THE BIOLOGICAL EFFECTIVENESS OF GIBBERELLIC ACID SEEDS SOAKING AND FOLIAR TO ABSCISIC ACID IN THE GROWTH , ANISE OIL YIELD AND ITS CHEMICAL CONTENT

S. B. I. Mustafa
Univ. Baghdad – Coll. Agric. - Field Crops Dept.
Drsbi1983@gmail.com

ABSTRACT

A field experiment was carried out during two winter season 2013, 2014 at the field of the Department of Field Crops, College of Agriculture, University of Baghdad, to study the effect of seeds soaking with Gibberellic acid and foliar with Abscisic Acid on the growth, yield, and content of Anise oil seeds using factorial experiment within RCBD design with three replicates. The seeds was treated within GA_3 were soaked with two concentrations of 30, and 60 mg. litter^{-1} in addition to without soaking and the code has been B_0 , B_1 , B_2 overlapped these transactions with two concentrations of Abscisic Acid 3, and 6 mg. litter^{-1} in addition to without foliar A_0 , A_1 , A_2The seeds to be treated with GA_3 are soaked for 24 hours prior of cultivation in the platelets according to the studied treatments, plants treated with Abscisic Acid were sprayed, at the height of the vegetative stage was 4-6 leaves and repeated foliar after 30 days, treated plants A_0B_2 (sprayed with distilled water only with 6 mg. litter^{-1}) achieved the highest values for both seasons: The plant hight (88.93,90.33) cm, number of leaves (64.71,70.50), number of branches (30.56,43.66), wet weight (915.70,1030.17) g, dry weight (221.67,256.80) g,Content of chlorophyll (70.46,71.83) mg, Content of carbohydrates (68.89,74.86)%, Content of auxin (56.46,64.10)%, Content of gibberellin (103.30,109.16)%, Content of volatile oil (4.03,5.36)%, Yield of volatile oil (56.06,96.98) L^{-1}.

Key words:medicinal plants, growth promoters,growth inhibitors,secondary metabolites.

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الفعالية الحيوية لنقع البذور بحامض الجبريليك والرش بحامض الأبسسك في نمو وحاصل زيت اليانسون Anise ومحتواه الكيميائي

سلا باسم إسماعيل مصطفى
مدرس
جامعة بغداد/ كلية الزراعة/ قسم المحاصيل الحقلية
Drsbi1983@gmail.com

المستخلص

نُفذت تجربة حقلية للموسمين الشتويين 2013/2012 و2014/2013 في الحقل التابع لقسم المحاصيل الحقلية– كلية الزراعة/ جامعة بغداد لدراسة الفعالية الحيوية لنقع البذور بالجبريليك والرش بالأبسسك في نمو وحاصل ومحتوى زيت اليانسون بتصميم القطاعات الكاملة المُعشاة بثلاث مكررات كتجربة عاملية، تم نقع البذورالمُعاملة ب GA_3 بتركيزين (30، 60) ملغم .لتر$^{-1}$ بالإضافة الى بدون النقع ، رمز لها B_0 و B_1 و B_2 لمدة 24 ساعة قبيل زراعتها في الأطباق وحسب المعاملات المدروسة ، وقد تداخلت هذه المعاملات مع تركيزين للرش بالأبسسك (30 ،60) ملغم .لتر$^{-1}$ بالإضافة الى بدون الرش رمز لها B_0 وB_1 وB_2، فقد رُشت على مرحلتين، الأُولى في أوج مراحل النشاط الخضري (مرحلة 4– 6 أوراق) وكُرر الرش بعد 30 يوماً. بينت نتائج التحليل الإحصائي معنوية التأثير المنشط بزيادة تراكيز مستويات حامض الجبريليك المستخدمة، وكذلك معنوية التأثير بإنخفاض وتراجع تراكيز مستويات حامض الأبسسك المستخدمة في المؤشرات المقاسة جميعها إذ حققت نباتات المعاملة A_0B_2 (الرش بالماء المقطر فقط مع 6 ملغم GA_3.لتر$^{-1}$) اعلى القيم للمتوسطات الحسابية ولكلا الموسمين منها إرتفاع النبات 88.93 و90.33 سم.نبات$^{-1}$، عدد الأوراق64.71 و70.50 ورقة. نبات$^{-1}$، عدد الأفرع 30.56 و43.66 فرعاً.نبات$^{-1}$، الوزن الرطب 915.70 و1030.17 غم . نبات$^{-1}$، الوزن الجاف 221.67 و256.80 غم. نبات، محتوى الكلوروفيل 70.46 و71.83 ملغم.غم. نسيج ورقي$^{-1}$، محتوى الكاربوهيدرات 68.89 و74.86%، محتوى الأوكسين 56.46 و65.10%، محتوى الجبريلين 103.30 و109.16%، محتوى الزيت الطيار 4.03 و5.36%، حاصل الزيت الطيار 36.06 و56.98 لتر.هكتار$^{-1}$.

