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Effect Of Growing Media, Irrigation Intervals And Di Ammonium Phosphate On The Growth And Yield Of Two Carrot (*Daucus Carota* L.) Cultivars

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Abstract

The experiment was carried out (from 6th December 2013 to 20th May 2014) to study of irrigation intervals (3 and 6 days), levels of peatmoss in the sowing media (0, 6, 12 and 24%) and DAP foliar spray (the levels of 0, 1.5, 3 and 6 ml DAP.l^{-1}) on the growth and yield of two carrot (*Daucus carota* L.) cultivars (Dordogene F1 and Ten Ten). Results indicated that Dordogene F1 gave the best results for the root characters, while the best results of vegetative growth were from of Ten Ten cultivar. Three days irrigation interval, 24% peatmoss and DAP levels significantly enhanced the vegetative growth. The best interaction treatment was among Dordogene F1 with 24% peat moss, 6 ml DAP.l^{-1}and 3 days irrigation interval for root (diameter, fresh and dry weight) and the longest root was in the same cultivar, various peatmoss and DAP levels but with 6 days irrigation interval. However, the best vegetative parameters were resulted various Ten Ten interactions with the three studied factors.

Key word: (*Daucus carota* L.) growth, irrigation, sowing media, DAP.

تأثير وسط الزراعة، فترات الري وفوسفات ثنائي الامونيوم في نمو و حاصل صنفين من الجزر (*Daucus carota* L.)

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الخلاصة

تم اجراء التجربة في الفترة من 6 كانون الثاني-2013 لغايه 20 مايس - 2014 لدراسة تأثير فترات الري (3 و 6 ايام)، اربعه نسب من البيت موس في وسط الزراعة (0، 6، 12 و 24%) و التسميد الورقي بفوسفات ثنائي الامونيوم(DAP) بأربع مستويات (0، 1.5، 3 و6 مل DAP .لتر$^{-1}$) في نمو وحاصل صنفين من الجزر (*Daucus carota* L.) وهما Dordogene F1 و Ten Ten. ان الصنف Dordogene F1 اعطت افضل النتائج بالنسبة لصفات الجذر اما افضل النتائج بالنسبة لصفات النمو الخضري فكانت في الصنف Ten Ten . معامله تداخل فتره الري 3ايام، 24%بيت موس و مستويات مختلفة من DAP اعطت معنويا افضل النتائج بالنسبة للنمو الخضري لكلا الصنفين المدروسين. معامله التداخل التي اعطت افضل النتائج لصفات الجذر (القطر، الوزن الطري والجاف) هي المتمثلة بتداخل الصنفDordogene F1، 24% بيت موس، و6 مل DAP .لتر$^{-1}$ و فتره الري 3 ايام، مع انه تم الحصول على اطول جذر في تداخل مستويات مختلفة من البيت موس وDAP و نفس الصنف ولكن مع فتره الري 6 ايام . التداخل بين الصنف Ten Tenمع مختلف العوامل الثلاثة المدروسة اعطت افضل الصفات للنمو الخضري.

الكلمات المفتاحية: الجزر، النمو ، الوسط الزراعي، فترات الري، فوسفات ثنائي الامونيوم.

Introduction

Carrot (*Daucuscarota* L.) is a cool season root crop and is grown all over the world (Alam *et al*., 2010). Carrot belongs to the family Apiaceae is a biennial and is usually cultivated as an annual crop in the tropics (De Lannoy, 2001). Apiaceae is a cosmopolitan family comprising 455 genera and over 3500 species which makes this family one of the largest taxon among higher plants, the most commonly cultivated members of the family are carrot , celery , parsley and parsnip. (Baranski, 2008). Prasad (2013) found that using of 17 varieties of carrot had significant differences in germination%, yield parameters and quality evaluations (test, length and overall appearance). Carrot can be cultivated in all types of soils, but it thrives best on a deep, loose, loamy soil for early crop, contains some appreciable amount of organic matter (Singh, 2012). The organic soils were preferred by commercial growers because of there are of tillage and the use of fallow flooding to reduce pest

production (Strandberg, 1984). Organic amendments (e.g. peat and compost) are generally targeted at improving soil physical and chemical properties (Day *et al*., 1995).

Bundiniene *et al.,* (2014) studied the effect of ammonium nitrate and calcium nitrate on two carrot cultivars (Nerac F1 and Tito) growth and quality, the investigations showed that Nerac F1 was affected more than Tito cultivar. Zaccari *et al.,* (2015) found significant difference in β-carotene, Ca, Mg and Zn content of six carrot cultivars (Becria, CRS, Gonzalez, Rodriguez, Kuroda and Brasilia).

Water is the most important factor which directly influences the yield of vegetables (Siddiqui, 1995). Nortje and Henrico (1986) referred to that the young carrot seedlings are very vulnerable to physiological damage if their moisture requirements are not met and long intervals between irrigations can cause the development of thinner roots and conical shaped shoulders, while β-carotene content increase. White (1992) studied the effect of three levels of irrigation consider by soil water concentrations (48% (low), 54% (medium), and 60% (high), the high and low soil water concentrations significantly reduced the number of marketable roots over the medium concentration, the high soil water concentration reduced root length but not width relative to the medium and low soil water concentrations. Lada and Stiles (2004) indicated that the highest water demand of carrots during the root enlargement phase. Hamma, *et al.,* (2012) studied that the different levels of (irrigation and NPK fertilizer application), the irrigations scheduling at 5 days interval after irrigation and NPK fertilizer at 250 $kg.h^{-1}$ significantly enhanced the production of highest values of carrot characters measured compared with other treatments and control.

Many fertilization are improving carrot production. . Hochmuth *et al.,* (1999) found nitrogen fertilization maximized carrot root yield and quality as determined by sugar and carotenoids concentrations. Sady *et al.,* (2005) found that foliar application of the nitrogen caused significant increase in total and marketable yield and nitrogen accumulation. Ojo and Akinrinde (2010) referred to that the application of phosphorus is essential for optimum crop growth and yield of carrot. Carrot yield and nutritional quality are affected by the types of fertilizer applied, nitrogen plays a dominant role in affecting the nutritional quality of carrot root, carrot yield improved by used fertilizers nitrogen, phosphorous and potassium compared to application of organic fertilizer alone (Win, 2010). Llyas *et al*., (2013) studied the effect of Phosphorous levels on the growth and yield of carrot components, 100kg h^{-1} showed significant increase in plant high, number of umbels. $plant^{-1}$, number of umbellate.$umbel^{-1}$, number of stems.$plant^{-1}$, seed yield.$umbel^{-1}$, seed yield.$plant^{-1}$and seed yield.$plot^{-1}$. Nahar *et al.,* (2014) studied the effect of phosphorus on growth and yield of carrot, 70 $kg.h^{-1}$ showed best results, when the highest marketable yield (35.9 $t.h^{-1}$) was recorded, and the lowest (24.1$t.h^{-1}$) recorded from the control.

The purpose of this study was to evaluate the effects of growing media, irrigation intervals, foliar spraying of di ammonium phosphate and their interactions on two cultivars of carrot growth and yield.

Materials and Methods

The study was carried out (from 6th December 2013 to 20th May 2014) in Grdarasha field of Agricultural Research Center, Ministry of Agriculture - Erbil - Kurdistan Region (Latitude north 36.4˚, Longitude 44.2˚ East elevation 436m above sea) **.**

The black polyethylene bags with a diameter of 30 cm and 40cm in length were used. Each bag was filled with sandy clay soil and peat moss. Some chemical and physical properties of the soil and the peat moss are shown in table (1).

In each bag five seeds of carrot were sown directly in a depth of two cm (Relf and McDanile, 2009), thinning was done after 25 days (at two true leafs emergence) three plants were left. The planting was in the plastic house at 2.5m height, width at 5 m and length 30 m, the cover was opened in 1th March. The pesticide (Tachigaren) from Sumitomo Company used for control

damping off deceases. Monthly maximum, minimum and averages of temperature and humidity were recorded throughout the experiment period and shown in table (2).

Table (1): Chemical and physical properties of the sowing media used in the study*

Properties	soil	Peat moss
pH	8.4	5-6.5
Total nitrogen	0.20%	140mg.l^{-1}
P_2O_5	6.3ppm	160mg.l^{-1}
K_2O	120ppm	180mg.l^{-1}
Organic matter	0.2ppm	85% - 95%
Clay	200 g.$kg.^{-1}$	----
Silt	125 g.$kg.^{-1}$	----
Sand	675 g.$kg.^{-1}$	----
Soil texture(Hydrometer Method)	sandy clay loam	----

***Agricultural Research Center Erbil, Ministry of Agriculture of Kurdistan Region**

Table (2): Maximum, minimum and average air temperature and relative humidity during the period of the study for field*.

Years	Month	Air Temperature ̊C			Air Humidity %		
		maximum	Minimum	Average	maximum	minimum	Average
2013	December	19.4	-1.9	8.7	100	10.2	58.8
2014	January	1.9	18	9.8	97	13.6	66
	February	25	-0.9	10.8	96.9	12.4	45.7
	March	27.2	5.5	15.5	98.5	13.6	60.9
	April	36	3.7	20.4	11.6	90.4	42.4
	May	39.3	14.3	27.4	69.2	8.2	24.4

***Agricultural Research Center Erbil, Ministry of Agriculture of Kurdistan Region**

Two Cultivars of carrot (Dordogene F1 and TenTen) were used in this experiment. The rate of germination of Dordogene F1was 92% and for TenTen was 80%. The Dordogene F1was obtained from Syngenta company- United States of America, it is early crops number of leaves about 6-9, the root is cylindrical in shape with a round end, the average length of 18-20 cm the color of orange, root fresh weight about 7.16 g.$plant^{-1}$ (Masley, 2009), and Ten Ten was from Argeto company-Turkey, it is later crops number of leaves about 7-11, the root is cylindrical in shape with a long end, the average length of 11-17 cm the color of orange, root fresh weight about 4.16 g.$plant^{-1}$.

