European Scholar Journal (ESJ)
Available Online at: https://www.scholarzest.com
Vol. 4 No.08, August 2023
ISSN: 2660-5562

EFFECT OF WATER QUALITY AND THE ADDED NUTRIENT SOLUTION'S CONCENTRATION ON BARLEY SPROUT *HORDEUM VULGARE* L PRODUCTION

Taghreed M. K.
1Data Palm Research Center, University of Basrah, Iraq
Al farjawi; Abeer S. Dhaher; Fatimah A. Jamel
2,3Department of Field Crop, College of Agriculture, University of Basrah, Iraq
Fatimah A. Jamel // fatima.chamel@uobasrah.edu.iq

Article history:

Received: 6th June 2023
Accepted: 6th July 2023
Published: 10th August 2023

Abstract:

A laboratory experiment was carried out in the Hydroponics Laboratory of the Department of Field Crops, College of Agriculture, University of Basrah for the 2018-2019 year to know effect of water quality and the concentration of the nutrient solution added on the production of cultured barley. The study included two factors; the first factor uses two types of water (R.O) and its symbol W1, (Tap water) its symbol W2, and the second factor is a plant nutrient NPK with a concentration of 30% N, 12% P, 8% K, where four concentrations of the nutrient were used in the following quantities: 0, 5, 10, 15 g l, which symbolized by the symbols (T1, T2, T3, T4) on the relay. The experiment used a completely randomized design (CRD) with three replications. The following characteristics (plant height, total wet weight, total dry weight, total green forage yield) were studied. The experiment results showed that the (R.O) water treatment was superior in all the studied characteristics, and the concentration of 10 g l of nutrient solution gave the highest average in a characteristic of plant height reaching 21.68 cm and total dry weight (0.38) g. Dish-1, as for the interaction between the quality of added water and the concentrations of nutrient solution, did not show any significant effect in all characteristics.

Keywords: water quality; nutrient solution; barley sprout; *Hordeum vulgare* L

INTRODUCTION

Hydroponics, barley cultivation, or landless cultivation, with different names, is an old technology that is renewed in a modern way in order to obtain fresh green fodder with good nutritional value at any time of year and under any environmental conditions and without any restrictions with the optimal utilization of spaces and the optimal use of water in a healthy environment. It is free from chemicals and pesticides; the culture technique has been used for centuries, especially in East Asian countries, to improve the food fodder of barley, wheat, oats, and other grains (Muela et al., 2005). The Animal Feed Advisory Center, based in Texas, USA, stated that barley is the fifth largest grain crop in the world and the most nutritious. More than half of the barley production grown today is used to feed livestock; this fits the historical use of barley. The barley cultivar is characterized by its higher protein content than dry barley. It may reach a ratio of 25%, and the high protein in cultured barley means providing suitable fodder for cows and sheep, with nutritional value throughout the world, as well as containing vitamins and minerals that have a role in animal health (Mahmoud, 2015).

The cultivation of barley is considered a good alternative not only when feed prices rise but also contributes to facilitating digestion, increasing the fertility rate of animals and their immunity (Grigas. et al., 2019). This technology is considered a scientific solution to confront the high global grain prices and increased food needs with the population explosion. (Muhammad, 2014), it was shown that adding nutrient solutions has a significant role in providing the plant with the nutrients it needs, the characteristics of the culture medium, and Abdel Wahed (2014) explained that the water quality has an important role in improving the characteristics of the barley sprout.

The experiment aims to determine the quality of the water, the amount of nutrients added to cultured barley, and which is more efficient and important.

MATERIALS AND METHODS

A laboratory experiment was carried out in the Hydroponics Laboratory of the Department of Field Crops, College of Agriculture, University of Basrah for the 2018-2019 year to know effect of water quality and the concentration of the nutrient solution added on the production of cultured barley. The study included two factors; the first factor uses two

types of water (R.O) and its symbol W1, (Tap water) its symbol W2, and the second factor is a plant nutrient NPK with a concentration of 30% N, 12% P, 8% K, where four concentrations of the nutrient were used in the following quantities: 0, 5, 10, 15 g l, which symbolized by the symbols (T1, T2, T3, T4) on the relay. Plastic trays were used with dimensions of 17 x 27 cm and a seed quantity of 100 g per plate (tray), equivalent to 2.178 kg m2. The experiment used a completely randomized design (CRD) with three replications.

