike was obtained from treating the gladiolus plant with 6 gm/plant nitrogen combined with diphenylamine at 150 ppm. These results may be due to the positive effect of nitrogen in the presence of suitable concentration of diphenylamine on the activity of the apical meristem which stimulates cell division and elongation of the spike, consequently the length of spike could be increased as reported by Singh and Uma [26].

Corm Production

Corm Diameter (cm): In general, all data of corms diameter were increased with adding the different levels of nitrogen, diphenylamine and the interactions between them compared with the control treatment. Furthermore, the best results were obtained by using nitrogen at 6 gm per plant combined with diphenylamine at 150 ppm. These results were probably due to the stimulating effect of each factor. Using nitrogen at a suitable level led to improve the vegetative growth of gladiolus plants, consequently the plants could produce a good quality of corms. These results are in agreement with Badran *et al*. [27]. Furthermore, nitrogen combined with diphenylamine had a positive effect on photosynthesis and respiration rates and leaf carbohydrate and this was reflect on the nutrients uptake and transport, consequently produced good plants which can store large amount of food in the corm, thus the corm diameter could be increased [14].

Corms and Cormels Dry Weight: Generally, data presented in Table 5 showed that using nitrogen at 6 gm per plant combined with diphenylamine at 150 ppm gave the maximum increase of corms and cormels dry weight, compared with other treatments, during the two seasons. These results may be due to the positive effect of the used factors in the stimulation of the vegetative growth and increase the back translocation and accumulation of organic matter in the new corms and cormels and finally reflexes on the corms and cormels dry weight [28, 29].

Table 5: Means of corms diameter (cm), corms dry weight (gm), Cormels dry weight (gm) and total chlorophyll contents (mg/100gm) in the leaves of *Gladiolus hybrida*, cv. Sancerre as influenced by the different levels of ammonium nitrate (AN), diphenylamine (D) and their interactions (ANXD) in the two seasons of 2010 and 2011

	Main effect of Ammonium Nitrate (AN)							
	Corms diameter (cm)		Corms dry weight (gm)		Cormels dry weight (gm)		Total chlorophyll contents of leaves (mg/100gmfw)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (AN)	3.35	3.41	2.37	2.35	1.13	1.14	170.76	171.44
2 gm/plant (AN)	3.9	3.89	3.5	3.51	2.03	2.07	219.40	220.53
4 gm/plant (AN)	4.68	4.74	4.24	4.26	3.27	3.28	263.66	263.46
6 gm/plant (AN)	4.98	4.98	4.57	4.59	3.62	3.63	300.29	300.75
L.S.D $_{0.05}$	0.218	0.424	0.191	0.173	0.165	0.192	1.704	2.335
	Main effect of Diphenylamine (D)							
	Corms diameter (cm)		Corms dry weight (gm)		Cormels dry weight (gm)		Total chlorophyll contents of leaves (mg/100gmfw)	
Treatments	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
Zero (control) (D)	3.67	3.7	3.2	3.19	1.92	1.95	196.3	196.89
100 ppm (D)	4.23	4.26	3.61	3.63	2.54	2.55	234.44	234.86
150 ppm (D)	4.47	4.5	3.83	3.83	2.73	2.75	257.99	259.04
200 ppm (D)	4.55	4.55	4.04	4.06	2.86	2.87	265.37	265.39
L.S.D $_{0.05}$	0.218	0.424	0.191	0.173	0.165	0.192	1.704	2.335

Table 5: Continue

Main effect of interaction between (ANXD) ammonium nitrate and diphenylamine									
		Corms diameter (cm)		Corms dry weight (gm)		Cormels dry weight (gm)		Total chlorophyll contents of leaves (mg/100gmfw)	
Nitrogen (gm/plant)	Diphenylamine (ppm)	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season	2010 season	2011 season
0	0	2.77	2.8	1.82	1.76	0.52	0.54	139.05	140.18
	100	3.23	3.35	2.08	2.07	1.17	1.18	157.44	158.46
	150	3.63	3.7	2.45	2.43	1.18	1.24	183.43	183.48
	200	3.77	3.8	3.12	3.13	1.64	1.61	203.13	203.67
2	0	3.77	3.7	3.08	3.04	1.57	1.63	204.17	205.58
	100	3.86	3.85	3.36	3.38	1.99	1.99	211.26	212.51
	150	3.9	3.95	3.63	3.65	2.15	2.24	228.52	230.21
	200	4.07	4.05	3.92	3.97	2.39	2.44	233.66	233.81
4	0	4.13	4.25	4	4.01	2.89	2.89	233.7	233.41
	100	4.57	4.65	4.25	4.29	3.2	3.28	258.65	258.04
	150	4.97	5	4.33	4.36	3.48	3.49	276.40	277.2
	200	5.06	5.05	4.39	4.4	3.51	3.46	285.87	285.18
6	0	4	4.05	3.91	3.95	2.7	2.75	208.29	208.38
	100	5.27	5.2	4.75	4.79	3.79	3.77	310.42	310.44
	150	5.37	5.35	4.89	4.87	4.09	4.04	343.62	345.28
	200	5.3	5.3	4.71	4.76	3.9	3.96	338.81	338.91
L.S.D $_{0.05}$ for (NXD)		0.33	0.63	0.29	0.26	0.25	0.28	2.57	3.46

L.S.D0.05= least significant differences at 0.05 probability.

Ammonium Nitrate (AN), Diphenylamine (D)

Chemical Analyses: Total Chlorophyll Content (mg/100gm): The results in the two seasons in Table 5 indicated that using the different level of nitrogen and diphenylamine alone or in combination led to significant increase in total chlorophyll contents in the leaves of Gladiolus plants as compared with the control. These results may be due attributed to that using nitrogen at a suitable level led to increase chlorophyll formation due to the importance of nitrogen in chlorophyll composition and synthesis. Besides, the used diphenylamine have the ability on keeping the chlorophyll from degradation and delaying its senescence, consequently the total chlorophyll content increased in the gladiolus leaves. This present data are in agreement with the findings of El-Maadawy [30] and Abou Dahab and Abd El-Aziz [5].

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