The method for water irrigation was modified from Prabhakar *et al*., (1991), Alam *et al*., (2010) and Hamma*et al*., (2012). The applications were in two irrigation intervals (3 and 6 days), the amount of irrigation water was 500ml.bag^{-1}, and the irrigation system was applied from 1th April till the end of the experiment.

The experiment of sowing media was prepared on four levels (0, 6, 12 and 24%) of peat moss in the sandy loam to sandy clay loam soil, this method was modified from Hasan *et al*., (2014).

DAP (N:P:K18: 44: 0 respectively) was used at the levels of 0, 1.5, 3 and 6 ml DAP.l^{-1} (El-Tohamy*et al*.,2011) for three times as foliar spraying starting on April 5th (with 10 days interval) according to their treatment.

- Experimental parameters:

At the end of experiment the plants were harvested, growth measurements were taken for all plants according to Just *et al*., (2007).

The parameters included number of leaves $Plant^{-1}$, plant height (cm), leaf fresh and dry weight (g), root length (cm), root diameter (mm), root fresh and dry weight (g). Root diameter was measured 2 cm below the collar using (digital vernier) (Mbatha, 2008 and Manosa, 2011).

The samples were dried to constant weight at 70 ˚C (Mbatha, 2008).

-Experimental design and statistical analysis:

Statistical analysis of results based on factorial complete randomized Design (F-CRD), the treatments contained one cultivars, two irrigation intervals and four di ammonium phosphate levels with three replications, each replicate was contained tow bags each with three plants. The data were submitted to analysis of variance, the means compared by (Duncan multiple range test) at probability level 5% (Al-Rawi and Khalaf-Allah 2000) using SAS system (SAS institute, 2005).

Results and Discussion

1 -Effect of cultivars:

Figure (1) shows significant effects of cultivars on all vegetative and root growth parameters of carrot except plant length. The highest values of leaves number, leaf fresh and dry weight (7.29, 4.48g and 1.01g respectively) were recorded from Ten Ten cultivar. But the best result of root length, root diameter, root fresh and dry weight (20.9cm, 17.3mm, 24.75g and 3.49g respectively) were obtained from Dordogene F1. These results were indicated that the genotype had a major role in influencing carrots production (Marta and Maniutiu, 2011), plant breeders always try to improve genotyping and phenotyping methods (Navazio, 2010).

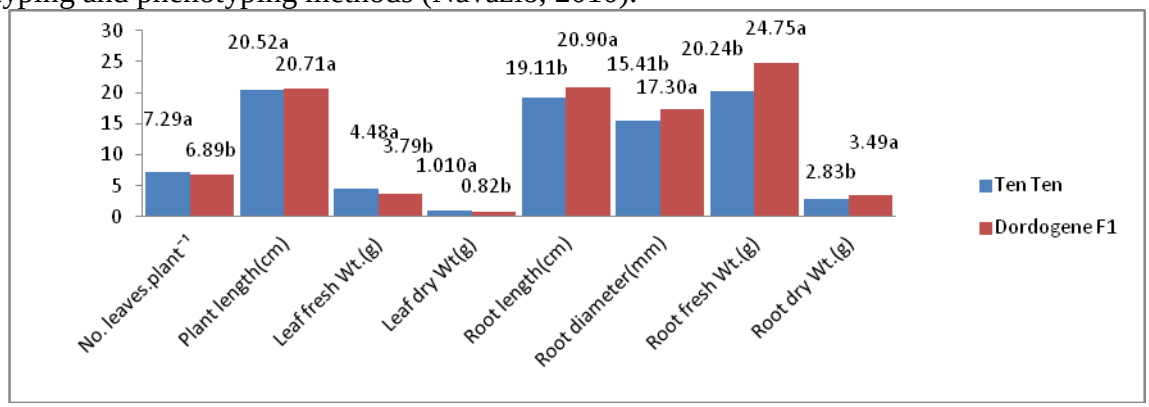

Figure (1): Effect of cultivars on vegetative and root growth characteristics of two carrot cultivars.
(A) same letter in the column indicates that there is no significant difference (p< 0.05)

2- Effect of irrigation intervals:

Figure (2) shows the effects of different irrigation intervals on vegetative and root growth parameters of carrot. The parameters except plant length were influenced significantly by different irrigation intervals. The highest values of leaves number, leaf (fresh weight, dry weight), root(diameter, fresh weight and dry weight) (7.41 No. leaves.plant^{-1}, 4.65g, 0.97mg, 17.35mm, 24.13g and 3.44g respectively) were recorded from 3 days irrigation interval and the lowest values were recorded from 6 days irrigation interval. However, the highest root length (21.29cm) was recorded from 6days irrigation interval and the lowest value was recorded from 3days irrigation interval. Our results are in agreement with the results of (Prabhakar *et al.*, 1991). The frequent irrigation with 100% replenishment of evaporation losses caused, highest root yield of carrot (Abdel- Mawly, 2004). Longer irrigation interval was producing thinner roots and reduced yield (Prabhakar *etal.*,1991).

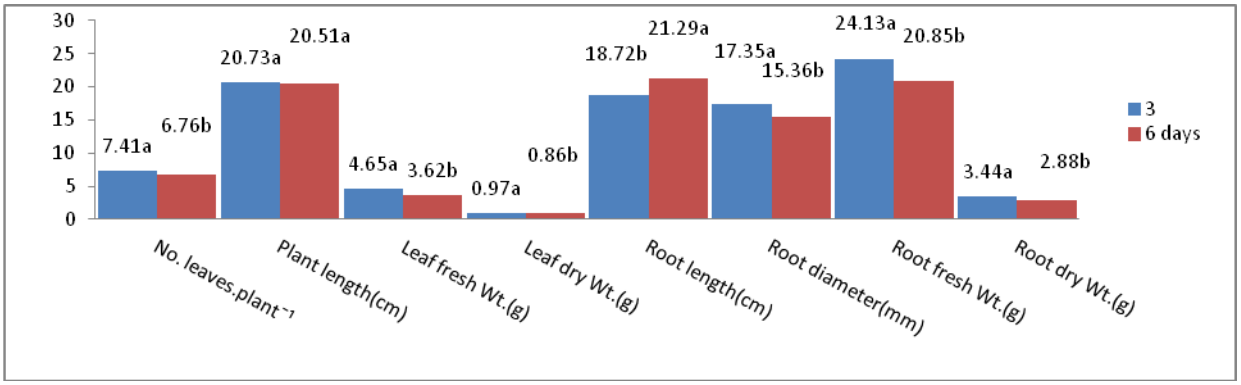

Figure (2): Effect of irrigation intervals on vegetative and root growth characteristics of two carrot cultivars.
(A) same letter in the column indicates that there is no significant difference (p< 0.05)

3-Effect of growing media:

Figure (3) shows no significant effect of different growing media on vegetative parameters the highest values of leaves number, root (length and fresh weight) (7.21No.leaves. plant^{-1}, 21.51cm and 24.22g respectively) were recorded from 24% peat moss. The lowest value of leaves number, root (length and fresh weight) were recorded from control (6.99 No.leaves. plant^{-1}, 18.34cm19.85g respectively). However, the highest values of root (diameter and dry weight) (16.80mm and 3.41g respectively) were recorded from 12% peat moss, the lowest value of were recorded from control (15.60mm and 2.80g respectively). These results are partially agree with (Mbatha, 2008 and Hasan *et al*., 2014). These results may be due to that the peat moss caused better aeration of soil media and promotes vigorous root growth, which allows rapid growth of foliage and therefore increases plant yield (Olle *et al*., 2012).

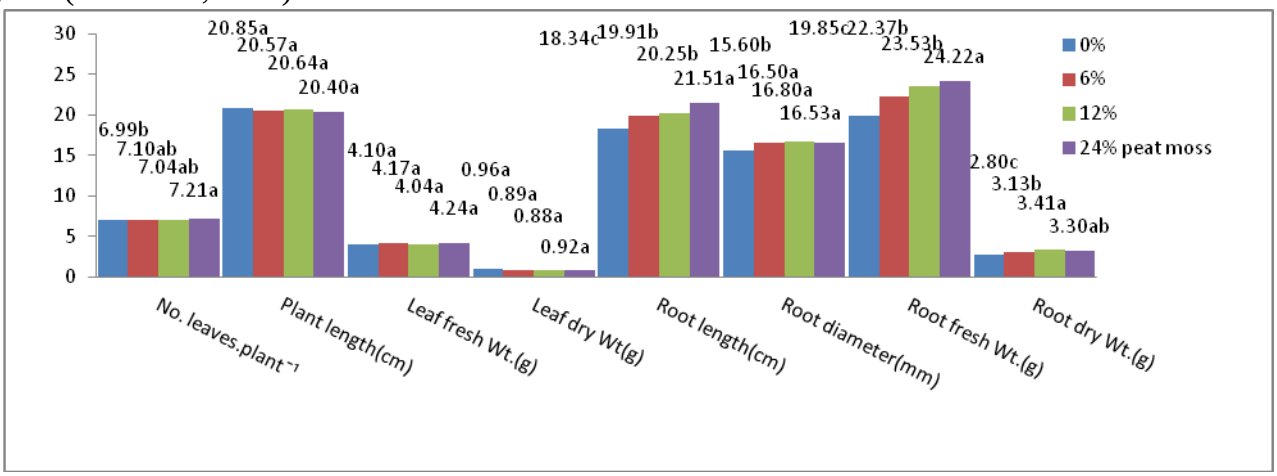

Figure (3): Effect of growing media on vegetative and root growth characteristics of two carrot cultivars
(A) same letter in the column indicates that there is no significant difference (p< 0.05))