The room was sterilized for 48 hours to create the conditions for natural culture, then the room was lit with electric lighting and natural lighting, and the data were analyzed using a spss statistical program. The averages were compared using the L.S.D method according to what was stated by (Al-Rawi and Khalaf Allah 1980). The following characteristics were calculated:

1- Plant height (cm)
2- Total wet weight (g)
3- Total dry weight (g)
4- Total green fodder yield (kg m^2)

RESULTS AND DISCUSSION

1- Height of sprout (cm)

The results of Table (1) showed that treatment (W1) was significantly superior to the R.O water by giving it the highest average height of cultured barley, amounting to 20.78 cm over the treatment (W2), as it gave the lowest height of 18.89 cm. The reason for a decrease in the height of cultured barley may be due to the increase in salinity, which leads to an increase in the osmotic effort in the plant cells, which results in a change in the components of the cellular juice as a result of the increase in absorption of salt ions, and accordingly the absorption of water decreases (Al-slimawy, 1998).

It is noted from the results that the concentrations of nutrient solution had a positive effect on increasing the height of culture barley, as the level 10 g l (T3) recorded the highest average of the height of cultured barley, reaching 21.68 cm without a significant difference with the level (T4) compared to the no-additive treatment that was recorded. The lowest average was 16.92 cm. This was confirmed by (Muhammad et al., 2014) that the different compositions of nutrient solution contributed significantly to optimal absorption of nutrients and their optimal participation in the vital activities within the plant tissue. This ability of the cells to divide, expand and fill the cells led to an increase in the height of the culture barley as well agreed with (Abdul Razzaq 2015).

While the interaction between the qualities of added water and the concentrations of nutrient solution did not show any significant effect on this characteristic.

Table (1) effect of water and nutrient concentration and their interaction on barley sprouts height (cm)

Water quality W	The concentration of nutrient solution T				Average Water quality
	T1	T2	T3	T4	
W1	17.83	21.10	22.70	21.50	20.78
W2	16.00	18.80	20.67	20.10	18.89
Average Concentration of nutrient solution	16.92	19.95	21.68	20.80	
L.S.D	T	W	T×W		
	1.113	0.787	N.S		

2- Total wet weight (gm. $dish^{-1}$)

Table (2) showed that the treatment (W1) was superior in giving it the highest average wet weight of 365.5 g dish-1 with a significant difference with tap water (W2), which gave the least wet weight of 300.2 g dish-1. This may be due to its high concentration of salts, which led to a decrease in plant height and, consequently, a decrease in wet weight. Also, from the results of Table (2), there are no significant differences in the concentrations of the nutrient solution and the interaction between the water quality and the concentrations of the nutrient solution in these traits.

Table (2) effect of water and nutrient concentration and their interaction on wet weight of barley sprouts (g $plate^{-1}$)

Water quality W	The concentration of nutrient solution T				Average Water quality
	T1	T2	T3	T4	
W1	324.3	378.3	386.0	373.3	365.5
W2	281.0	280.0	318.3	321.3	300.2
Average Concentration of nutrient solution	302.7	329.2	352.2	347.3	
L.S.D	T	W	T×W		
	N.S	22.84	N.S		

3- Total dry weight (g $plate^{-1}$)

Table (3) showed that treatment (W1) was significantly superior to the R.O water by giving the highest average dry weight of cultured barley, which was 36.50 g Plate-1 was applied to (W2) treatment, as it gave the lowest dry weight of 32.75 g Plate-1 that the decrease in dry weight resulting from increase in salinity is due to the accumulation of

salts in the root zone, which leads to an increase in the osmotic stress within plant, or through the negative effect of ions on the nutritional balance inside plant (Ehret et al., 1990).

Also, notice that the concentration of nutrient solution T3 had a significant effect on the increase in dry weight of barley culture, as the level of 10 g l (T3) recorded the highest mean for this characteristic, amounting to 38.00 g Plate-1, compared with the no-additive treatment, which recorded the lowest average of 32.50 g. Plate-1. The reason for this is attributed to the fact that the nutrient solution contributed to giving the plant height in addition to the large root system, which contributed to giving the highest total dry weight of the plant, and this was confirmed by (Muhammad et al., 2014) and (Abdul Razzaq, 2015).

