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EFFECT OF SOWING DATES, SOIL MULCHING AND FOLIAR SPRAYING OF CALCIUM ON LEAVES CHEMICAL COMPONENTS OF OKRA PLANT GROWN IN PLASTIC HOUSES

Kazem S.L. Alhamrani[1] Abdullah A. Abdullah[2] and Dhia Ahmed Taain[2]

[1]Agriculture Directorate of Maysan, Iraq.
[2]Department of Horticulture and Landscape, College of Agriculture, University of Basrah, Iraq.

Abstract

The experiment was carried out during winter season of 2018-2019 in a plastic house belongs to the Maymunah *Horticulture Station* / Agriculture Directorate of Maysan to investigate the effect of three dates of Okra planting, soil mulching and calcium foliar spraying on leaves chemical components of Okra plant cultivar " btayrh" under the conditions of the Amara city in the south of Iraq. The experiment included 24 treatments of possible combinations between three sowing dates (15/12, 31/12 and 15/1), two soil mulching treatments (without mulching, mulching the soil by black polyethylene) and four concentrations of calcium (0, 0.5, 1 and 1.5) $ml.l^{-1}$.

A split- split plot design was used with three replicates. Treatment means were compared using least significant difference L.S.D. test at a probability of 0.05.

Results may be summarized as follows:

The cultivated plants at the third date showed significant increase in the total chlorophyll, total soluble carbohydrate, percentage of nitrogen,phosphorus and potassium in the leaves compared to plants of first and second dates.

The cultivated plants of the mulching soil by black polyethylene were significantly higher in all studied leaves chemical components except the percentage of potassium compared to plants grown without mulching soil.

The sprayed plants by calcium with a concentration of 1 $ml.l^{-1}$ were significantly higher in all studied leaves chemical components compared to control plants and plants sprayed with (0.5 and 1.5) $ml.l^{-1}$ concentrations .

The second interactions between the studied factors were significant effect in some leaves chemical components.

The third interaction between the studied factors was significant effect in the total chlorophyll in the leaves only.

Key words **:** Sowing dates, Soil mulching, Calcium, Plastic houses, chemical components, okra plant.

Introduction

Okra (*Abelmoschus esculentus* L.) which belongs to the Malvaceae family, is an important summer vegetable crop in Iraq and the world where it is grown extensively in the tropical and subtropical regions and warm temperate regions of the world (Saifullah and Rabbani, 2009).

It planted for green fruits, Iraqi prefers it for cooking in the summer and we can packaged, frozen and dried for consumption in winter (Taain *et al.*, 2014).

The total cultivated area in Iraq in 2015 was about 16,750 ha with a total production of 124000 tons and a low production rate of 7.403 tons per ha. compared with some Arab countries (Arab Organization Agricultural Development, 2016). The main reasons for the low rate of production in Iraq was not used the modern techniques in management of the crop because of its positive impact on the plant growth and leaves chemical components and also the production, including determining the appropriate sowing date for plants, especially in plastic houses, mulching the soil and foliar spraying nutrients.

Determining the appropriate sowing date in plastic houses is very important especially after the spread and

expansion of protected agriculture in Iraq, the statistics of the Ministry of Agriculture indicates that the number of plastic houses planted of okra reached to 759 houses with an area estimated at 500 m^2 per house and a total production about 666 tons for 2012 (Ministry of Agriculture- Iraq, 2012). The chemical components of leaves is greatly influenced by planting dates, Therefore, timely planting provides the plant with different environmental conditions that are favorable and encouraged to the vegetative growth of the plant. The various environmental factors surrounding in plant growth have a significant impact on all biological and chemical processes in the plant which represented by water absorption and nutrients (Wojcik, 2004). The leaf is the main center of various bio-reactions and manufactures of nutrients through photosynthesis and its relationship with the absorption, transport and distribution of nutrients in the plant (Lutfi, 1986) and then increase the chemical components in the leaves.

The seeds of okra grow at 20 °C and the appropriate degree of germination is 30 °C, the reduce temperature delayed germination and caused slow growth, small size of fruits (Matlub *et al.*, 1989). Soubeih *(*2016) studied the effect of sowing okra in five dates (15 /1,1 / 2,15 / 2, 1 / 3 and 15 / 3) on the chemical components of the leaves in the field in Egypt and observed that the last date (15 / 3) recorded the highest value of the total chlorophyll (46.64 mg / 100g fresh weight) and the percentage of nitrogen 1.86) %) compared to the rest dates. Also in Egypt Manal *et al.,* (2018) found a significant increase in the total chlorophyll and the percentage of nitrogen, phosphorus and potassium in the leaves for okra plant sowing at three dates (15/2,15/3 and 15/4) for two sequent seasons (2014 and 2015), the date 15/4 recorded highest values of these characteristics for two seasons compared to the rest dates.