4-Effect of DAP:

Figure (4) shows significant effects of different DAP levels on vegetative and root growth parameters of carrot. The vegetative and root characteristics increased with increasing of DAP levels over control. The highest values of leaves number, plant length, leaf fresh weight and dry weight, root length, diameter, fresh weight and dry weight (7.32, 21.07cm, 4.43g, 1.04g, 21.48cm,17.92mm, 25.86g and 3.63g respectively) were recorded from 6 ml DAP.l^{-1}when compared with the control except plant length was recorded from 1.5 ml DAP.l^{-1}, these results agree with(Abde- Mawly, 2004) and (Llyas *et al.*, 2013). The increase in yield of carrot by phosphorous application might be due to the role of phosphorous in improving soil fertility and increasing the nutrients Availability, which in result cause increasing growth and yield (Llyas *et al.*, 2013), inorganic nitrogenous fertilizer supplement readily caused to available plant nutrients or quick root development (Mehedi *et al*., 2012).

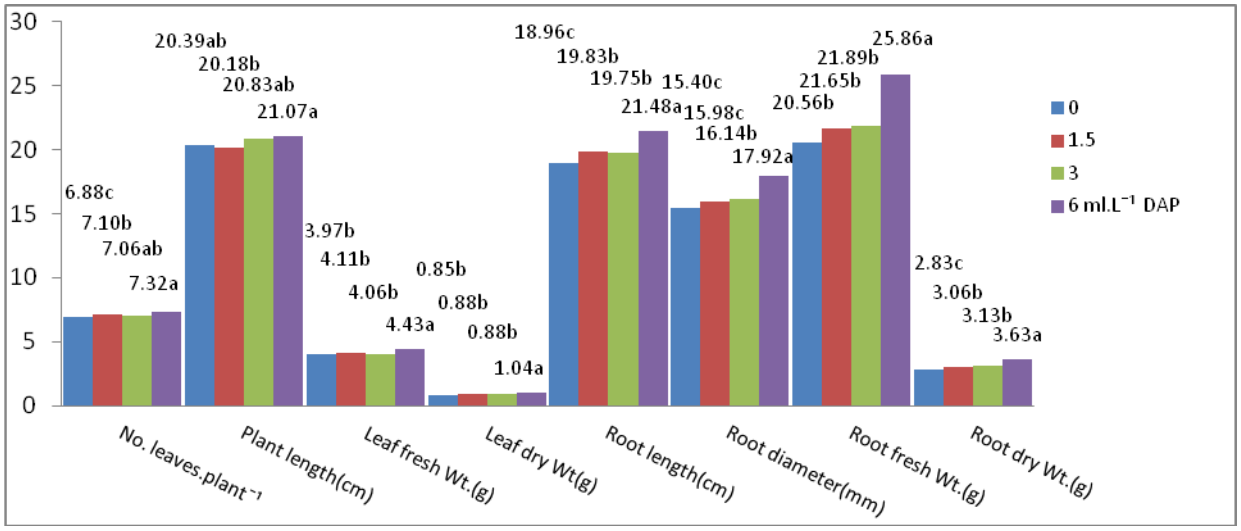

Figure (4): Effect of DAP on vegetative and root growth characteristics of two carrot cultivars.
(A) same letter in the column indicates that there is no significant difference (p< 0.05)

5- Interaction effects of cultivars and irrigation intervals:

It is evident from table (3) that cultivars and irrigation intervals interaction caused significant effects on all vegetative and root parameters except plant length. The maximum leaves number, leaf fresh weight and dry weight (7.53, 4.92g and 1.03g respectively) were recorded from the interaction of Ten Ten cultivar and 3 days irrigation interval. While the best results for root diameter, fresh and dry weight (18.64mm, 26.89g and 3.79g respectively) were recorded from interaction of Dordogene F1and 3 days irrigation interval. The highest value of root length (22.32cm) was recorded from the interaction of Dordogene F1and 6 days irrigation interval. These results partially agreement with (Alam *et al*., 2010), they mentioned to that the absorption of ample moisture throughout the growing period that facilitated lower soil strength, greater nutrient uptake and proper physical environment for better root growth and bulking, these increased the volume of root by both in length and diameter and ultimately increased the yield. It was indicated that this applicable varied on both cultivars in different irrigation intervals.

Table (3): Interaction effects of carrot cultivars and irrigation intervals on vegetative and root growth characteristics.

Cultivars	Irrigation Intervals (days)	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
Ten Ten	3	7.53a	20.26a	4.92a	1.03a	17.97d	16.07b	21.38b	3.10b
	6	7.04c	20.77a	4.05c	1.00a	20.25b	14.75c	19.09c	2.56c
Dordogene F1	3	7.30b	20.75a	4.39b	0.91a	19.47c	18.64a	26.89a	3.79a
	6	6.48d	20.68a	3.20d	0.72b	22.32a	15.97b	22.61b	3.19b

A same letter in the column indicates that there is no significant difference (p< 0.05)

6- Interaction effects of cultivars and growing media:

The data in table (4) shows that the cultivars and growing media interaction caused significant effects on all vegetative and root parameters except plant length, the maximum leaves number (7.31) was recorded from the interaction of Ten Ten cultivar and 12% peat moss and. However the maximum leaf fresh weight (3.66g) was recorded from the interaction of Ten Ten and 24% peat moss. While, the maximum leaf dry weight (1.15g) was recorded from the interaction of Ten Ten cultivar and 0% peat moss. The best results of root length, root fresh weight and dry weight (22.34cm, 28.95g and 4.03g respectively) were recorded from Dordogene F1 cultivar when was sown in 24% peat moss media. While the best result of root diameter (17.40mm) was recorded from

the interaction of Dordogene F1 and 12% peat moss interaction, our results partially agree with (Mbatha, 2008). The finding of Olle *et al*. (2012) was that the yield of various vegetables tends to be higher for the plants grown in various growing media (peat, perlite, compost and zeolite) than those grown in the soil, indicating that the growing media could meet plant demands better than the soil.

Table (4): Interaction effects of carrot cultivars and growing media on vegetative and root growth characteristics of two carrot cultivars.

Cultivars	Peat moos (%)	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
Ten Ten	0	7.26ab	20.60a	4.45a	1.15a	17.66d	14.84d	17.77d	2.51c
	6	7.20ab	20.15a	4.50a	0.95ab	18.97c	15.27cd	20.16c	2.82b
	12	7.36a	20.95a	4.44a	0.98ab	19.40c	15.88bc	21.54c	3.12b
	24	7.31a	20.36a	4.55a	0.97ab	20.42b	15.65bcd	21.49c	2.88b
Dordogene F1	0	6.72c	21.10a	3.74b	0.78b	19.02c	16.36b	21.93c	3.10b
	6	7.01b	21.00a	3.84b	0.83b	20.86b	17.73a	24.57b	3.44a
	12	6.72c	20.33a	3.66b	0.79b	21.10b	17.73a	25.53ab	3.70a
	24	7.11ab	20.43a	3.93b	0.87b	22.60a	17.40a	26.95a	3.72a

A same letter in the column indicates that there is no significant difference (p< 0.05)

7- Interaction effects of cultivars and DAP:

It is obvious from table (5) that the cultivars and DAP interaction caused significant effects on all vegetative and root parameters except plant length. The maximum leaves number (7.58) was recorded from the interaction of Ten Ten cultivar and 6ml DAP.l^{-1}. However the best results of leaf fresh and dry weight (4.86g and 1.22g respectively) were recorded from the interaction of Ten Ten and 6 ml DAP.l^{-1}. However, the best results of root length, diameter, fresh and dry weight (22.34cm, 19.71mm, 28.95g, 4.03g respectively) were recorded from the interaction of Dordogene F1 and 6 ml DAP.l^{-1}. These results partly agree with Nahar *et al*.(2014), when they found that various phosphorus levels caused significant increase of plant lengths, number of leaves, root length and diameter and root fresh weight of carrot. Results of root length, diameter, fresh and dry weight (22.34cm, 19.71mm, 28.95g and 4.03g respectively) were recorded from the interaction of Dordogene F1 and 6 ml DAP.l^{-1}. These results agree with Nahar *et al*.(2014), when they found that various phosphorus levels caused significant increase of plant lengths, number of leaves, root length and diameter and root fresh weight of carrot.

Table (5): Interaction effects of carrot cultivars and DAP on vegetative and root growth characteristics of two carrot cultivars.

