Growth and Yield of Some Cucumber Cultivars as Affected by Plant Density and Royal Jelly Application

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Abstract: The present study was carried out at the Experimental Farm of Agriculture Faculty, Sohag University, Egypt during the growing seasons of 2009 and 2010. This experiment aimed to investigate the effect of plant density (20000, 30000 and 60000 plants/fed.) and royal jelly application level (0.04, 0.06 and 0.08 %.) on growth, sex ratio percentage, early yield and total fruits yield of two cucumber cultivars (Medina and Prince) under Sohag conditions. The obtained results indicated that cultivar type had significant effect on all studies characteristics. Medina cultivar significantly increased number of branches/plant, sex ratio percentage, early yield and total fruits yield compared to Prince cultivar in both seasons. Concerning the effect of plant density, results approved that sowing cucumber plants at medium plant density (30000 plant/fed.) significantly increased sex ratio percentage, early yield and total fruits yield/fed. compared to other plant densities in both seasons. Regarding the effect of royal jelly level, the findings revealed that royal jelly markedly increased all studied characteristics. The highest level (0.08%) significantly increased vegetative growth, sex ratio percentage, fruit characteristics, early yield and total fruits yield per feddan. Similar results were obtained in the two studied seasons. Regarding the interaction effect of the three studied factors, the obtained data showed that all possible interactions had significant effects on most studied characteristics in both seasons. The triple combination among Medina cultivar, 30000 plant/fed. and royal jelly level (0.08%). recorded the highest early yield and total fruits yield per feddan in both seasons.

Key words: *Cucumis sativus* · Vegetative growth · Sex ratio percentage · Total fruits yield · Honey bee products · Medina C.V. · Prince C.V · Plant spacing

INTRODUCTION

Cucumber (*Cucumis sativus*, L.) is one of the most popular cucurbitaceae crops in Egypt. It is cultivated for fresh fruits and pickling which are locally consumed or exported to increase national income. The total cultivated area of cucumber in Egypt in 2008 was 67810 feddan and the total production reached 576732 tons with an average of 8.51 tons/feddan.

Nowadays, great efforts are being made all over the world to produce more and better food to meet out the great demand of the increasing global population especially, in the developing countries. In this connection, the adjustment of plant density offers a promising mean of reducing the cost of cultivation by increasing the productivity per area unit. Many researchers reported the importance of selecting the optimum plant density for improving cucumber growth

and yield [1-7]. Recently, using high yield cultivars and/or improving growth and yield of cucumber were investigated to meet out the increasing demand of local consumption and exportation. It was possible to improve yield throughout agricultural practices and suitable cultivars. However, cucumber cultivars differed significantly in there growth, yield and its components [7-15].

Very little literatures are available about the influence of royal jelly on vegetables crops. Royal jelly is secreted from glands on the heads of worker bees. It is synthesized from pollen, water and honey mixed with saliva, hormones and vitamins. Royal jelly contains 65.3% water and 34.7% dry residue. The later is composed from 48.2% proteins, 37.8% carbohydrates, 10.4% lipids and 2% ash. Royal jelly also contains the vitamins B1, B2, B5, B6, B8, B9 and C. Royal jelly is also one of the richest natural products in amino acids. It contains at least 17 amino

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acids including 8 essential ones. Amino acids are very important for enhancing growth, sex ratio percentage, yield and its components. Royal jelly is also rich in minerals, especially potassium, magnesium, calcium, iron, phosphorus, sulfur, manganese, silicon (http://membres.lycos.fr/ecrausaz/ Jaleareal.html and Nation and Robinson [16]).

Townsend and Lucas [17] and Heyl [18] reported that royal jelly had strongly evidence of the presence of gonadotrophic and sex hormones. El-Maziny and Hassan [19] concluded that royal jelly at 0.05% is strongly recommended to be used as foliage application in cucumber production as a result of its tremendous effect on yield and its components.

This investigation aimed to study the influence of plant density and foliar spray with royal jelly on growth, sex ratio percentage, early yield and total fruits yield of two cucumber cultivars (Medina and Prince) under Sohag Governorate conditions.

MATERIALS AND METHODS

The present study was carried out at the Experimental Farm of Agriculture Faculty, Sohag University, Egypt during 2009 and 2010 growing seasons. It aimed to investigate the influence of three plant densities (20000, 30000 and 60000 plants/fed.) and three royal jelly application rates (0.04, 0.06 and 0.08 %.) on the productivity of two cucumber cultivars (Medina and Prince) under Sohag conditions. Royal jelly was stored at 0°C just after taking from bee-hive. It was dissolved in cold water before application to prevent degradation. Royal jelly foliar sprays were applied twice; the first was after the c omplete germination and the second 15 days later.

