

EFFECT OF SOWING DATE, PLANT SPACING AND TREATMENT WITH BIO HEALTH WSG ON GROWTH AND YIELD OF KHELLA (*AMMI VISNAGA* (L.) LAM.)

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ABSTRACT

The present study was conducted during the growing season of 2012/2013 and 2013 /2014 in medicinal and aromatic plants field of the College of Agriculture/ Basrah University, to study the effect of sowing date 1/10, 20/10, plant spacing 20, 30 or 40 cm and treatment with Bio Health WSG and lack of treatment, and their interaction on growth, yield and aromatic oil of getter seeds *Ammi visnaga* (L.) Lam plant Locally and Syrian. The results showed Cultivated plants on 1/10 had a significant in plant height, the number of main branches.plant⁻¹, the leaves number.plant⁻¹, the percentage for dry substance, the total number of inflorescences.Plant⁻¹, the total sum of seed.plant⁻¹ (47.3 and 47.3g), the weight of 1000 fruits, the productivity seed of per hectare (5.9 and 6.0 tons), percentage of oil (16.29 and 16.44 %), oil yield per plant (7.78 and 8.29 g), the productivity of oil per hectare (93.5 and 98.6 Kg) for both seasons.

Cultivated plants at 20 cm had a significant in the plant height, productivity fruits of per hectare (5.5 and 5.6 tons), the productivity of oil per hectare (65.7 and 71.9 kg) for both seasons. However, plants cultivated at 40 cm also had a significant in the number of main branches.plant⁻¹, the leaves number.plant⁻¹, the percentage for dry substance, the total number of inflorescences.Plant⁻¹, the total sum of seed.plant⁻¹ (35.7 and 37.5g), the weight of 1000 fruits, percentage of oil (16.66 and 16.57%), oil yield per plant (6.53 and 7.13g), for both seasons. Treated plants with Bio Health WSG gave significant the plant height, the number of main branches.plant⁻¹, the leaves number.plant⁻¹, the percentage for dry substance, the total number of inflorescences. Plant⁻¹, the total sum of seed.plant⁻¹ (35.8 and 36.9g), the weight of 1000 fruits, the productivity seed of per hectare (4.4 and 4.6 tons), percentage of oil (14.46 and 14.59%), oil yield per plant (5.72 and 6.23g), the productivity of oil per hectare (67.1 and 73.6 Kg) for both seasons. The Interactions between the study factors, showed a significant effect in all studied parameters.

Keywords: *Ammi visnaga* (L.) Lam, sowing date, plant spacing, Bio Health WSG.

1. INTRODUCTION

Ammi visnaga L. is known by many common names, including bisnaga, toothpick weed and known as Khella, is an annual or perennial herb. It is a member of the Apiaceae (Umbelliferae) family; widely distributed in Europe, Asia, and North Africa and also throughout the world as introduced specie. Khella is native to the Mediterranean and is cultivated in Egypt [1]. *Ammi visnaga* is antiasthmatic, diuretic, lithontripic and vasodilator. It is an effective muscle relaxant and has been used for centuries to alleviate the excruciating pain of kidney stones [2]. The seeds used as a folk medicine for diuretic and lithontripic [3]. *Visnaga* seeds contain oil that includes the substance 'khellin', which is used in the treatment of asthma. They have antispasmodic action on the smaller bronchial muscles, dilate the bronchial, urinary and blood vessels without affecting blood pressure [4]. *A. visnaga* has been commonly used for colic and gastrointestinal cramps [5]. Also, *A. visnaga* is used in the treatment of mild angina. Further, it is used as a supportive treatment in the respiratory conditions such as asthma, bronchitis, cough and whooping cough [6]. *A. visnaga* is also used in the cardiovascular disorders for example hypertension, cardiac arrhythmias, congestive heart failure, atherosclerosis and hypercholesterolemia [7,8]. Moreover, it is used for relieving liver and gall bladder disorders [6]. When applied topically, *A. visnaga* has been found useful in the recovery of vitiligo, psoriasis, wound healing, inflammation conditions, and poisonous bites [9].

Studying the managing agricultural practices in the production of a crop is crucially important. Among all practices, planting dates and distances play important roles in the performance, production and consequently the yield of medicinal and aromatic plants which in turn affect the farm income and food security. Changing in planting date leads to significant changes in the weather which affects the total period of plant growth and exposure to the environment. Thus, planting date may influence the crop productivity and its inner components Ebrahimi *et al.* [10]. The effect of planting dates on medicinal and aromatic plants was carried out by many investigators; Barros *et al.* [11] on *Helianthus annuus* L., Zheljzakov *et al* [12] on *Coriandrum sativum*, Verma *et al.* [13] on *Artemisia annua* and Habib Ullah and Honermeier [14] on anise plant. Meanwhile, planting distances play important roles in manipulating the micro-climate which means better crop growth and response to inputs. A proper distance improves

the availability of nutrients, aeration and light intensity by which the genetic potential of a species can be expressed in terms of quantity [15]. The effect of planting distance on the growth, yield and active ingredients has been studied by Sharma *et al.* [16] on *Callicarp amacrophylla*, Singh *et al.* [17] on *Curcuma aromatica*, Hussein *et al.* [18] on *Dracocephalum moldavica* and Ramos *et al.* [19] on *Hibiscus sabdariffa*.

Bio Health WSG is a water soluble blend of *Bacillus subtilis* and *Trichoderma harzianum* in a ratio 10% with humic acid 75% and seaweed extract 5%. Its benefits are destroys the bacteria and the hyphens of most of soil borne pathogens like e.g. *Pseudomonas spp.*, *Pythium*, *Phytophthora*, *Rhizoctonia* or *Fusarium*, increases the resistance of the plant roots against water, disease, temperature and salt stress,

produces hormone like substance and improves the roots growth, promotes the growth of roots and regenerates damaged roots, stimulates the growth of useful microorganisms in the root area, enhances the germination and increases their growth.