Soil mulching plays an important role in increasing soil temperature, growth roots, an ability to absorb water and nutrients, help to retain water, reduce lost evaporation, help fight the weeds and keep the fruits clean. Carbon dioxide also accumulates under the mulch and exits through the hole of the plant in the cover, which lead to high photosynthesis and increased chemical content in the leaves and increase the productivity (McCraw, 2003). So, the plastic mater works to transfer salt away from the mulching area. Abdullah *et al.,* (2017) showed that the use of black plastic in mulching the soil when cultivating the plants of the local cultivar "Al-Khunessary" under the conditions of protected agriculture had a significant increase in the total chlorophyll in the leaves compared to non-mulching. Shivaraj *et al*., (2018) showed when using three types of plastic mulches (black, silver, white and without mulch) in cultivating okra plant that all types of plastic mulches significantly affected on the chlorophyll (a and b) after 30 and 60 days from planting and the most effective was white mulch compared to non-mulching.

It is known that the soil of centre and south of Iraq has basic characteristics and high content of clay, which affects on the loss of many nutrients by stabilizing or sedimentation or reduce their readiness and this negatively affects on the plant's obtaining to need from it. The reflection on the quantity and quality yield, and from these elements calcium considered as a slow motion element in the plant (Abu Dhahi and Yunis, 1988 ; Hickman, 2011). Calcium is a major nutrient that has many physiological functions and is important for plant growth and development, it plays a key role in building the structure of the cell, the main component of the middle lamella in a manner calcium pactate, it enters in formation of Phosphatidic acid, which contributes the synthesis of cell membranes (Sahaf, 1989). gives flexibility and elasticity to the cellular wall, which facilitates the growth and expansion of the cells and then increase the growth of the plant (Mengel *et al.,* 2000). It helps to accelerate the transmission of carbohydrates and amino acids and build proteins by increasing absorbed nitrates and high plant content of chemical components, that affecting on division and elongation of cell, growth developing peaks and formation a new out growth (Marscher, 2012). In addition to his ability in reducing the phenomenon of falling flowers in the early stages of plant growth when sowing under the conditions of plastic houses, So, it plays a role in strengthening contact the area of fruit with plant. Husein *et al*., (2015) found when sprayed tomato plants with calcium fertilizer in concentration (0.25%) for two seasons and four times after (2, 4, 6 and 8) weeks of planting, a significant increase in the leaf components of nitrogen, phosphorus, potassium and calcium for both seasons.

The importance of the date of cultivation, mulching the soil and calcium foliar spraying in the growth, chemical components of leaves and production of vegetable crops. Because of the few studies on the effect of these factors and their interactions on the growth and leaves chemical components of okra plant cv. "btayrh" grown under unheated plastic house in the province of Maysan, south of Iraq the present study has been conducted .

Materials and Methods

The experiment was carried out during the agricultural season 2018 / 2019 in one of the unheated plastic house

with dimensions 42 × 9 m and 378 m^2 area belong to the Maymunah *Horticulture Station* / Agriculture Directorate of Maysan, Iraq. Randomize Complete Block Design (RCBD) was used in spilt-spilt-plot experiment, with three duplicates (Alrawi and Khalaf Allah, 1980). The soil of the plastic house ploughed two times and sterilized with solar sterilization, then divided into nine lines (40 m length, 40 cm wide and 30 cm high) and the distance between lines 50 cm. Then the animal fertilizer (sheep residues) has been added to the lines before planting at a rate of 6 m^3. plastic $house^{-1}$, in addition to the super-phosphate calcium 45% P_2O_5 at the rate of 27 kg. plastic $house^{-1}$. In order to prevent fungal diseases, the Rial pesticide add at a rate of 900 ml each plastic house (100 ml per line) according to the instructions of the productive company. The fertilizer covered with soil and the drip irrigation system was installed. Each line divided into two halves, one of them covered by black polyethylene and the other left without covering, then each line divided into eight experimental units with a length of 5 m. The treatments were distributed to experimental units in each half of the line. The local seeds cultivar "btayrh" were used in this study, this cultivar is more desirable and widespread in Maysan province and Iraq. It can be gotten a yield of okra after 50 days of planting seeds, the length of plant is short and the color and the form of fruits are desirable, but it's become woody and hard in when leaves more than three days after harvest. The harvest period is limited and cultivated to be early mainly, (Matlub *et al.*, 1989). The seeds were planted directly in the middle of the line in the soil of the plastic house, and the number of holes was 20 in each experimental unit. 5-7 seeds were put in one hole and after germination left three plants in a hole only (16.66 $plant.m^{-2}$). The plants were fertilized when the true third leaf was appearance by using NPK (8: 48: 12) at the rate of 0.5 $g.l^{-1}$ to encourage the formation of roots and to obtain a strong total radical. After 7 days the plants fertilized with a NPK (20 : 20: 20) for two times and another 7 days with the same above concentration according to the instructions of the productive company. All service operations were carried out for all treatments equally, the plants irrigation according to the need for regular periods it also followed a protective program to prevent insects and diseases and sprayed pesticides according to the instructions of the manufactured company.

