IJASVM

International Journal of Agricultural Sciences and Veterinary Medicine

ISSN : 2320-3730
Vol. 6, No. 1, February 2018

www.ijasvm.com

E-Mail: editorijasvm@gmail.com or editor@ijasvm.comm@gmail.com

International Journal of Agricultural Sciences and Veterinary Medicine

ISSN 2320-3730 www.ijasvm.com
Vol. 6, No. 1, February 2018

Research Paper

INFLUENCE OF DIFFERENT TREATMENTS OF NUTRITION, PUTRESCINE AND MEDIA ON CORM, CORMEL PRODUCTION AND SOME BIOCHEMICAL PARAMETERS OF TWO CULTIVARS GLADIOLUS UNDER SOILLESS CONDITION

Ali Jabbar[1*], Ali Tahranifar[1], Mahmood Shour[1] and Seyyed Hosein Nemati[1]

*Corresponding Author: Ali Jabbar, ✉ alijabbar70@yahoo.com

Received on: 25th November, 2017 Accepted on: 17th January, 2018

This experiment was conducted to evaluate the effects of Nutrition (Hoagland solution and calcium nitrate solution), putrescine (50 and 100 ppm) and coco peat: perlite medium with three ratios (v/v) (1:1, 3:1 and 1:3) on some corm, cormel parameters and some biochemical parameters of two cultivars of gladiolus (Strong and White) under soilless condition in 2016. Data indicated that most criteria of corm and cormel parameters expressed as number of corms (2.18), number of cormels (45.00), corm diameter (6.02 cm), fresh weight of corm (60.59 g), and biochemical parameters expressed as leaf soluble sugar (6.23 mg/g F.W), leaf phenols content (37.01 mg/ 100 g F.W) and flower ascorbic acid content(11.71 mg/100 g F.W) significantly increased by the application of Hoagland solution + putrescine 100 ppm, while days to corm sprouting decreased (7.46 day). In terms of media the same traits ((1.59), (33.33), (5.93 cm), (60.14 g), (4.58 mg/g F.W), (28.91 mg/100 g F.W) and (8.13 mg/100 g F.W) respectively) significantly increased by the coco peat: perlite medium with ratio (1:3), while days to corm sprouting decreased (7.90 day). In terms of cultivars also white cultivar was superior ((1.56), (32.33), (5.94 cm), (59.16 g), (4.87 mg/g F.W), (28.56 mg/100 g F.W) and (8.36 mg/100 g F.W) respectively), to strong cultivar, while days to corm sprouting decreased in white (7.09 days). Interaction between cultivars, media and treatments in term of number of cormels was significant and the highest number of cormels (48.00) obtained by white cultivar, coco peat: perlite medium with ratio (1:3) and application of Hoagland solution + putrescine 100 ppm.

Keywords: Calcium nitrate, Gladiolus, Hoagland solution, Putrescine, Soilless

INTRODUCTION

Gladiolus is a flower of glamour and perfection which is known as the queen of bulbous flowers due to its flower spikes with florets of massive form, brilliant colours, attractive shapes, varying size and excellent shelf life. Gladiolus stands

[1] Department of Horticultural Science and Landscape, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran.

