Effect of GA_3 on Growth and Some Physiological Characterizes in Carrot Plant (*Daucus Carota L.*)

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Abstract

This experiment was carried out in the field of researches in Kalar Technical Institute / Field crop dept. The aim of the research is to study the effect of foliar sprays of different concentrations of Gibberellic acid on growth and some physiological characterizes in Carrot plant (local white cultivar). The experiment treatments included three concentrations of Gibberellic acid (0, 50 and 100 ppm) and were carried out as applicable agricultural project (3×4). And the results were recorded as follows:

In using the Gibberellic acid concentration at (50 ppm) led to increase significantly the studied characteristics particularly plant height cm, number of branch/ plant, number of flower/ plant, shoot fresh weight (gm), fresh weight of biological weight gm/plant, shoot dry weight (gm), dry weight of biological weight gm/plant, chlorophyll content (µg/cm2), when compared with the other concentrations levels and controlling plants. And GA_3 decreases significantly some of the studied characteristics as root fresh weight (gm), root dry weight (gm) and soluble carbohydrate which that compared with the controlling plants.

Key words: Plant Physiology ,Daucus Carota , Gibberelic acid

Introduction

The carrot (*Daucus carota* L.) belongs to the Umbelliferae family. It is related to celery, celeriac, coriander, fennel, parsnip and parsley, which are all members of this family. The carrot originated in Asia. Initially the roots were long and thin, and either purple or yellow in colors. These colors, as well as white and orange, still exist, with the orange or orange-red colors being by far the most popular today [1]. Many shapes of roots also exist, from rather long and thin roots to shorter and thick. Roots may be cylindrical, conical, or even spherical in shape [1]. Carrots are particularly rich in carotene (pro-vitamin A), B1, C and essential oil, rich in vitamin E. Carrots also have large amount of carbohydrates and are low in protein and lipids. They are consumed either fresh, as a salad crop, or cooked. Large quantities are also processed, either alone or in mixtures with other vegetables, by canning, freezing or dehydration [1] and [2]. Carrot is a biennial herb, which is widely distributed throughout the world. The fruits of the plant (common name: wild carrot fruits) have been used in Traditional Chinese Medicine for the treatment of an cylostomiasis, dropsy, chronic kidney disease and bladder afflictions, due to a wide range of reported pharmacological effects, including antibacterial, antifungal, anthelmintic, hepatoprotective, cytotoxic and activities [3].

Most gardeners grow carrots for munching, salads, or juicing. It is a cool weather plant, growing best in cool, even temperatures; ideally of (10° to 25°C) Warm weather produces course roots with poor flavor. Sow seed thinly in rows ¼ to ½ inch deep with 12 to16 inches between the rows (rows can be spaced 3 to 6 inches apart in raised beds) [4] and [5]. The aims

for this study to show affects of GA_3 on growth of carrot plant and illustrate how GA3 can increase the ability of shoot system in plants.

Materials and Methods

Experimental Design

The experiment was designed according to the Complete Random Design (C.R.D) at the field of Horticulture Department / Kalar Technical institute (Sulaimani Province), during the growing season of 25/9/2009- 1/5/2010. The experiment includes studding the effect of three concentrations of gibberellic acid (GA_3) (0. 50 and 100 ppm) with four replications on growth and some physiological characterizes for carrot plant (*Daucus carota* L.). Area of each experimental unit was 2 m2. Date of taking the measurements for all parameters at 20/4/ 2010. Service operations of the plant irrigation and the removal of the bush were carried out daily for the all plants.

Experiment treatments

1- Three concentrations of gibberellic acid which are (0, 50, and 100ppm) respectively.
3- Agricultural experiment (3×4) conducted in C.R.D, which are includes (12 experimental units).

Preparation of growth regulator (GA_3)

Gibberellic acid in the rate of one gram was taken and dissolved in some drops of NaOH (10N), and the volume was completed to 1000 ml of distilled water [6]. Gibberellic acid solutions were prepared for foliar spraying in the concentrations of (0, 50, and 100ppm). These concentrations were sprayed once on leaves at the stage of (4-6) leaves. Tween (80) at the concentration of (0.025)% was added to the foliar solution as surfactant agent. Spraying processes were carried out during the morning until the solutions were run off all plants by using a manual sprayer.

