J. of Plant Production, Mansoura Univ., Vol. 14 (10): 453 -459, 2023

Journal of Plant Production

Journal homepage & Available online at: www.jpp.journals.ekb.eg

Response of some Cultivars of Barley to Humic Acid under Saline Soil Conditions - Siwa Oasis

Cross Mark

Abd El-Aziz, M. A.*

Plant production Department, Ecology and Dry Lands agriculture Division, Desert Research center, Egypt.

ABSTRACT

The goal of this study was to use the normalized differential vegetation index to forecast the harvest of several barley cultivars. the two years experiments were carried out during the barley growing season of 2020/2021 and 2021/2022 at Siwa Oasis, Egypt to investigate in the effects of humic (HA) without humic (HA0), 1 kg/ha humic (HA1), 2 kg/ha humic (HA2) and 3 kg/ha humic (HA3) in the yield related traits of barley cultivars of Giza 128 (V1), Giza 129 (V2), Giza 132 (V3), Giza 133 (V4), Giza 2000 (V5), S (V6), B (V7), H (V8), O (V9) and BL (V10) and which were obtained from Spanish origins were used in this study, under new reclaimed sandy soil and salinity water conditions. All evaluated characters were greatly by using either humic acid or humectants 3 kg/ha. The Giza 132 barley cultivar achieved the maximum grain output over the course of two seasons (4297 kg/ha in the initial 4135 kg/ha in the second). However, the barley cultivar Giza 132 with treatment of 3 kg/ha humic acid under the Siwa Oasis of Egypt might generate the most economically viable amounts of barley grain and straw. These results offer a thorough grasp of the advantages that humic acid offers for creating sustainable agriculture.

***Keywords*: Barley, cultivars, salinity, yield.**

INTRODUCTION

Egypt in semiarid region of world with alkaline soils. Barley cultivars (*Hordeum vulgare* L.) commonly cultivated in North-Coastal Egyptian calcareous soil the semi-arid and arid Mediterranean regions that receive rain. A variety of environmental variables are used to grow barley. It is the fourth-largest crop in the world. Using straws is a crucial source of roughage for animal feed, while its grains are used for food and animal feed, and malting (Asal *et al.* 2018). Along with rice, wheat, and maize, it is one of the top ten crops in the world with a history of domestication dating back more than 10,000 years (El-Metwally *et al.* 2010). In Egyptian landraces, it is one of the most widely-cultivated traditional cereals in the nation, after wheat (*Triticum ssp.*), maize (*Zea mays L.*) FAO. (2022). Additionally, they typically have a good capacity for environmental stressors and are able to adapt to local conditions challenges such soil acidity and deterioration, drought, water logging, and frost. Additionally, they are resistant to pests and illnesses (Lakew *et al.* 1997). In recent years, some landraces that had been widely cultivated over the previous decades in the nation as a whole and in the Siwa Oasis administrative zone in particular have been lost. The paucity of scientific interventions aimed at its enhancement, the switch to commercial barley varieties, and the widespread degradation brought on by climate change are mostly to blame for this apparent genetic erosion. In order to accurately assess the levels of genetic diversity in Egyptian barley landraces, the current study was initiated. Maintain the genetic resources and produce first-hand data to support improvement initiatives and effective design includes both in situ and ex situ preservation techniques. Another goal of this endeavour is to persuade small farmers to grow this significant crop in the degraded calcareous soil of Siwa Oasis with low cost agriculture process.

Improved soil qualities due to humic acid include their physical, chemical, and biological aspects (Mikkelsen. 2005). Humic acid has a well-known role in preventing and treating diseases that are transmitted through the soil, as well as in maintaining healthy soil and enhancing plant nutrient uptake and mineral availability (Mauromicale *et al.* 2011). Increased crop yield, stimulation of plant hormones and enzymes, and improved soil fertility are all benefits of humic acid-based fertilisers in a way that is ecological and environmentally friendly (Mohamed *et al.* 2009). Major components of organic matter, humic compounds frequently make up 60 to 70 percent of all organic matter. Animal and plant humification by chemical and biological processes parts as well as the biological operations of microorganisms result in the formation of humic matter. Due to the ease with which nutrients, particularly nitrate, are taken up by low humic molecular size fraction, plant growth is positively impacted. Although the effects of humic compounds on intermediate metabolites are less clear, it appears that they may have an impact on both respiration and photosynthesis. The stimulatory effects of humic compounds have been linked to increased uptake of micronutrients like Fe, Zn, Cu, and Mn as well as macronutrients like nitrogen, phosphorus, and sulfur. (Nardi *et al.* 2002), noticed that the application of humic acids to crops usually associated with improved root initiation and expanded root development. An organically charged biostimulant called humic acid has a considerable impact on plant development and growth increases crop output. It has been carefully investigated (Nardi *et al.* 2004). The goal of this study was to use the normalized differential vegetation index to forecast the harvest of several barley cultivars and All