Cultivars	DAP (ml.l^{-1})	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
Ten Ten	0	7.04bc	20.36a	4.22bc	0.90b	17.79d	14.58e	18.18c	2.35e
	1.5	7.31ab	20.12a	4.62ab	0.99b	19.06c	15.66cd	20.25c	2.97cd
	3	7.21b	20.70a	4.23bc	0.94b	18.98c	15.28de	19.75c	2.79d
	6	7.58a	20.89a	4.86a	1.22a	20.62b	16.12bcd	22.77b	3.23bc
Dordogene F1	0	6.71d	20.42a	3.72d	0.80b	20.13b	16.21bc	22.95b	3.31bc
	1.5	6.88cd	20.24a	3.59d	0.77b	20.60b	16.30bc	23.06b	3.16bc
	3	6.91cd	20.95a	3.88cd	0.83b	20.51b	17.00b	24.03b	3.47b
	6	7.06bc	21.25a	3.99cd	0.87b	22.34a	19.71a	28.95a	4.03a

A same letter in the column indicates that there is no significant difference (p< 0.05)

4.1.8 Interaction effects of growing media and DAP:

It is obvious from table (6) that the growing media and DAP interaction caused significant effects on all vegetative and root parameters except plant length and leaf fresh weight. The highest values of leaves number, root (length, fresh weight and dry weight) (7.73 leaves. plant^{-1}, 24.80cm, 30,74g and 3.91g respectively) were recorded from the interaction of 24% peat moss and 6 ml DAP.l^{-1}. However, the highest value of leaf dry weight (1.28g) was recorded from the interaction of 0% peat moss and 6 ml DAP.l^{-1}. While, the best results of root diameter (20.15mm) was recorded from the interaction of 24% peat moss and 6 ml DAP.l^{-1}. These results agree with Bender *et al*.(2009) when they mentioned to that the marketable yield of organic carrots was higher than that of conventionally grown carrot. Sometimes growth and development of vegetables are enhanced when plants grown in inorganic media compared to organic media (Olle *et al*.,2012).

9- Interaction effects of growing media and irrigation intervals:

Table (7) shows that the interaction of peat moss percentage and irrigation intervals led to significant effects on leaves number, leaf fresh weight, root length, root diameter, root fresh weight and root dry. The best values of leaves number, root fresh and dry weight (7.77, 26.36g and 3.63g respectively) were observed from interaction between 24% peat moss and 3 days irrigation interval. While the highest value of leaf fresh weight (4.73g) was recorded from 24% peat moss and 3 days irrigation interval. 24% peat moss with 6 days irrigation interval gave the highest value (22.91cm) of root length. The thickest root diameter (17.78mm) was obtained from the interaction between 24% peat moss and 3 days irrigation interval. Addition of inorganic substances to organic substances produces a better plant growth and higher yield probably owing to increasing water- holding capacity and aeration of peat. Better aeration of peat promotes vigorous root growth, which allows better growth of foliage and therefore increases whole yield of plants (Olle *et al*., 2012).

Table (6): Interaction effects of growing media and DAP on carrot vegetative and root growth characteristics of two carrot cultivars.

Peat moos (%)	DAP (ml.l^{-1})	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
0	0	6.65c	20.82a	3.73a	0.79b	17.17g	15.14fg	18.87f	2.40d
	1.5	6.97bc	20.64a	4.14a	0.89b	18.33fg	15.64d-g	19.39ef	2.80cd
	3	7.20b	21.02a	4.08a	0.90b	18.64ef	15.31efg	19.38ef	2.84cd
	6	7.13b	20.93a	4.45a	1.28a	19.23def	16.31c-f	21.76c-f	3.17bc
6	0	6.98bc	20.68a	3.99a	0.87b	19.74cde	15.59d-g	21.19c-f	2.90c
	1.5	7.25b	19.42a	4.04a	0.87b	20.29bcd	16.45c-f	21.63c-f	3.10bc
	3	7.12b	21.01a	4.18a	0.87b	19.16def	16.66cde	22.47cde	3.07bc
	6	7.07bc	21.19a	4.47a	0.94b	20.45bcd	17.30bc	24.18bc	3.46b
12	0	6.91bc	20.40a	4.02a	0.84b	19.11def	16.13c-f	21.54c-f	3.06cb
	1.5	7.03bc	20.70a	4.00a	0.85b	20.27bcd	16.25c-f	23.03cd	3.30bc
	3	6.90bc	20.36a	3.79a	0.88b	20.19bcd	16.91bcd	22.80cd	3.30bc
	6	7.33b	21.11a	4.39a	0.96b	21.44b	17.91b	26.76b	3.97a
24	0	6.98bc	19.66a	4.13a	0.90b	19.82cde	14.73g	20.66def	2.95cb
	1.5	7.13b	19.96a	4.25a	0.90b	20.43bcd	15.57d-g	22.57cde	3.05bc
	3	7.01bc	20.92a	4.18a	0.88b	20.99ab	15.66d-g	22.90cd	3.30bc
	6	7.73a	21.05a	4.40a	1.00ab	24.80a	20.15a	30.74a	3.91a

A same letter in the column indicates that there is no significant difference (p< 0.05)

Table (7): Interaction effects of growing media and irrigation intervals on carrot vegetative and root growth characteristics of two carrot cultivars.

Peat moos%	Irrigation interval (days)	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
0	3	7.30b	20.70a	4.63a	0.97a	16.90g	16.56b	21.32de	3.05cd
	6	6.68c	21.00a	3.56b	0.95a	19.79de	14.65d	18.38f	2.55e
6	3	7.31b	20.76a	4.71a	0.98a	19.07ef	17.39a	24.67ab	3.46ab
	6	6.90c	20.39a	3.63b	0.80a	20.75c	15.61c	20.06ef	2.80de
12	3	7.39b	20.43a	4.55a	0.93a	18.81f	17.68a	24.18bc	3.63a
	6	6.70c	20.86a	3.55b	0.83a	21.70b	15.92bc	22.89bcd	3.91bc
24	3	7.77a	20.13a	4.73a	1.00a	20.11cd	17.78a	26.36a	3.63a
	6	6.77c	20.67a	3.75a	0.84a	22.91a	15.27cd	22.07cde	2.96cd

A same letter in the column indicates that there is no significant difference (p< 0.05)

10- Interaction effects of DAP and irrigation intervals:

Result in the table (8) indicated that the interaction of DAP and irrigation intervals have significant effects on all vegetative and root characteristics except plant length. The best results of leaves number, leaf fresh dry weight), root diameter, root fresh weight and dry weight (7.84, 5.01g, 1.06g, 19.82mm, 29.06g and 4.05g respectively) were obtained from 6 ml DAP.l^{-1}and 3 days irrigation interval. Greatest average of root length (22.78cm) was obtained in the 6 ml.L^{-1} ml DAP.l^{-1} and 6 days irrigation interval. These results partially agree with Cezary *et al*. (2013). Received adequate supply of water and fertilizer which probably increased water content of every cell, and ultimately contributed to higher fresh root yield (Hamma *et al*., 2012).

Table (8): Interaction effects of DAP and irrigation intervals on carrot vegetative and root growth characteristics of two carrot cultivars.

DAP (ml.l^{-1})	Irrigation interval (days)	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
0	3	7.13b	20.18a	4.51b	0.93abc	17.68d	15.97bc	21.57bcde	3.08bcd
	6	6.62c	20.59a	3.43c	0.76c	20.24b	14.83d	19.56e	2.57e
1.5	3	7.34b	19.98a	4.58ab	0.95abc	18.62c	16.73b	22.82bc	3.34b
	6	6.85c	20.39a	3.63c	0.81bc	21.05b	15.22cd	20.49de	2.78de
3	3	7.33b	20.67a	4.52b	0.94abc	18.37cd	16.88b	23.08b	3.31b
	6	6.79c	20.98a	3.60c	0.83bc	21.12b	15.40cd	20.69cde	2.95cd
6	3	7.84a	21.19a	5.01a	1.06a	20.22b	19.82a	29.06a	4.05a
	6	6.79c	20.95a	3.84c	1.03ab	22.78a	16.01bc	22.66bcd	3.21bc

A same letter in the column indicates that there is no significant difference (p< 0.05)

11- Interaction effects of cultivars, growing media and DAP:

Significant effects of root and vegetative growth parameters were varied among the interaction treatments of cultivars, peat moss and DAP (table 9). The highest value of leaves number, plant length, root length, diameter, root fresh weight and dry weight (7.74, 21.66cm, 26.86cm, 23,13mm, 34.94g and 4.48g respectively) were measured in Dordog ene F1 with 24% peat moss and 6 ml DAP.l^{-1}treatment. The highest value of leaf fresh weight and dry weight (5.20g and 1.80g respectively) were resulted from Ten Ten, 0% peat moss and ml DAP.l^{-1}. Our results is in agreement with Ahmed *et al.*, (2014) when they suggested that the availability of nitrogen increasing which affects growth is may be due to the fact that, it enhanced vegetative growth of plant foliage, which is an important constituent of chlorophyll, amino acid and nucleic acids that caused significant increase in growth and yield parameters of carrot.

12- Interaction effects of cultivars, growing media and irrigation intervals:

The comparison among the values of the growth characteristics which were affected by cultivars, growing media and irrigation intervals interactions is present in table (10). The highest value of leaves number (7.70) was resulted in the interaction of Dordogene F1cultivar, 24% peat moss and 3 days irrigation interval. The longest plant length (21.94cm) was counted in the Ten Ten cultivar when sown in 12% peat moss with 6 days irrigation interval. The greatest leaf fresh weight (5.10g) was recorded in Ten Ten with 6% peat moss and 3 days irrigation interval. The highest leaf dry weight (1.25g) was measured in Ten Ten with 0% peat moss and 6 days irrigation interval. The best result of root length (24.41cm) was obtained from the Dordogene F1cultivar, 24% peat moss and 6 days irrigation interval. The thickest root diameter (19.37mm) was recorded from the interaction of Dordogene F1, 12% peat moss and 3 days irrigation interval. However, the lowest value (14.01mm) was recorded from Ten Ten, 0% peat moss and 6 days irrigation interval interaction. The best results of root(fresh weight and dry weight) (29.52g and 4.06g respectively) were recorded from interaction of Dordogene F1, 24% peat moss and 3 days irrigation interval but the lowest values (17.09g and 2.35g respectively) were recorded from Ten Ten, 0% peat moss and 6 days irrigation

Table (9): Interaction effects of cultivars, growing media and DAP on carrot vegetative and root growth characteristics.