The solution of calcium was prepared with three concentrations (0, 0.5, 1, 1.5) $ml.l^{-1}$, the number of spraying was 3 times with 10 days interval. The first spray was after 40 days of field cultivation. The determination of chemical characteristics of the leaves were taken after 70 days of planting, represented by the total chlorophyll concentration in the leaves, as described by Goodwin (1976). Total soluble carbohydrates determined according to the Phenol - Sulfuric Acid method (Dubois *et al.*, 1956). The nitrogen was determined according to the method of Cresser and Parsons (1979), the phosphorus determined according to the method of Murphy and Riley (1962), while potassium determined using method of *Page et al*., (1982).

Results and Discussion

The obtained results shown in table 1 indicated that sowing dates significant effect in the total chlorophyll and total soluble carbohydrate in the leaves, the total chlorophyll and total soluble carbohydrate of plants cultivated at the third date15/1 were significant increase compared to the rest dates with the increment percentages of 20.30, 11.76 % and 90.89, 2.22 % sequentially.

The total chlorophyll and total soluble carbohydrate in the leaves of plants cultivated in the mulching soil with black polyethylene were a significant increase in compared to the plants grown in without mulching soil with the increment percentages of 9.74, 3.59 % sequentially.

The sprayed plants by calcium with a concentration of 1 $ml.l^{>1}$ showed significantly increase in these characteristics compared to control plants and plants sprayed with the concentrations of 0.5 and 1.5 $ml.l^{-1}$ with the increment percentages of 19.85, 9.07, 3.17 % and 109.12, 24.77, 6.69 % sequentially. The sprayed plants by calcium with a concentration of 1.5 $ml.l^{-1}$ showed significantly increase in the total chlorophyll and total soluble carbohydrate in the leaves compared to plants sprayed with a concentration of 0.5 $ml.l^{-1}$, with the increment percentages of 5.72, 18.52% sequentially.

The interaction between sowing dates and soil mulching was significant in the total chlorophyll in the leaves only. The cultivated plants at the third date and the mulching soil gave the highest value of the total chlorophyll (66.36 mg.100 g^{-1} fresh weight). While the cultivated plants at the first date and without mulching soil gave the lowest value of the total chlorophyll (50.38 mg.100 g^{-1} fresh weight). The cultivated plants at the third date and the sprayed by calcium with the concentration of 1 $ml.l^{-1}$ gave the highest values of the total chlorophyll and total soluble carbohydrate in the leaves (68.35 mg.100 g^{-1} fresh weight and 81.03mg.g^{-1} dry mater) sequentially, while the cultivated plants at the first date and 0 $ml.l^{-1}$ calcium gave the lowest values of total chlorophyll and total soluble carbohydrate in the

Table 1: Effect of sowing dates and soil mulching and calcium foliar spraying on the total chlorophyll and total soluble carbohydrate in the leaves of okra.