fourth in the international cut flower trade after carnation, rose and chrysanthemum. Commercial floriculture is one of the most profitable agro industries in the world (Ezhilmathi *et al.*, 2008). Gladiolus (*Gladiolus grandiflorus* L.) is one of the most cultivated, economically important and common flowering plant world-wide including Iran and is among the elite cut flowers due to different shapes, hues and prolonged vase life (Bose *et al*., 2003). Gladiolus, a member of family Iridaceae and sub-family Ixidaceae, originated from South Africa, is a prominent bulbous cut flower plant. Production of healthy and vigorous corms and cormels depend on many factors, of which nutrient supply is an important one. Gladiolus requires nutrients throughout the period of growth, corm development, and flowering. So, application of suitable nutrients in an optimum amount is important. Gladiolus cormels responded better to heavy doses of fertilizers compared to corms (Mukhopadhaya, 1995). The growers do not have any recommended doses of chemical fertilizers for quality corm and cormel production. Even the flower producers multiply their seeds without applying any chemical fertilizers. As a result, they are deprived to get optimum sized corms and cormels for flower cultivation. So, there is a good scope of increasing the yield and vigorous corm and cormel production of gladiolus from cormel by the use of appropriate amount of nutrition (Khan *et al.*, 2002). Polyamine (PAs) namely putrescine (Put), spermine (Spm) and spermidine (Spd) in different plant developmental process (Martin, 2001). They modulate several growths and developmental processes viz., cell division, differentiation, flowering fruit ripening, embryogenesis, senescence and rhizogenesis (Kakkar *et al.*, 2000). In all these, PAs have been ascribed various roles such as that of a new class of plant growth regulators, hormonal second messengers and as one of the reserves of carbon and nitrogen at least in cultured tissues (Slocum and Floree, 1991). PAs regulate root development and interaction between microbes and plant roots but this function is not yet well known (Walters, 2000; Hummel *et al.*, 2002; and Couee *et al.*, 2004). It is reported that foliar application of PAs has increased some nutrients, particularly K uptake, which its vital role in photosynthesis by directly enhancing the growth and photosynthetic pigments and carbon dioxide absorption has been found (Salama, 1999). In recent years, some problems in soil culture (such as salinity and unsuitable soil characteristics) and limitation of water resources in many countries, especially in Iran, causes the expansion of soilless culture. Soilless cultures an artificial means of providing plants with support and a reservoir for nutrients and water. The use of soil in protected agriculture is facing many limitations in this country. After years of cultivation, deterioration in soil fertility and increase in soil salinity, in addition to the increase of soil-borne diseases and limited productivity of crops, have often been observed. Therefore, utilizing substrate-based agriculture is a logical alternative to the current soil-based production approach in the country. Hydroponic scientist with a lot of examination had resulted that the growth of plant have not needed soil if grower supply nutrient elements for plants by fertilization and fertigation (Papadopolus, 1994). Dobrzansks (1981) reported that the yield of gladiolus flower was highest in peat and lowest yield was found in lignite soil. Leinfelder and Rober (1989) used peat + clay, rockwool, foam, perlite and clay for raising gladiolus. They found that flower quality was similar in peat + clay, rockwool and foam, but was very inferior in clay. Sorokina *et al.* (1984) reported that bark and peat mixture was the best

media for growing ornamental plants. Ahmed (1989) reported that sand + peat, sand + leaf mould enhanced the flowering, number of flower and flower size significantly. Magnani *et al.* (2003) reported that Lapillus was compared to a traditional substrate with perlite and alternative ones with coconut fibre, either single or in a mixture can give excellent productions for the bulbous species tested. Lapillus gave good results with gladiolus, similar to those with traditional perlite, with regards to the qualitative characteristics of the stem (fresh weight and height). Slight decrease in the qualitative characteristics of lily was observed when the lapillus was used singly, whereas it allowed us to obtain very satisfying results when used in a mixture with coconut fibre. Tribulato *et al.* (2003) reported that among substrates, lavic basalt mixed with peat led to higher values of stem length and thickness and fresh weight of cut flowers. The highest plant density slightly decreased product quality, thus it seems possible to grow a high number of plants per square meter and increase the yield. Tehranifar *et al.* (2011) reported that the effect of three soilless media on growth and development of two types of *Lilium* The media were 100% coco peat, 50% gravel + 50% sand and 40% peat + 60% perlite. In general, the media of 50% gravel + 50% sand was equal compared with two other media in most of the measured traits. In the present study, we investigated the effects of different treatments of putrescine, nutrition and media on some flowering parameters and macronutrients uptake of two cultivars of gladiolus under soilless condition.

MATERIAL AND METHODS

This experiment was conducted at the glasshouse of the Department of Horticultural Science and Landscape, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran, in 2016 to study the effects of nutrition (Hoagland solution, calcium nitrate solution (1.26 g/L^{-1}) and control (only water), putrescine (50 and 100 ppm) and two media (coco peat: perlite) with three ratios (v/v) (1:1, 3:1 and 1:3) on corm, cormels and some biochemical parameters of two gladiolus cultivars (strong and white) under soilless conditions. The corms used in the experiment were purchased from a local commercial in (Mahallat). The mean size of these corms was 2.5 cm in circumference. In the present study, two gladiolus cultivars, three ratios of coco peat: perlite and 9 treatments including {T_1 control (only water), T_2 Put. 50 ppm, T_3 Put. 100 ppm, T_4 Hoagland solution, T_5 Hoagland solution + Put. 50 ppm, T_6 Hoagland solution + Put. 100 ppm, T_7 Calcium nitrate solution (1.26 g/L^{-1}), T_8 Calcium nitrate solution (1.26 g/L^{-1}) + Put. 50 ppm and T_9 Calcium nitrate solution (1.26 g/L^{-1}) + Put100 ppm} were investigated. The pots were filled by the medium (10 kg/pot) with three ratios (v/v) (1:1, 3:1 and 1:3), and then three healthy corms were planted at the depth of 10 cm the size of pot was (25 cm x 40 cm) in May 2016 with an soilless open system. Plants were irrigated 2 times every day for 5 min (the amount of water was ½ litters per each pot per day). Four weeks after planting plants were sprayed with different levels of putrescine in related treatments at the rates of 50 and 100 ppm and sprayed again before two weeks of flowering. To facilitate putrescine absorption, a few drops of twin 20 (Merk) were added to spray solutions. Bed leaching was done weekly to prevent the salt accumulation. Hoagland solution, calcium nitrate solution were set for pH = 6 and EC = 2 dS/ m^{-1}. The glasshouse day and night temperatures were 24/20 °C during the experiment. Relative humidity was adjusted at 50% and the light intensity averaged 90 mmol/

