

## EFFECT OF SALINE WATER IRRIGATION AND MELATONIN ON TWO CULTIVARS OF CAULIFLOWER

Abdulkareem N. Jasim<sup>1</sup> and Abbas K. Obaid

<sup>1</sup>Horticulture Division, Abu Ghraib, Ministry of Agriculture, Baghdad, Iraq  
Department of Horticulture and Garden Landscape, College of Agriculture, University of Basrah,  
Iraq, [ANJ, AKO].

Emails: K.n.Jassim73@gmail.com, baskadium@gmail.com

**Abstract.** An experiment was conducted in the agricultural research station / College of Agriculture / University of Basrah to study the impact of saline water irrigation and melatonin on two cultivars of cauliflower. The experiment included three factors, saline water irrigation at three levels (Ro, 2.5 & 4.5 dsm<sup>-1</sup>), Melatonin at four levels (0, 50, 100 & 150 mM l<sup>-1</sup>) and two Cultivars of Cauliflower (Nahar & Solid Snow). Results showed that the "Nahar" hybrid have a significant increase on "Solid Snow" hybrid in plant height, number of leaves, leaf area, dry weight, crud weight, total yield (38.712 ton.ha<sup>-1</sup>) and number of days to maturity 50%. Saline water irrigation caused a significant decrease in all the vegetative, flowering and yield growth characteristics. Foliar application of Melatonin (100 mM l<sup>-1</sup>) caused a significant increase in plant height, crud weight (1349.5 gm) and total yield (39.565 ton.ha<sup>-1</sup>), while (150 mM l<sup>-1</sup>) gave a significant increase in dry weight and decrease in the number of days to maturity 50%, the concentrations (100 & 150 mM l<sup>-1</sup>) gave a significant increase in the number of leaves and leaf area.

**Keywords:** Cultivars, saline water irrigation, melatonin, Cauliflower

### 1. Introduction

Dry and semi-arid regions of the world depend on river water or ground water to irrigate their plants, which is characterized by its scarcity and poor quality, as it contains dissolved salts and this negatively effects on growth and yield, because of its negative effects on plants (Maas, 1986 ; Juan et al., 2005). Hmiz *et al.* (2021) mentioned that salt stress had an effect on leaf area, pigments, total sugar, and total soluble solids. Also in the study of the effect of drought on castor plant (*Brachychiton dopulneus* L.), conducted by Karim *et al.* (2020) where they found that stress Dehydration led to a decrease in height, dry weight and photosynthesis. It is become necessary to use some methods that increase the tolerance of plants to stress and then work to reduce their harmful effects. As the use of compounds such as melatonin N-acetyl-5-methoxy-tryptamine to protect plants from the effects of oxidative stress caused by salt stress (Altaf, 2020), many researchers have hypothesized that melatonin, a plant hormone, may have some similar effects to the compound. Indole-3-acetic acid (IAA) (Kolár and Machackova, 2005). It may act as a regulatory molecule in plants as an antioxidant to protect various plant tissues and organs, especially flowers. Fruits and seeds are subject to oxidative stress due to environmental stresses, such as drought, salinity, cold and high temperatures, as well as ultraviolet radiation and ozone (Van Tassel et al., 2001; Tan et al., 2007). It leads to the removal of free radicals (Tan et al., 2007). Arnao and Hernández-Ruiz (2009) found that the content of melatonin has an important role in

defense against stress due to its antioxidant activity by eliminating free radicals. It increases antioxidant enzyme activity, protecting antioxidant enzymes from oxidative damage and reducing the production of free radicals. It also leads to an increase in the efficiency of the photosynthesis process (Tan et al., 2010). In a study by Mansha Gul et al. (2018) When broccoli plant was treated with five concentrations of Melatonin, which are 0, 20, 40 and 80 ppm, there was an increase in plants treated with the compound in both plant height, leaf area, fresh and dry weight, in addition to chlorophyll and carotene.

## 2. Materials and Methods

The experiment was carried out during 2021-2022 planting season in the agricultural research station / College of Agriculture / University of Basrah, to study the impact of saline water irrigation and melatonin on two cultivars of cauliflower.