Unfortunately, until now there is very few of available research papers that could be supported the khella production in commercial scale, this study carried out to search for optimum sowing date, plant spacing and benefit Bio Health application on growth and yield of this medical plant.

2. Materials and Methods

Site Description and Soil Type

This experiment was conducted during 2012-2013 and 2013-2014 cropping season at the Medicinal and Aromatic Unit Field, College of Agriculture, Basrah University, Basrah, Iraq. The soil at the experimental site was sandy-loam with an initial fertility status of organic matter 0.95 and 0.085%, N 30.0 and 32.0 mg.kg⁻¹, P₂O₅ 54.65 and 51.86 mg. kg⁻¹, K₂O 7.95 and 6.55 mol. l⁻¹, pH of 7.54 and 7.30 and EC 4.55 and 4.33 ds m⁻¹.

Experimental Design

The field experiment was Factorial Experiment conducted in Randomized Complete Block Design (RCBD) in three replications. Two sowing dates of 1 or 20/10, three rows spacing 20 or 30 or 40 cm and treatments with BioHealth WSG from Humin Tech GmbH, Germany by solving 2 gm in liter of distilled water or without treatment (control-distilled water only) was applied every 15 days after 20 day from transplanting.

Transplants Preparation

Seeds were sown in 1 and 20/10 for both seasons at plastic tray content 205 cell of 3.5 x 6.0 x 3.5 cm dimensions filled with peat moss produced by Substrate 1 (SAB) Germany with organic matter 95-97%, total nitrate 1%, density 70-90 gm. Cm⁻³, ash 3-5%, moisture capacity 50%, pH 3.5-4.5 at average of 5 seeds in each cell. After germination, on the 15th day thinning was done, to retain single healthy plant at each sowing date.

Agronomic Practices

Individual experimental plot 1.5 m long, 1.2 m widths of 6 rows of 20 cm distance between rows, 4 rows of 30 cm distance between rows and 3 rows of 40 cm distance between rows. Each row content 6 holes apart 25 cm between each other, the plot comprised 36, 24 and 18 plants of 6, 4 and 3 rows. The experimental fields were mould-board ploughed and manure was added at a rate 40 m³. h⁻¹ and seedbed preparation comprised of two passes with a tandem disk. After land leveling and furrow preparation, the plots were irrigated using the furrow irrigation method. After 25 days from the germination the transplants were planting when their heights were between 10-15 cm. All agricultural processes were conducted similarly as was done for the practical production such as irrigation, weeding and cultivation and fertilization with NPK (10-10-10) at the rate of 120 Kg. h⁻¹ which was divided into two batches, plant were sprayed several times for prevention and resistance to diseases and insect. On 1 and 25/5 hand harvest was done for both seasons. Table (1) shows maximum, minimum temperatures (c) and humidity percent(%). Vegetative growth parameters for 3 plants were taken randomly from each experiment unit at the 50% fruit set stage, which includes; Plant height (cm), total leaf number. plant⁻¹, lateral shoot number. plant⁻¹, dry matter percentage, influences number. plant⁻¹. In addition to the measurement of yield:- fruits yield. plant⁻¹ (gm), weight 1000 fruits (gm), yield productivity (ton⁻¹)[176000, 117333 and 88000 plants. h⁻¹ for rows distances 20, 30 and 40 cm], fixed oil (%) (Fixed oil was extracted from seeds powder by chloroform in a Soxhlet apparatus as described by Stahl [20], fixed oil yield. plant⁻¹(gm), fixed oil productivity (Kg.⁻¹).

Statistical analysis

The obtained data of both seasons were statistically analyzed using analysis of variance (ANOVA) as described by Al-Rawi and Khalaf Allah [21]. Means were tested using the Least Significant Differences Test at probability level of 0.05.

Table(1). Average of maximum, minimum temperatures (c) and humidity percent(%) during growth seasons

Season 2012/2013	Max. temp.(c)	Min. temp.(c)	humidity percent(%)	Season 2013/2014	Max. temp.(c)	Min. temp.(c)	humidity percent(%)
1-10/10	38.9	19.5	36.0	1-10/10	37.1	16.7	26.3
11-20/10	37.0	18.5	39.8	11-20/10	36.2	13.9	27.8
21-/31/10	36.6	17.1	41.0	21-/31/10	30.5	14.0	41.2
1-10/11	31.9	15.2	47.9	1-10/10	28.0	16.8	70.0
11-20/11	26.2	14.8	65.4	11-20/10	24.2	16.0	85.1
21-/30/11	22.2	13.0	73.9	21-/31/10	23.3	13.8	88.3
1-10/12	22.0	12.6	60.2	1-10/10	20.7	11.9	75.8
11-20/12	20.9	10.4	62.0	11-20/10	17.4	7.7	70.7
21-/31/12	19.3	8.1	65.5	21-/31/10	18.8	5.2	61.1
1-10/1	18.4	6.0	65.0	1-10/10	14.5	6.3	88.6
11-20/1	19.8	7.0	75.0	11-20/10	16.3	7.8	92.1
21-/31/1	19.9	10.3	79.0	21-/31/10	19.9	10.8	89.2
1-10/2	21.9	9.5	59.0	1-10/10	15.9	5.9	73.6
11-20/2	22.9	8.5	50.5	11-20/10	22.3	8.2	61.3
21-28/2	26.8	12.3	60.3	21-/31/10	26.9	13.2	56.5
1-10/3	28.8	12.5	40.4	1-10/10	28.9	16.0	52.4
11-20/3	27.5	12.9	45.0	11-20/10	25.7	14.3	63.1
21-/31/3	26.0	13.1	40.0	21-/31/10	29.4	15.8	44.3
1-10/4	30.5	15.8	40.0	1-10/4	29.7	14.9	45.9
11-20/4	33.7	18.5	40.5	11-20/4	35.8	22.3	34.8
21-/30/4	35.9	22.4	43.2	21-/30/4	38.6	27.6	29.6
1-10/5	37.9	22.1	37.1	1-10/5	40.1	24.9	26.4
11-20/5	38.5	22.5	30.6	11-20/5	39.9	24.4	25.8
21-/31/5	40.4	26.7	27.2	21-/31/5	42.9	27.5	21.0

