Kirkuk University Journal for Agricultural Sciences
ISSN:2958-6585
https://kujas.uokirkuk.edu.iq

RESEARCH ARTICLE
https://doi.org. 10.58928/ku24.15325

Effect of shading and spraying with alcoholic sugars on the physiological lifespan of Seeds celery plant.

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Received: 07/07/2024 **Revised:13/08/2024** **Accepted:19/08/2024** **Published: 01/09/2024**

ABSTRACT

The experiment was carried out at the research station north of Ramadi city in GPS location (33.459387,43.317831) of the College of Agriculture – University of Anbar to study the effect of shading and spraying with sugar alcohols (sorbitol) on the physiological lifespan of celery seeds (*Apium graveolens* L.). The experiment included two levels of shading (0% without shading and 50%) and spraying with sugar alcohols (sorbitol) at three levels (spraying with distilled water only, 10 and 20 mg L^{-1}). The characteristics of plant height, stem diameter, chlorophyll content of leaves, number of days from planting to flowering, number of days required for complete flowering and number of days required for seed maturation were studied.

The results showed that the percentage of shading S1 (50%) led to a significant increase in stem diameter and the chlorophyll content of the leaves. In contrast, the level of shading S0 (without shading) significantly increased the height of the plant, the number of days from planting to flowering, the number of days required for full flowering, and the number of days required for seed maturity. As for the spraying factor with alcoholic sugars, the spraying level K3 (20mg L^{-1}) was significantly superior in stem diameter and the chlorophyll content of the leaves. As for spraying with distilled water only, it was significantly superior in the number of days from planting to flowering, the number of days required for complete flowering, and the number of days required for seed maturity.

***Keywords*:** shading, Light, spraying, sugar alcohols, celery.

INTRODUCTION

The celery plant belongs to *Apium graveolens* L. Umbelliferae family. It is an herbaceous plant with a special flavor because it contains volatile oils. It is an annual or biennial plant. The stem has hollow internodes and the leaves are alternate or basal, compound, feathery or palmate [1]. "Celery is extensively cultivated for seed production in India, France, and the United States." Celery essential oil contributes a floral fragrance to oriental perfumes, adding warm and persistent tones [2]. It possesses abundant nutritional and physiological benefits. Celery, in particular, possesses potent qualities such as excellent blood pressure reduction, strong antioxidant activity, free radical scavenging ability, and potential for cancer prevention and anti-cancer effects. Anthocyanins and apigenin, flavonoids found in celery, are crucial in enhancing the body's immune system to combat infections. Environmental elements, including light, can impact the components and content of plants. Insufficient or excessive light can hinder plant growth; therefore, optimal light intensity is necessary to enhance vegetable creation" [3].

"Light serves as a crucial source of energy and signals for plants, exerting an influence on plant growth, development, and structural characteristics." The morphology and material accumulation of plants are intricately linked to the intensity of light, and both low and high light levels have negative effects on plant growth" [4]. It is shown that insufficient light intensity results in a decrease of vitamin C and soluble carbohydrate concentrations. This indicates that synthesis of vitamin C and soluble sugars is repressed under low light conditions. [5,6].

Alcohol sugars, or simple organic molecules in natural plant tissues, are essential to photosynthesis. Sugars - hydrogenated carbohydrates are an extremely important element of photosynthesis. They are called alcoholic because of their content. Although these molecules are quite mobile within the plant, they derive into them via an alcohol but with a reduced Aldehyde group (CHO) to CH2OH. One example of an alcoholic sugar is sorbitol, also called sorbital,chem=Sorbitol (sugar alcohol). One of its main functions is to help in the transportation of boron and other Performance Micronutrients inside phloem tubes, which then promotes growth, flowering, and seed production in plants. Sorbitol is synthesized during photosynthesis in leaves as a polyalcohol and falls under the category of sugar alcohols, which are water-soluble metabolites. It is a crucial component in the metabolism of important carbohydrates and can be found in various plant species, facilitating its transportation [7].