m^2/s^{-1} during the day. The standard cultural practices were followed during the entire growing period of the crop. The experiment was laid out in factorial based on completely randomized design with three factors with three replications. The observations related to the corm, cormels and some biochemical parameters were recorded at the end of the experiment. Sprouting corm was account from planted to the day of sprouting. Diameter of harvested corm was measured by using slide calipers from three plants, averaged and expressed in centimeter. Corm fresh weight was determined by weighting the corm from three plants; their mean weight was calculated and expressed in grams. Total leaf soluble sugars (mg/g/ F.W) were determined in the methnolic extract by using the phenol–sulphuric method according to Dubois *et al*. (1966), leaf Phenols content (mg/100 g/ F.W) were determined colourimetrically by using Folin Ciocaltea reagent AOAC (1985) and flower ascorbic acid concentration (mg/100 g/F.W) of gladiolus was determined by the method suggested by Hans (1992).

RESULTS AND DISCUSSION

Sprouting Corm: The results regarding sprouting corm showed the significant difference between cultivars, media and different treatments of nutrition and putrescine. Where the lowest day to sprouting corm was obtained by white cultivar (7.09 days), in comparison with strong cultivar (8.89 days). The lowest day to sprouting corm was obtained by coco peat: perlite media with the ratio of (3:1), (7.90 days). Furthermore, the lowest day to sprouting corm was in the treatment containing Hoagland solution + putrescine 100 ppm (7.46 days), (Table 1).

Number of Corms: As can be seen in Table 1, there was significant difference between the two cultivars, media and different treatments of nutrition and putrescine in terms number of corms, so that white cultivar showed higher number of corms (1.56 per plant) than strong cultivar with (1.45 per plant). The highest number of corms was obtained by coco peat: perlite media with the ratio of (3:1), (1.59 per plant). In addition, Hoagland solution + putrescine 100 ppm resulted in the production of the highest number of corms (2.01) per plant.

Number of Cormels: Data presented in Table 1 showed the significant difference between the two cultivars, media and different treatments of nutrition and putrescine in terms of number of cormels, where white cultivar showed higher number of cormels (32.33) than strong cultivar with number of cormels (30.32). Besides, coco peat: perlite medium with the ratio of 1:3 produced the highest number of cormels (33.33). Application of Hoagland solution + putrescine 100 ppm produced the highest number of cormels (45.00). As the results showed, significant interactions were found between cultivars and media, media and treatments, cultivars and treatments, and cultivars, media, and treatments. Where white cultivar, coco peat: perlite media with the ratio of 1:3 and application of Hoagland solution + putrescine 100 ppm showed highest number of cormels (48.00) (Figure 1).

Corm Diameter (cm): As can be seen in Table 2, the results showed that there was significant difference between the different treatments of nutrition and putrescine; the application of Hoagland solution + putrescine 100 ppm resulted in the largest corm diameter (8.17 cm) when compared with control (water only) with corm diameter (3.36 cm).

Fresh Weight of Corm (g): According to the data exhibited in Table 2, there was significant difference

Table 1: Main Effects of Different Treatments of Putrescine, Nutrition and Media on Corm Sprouting (Day), Number of Corms and Number of Cormels of Two Cultivars of Gladiolus Under Soilless Condition