3. Results and Discussion

Shown in Table (2) that the main factors and their interaction has significant effect on vegetative growth indicators, it has outperformed the cultivated plants in the first date (1/10) morally "in plant height and number of main vegetative branches.plant⁻¹, the total number of plant leaves⁻¹ and the percentage of dry material plant⁻¹ compared to those cultivated in the date 20/10 for both study seasons, also outperformed the plants cultivated on 20 cm distance morally "in plant height compared to those planted on the other distances in the first season and the distance of 40 cm second season, and excelled on cultivated plants on the distance of 40 cm in the total number of securities plant⁻¹ and the percentage of dry material. plant⁻¹ compared to those planted on other distances for both seasons, while it was not for a distance of Agriculture any significant effect on the number of main vegetative branches.plant⁻¹ for both seasons. It is noted from the table itself outweigh the plants treated with bio-health morally "in all vegetative growth characteristics under study for both seasonal compared to those not treated. And there was significant effect due to overlap the date and distance of Agriculture, cultivated plants in the date 1/10 plants at a distance of 20 cm has given highest elevation of the plant reached 128.5 and 122.6 cm for both seasons respectively, compared with less height of the plants was 70.7 and 72.1 cm resulted from cultivated plants in the date 20/10 on the distance of 20 cm, respectively, for both agriculture seasons. While plants cultivated in the date 1/10 plants at a distance of 40 cm has given largest number of the main vegetative branches. plant⁻¹ and total number of leaves and the percentage of dry material reached to 8.07 and 9.02 branches "and 87.75 and 94.08 leaf and 20.43 and 20.43%, respectively for both seasons of agriculture, compared with less number of the main vegetative branches. plant⁻¹, total number of leaves.plant⁻¹ and the percentage of dry material was 5.70 branches resulted from cultivated plants in 20/10 to 30 cm and 6.18 branches distance "resulted from cultivated plants on the same date at 20 cm distance, and 40.55 and 41.78 leaf and 7.83 and 7.67% resulted from cultivated plants in 20/10 at 20 cm distance, for both seasons, respectively. And there was a significant effect for overlap of agriculture date and bio-health on these indicators, plant cultivated in the date 1/10 and treated with bio-health has given the highest height and the largest number of the main vegetative branches.plant⁻¹ and total number of securities.plant⁻¹ and the percentage of dry material reached to 119.1 and 115.1 cm and 8.03 and 8.89 branches "and 84.42 and 86.87 leaf and 18.63 and 18.19%, respectively, compared to the height of the shortest and the lowest number of the total vegetative branches and leaves.plant⁻¹.plant and the

percentage of dry material was 70.0 and 70.9 cm and 5.49 and 6.03 branches" and 49.76 and 50.87 leaf and 9.56 and 9.44% resulted from the date of 20/10 cultivated plants that were not treated by bio-health. There was also an overlap of Agriculture distance and bio-health that has significant effect on these indicators, cultivated plants on the 20 cm distance and treated with bio-health it has given top of her height of 106.1 and 101.5 cm and cultivated plants at a distance of 40 cm treated with bio-health the largest number of the total vegetative branches. plant⁻¹ and the percentage of dry material reached to 7.23 and 7.95 branches "and 78.42 and 86.25 leaf and 19.38 and 18.88% for both seasons, respectively, compared with less values for plant height were 88.5 and 84.5 cm resulted from plants planted on a 40 cm distance that did not treated with bio-health and the lowest number of the vegetative branches. plant⁻¹ and the lowest number of papers.plant⁻¹ and the percentage of dry material was 6.22 and 6.58 branches "and 55.22 and 53.22 paper and 10.38 and 9.72%, for both seasons, respectively, resulted from cultivated plants at 20 cm distance that did not treated by bio-health.

Table (2). The impact of agriculture date and its distance and treatment with bio-health and their interaction in the vegetative growth indicators for Khella plant.