كلمات مفتاحية: النباتات الطبية، مشجعات النمو، مثبطات النمو، الأيض الثانوي.

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INTRODUCTION

Anise (*Pimpinella anisum* L.) is classified as one of the most important medical plants that belongs to Umbellifereae, Mediterranean region is the natural origin for Anise plants specially Greece and Egypt, and the cultivation of its species were spread at the most temperate regions in each Asia, middle and southern Europe whereas Germany and Russia became the world's largest countries in their production of Anise followed by Holland, Spain, Morocco, Syria, China, India and Iraq (3 , 11) , The seeds of Anise were used since ancient times for general nutrition and stomach stimulation and to help digestive and remove colic and gases and distension in stomach and intestine and helps also in increasing urinary retention and the secretion of sweat and leads to the alleviation of cough, pharyngitis and chest pain, the biological effectiveness and medical impact of anise seeds due to its content of volatile oil and its components each according to its concentration. Its hydrocarbon turbine compound differs in quantity and quality according to seed degree of maturation whether for one specie or different anise species as well as the type of agricultural treatments used and their effect as explained by Peter (19), Seeds production of this crop and its reflection on volatile oil considered low compared with the world production rate and that is mentioned Al-naimi (3). In order to improve the productivity of this crop, It was recommended by some researchers (7) confirmed that the use of growth regulators plays an important role in the growth of medical plants in general and the amount of volatile oil extracted from it specially those which have motivational or inhibitory effect that returns in oil production and changing its chemical composition and that was confirmed also by other researchers (18, 19) . Gibberellic acid increases the activation of elongation, vegetative and syphiliss growth of plants by effecting on subatomic cells area by activating cell elongation in this area and also as well as increasing the rate of mitotic division by its effect on several processes ; Cell elongation , membrane permeability, osmatic potential, enzymatic activity and mobilization of potassium and sugars that reflected directly on growth and development, which helps seeds and prepares them to receive (skin) photosynthesis products and nutrient products to compete with the total vegetative in getting stored food . Gibberellin is responsible for elongation of short stalks, this almost indisputable, as dwarfism usually due to the sensitivity lack of short plants and the ineffectiveness of internal Gibberellic acid in plant tissue because of the lack of cellular division , cellular elongation or both together, and this may due to the presence of a growth inhibitory hormone (5).Plants differ in their response to Abscisic acid effectiveness its noted that most plants treated with Abscisic acid resulted in preventing or weakening growth and the plants couldn't restore their normal growth only after a long period or getting rid from this acid by being removed or analyzed losing its preventive effect, the other plants were active in growth and production when treated with low concentrations of Abscisic acid sprayed on plant leaves as with potato and cucumber (1). Abscisic acid is considered a hormonal complex and its effectiveness on plants in particular has not been clearly defined so far. Further studies and deep research should be pursued to determine the effectiveness of this acid together with the effectiveness of Gibberellic acid on different plants such as medical plants.The objective of this experiment was to identify the effect of seeds soaking with Gibberellic acid and spray with Abscisic Acid on the growth, yield, and content of Anise oil yield and its chemical content .

MATERIALS AND METHODS :

An experiment was conducted during two winter seasons 2012/2013 and 2013/2014 at the field of Field Crop department– College of Agriculture – Uni. Of Baghdad to study the biological effectiveness of seeds soaking Gibberellic acid and foliar with Abscisic acid in the growth, production and oil content of Anise plants, Factorial experiments within randomized complete block design (RCBD) were used with three replications. The soaking in Gibberellic acid (0, 30,60) $mg.L^{-1}$ represents factor B (B_0 B_1, B_2), respectively whereas Abscisic acid (0, 3, 6) $mg.L^{-1}$ represents factor A (A_0, A_1,A_2), respectively eeds were planted in cork plates private nursery till the age of seedling 3-4 real leaves, then transferred to the field with a distance of 3×3 m^2 for each unit ,