### 2.1. Treatments and Experimental Design

The study was designed as three factors corresponding to the split –split plot design, each treatment had 3 replicate. The main plot was two Cultivars of Cauliflower the first "Nahar" and the second "Solid Snow" . The sub plot was three levels of saline water irrigation the first (Ro) the second ( $2.5 \text{ ds m}^{-1}$ ) and the third ( $4.5 \text{ ds m}^{-1}$ ). The sub-sub plot includes spraying plants with four concentrations of Melatonin, the first ( $0 \text{ mM l}^{-1}$ ), second ( $50 \text{ mM l}^{-1}$ ), third ( $100 \text{ mM l}^{-1}$ ) and the fourth ( $150 \text{ mM l}^{-1}$ ) sprayed three times, the first spray three weeks after transplanting and the other spray two weeks after the date of the first spray. The averages were compared according to the test. (LSD) is below the 5% probability level and the data is analyzed using Ver.7 Genstat statistical analysis software.

### 2.2. Study Traits

It included plant height (cm), number of leaves, leaf area ( $\text{cm}^2$ ) based on Watson & Watson (1953), dry matter (gm), the date of ripening 50% of the curd (day), crud weight (gm) and total yield of the plant ( $\text{ton.ha}^{-1}$ ).

## 3-Results

### 3-1 Plant height (cm)

The table 1 indicates that the "Nahar" hybrid plants outgrow the "Solid Snow" hybrid plants with an increase of 5.06%. Irrigation with RO water considerably enhanced plant height compared to irrigation with 2.5 and 4.5  $\text{ds m}^{-1}$ , with the plant heights being 57.80, 56.05, and 52.53 cm, Respectively. Foliar application with  $100 \text{ mM l}^{-1}$  Melatonin caused significant increase on plant height 57.05 cm comparison with the  $0 \text{ mM l}^{-1}$  gave the lowest height plant of 53.33 cm.

The interactions between cultivars and water salinity, cultivars and melatonin is not significant, whereas the plants which irrigated with RO and foliar application with Melatonin  $100 \text{ mM l}^{-1}$  gave high value 59.49 cm comparison with the less value gave by the plants which irrigated with  $4.5 \text{ ds m}^{-1}$  and  $0 \text{ mM l}^{-1}$  melatonin (Control) reached 50.81 cm, The triple interactions between the studied factors was significant in plant height, where the "Nahar" hybrid plants

which Irrigated with RO and sprayed by Melatonin 100 mM<sup>-1</sup> gave highest plant height 61.36 cm while "Solid Snow" hybrid irrigated with 4.5 dsm<sup>-1</sup> water and non spraying resulted the least value 48.88 cm.

Cultivars	Melatonin (mM <sup>-1</sup> )	Water irrigation (dsm <sup>-1</sup> )			Cultivars X Melatonin
		RO	2.5	4.5	
Nahar	0	56.45	54.29	52.73	54.49
	50	59.70	57.50	54.09	57.10
	100	61.36	59.36	55.40	58.71
	150	60.55	57.59	52.93	57.02
Solid Snow	0	53.21	54.40	48.88	52.16
	50	55.77	55.39	50.84	54.00
	100	57.61	55.73	52.86	55.40
	150	57.72	54.18	52.53	54.81
L.SD 0.05		1.88			NS
Water irrigation		57.80	56.05	52.53	Cultivars
L.SD 0.05		1.26			
Cultivars x	Nahar	59.52	57.19	53.79	56.83
Water irrigation	Solid Snow	56.08	54.92	51.28	54.09
L.SD 0.05		NS			1.03
					Melatonin
Melatonin X Water irrigation	0	54.83	54.35	50.81	53.33
	50	57.74	56.44	52.47	55.55
	100	59.49	57.55	54.13	57.05
	150	59.14	55.88	52.73	55.92
L.SD 0.05		1.46			0.59