sowing dates	rows spacing	BioHealth	plant (cm)	height	n. main branches. plant ⁻¹		leaves n. plant ⁻¹		percentage dry matter	
					2012/2013	2013/2014	2012/2013	2013/2014	2012/2013	2013/2014
1/10	20	No treatment	122.4	117.4	7.47	7.47	75.33	70.33	14.10	13.10
		treatment	134.5	127.8	7.30	8.30	74.70	74.70	15.67	14.67
	30	No treatment	105.7	105.7	6.80	7.57	84.47	83.80	15.50	15.17
		treatment	120.0	123.3	8.67	9.23	85.87	85.87	18.80	18.13
	40	No treatment	103.9	97.2	8.00	8.90	82.80	88.13	19.43	19.10
		treatment	102.8	94.2	8.13	9.13	92.70	100.03	21.43	21.77
20/10	20	No treatment	63.7	69.0	4.97	5.70	35.10	36.10	6.67	6.33
		treatment	77.6	75.3	6.67	6.67	46.00	47.47	9.00	9.00
	30	No treatment	73.3	72.0	5.73	6.07	51.47	50.47	8.77	9.10
		treatment	78.3	77.6	5.67	6.57	57.33	60.47	11.23	11.23
	40	No treatment	73.1	71.7	5.77	6.33	62.70	66.03	13.23	12.90
		treatment	78.8	78.8	6.33	6.77	64.13	72.47	17.33	16.00
L.S.D at probability level of 0.05			78.8	78.8	6.33	6.77	64.13	72.47	17.33	16.00
sowing dates		1/10	114.9	110.9	7.73	8.43	82.64	83.81	17.49	16.99
		20/10	74.1	74.1	5.86	6.35	52.79	55.50	11.04	10.76
L.S.D at probability level of 0.05			3.8	5.1	0.67	0.52	3.08	3.15	1.05	1.19
rows spacing		20	99.6	97.4	6.60	7.03	57.78	57.15	11.36	10.78
		30	94.3	94.7	6.72	7.36	69.78	70.15	13.58	13.41
		40	89.7	85.5	7.06	7.78	75.58	81.67	17.86	17.44
L.S.D at probability level of 0.05			4.6	6.2	0.84	0.64	3.77	3.85	1.29	1.46
BioHealth		No treatment	90.3	88.8	6.46	7.01	65.31	65.81	12.95	12.62
		treatment	98.7	96.2	7.13	7.78	70.12	73.50	15.58	15.13
L.S.D at probability level of 0.05			3.8	5.1	0.67	0.52	3.08	3.15	1.05	1.19
sowing dates and rows spacing		1/10 20	128.5	122.6	7.38	7.88	75.02	72.52	14.88	13.88
		30	112.9	114.5	7.74	8.40	85.17	84.83	17.15	16.65
		40	103.4	95.7	8.07	9.02	87.75	94.08	20.43	20.43
		20/10 20	70.7	72.1	5.82	6.18	40.55	41.78	7.83	7.67
		30	75.8	74.8	5.70	6.32	54.40	55.47	10.00	10.17
		40	76.0	75.3	6.05	6.55	63.42	69.25	15.28	14.45
L.S.D at probability level of 0.05			6.6	8.8	1.18	0.89	5.34	5.45	1.82	2.07
sowing dates and BioHealth		1/10 No treatment	110.7	106.8	7.42	7.98	80.87	80.76	16.34	15.79
		treatment	119.1	115.1	8.03	8.89	84.42	86.87	18.63	18.19
		20/10 No treatment	70.0	70.9	5.49	6.03	49.76	50.87	9.56	9.44
		treatment	78.3	77.3	6.22	6.67	55.82	60.13	12.52	12.08
L.S.D at probability level of 0.05			5.4	7.2	0.96	0.73	4.36	4.45	1.49	1.69
rows		20 No treatment	93.1	93.2	6.22	6.58	55.22	53.22	10.38	9.72

spacing	treatment	106.1	101.5	6.99	7.48	60.35	61.08	12.33	11.83
and	30 No treatment	89.5	88.8	6.27	6.82	67.97	67.13	12.13	12.13
BioHealth	treatment	99.1	100.5	7.17	7.90	71.60	73.17	15.02	14.68
	40 No treatment	88.5	84.5	6.88	7.62	72.75	77.08	16.33	16.00
	treatment	90.8	86.5	7.23	7.95	78.42	86.25	19.38	18.88
L.S.D at probability level of 0.05		6.6	8.8	1.18	0.89	5.34	5.45	1.82	2.07

And also there was significant effect for the triple overlap on these indicators, cultivated plants in 1/10 to 20 cm distance and treated with bio-health it has given the highest elevation of the plant reached to 134.5 and 127.8 cm and cultivated plants in the same date on the 30 cm distance and treated with bio-health the largest number of the vegetative branches.plant⁻¹ 8.67 and 9.23 branches was "planted in the same date on the 50 cm distance and treated with bio-health it has given the largest number of papers.plant⁻¹ and the percentage of dry material reached to 92.70 and 100.03 paper and 21.43 and 21.77%, for both seasons respectively, in comparison with least values for it were 63.7 and 69.0 cm and 4.97 and 5.70 branches and 35.10 and 36.10 paper and 6.67 and 6.33%, respectively, resulted from cultivated plants in date of 20/10 to 20 cm distance that did not treated with bio-health.