Materials and working methods

A research project was conducted at the College of Agriculture - University of Anbar from 1\9\2023 to 1\5\2024. The aim was to examine the influence of shade and alcoholic sugars on the physiological lifespan of celery plants. The study consisted

of two components and was replicated three times.
The initial factor involved the implementation of shading at two distinct levels, represented by the symbols S0 and S1. The levels were varied between 0% and 50% in a consecutive manner in order to investigate the impact of the environmental component. The second aspect was the application of sugar alcohol (sorbitol) at three different levels, represented by the symbols K0, K1, and K2. The spray levels consisted of spraying with distilled water only, as well as solutions with concentrations of 10% and 20%. Using a factorial experiment in a randomized complete block design (RCBD) [8].

Table 1. Some chemical and physical soil characteristics of the orchard

Unit	Values	Traits
DC Simens.m^{-1}	3.09	EC 1:1)(
g.L^{-1}	1.42	TDS
%	6.1	NaCl
	7.3	pH
	Mixed clay	Texture
g.Kg^{-1} Soil	270	Sand
g.Kg^{-1} Soil	340	Alluvial
g.Kg^{-1} Soil	390	Clay
ml Mol.L^{-1}	16.41	Ca
ml Mol.L^{-1}	4.82	Mg
ml Mol.L^{-1}	2.31	Na
ml Mol.L^{-1}	2.08	HCO_3
mlg.Kg^{-1}	69.00	N
mlg.Kg^{-1}	41.00	P
mlg.Kg^{-1}	119.00	K
g.Kg^{-1} Soil	2.29	O.M
g.Kg^{-1} Soil	2.41	Gypsum
g.Kg^{-1} Soil	231	Lime

Studied attributes

1- **Plant height (m)**

Plant height was measured on 10/5/2024 using a metric tape measure.

2- Leg diameter (cm)

The stem diameter was measured on 10/5/2024 using a Vernier Caliper [9].

3- Leaf chlorophyll content (SPAD)

Chlorophyll was estimated using a Chlorophyll meter type SPAD-502, where 5 were taken from each of the selected plants within the experimental unit.

4- Number of days from planting to flowering

The number of days was calculated starting from planting on 1/9/2023 until 11/4/2024, the date of the first pink inflorescence.

5- The number of days required for full flowering

The number of days was calculated starting from the date of planting on 1/9/2023 until the completion of flowering on 5/5/2024.

6- Number of days from planting to seed maturity

The number of days was calculated starting from the date of planting on 1/9/2023 until 1/6/2024 when the seeds were physiologically mature.

Results and discussion

Plant height

According to Table (2), shade has a notable impact on the height of plants. The therapy without shading shown a much higher level of effectiveness compared to the treatment with shading. The mean height of the plants was 138 cm, whereas the height of the shaded plant was 114 cm. The application of sorbitol through spraying, as well as the interaction between the spraying treatments, did not result in a noteworthy impact on the plant's height characteristics.

Table 2. Effect of shading, spraying with sorbitol, and their interaction on plant height (cm)

Shading (S)	spraying with sorbitol (K)			Average (S)
	(K0) Spraying with	(K1) 10%	(K2) 20%	

	distilled water Only			
(S0) Without shading	1.337	1.293	1.520	1.383
(S1) Shading with50%	1.117	1.187	1.143	1.149
Average (K)	1.227	1.240	1.332	
LSD S= (0.1967)	LSD K= (N.S)	LSD S.K= (N.S)		0.05

Stem diameter

Table (3) indicates that shading and spraying with sorbitol have a significant effect in diameter The stem treatment (50%) was significantly superior to the treatment without shading The average stem diameter was 24.51 mm, while the stem diameter was 24.94 mm when treated without shading and the spray treatment of sorbitol at a concentration of 20% was significantly superior to the spray level 10%, which gave 24.12 and 22.33 respectively, and there were no significant differences between the two concentrations had no effect on the interaction factors between shading and spraying with sorbitol morally in this capacity

Table 3. Effect of shading, spraying with sorbitol, and their interaction on main stem diameter (mm)

Shading (S)	spraying with sorbitol (K) (K0) Spraying with distilled water Only	(K1) 10%	(K2) 20%	Average (S)
(S0) Without shading	21.50	21.87	22.47	21.94
(S1) Shading with50%	23.17	24.60	25.77	24.51
Average (K)	22.33	23.23	24.12	
LSD S= (0.680)	LSD K= (0.832)	LSD S.K= (N.S)		0.05

Chlorophyll content of leaves

Table (4) indicates that shading and spraying with sorbitol have a significant effect on the percentage Chlorophyll/shading treatment (50%) was significantly superior to the treatment without shading. It reached 44.03 SPAD units for chlorophyll, while it reached 34.30 SPAD units when treated without shading, and the 20% Sorbitol spray treatment was significantly superior to the comparison which gave 42.52 and 35.45 units, respectively, and there were no significant differences between . The two concentrations had no effect on the interaction factors between shading and spraying with sorbitol

The percentage of chlorophyll in leaves was significantly affected, and the interaction treatments between shading and spraying with sorbitol did not have a significant effect on the percentage of chlorophyll.