Cultivars	Corm Sprouting (day)	Number of Corms	Number of Cormels
Strong	8.89b	1.45b	30.32b
White	7.09a	1.56a	32.33a
Media			
Cocopeat: perlite 1:1	7.98b	1.52a	31.29b
Cocopeat: perlite 3:1	8.09b	1.41c	29.35c
Cocopeat: perlite 1:3	7.90a	1.59a	33.33a
Treatments			
Control	8.64g	1.16cd	20.05i
Put. 50 ppm	8.51fg	1.22cd	22.00h
Put. 100 ppm	8.40ef	1.24cd	23.00g
Hoagland	7.76b	1.88b	41.27c
Hoagland + Put. 50 ppm	7.57ab	2.01b	43.00b
Hoagland + Put. 100 ppm	7.46a	2.18a	45.00a
Nitrate calcium	7.96de	1.27cd	27.00f
Nitrate calcium + Put. 50 ppm	7.90cd	1.27cd	29.33e
Nitrate calcium + Put. 100 ppm	7.72c	1.33c	31.27d
Significance Levels			
Cultivars	**	*	**
Media	*	*	**
Treatments	*	*	**
Cultivars x Media	ns	ns	*
Media x Treatments	ns	ns	*
Cultivars x Treatments	ns	ns	*
Cultivars x Media x Treatments	ns	ns	*

Note: Column and main effect followed by different letters are significantly different at P<0.05, Duncan's multiple range test. ns: not significant; *, ** significant at P<0.05, P<0.01, respectively.

between the two cultivars, media and different treatments of nutrition and putrescine in terms of corm fresh weight, so that white cultivar showed higher corm fresh weight (22.89 g) than strong cultivar with corm fresh weight (20.87 g). Moreover, plants in coco peat: perlite (with ratio of 1:3) showed the highest corm fresh weight (23.96 g). The results also showed that application of Hoagland solution + putrescine 100 ppm resulted in the highest corm fresh weight (35.73 g).

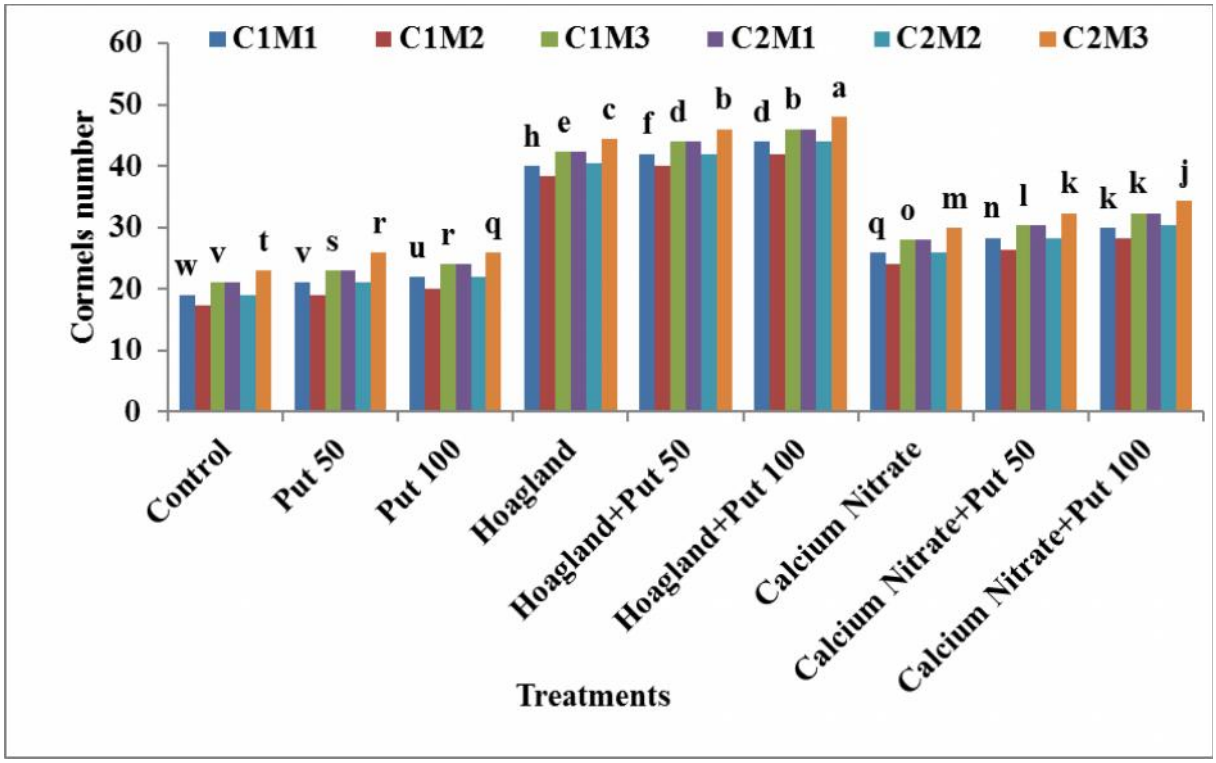
Table 2: Main Effects of Different Treatments of Putrescine, Nutrition and Media on Corm Diameter (cm) and Fresh Weight of Corm (g) of Two Gladiolus Cultivars Under Soilless Condition