Cultivars	Peat moss (%)	DAP ($ml.l^{-1}$)	No. of Leaves. $plant^{-1}$	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
Ten Ten	0	0	7.01c-g	20.39ab	3.84c-f	0.84b	15.99k	14.59i-l	16.16j	1.85k
		1.5	7.26a-f	20.79ab	4.59a-e	1.03b	18.12ij	15.07h-l	18.36h-j	2.72g-j
		3	7.30a-f	20.54ab	4.19a-e	0.94b	17.79jk	14.30jkl	17.65i-j	2.49h-l
		6	7.50abc	20.69ab	5.20a	1.80a	18.86f-j	15.42f-l	18.89g-j	2.97e-j
	6	0	6.83c-h	20.13ab	4.30a-e	0.90b	18.78f-j	14.24kl	19.26f-j	2.47i-k
		1.5	7.20a-g	18.47b	4.14a-f	0.88b	18.80f-j	15.59e-l	20.13e-j	2.95e-j
		3	7.37a-e	20.58ab	4.60a-e	0.99b	18.05ij	15.75e-l	20.41e-j	2.98e-j
		6	7.41a-d	21.43a	4.94ab	1.02b	20.23c-h	15.51e-l	20.85d-j	2.90f-j
	12	0	7.12a-g	20.83ab	4.31a-e	0.90b	18.10ij	15.60e-l	19.33f-j	2.72g-j
		1.5	7.48abc	21.29a	4.93abc	1.05b	19.23f-j	15.99e-k	21.40d-i	3.16d-i
		3	7.16a-g	20.70ab	3.58ef	0.90b	19.63e-j	15.53e-l	20.61d-j	2.90f-j
		6	7.67abc	21.00ab	4.92abc	1.05b	20.65c-f	16.39d-i	24.81b-e	3.69b-e
	24	0	7.22a-g	20.10ab	4.41a-e	0.95b	18.28hij	13.90l	17.96i-j	2.34jk
		1.5	7.30a-e	19.93ab	4.84a-d	1.01b	20.11d-i	16.00e-k	21.10d-j	3.05d-j
		3	7.02b-g	20.99ab	4.56a-e	0.93b	20.57c-g	15.53e-l	20.33e-j	2.78f-j
		6	7.72a	20.44ab	4.39a-e	0.99b	22.75b	17.16d-g	26.55bc	3.35c-g
Dordogene F1	0	0	6.30h	21.24a	3.61ef	0.73b	18.35hij	15.69e-l	21.59d-i	2.94e-j
		1.5	6.69fgh	20.49ab	3.69ef	0.75b	18.55g-j	16.21e-k	20.41e-j	2.89f-j
		3	7.11a-g	21.50a	3.97b-f	0.86b	19.60e-j	16.33e-j	21.11d-j	3.19d-h
		6	6.77d-h	21.16a	3.69ef	0.75b	19.60e-j	17.21d-g	24.62b-e	3.37c-g
	6	0	7.13a-g	21.22a	3.67ef	0.84b	20.69c-f	16.95d-h	23.11c-h	3.32c-g
		1.5	7.30a-f	20.39ab	3.94c-f	0.87b	21.79bcd	17.32c-f	23.14c-h	3.26c-g
		3	6.88c-g	21.44a	3.76def	0.75b	20.26c-h	17.57cde	25.53b-e	3.16d-i
		6	6.72e-h	20.96ab	4.00b-f	0.86b	20.68c-f	19.09bc	27.51bc	4.02abc
	12	0	6.69fgh	19.97ab	3.73ef	0.78b	20.11d-i	16.66d-i	23.75c-g	3.40c-g
		1.5	6.58gh	20.12ab	3.07f	0.66b	21.31b-e	16.51d-i	25.66b-e	3.45c-g
		3	6.63fgh	20.02ab	4.00b-f	0.86b	20.76c-f	18.30bcd	25.00b-e	3.70a-c
		6	7.00c-g	21.23a	3.85c-f	0.87b	22.23bc	19.43b	28.71b	4.24ab
	24	0	6.73e-h	19.23ab	3.85c-f	0.85b	21.37b-e	15.55e-l	23.36c-h	3.59b-f
		1.5	6.97c-g	19.99ab	3.66ef	0.78b	20.75c-f	15.14g-l	24.04b-f	3.04e-j
		3	7.01b-g	20.85ab	3.81def	0.84b	21.42b-e	15.79e-l	25.47bcd	3.82a-c
		6	7.74a	21.66a	4.41a-e	1.00b	26.86a	23.13a	34.94a	4.48a

A same letter in the column indicates that there is no significant difference ($p< 0.05$)

interval. These results partially are in agreement with White (1992) and with Dawuda *et al*. (2011) when they found that the yield and the root length of carrot were more influenced by water and soil water content during the vegetative period, while the high soil water concentration reduced root length, the moisture content in the sowing media dependent on the portions of the peat moss.

Table (10): Interaction effects of cultivars, growing media and irrigation intervals on carrot vegetative and root growth characteristics.

Cultivars	Peat moss (%)	Irrigation Intervals (days)	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
Ten Ten	0	3	7.49a-d	20.78ab	4.97ab	1.06ab	16.27j	15.68d-g	18.44ef	2.66fg
		6	7.04ef	20.43ab	3.94de	1.25a	19.06fgh	14.01h	17.09f	2.35g
	6	3	7.45a-e	20.50ab	5.10a	1.06ab	18.20ghi	16.18c-f	22.21cd	3.21b-e
		6	6.95f	19.80b	3.89de	0.84bc	19.73def	14.36gh	18.11f	2.43fg
	12	3	7.56abc	19.97b	4.83ab	1.00abc	17.98hi	15.99def	21.66cd	3.31bcd
		6	7.16c-e	21.94a	4.04cde	0.95abc	20.82cd	15.76def	21.41cde	2.93def
	24	3	7.62ab	19.80b	4.78ab	0.99abc	19.44efg	16.42cde	23.21c	3.23b-e
		6	7.01f	20.93ab	4.32bcd	0.95abc	21.41bc	14.88fgh	19.76def	2.54fg
Dordogene F1	0	3	7.10def	20.62ab	4.29bcd	0.89bc	17.53i	17.44bc	24.20bc	3.44bcd
		6	6.33h	21.58ab	3.19f	0.66c	20.51cde	15.29e-h	19.67def	2.76efg
	6	3	7.16c-e	21.02ab	4.31bcd	0.90bc	19.94def	18.60ab	27.14ab	3.71ab
		6	6.85fg	20.97ab	3.37ef	0.76bc	21.77bc	16.86cd	22.01cd	3.17cde
	12	3	7.22c-e	20.90ab	4.26bcd	0.86bc	19.63def	19.37a	26.70ab	3.94a
		6	6.23h	19.77b	3.06f	0.73bc	22.58b	16.08def	24.36bc	3.46bc
	24	3	7.70a	20.46ab	4.68abc	1.00abc	20.78cde	19.14a	29.52a	4.06a
		6	6.52gh	20.40ab	3.18f	0.73bc	24.41a	15.67d-g	24.38bc	3.39bcd

A same letter in the column indicates that there is no significant difference (p< 0.05)

13- Interaction effects of cultivars, DAP and irrigation intervals:

Growth characteristics response significantly to cultivars, DAP and irrigation intervals interaction except plant length (table 11). The greatest leaves number and leaf fresh weight (8.07 and 5.53g respectively) were found from Ten Ten cultivar, 6 ml DAP.l^{-1}and 3 days irrigation interval. The highest leaf dry weight (1.31g) was recorded from Ten Ten, 6 ml DAP.l^{-1}and 6 days irrigation interval. The longest root (23.66cm) was observed from Dordogene F1, 6 ml DAP.l^{-1}and 6 days irrigation interval. The best results of root diameter, root fresh and dry weight (22.41mm, 33.68g and 4.54g respectively) were recorded from Dordogene F1, 6 ml DAP.l^{-1}and 3 days irrigation interval. These results are agreement with Abdel-Mawly (2004), when he was found that using of nitrogen fertilization in the carrot field caused high yield, which may be due to the increasing of photosynthetic surface then lead to increasing of root size, and application of these fertilizers to the two studied cultivars have been shown to promote general growth characters in both irrigation intervals.

Table (11): Interaction effects of cultivars, DAP and irrigation intervals on carrot vegetative and root growth characteristics.