While the interaction in Table (3) between the quality of the added water and the concentrations of the nutrient solution did not show any significant effect on this characteristic.

Table (3) Effect of water and nutrient concentration and their interaction on the dry weight of barley sprouts (g plate^{-1})

Water quality W	The concentration of nutrient solution T				Average Water quality
	T1	T2	T3	T4	
W1	33.67	37.67	40.67	34.00	36.50
W2	31.33	32.00	35.33	32.33	32.75
Average Concentration of nutrient solution	32.50	34.83	38.00	33.17	
L.S.D	T	W	T×W		
	2.15	1.52	N.S		

4- Forage yield per m^2 (kg m^2)

From the results of Table (4) that the treatment (W1) was superior in giving it the highest average green fodder yield of 8.27 kg m^2 with a significant difference with the tap water (W2), which gave the lowest forage yield of 6.76 kg m^2, due to the increase in plant height as well as the increase in wet weight, which led to an increase in the amount of forage yield, and this is consistent with (Al-Janabi et al. 2017).

Table (4) shows no significant differences in the concentrations of the nutrient solution and the overlap between the water quality and the concentrations of the nutrient solution in this trait.

Table (4) effect of water and nutrient concentration and their interaction on Forage yield per square meter for barley sprouts

Water quality W	The concentration of nutrient solution T				Average Water quality
	T1	T2	T3	T4	
W1	7.17	8.53	8.67	8.73	8.27
W2	6.43	6.73	7.23	6.67	6.76
Average Concentration of nutrient solution	6.80	7.63	7.95	7.68	
L.S.D	T	W	T×W		
	N.S	0.437	N.S		

REFERENCES

1. Ehret, D. L.; R.E.Redmann; B. L. Harvey and A.Cipywnyk. (1990). Salinity-induced Calcium deficiencies in Wheat and Barley. Plant and Soil, 128: 143-151.
2. Grigas, A., Kemzūraitė, A., & Steponavičius, D. (2019, November), Hydroponic devices for green fodder production: a review. In Proceedings of the International Scientific Conference "Rural Development" (pp. 21 – 27).
3. Muela, CR, Rodriguez, HE, Ruiz, O., Flores, A., Grado, JA, & Arzola, C. (2005). Use of green fodder produced in hydroponic systems as a supplement for Salers lactating cows.
4. Al-Janabi, M. A. A., and Haider, H. A. (2017). The effect of the germination period, the amount of seed and nitrogen fertilizer on the growth and yield of green fodder for cultivated barley. Tikrit Journal of Agricultural Sciences, Vol. 17 (1). 1646-1813.
5. Al-Rawi, K. M., and Abd-ulAziz K. A. (1980). Design and analysis of commercial agriculture, University of Mosul, College of Agriculture.
6. Al-Sulaimawi, W. F. H. (1998). Effect of type and levels of irrigation water salinity and nitrogen fertilization on the yield and efficiency of fertilizer use for barley plants.
7. Abdel-Razzaq, Z. A., and Sahar, K.Anhar, M. J. (2015). Yield of barley culture grown with different levels of nutrient solution and seed quantities. Al-Muthanna Journal of Agricultural Sciences: Volume 3, Issue 2.
8. Abdul-Wahed, A. N. (2014). The effect of different water sources and culture rates on the production of green fodder for the barley crop (*Hurdeum vulgare* L.) and the mixed fodder barley + mash (*Vigna Radiate* L.), master's thesis, University of Basra, College of Agriculture, Department of Crops field.
9. Mahmoud, R. S., and Mowaffaq, A. N. (2015). The effect of the lighting duration on the yield of green and dry fodder for barley and oat crops under the conditions of the cultivator. Al-Furat Journal of Agricultural Sciences. Vol. 7 (1): 167-174.

10. Muhammad, D. S., Haitham, A., and Kazem, H. H. (2014). The effect of nutrient solutions and methods of their addition in the cultivation of barley (*Hurdeum vulgare* L.), Basra Journal of Agricultural Sciences, Vol. (27) (2), 330-339.
11. Muhammad, D. S. (2014). The effect of nutrient solutions and methods of adding them on the characteristics of barley and fodder mixture (barley + mash). Master's thesis. University of Basrah - College of Agriculture - Department of Field Crops.