using plot with 0.75 m row spacing , and 0.25 m within the row seed rate of 8 kg seed.ha^{-1} as mentioned by Al-naimi (2). The selected plants were similar in size and planted in the field at first november for the two seasons, crop and soil management practices were performed as needed, especially irrigation because anise is so sensitive to thirst, Nitrogen fertilizer in the form of urea (46% N) in three batches of 60 kg N.ha^{-1} for each, the first was after one month of planting and the other two split were added with interval of one month between each batch. Phosphorus fertilizer was added with the form of triple superphosphate (20%P) and the potassium fertilizer in the form of potassium sulphate (41.5 k%) before planting at once at rate of 60 kg K.ha^{-1}. Seeds were soaked with Gibberellin for 24 hours before planting in cork plates Abscisic acid were sprayed at the peak of vegetative (4-6 leaves stage), and repeated after 30 days. 10 plants were randomly selected from
the three central lines of each treatment to study

- Length of the main floral stem (plant^{-1}.cm).
- Number of leaves (plant^{-1}.leave).
- Number of sub- branches (plant^{-1} . branch).
- Dry weight (plant^{-1}. gm).
- Relative content of chlorophyll (%).
- Leaves content of total carbohydrates (%) .
- Leaves content of plant hormones (leave tissue^{-1}.mg.gm) .
- Seeds content of volatile oil (%).

RESULTS AND DISCUSSION:

Length of main floral stalk

Results of Table 1 shows that the plants under treatment A_0 gave the tallege floral stalk length of Anise plants (73.40 and 72.66 cm.plant^{-1}) for the two seasons of this study with significant differences from treatment A_1 (3 mg.L^{-1}) that gave (36.68 and 39.37 cm.plant^{-1}) for the two seasons and treatment A_2(6 mg.L^{-1}) which gave floral stalk length (22.13 and 23.76 cm.plant^{-1}). Soaking szeeds in Gibberellic acid in the same Table shows that plants of treatment B_2 (60 mg.L^{-1}) producted the highest values of floral stalk length reached (52.74 and 54.58 cm.plant^{-1}) for the two seasons, respectively with significant differences from treatment B_0 which gaves 35.43 and 35.60 cm.plant^{-1} and treatment B_1 (30 mg.L^{-1}) gave plants (44.04 and 45.62 cm.plant^{-1})for the two seasons. Results shows significantly decrease in floral stalk length of Anise plants from (88.93 to 90.33 cm.plant^{-1}) in treatments A_0B_2 of foliar with distilled water only with soaking 60 mg.L^{-1} to (17.80 and 19.56 cm.plant^{-1})in plants of treatments A_2B_0 of foliar at 6 mg.L^{-1} with soaking in distilled water only was significantly exceeded compared to all other interventions for the two seasons, Some Researchers (2, 6, 22) found that the reason behind plants dwarf and shortness along with the increase in the levels of Abscisic acid due to correlation with the decrease in levels of Gibberellic acid in which they soaked is due to the effect of foliar by Abscisic acid in reducing plant growth and decreasing stalks elongation, these plants will be unable to developed only after a long period time or until getting rid from this acid by removal or decomposition and loos its biological effectiveness as the plant has terminal buds active in growth when treated with Abscisic acid .

Table 1. Length of main floral stalk (cm.plant^{-1}) as affected by the concentrations of Gibberellic acid and Abscisic acid

	The first season				The second season			
Levels of Gibberellic Mg.L^{-1}	Levels of Abscisic acid Mg.L^{-1}				Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	56.93	31.56	17.80	35.43	54.16	33.06	19.56	35.60
B_1	74.33	35.93	21.86	44.04	73.50	40.10	23.26	45.62
B_2	88.93	42.56	26.73	52.74	90.33	44.96	28.46	54.58
L.S.D 5%	8.05			4.65	4.76			2.75
Means	73.40	36.68	22.13		72.66	39.37	23.76	
L.S.D 5%	4.65				2.75			