Sowing Dates	Soil Mulching	Total chlorophyll (mg .100 g $^{-1}$ fresh weight) Ca concentrations (ml .l^{-1})				T×M	CHO) mg .g $^{-1}$ dry mater) Ca concentrations (ml .l^{-1})				T×M
		0	0.5	1	1.5		0	0.5	1	1.5	
T_1	M0	38.99	52.90	56.09	53.55	50.38	28.89	32.91	34.80	31.37	32.09
	M1	53.49	58.01	63.43	62.01	59.24	30.35	35.73	40.59	32.82	34.87
T_2	M0	44.09	51.70	63.49	62.65	55.48	31.15	61.18	78.73	77.25	62.08
	M1	56.47	62.16	66.81	64.64	62.52	32.58	62.11	79.95	77.22	62.69
T_3	M0	64.26	64.43	67.87	65.52	65.62	32.17	62.06	79.37	78.13	62.93
	M1	65.19	65.15	68.84	66.25	66.36	34.30	63.45	82.70	79.11	64.89
L.S.D.(0.05)		6.45				5.61	NS				NS
Average of Ca effect		53.75	59.06	64.62	62.44		31.57	52.91	66.02	62.71	
L.S.D.(0.05)		1.89					0.85				
						Average of dates effect					Average of dates effect
Ca × T	T_1	46.24	55.46	59.76	57.78	54.81	29.62	34.32	37.70	32.27	33.48
	T_2	50.28	56.93	65.15	63.64	59.00	31.87	61.64	79.34	77.23	62.52
	T_3	64.72	64.79	68.35	65.88	65.94	33.23	62.75	81.03	78.62	63.91
L.S.D.(0.05)		5.64				5.65	1.68				1.41
						Average of mulching effect					Average of mulching effect
Ca× M	M0	49.11	56.34	62.48	60.57	57.13	30.74	52.05	64.30	62.37	52.36
	M1	58.38	61.77	66.36	64.30	62.70	32.41	53.76	67.75	63.05	54.24
L.S.D.(0.05)		2.03				2.30	1.20				0.72

leaves (46.24 mg.100 g $^{-1}$ fresh weight and 29.62 mg.g^{-1} dry mater) sequentially. The cultivated plants in the mulching soil and sprayed with 1 ml.l^{-1} calcium gave the highest values of these characteristics (66.36 mg.100 g^{-1} fresh weight and 67.75 mg. g^{-1} dry mater) sequentially. The cultivated plants without mulching soil and sprayed with 0 ml.l^{-1} calcium gave the lowest values of total chlorophyll and total soluble carbohydrate in the leaves about (49.11 mg.100 g $^{-1}$ fresh weight and 30.74 mg. g^{-1} dry mater) sequentially.

Triple interaction between the all studied factors was significant in the total chlorophyll in the leaves only . The cultivated plants at the third date in the mulching soil and the sprayed with calcium with the concentration of 1 ml.l^{-1} gave the highest value of the total chlorophyll in the leaves 68.84mg.100 g $^{-1}$ fresh weight, while the cultivated plants at the first date and without mulching soil and sprayed with 0 ml.l^{-1} calcium gave the lowest value of the total chlorophyll in the leaves about 38.99mg.100 g $^{-1}$ fresh weight.

It is clear from the results of table 2 that the dates of cultivation had a significant effect on the percentage of nitrogen and phosphorus in the leaves. Plants of the third date significant superiority compared to the first and second date plants in these two characteristics with an increment percentages (19.65, 5.15) and (16.80, 4.65)% sequentially. The second date plants had significant superiority compared to the first date plants with an increment percentages (13.79, 11.60)% sequentially. Plants grown in the mulching soil with black polyethylene had a significant increase in the percentage of nitrogen and phosphorus in the leaves compared to the those grown without mulching soil with an increment percentages (8.06 and 5.24%) sequentially. The foliar spraying of calcium fertilizer had a significant effect on both of the percentage of nitrogen and phosphorus in the leaves, the sprayed plants with the concentrations of (0.5 and 1) ml.l $^{-1}$ were superior compared with control plants and plants sprayed with 1.5 ml.l^{-1} calcium in the percentage of nitrogen in the leaves. The sprayed plants with calcium at the concentrations of 1 ml.l $^{-1}$ were superior compared to control plants and plants sprayed with (0.5 and 1.5) ml.l^{-1} in the percentage of phosphorus in the leaves with an increment percentages (27.19, 10.14, 10.14)% sequentially, whereas, there was no significant difference between the concentrations (0.5 and 1.5) ml.l $^{-1}$.

Table 2: Effect of sowing dates and soil mulching and calcium foliar spraying on the percentage of nitrogen and phosphorus in the leaves of okra.