Cultivars	Corm Diameter (cm)	Fresh Weight of Corm (g)
Strong	5.88a	57.20b
White	5.94a	59.16a
Media		
Coco peat: perlite (1:1)	5.92a	58.19b
Coco peat: perlite (3:1)	5.89a	56.21c
Coco peat: perlite (1:3)	5.93a	60.14a
Treatments		
Control	3.66f	33.33i
Put. 50 ppm	3.82ef	37.26h
Put. 100 ppm	3.95e	39.33g
Hoagland	7.90b	77.30c
Hoagland + Put. 50 ppm	8.03ab	79.33b
Hoagland + Put. 100 ppm	8.17a	81.37a
Nitrate calcium	5.75d	56.54f
Nitrate calcium + Put. 50 ppm	5.92cd	58.57e
Nitrate calcium + Put. 100 ppm	6.02c	60.59d
Significance Levels		
Cultivars	ns	*
Media	ns	*
Treatments	*	*
Cultivars x Media	ns	ns
Media x Treatments	ns	ns
Cultivars x Treatments	ns	ns
Cultivars x Media x Treatments	ns	ns

Note: Columns and main effects followed by different letters are significantly different at P<0.05, Duncan's multiple range test. ns: not significant; *, ** significant at P<0.05, P<0.01, respectively.

As the results showed, there was a significant difference between the two cultivars in terms of sprouting corm, number of corms, number of cormels and corm fresh weight which can be due to the genetic traits of the cultivars. These findings confirm the fact that the individual corm characteristics are cultivar specific. Similar variation in varietal response with respect to corm attributes was reported by several workers (Paswan, 1985; and Seenivasan, 2001). From the result, it was evident that where perlite rate used more than cocopeat rate (3:1), it caused sprouting easier and early. Whereas cocopeat rate used more than perlite rate (1:3) caused delay in sprouting. The possible reason related physical properties of these two media. In perlite particles are loose and more porosity and absorbs water sufficiently, which can be utilized by corm. The cocopeat particles are closely linked with very little space for aeration and high water holding capacity; hence it hinders the emergence (Khan *et al*., 2002). Coco peat is organic substrates and perlite is inorganic substrates and when mixed together become more effective in the composting process that can cause the mineralization of organic matter and change the organic forms of N and P to mineral forms (Michael and Heinrich, 2008). Coco peat has high water holding capacity which creates a poor relationship between air and water, leading to low aeration within the medium which affects oxygen diffusion to the roots (Abad *et al*., 2002). Perlite substrate with very low Cation Exchange Capacity (CEC), and good capacity of water absorption and coco peat substrate, with its high water holding capacity and nutrients can be considered as good growing media in soilless culture (Djedidi *et al*., 1999). For these reasons also can obtain the maximum corms, cormels and corm fresh weight. Application of Hoagland + putrescine 100 ppm resulted in the supply of nutrition required for growth as well as the elongation of the cells,

Figure 1: Interaction Effects Interaction of Different Treatments of Nutrition, Putrescine and Media on Number of Cormels of Two of Gladiolus Under Soilless Condition, where C1M1 = Strong Cultivar and Cocopeat: Perlite 1:1, C1M2 = Strong Cultivar and Cocopeat: Perlite 3:1, C1M3 = Strong Cultivar and Cocopeat: Perlite 1:3, C2M1 = White Cultivar and Cocopeat: Perlite 1:1, C2M2 = White Cultivar and Cocopeat: Perlite 3:1 and C2M3 = White Cultivar and Cocopeat: Perlite 1:3



thereby enhancing corm and cormel production (Thompsond and Troeh, 1975; and Kakkar *et al.*, 2000).

Biochemical Parameters

Total Leaf Soluble Sugars (mg/g): The results in Table 2 showed that the two cultivars significantly differed from each other in terms of total soluble sugars, with white cultivar showing higher total soluble sugars content (4.87 mg/g) in comparison with strong cultivar with (3.89 mg/g). In addition, the highest total soluble sugars content (4.58 mg/g) was obtained in plants grown in coco peat: perlite media (1:3 ratios). The results regarding different treatments showed that application of Hoagland solution + putrescine 100 ppm resulted in the highest total soluble sugars content (6.23 mg/g).