Nitrogen chemical fertilizer was added at 100 kg N per feddan in the form of ammonium nitrate (33.5% N) in three equal doses at 15, 30 and 45 days after sowing. Phosphorus fertilizer was added as calcium super phosphate (15.5% P_2O_5) during soil preparation at the recommended dose of 45 kg P_2O_5/fed. Potassium fertilizer was applied at two equal patches as potassium sulphate (50% K_2O) at 50 kg K_2O /fed with the first irrigation and at the flowering and fruits setting.

Treatments were arranged in split-split plot design with four replicates. The three plant densities were distributed in the main plots, the two cucumber cultivars were allocated in sub plots and the three royal jelly levels were distributed in the sub-sub plots. The area of each plot was 12.60 m². It contained three ridges of 300 cm long

and 140 cm width. Two seeds was sown per hill in 13th and 14th March for the first and second seasons, respectively. Growing seedlings were thinned to one plant per hill just before the first irrigation. All the other agricultural practices of cucumber production were done similarly for all treatments as recommend by the Egyptian Ministry of Agriculture.

The physical and chemical properties of the used experimental farm are shown in Table (1).

Ten plants were randomly selected from each plot to determine the following characteristics:

- Main stem length cm. (recorded at the end of growing seasons).
- Number of branches/plant (recorded at the end of growing seasons).
- Number of leaves/plant (recorded 60 days after sowing)
- Sex ratio percentage (No. female flowers / No. male flowers x 100)

Harvest was done every two days where twenty fruits were taken from each plot at the fifth picking to determine the following criteria:

- Fruit length (cm).
- Fruit diameter (cm).

The following data were also recorded:

- Early fruits yield (ton/fed) at the first two pickings.
- Total fruits yield (ton/fed) at the end of experiment.

Table 1: Physiochemical characteristics of the experimental farm

	Clay %	13.44
Physical properties	Silt %	39.00
	Sand %	47.56
Texture class	Loam	
	pH	8.5
	EC mmhos/cm at 25°C	0.80
	Ca^{++}	1.80
Soluble cations and	Mg^{++}	0.80
anions	Na^+	3.55
(meq/100 gm soil)	K^+	1.28
	CO_3^-	--
	$CaCO_3$%	4
	HCO_3^-	0.40
	Cl^-	1.00
	SO_4^-	6.03
Concentration of	N	15
available	P	20
nutrients in ppm	K	924

All the collected data were subjected to statistical analysis according to Gomez and Gomez, [20] using MSTAT-C [21]. The least significant difference (L.S.D.) was calculated at 5% level of probability to determine significant differences among means.

RESULTS AND DISCUSSION

Vegetative Growth Characteristics: Data presented in Table (2 and 3) reveal that the various plant densities significantly affected the main stem length, number of branches/plant and number of leaves/plant in the two studied seasons. The main stem length significantly increased with increasing plant density from 20000 to 60000 plant/fed. This result may be attributed to the reduction in light intensity under the high plant density, encouraged IAA synthesis which caused cell enlargement [22]. However, number of branches/plant and number of leaves/plant decreased with higher plant densities. This result can be explained by the strong competition among plants under the high density conditions. These findings are in accordance with those found by Akintoye, *et al.* [4], Choudhari and More [5] and El-Shaikh, *et al.* [7].

Data also show that the two studied cucumber cultivars (Medina and Prince) were significantly differed in vegetative growth characteristics expressed as main stem length (cm), number of branches/plant and number of leaves/plant for both seasons. Prince cultivar gave higher values than Medina cultivar. The increment percentage was 10.2% and 46.5% for main stem length (cm) and number of leaves/plant, respectively. On the other hand, Medina cultivar surpassed prince cultivar by 3.9% in number of branches. The differences among different cucumber cultivars in vegetative growth characteristics were approved by many authors [7,12,13,15].

Significant differences were found among the studied concentrations of royal jelly for main stem length, number of branches/plant and number of leaves/plant in the two studied seasons. The highest values of vegetative growth characteristics were recorded with the highest royal jelly level (0.08 %.) for both seasons. These increments in vegetative growth characteristics may be attributed to the highly nutritional and hormonal status of royal jelly. These results are in line with those found by Nation and Robinson [16], Townsend and Lucas [17] and Heyl [18].