Number of leaves number

Results in the Table 2 shows that the means in the leaves number in plants indicated significant decrease gradually within foliar treatments down to 6 mg.L^{-1}, the plants of this treatment shows a lower leaves number average of (29.61 and 28.27 leaf.$plant^{-1}$) for the two seasons, respectively whereas the plants in A_1 shows an average of leaves number (41.97 and 43.05 leaf.$plant^{-1}$) for the two seasons, the plants in treatment A_0 shows a higher leaves number (56.68 and 60.87 leaf.$plant^{-1}$) for the two seasons, the results also shows a significant effect for soaking treatments with Gibberellic acid by increasing the average of used concentrations to reach the concentration 60 mg.L^{-1} in which plants showed a higher leaves number average of (46.13 and 47.61 leaf.$plant^{-1}$) for the two seasons followed by the plants of treatment B_1 (30mg.L^{-1}) which gave an average of (41.97 and 43.05 leaf.$plant^{-1}$) compared to B_0 plants which showed a lower leaves number (36.30 and 36.27 leaf.$plant^{-1}$) for the two seasons, The effect of interaction between Abscisic acid and Gibberellic acid the results showed a significant decrease in leaves number from (88.93 and 19.56 leaf.$plant^{-1}$) for the treatment A_0B_2 of foliar with distilled water only with soaking 60 mg.L^{-1} to 17.80 and 19.56 leaf.$plant^{-1}$ in treatment A_2B_0 of foliar at 6 mg.L^{-1} with soaking in distilled water only which significantly exceeded at all other interaction for the two seasons of study. It was indicated by (4, 8, 9) that the reduction in leaves number with increased levels of Abscisic acid used correlated with decreased levels of Gibberellic acid in which they soaked due to the effect of Abscisic acid in reducing buds growth.

Table 2. Number of leaves number (leaf.$plant^{-1}$) as affected by the concentrations of Gibberellic acid and Abscisic acid

	The first season				The second season			
Levels of Gibberellic Mg.L^{-1}	**Levels of Abscisic acid Mg.L^{-1}**				**Levels of Abscisic acid Mg.L^{-1}**			
	A_0	**A_1**	**A_2**	**Means**	**A_0**	**A_1**	**A_2**	**Means**
B_0	**46.96**	**35.26**	**26.66**	**36.30**	**49.83**	**34.00**	**25.00**	**36.27**
B_1	**58.36**	**38.06**	**26.50**	**41.97**	**62.30**	**37.53**	**29.33**	**43.05**
B_2	**64.71**	**41.03**	**32.66**	**46.13**	**70.50**	**41.83**	**30.50**	**47.61**
L.S.D 5%	**10.55**			**6.09**	**6.45**			**3.72**
Means	**56.68**	**38.12**	**29.61**		**60.87**	**37.78**	**28.27**	
L.S.D 5%	**6.09**				**3.72**			

Number of sub-branches

Results in the Table 3 shows that plants in treatment A_0 gave the highest values in number of sub- branches in Anise plants (25.41 and 33.88 branch.$plant^{-1}$) for the two seasons with significant differences from treatment A_1 of (15.83 and 17.11 branch.$plant^{-1}$) and treatment A_2 which gave (9.94 and 11.72branch.$plant^{-1}$) for the two seasons respectively. The results in the same Table indicate also that soaking plants with Gibberellic acid in treatment B_2(60 mg.L^{-1}) gave the highest values in number of sub-branches of anise plants (20.13 and 24.77 branch.$plant^{-1}$) with significant difference from treatment B_0 which gave (13.49 and 16.44 branch.$plant^{-1}$) and treatment B_1 (30 mg.L^{-1}) with values of (17.11 and 21.50 branch.$plant^{-1}$) for the two seasons respectively , and about the effect of interaction between Abscisic acid and Gibberellic acid the results shows a significant decrease in the number of sub-branches of Anise from 30.56 and 43.66 branch.$plant^{-1}$ in treatment A_0B_2 in which plants foliar with distilled water only and soaking 60 mg.L^{-1} to 6.66 and 10.00 branch.$plant^{-1}$ in treatment A_2B_0 of foliar at 6 mg.L^{-1} with soaking in distilled water only exceeded significantly on all other interactions of the two seasons, this may due to the effect of Abscisic acid (14, 15, 16,17).

Table 3. Number of sub-branches (branch.plant^{-1}) as affected by the concentrations of Gibberellic acid and Abscisic acid

	The first season				The second season			
Levels of Gibberellic Mg.L^{-1}	Levels of Abscisic acid Mg.L^{-1}				Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	20.33	13.50	6.66	13.49	24.00	15.33	10.00	16.44
B_1	25.33	15.16	10.83	17.11	34.00	18.66	11.83	21.50
B_2	30.56	17.50	12.33	20.13	43.66	17.33	13.33	24.77
L.S.D 5%	6.49			3.75	9.46			5.46
Means	25.41	15.38	9.94		33.88	17.11	11.72	
L.S.D 5%	3.75				5.46			