Leaf Phenols Content (mg/100 g): Results presented in Table 2 suggested that phenols content differed in the two cultivars. White cultivar with (28.56 mg/100 g) had higher phenols content than strong cultivar with (27.46 mg/100 g). Moreover, among the three media ratios, plants grown in coco peat: perlite (1:3) had the highest content of phenols (28.91 mg/100 g). The results also showed that treatment containing application of Hoagland solution + putrescine 100 ppm showed the highest phenols content (37.01 mg/100 g) among all the treatments.

Flower Sscorbic Acid Content (mg/100 g): Regarding ascorbic acid content, there was significant difference between the two cultivars as shown in Table 3; white cultivar with (8.36 mg/100 g) had higher ascorbic acid content in comparison with strong cultivar with (7.35 mg/100 g). Furthermore, coco peat: perlite (1:3) showed to have the highest ascorbic acid content

Table 3: Main Effects of Different Treatments of Putrescine, Nutrition and Media on Soluble Sugar (mg/g F.W), Phenols (mg/100 g F.W) and Ascorbic Acid Content (mg/100 g F.W) of Two Cultivars of Gladiolus Under Soilless Condition

Cultivars	Soluble Sugar (mg/g F.W)	Phenols (mg/100 g F.W)	Ascorbic Acid (mg/100 g F.W)
Strong	3.89b	27.46b	7.35b
White	4.87a	28.56a	8.36a
Media			
Cocopeat: perlite 1:1	4.37b	28.00b	7.86b
Cocopeat: perlite 3:1	4.19c	27.11c	7.57c
Cocopeat: perlite 1:3	4.58a	28.91a	8.13a
Treatments			
Control	2.68i	18.81i	4.66fi
Put. 50 ppm	3.15h	20.70h	5.69h
Put. 100 ppm	3.28g	21.57g	5.86g
Hoagland	5.86c	35.21c	9.27c
Hoagland + Put. 50 ppm	6.07b	36.13b	10.49b
Hoagland + Put. 100 ppm	6.23a	37.01a	11.71a
Nitrate calcium	3.87f	26.65f	6.63f
Nitrate calcium + Put. 50 ppm	4.05e	27.55e	7.58e
Nitrate calcium + Put. 100 ppm	4.23d	28.45d	8.78d
Significance Levels			
Cultivars	**	*	*
Media	*	*	*
Treatments	**	**	**
Cultivars x Media	ns	ns	ns
Media x Treatments	ns	ns	ns
Cultivars x Treatments	ns	ns	ns
Cultivars x Media x Treatments	ns	ns	ns

Note: Column and main effect followed by different letters are significantly different at P<0.05, Duncan's multiple range test. ns: not significant; *, ** significant at P<0.05, P<0.01, respectively

were (8.13 mg/100 g) among all the three medium ratios. Regarding treatments, the results showed that application of Hoagland solution + putrescine 100 ppm resulted in the highest ascorbic acid content (11.71 mg/100 g).

Biochemical parameters showed that the culture medium including perlite rate more than cocopeat rate (3:1), results to higher leaf soluble solids, phenol and ascorbic content. The possible reason may be to large leaf area where also the rate of perlite: cocopeat (3:1) had been given (data was hidden), these results may be due to the increase in leaves expansion and size or both as a result the leaf area increased which can be effective for produce highest leaf soluble solids and phenol content in leaf. Ascorbic acid is an important non-enzymatic antioxidant, the most abundant antioxidant within plants (Bolkhina *et al.,* 2003), plays a role to protect plants from oxidative damage and which also declines other stresses. It is also associated with in plant growth and development (Bedour *et al*., 2011) by acting a cofactor of several enzymes that metabolize the protein and carbohydrates synthesis, and also involved in photosynthetic process. These results are consistent with many researches (Sami, 2004; Hamtiandehkordi *et al.*, 2010; and Shabani, 2011). In the present work the results obtained from application of nutrition and sprayed Put. are in agreement with the results by (El-Bassiuony and Bekheta, 2001) as they obtained increases in the total carbohydrates content in gladiolus plants treated with Put. These increments in total carbohydrates contents may be attributed to increase in photosynthetic process efficiency, which led to increase net assimilation of leaf CO_2 which is known as the basic unit of carbohydrate. The present data are in agreement with the finding of (Youssef and Talaat, 2003) on rosemary plants, Abdel Aziz *et al*. (2006) on *Khya senegalensis* plants (Abdel Aziz *et al.*, 2007) on *Syngonium podyphyllum* L. plants, and (Farahat *et al.,* 2007) on *Cupressus sempetrirens* L. they found that foliar application of nutrition and sprayed Put. caused an increase in photosynthetic pigments and total soluble sugars content, phenols content and ascorbic acid content.