Cultivars	DAP (ml.l^{-1})	Irrigation Intervals (days)	No. of Leaves. plant^{-1}	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
Ten Ten	0	3	7.23cde	20.07a	4.67bc	0.98bcd	16.53i	15.02gh	18.51gh	2.53de
		6	6.86ef	21.21a	3.76efg	0.81bcd	19.05e-h	14.14h	17.85h	2.16e
	1.5	3	7.52b	19.82a	5.05ab	1.05abc	17.90h	16.53c-f	22.03d-f	3.36bc
		6	7.10cde	20.42a	4.16cde	0.93bcd	20.23cde	14.80gh	18.46gf	2.58de
	3	3	7.30b-e	20.20a	4.57bcd	0.95bcd	18.05gh	15.48fgh	20.53e-h	2.97cd
		6	7.12cde	21.21a	3.90def	0.93bcd	19.91def	15.07gh	18.97fgh	2.61de
	6	3	8.07a	20.96a	5.53a	1.13ab	19.41ef	17.24b	24.45bcd	3.56b
		6	7.08cde	20.82a	4.38cde	1.31a	21.83b	15.00gh	21.10d-h	2.90de
Dordogene F1	0	3	7.04de	20.29a	4.34cde	0.88bcd	18.84fgh	16.92cde	24.63bc	3.63b
		6	6.38g	20.54a	3.09g	0.72cd	21.43bc	15.51fg	21.28d-g	2.99cd
	1.5	3	7.16cde	20.14a	4.07cde	0.84bcd	19.33efg	16.94cde	23.61b-e	3.33bc
		6	6.60fg	20.35a	3.11g	0.69d	21.87b	15.65efg	22.51b-e	2.99cd
	3	3	7.36bcd	21.14a	4.47b-e	0.92bcd	18.70fgh	18.27b	25.63b	3.36b
		6	6.45fg	20.76a	3.30fg	0.73cd	22.32b	15.72d-g	22.42b-e	3.29bc
	6	3	7.62b	21.42a	4.66bc	1.00a-d	21.02bcd	22.41a	33.68a	4.54a
		6	6.50fg	21.08a	3.31fg	0.74cd	23.66a	17.02cd	24.21bcd	3.51b

A same letter in the column indicates that there is no significant difference (p< 0.05)

14- Interactions effect of growing media, DAP and irrigation intervals:

The results in table (12) show the promotive effects of the interaction of growing media, DAP and irrigation intervals interaction on all vegetative and root growth parameters except plant length. The highest leaves number and leaf fresh weight (8.61 and 5.08g respectively) were obtained from the 24% peat moss, 6 ml.L^{-1} DAP and 3 days irrigation interval. The greatest leaf dry weight (1.51g) was results from 0% peat moss, 6 ml.L^{-1} DAP and 3 days irrigation interval. The longest root (26.50cm) was measured in 24% peat moss, 6 ml.L^{-1} DAP and 6 days irrigation interval interaction. The best result of root diameter, root fresh and dry weight (22.70mm, 36.32g and 4.42g respectively) were obtained from 24% peat moss, 6 ml.L^{-1} DAP and 3 days irrigation interval. These results partially are in agreement with the results of Hailu *et al*. (2008). Addition of inorganic substances to organic substances produces higher yield probably owing to increasing water-holding and capacity and aeration by organic substances, which demonstrates that inorganic substances could partially replace organic substances (Gao *et al*., 2010).

Table (12): Interaction effects of growing media, DAP and irrigation intervals on carrot vegetative and root growth characteristics of two carrot cultivars.

Peat moss(%)	DAP (ml.l^{-1})	Irrigation interval (days)	No. of Leaves. $plant^{-1}$	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
0	0	3	6.94c-k	19.93a	4.40a-g	0.92b	15.41m	15.88d-j	19.90e-h	2.67cde
		6	6.37k	21.70a	3.05j	0.65b	18.93g-k	14.40hij	17.94gh	2.12e
	1.5	3	7.27b-h	21.08a	4.63a-f	0.99b	16.58lm	16.24d-i	21.08d-h	3.01bcd
		6	6.67g-k	20.20a	3.65f-j	0.79b	20.09c-j	15.04g-j	17.69h	2.59de
	3	3	7.44b-e	20.30a	4.42a-e	0.94b	16.95klm	15.72e-j	20.00e-h	2.93bcd
		6	6.97c-k	21.74a	3.74e-j	0.87b	20.34c-h	14.91g-j	18.78fgh	2.75cde
	6	3	7.53bc	21.48a	5.07a	1.05b	18.67h-k	18.38bc	24.29cde	3.59b
		6	6.67h-k	20.37a	3.82d-j	1.51a	19.78f-j	14.25ij	19.23fgh	2.75cde
6	0	3	7.02c-k	20.75a	4.43a-h	0.91b	18.70h-k	15.92d-j	22.41c-h	3.11bcd
		6	6.94c-k	20.60a	3.65f-j	0.82b	20.78c-g	15.27g-j	19.96e-h	2.68cde
	1.5	3	7.38b-f	19.31a	4.76a-e	1.00b	19.97d-j	17.50c-f	24.31b-e	3.60b
		6	7.11c-j	19.54a	3.32g-j	0.75b	20.62c-h	15.41g-j	18.96fgh	2.61cde
	3	3	7.36b-g	21.36a	4.75a-e	0.98b	18.09i-l	17.63cde	25.17bcd	3.44bc
		6	6.89c-k	20.66a	3.61f-j	0.76b	20.22c-h	15.68e-j	19.78e-h	2.70cde
	6	3	7.47bcd	21.63a	4.97ab	1.01b	19.52f-j	18.52bc	26.81bc	3.70b
		6	6.67h-k	20.75a	3.96c-j	0.88b	21.39b-f	16.07d-j	21.54d-h	3.22bcd
12	0	3	7.29b-h	20.75a	4.82a-d	0.97b	18.06jkl	16.79c-g	21.68d-h	3.38bcd
		6	6.52jk	20.05a	3.22ij	0.71b	20.15c-i	15.48f-j	21.40d-h	2.75cde
	1.5	3	7.27b-h	20.11a	4.14b-i	0.84b	19.04g-j	16.36d-h	23.44c-f	3.40bc
		6	6.79e-k	21.30a	3.85c-j	0.87b	21.51b-f	16.14d-j	22.62c-h	3.21bcd
	3	3	7.22c-i	20.34a	4.32a-h	0.87b	18.55h-k	17.88bcd	22.76c-g	3.24bcd
		6	6.58ijk	20.39a	3.26hij	0.88b	21.98bcd	15.95d-j	22.84c-g	3.37bcd
	6	3	7.77b	20.53a	4.90abc	1.04b	19.79f-j	19.69b	28.83bc	4.49a
		6	6.90c-k	21.67a	3.87c-j	0.88b	23.31b	16.13d-j	24.69b-e	3.45bc
24	0	3	7.29b-h	19.29a	4.47a-e	0.93b	18.56h-k	15.29g-j	22.28c-h	3.16bcd
		6	6.66h-k	20.03a	3.79d-j	0.87b	21.08c-f	14.16j	19.09fgh	2.74cde
	1.5	3	7.44b-e	19.41a	4.79a-e	0.96b	18.88g-k	16.84c-g	22.45c-h	3.37bcd
		6	6.83d-k	20.51a	3.71f-j	0.84b	21.98bcd	14.30hij	22.68c-h	2.73cde
	3	3	7.31b-h	20.69a	4.58a-f	0.95b	19.70e-j	16.28d-i	20.40b-e	3.62b
		6	6.71f-k	21.15a	3.79d-j	0.82b	22.08bcd	15.04g-j	21.39d-h	2.29bcd
	6	3	8.61a	21.12a	5.08a	1.15ab	23.10b	22.70a	36.32a	4.42a
		6	6.86d-k	20.97a	3.72e-j	0.84b	26.50a	17.59cde	25.17bcd	3.41bc

A same letter in the column indicates that there is no significant difference (p< 0.05)

15- Interactions effect of cultivars, growing media, DAP and irrigation intervals:

Table (13) shows that the interactions of cultivars, growing media, DAP and irrigation intervals affected significantly on all vegetative and root growth parameters.

Table (13): Interaction effects of cultivars, growing media, DAP and irrigation intervals on carrot vegetative and root growth characteristics.