Concerning the interaction effect, results presented in Table (2 and 3) show that most interactions had a significant effect on cucumber vegetative growth in both seasons. The foliar spray of prince cultivar sown at 6000 plant/fed. and applied by 0.08% royal jelly resulted in the highest main stem length (216.6 and 215.7 cm) for the first and second seasons, respectively. However, the applications of similar treatment on Medina cultivar sown at 30000 plant/fed. produced the highest number of branches/plant (8.70 and 8.80) for the first and second seasons, respectively.

Sex Ratio Percentage: Data presented in Table (3) indicate that plant densities significantly affected the sex ratio percentage in the two tested seasons. The plant density (30000 plant/fed.) resulted in the highest sex ratio percentage (46.52 and 47.26%) compared to the two other plant densities for the first and second season, respectively. These results are in harmony with those reported by Hanna and Adams [1] and El-Shaikh, *et al.* [7].

The two studied cultivars differed significantly in the sex ratio percentage. Medina cultivar recorded the highest values of (51.59 and 52.97%) compared to (21.38 and 21.44 %) for prince cultivar in the first and second seasons, respectively. Many authors approved the genetic differences in flowering characteristics among different cucumber cultivars [7, 8, 10, 11, 15].

Foliar spray of cucumber plants with royal jelly significantly affected sex ratio percentage where it increased with increasing concentration for both seasons. Meanwhile, the highest royal jelly level (0.08%) achieved sex ratio percentage values surpassed the lowest one (0.04%) by (24.9 and 25.4%) for the first and second season, respectively. This finding may be due to the presence of sex hormones in royal jelly which encourages the formation of female flowers [19].

The obtained results clearly indicate that all possible combinations affected significantly the sex ratio percentage in both seasons. Sowing Medina cultivar at 30000 plant/fed. and treating it with royal jelly at (0.08%) as foliar spray showed the highest values of sex ratio percentage in both seasons. The positive response of Medina cultivar to the optimum plant density and the presence of sex hormone in royal jelly could explain this attractive finding.

Fruits Characteristics: Data presented in Table (4) clearly show that cucumber plant densities have significant effect on both fruit length and diameter (cm.). Values of fruit length and diameter negatively related with

Table 2: Stem length (cm.) and number of branches per plant for two cucumber cultivars as affected by plant density and royal jelly application during 2009 and 2010 seasons

		Stem length cm								Number of branches/plant							
		2009 season				2010 season				2009 season				2010 season			
		Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % © Plant			
density (A)	Cultivar (B)	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean
20000	Medina	161.08	164.98	169.58	165.21	160.88	164.30	169.63	164.93	6.08	7.25	8.65	7.33	6.18	7.38	8.65	7.40
	Prince	183.18	186.13	191.03	186.78	182.75	185.78	190.90	186.48	6.25	7.30	8.40	7.32	6.08	7.33	7.95	7.12
	Mean	172.13	175.55	180.30	175.99	171.81	175.04	180.26	175.70	6.16	7.28	8.53	7.32	6.13	7.35	8.30	7.26
30000	Medina	179.45	181.03	185.15	181.88	180.18	182.35	184.50	182.34	6.13	7.50	8.70	7.44	6.23	7.60	8.80	7.54
	Prince	200.43	204.35	207.73	204.17	201.00	205.23	208.98	205.07	6.03	7.03	7.95	7.00	5.98	7.03	7.83	6.94
	Mean	189.94	192.69	196.44	193.02	190.59	193.79	196.74	193.70	6.08	7.26	8.33	7.22	6.10	7.31	8.31	7.24
60000	Medina	190.10	191.08	197.43	192.87	190.33	192.18	198.05	193.52	5.13	5.60	6.68	5.80	4.93	5.63	6.83	5.79
	Prince	205.88	211.93	216.55	211.45	201.83	210.15	215.70	209.23	5.00	5.60	6.50	5.70	4.75	5.55	6.58	5.63
	Mean	197.99	201.50	206.99	202.16	196.08	201.16	206.88	201.37	5.06	5.60	659	5.75	4.84	5.59	6.70	5.71
Average of cultivars	Medina	176.88	179.03	184.05	179.98	177.13	179.61	184.06	180.26	5.78	6.78	8.01	6.86	5.78	6.87	8.09	6.91
	Prince	196.49	200.80	205.10	200.80	195.19	200.38	205.19	200.26	5.76	6.64	7.62	6.67	5.60	6.63	7.45	6.56
	Mean	186.68	189.91	194.58		186.16	190.00	194.63		5.77	6.71	7.81		5.69	6.75	7.77	