**Table 1. Effect of saline water and melatonin on the height (cm) of two Cultivars of Cauliflower**

### 3-2 Number of leaves

It seems from table 2 that the "Nahar" hybrid outperformed the "Solid Snow" hybrid in the number of leaves of a plant with an increase of 18.48%. From the same table notice significant difference for the plants that irrigated with RO water resulted highest leaves number than the other water salinity levels such as 2.5 and 4.5 dsm<sup>-1</sup> reach 19.520, 17.824, 16.650 leaf.plant<sup>-1</sup> for three salinity levels, respectively. Foliar application with Melatonin 100 mM<sup>-1</sup> recorded the highest number of leaves of 18.970 leaf.plant<sup>-1</sup> which did not differ significantly from the

treatment 150 mM<sup>-1</sup>18.529 leaf.plant<sup>-1</sup> ,while the comparison treatment recorded gave the lowest number of leaves of 16.816leaf.plant<sup>-1</sup>.The interactions between two factors it seems that "Nahar" hybrid plants irrigated with RO water gave highest number of leaves reached 21.418 leaf.plant<sup>-1</sup> comparison with"Solid Snow"irrigated with 4.5 dsm<sup>-1</sup> was 15.582 leaf.plant<sup>-1</sup>. The

Cultivars	Melatonin (mM <sup>-1</sup> )	Water irrigation (dsm <sup>-1</sup> )			Cultivars X Melatonin
		RO	2.5	4.5	
Nahar	0	20.050	18.160	15.937	18.049
	50	21.010	19.063	17.303	19.126
	100	22.823	20.730	19.390	20.981
	150	21790	19.740	18.237	19.922
Solid Snow	0	16.327	15.810	14.613	15.583
	50	16.760	16.193	15.720	16.224
	100	18.330	16.387	16.157	16.959
	150	19.063	16.507	15.840	17.137
L.SD 0.05		NS			2.588
Water irrigation		19.520	17.824	16.650	Cultivars
L.SD 0.05		0.48			
Cultivars x Water irrigation	Nahar	21.418	19.423	17.717	19.519
	Solid Snow	17.621	16.224	15.582	16.476
L.SD 0.05		2.70			3.06
Melatonin X Water irrigation	0	18.188	16.985	15.275	16.816
	50	18.885	17.628	16.512	17.675
	100	20.578	18.558	17.773	18.970
	150	20.427	18.123	17.038	18.529
L.SD 0.05		NS			0.49

interactions between Melatonin and water salinity wasn't significant, while the "Nahar" hybrid plants sprayed with 100 mM<sup>-1</sup> gave highest number of leaves reached 20.981 leaf.plant<sup>-1</sup> comparison with "Solid Snow" hybrid plants that non spraying that gave 15.583 leaf.plant<sup>-1</sup> , The triple interactions between the studied factors was no significant in the number of leaves of a plant.

Table2. Effect of saline water and melatonin on the leaves number plant<sup>-1</sup> of two Cultivars of Cauliflower

### 3-3 Leaf area (cm<sup>2</sup>)

It appears from the table 3 that the "Nahar" hybrid plants excelled compared to the "Solid Snow" hybrid in the leaf area with an increase of 11.23%.The results showed a significant difference in the plants how irrigated with RO of 5442 cm<sup>2</sup> compared to the lowest leaf area of

4624cm<sup>2</sup> at a concentration of 4.5 dsm<sup>-1</sup>.Foliar application with 150 mMl-1Melatonin caused significant increase on leaf area which amounted to 5345 cm<sup>2</sup> compared to 4498 cm<sup>2</sup> for control treatment. The interactions between two factors cultivars and water salinity levels differed significantly, where the "Nahar" hybrid plants that irrigated with RO water excelled which

Cultivars	Melatonin (mM l <sup>-1</sup> )	Water irrigation (dsm <sup>-1</sup> )			Cultivars X Melatonin
		RO	2.5	4.5	
Nahar	0	5011	4509	4314	4611
	50	5662	4851	4656	5057
	100	6282	5427	5209	5639
	150	6403	5447	5244	5698
Solid Snow	0	4690	4311	4155	4385
	50	4895	4608	4276	4593
	100	5280	4937	4520	4912
	150	5312	5052	4613	4992
L.SD 0.05		NS			287.4
Water irrigation		5442	4893	4624	Cultivars
L.SD 0.05		141.7			
Cultivars x Water irrigation	Nahar	5839	5059	4856	5251
	Solid Snow	5045	4727	4391	4721
L.SD 0.05		292.1			378.9
Melatonin X Water irrigation	0	4851	4410	4234	4498
	50	5279	4730	4466	4825
	100	5781	5182	4865	5276
	150	5858	5250	4929	5345
L.SD 0.05		NS			136.6