*** Corresponding author.**
E-mail address: mahmoud75@drc.gov.eg

DOI: 10.21608/jpp.2023.226051.1257

evaluated characters were greatly by using either humic acid under new reclaimed sandy soil and salinity water conditions.

MATERIALS AND METHODS

Plants material

Samples had been gathered of barley cultivars Giza 128 (V_1), Giza 129 (V_2), Giza 132 (V_3), Giza 133 (V_4) and Giza 2000 (V_5), which were acquired from the Barley Research Section, Field Crops Research Institute, Agricultural Research Centre, Giza, Egypt, and S (V_6), B (V_7), H (V_8), O (V_9) and BL (V_{10}) and which were obtained from Spanish origins were used in this study, reclaimed sandy soil and salinity-affected water. The study carried out in a split-split plot design with four repetitions and 30 treatments, which were combinations of ten barley cultivars with different quantities of humic acid (HA) treatments, (HA0), 1 kg/ha humic acid (HA1), 2 and 3 kg/ha (HA3). Barley cultivar were as the main plot, and the humic acid treatments as the sub-plots. The sub-plot's dimensions were 10.5 m^2, 3.5 m, and 3 m, and represented 1/952 of ha. The barley seeds were sown On November 25 of each season, seeds were spread by hand drilling in rows that were 3.5 m long and 20 cm apart at a seeding rate of 143 kg/ha (based on the 1000-grain weight of each cultivar). Humic acid is applied after planting, spread on the ground before irrigation.

Soil characteristics and agronomic practices.

Trials were carried out at Egypt's Siwa Oasis, which located 19 km east of Cairo, during the winter growing seasons of 20/21 and 20/22 of Siwa Oasis at the (25◦39′ 20″ N, 47◦16′ 29″ E).

Before sowing, Auger investigated the soil samples physically and chemically after taking them to a depth of 0–30 cm. can be seen in Table 1.

Table 1. The typical chemical and physical characteristics of representative soil samples (0–30 cm in depth) taken from the experiment location before sowing, as well as the irrigation water used during the two growing seasons.

Soil properties	Values	Irrigation Water	Values
Clay	3.8	pH	7.74
Silt	8.9	EC (dS m^{-1})	4.22
Sand	89.1	Ammonium N (mg L^{-1})	5.74
Texture Grade	Sandy	Nitrate N (mg L^{-1})	23.3
pH (Ext. 1:1)	7.92	Phosphorus (mg L^{-1})	0.09
EC (Ext. 1:1), dS m^{-1}	3.34	Potassium (mg L^{-1})	0.77
Total $CaCO_3$ (%)	34.2		
Total Organic Carbon (%)	0.27		
Total Organic Matter (%)	0.398		
Nitrogen (mg kg^{-1})	18.2		
Phosphorus (mg kg^{-1})	1.68		
Potassium (mg kg^{-1})	46.7		

The experimental field was divided into experimental units with the aforementioned dimensions after being ploughed twice, compacted, and divided. Calcium superphosphate (15.5% P2O5) was used to prepare the soil at a rate of 74 kg P_2O_5/ha. Potassium sulphate (48% K_2O) was broadcast prior to sowing at a rate of 115 kg K_2O/ha. Ammonium sulphate (20.6% N) was broadcast Prior to irrigation, ammonium nitrate (33.5% N) was applied in three equal doses at a rate of 250 kg N/ha at 25, 50, and 75 days after sowing. Prior to seeding, 150 kg N/ha of nitrogen was applied (750 kg ammonium nitrate). A total of 282 kg N/ha of nitrogen fertiliser was applied, and so forth. The Ministry of Agriculture's instructions for standard agricultural practices for growing barley were followed. As shown in Fig. (1), meteorological information was gathered from a station in the Siwa Oasis region, station Desert Research Centre, throughout the course of two seasons. According to Table 1 the irrigation water was examined for pH, EC, cations, and anions throughout the course of two seasons.