Sowing Dates	Soil Mulching	N%				T×M	P%				T×M
		Ca concentrations (ml .l^{-1})					Ca concentrations (ml .l^{-1})				
		0	0.5	1	1.5		0	0.5	1	1.5	
T_1	M0	2.29	3.13	3.08	2.78	2.82	0.188	0.253	0.280	0.274	0.242
	M1	2.46	3.24	3.23	2.97	2.97	0.213	0.269	0.299	0.252	0.258
T_2	M0	3.10	3.30	3.27	3.00	3.17	0.242	0.270	0.304	0.280	0.274
	M1	2.85	3.67	3.89	3.29	3.43	0.257	0.282	0.310	0.289	0.285
T_3	M0	2.86	3.69	3.51	3.17	3.31	0.259	0.280	0.307	0.290	0.284
	M1	3.06	3.91	4.09	3.50	3.64	0.275	0.301	0.325	0.300	0.300
L.S.D.(0.05)		NS				NS	NS				NS
Average of Ca effect		2.77	3.49	3.51	3.12		0.239	0.276	0.304	0.276	
L.S.D.(0.05)		0.24					0.009				
						Average of dates effect					Average of dates effect
Ca × T	T_1	2.37	3.18	3.15	2.88	2.90	0.201	0.261	0.290	0.249	0.250
	T_2	2.97	3.48	3.58	3.15	3.30	0.250	0.276	0.307	0.284	0.279
	T_3	2.96	3.80	3.80	3.33	3.47	0.267	0.290	0.316	0.295	0.292
L.S.D.(0.05)		NS				0.15	0.016				0.009
						Average of mulching effect					Average of mulching effect
Ca× M	M0	2.75	3.37	3.29	2.98	3.10	0.230	0.268	0.297	0.272	0.267
	M1	2.79	3.61	3.74	3.25	3.35	0.249	0.284	0.311	0.280	0.281
L.S.D.(0.05)		NS				0.016	NS				0.008

Binary interaction between the factors of the study had no significant effects in the percentage of nitrogen and phosphorus in the leaves, except the interaction between the date of cultivation and calcium concentrations which had significant effect in percentage of phosphorus in the leaves. The third date cultivated of plants and the sprayed plants with concentration of 1 ml.l $^{-1}$ gave the highest percentage of phosphorus in the leaves which recorded 0.316 %, while the first date of cultivation of untreated plants with calcium fertilizer gave the lowest percentage of phosphorus recorded 0.201 %.

The triple interaction between the factors of the study has no significant effect in the percentage of nitrogen and phosphorus in the leaves.

The results of table 3 showed that the dates of cultivation had a significant effect on the percentage of potassium in the leaves. The third date of cultivation of plants was superior to the first and second dates.

The soil mulching with black polyethylene had no significant effect in the percentage of potassium in the leaves. The spray of calcium fertilizer had a significant effect in the percentage of potassium in the leaves. The sprayed plants with concentration of 1 ml.l $^{-1}$ were superior compared with control plants and plants sprayed with concentrations (0.5 and 1.5) ml.l^{-1}, with an increment percentages (11.04, 6.11, 4.94) % sequentially.

Binary and triple interactions had no significant effects in the percentage of potassium in the leaves.

The results of the (Tables 1, 2, 3) showed that all the factors of the study had a significant effect on the chemical components in the leaves except the soil mulching with black polyethylene which had not significant effect in the percentage of potassium in the leaves, the binary interactions between the studied factors had significant effect in some chemical characteristics and the triple interaction had significant effect in the total chlorophyll in the leaves only. The dates of sowing influenced in the chemical components in the leaves, the third date was the best compared to the first and second dates. The increment in the chemical components of the third date plants may be due to the improvement in weather conditions from the temperature degree, relative humidity, ventilation and lighting surrounding the plastic house in the period following that date during the month February and March. This improvement had contributed to the improvement of weather conditions surrounding

Table 3: Effect of sowing dates and soil mulching and calcium foliar spraying on the percentage of potassium in the leaves of okra.

Sowing Dates	Soil Mulching	K%				T×M
		Ca concentrations (ml .l^{-1})				
		0	0.5	1	1.5	
T_1	M0	1.66	1.75	1.86	1.69	1.74
	M1	1.65	1.73	1.87	1.76	1.75
T_2	M0	1.67	1.79	1.88	1.85	1.80
	M1	1.71	1.80	1.93	1.86	1.82
T_3	M0	1.80	1.84	1.93	1.86	1.86
	M1	1.86	1.89	1.97	1.88	1.90
L.S.D.(0.05)		NS				NS
Average of Ca effect		1.72	1.80	1.91	1.82	
L.S.D.(0.05)		0.05				
						Average of dates effect
Ca × T	T_1	1.65	1.74	1.86	1.73	1.75
	T_2	1.69	1.79	1.90	1.85	1.81
	T_3	1.83	1.87	1.95	1.87	1.88
L.S.D.(0.05)		NS				0.02
						Average of mulching effect
Ca× M	M0	1.71	1.79	1.89	1.80	1.80
	M1	1.74	1.81	1.92	1.83	1.83
L.S.D.(0.05)		NS				NS