amounted to 5839 cm<sup>2</sup> compared to the "Solid Snow" plant that irrigated with 4.5 dsm<sup>-1</sup> reached 4391 cm<sup>2</sup>.The interactions between Melatonin and water salinity wasn't significant, Whereas the interactions between the "Nahar" hybrid plants and 150 mMl-1 Melatonin gave highest leaf area reached 5698 cm<sup>2</sup> compared with the "Solid Snow" hybrid" plants non spraying Melatonin that gave lowest leaf area 4385 cm<sup>2</sup>.The triple interactions between the studied factors was no significant in the leaf area of.

Table3. Effect of saline water and melatonin on the Leaf area (cm<sup>2</sup>) of two Cultivars of Cauliflower

### 3-4 Dry weight (gm)

The table (4) indicated to found significant difference for three trial factors in the dry weight, where overcame the " Nahar" hybrid plants on the" Solid Snow" hybrid plants with an increase

of 28.33%. The table showed that the irrigated with RO water caused a significant increase in the dry weight reached 173.49 gm compared to the lowest weight reached 140.49 gm in the plants irrigated with 4.5 dsm<sup>-1</sup>. The plants spraying with 150 mMl<sup>-1</sup> Melatonin gave highest dry weight reached 170.79 gm compared to the lowest weigh reached 144.00 gm resulted in

Cultivars	Melatonin (mMl <sup>-1</sup> )	Water irrigation (dsm <sup>-1</sup> )			Cultivars X Melatonin
		RO	2.5	4.5	
Nahar	0	179.42	163.11	139.41	160.65
	50	188.50	165.59	147.7	167.29
	100	204.55	189.24	163.81	185.87
	150	211.05	194.06	167.72	190.94
Solid Snow	0	138.26	128.81	114.99	127.35
	50	143.75	127.90	119.77	130.47
	100	157.71	138.15	126.26	140.71
	150	164.70	14306	144.17	150.64
L.SD 0.05		NS			4.56
Water irrigation		173.49	156.24	140.49	Cultivars
L.SD 0.05		2.08			
Cultivars x Water irrigation	Nahar	195.88	178.00	154.68	5251
	Solid Snow	151.10	134.48	126.30	4721
L.SD 0.05		3.52			4.42
Melatonin X Water irrigation	0	158.84	145.96	127.20	4498
	50	166.13	146.75	133.78	4825
	100	181.13	163.70	145.03	5276
	150	187.88	168.56	155.94	5345
L.SD 0.05		NS			3.33

the control treatment. As for the interaction between two factors ,it showed that the " Nahar" hybrid plant irrigated with RO water gave the highest dry weight reaching 195.88 gm compared to " Solid Snow" that irrigated with 4.5 dsm<sup>-1</sup> gave the lowest dry weight in the plants it amounted to 126.30 gm. showed that the " Nahar" hybrid plant spraying with 150 mMl<sup>-1</sup> Melatonin gave the highest dry weight reaching 190.94gm compared to " Solid Snow" spraying with 0 mMl<sup>-1</sup> Melatonin gave the lowest dry weight in the plants it reached to 127.35gm. The interactions between Melatonin and water salinity wasn't significant. The triple interaction between the studied factors was no significant in the dry weight. Table 4.The effect of saline water and melatonin on the dry weight (gm) of two Cultivars of Cauliflower.