LSD at 0.5 level for:

Plant densities (A)		1.00			0.39		0.08		0.11
Cultivars (B)		0.62			0.74		0.08		0.06
Royal jelly (C)		0.68			0.59		0.07		0.07
(A) x (B)		1.08			1.28		0.13		0.10
(A) x ©		NS			1.02		0.13		0.12
(B) x ©		0.97			0.83		0.11		0.10
(A) x (B) x (C)		1.68			1.44		0.18		0.17

Table 3: Number of leaves per plant and sex ratio percentage for two cucumber cultivars as affected by plant density and royal jelly application during 2009 and 2010 seasons

		Number of leaves/plant								Sex ratio percentage							
		2009 season				2010 season				2009 season				2010 season			
		Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % ©			
Plant density (A)	Cultivar (B)	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean
20000	Medina	76.25	81.00	84.25	80.50	76.75	80.25	84.25	80.42	25.68	29.70	34.55	29.30	25.55	29.95	35.30	30.27
	Prince	157.25	165.25	173.00	165.17	157.00	165.50	173.50	165.33	20.45	22.65	26.78	23.29	20.53	22.88	24.40	23.27
	Mean	116.75	123.13	128.63	122.83	116.88	122.88	128.88	122.88	23.06	26.18	30.66	26.63	23.04	26.41	30.85	26.77
30000	Medina	68.25	71.25	76.00	71.83	68.50	72.25	76.00	72.25	68.00	78.30	88.70	78.33	68.90	80.80	89.78	79.83
	Prince	123.25	129.25	136.00	129.50	119.75	129.25	135.75	128.25	12.50	14.48	17.13	14.70	12.60	14.55	16.95	14.70
	Mean	95.75	100.25	106.00	100.67	94.13	100.75	105.88	100.25	40.25	46.39	52.91	46.52	40.75	47.68	53.36	47.26
60000	Medina	53.00	55.75	59.75	56.17	53.00	55.75	60.00	56.25	38.83	45.65	54.88	46.45	38.95	49.80	57.70	48.82
	Prince	93.25	96.25	99.75	96.42	91.50	95.00	101.50	96.00	23.10	26.30	29.03	26.14	23.70	26.50	28.90	26.37
	Mean	73.13	76.00	79.75	76.29	72.25	75.38	80.75	76.13	30.96	35.98	41.95	36.30	32.33	38.15	43.30	37.59
Average of cultivars	Medina	65.83	69.33	73.33	69.50	66.08	69.42	73.42	69.64	44.17	51.22	59.38	51.59	44.47	53.52	60.93	52.97
	Prince	124.58	130.25	136.25	130.36	122.75	129.92	136.92	129.86	18.68	21.14	24.31	21.38	18.94	21.31	24.08	21.44
	Mean	95.21	99.79	104.79		94.42	99.67	105.17		31.43	36.18	41.84		31.70	37.41	42.50	

LSD at 0.5 level for:

(A)		1.27			1.60		1.06		1.33
(B)		0.99			0.80		1.02		1.09
©		0.87			0.85		0.82		0.69
(A) x (B)		1.71			1.39		1.76		1.89
(A) x ©		1.50			1.47		1.43		1.16
(B) x ©		1.23			1.20		1.17		0.95
(A) x (B) x (C)		2.13			2.09		2.02		1.64

Table 4: Fruit length and diameter of two cucumber cultivars as affected by plant density and royal jelly application during 2009 and 2010 seasons