REFERENCES

1. Abad M, Noguera P, Puchades R, Maquieira A and Noguera V (2002), "Physico-Chemical and Chemical Properties of Some Coconut Dusts for Use as a Peat Substitute for Containerized Ornamental Plants", *Biores. Technol.*, Vol. 82, pp. 241-245.
2. Abd El-Aziz, Nahed G, Fatma El-Quesni E M and Farahat M M (2007), "Response of Vegetative Growth and Some Chemical Constituents of *Syngonium podophyllum* L. to Foliar Application of Thiamine, Ascorbic Acid and Kinetin at Nubaria", *World J. Agric. Sci*., Vol. 3, No. 3, pp. 301-305.
3. Ahmed K K (1989), "Effect of Different Potting Media on Different Rose Cultivars Under Plastic Tunnel", M.Sc (Agric.) Thesis, Department of Horticulture, NWFP Agricultural University Peshawar, Pakistan.
4. AOAC (1985), *Official of Analysis of the Association of Agriculture Chemist*, 13th Edition, Benjamin Franklin Station, Washigton DC, B.O. Box 450.
5. Bedour A, Leila A, Rawia A and Eid F (2011), "Improving Gladiolus Growth, Flower Keeping Quality by Using Some Vitamins Application", *J. Amer. Sci*., Vol. 7, No. 3, pp. 169-174.
6. Blokhina O, Virolainen E and Fagerstedt K

V (2003), "Antioxidant, Oxidative Damage and Oxygen Deprivations Stress", *A Rev. Ann. Bot*., Vol. 91, pp. 179-194.

7. Bose T K, Yadav L P, Pal P, Parthasarathy V A and Das P (2003), *Commercial Flowers*, Vol. 2, pp. 1-112, Naya Udyog, Kolkata, India.
8. Couee I, Hummel I, Sulmon C, Gouesbet G and ELAmrani A (2004), "Involvement of Polyamines in Root Development", *Plant Cell, Tissue and Organ Culture*, Vol. 76, pp. 1-10.
9. Djedidi M, Gerasopoulos D and Maloupa E (1999), "The Effect of Different Substrates on the Quality of "Carmelo" Tomatoes (*Lycopersicom esculentum* Mill.) Grown Under Protection in a Hydroponic System", *Cahier Option Mediterranneenes*, Vol. 31, pp. 379-383.
10. Dobrzansks J (1981), "Suitability of Different Substance for Growing Several Tomato Cultivars Under Glass", *Biuletyl Warzynizy*, Vol. 32, pp. 393-404.
11. Dubois M, Smith F, Gilles K A G, Hamilton J K and Robers P A (1966), "Colorimetric Method for Determination of Sugars and Related Substances", *Anal. Chem*., Vol. 28, pp. 350-356.
12. El-Bassiony H M and Bekheta M A (2001), "Role of Putrescine on Growth Regulation of Stomatal Aperture, Ionic Contents and Yield by Two Gladiolus Cultivars Under Salinity Stress", *E.J. Physiol. Sci*., Nos. 2-3, pp. 235-258.
13. Ezhilmathi P V Singh and Arora A (2008), "Effect of 5-Sulfosalicylic Acid on Antioxidant Activity in Relation to Vase Life of Gladiolus Cut Flowers", *Plant Growth Regulation*, Vol. 55, pp. 65-71.
14. Farahat M M, Soud Ibrahim M M, Lobna Taha S L and Fatma El-Quesni E M (2007), "Response of Vegetative Growth and Some Chemical Constituents of *Cupressus sempervirens* L. to Foliar Application of Ascorbic Acid and Zinc at Nubaria", *World J. of Agric.Sci*., Vol. 3, No. 3, pp. 282-288.
15. Hans Y S H (1992), "The Guide Book of Food Chemical Experiments", pp. 156-161, Pekin Agricultural University Press, Pekin.
16. Hematian Dehkordi M, MohamadiGhahsareh A and Kalbasi M (2010), "Effect of Palm Peat and its Mixtures with Perlite on Yield and Some Growth Index of Hydroponically Grown Cucumber", Proceedings of the 5 Red National Conference on New Ideas in Agricultural Branch, p. 215, Isfahan, Iran.
17. Hummel I, Couee I, El-Amrani A, Martin-Tanguy J and Hennion F (2002), "Involvement of Polyamines in Root Development at Low Temperature in the Sub-Antarctic Cruciferous Species *Pringlea antiscorbutica*", *Journal of Experimental Botany*, Vol. 53, pp. 1463-1473.
18. Kakkar R K, Nagar P K, Ahuja P S and Rai V K (2000), "Polyamines and Plant Morphogenesis", *Boil. Plant*., Vol. 43, pp. 1-11.
19. Khan F N, Rhaman M M, Karim A J and Hossain K M (2002), "Effects of Nitrogen and Potassium on Growth and Yield of Gladiolus Corms", *Bangladesh J. Agril. Res*., Vol. 37, No. 4, pp. 607-616.
20. Khan S, Abdul Humed K, Aqib L and Main J R (2002), "Effect of Different Media on Growth and Quality of Gladiolus (*gladiolus hortulanus*) cv. Jacksonvilla Gold)", *Asian Journal of Plant Sciences*, Vol. 6, pp. 670-675.