### 3-5The date of ripening 50% of the curd

It is evident from Table (5) the effect of cultivars, water salinity levels and spraying Melatonin and their interaction in the date of ripening 50% of the curd. The hybrid “Nahar” showed an early crude maturation of 131.50 days compared to the “Solid Snow” hybrid which gave the highest number of days amounting to 129.88 days. The plants irrigated with RO caused a significant increase in the date of ripening 50% of the curd of 139.58 days compared with plants that irrigated with 4.5 dsm<sup>-1</sup> which gave the lowest number of days amounting to 122.58 days. The plants spraying with 150 mM<sup>-1</sup> Melatonin caused a significant decrease in the date of ripening 50% of the curd of 128.33 days compared to plants that were not treated with Melatonin which gave the largest number of days reached 133.22 days. As for the interaction between the cultivars and water salinity levels it showed no significant effect, whereas that the plants irrigated with RO and no spraying Melatonin gave the highest date of ripening 50% of the curd reached 142.00 days compared to the plants irrigated with 4.5 dsm<sup>-1</sup> and spraying with 150 mM<sup>-1</sup> gave the lowest date of ripening 50% of the curd reached 120.33 days. The triple interactions between the studied factors was no significant in date of ripening 50% of the curd.

Cultivars	Melatonin (mM l <sup>-1</sup> )	Water irrigation (dsm <sup>-1</sup> )			Cultivars X Melatonin
		RO	2.5	4.5	
Nahar	0	143.00	134.33	125.33	134.22
	50	140.33	131.33	124.33	132.00
	100	139.66	129.33	123.33	130.77
	150	138.33	128.00	120.66	129.22
Solid Snow	0	141.00	132.66	123.00	132.22
	50	139.66	129.66	122.00	130.44
	100	137.66	128.00	122.00	129.22
	150	137.00	126.00	120.00	127.66
L.SD 0.05		NS			NS
Water irrigation		139.58	129.91	122.58	Cultivars
L.SD 0.05		0.47			
Cultivars x Water irrigation	Nahar	140.33	130.75	123.41	131.50
	Solid Snow	138.83	129.08	121.75	129.88
L.SD 0.05		NS			2.19
					Melatonin
Melatonin X Water irrigation	0	142.00	133.50	124.16	133.22
	50	140.00	130.50	123.16	131.22
	100	128.00	128.66	122.66	130.00
	150	126.33	127.00	120.33	128.33
L.SD 0.05		0.80			0.46

Table5. Effect of saline water and melatonin on the date of ripening 50% of the curd of two Cultivars of Cauliflower .

### 3-6 Crud weight (gm)

It a show from the table(6) that the cultivars differed significantly in this experiment where the "Nahar" hybrid plants excelled compared to the "Solid Snow" 5.92% . The same table indicated that the salinity of irrigation water caused a significant decrease in crud weight, where the plants that irrigated with RO gave 1399.5 gm comparison with the plants that irrigated with 4.5 dsm-1 that gave 1193.00 gm. Foliar application with Melatonin with 100 mMl-1 caused significant increase in the crud weight reached 1349.5 gm compared to the lowest weigh 1203.8 gm inthe control treatment.The interactions between "Nahar" hybrid and irrigated with RO water gave highest weight reached 1445.2 gm compared to the lowest weight produced in "Solid Snow" irrigated with 4.5 dsm-1 which amounted to 1181.1 gm.The interaction between the plants irrigated with RO and spraying with100mMl-1 Melatonin gave the highest curd weight 1501.0 gm comparison to the lowest weight produced in plants that irrigated with 4.5dsm-1 and no spraying Melatonin 1144.0 gm. whereas the interactions between cultivars and Melatonin was no significant ,also between three experiment factors was no a significant effect.

Table 6. Effect of saline water and melatonin on the Crud weight (g)of two Cultivars of Cauliflower

Cultivars	Melatonin (mM l <sup>-1</sup> )	Water irrigation (dsm <sup>-1</sup> )			Cultivars X Melatonin
		RO	2.5	4.5	
Nahar	0	1304.0	1254.0	1166.0	1241.3
	50	1408.0	1288.0	1177.0	1291.0
	100	1558.0	1354.0	1244.0	1385.3
	150	1511.0	1332.0	1232.3	1358.4
Solid Snow	0	1233.0	1144.0	1122.0	1166.3
	50	1334.0	1177.0	1155.0	1222.0
	100	1444.0	1261.0	1236.0	1313.7
	150	1404.3	1221.7	1211.3	1279.1
L.SD 0.05		NS			NS
Water irrigation		1399.5	1254.0	1193.0	Cultivars
L.SD 0.05		23.48			
Cultivars x Water irrigation	Nahar	1445.2	1307.0	1204.8	1319.0
	Solid Snow	1353.8	1200.9	1181.1	1245.3
L.SD 0.05		29.14			24.61
					Melatonin
Melatonin X Water irrigation	0	1268.5	1199.0	1144.0	1203.8
	50	1317.0	1232.5	1166.0	1256.5
	100	1501.0	1307.5	1240.0	1349.5
	150	1457.7	1276.8	1221.8	1318.8
L.SD 0.05		46.79			28.21