the plant inside the plastic house, therefore the temperature began to rise gradually up to the appropriate degree of growth 18 – 35 C^0 (Abd El-Kader, 2010), that caused slow in growth of plant and dwarfs fruits at low temperature (Matlub *et al.,* 1989), the relative humidity was also suitable for plant growth. This improvement in temperature and humidity helps to get ventilation for a longer period of time by opening the doors and sides of the plastic house and thus provide a greater opportunity to enter carbon dioxide in to the plastic house, increase the absorption of water and nutrients, improve the efficiency of photosynthesis process and increase the outputs of the process (carbohydrates), and transfer it to all parts of the plant and then increase the percentage of elements in the leaves, (nitrogen, phosphorus and potassium). Nitrogen contribute to the building of the chlorophyll molecule, Peter and Carl (2005) confirmed that chlorophyll is directly related to leaf nitrogen content, Nitrogen concentration in leaves can be determined by their concentration of chlorophyll, phosphorus improves roots and thus increase their absorption efficiency and Potassium contributes to the building of carbohydrates. In addition, improved weather conditions may help the plant to increase the absorption of some nutrients from the soil, which helps in the construction of the chlorophyll molecule such as iron, manganese and magnesium (Al-Sahaf, 1989). Boron, which keep the chlorophyll pigment by increasing the activity of some growth hormones, especially Cytokinin and kinetin, that increase the greening of plants (Mengel and Kirkby, 1982). This increase the rate of photosynthesis in the leaves and then increase the manufacture of carbohydrates and their transfer to different parts of the plant and increase the chemical components in the leaves. And also, increase the vegetative growth and the activity of plants.

The results are agree with Soubeih (2016) and Manal *et al*., (2018).

Results also showed that the mulching of the soil with the black polyethylene had a significant effect on the chemical components compared to the non mulching soil, except the percentage of potassium in the leaves. The reason for the superiority of mulching treatment maybe due to provided a good environmental conditions suitable for plant growth by raising soil temperature and improving physical and chemical properties, reduced water evaporation, increased retention of water and nutrient and facilitated plant absorption (Mahmood *et al.,* 2002), also mulching with black plastic contributed in remove the weeds, reduced its density, controlled and reduced the competition to the main crop (Singh *et al.,* 2010), that improved the growth and the activity of the plant and increased the characteristics of vegetative growth, photosynthesis activity and the accumulation of nutrients (carbohydrates) and this leads to an increase the chemical components in the leaves. These results are agree with Abdullah *et al.,* (2017) and Shivaraj *et al*., (2018(.

The results of the previous tables confirm that calcium foliar spraying had a significant effect on the chemical components, and the most effective concentration was 1 ml.l $^{-1}$. The significant effect of calcium can be attributed to it's role that encouraged and activated some enzymes lead to increase the division of cell and increased the numbers and size of cell. It stimulated and encouraged formation of the walls of cells by entering into the structure of calcium lactate, gaining hardness, regulating permeability, making more rubbery, and also influencing

and stimulating on the formation of oxygen (IAA), which presents in the metastatic tissue (David, 2007). That increase the characteristics of vegetative growth and this activated the process of photosynthesis and increased the accumulation of nutrients. The element of calcium works to raise the efficiency of the plant in the metabolism of carbon dioxide and participate in the transfer of carbohydrates (Abu Dhahi and Yunis, 1988). That is reflected positively in the increase of the chemical components of the leaves. The finding are in accordance with Husein *et al.,* (2015) and Ekinci *et al*., (2015).

Conclusion

It is concluded from the study that in order to obtain the best results according to the conditions of the experiment and as a result of the superiority of the plants at the third date in the chemical components of the leaves. It must be adopting the third date (15/1/2019) for sowing the seeds of okra plant in the plastic houses, and mulching the soil with the black polyethylene for the role that we mentioned previously, and foliar spraying by calcium solution at a concentration of 1 ml.1^{-1} and with three sprinkling after 40 days of planting seeds and ten days between the sprinkling and another.

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