Table 4. Effect of shading, spraying with sorbitol, and their interaction on chlorophyll in leaves(Spad Unit

Shading (S)	spraying with sorbitol (K) (K0) Spraying with distilled water Only	(K1) 10%	(K2) 20%	Average (S)
(S0) Without shading	30.47	34.90	37.53	34.30
(S1) Shading with50%	40.43	44.17	47.50	44.03
Average (K)	35.45	39.53	42.52	
LSD S= (1.589)	LSD K= (1.946)	LSD S.K= (N.S)		0.05

Number of days from planting to flowering

Table (5) indicates that shading and spraying with sorbitol have a significant effect on early flowering. The treatment without shading was significantly superior to the shading treatment in terms of early flowering. The number of days from planting to the beginning of the appearance of flower inflorescences reached 102.8 days, while the number of days with the shading treatment reached 120.7 days. The treatment without spraying Sorbitol outperformed the early flowering treatments over the spraying treatments, which lasted 104.8 days, while the number of days to flowering for the Sorbitol spraying treatments reached 112.5 and 117.8 days, respectively. The interaction treatments between shading and spraying with Sorbitol did not have a significant effect on the earlyness of flowering.

Table 5. The effect of shading and spraying with sorbitol and their interaction on chlorophyll. The number of days required for the beginning of flowering.

Shading (S)	spraying with sorbitol (K) (K0) Spraying with distilled water Only	(K1) 10%	(K2) 20%	Average (S)
(S0) Without shading	97.3	100.3	110.7	102.8
(S1) Shading with50%	112.3	124.7	125.0	120.7
Average (K)	104.8	112.5	117.8	
LSD S= (8.22)	LSD K= (10.07)	LSD S.K= (N.S)		0.05

The number of days required for full flowering

Table (6) indicates that shading and spraying with sorbitol have a significant effect on full flowering/day. The treatment without shading was significantly superior to the shading treatment in full flowering. The number of days from planting to full flowering reached 162.8 days, while the number of days with the shading treatment reached 180.7 days. The treatment without spraying sorbitol resulted in early flowering in the spray treatments, which amounted to 164.8 days during that period, while the number of days to flowering for the treatments spraying with sorbitol was 172.5 and 177.8 days, respectively. The interaction treatments between shading and spraying with sorbitol did not have a significant effect on the earlyness of full flowering.

Table 6. The effect of shading and spraying with sorbitol and their interaction on chlorophyll. Number of days required for full flowering.

Shading (S)	spraying with sorbitol (K) (K0) Spraying with distilled water Only	(K1) 10%	(K2) 20%	Average (S)
(S0) Without shading	157.3	160.3	170.7	162.8
(S1) Shading with50%	172.3	184.7	185.0	180.7
Average (K)	164.8	172.5	177.8	
LSD S= (8.22)	LSD K= (10.07)	LSD S.K= (N.S)		0.05

The number of days required for the seeds to mature

Table (7) indicates that shading and spraying with sorbitol have a significant effect on the maturity of seeds by day. The treatment without shading was significantly superior to the shading treatment in the number of days required for signs of seed maturity to appear. The number of days reached 191.8 days, while the number of days with the shading treatment reached 213.7 days. The treatment without spraying Sorbitol was superior in the early appearance of signs of seed maturity over the spraying treatments, which amounted to 193.2 days, while the number of days for the Sorbitol spraying treatments reached 204.2 and 210.8 days, respectively, and the interaction treatments between shading and spraying with Sorbitol did not have a significant effect on the earliness characteristic of seed maturity.

Table 7. The effect of shading and spraying with sorbitol and their interaction on chlorophyll. The number of days required for signs of seed maturity to appear.