### 3-1-7 Total yield (ton.ha<sup>-1</sup>)

It notices from table(7) That there is a significant effect of the three factors in the total yield, Where the "Nahar" hybrid plants gave a significant increase reached 38.712 ton.ha<sup>-1</sup> compared "Solid Snow" hybrid was 36.459 ton.ha<sup>-1</sup> with an increase of 5.42% . Seems from the same table Irrigation with RO water gave a significant increase reached 40.996 ton.ha<sup>-1</sup> comparison with plants that irrigated with 4.5 dsm<sup>-1</sup> reached 34.992 ton.ha<sup>-1</sup>. Foliar application with Melatonin 100 mM<sup>-1</sup> caused significant increase in total yield 39.565 ton.ha<sup>-1</sup> comparison with control treatment cues lower yields 35.314 ton.ha<sup>-1</sup> .The twice interactions between "Nahar" hybrid plants and irrigated with RO water gave highest yields reached 42459 ton.ha<sup>-1</sup> compared to the "Solid Snow" hybrid plant irrigated with 4.5 dsm<sup>-1</sup> gave lowest yields reached 34644 ton.ha<sup>-1</sup> . The plants that irrigated with RO water and sprayed with 100 mM<sup>-1</sup> Melatonin gave highest total yield reached 44.028 ton.ha<sup>-1</sup> compared with the plants that irrigated with 4.5 dsm<sup>-1</sup> and non spraying Melatonin gave 33.556 ton.ha<sup>-1</sup> . The interactions between cultivars and Melatonin and between three factors was no a significant effect.

Cultivars	Melatonin (mM l <sup>-1</sup> )	Water irrigation (dsm <sup>-1</sup> )			Cultivars X Melatonin
		RO	2.5	4.5	
Nahar	0	38250	36783	34202	36412
	50	41300	37780	34524	37868
	100	45700	39716	36490	40635
	150	44322	39071	36147	39935
Solid Snow	0	36167	33573	32911	34217
	50	39130	34524	33879	35844
	100	42356	36870	36255	38494
	150	41192	35835	35531	37282
L.SD 0.05		NS			NS
Water irrigation		40996	36769	34992	Cultivars
L.SD 0.05		794.8			
Cultivars x Water irrigation	Nahar	42459	38338	35341	38712
	Solid Snow	39533	35201	34644	36459
L.SD 0.05		1004.5			909.7
					Melatonin
Melatonin X Water irrigation	0	37208	35178	33556	35314
	50	40215	36152	34202	36856
	100	44028	38293	36372	39565
	150	42533	37453	35839	38608
L.SD 0.05		1361.9			784.6

Table 7. Effect of saline water and melatonin on the total yield (ton.h<sup>-1</sup>) of two Cultivars of

Cauliflower .