Cultivars	Peat moss (%)	DAP ($ml.l^{-1}$)	Irrigation intervals (days)	No. of Leaves. $plant^{-1}$	Plant length (cm)	Leaf fresh Wt. (g)	Leaf dry Wt. (g)	Root length (cm)	Root diameter (mm)	Root fresh Wt. (g)	Root dry Wt. (g)
Ten Ten	0	0	3	7.27c-l	19.71abc	4.62a-j	1.01b	13.48s	15.48g-n	15.53m	2.04pq
			6	6.74f-p	21.07abc	3.06j-m	0.67b	18.51l-r	13.70n	16.79klm	1.66q
		1.5	3	7.38c-j	21.87abc	5.13a-e	1.08b	16.77pqr	16.02f-n	20.15h-m	2.90e-p
			6	7.13c-n	19.70abc	4.04c-m	0.97b	19.47f-p	14.11k-n	16.58klm	2.54l-q
		3	3	7.44c-i	19.82abc	4.31a-k	0.93b	16.43qr	14.49i-n	19.03h-m	2.58k-q
			6	7.16c-m	21.27abc	4.06c-m	0.96b	18.95i-r	14.10k-n	16.28lm	2.40n-q
		6	3	7.86b-e	21.73abc	5.81a	1.22b	18.41l-r	16.71f-n	19.06h-m	3.14c-p
			6	7.13c-n	19.66abc	4.60a-j	2.38a	19.31g-r	14.13k-n	18.73h-m	2.80h-p
	6	0	3	6.77f-p	20.87abc	4.59a-k	0.97b	18.65l-r	14.64h-n	21.00g-m	2.77h-q
			6	6.88f-p	19.39abc	4.02c-m	0.83b	18.92j-r	13.87n	17.52i-m	2.18n-q
		1.5	3	7.61b-f	18.34c	4.97a-f	1.02b	19.05h-r	17.06e-k	23.91e-k	3.69c-k
			6	6.78f-p	18.62bc	3.32g-m	0.74b	18.55l-r	14.12k-n	16.35lm	2.21n-q
		3	3	7.49c-h	20.68abc	5.10a-e	1.07b	16.74pqr	16.54f-n	22.03f-m	3.22c-o
			6	7.25c-l	20.48abc	4.11c-m	0.90b	19.36g-r	14.96g-n	18.80h-m	2.74i-q
		6	3	7.94bcd	22.14abc	5.75ab	1.16b	18.38l-r	16.50f-n	21.92f-m	3.19c-o
			6	6.88f-p	20.71abc	4.13c-m	0.88b	22.08c-g	14.52i-n	19.79h-m	2.60k-q
	12	0	3	7.36c-j	20.34abc	4.84a-h	0.99b	16.84pqr	16.09f-n	18.79h-m	2.81g-p
			6	6.88f-p	21.32abc	3.77d-m	0.81b	19.37g-r	15.12g-n	19.88h-m	2.64k-q
		1.5	3	7.55b-g	19.89abc	4.97a-f	1.07b	17.41m-r	15.63g-n	21.87f-m	3.27c-o
			6	7.42c-j	22.69a	4.88a-g	1.03b	21.06c-l	16.34f-n	20.93g-m	3.05d-p
		3	3	7.27c-l	19.68abc	4.32a-l	0.88b	18.83j-r	15.26g-n	20.28h-m	3.06d-p
			6	7.05d-o	21.72abc	2.85lm	0.92b	20.42d-m	15.80f-n	20.93g-m	2.75i-q
		6	3	8.05abc	19.96abc	5.18a-e	1.07b	18.87j-r	16.97e-l	25.72b-h	4.10a-d
			6	7.30c-l	22.04abc	4.66a-i	1.04b	22.43c-f	15.80f-n	23.91e-k	3.29c-o
	24	0	3	7.49c-h	19.38abc	4.62a-j	0.96b	17.170-r	13.87n	18.71h-m	2.52m-q
			6	6.96e-p	20.82abc	4.21b-m	0.94b	19.38g-r	13.92m-n	17.21j-m	2.17opq
		1.5	3	7.55b-g	19.17abc	5.25a-d	1.05b	18.38l-r	17.39d-j	22.22f-m	3.58c-l
			6	7.05d-o	20.68abc	4.39a-l	0.97b	21.83c-j	14.61h-n	19.99h-m	2.53l-q
		3	3	7.00d-o	20.62abc	4.55a-k	0.91b	20.21e-n	15.64g-n	20.80g-m	3.01d-p
			6	7.04d-o	21.36abc	4.57a-k	0.94b	20.92c-l	15.42g-n	19.86h-m	2.56l-q
		6	3	8.44ab	20.02abc	4.66a-i	1.05b	21.98c-h	18.78c-f	31.10bcd	3.80c-j
			6	7.01d-o	20.85abc	4.11c-m	0.94b	23.51bc	15.55g-n	22.00f-m	2.91e-p
Dordogene F1	0	0	3	6.61g-p	20.16abc	4.18b-m	0.84b	17.35n-r	16.29f-n	24.28d-j	3.31c-o
			6	6.00p	22.33ab	3.04j-m	0.63b	19.36g-r	15.10g-n	18.89h-m	2.58k-q
		1.5	3	7.16c-m	20.29abc	4.12c-m	0.90b	16.39r	16.46f-n	22.02f-m	3.13c-p
			6	6.22m-p	20.69abc	3.28h-m	0.61b	20.71c-l	15.97f-n	18.80h-m	2.65k-q
		3	3	7.44c-i	20.78abc	4.53a-k	0.94b	17.47m-r	16.94e-m	20.98g-m	3.28c-o
			6	6.77f-p	22.21abc	3.41f-m	0.77b	21.73c-k	15.73g-n	21.25f-m	3.10c-p
		6	3	7.21c-l	21.24abc	4.33a-l	0.87b	18.94i-r	20.06bcd	29.52b-e	4.04b-e
			6	6.33l-p	21.08abc	3.05j-m	0.63b	20.25d-n	14.36j-n	19.73h-m	2.70i-q
	6	0	3	7.26c-l	20.63abc	4.07c-m	0.85b	18.76k-r	17.20e-j	23.82e-k	3.46c-m
			6	7.00d-o	21.82abc	3.28h-m	0.82b	22.63b-e	16.70f-n	22.41e-m	3.19c-o
		1.5	3	7.16c-m	20.29abc	4.57a-k	0.97b	20.90c-l	17.94c-g	24.71d-i	3.51c-m
			6	7.43c-i	20.46abc	3.32g-m	0.76b	22.68b-e	16.71f-n	21.57f-m	3.01d-p
		3	3	7.22c-l	22.03abc	4.41a-l	0.90b	19.45f-q	18.73c-f	28.32b-f	3.66c-l
			6	6.54h-p	20.84abc	3.10i-m	0.61b	21.08c-l	16.41f-n	20.75g-m	2.66j-q
		6	3	6.99d-o	21.12abc	4.20b-m	0.86b	20.66c-l	20.54bc	31.70bc	4.20abc
			6	6.45j-p	20.79abc	3.80d-m	0.87b	20.69c-l	17.62d-h	23.31e-l	3.83b-i
	12	0	3	7.22c-l	21.16abc	4.79a-h	0.95b	19.29g-r	17.49d-i	24.57d-j	3.95b-g
			6	6.16nop	18.77bc	2.66m	0.61b	20.93c-l	15.84f-n	22.93e-l	2.86f-p
		1.5	3	7.00d-o	20.32abc	3.31g-m	0.61b	20.67c-l	17.09e-k	25.02b-h	3.53c-m
			6	6.16nop	19.91abc	2.82lm	0.70b	21.96c-i	15.93f-n	24.30d-j	3.37c-m
		3	3	7.16c-m	20.99abc	4.33a-l	0.87b	18.27l-r	20.50bc	25.25b-h	3.41c-m
			6	6.11op	19.06abc	3.68e-m	0.85b	23.24bcd	16.10f-n	24.75c-i	4.00b-f
		6	3	7.50c-h	21.11abc	4.62a-i	1.02b	20.27d-n	22.41b	31.95b	4.88ab
			6	6.50i-p	21.35abc	3.07j-m	0.72b	24.18b	16.46f-n	25.47b-h	3.62c-l
	24	0	3	7.08c-n	19.21abc	4.33a-l	0.89b	19.96e-o	16.71f-n	25.85b-h	3.81c-i
			6	6.38k-p	19.24abc	3.37g-m	0.80b	22.78b-e	14.39j-n	20.88g-m	3.32c-n
		1.5	3	6.33c-k	19.65abc	4.29a-l	0.87b	19.37g-r	16.30f-n	22.69e-l	3.15c-p
			6	6.61g-p	20.34abc	3.02klm	0.70b	22.13c-g	13.99l-n	25.37b-h	2.94e-p
		3	3	7.63b-f	20.76abc	4.62a-j	0.99b	19.59f-p	16.91e-m	28.00b-g	4.23abc
			6	6.38k-p	20.93abc	3.01klm	0.69b	23.24bcd	14.66h-n	22.93e-l	3.41c-m
		6	3	8.77a	22.20ab	5.54abc	1.25b	24.22b	26.63a	41.54a	5.05a
			6	6.72f-p	21.10abc	3.34g-m	0.76b	29.50a	19.63cde	28.35b-f	3.90b-h

A same letter in the column indicates that there is no significant difference ($p< 0.05$)

The highest leaves number 8.77 was found from the interaction of Dordogene F1, 24% peat moss, 6 ml.L^{-1} DAP and 3 days irrigation interval. The longest plant (22.69cm) was observed from Ten Ten with 12% peat moss, 1.5 ml.L^{-1} DAP and 6 days irrigation interval. The greatest leaf fresh weight (5.81g) was resulted from the interaction of Ten Ten, 0%peat moss, 6 ml.L^{-1} DAP and 3 days irrigation interval. The highest leaf dry weight (2.38g) was obtained from Ten Ten, 0%peat moss, 6 ml.L^{-1} DAP and 6 days irrigation interval. The best root length (29.50cm) was measured in Dordogene F1 with 24% peat moss, 6 ml.L^{-1} DAP and 6 days irrigation interval. The maximum values of root diameter, root fresh weight and dry weight (26.63mm, 41.54g and 5.05g respectively) were observed from Dordogene F1, 24% peat moss, 6 ml.L^{-1} DAP and 3 days irrigation interval. These results partially agree with the results of Moniruzzaman *et al*. (2013), when they found that the yield and root length gradually increased with increasing nitrogen level, moreover supplies nitrogen and phosphorous cause improving the physiochemical properties of the soil, resulting in improved soil conditions and better nutrient availability. The nitrogen and phosphorus supplements also help gradual release of nutrients in the soil, which makes it an ideal input for good carrot crop growth (Ahmed *et al*., 2014).

Conclusion:

1- Generally Dordogene F1 cultivar gave the best results for the root parameters, while the the best results of vegetative growth characters were from of Ten Ten cultivar.

2- Three days irrigation interval, 24% peatmoss in the sowing media and all DAP levels significantly enhanced vegetative and root growth.

3-The best interaction treatment was among Dordogene F1 with 24% peat moss, 6 ml DAP.$l^{-1}$and 3 days irrigation interval interaction for growth parameters.