		Fruit length (cm)								Fruit diameter (cm)							
		2009 season				2010 season				2009 season				2010 season			
		Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % ©			
Plant density (A)	Cultivar (B)	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean
20000	Medina	15.35	15.88	16.80	16.01	15.53	15.88	16.43	15.94	3.25	3.75	3.95	3.65	3.45	3.93	4.13	3.83
	Prince	17.83	19.13	19.93	18.96	18.45	19.83	20.38	19.55	3.78	3.93	4.05	3.92	3.95	4.45	4.65	4.35
	Mean	16.59	17.50	18.36	17.48	16.99	17.85	18.40	17.75	3.51	3.84	4.00	3.78	3.70	4.19	4.39	4.09
30000	Medina	16.00	16.35	16.73	16.36	15.15	15.95	16.15	15.75	2.84	2.90	3.15	2.96	3.05	3.43	3.83	3.43
	Prince	16.98	17.88	18.43	17.76	17.33	18.40	18.85	18.19	3.43	3.83	4.03	3.76	3.85	3.95	4.25	4.02
	Mean	16.49	17.11	17.58	17.06	16.24	17.18	17.50	16.97	3.13	3.36	3.59	3.36	3.45	3.69	4.04	3.73
60000	Medina	14.38	14.63	15.25	14.75	14.38	14.73	15.10	14.73	2.44	2.59	2.84	2.62	2.65	2.80	3.03	2.83
	Prince	14.90	15.50	16.13	15.51	16.20	16.53	16.68	16.47	3.23	3.60	3.88	3.57	3.00	3.65	3.88	3.51
	Mean	14.64	15.06	15.69	15.13	15.29	15.63	15.89	15.60	2.83	3.10	3.36	3.09	2.83	3.23	3.45	3.17
Average of cultivars	Medina	15.24	15.62	16.26	15.71	15.02	15.53	15.89	15.48	2.84	3.08	3.31	3.08	3.05	3.38	3.66	3.36
	Prince	16.57	17.50	18.16	17.41	17.33	18.25	18.63	18.07	3.48	3.78	3.98	3.75	3.60	4.02	4.26	3.96
	Mean	15.90	16.56	17.21		16.17	16.88	17.26		3.16	3.43	3.65		3.33	3.70	3.96	

LSD at 0.5 level for:

					Mean				Mean				Mean				Mean
	Plant densities (A)				0.09				0.14				0.53				0.05
	Cultivars (B)				0.13				0.10				0.04				0.04
	Royal jelly (C)				0.15				0.17				0.07				0.07
	(A) x (B)				0.22				0.09				0.06				0.07
	(A) x ©				0.26				0.15				NS				NS
	(B) x ©				2.09				0.12				NS				NS
	(A) x (B) x (C)				NS				0.21				0.14				0.16

Table 5: Early and total fruits yield (ton/fed.) of two cucumber cultivars as affected by plant density and application by royal jelly during 2009 and 2010 seasons

		Early fruits yield (ton/fed.)								Total fruits yield (ton/fed.)							
		2009 season				2010 season				2009 season				2010 season			
		Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % (c)				Royal jelly concentration % ©			
Plant density (A)	Cultivar (B)	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean	0.04	0.06	0.08	Mean
20000	Medina	2.44	2.63	2.92	2.66	2.45	2.64	2.97	2.69	22.22	23.13	24.00	23.12	23.13	23.53	24.23	23.63
	Prince	2.01	2.23	2.50	2.25	1.51	1.76	2.01	1.76	18.11	18.83	19.30	18.75	17.81	18.63	19.36	18.60
	Mean	2.23	2.43	2.71	2.45	1.98	2.20	2.49	2.22	20.17	20.98	21.65	20.93	20.47	21.08	21.79	21.11
30000	Medina	2.96	3.23	3.53	3.24	3.10	3.35	3.63	3.36	25.10	26.000	27.03	26.04	25.08	26.13	27.39	26.20
	Prince	2.28	2.60	2.86	2.58	1.95	2.22	2.52	2.23	15.80	17.06	17.98	16.95	19.31	19.90	21.21	20.14
	Mean	2.62	2.91	3.19	2.91	2.53	2.79	3.08	2.79	20.45	21.53	22.50	21.49	22.19	23.01	24.30	23.17
60000	Medina	2.76	2.96	3.15	2.96	2.21	2.55	2.85	2.54	21.02	24.05	25.15	23.41	23.60	25.15	26.20	24.98
	Prince	2.04	2.23	2.49	2.25	2.03	2.22	2.47	2.24	17.68	18.60	20.77	19.02	18.24	19.13	20.55	19.30
	Mean	2.40	2.59	2.82	2.60	2.12	2.39	2.66	2.39	19.35	21.33	22.96	21.21	20.92	22.14	23.37	22.14
Average of cultivars	Medina	2.72	2.94	3.20	2.95	2.59	2.85	3.15	2.86	22.78	24.39	25.39	24.19	23.93	24.93	25.93	24.94
	Prince	2.11	2.35	2.62	2.36	1.83	2.07	2.33	2.08	17.20	18.16	19.35	18.24	18.46	19.22	20.37	19.35
	Mean	2.42	2.65	2.91		2.21	2.46	2.74		19.99	21.28	22.37		21.19	22.08	23.16	

LSD at 0.5 level for:

					Mean				Mean				Mean				Mean
	Plant densities (A)				0.08				0.05				0.20				0.12
	Cultivars (B)				0.05				0.03				0.20				0.18
	Royal jelly (C)				0.03				0.04				0.23				0.12
	(A) x (B)				0.09				0.05				0.34				0.31
	(A) x ©				0.05				NS				0.39				0.20
	(B) x ©				NS				NS				NS				NS
	(A) x (B) x (C)				NS				NS				0.56				0.29

plant densities where the highest values were obtained with the lowest plant density (20000 plant/fed.) for both seasons. These results may be explained by the high competition between plants in higher plant densities. These findings are also in similar general trend of those reported by Akintoye, *et al*. [3] and El-Shaikh, *et al*. [7].

Significant difference was found between the two studied cultivars in fruit characteristics. Prince cultivar recorded higher values than Medina cultivar. These results held true in the two tested seasons. El-Shaikh *et al*. [7] and Muhammad-Zamin *et al*. [9] came to the same general trend.

Regarding the effect of various applied levels of royal jelly, the obtained results in Table (4) reveal that the fruit length and diameter significantly increased with increasing royal jelly concentration from 0.04% to 0.08% in both seasons. These results are in harmony with those reported by El-Maziny and Hassan [19].

Concerning the effect of interaction, data show that most interactions affected significantly fruit length and diameter (cm) in both seasons. The highest values (19.93 and 20.38 and 4.05 and 4.65 cm) were obtained with Prince cultivar sown at (20000 plant/fed.) and treated with (0.08%) royal jelly for fruits length and diameter in both tested seasons.

Early and Total Fruits Yield (ton/fed.): It is clear from data presented in Table (5) that plant density significantly affected the early and total fruit yield in both seasons. The highest cucumber fruits yield (21.49 and 23.17 ton/fed.) was obtained with the intermediate plant density (30000 plant/fed.) in the first and second seasons, respectively. This result may be attributed to the greater amount of light energy intercepted by foliage under this intermediate density (30000 plant/fed.) compared to the dense (60000 plant/fed) and wide (20000 plant/fed) ones. It might in turn result in the increment in the amount of metabolites synthesized by plants and consequently the total yield per unit area became greater. Moreover, the same plant density increased the values of sex ratio percentage which led to the highest total fruits yield. Many researchers were coincide with these findings [1-3, 6, 7].

Concerning the effect of cultivars, data listed in Table (5) show that early and total fruit yield (ton/fed.) significantly affected by cultivar. Medina cultivar showed higher values in both seasons. In addition, the early and total fruits yield of Medina cultivar exceeded by (20 and 27.3%) and (24.6 and 22.4 %) compared to prince cultivar for the first and second seasons,

respectively. The higher total fruits yield produced by Medina cultivar could be explained by the light increments induced in sex ratio percentage and early fruits yield. These results are in general trend with those reported by Ylimaz and Gebologlu [6], El-Shaikh *et al*. [7] and Abdul-Hamid *et al*. [8].

The foliar spray of cucumber cultivars with various concentrations of royal jelly significantly affected the early and total fruits yield ton/fed. in both seasons. These characteristics significantly increased with increasing royal jelly concentration from 0.04 % to 0.08% in both seasons. The positive effect of royal jelly on early and total fruits yield ton/fed. may relate to its content of hormones and nutrition elements [16-18]. Also, the enhancement induced in vegetative growth characteristics and sex ratio percentage previously discussed surely reflected positively on early and total fruits yield ton/fed. Royal jelly contains at least 17 amino acids, including the 8 essential ones, which are essential for growth and yield. Beside its tremendous effects on increasing cucumber yield, royal jelly is safe to be used because it's natural material which has no harmful effect on plant or human [19].

Regarding the effect of interaction, the obtained data show that all possible interactions had significant effects on the total fruits yield ton/fed. except the interaction between cultivars and royal jelly concentrations in both seasons. The triple combination among Medina cultivar, 30000 plant/fed. and spraying with royal jelly at (0.08%) recorded the highest early and total fruit yield of (3.35 and 3.63 ton/fed.) and (27.03 and 27.39 ton/fed.) for the first and second seasons, respectively.

Recommendation: Finally, it could be strongly recommended that the growers can sow Medina cultivar at plant density of 30000 plant/fed. and spray it with royal jelly at (0.08%) for the highest early and total fruits yield. More studies are needed for maximizing benefits from this safe and natural royal jelly which has no harmful effect on plant, human or environment.

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