Characteristics studied

Plant height (cm):

Plant height was measured from the soil level to the upper point of the main stem by ruler for the four labeled plants.

Number of branches/ plant:

The numbers of the branches were counted when they appeared and became visible for the four labeled plants.

Number of flower/ plant:

The total number of flowers was counted when they appeared and became visible flower for the four labeled plants and calculated after 90 days from the sowing.

Shoot fresh weight (gm):

Shoot system weighted by digital balance.

Root fresh weight (carrot) (gm):

Root system weighted by digital balance.

Fresh biological weight gm/plant:

Is the all biomass per plant was recorded by weighting the whole plant including straw and grains, from the plant samples collected during threshing for the four labeled plants.

Chlorophyll content ($\mu g/cm^2$):

Chlorophyll content of the leaves was estimated by using the SPAD-502 instrument (for chlorophyll measurement); four leaves from each experiment were taken for chlorophyll measurement.

Shoot dry weight (gm):

Shoot was oven dried to a constant weight at (65-70°C) for 48 hours.

Root dry weight (carrot) (gm):

Root was oven dried to constant weight at (65-70°C) for 48 hours.

Dry biological weight gm/plant:

Dry biological weight was oven dried to constant weight at (65-70°C) for 48 hours.

Soluble carbohydrate determination (in carrot)

Based on [7] a method which is called phenol sulfuric acid method for the determination of soluble carbohydrate, the method involved taking a constant weight 0.4 g. of the sample, adding 50 ml of boiled distiller water, then boiling in water path at (80) °C for 1/2 hour. The sample is filtered and completed to 50 ml distal water.

One ml of the filtered solution is taken and 1 ml of (5%) phenol indicator is added and mixed well. Next (5) ml of sulfuric acid is added to the mixture, (10) ml of distal water is added to dilute the mixture; lastly the mixture is read by spectrophotometer at (488) nm.

Results and Discussions

Effect of GA_3 concentrations on plant height cm., number of branch/ plant and number of flowers/ plant

The results in table (1) show that the more plant height affected significantly by the 50 ppm concentration of GA_3 which was (127.33) cm. in comporison to the other concentrations**.** The increase in plant height may be due to the effect of GA_3 on the cell division and cell enlargement, and also GA_3 stimulated the growth and expansion of cells through increasing the wall plasticity of cells ([8] and [9]).Table 1 shows that (50) ppm concentration of gibberellic acid resulted in a significant increase in the number of branches/ plant and the highest average was (30.67) branch/ plant compared with other concentrations and that is due to the effect of the gibberellic acid which enhances the lateral buds, breaking apical dominance and vegetative growth [10]. And these results are in agreement with [11], [12] and [13] which say the foliar application increases the shoot system such as plant high, number of leafs, lateral buds, number of branch and number of flowers.

Table (1) also indicates that the gibberellic acid concentrations had a significant effect on the number of flowers/ plant and the highest value which was (32.33) flower/ plant recorded at (50) ppm concentration compared with (0) concentrations. Thus increasing branches will result in increasing nodes and more flowers [14], or may due to the competition which may occur between the vegetative and reproductive parts of the plant on the available carbohydrate materials and the effect of gibberellic acid on the direction of carbohydrate material inside the plant as reported by [15].

Effect of GA_3 concentrations on fresh weight of shoot system, fresh weight of carrot, fresh weight of biological weight and chlorophyll content

Table (2) shows that the GA_3 affected significantly on all characters in table (2) by (50) ppm concentration of GA_3 accepted in carrot fresh weight which was not significant and (0) ppm concentration of GA_3 gave the highest weight.

This might be due to the effects of gibberellic acid on cell division, leaf expansion, cell enlargement and thus the number of leaves. The role of gibberellic acid in the formation of a new RNA particularly mRNA had been reported [16]. Gibberellic acid enhances the formation of proteins and new RNA and increases chlorophyll content which increases the process of photosynthesis, all this leads to the increase of shoot dry weight [17]. Moreover

gibberellic acid enhances the formation of chlorophyll pigments [18]. And all research indicates to the GA_3 can not enhance root system for that shows the control plant are gave high results [8]. And this results in agreement with [11] and [12].

Effect of GA_3 concentrations on dry weight of shoot, dry weight of carrot, dry weight of biological weight and soluble carbohydrate percentage.