Notes from the table (3) the main study factors and their interaction it has significant effect on the number of inflorescences.plant⁻¹ and indicators of the seeds yield, cultivated plants in 1/10 has excelled morally "in the number of inflorescences. Plant⁻¹ and weight of 1000 seeds and seeds yield.plant⁻¹ and seeds yield.hectar⁻¹ compared to plants cultivated in 20/10 and outperformed the cultivated plants on 40 cm distance morally compared to those planted on the other two distances in the number of inflorescences.plant⁻¹ and seeds yield.plant⁻¹ excelled cultivated plants at a distance of 30 cm in 1000 seed weight and outperformed the cultivated plants on 20 cm distance in seeds yield.hectar⁻¹ for both seasons of agriculture, treated plants outperformed morally in comparison with plants that were not treated in the number of inflorescences.plant⁻¹ and indicators of the seeds yield for both seasonal agriculture. The overlap of the date and distance of agriculture has significant effect, and has given cultivated plants in date 1/10 at a distance of 40 cm higher number of inflorescences.plant⁻¹ and weight of 1000 seeds and seeds yield.plant⁻¹ reached to 17.0 and 18.5 inflorescence and 0.868 and 0.869 g and 50.1 and 51.8 g, for both seasons, respectively, compared with less number of inflorescences.plant⁻¹ and seeds yield.plant⁻¹ was 13.3 and 13.6 inflorescence and 18.9 and 19.9 grams of cultivated plants resulted in 10/20 at 20 cm distance and less weight of 1000 seeds was 0.669 and 0.669 g resulted from cultivated plants in 1/10 at 30 cm distance, and the cultivated plants in the 1/10 and treated with bio-health gave the highest values of the number of inflorescences.plant⁻¹ and indicators of seeds yield reached to 16.7 and 17.9 inflorescence and 0.872 and 0.872 g and 49.10 and 50.2 g and 4.62 and 4.72 tons for both seasons, respectively, in comparison with less values 13.9 and 14.4 inflorescence and 0.710 and 0.710 g and 18.39 and 19.8 g and 1.78 and 1.88 tons have been resulted from cultivated plants in 10/20 which did not treated with bio-health, and the cultivated plants at a distance of 40 cm treated with bio-health gave highest number of inflorescences.plant⁻¹ and weight of 1000 seeds and seeds yield.plant⁻¹ reached to 17.0 and 18.9 and inflorescence 0.836 and 0.852 g and 38.8 g and 40.5, For two seasons, respectively, compared with less values were 13.3 and 13.8 and inflorescence 0.685 and 0.679, and 30.1 and 30.0 g, for two seasons in a row that resulted from cultivated plants at 20 cm distance that did not treated with bio-health. And the cultivated plants on the date 1/10 at 20 cm distance gave highest seeds yield.hectar⁻¹ reached to 7.6 tons, in comparison with less yield was 1.9 and 2.0 tons resulted from cultivated plants in date 10/20 at a distance of 40 cm, and the plants cultivated in date 1/10 and treated with bio-health gave highest seeds yield.hectar⁻¹ was 6.1 and 6.2 tons, in comparison with less yield was 2.3 and 2.5 tons resulted from cultivated plants in date 10/20 and not treated with bio-health, and the cultivated plants to a distance of 20 cm treated with bio-health gave the highest yield. hectare⁻¹ 5.6 and 5.8 tons, compared with less yield her was 2.9 and 3.0 tons resulted from cultivated plants at 40 cm distance that did not treated with bio-health, as was for the triple overlap significant effect on these indicators, plants cultivated in 1/10 at a distance of 40 cm treated with bio-health it has given the highest number of inflorescences.plant⁻¹ and weight of 1000 seeds and seeds yield.plant⁻¹ reached to 18.0 and 19.9 inflorescence, 0.909, 0.942 g and 52.9, 54.9 g, compared with less values were 12.9 and 13.3 and inflorescence 0.658 and 0.658 and 17.7 g and 18.3 g resulted from cultivated plants in 10/20 at 20 cm distance that did not treated with bio-health, and the cultivated plants in 1/10 at the distance of 20 cm treated with bio-health gave higher seeds yield.hectar⁻¹ reached to 7.7 and 7.9 tons, compared with less yield her it was 1.6 and 1.8 tons resulted from cultivated plants 10/20 at 40 cm distance that did not treated with bio-health.

Table (3). The impact of agriculture date and its distance and treatment with bio-health and their interaction in the number of inflorescences and seeds yield indicators of the for Khella plant.

sowing dates	rows spacing	BioHealth	Inflorescences number.plant ⁻¹		weight of 1000 fruits		Seed yield. plant ⁻¹		Seed productivity . h ⁻¹	
			2012/2013	2013/2014	2012/2013	2013/2014	2012/2013	2013/2014	2012/2013	2013/2014
1/10	20	No treatment	13.6	14.3	0.712	0.701	42.5	41.8	7.5	7.4
		treatment	14.4	15.0	0.818	0.785	44.0	45.0	7.7	7.9
	30	No treatment	14.2	15.0	0.849	0.850	46.4	47.4	5.4	5.6
		treatment	17.7	18.7	0.887	0.887	50.4	50.7	5.9	5.9
20/10	40	No treatment	15.9	17.2	0.804	0.838	47.3	48.7	4.2	4.3
		treatment	18.0	19.9	0.909	0.942	52.9	54.9	4.7	4.8
	20	No treatment	12.9	13.3	0.658	0.658	17.7	18.3	3.1	3.2
		treatment	13.6	13.9	0.680	0.680	20.2	21.5	3.6	3.8
	30	No treatment	14.0	14.2	0.790	0.790	19.7	20.7	2.3	2.4
		treatment	14.7	15.7	0.784	0.784	22.5	23.5	2.6	2.8
40	No treatment	14.7	15.7	0.683	0.683	17.8	20.5	1.6	1.8	
	treatment	16.0	18.0	0.761	0.761	24.7	26.1	2.2	2.3	
L.S.D at probability level of 0.05			1.4	1.8	0.094	0.092	4.8	4.1	0.6	0.5
sowing dates		1/10	15.7	16.7	0.830	0.834	47.3	48.1	5.9	6.0
		20/10	14.3	15.1	0.726	0.726	20.4	21.8	2.6	2.7
L.S.D at probability level of 0.05			0.6	0.8	0.038	0.037	1.9	1.7	0.2	0.2
rows spacing		20	13.6	14.1	0.717	0.706	31.1	31.7	5.5	5.6
		30	15.2	15.9	0.828	0.828	34.7	35.6	4.1	4.2
		40	16.2	17.7	0.789	0.806	35.7	37.5	3.2	3.3
L.S.D at probability level of 0.05			0.7	0.9	0.047	0.046	2.4	2.0	0.3	0.2
BioHealth		No treatment	14.2	14.9	0.749	0.753	31.9	32.9	4.0	4.1
		treatment	15.7	16.9	0.806	0.807	35.8	36.9	4.4	4.6
L.S.D at probability level of 0.05			0.6	0.8	0.038	0.037	1.9	1.7	0.2	0.2
sowing dates and rows spacing		20	14.0	14.6	0.765	0.743	43.3	43.4	7.6	7.6
		30	16.0	16.9	0.669	0.669	48.4	49.1	5.7	5.7
		40	17.0	18.5	0.868	0.869	50.1	51.8	4.4	4.6
		20	13.3	13.6	0.787	0.787	18.9	19.9	3.3	3.5
		30	14.4	15.0	0.857	0.890	21.1	22.1	2.5	2.6
		40	15.4	16.9	0.722	0.722	21.3	23.3	1.9	2.0
L.S.D at probability level of 0.05			0.9	1.3	0.067	0.065	3.4	2.9	0.4	0.3
sowing dates and BioHealth		1/10	14.6	15.5	0.789	0.796	45.41	46.0	5.7	5.7
		treatment	16.7	17.9	0.872	0.872	49.10	50.2	6.1	6.2
		20/10	13.9	14.4	0.710	0.710	18.39	19.8	2.3	2.5
		treatment	14.8	15.9	0.742	0.742	22.48	23.7	2.8	2.9
L.S.D at probability level of 0.05			0.8	1.1	0.054	0.053	2.8	2.3	0.3	0.3
rows spacing and BioHealth		20	13.3	13.8	0.685	0.679	30.1	30.0	5.3	5.3
		treatment	14.0	14.5	0.749	0.733	32.1	33.3	5.6	5.8
		30	14.1	14.6	0.820	0.820	33.1	34.1	3.9	4.0
		treatment	16.2	17.2	0.836	0.836	36.4	37.1	4.3	4.3
		40	15.3	16.5	0.744	0.760	32.6	34.6	2.9	3.0
		treatment	17.0	18.9	0.835	0.852	38.8	40.5	3.4	3.6
L.S.D at probability level of 0.05			0.9	1.3	0.067	0.065	3.4	2.9	0.4	0.3