Wet weight

Results in the Table 4 shows that the plants of treatment A_0 produced the highest wet weight Anise plants (605.06 and 778.72 gm.plant^{-1}) for the two seasons respectively , with significant difference from treatment A_1 (3mg.L^{-1}) which gave (74.90 and 133.00 gm.plant^{-1}) and treatment A_2 (6 mg.L^{-1}) which gave (28.56 and 19.17 gm.plant$^{-1)}$, and the treatments of soaking in Gibberellic acid in the same Table shows that plants of treatment B_2 and (427.28 gm.plant^{-1}) for the two seasons with significant differences from treatment B_0 which gave 86.17 and 163.22 gm.plant^{-1} and the treatment B_1 (269.89 and 340.39 gm.plant^{-1}) for the two seasons respectively , concerning the effect of interaction between Abscisic acid and Gibberellic acid the results shows significant decrease in plant wet weight from (915.70 and 1030.17 gm.plant^{-1}) in treatment A_0B_2 of foliar with distilled water only 60 mg.L^{-1} to (16.00 and 7.33 gm.plant^{-1}) in treatment A_2B_0 of foliar at 6 mg.L^{-1} with distilled water only significantly exceeded on all other interaction for the two seasons, this may due to gathering and concentrating of Abscisic acid in plant tissue accompanied by decrease average and concentration of Gibberellic acid.Abscisic acid and growth stimulant Gibberellic acid, and its interaction in increasing the activity of the analytical enzyme and biological control of ouxin and Gibberellins and this reflects on cells division and elongation which results in decreasing vegetative growth of plant including wet weight of plant and this was mentioned by (10,18, 19).

Dry weight

Results in the Table 5 shows that plants in treatment A_0 gave highest dry weight values in Anise plants (129.61 and 161.46 gm.plant^{-1}) for the two reasons with significant differences from treatment A_1(3 mg.L^{-1}) which gave (24.54 and 33.18 gm.plant^{-1}) and treatment A_2 (6 mg.L^{-1}) gave (7.17 and 9.06 gm.plant^{-1}) for the two seasons respectively, The treatments of soaking in Gibberellic acid in the same Table indicate that plants in treatment B_2 (60 mg.L^{-1}) gaved the highest dry weight in Anise plants (89.11 and 106.23 gm.plant^{-1}) with significant differences from treatment B_0 (not soaked) which gave (29.44 and 33.58 gm.plant^{-1}) for the two seasons and treatment B_1 (30 mg.L^{-1}) in giving (42.77 and 63.88 gm.plant^{1}), and concerning the effect of interaction treatment between Abscisic acid and Gibberellic acid, the results shows significant decrease in dry weight of Anise plant from 221.67 and 256.80 gm.plant^{1} in treatment A_0B_2 of foliar with distilled water only with soaking 60 mg.L^{-1} to 4.67 and 5.50 gm.plant^{-1} in treatment A_2B_0 of foliar at 6 mg.L^{-1} with soaking in distilled water only was exceeded significantly on all other interaction for the two seasons, this may due to the physiological effect of Abscisic acid (18, 19).

Table 4. Wet weight (gm.plant^{1}) as affected by the concentrations of Gibberellic acid and Abscisic acid

Levels of Gibberellic Mg.L^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	191.67	50.83	16.00	86.17	426.67	55.67	7.33	163.22
B_1	707.80	72.20	29.67	269.89	879.33	123.33	18.50	340.39
B_2	915.70	101.67	40.00	352.46	1030.17	220.00	31.67	427.28
L.S.D 5%	136.67			78.90	193.90	133.00	19.17	111.95
Means	605.06	74.90	28.56		778.72			
L.S.D 5%	78.90				111.95			

Table 5. Dry weight (gm.plant^{1}) as affected by the concentrations of Gibberellic acid and Abscisic acid

Levels of Gibberellic Mg.L^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	68.33	15.33	4.67	29.44	76.90	18.33	5.50	33.58
B_1	98.83	22.63	6.83	42.77	150.67	31.87	9.10	63.88
B_2	221.67	35.67	10.00	89.11	256.80	49.33	12.57	106.23
L.S.D 5%	75.96			43.85	108.93			62.89
Means	129.61	24.54	7.17		161.46	33.18	9.06	
L.S.D 5%	43.85				62.89			