Shading (S)	spraying with sorbitol (K) (K0) Spraying with distilled water Only	(K1) 10%	(K2) 20%	Average (S)
(S0) Without shading	186.0	189.7	199.7	191.8
(S1) Shading with50%	200.3	218.7	222.0	213.7
Average (K)	193.2	204.2	210.8	
LSD S= (9.68)	LSD K= (11.85)	LSD S.K= (N.S)		0.05

One of the most significant variables influencing several essential plant functions is lighting, which has a direct impact on the activity of certain enzymes and the light reactions stage of photosynthesis. It also has an indirect impact on the tissues' thermal characteristics. Plants are often negatively impacted by illumination intensity variations that beyond the necessary thresholds. Overindulging in illumination may be detrimental to plant tissues because it breaks down chlorophyll, which slows down the process of carbon synthesis. Lowering it below the necessary threshold, however, inhibits the plant's ability to grow and develop since it directly affects the break-even point, also known as the Compensation point, when the quantity of CO_2 absorbed during photosynthesis equals the amount lost during respiration [10].

"Shading networks play an important role in the process of molecular transport as well as the optimal use of light rays in the process of photosynthesis. It was found that shading networks have the ability to reduce temperature, evaporation and transpiration and thus increase photosynthesis activity" [11]. It was found that the exposed treatments without shading were superior in plant height, the number of days from planting to flowering, the number of days required for flowering, and the number of days required for seed maturation as for the 50% shading treatment, it was significantly superior in stem diameter and the chlorophyll content of the leaves.

The results are consistent with what was reported by [12] regarding the effects of different light intensities on changes in various morphological indicators of celery. With increasing light intensity, the height of the celery tends to affect the ability of photosynthesis. The results are consistent with what was reported by [13] in Celery plant shading. As for spraying with alcoholic sugars, the comparison treatment (spraying with distilled water only) was significantly superior in the number of days from planting to flowering, the number of days required for flowering, and the number of days required for seed maturation. As for the K2 treatment (20 mg L^{-1}), it had a significant effect on stem diameter and leaf content from chlorophyll The reason for the superiority could be attributed to the efficient way in which alcoholic sugars improve vegetative growth by making it easier for the elements potassium and boron to enter plant tissues. It could also be because sugar alcohols have small particles, which make it easier for the elements to be absorbed through the stomata on leaves and to be transported directly through the bark. [14].

Sugar alcohol also transports boron, calcium, potassium, magnesium, iron, copper, nickel, silicon, and other elements in the leaves to the active areas of the plant, such as the apical meristems, which caused an increase in the size of vegetative growth as a result of increased cell division and elongation. These results were in line with what [15] found when spraying. With sugar alcohols on pepper crops, and as mentioned by [16] on watermelon plan

Conclusion

It has been shown that high lighting intensity has a significant impact on reducing the physiological lifespan of vegetative growth and the plant's tendency towards flowering. Therefore, the celery plant must be shaded to reduce the light radiation penetrating to protect the celery for as long as possible

REFERENCES

[1.] Al-Katib, Youssef Mansour. 1988. Classification of seed plants. First edition. Dar Al-Kutub for Printing and Publishing. University of Mosul, pp. 441-444.

[2.] Lewis, Y. S. 1984. Spices and herbs for the food industry. England: Food Trade Press (Pp.12–122).

[3.] Li, S., T. Yuan, M. Ibrahim, and F. Wu. 2024. Rotational Strip Bean and Celery Intercropping Alters the Microbial Community to Improve Crop Yield and Soil Nutrients. Horticulturae, 10(5), 432.

[4.] Lv, Z., He, L., H.Jiang, X.Ma, F.Wang, L.Fan, ... and N. Yang. 2021. Diluted-CdS quantum dot-assisted SnO2 electron transport layer with excellent conductivity and suitable band alignment for high-performance planar perovskite solar cells. ACS Applied Materials & Interfaces, 13(14), 16326-16335.

[5.] Fu, Y., H. Li, J. Yu, H. Liu, Z. Cao, N. Manukovsky and et al. 2017. Interaction effects of light intensity and nitrogen concentration on growth, photosynthetic characteristics and quality of lettuce (Lactuca sativa L. Var. youmaicai). Scientia Hortic. 214, 51–57. doi: 10.1016/j.scienta.2016.11.020

[6.] Liu, K., M. Gao, H. Jiang, S. Ou, X. Li, R. He and et al. 2022. Light intensity and photoperiod affect growth and nutritional quality of brassica microgreens. Molecules (Basel Switzerland) 27 (3), 883. doi: 10.3390/molecules27030883

[7.] Godswill, A. C. 2017. Sugar alcohols: chemistry, production, health concerns and nutritional importance of mannitol, sorbitol, xylitol, and erythritol. Int. J. Adv. Acad. Res, 3(2), 31-66.