Table (4). The impact of agriculture date and its distance and treatment with bio-health and their interaction in the oil yield indicators of the for Khella plant.

sowing dates	rows spacing	BioHealth	Oil percentage (%)		oil yield per plant(g)		Oil productivity. h ⁻¹		
			2012/2013	2013/2014	2012/2013	2013/2014	2012/2013	2013/2014	
1/10	20	No treatment	13.13	12.80	5.60	5.43	100.8	95.6	
		treatment	13.50	14.33	5.90	6.97	100.9	122.7	
	30	No treatment	13.30	13.30	6.20	7.27	72.7	85.3	
		treatment	16.07	16.07	8.10	7.93	97.4	93.0	
	40	No treatment	17.17	17.17	7.90	8.47	71.0	74.5	
		treatment	24.60	23.80	13.00	13.70	118.5	120.5	
20/10	20	No treatment	9.00	9.00	1.60	1.63	27.6	28.7	
		treatment	9.30	9.30	1.90	2.30	33.4	40.5	
	30	No treatment	9.20	9.73	1.80	2.33	20.7	27.3	
		treatment	10.33	10.50	2.30	2.67	25.8	31.3	
	40	No treatment	11.90	11.90	2.10	2.53	18.8	22.3	
		treatment	12.97	13.40	3.10	3.83	26.9	33.7	
	L.S.D at probability level of 0.05			0.68	1.57	0.98	1.40	7.5	15.1
	sowing dates		1/10	16.29	16.44	7.78	8.29	93.5	98.6
			20/10	10.45	10.64	2.13	2.55	25.5	30.6
	L.S.D at probability level of 0.05			0.28	0.64	0.39	0.57	3.1	6.2
	rows spacing		20	11.23	11.40	3.75	4.08	65.7	71.9
			30	12.23	12.66	4.60	5.05	54.1	59.2
		40	16.66	16.57	6.53	7.13	58.8	62.8	
L.S.D at probability level of 0.05			0.34	0.79	0.49	0.70	3.8	7.6	
BioHealth		No treatment	12.28	12.49	4.20	4.61	51.9	55.6	
		treatment	14.46	14.59	5.72	6.23	67.1	73.6	
L.S.D at probability level of 0.05			0.27	0.64	0.39	0.57	3.0	6.2	
sowing dates and rows spacing	1/10	20	13.32	13.65	5.75	6.20	100.8	109.2	
		30	14.68	15.20	7.15	7.60	85.0	89.2	
	20/10	40	20.88	20.48	10.45	11.08	94.7	97.5	
		20	9.15	9.15	1.75	1.97	30.5	34.6	
	30	30	9.77	10.12	2.05	2.50	23.3	29.3	
		40	12.43	12.65	2.60	3.18	22.8	28.0	
L.S.D at probability level of 0.05			0.48	1.12	0.69	0.99	5.3	10.7	
sowing dates and BioHealth	1/10	No treatment	14.53	14.77	6.57	7.06	81.5	85.1	
		treatment	18.06	18.12	9.00	9.53	105.6	112.1	
	20/10	No treatment	10.03	10.21	1.83	2.17	22.4	26.1	
		treatment	10.87	11.07	2.43	2.93	28.7	35.2	
	L.S.D at probability level of 0.05			0.39	0.91	0.56	0.81	4.6	8.7
	rows spacing and BioHealth	20	No treatment	11.07	10.90	3.60	3.53	64.2	62.2
treatment			11.40	11.90	3.90	4.63	67.1	81.6	
30		No treatment	11.25	12.03	4.00	4.80	46.7	56.3	
		treatment	13.20	13.28	5.20	5.30	61.6	62.2	
40		No treatment	14.53	14.53	5.00	5.50	44.9	48.4	
		treatment	18.78	18.60	8.05	8.77	72.7	77.1	
L.S.D at probability level of 0.05			0.48	1.12	0.69	0.99	5.3	10.7	