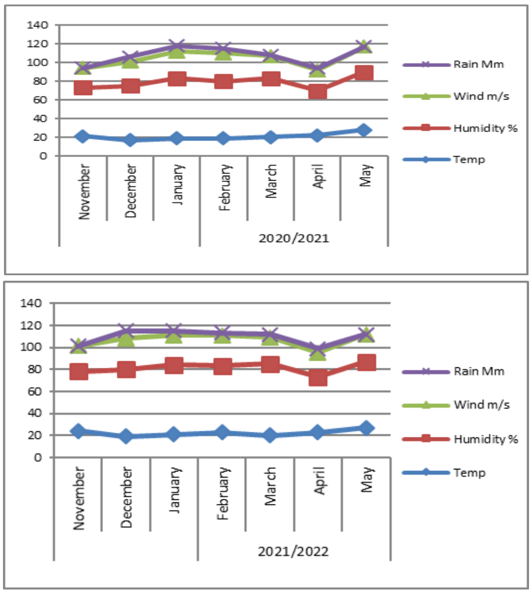

Fig. 1. Siwa Oasis, Egypt's meteorological conditions. Desert Research Center in 20/21 and 21/22 growing seasons.

Determine yield characteristics

Each sub-sub plot had one square metre randomly chosen during harvest in order to examine the associated features. Each sub-plot was utilised to calculate the yields of grain, straw, and biological products. To assess the yield attributes of barley, 10 guarded plants were randomly selected from each sub-plot during harvest.10 guarded plants were randomly chosen from each sub-plot at harvest to evaluate the barley production characteristics.

Yield as well as its elements.

Following characters were estemated on a square metre that was randomly chosen from each subplot during harvest:

1- Plant Height (cm): Ten plants from each sub-sub plot were measured from the ground to the tips the average was calculated.

2- The weight of the spike kernels that were drawn at random from each subplot, and the results were utilised to determine the spike weight (g).

3- 1000-grain weight (g): This measurement was made by weighing 1000 kernels randomly selected from each sub-sub plot.

4- Biological yield (kg/ha): To calculate this, each plant in the chosen square metre was weighed, and the weight was then converted to kg/ha.

5- Grain yield (kg/ha): The harvested grains from each sub plot's square meter were air dried, then threshed, and the grains' 13% moisture content was determined by weighing them in kg before converting to kg/ha.

6- Weighing the straw yield provided an estimate for the straw yield (kg/ha)

7-Crop Index (%): The following formula was used to determine it = Grain yield (kg/fed)/ Straw yield (kg/ha).

8- Harvest index (%): It was determined via the following formula = Grain yield (kg/fed)/Biological yield (kg/ha).

Economic evaluation

1- Total gain (LE/ ha.) = Grain yield x price + straw yield x price.
2- Net return (LE/ ha.) = Total gain – costs.
3- Cost information for labour, equipment, and all farm inputs were included. The cost of barley seed (ton) was 12000 LE. Whereas the price of straw was (ton) = 3000 LE respect.
4- Total costs = 15420 LE/ha.

Statistical analysis

In accordance with Gomez and Gomez's 1984 description of the split design, the data were collected, and statistical analysis using the analysis of variance was carried out. The SPSS 20.0 analysis programme was used to conduct the analyses. When there was statistically significant data *P < 0.05, respectively. The observations resulting from the split-plots within entire plots form the basis for the analysis of variance.

RESULTS AND DISCUSSION

Barley cultivars differences:

Data in Table 2 showed considerable variations amongst barley cultivars for all characters that were investigated during each season. In the first season, plant height (in cm) varied from 69.17 cm (O) to 101.25 cm (Giza 2000), and in the second season, it varied from 66.67 cm (Giza 129) to 96.92 cm (Giza 2000). Weight in 1000 grains (gm), ranging from 28.42g (H) to 53.50g (Giza 2000) in the first season and27.83 (H) to 51.42 (Giza 2000) in the second one. Weight of grains Spike, varied from 1.010 (H) to 2.291 (Giza 2000) in the first season and 0.968 (H) to 2.202 (Giza 2000) in the second one. These outcomes align with those attained by (Seadh *et al.* 2022, Mekdad *et al.* 2021 and Khan *et al.* 2018**)**. The difference in grain yield kg/ha was substantial 1222 (H) to 4297 (Giza 132) in the first season and 1172 (H) to 4135 (Giza 132) in the following season. Varietal differences for straw and biological yields were also noted in this context. Varietal differential for grain yield L.E/ha were also reported by (Newton *et al.* 2020, Dinçsoy and Sönmez 2019 and Pačuta *et al.* 2021**)**. Straw yield kg/ha changed from 1996 (H) to 6722 (Giza 132) in the first season and 1916 (H) to 6461 (Giza 132) in the following season. Additionally, in this regard, the varietal differential for straw production was reported by El-Hashash, E.F and (Agwa 2018, Attia *et al.* 2022 and Chen *et al* 2020**)**. Biological yield kg/ha ranged from 3218 (H) to 11019 (Giza 132) in the first season and 3087 (H) to 10596 (Giza 132) in the following season. Varietal differences for straw and biological yields were also noted in this regard, according to **(**Hellal *et al.* 2020, Júnior *et al.* 2019 and Hegab *et al.* 2020**)**.

Table 2. Performance of barley varieties with regard to yield characteristics over 2020/2021 and 2021/2022 seasons.

Barley Cultivars (BC)	Plant height Cm		1000 Grain weight		Weight of Grains /Spike		Grain yield kg/ha		Straw yield kg/ha		Biological yield kg/ha	
	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22
Giza 128	79.33	76.33	33.25	32.25	1.307	1.253	3094	2962	5380	5173	8474	8136
Giza 129	69.67	66.67	41.17	39.50	1.760	1.691	3862	3724	6325	6080	10187	9804
Giza 132	73.83	70.67	39.50	38.08	1.659	1.616	4297	4135	6722	6461	11019	10596
Giza 133	86.92	83.25	51.75	49.33	2.250	2.161	3108	2993	5397	5197	8505	8190
Giza 2000	101.25	96.92	53.50	51.42	2.291	2.202	3791	3632	6177	5964	9968	9595
S	98.17	94.17	51.00	49.00	2.167	2.091	4059	3897	6475	6209	10534	10105
B	74.83	72.17	30.17	29.00	1.232	1.188	3643	3481	6355	6117	9998	9598
H	70.83	67.67	28.42	27.83	1.010	0.968	1222	1172	1996	1916	3218	3087
O	69.17	66.92	36.50	34.92	1.465	1.407	4141	3968	6480	6230	10621	10197
PL	73.75	70.67	34.75	33.50	1.270	1.221	4107	3968	6438	6189	10545	10156
F. test	**	**	**	**	**	**	**	**	**	**	**	**

****: 0.05 threshold of significance for significant, and N.S. for not significant.**

Data in Table (3) showed significant variations between barley cultivars for all variables in both seasons that were the subject of the study crop index varying from 36.49 (Giza 133) to 38.97 (Giza 132) in the first season and 36.31 (B) to 39.00 (Giza 132) in the following season. These outcomes are consistent with those obtained by (Abd El-Aziz *et al.* 2017, Abou Tahoun *et al.* 2022 and Shen *et al.* 2020).

Table 3. Performance of barley varieties with regard to yield characteristics over 2020/2021 and 2021/2022 seasons.

Barley Cultivars (BC)	Crop index (%)		Harvest Index (%)		Grain Yield (L.E /ha)		Straw Yield (L.E /ha)		Total Gain (L.E /ha)		Net gain (L.E /ha)	
	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22
Giza 128	36.51	36.41	57.59	57.35	37126	35549	16141	15519	53267	51068	37622	35423
Giza 129	37.80	37.87	60.89	61.06	46344	44691	18974	18240	65318	62931	49673	47286
Giza 132	38.97	39.00	63.91	63.98	51567	49614	20166	19384	71733	69000	56088	53353
Giza 133	36.49	36.47	57.53	57.49	37302	35912	16190	15592	53492	51504	37847	35859
Giza 2000	37.94	37.77	61.25	60.79	45490	43578	18530	17890	64020	61469	48376	45824
S	38.47	38.52	62.57	62.70	48702	46758	19426	18626	68128	65384	52483	49739
B	36.48	36.31	57.52	57.09	43718	41772	19064	18352	62782	60124	47137	44479
H	38.00	37.95	61.44	61.40	14670	14050	5988	5748	20658	19807	5013	4162
O	38.88	38.79	63.67	63.45	49696	47610	19441	18689	69137	66299	53492	50654
PL	38.87	38.98	63.66	63.97	49285	47614	19314	18566	68598	66180	52954	50535
F. test	**	**	**	**	**	**	**	**	**	**	**	**