#### 4- Discussion

Tables (1,2,3,4 & 5) indicated that there was a significant difference between the two cultivars, where the hybrid "Nahar" was superior on "Solid Snow" in all the traits under the experiment, such as plant length, number of leaves, leaf area, dry weight and the date of ripening 50% of the curd. The reason may be due to the difference in genotypes between the two cultivars. Tables (6&7) notes that "Nahar" hybrid a significant effect on the "Solid Snow" hybrid in curd weight and the total yield. It may be due to the superiority of Nahar cultivar in increasing the number of leaves and leaf area (table 2,3), which helped in increasing the outputs of the photosynthesis process, which was reflected in the weight of the in the crud weight and total yield. Similar results are tested by Voitenkova (2002) report that Artemorka variety during the period of harvesting 162-130 days and 62 ton/ha and Stoka variety with 135-168 days for maturity and 63 ton/ha in Russia. It is noted from tables (1, 2, 3, 4, 5) that there is a significant decrease in all measurements of vegetative growth under the conditions of increasing salinity of irrigation water such as plant height, number of leaves and leaf area. And the dry weight in addition to an increase in the maturity date of 50% of the curd, due to the lack of transfer of nutrients from the roots to the rest of the plant parts due to the low amount of water absorbed (Tutija, 2005), or this decrease is due to the effect of the salinity of irrigation water on physiological processes For plants, such as water condition, stomata behavior, ionic balance, and photosynthesis efficiency (Mons, 1993), they also have an effect on increasing the osmotic potential and decreasing water potential as a result of an increase in the concentration of salts in plant tissues due to irrigation with high salinity water (Ashraf and Fool ad, 2005). It is noted in ables 6 & 7 that the salinity of the irrigation water caused a decrease in the weight of the curd and the total yield, and this decrease may be due to the direct effects of salinity in inhibiting the activity of enzymes, ionic imbalance and low content of chlorophyll, carbohydrates, proteins and plant hormones (Nikee et al., 2014). All of this affects plant growth and leads to a decrease in plant height, number of leaves, leaf area and dry weight. As a result, there was a decrease in plant productivity and these results are in agreement with Simon et al. (1983) found that there was a significant decrease in the mean dry weight of leaves when spinach was exposed to salt stress.

The current study highlights the significant decline in almost all of the growth parameters of plants under salt stress, but this decline was significantly alleviated by the exogenous Melatonin, the concentration  $100 \text{ mMl}^{-1}$  Melatonin caused significant increase in the plant length, curd weight and the total yield tables (1,6&7), while in tables (2&3) show that the concentration  $150 \text{ mMl}^{-1}$  caused significant increase in the number of leaves and leaf area, but tables (2&3) show the spraying with  $100\& 150 \text{ mMl}^{-1}$  Melatonin caused significant increase in the number of leaves and leaf area. The reason for the significant increase in all characters when sprayed Melatonin may be that functions as an anti-stress against a variety of a biotic stresses by protecting plants against ROS (Reiter et al., 2015). It also functions as a plant regulator, with growth-promoting effects similar to those of IAA investigate the effect of foliar application of melatonin on plant growth, and also alleviate negative effect of NaCl on root and whole plant fresh and dry masses,

this agree with the (Zhao et al., 2018; Hernandez et al., 2015; Wei et al., 2015; Antoniou et al., 2017) and Mansha Gul et al. (2018).

### Conclusions

Results showed that saline water irrigation caused a significant decrease in all the vegetative characteristics, flowering and yield growth of cauliflower, but the "Nahar" cultivar can be cultivated and will yield a profit if plants are treated with RO water or sprayed with concentration 100 mM-1 melatonin.

### Acknowledgements

We wish to thank all people who help me to complete the experience.

### References

- Altaf, M.A.; Shahid, R.; Ren, M.X.; NAZ3, S.; Altaf, M.M.; Qadir, A.; Anwar M.; Shakoor, A. and Hayat, F. (2020). Exogenous melatonin enhances salt stress tolerance in tomato seedlings. *Biologic plant arum*, 64: 604-615.
- Antoniou, C., Chatzimichail, G., Xenofontos, R., Pavlou, J.J., Panagiotou, E., Christou, A. and Fotopoulos (2017). Melatonin systemically ameliorates drought stress-induced damage in *Medicago sativa* plant by modulating nitro-oxidative homeostasis and proline metabolism. *Journal of Pineal Research*, 62: e12401.
- Arnao, M.B. and Hernandez-Ruiz, J. (2009). Protective effect of melatonin against chlorophyll degradation during the senescence of barley leaves. *J. Pineal Res.*, 46 (1) :58-63.
- Ashraf, M. and M. R. Foolad (2005). Pre-sowing seed treatment-A Shotgun approach to Improve germination, Plant growth, and crop yield under saline and non-saline conditions. *Adv. Agron.*, 88:223- 271.
- Fuentes-Broto, L. and Sakr, M.T., El-Emery, M.E., Fouda, R.A & M.A. Mowafy, (2007). Role of some antioxidants in alleviating soil salinity stress. *J. Agric. Sci. Mansoura. univ.* 32:9751-9763.
- Hernandez, I.G., Gomes, F.J., Cerutti, S., Arana, M.V., and Silva M.F. (2015). Melatonin in *Arabidopsis thaliana* acts as plant growth regulator at low concentration and preserves seed viability at high concentrations. *Plant physiology and Biochemistry* 94:191-196.
- Hmiz, D. J. & Ithbayyib, I.J. (2021). Effect of the Root Zone Temperature and Salt Stress on Plant Growth, Main Branches and some other Chemical Characteristics of Tomato Fruit (*Solanum lycopersicum* L.) Basrah *J. Agric. Sci.* 34(1):156-170.
- Karim, S.A.; Qadir, S. A & Saber, H.A. (2020). Study Some of Morphological and physiological Traits of *Kurrajong Brachchiton Popuineus* (Schoot & Endl.) Seedlings planted under water Stress Condition Basrah *J. Agric. Sci.*, 33(1): 213-220.
- Jamil, M., Lee, C.C., Rehman, S.U., Lee, D.B., Ashraf, M & E.S. Rha. (2005). Salinity (NaCl) tolerance of Brassica species at germination and early seedlings growth. *EJEAF Che*, 4(4), 2005. [970-976].