Leaves content of chlorophyll

Results in the Table 6 shows a significant decrease in the chlorophyll content in Anise plant leaves in treatments of foliar with Abscisic acid towards low levels of concentrations used to reach the levels A_0 . The highest values in leaves content of chlorophyll (54.31 and 57.38 mg.gm.leave tissue^{-1}) for the two seasons with significant differences from treatment A_1 (3 mg.L^{-1}) which gave (28.11 and 28.5 mg.gm.leave tissue^{-1}) and treatment A_2 (6 mg.L^{-1}) which gave levels of 19.10 and 18.56 mg.gm.leave tissue^{-1} for the two seasons, the treatments of soaking in Gibberellic acid in the same Table indicated that the plants of treatment B_2 (60 mg.Lt^{-1}) gave the highest values of leaves content of chlorophyll in Anise plants (41.13 and 41.85 mg.gm.leave tissue^{-1})for the two seasons with significant differences from the treatment B_0 which gave 25.93 and 27.54 mg.gm.leave tissue^{-1} and treatment B_1 (30 mg.L^{-1}) which gave (34.27 and 35.06 mg.gm.leave tissue^{-1}) for the two seasons and concerning the effect of the interaction treatment between Abscisic acid and Gibberellic acid, the results showed significant decrease in leaves content of chlorophyll in Anise plants of (70.46 and 71.83 mg.gm.leave tissue^{-1}) in treatment A_0B_2 of spraying with distilled water only with soaking in 60 mg.L^{-1} to (16.00 and 16.30 mg.gm.leave tissue^{-1}) , plants in treatment A_2B_0 of foliar with 6 mg.Lt^{-1} with soaking in distilled water only was exceeded significantly on all other interference for the two seasons, Researchers (2 , 4) indicated that the growth inhibition effect and the formation of Gibberellin and Ouxin hormones may due to Abscisic acid action through stimulation of demolition and internal decomposition and Gibberellic acid .

Table 6. Leaves content of chlorophyll (mg.gm.leave tissue^{-1}) as affected by the concentrations of Gibberellic acid and Abscisic acid

Levels of Gibberellic Mg.L^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	37.30	24.50	16.00	25.93	41.46	24.86	16.30	27.54
B_1	55.16	28.33	19.33	34.27	58.86	28.16	18.16	35.06
B_2	70.46	31.50	21.96	41.31	71.83	32.50	21.23	41.85
L.S.D 5%	6.20			3.58	8.74			5.04
Means	54.31	28.11	19.10		57.38	28.51	18.56	
L.S.D 5%	3.58				5.04			

Table 7. Leaves content of carbohydrates (%) as affected by the concentrations of Gibberellic acid and Abscisic acid

Levels of Gibberellic Mg.Lt^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	40.80	21.66	12.13	24.86	39.46	23.03	13.16	25.22
B_1	61.04	25.30	14.50	33.61	58.60	27.70	15.96	34.08
B_2	68.89	34.16	18.76	40.60	74.86	33.30	18.76	42.31
L.S.D 5%	15.45			8.92	6.93			4.0
Means	56.91	27.04	15.13		57.64	28.01	15.96	
L.S.D 5%	8.92				4.00			

Leaves content of carbohydrates

Results in the Table 7 shows significant decrease in the carbohydrates content in plant leaves in the treatments of foliar with Abscisic acid towards low levels of concentrations used to reach the levels A_0 , The highest values in leaves content of carbohydrates (56.91 and 57.64 %) for the two seasons with significant difference from treatment A_1 (3 mg.L^{-1}) which gave (27.4 and 28.01%) and treatment A_2 (6 mg.L^{-1}) which gave levels of (15.13 and 15.96%) for the two seasons, the treatments of soaking in Gibberellic acid in the sameTable indicated that the plants of treatment B_2 (60 mg.L^{-1}) gave the highest values of leaves content of carbohydrates in Anise plants (40.60 and 42.31%) for the two seasons with significant differences from the treatment B_0 which gave (24.86 and 25.22 %) and treatment B_1 (30 mg.L^{-1}) which gaved (33.61 and 34.08 %) for the two seasons and The effect of interaction treatment between Abscisic acid and Gibberellic acid respectively, Showed significant decrease in leaves content of carbohydrates in Anise plants of (68.89 and 74.86 %) in treatment A_0B_2 of spraying with distilled water only with soaking in 60 mg.L^{-1} to (12.13 and 13.16 %) , Plants in treatment A_2B_0 of spraying with 6 mg.L^{-1} with soaking in distilled water only was increased significantly on all other interactions for the two seasons, this increase in carbohydrates percentage in leaves may due to the effect of both factors on physiological activities mainly on the decrease in cells division and elongation, reducing total vegetative, reducing areas of photosynthesis and reducing nutrients formation and therefore causing lack in plants content of dry matter and also inhibiting enzymes to convert noncomplex compounds to complex and the deficit in supplying plant with needed energy for better growth (2, 4).