****: 0.05 threshold of significance for significant, and N.S. for not significant.**

Harvest index (%) ranged from 57.52 (B) to 63.91 (Giza 132) in the first season and 57.09 (B) to 63.98 (Giza 132) in the following season. These outcomes are consistent with those obtained by (Kumar *et al.* 2020, Abdelaal *et al.* 2020 and Bijanzadeh *et al.* 2019). Grain yield L.E /ha substantial differences from 14670 (H) to 51567 (Giza 132) in the first season and 14050 (H) to 49614 (Giza 132) in the second season. Straw yield L.E /ha significantly varied 5988

(H) to 20166 (Giza 132) in the first season and 5748 (H) to 19384 (Giza 132) in the following season. Significant differences between the Net Gain L.E /ha 5013 (H) to 56088 (Giza 132) in the first season and 4162 (H) to 53353 (Giza 132) in the second season.

Result of Humic acid:

For all characters in both seasons that were analysed, the data in Table (4) showed humic acid to differ significantly from one another. Plant heights (in cm) varied between 74.73 cm (0 kg/ha) to 85.10cm (3 kg/ha) in the first season and 71.33cm (0 kg/ha) to 82.03cm (3 kg/ha) in the following. These outcomes align with those attained by (Saheed *et al.* 2021, Dulaimy and El Fahdawi. 2020 and Moustafa *et al.* 2021). 1000-grain weight (gm), varied from 34.50 g (0 kg/ha) to 45.53g (3kg/ha) in the first season and 33.10 (0 kg/ha) to 43.93 g (3 kg/ha) in the second one. Weight of grains Spike, varied from 1.364 (0kg/ha) to 1.894 (3 kg/ha) in the first season and 1.310 (0 kg/ha) to 1.834 (3 kg/ha) in the second one.

In the first season, grain yield kg/ha ranged greatly from 3119 (0 kg/ha) to 3871 (3 kg/ha), and in the second season, it ranged significantly from 3005 (0 kg/ha) to 3733 (3 kg/ha). Additionally, in this regard, the varietal differential for grain yield was reported by (Zahraa *et al.* 2022, Salwa and El-Sanatawy. 2022 and Amer *et al.* 2020). Straw yield kg/ha changed from 5571 (0 kg/ha) to 5905 (3 kg/ha) in the first season and 5355 (0 kg/ha) to 5676 (3 kg/ha) in the following season. Biological yield kg/ha was in the range of 8690 (0 kg/ha) to 9776 (3 kg/ha) in the first season and 8359 (0 kg/ha) to 9408 (3 kg/ha) in the second season. In this connection, additionally, there were variations in biological yield reported by (Wali *et al.* 2018, Abbas *et al.* 2022 and Ali *et al.* 2020).

Table 4. Humic acid performance with regard to yield characteristics during 2020/2021 and 2021/2022 seasons.

Humic Acid (HA)	Plant height Cm		1000 Grain Weight		Weight of Grains /Spike		Grain Yield kg/ha		Straw Yield kg/ha		Biological yield kg/ha	
	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22
Without	74.73	71.33	34.50	33.10	1.364	1.310	3119	3005	5571	5355	8690	8359
1 kg/ha	78.13	74.97	38.30	36.70	1.558	1.498	3456	3311	5797	5571	9253	8883
2 kg/ha	81.13	77.83	41.67	40.20	1.748	1.678	3683	3523	5825	5612	9509	9136
3 kg/ha	85.10	82.03	45.53	43.93	1.894	1.834	3871	3733	5905	5676	9776	9408
F. test	**	**	*	*	**	**	**	**	**	**	**	**

****: 0.05 threshold of significance for significant, and N.S. for not significant.**

Data in Table (5) showed significant variations between barley cultivars for all variables in both seasons that were the subject of the study. % crop index. varying from 35.86 (0 kg/ha) to 39.62 (3 kg/ha) in the first season and 35.84 (0 kg/ha) to 39.73 (3 kg/ha) in the second season. Harvest index (%). ranged from 55.94 (0 kg/ha) to 65.65 (3 kg/ha) in the first season and 55.92 (0 kg/ha) to 65.95 (3 kg/ha) in the second season. Grain yield L.E/ha significantly varied from 37433 (0 kg/ha) to 46455 (3 kg/ha) in the first season and 36054 (0 kg/ha) to 44791 (3 kg/ha) in the second season.