Notes from the table (4) that the main factors of the study and their interactions has significant effect on the percentage of the fixed oil and oil yield.plant⁻¹ and oil yield.hectar⁻¹, cultivated plants in 1\10 has excelled morally in all oil characteristics under study in comparison with plants cultivated in 20/10 excelled cultivated plants at a distance of 40 cm morally compared to those planted on the other two distances in the percentage of fixed oil and oil yield.plant⁻¹ excelled cultivated plants at a distance of 20 cm compared to those cultivated in the other two distances

in oil yield.hectare⁻¹ for both seasons, and excelled the plants treated with bio-health morally in comparison to those not treated in the percentage of oil and oil yield.plant⁻¹ and oil yield.hectare⁻¹ for both seasons. And there was significant effect for interaction between the date and distance of agriculture, cultivated plants in 1/10 at a distance of 40 cm has given higher percentage of the fixed oil and oil yield.plant⁻¹ reached to 20.88 and 20.48% and 10.45 and 11.08 g for both seasons, respectively, compared with least percentage of the fixed oil and oil yield.plant⁻¹ was 9.15 and 9.15% and 1.75 and 1.97 g resulted from cultivated plants in date 10/20 at 20 cm distance, and the plants cultivated in 1/10 to 20 cm distance gave highest seeds yield.hectare⁻¹ reached to 100.8 and 109.2 kg, compared with less yield for her was 22.8 and 28.0 kg resulted from cultivated plants in 20/10 at a distance of 40 cm, and gave the cultivated plants in the 1/10 and treated with bio-health gave the highest values of the percentage of the fixed oil and oil yield.plant⁻¹ and oil yield.hectare⁻¹ reached to 18.06 and 18.12% and 9.00 and 9.53 g and 105.6 and 112.1 kg for both seasons, respectively, compared with least values for her were 10.03 and 10.21% and 1.83 and 2.17 g and 22.4 and 26.1 kg resulted from plants planted in the 10/20 and treated with bio-health, and the cultivated plants at a distance of 40 cm treated with bio-health gave the highest percentage of the fixed oil and oil yield.plant⁻¹ reached 18.78 and 18.60% and 8.05 and 8.77 g for both seasons, respectively, compared with least values It was 11.07 and 10.90% and 3.60 and 3.53 g resulted from cultivated plants at 20 cm distance that did not treated with bio-health, and the cultivated plants to a distance of 20 cm treated with bio-health gave higher oil yield.hectare⁻¹ reached to 67.1 and 81.6 kg, compared with less oil yield was 44.9 and 48.4 kg resulted from cultivated plants at a distance of 40 cm and treated with bio-health, as was the triple interaction has significant effect on these indicators, cultivated plants in 1/10 at a distance of 40 cm treated with bio-health and has given highest percentage of fixed oil and oil yield.plant⁻¹reached to 24.60% and 23.80 13.00 and 13.70 g, compared with less values her were 9.00 and 9.00% and 1.60 and 1.63 g resulted from cultivated plants in the 10/20 to 20 cm distance that did not treated with bio-health, and cultivated plants in the first season in 1/10 at a distance of 40 cm treated with bio-health gave higher oil yield.hectare⁻¹ reached to 118.5 kg, compared with least yield her was 18.8 kg resulted from cultivated plants in 10/20 at 40 cm distance that did not treated with cultivated plants in the second season in 10/1 at a distance of 20 cm and treated with bio-health gave higher oil yield.hectare⁻¹ reached to 122.7 kg, compared with less oil yield reached 22.3 kg resulted from cultivated plants in 10/20 at 40 cm distance that did not treated with bio-health.

It is thus clear superiority of cultivated plants in 1/10 in plant height and number of main vegetative branches and total number of leaves per plant and the percentage of dry material may be due to temperatures accompanying for plant growth, which reached their rates of maximum and minimum heat 27.8 and 12.9° m, respectively, which were more suitable for growth compared to maximum and minimum temperature in the second date (20/10), which was 21.5 and 11.0°c, respectively, which has worked to increase the efficiency of photosynthesis that reflected positively in the strength of plant growth, including the height [22].decreased plants height on the second date (20/10) could be due to the low temperatures that lead to the dereliction phalanges or to the imbalance in the production of Gibberellins leading to reduced height [23]. That lead to the availability of a greater amount of processed food needed to stimulate vegetative buds and growth of the plants that are grown in this date as a result of favorable weather conditions. And that the apical dominance of the apical leg begin to weaken whenever as plant aged [24], this result agreed with Al- Janabi [25] and Bhambri *et al.* [26] on Bishop's Weed (*Ammi majus*). And that the preponderance of cultivated plants in 1/10 in the total number of securities may be due to increasing the efficiency of photosynthesis and the accumulation of metabolites, which stimulate the increase of cell division and the emergence of new vegetative buds or to the formation of profuse vegetative shoot system represented an increase of number of the main vegetative branches (Table 0.4) so as a result there was increase in the number of leaves [27]. And the significant increase in the percentage of dry material of cultivated plants in the first date may be due to the early date of Agriculture gives the great vegetative growth and this explains on the basis of the length of vegetative growth duration and appropriateness of the environmental conditions for growth and increase the efficiency of photosynthesis as a result of the relatively high temperature At the beginning of the first appointment plants growth in comparison with the second date plants (table 4). and increase the accumulation of these products in the first appointment plants (1/10) led to reduce competition between inflorescences formed which lead to increase their numbers in this date, in comparison with plants of second date 20/ 10, and this is in agreement with Al-Janabi [25], Bhambri *et al.* [26] on Bishop's Weed. And that the reason outweigh the first sowing date (1/10) in seeds yield per plant and the weight of 1000 seed and yield per hectare of seeds may be due to the strength of the growth of the shoot system (Table 2), which is reflected in the increase in processed food and its role in the transmission and distribution of these solutes between consuming parts (sink) in the plant including the seeds or worked to reduce the competition between fruits and vegetative parts thus increasing the weight of 1000 seeds, which reflected positively in the increase yield of the seeds of the plant as a result productivity of area unit has been increased (hectare) and this is in agreement with Al-Janabi [25]. This can be attributed reason for the increase in the percentage of fixed oil in the early date that this date marked by high efficiency of the process of photosynthesis as a result of the

availability of all requirements of this process, which led to the production of high amounts of the products of the primary metabolism, which is considered as one of types of oils, and that the reason behind the increase yield per plant from oil due to the increase total seeds yield.plant⁻¹. At this early time and to increase the percentage of oil in the plant (Table 4) and yield of the plant seeds (Table 3) This is in agreement with Al-Janabi [25].