Leaves content of Auxin – like materials

Results in the Table 8 indicated that plants of treatment A_0 achieved the highest values in the level of ouxin - like materials in Anise plant (48.94 and 55.35%) for the two seasons, with significant differences from treatment A_1 (3 mg.L^{-1}) which gave (26.96 and 25.37%) and treatment A_2 (6 mg.L^{-1}) which gave levels of (17.34 and 16.15%) for the two seasons, the treatments of soaking in Gibberellic acid in the same Table indicated that the plants of treatment B_2 (60 mg.L^{-1}) gave the highest values of ouxin – like materials level in Anise plants (35.56 and 37.57%) for the two seasons with significant differences from the treatment B_0 (not sprayed) which gave 26.13 and 26.14

% and treatment B_1 (30 mg.L^{-1}) which gave 31.55 and 33.16% for the two seasons and concerning the effect of interaction between Abscisic acid and Gibberellic acid, the results shows significant decrease in auxin – like materials level in Anise plants of 56.46 and 65.10 % in treatment A_0B_2 of foliar with distilled water only with soaking in 60 mg.L^{-1} to 14.90 and 13.80%, plants in treatment A_2B_0 of foliar with 6 mg.L^{-1} with soaking in distilled water only was increased significantly on all other for the two seasons.

Table 8. Leaves content of Auxin – like materials (%) as affected by the concentrations of Gibberellic acid and Abscisic acid

Levels of Gibberellic Mg.L^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	39.83	23.66	14.90	26.13	43.20	21.43	13.80	26.14
B_1	50.53	26.56	17.56	31.55	57.76	25.73	16.00	33.16
B_2	56.46	30.66	19.56	35.56	65.10	28.96	18.66	37.57
L.S.D 5%	5.44			3.14	7.20			4.15
Means	48.94	26.96	17.34		55.35	25.37	16.15	
L.S.D 5%	3.14				4.15			

Leaves content of gibberellin– like materials

Results in the Table 9 indicated that plants of treatment A_0 achieved the highest values in the level of gibberellin- like materials in Anise plant (86.14 and 87.21%) for the two seasons with significant difference from treatment A_1 (3 mg.L^{-1}) which gave (40.55 and 45.22%) and treatment A_2 (6 mg.L^{-1}) which gave levels of (26.83 and 27.81%) for the two seasons, the treatments of soaking in Gibberellic acid in the same Table indicate that the plants of treatment B_2 (60 mg.Lt^{-1}) gave the highest values of gibberellin – like materials level in Anise plants (60.13 and 64.66%) for the two seasons with significant differences from the treatment B_0 which gave (42.42 and 41.63%) and treatment B_1 (30 mg.L^{-1}) which gave values of 50.96 and 53.94% for the two seasons and concerning the effect of interaction between Abscisic acid and Gibberellic acid, the results showed significant decrease in gibberellin – like materials level in Anise plants of (103.30 and 109.16%) in treatment A_0B_2 of foliar with distilled water only with soaking in 60 mg.L^{-1} to (12.06 and 22.30%) in treatment A_2B_0 of foliar with 6 mg.L^{-1} with soaking in distilled water only was increased significantly on all other interaction for the two seasons, this may do to the above mentioned about the competition in effectiveness between Abscisic acid and Gibberellic acid and their effect of each in the same place of activation as well as preventing the internal synthesis of Gibberellic acid and each ouxin and gibberellin have no effect in cancelling this inhibitory effect and that what is confirmed by (20, 21, 22).

Table 9. Leaves content of gibberellin– like materials (%) as affected by the concentrations of Gibberellic acid and A acid

Levels of Gibberellic Mg.L^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	69.65	36.56	21.06	42.42	63.27	39.33	22.30	41.63
B_1	85.46	40.36	27.06	50.96	89.20	45.83	26.80	53.94
B_2	103.30	44.73	32.36	60.13	109.16	50.50	34.33	64.66
L.S.D 5%	11.89			6.86	17.91			10.34
Means	86.14	40.55	26.83		87.21	45.22	27.81	
L.S.D 5%	6.86				10.34			