- Kolář, J.; Johnson, CH. and Macháčková, I. (2003) Exogenously applied melatonin (N-acetyl-5-methoxytryptamine) affects flowering of the short-day plant *Chenopodium rubrum*. *Physiol Plant*, 11(8):605–612.
- Maas, E. V. (1986) .Salt tolerance of plants. *Appl. Agr. Res.*, 1: 12 – 26 .
- Mansha Gul; F.A. Khan ; Shafiq A. Wani<sup>1</sup>; S.A. Bhat; S.A. Mir; A.A. Malik; Amit Kumar; S. Narayan; K. Stephen and S.A. Lone(2018). Foliar application of melatonin modulates the growth and photosynthetic pigments in broccoli cv. PalamSamridhi. *SKUAST Journal of Researchm*, 20 (2): 193-198.
- Reiter, R.J., Tan, D., Zhou, Z., Cruz, M.H.C., Reiter, R.J., Tan, D., Zhou, Z., Cruz, M.H.C., Fuentes-Broto, L. and Galano, A. (2015). Phoyto melatonin: assisting plants to survive and thrive. *Molecules*, 20(4): 7396-7437.
- Simon P., Robinson, W., John S., Downton & A. Jenny, (1983). Photosyn- thesis and Ion Content of Leaves and Isolated Chloroplasts of Salt-Stressed Spinach. *Plant Physiology*, Vol. 73, No. 2: 238-242.
- Tan, D.-X.; . Manchester, L.C ; Di Mascio, P. ; Martinez, G.R.; Prado, F.M. and Reiter, R.J. (2007). Novel rhythms of N1-acetyl-N2-formyl-5-methoxykynuramine and its precursor melatonin in water hyacinth: importance for phytoremediation. *Faseb. J.*, 21 (8) : 1724-1729.
- Tuteja, N .(2005).Unwinding after high salinity stress. II. development of salinity tolerant plant without affecting yield .*plant J. (India)*.24.219-229
- Van Tassel, D.L.; Roberts, N.; Lewy, A.and Neill, S.D. O. (2001).Melatonin in plant organs. *J. Pineal Res.*, 31 (1): 8-15.
- Voitenkova LI. (2002). Promising cultivars of Brassica Oleracea for the Russian forEast.KartofelOvoshehi (2002) N0. 7.10 Moscow. Russia.
- Wei, W., Li, Q.T., Chu, Y.N., Reiter, R.J., Yu, X.M., Zhu, D.H., Zhang, W.K., Ma, B., Lin, Q., Zhang J.S. and Chen S.Y. (2015). Melatonin enhances plant growth and a biotic.
- Zhao, G., Zhao, Y., Yu, X., Kiprotich, F., Han, H., Guan, R., Wang and Shen W. (2018). Nitric Oxide Is Required for Melatonin-Enhanced Tolerance against Salinity Stress in Rapeseed (*Brassica napus* L.) Seedlings.*Int J MolSci*, 19(7): 1912.