Table (3) observed that the (50) ppm concentration of GA_3 affected significantly on all characters in this table accepted dry weight of carrot which was not affected by GA_3 compared with plants control.

This may be due to the same effects of GA_3 on the cell division, cell enlargement, growth and expansion of cells and sizable increasing of auxin content of the tissues [19].

And this may be due to the effect of gibberellic acid in activation of photosynthesis process and increase of absorption to water and nutrition, then lead to the increase of metabolism of this nutrition by plant and movement to the fruits and increase its growth and storage as dry weight then this leads to the increase of the dry weight, and increase of plant high, number of branch and flowers leads to increase of dry weight but decrease of carrot dry weight may be due to disaffected of GA_3 on root system. [11] and [20]. These results mean that gibberellic acid increase specifically the synthesis of mRNA in this tissue, for example incubation of isolated barley aleurone layers with gibberellic acid for 16 hr caused a 50% increase in the synthesis of RNA that contains poly(A) sequences [poly(A)-RNA], but had no measurable effect on the syntheses of the major RNA species. The syntheses of both the poly (A) and the heteropolymeric fractions of the poly (A)-RNA were increased. [21].

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Table (1): Effect of GA_3 concentrations on plant height (cm), number of branch/ plant and number of flowers/ plant.

concentration	properties		
	Plant high cm.	No. of branches	No. of flowers
0	96.67	17.66	20.33
50	127.33	30.67	32.33
100	106.66	23.67	26.00
	L.S.D(0.05)=4.15	L.S.D(0.05)=7.24	L.S.D(0.05)=2.74

Table (2): Effect of GA_3 concentrations on fresh weight of carrot, fresh weight of shoot system, fresh weight of biological weight and chlorophyll content.

concentration	properties			
	Fresh weight of carrot gm/plant	Fresh weight of shoot gm/plant	Fresh weight of biological weight gm/plant	Chlorophyll content µg/cm2
0	45.33	186.00	231.33	30.67
50	38.00	303.00	341.00	45.33
100	34.67	271.33	306.00	40.00
	L.S.D(0.05)=4.41	L.S.D(0.05)=10.77	L.S.D(0.05)=11.43	L.S.D(0.05)=1.88

Table(3): Effect of GA_3 concentrations on dry weight of carrot, dry weight of shoot system, dry weight of biological weight and سoluble carbohydrate.

concentration	properties			
	Dry weight of shoot system gm/plant	Dry weight of carrot gm/plant	Dry weight of biological product gm/plant	Soluble Carbohydrate
0	3.27	20.87	24.13	9.31
50	2.60	27.4	30.00	8.12
100	2.23	24.97	27.2	7.87
	L.S.D(0.05)=0.32	L.S.D(0.05)=0.72	L.S.D(0.05)=0.85	L.S.D(0.05)=0.072

تاثير حامض الجبرلين على نمو وبعض الصفات الفسلجية لنبات الجزر (*Daucus carota* L.).

عماد داود عباس
قسم البستنة، المعهد التقني – كلار، هيئة التعليم التقني - كوردستان
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الخلاصة

اجريت التجربة في حقل الابحاث التابع لقسم المحاصيل الحقلية داخل المعهد الفني كلار/ محافظة السليمانية. بهدف دراسة تاثير رش حامض الجرلين بتراكيز مختلفة هي(0، 50، 100 جزء من المليون). على بعض الصفات المظهرية والفسلجية لنبات الجزر (صنف الابيض المحلي).
استخدم التصميم العشوائي الكامل باربع مكررات بحيث تضمنت التجربة (12) وحدة تجريبية. وحللت النتائج احصائيا باستخدام اختبار اقل فرق معنوي تحت مستوى احتمالية (0.05) واظهرت النتائج ما يلي:
ان الرش بحامض الجبرلين بتركيز 50 جزء من المليون ادى الى زيادة معنوية في جميع الصفات المدروسة مقارنة مع التراكيز الاخرى من الحامض الجبرلين ونباتات السيطرة ، ولكن وزن الطري للجزر ، الوزن الجاف للجزر والكاربوهيدرات الذائبة لم تتاثر بتراكيز حامض الجبرلين المستخدمة مقارنة مع نباتات السيطرة.

الكلمات المفتاحية: Daucus Carota , فسلجة نبات , حامض الجرلين