Seed concentration of volatile oil

Results in the Table 10 shows that the treatments of spraying with Abscisic acid in general significantly affected Anise plants content of volatile oil, however the treatment A_0 achieved the highest values in this characteristic (3.26 and 3.86%) for the two seasons with significant differences from treatment A_1 (3 mg.L^{-1}) which gave (1.54 and 1.62%) and treatment A_2 (6 mg.L^{-1}) which gave levels of 0.92 and 1.00% for the two seasons, The treatments of soaking in Gibberellic acid in the same Table indicate that the plants of treatment B_2 (60 mg.L^{-1}) gave the highest values in plant volatile oil content level in Anise plants 2.29 and 2.82% for the two seasons with significant differences from the treatment B_0 which gave 1.48 and 1.52%, treatment B_1 (30 mg.L^{-1}) which gave (1.95 and 2.14%) for the two seasons. interaction treatment between Abscisic acid and Gibberellic acid, the results shows significant decrease in plant volatile oil content level in Anise plants of (4.03 and 5.36%) in plants of treatment A_0B_2 of foliar with distilled water only with soaking in 60 mg.L^{-1} to (0.75 and 0.87%) in plants of treatment A_2B_0 of spraying with 6 mg.L^{-1} with soaking in distilled water only exceeded significantly on all other interference of the two seasons (2, 22) .

Table 10. Seed concentration of volatile oil (%) as affected by the concentrations of Gibberellic acid and Abscisic acid

Levels of Gibberellic Mg.Lt^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	2.41	1.29	0.75	1.48	2.41	1.29	0.87	1.52
B_1	3.33	1.55	0.97	1.95	3.80	1.62	1.00	2.14
B_2	4.03	1.78	1.06	2.29	5.36	1.97	1.13	2.82
L.S.D 5%	0.87			0.50	0.98			0.56
Means	3.26	1.54	0.92		3.86	1.62	1.00	
L.S.D 5%	0.50				0.56			

Volatile oil concentration

Results in the Table 11 shows that treatments of foliar with Abscisic acid in general has a significant effect in volatile oil content, however treatment A_0 achieved the highest in volatile oil content of Anise plant (21.26 and 33.42 L.ha^{-1}) for the two seasons with significant differences from treatment A_1 (3 mg.L^{-1}) which gave (1.11 and 2.13 L.ha^{-1}) and treatment A_2 (6 mg.L^{-1}) which gave levels of (90.25 and 0.19) L.ha^{-1} for the two seasons, the treatments of soaking in Gibberellic acid in the same Table indicate that the plants of treatment B_2 (60 mg.L^{-1}) gave the highest volatile oil content in Anise plants (12.72 and 20.42 L.ha^{-1}) for the two seasons with significant differences from the treatment B_0 which gave 1.62 and 3.64 L.ha^{-1} and treatment B_1 (30 mg.L^{-1}) which gave (1.95 and 2.14 L.ha^{-1}) for the two seasons. The interaction treatment between Abscisic acid and Gibberellic acid concerning the effect of interaction between Abscisic acid and Gibberellic acid, the results showed significant decrease in volatile oil content in Anise plants 36.06 and 56.98 L.ha^{-1} in plants of treatment A_0B_2 of foliar with distilled water only with soaking in 60 mg.L^{-1} to 0.11 and 0.06 L.ha^{-1} in plants of treatment A_2B_0 of spraying with 6 mg.t^{-1} with soaking in distilled water only exceeded significantly on all other interaction of the two seasons, the decrease in volatile oil content as mentioned before is due to the effect of Abscisic acid in inhibition of enzymes activity and decreasing the activity of photosynthesis which focus on efficiency of vegetative growth (the source) and adversely affected the content of volatile oil content (the denominator) as well as the decrease in plant wet weight (Table 4) and the content of volatile oil, therefore the obvious decrease in both characteristics which resulted in reduction of volatile oil content.

Table 11. Volatile oil concentration (%) as affected by the concentrations of Gibberellic acid and Abscisic acid

Levels of Gibberellic Mg.L^{-1}	The first season Levels of Abscisic acid Mg.L^{-1}				The second season Levels of Abscisic acid Mg.L^{-1}			
	A_0	A_1	A_2	Means	A_0	A_1	A_2	Means
B_0	4.16	0.59	0.11	1.62	10.21	0.66	0.06	3.64
B_1	23.55	1.03	0.26	8.28	33.08	1.78	0.17	11.67
B_2	36.06	1.72	0.39	12.72	56.98	3.96	0.33	20.42
L.S.D 5%	9.41			5.43	15.70			9.06
Means	21.26	1.11	0.25		33.42	2.13	0.19	
L.S.D 5%	5.43				9.06			

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