References

1. Abdel-Mawly, S.E (2004). Growth, yield, nitrogen uptake and water use efficiency of carrot (*Daucus carota* L.) plant as influenced by irrigation levels and nitrogen fertilization rate. Univ. Bull. Environ Res.7 (1): 111-119.
2. Ahmed, A., B.E.Sambo, U.L.Arunah and E.C.Odion (2014). Response of Farmyard manure and inorganic fertilizers for sustainable growth of carrot (*Daucus carota* L.) in northern Nigeria. J. Agri. An Vet. Sci.2:18-25.
3. Alam, M.S., S.A.Malik, D.J.Costa and A.Alam (2010). Effect of irrigation on the growth and yield of carrot (*Daucus carota ssp. Sativus*) in the Hill Valley. J. Agri. Res. 35(2): 323-329.
4. Al-Rawi, K.H.M. and A.M.Khalaf - Alla (2000). Agriculture Experiment Designs and Analysis. Dar – Alkuteb for Publishing and Printing. Mousel-Iraq. (In Arabic).
5. Baranski, R (2008). Genetic transformation of carrot and other apiaceae species. Uni. of Krakow Poland Transgenic plant J. 54: 31-42.
6. Bender, I., M.Ess., D.Matt., U.Moor., T.Tonutare and A.Luik (2009). Quality of organic and conventional carrots. Agronomy Res.**7**(2): 572-577.
7. Bundiniene,O., V.Zalatorius, D.K.avaliauskaite and R.Starkute (2014). Efficiency of the additional fertilization with nitrogen fertilizers growing carrot of exceptional quality and its influence on production storage. Hort. Lithuanian Res. Centre for Agri. Fore. p:156- 158.
8. Cezary, A., B.Kolodziej and A.Wozniak (2013). Yield and quality parameters of carrot (*Daucus carota* L.) roots depending on growth stimulators and stubble crops. Acta Sci. Pol., Hortorum 12(5): 55-68.
9. Dawuda, M.M., P. Y. Boateng, O. B. Hemeng and G. Nyarko (2011). Growth and yield response of carrot (*Daucus carota* L.) to different rates of soil amendments and spacing. J. Sci. Tech. 31(2): 11-20.

10. Day, S.D., N.L.Bassuk and H.van (1995). Effects of four compaction remediation methods for landscape trees and soil aeration, mechanical impedance and tree establishment. J. of Envi. Hort., 13:64-71.
11. De Lannoy, G (2001). Carrot in Crop Production in Tropical Africa.R.H. Raemaekers (ed.) Directorate General for International Corporation. Brussels, Belgium. P: 480– 485.
12. El-Tohamy, W.A., H.M.El-Abagy, M.A.Badr, S.D.Abou-Hussein and Y. I. Helmy (2011). The Influence of Foliar Application of potassium on yield and quality of carrot (*Daucus carota* L.) plants grown under sandy soil conditions Australian J. of Basic and Applied Sci. 5(3): 171-174.
13. Gao, H. B., T.J.Zhang, G.Y.Lv, G.H.Zhang, X.L.Wu, J.R.Li and B.B. Gong (2010). Effects of different compound substrates on growth, yield and fruit quality of cucumber. Acta Horti. 856: 173–180.
14. Hailu, S., T.Seyoum and N.Dechassa (2008). Effect of combined application of organic-P and inorganic-N fertilizers on yield of carrot. African J. Biotech., 7 (1): 27-34.
15. Hamma, I. L., U.Ibrahim and M.Haruna (2012). Effect of irrigation intervals and NPK application on the growth and yield of carrot (*Daucus carota* L.). Samaru College of Agriculture, Ahmadu Bello Uni., Zaria.Nigerian J. of Agri. Food and Envi., 8(1):59-62.
16. Hasan, E.A., K. M.Bhiah and M.T.H. Al-Zurfy (2014). The impact of peat moss and sheep manure compost extracts on marigold (*Calendula*
17. *officinalis* L.) growth and flowering J. of Organic Systems 9 (2):57- 61.
18. Hochmuth, J.G., K.B.Jeffrey and M.J.Bassett (1999). Nitrogen fertilization to maximize carrot yield and quality on a sandy Soil. Hort. Sci. 34 (4):641-645.
19. Just, B.J., C.A.F.Santos, M.E.N.Fonseca, L.S.Boiteux, B.B.Oloizia and P. W. Simon (2007). Carotenoid biosynthesis structural genes in carrot (*Daucus carota*.L): isolation, sequence - characterization, single nucleotide polymorphism (SNP) markers and genome mapping. Theor Appl. Genet. J. 114:693-704.
20. Manosa, N.A (2011). Influence of temperature on yield and quality of carrots (*Daucus carota* var. *sativa*). Ph.D. thesis, Facultyof Natural and Agricultural Sciences Department of Soil, Uni.of the Free State Bloemfontein.
21. Lada, R and A.Stiles (2004). Processing carrot research program water requirement and irrigation management for optimizing carrot yield and quality. Nova Scotia Agricultural College, Truro, Nova Scotia, Canada. http://www.irrometer.com.
22. Llyas,M., G.Ayub, N.Ahmad, O.Ullah, S.Hassan and R.Ullah (2013). Effect of different steckling size and phosphorous levels on seed production in carrot (*Daucus carota L.*). Middle-East J. of Scientific Res.17(3):280-286.
23. Marta, G.T. and D.N. Maniutiu (2011).Research regarding the fertilization system depending on the period of cultureof carrots. J. of Hort. For. and Bio. 15(1), 84-86.
24. Masley,S. (2009). Carrot Varieties and Types. http://www.grow-it-organically. com.
25. Mbatha, A.N (2008). Influence of Organic Fertilizers on the Yield and Quality of Cabbage and Carrots. Ph.D. Thesis, Faculty of Natural and Agri. Sci. University of the Free State Bloemfontein.
26. Mehedi, T.A., M. A.Siddique and S.B.Shahid (2012). Effects of urea and cowdung on growth and yield of carrot. J. Bangladesh Agri. Uni., 10 (1): 9-13.
27. Moniruzzaman, M., M.H.Akand, M.I.Hossain., M.D.Sarkar and A.Ullah (2013). Effect of nitrogen on the growth and yield of carrot *(Daucus carota L.)*.The Agriculturists J., 11(1): 76-81.

28. Nahar,N., M.K.Mazed, J.F. Moonmoon, H.Mehraj and A.F.M.Jamal-uddin (2014). Growth and yield response of carrot (*Daucus carota* L.) to phosphorus. International J. of Business, Social and Scientific Res.,1(2):125-128.
29. Navazio, J (2010). Principles and practices of organic carrot seed production in the pacific northwest. Organic Seed Alliance J., 719: 360-385.
30. Nortje, P.F and P.J.Henrico (1986). The influence of irrigation interval on crop performance of carrots (*Daucus carota* L.) during winter production. Acta. Hort. J., 194: 153-158.
31. Ojo, O.D and E. A. Akinrinde (2010). Residual Phosphorus Influence Carrot Production in African Humid Tropics. Uni. of Ibadan, Ibadan, Nigeria. p:35- 40.
32. Olle, M., M .Ngouajio and A.Siomos (2012). Vegetable quality and productivity as influenced by growing medium. Plant Breeding institute J., 99 (4): 399-408.
33. Prabhakar, M., K.Srinivas and D.M.Hegde (1991). Effect of irrigation regimes and nitrogen fertilization on growth, yield, nitrogen uptake and water use of carrot (*Daucus carota* L.). Gartenbauwissenschaft. J. 56(5):206-209.
34. Prasad, R (2013). Organic sector development program in lower mainland. Hort. improvement association. http://www.escrop.com.P:2-5.
35. Relf, D. and A. Mc Daniel (2009). Root Crops. Verginia state university -WWW.ext.vt.edu.
36. Riley, C. (2003). Does a reduction in irrigation equal a reduction in marketable carrot yield. Department of plant science, Uni. of California. Davis, CA 95616.
37. Sady W., S. Smolen and S.Rozek (2005). Effect of differentiated nitrogen fertilization and foliar application on yield and biological quality of carrot crop. J. Hort. and Veg. Growing, 24 (3): 273-281.
38. SAS, (2005). Statistical analysis system institute, cary NC, USA.
39. Siddiqui, A.B. (1995). Local adaptability and sustainability of vegetable and spice crops. In: training manual: winter vegetable and spice production. Hort. Researches and Development Projects. FAO/ UNDP/AsDB in collaboration with DAE, BADC, Dhaka. P: 62-74.
40. Singh, G (2012). Commercial varieties of vegetable. Hort. Commissioner Department of Agri. and Cooperation Ministry of Agri. government of India Krishi Bhawan, New Delhi. p: 134.
41. Strandberg, J.O (1984). Flooding organic soil to control species of pythium which attack carrots and other vegetables. Proc. Fla. State Hort. Soc.97:164- 168.
42. White, B.J (1992). Carrot yield when grown under three soil water concentrations. J. Food and Agri. Sci. Uni. of Florida. Hort., 27(2):105-106.
43. Win ,L (2010). Agronomic Characteristics and Nutritional Quality of Carrot (*Daucus carota* L.) Cultivars from Myanmar and Germany as Affected by Mineral and Organic Fertilizers. Ph.D. Thesis, Faculty of Agri. Sci., Uni. Göttingen, Germany.
44. Zaccari,F.; M.C.Cabrera; A. Ramos and A.Saadoun (2015). In vitro bioaccessibility of b-carotene, Ca, Mg and Zn in landrace carrots (*Daucus carota* L.). J. Food chemicals, 166: 365- 371.