21. Leinfelder J and Rober R (1989), "Environmental Suitable Gladiolus Cultivation", *Cut Flower from a Closed System*, Vol. 89, pp. 948-953, Gartnerborse, und-Gartenwelt.

22. Magnani G, Grassotti A and Nesi B (2003), "Lapillus Growing Medium for Cut Bulbous Flowers in Soilless Culture", *Acta Hort*., Vol. 609, pp. 389-393.

23. Martin-Tanguy J (2001), "Metabolism and Function of Polyamines in Plants; Recent Development (New Approaches)", *Plant Growth Regulation*, Vol. 34, pp. 135-148.

24. Michael Ravin and Heinrich Lieth J (2008), "Soilless Culture: Theory and Practice", *Elsevier*, p. 571.

25. Mukhopadhyay A (1995), "Gladiolus: Publication and Information Division", *Indian Council of Agric. Res.,* pp. 1-83, Krishi Anusandhan Bhavan, New Delhi.

26. Papadopolos A P (1994), "Growing Greenhouse Seedless Cucumbers in Soil and in Soilless Media, Agricultural Canada Publication 1902/E", p. 108, Communications Branch, Agricultural and Agri-Food Canada, Ottawa, Canada.

27. Paswan L (1985), "Studies on Dormancy of Gladiolus", Ph.D. Thesis, IARI, New Delhi, India.

28. Salama Karima H A (1999), "Amelioration of Salinity Effect in Wheat Plant by Polamines", Ph.D. Thesis, Fac. Ain Shams Univ., Egypt.

29. Samiei L, Khalighi A, Kafi M and Samavat S (2004), "Peat Moss Substitutingwith Some Organic Wastesin Pothos (*Epipremnumaureum* Golden Pothos) Growing Media", *Iranian Journal of Horticultural Sience and Technology*, Vol. 6, No. 2, pp. 88-79.

30. Seenivasan N (2001), "Effect of Plant Growth Regulators on Dormancy and Growth of Gladiolus", M.Sc (Hort) Thesis, Acharya N G Ranga Agricultural University, Hyderbad, AP, India.

31. Shabani T, Peyvast G H and Olfati J (2011), "Effect of Different Substrates on Quantitative and Qualitative Traits of Three Pepper Cultivars in Soilless Culture", *J. Science and Technology of Greenhouse Culture*, Vol. 2, No. 6, pp. 11-21.

32. Slocum R D and Floree H E (1991), "Biochemistry and Physiology of Polamines in Plants", p. 264, CRC Pres, Boca Raton.

33. Sorokina L I, Kuclrnk E L and Torgasherer V V (1984), "Using Bark in Greenhouse", *Lesnaya Promysch-Lennost*, Vol. 5, pp. 92-99.

34. Tehranifar A, Selahvarzi Y and Alizadeh B (2011), "Effect of Different Growing Media on Growth and Development of Two *Lilium* (Oriental and Asiatic Hybrids) Types in Soilless Conditions", Proc. IInd IS on the Genus *Lilium.* Acta Hort, pp. 900-911.

35. Thompsond L and Troeh F (1975), "Soil and Soil Fertility", p. 495, TATA Mc Grawl Hill Publishing Company Ltd., New Delhi.

36. Tribulato A, Noto G and Argento S (2003), "Soilless Culture on Quality Production in Lily", *Acta Hort*., pp. 614-621.

37. Walters D R (2000), "Polyamines in Plants-Microbe Interactions", *Physiological and Molecular Plant Pathology*, Vol. 57, pp. 137-146.

38. Youssef A A and Iman M Talaat (2003), "Physiological Response of Rosemary Plants to Some Vitamins", *Egypt. Pharm. J.*, Vol. 1, pp. 81-93.

International Journal of Agricultural Sciences and Veterinary Medicine

Hyderabad, INDIA. Ph: +91-09441351700, 09059645577
E-mail: editorijasvm@gmail.com or editor@ijasvm.com
Website: www.ijasvm.com