superiority of the cultivated plants at a distance of 20 cm between the lines could be due to reduce the distance between the lines that led to an increase in the shoot system per area unit, which led to increased shading between plants and then the lack of light in force into the vegetation allowing auxin in cooperation with gibberellins to work on the elongation of phalanges, thereby increasing plant height [28]. The reason for the superiority of cultivated plants at distances spaced 40 cm between the lines in the number of lateral branches that cultivated on the distance spaced lead to the further spread of root system of the plant in a larger space allowing it to growth and the formation of a larger number of tops that work in turn on the cytokinins manufacturing which in turn works for the abolition of apical dominance and promote the formation of lateral branches [29]. The increase in the total number of leaves.plant⁻¹ and the percentage of dry material.plant⁻¹ probably dating back to the distant spaces between the plants have an important role in increasing the amount of incident light on the plant, which is specific to the efficiency of photosynthesis process that causes their outputs of nutrients lead to the emergence of the principles of the leaves creation and increase cell division [30], the superiority of cultivated plants in the distant spaces in the percentage of dry material may be due to decrease in competition between plants on the nutrients available to the unity of space, which has helped to spread root system and thus get the largest amount of the plant's needs of food and water as well as exposure most or all of the light to shoot influential in the efficiency of photosynthesis and increase reflected metabolites that improve the growth and increase the dry weight [31]. And increase the number of inflorescences as greater as the agriculture distance between plants may be due to agriculture on the vast distance has provided the basic elements of the process of photosynthesis including water and nutrients, which has resulted in an increase in the accumulation of solutes that decrease the competition between flowering inflorescences that considered as a major consumer of solutes which are reflected positively in increasing the number of advanced inflorescences [22] This is consistent with the findings of Baktash *et al.* [32] on Bishop's Weed. And the reason for the lack of total seeds yield.plant⁻¹ in tight spaces could be due to the increased plant density (when the narrow spaces) lead to a tangle of branches between one plant or between plant and another dropped accordingly the amount of solar radiation received by a single plant resulting in lower photosynthesis rate and then the lack of accumulation of dry material (Table 2), in which That reflected on the weight of 1000 seeds and this in turn affects the total seeds yield.plant⁻¹ and this result reached by the Al-Janabi [25] on Bishop's Weed preponderance cultivated plants on the distance of 20 cm in the total yield.hectare⁻¹ is attributable to the increase in weight of 1000 seed (Table 0.3) on the one hand and increase the number of plants per unit area of this distance on the other hand compared to the other two distance. And agree with results of Akhane *et al.* [33] on the coriander plant. The increase in the percentage of oil at the plant cultivation on vast distances due to decrease competition between plants on different growth factors including light and nutrients factors, thus increasing the vegetative and flowering growth, which is reflected in the percentage of oil or provide good conditions for growth as a result of the efficiency of photosynthesis and the accumulation of their products in the plant and the continued shift of metabolism, causing "increasing stored oils [19] This is consistent with the results Al-Janabi [25] on Bishop's Weed, and that the increase total plant yield of oil in cultivated plants in the divergent distances attributed to the cultivated plants in the divergent distances gave more yield of fruits.plant⁻¹ (Table 3) and a higher percentage of volatile oil (Table 4). This is consistent and agree with the Al-Janabi [25] on Bishop's Weed can be explained by changes in the yield per hectare of the volatile oil increase when agriculture in narrow distances to increase the number of plants per area unit when reducing the distance between plants that lead to the increase of productivity per hectare of fruits (Table 3), which in turn lead to an increase in the volatile oil per hectare compared to productivity of cultivated plants on vast distances.

The increase in the vegetative growth indicators for plants treated with bio-health could be due to stimulation of the growth of roots, which works to increase the absorption of water and nutrients from the growth medium which stimulates photosynthesis and cell division and result in the emergence of the principles of the primitive papers that develop into true leaves [34]. Or because it contains 75% humic acid, which plays a role in increasing the permeability of cell membranes and photosynthesis and root growth [35] as well as it is indirect role in increasing the efficiency of available and added fertilizers or direct role in improving all vital events in plant [36] and to stimulate the plant to respond to growth hormones [37]. This is consistent with the results by Abbas [38] on caraway. The reason for the early flowers and increase seeds yield indicators as a result of plants spraying with bio-health probably be attributed to the role of humic acid which increases nutrient absorption rate of the root surfaces and it is entry to the cells of plant tissues [39] or by stimulating enzymes and plant hormones [40,41], which will reflect positively on early flowering and increased seeds yield indicators. and increase indicators of the oil yield may

be due to the nutrients embedded in the humic acid structure may play an important role in biological processes within the plant thus increasing the phosphate and fatty acid composition and the amount of fat and specifications [37]. This corresponds with Abbas [38] on the caraway.

We conclude from the study that the cultivated plants in 1/10 at the distance of 20 cm treated with bio-health gave higher seeds and oil yield per unit area.

4. References

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