[8.] Al-Mohammadi, Shaker Musleh and Fadel Musleh Al-Mohammadi. 2012. Statistics and Experimental Design. Dar Osama for publishing and distribution. Oman . Jordan.

[9.] [9] Head, G. C. 1968. Seasonal changes in the diameter of secondarily thichened roots of fruit trees in relation to growth of other parts of the tree. J. Hort. Sci., 43: 275-282.

[10.] Anderson, M. 2012. Plant Reproduction, Growth and Ecology. First Edition. Britannica Educational Publishing. 29 East 21st Street New York, YY 10010.

[11.] Mditshwa, A., L. S. Magwaza and S. Z.Tesfay .2019. Shade netting on subtropical fruit: Effect on environmental conditions, tree physiology and fruit quality. Scientia Horticulturae, 256, 108556

[12.] Qin, Y., Liu, X., Li, C., Chu, Q., Cheng, S., Su, L.and Zhou, X. 2024. Effect of light intensity on celery growth and flavonoid synthesis. Frontiers in Plant Science, 14, 1326218.

[13.] Siwek, P., Wojciechowska, R., Kalisz, A., Libik, A. and Gryza, I. 2010. Effect of Shading with Various Coloured Films on the Yield and Quality of Celery and Butterhead Lettuce. Ecological Chemistry and Engineering. A, 17(12), 1619-1627.
[14.] Will, S. 2011. Boron foliar fertilization: Impacts on absorption and subsequent translocation of foliar applied boron. Ph.D.Dissertation in Agricultural Sciences. Faculty of Agricultural sciences.University of Hohenheim Germany.pp :93.
[15.] Al-Shammari, Moneim Fadel Musleh .2018. The role of spraying boron and sugar alcohols (sorbitol and mannitol) on growth, yield and seeds of pepper plants - Doctoral thesis, College of Agriculture - University of Baghdad, Republic of Iraq.
[16.] Abdullah, S. K., and M. M. Alabdaly,. 2023. December. Influence of Spraying Potassium, Sugar Alcohol, and Boron on Yield and Quality of Melon under Protected Cultivation. In IOP Conference Series: Earth and Environmental Science (Vol. 1262, No. 4, p. 042035). IOP Publishing..

تأثير التظليل والرش بالسكريات الكحولية على العمر الفسلجي لبذور نبات الكرفس.

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الخلاصة
نفذت التجربة في المحطة البحثية التابعة لكلية الزراعة – جامعة الانبار لدراسة تأثير التظليل والرش بالسكريات الكحولية (السوربيتول) على العمر الفسلجي للكرفس ، تضمنت التجربة مستويين من التظليل (0 بدون تظليل و 50%) والرش بالسكريات الكحولية (السوربيتول) بثلاث مستويات (الرش بالماء المقطر فقط ، 10 و20 %). ودرست صفات ارتفاع النبات ، قطر الساق ، محتوى الأوراق من الكلوروفيل ، عدد الأيام من الزراعة للتزهير ، عدد الأيام اللازمة للتزهير الكامل و عدد الأيام اللازمة لنضج البذور لنضج البذور . أظهرت النتائج ان نسبة التظليل (50%) أدت الى زيادة معنوية في قطر الساق ومحتوى الأوراق من الكلوروفيل بينما تفوق مستوى التظليل (0%) معنوياً في ارتفاع النبات و عدد الأيام من الزراعة للتزهير وعدد الأيام اللازمة للتزهير الكامل وعدد الأيام اللازمة لنضج البذور . اما بالنسبة لعامل الرش بالسكريات الكحولية فان مستوى الرش (20%) تفوق معنوياً في قطر الساق ومحتوى الأوراق من الكلوروفيل ، اما الرش بالماء المقطر فقط فقد تفوق معنوياً في عدد الأيام من الزراعة للتزهير وعدد الأيام اللازمة للتزهير الكامل وعدد الأيام اللازمة لنضج البذور

الكلمات المفتاحية: التظليل ، الإضاءة ، الرش ، السكريات الكحولية ، الكرفس.