In this connection, varietal differential for grain yield L.E/ha were also reported by (Junaid *et al.* 2020). Straw yield L.E /ha significantly differed from 16713 (0 kg/ha) to 17715 (3 kg/ha) in the first season and 16065 (0 kg/ha) to 17027 (3 kg/ha) in the second season. Net gain L.E /ha substantial differences from 38727 (0 kg/ha) to 48300 (3 kg/ha) initially season and 36699 (0 kg/ha) to 45948 (3 kg/ha) in the following season. That is connection, a difference in varieties for net gain were also reported by (Abd El-Aziz *et al.* 2022 and Li *et al.* 2019).

Table 5. Humic acid performance with regard to yield characteristics during 2020/2021 and 2021/2022 seasons.

Humic Acid (HA)	Crop Index (%)		Harvest Index (%)		Grain Yield (L.E /ha)		Straw Yield (L.E /ha)		Total Gain (L.E /ha)		Net Gain (L.E /ha)	
	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22	20/21	21/22
Without	35.86	35.84	55.94	55.92	37433	36054	16713	16065	54147	52119	38727	36699
1 kg/ha	37.25	37.19	59.42	59.25	41473	39737	17390	16714	58863	56451	43293	40881
2 kg/ha	38.63	38.47	63.01	62.59	44198	42280	17476	16837	61675	59117	45955	43397
3 kg/ha	39.62	39.73	65.65	65.95	46455	44791	17715	17027	64170	61818	48300	45948
F. test	*	*	*	*	**	**	**	**	**	**	**	**

****: Significant at 0.05 level of probability, and N.S: not significant.**

Effect of interactions:

For Straw yield kg/ha, the relationship between barley cultivars and humic acid was significantly significant (Fig. 2). The barley cultivar Giza 132 with an application of 3 kg/h produced the maximum yield of straw (6807 kg/ha). The lowest figure (1839 kg/ha) was recorded in H without the use of humic acid. Significant interactions exist between humic acid levels and barley cultivars for straw yield (kg/ha). Was also found by (Abd El-Aziz *et al.* 2018, Roozbahani. 2015 and Canellas *et al.* 2020).

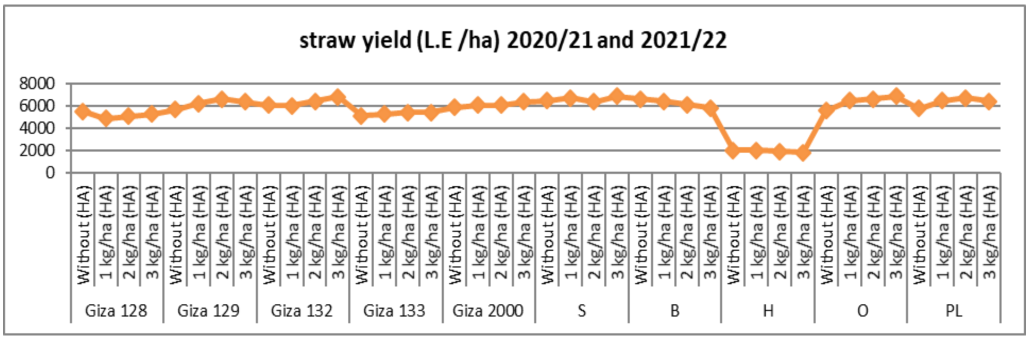

Fig. 2. Effect of the relationship between humic acid straw yield (kg/ha) and barley cultivars over the course of two seasons.

For grain yield kg/ha, barley cultivars and humic acid interacted in a very substantial way (Fig. 3). With an application rate of 3 kg/h, the wheat cultivar Giza 132 produced the maximum grain yield (4555 kg/ha). The lowest amount (1121 kg/ha), however, was recorded in H without the use of humic acid. Humic acid levels for grain yield (kg/ha) and barley cultivars interact significantly. Harmonic results were noted by (Abd El-Aziz and El Sahed. 2021 and Attia *et al*. 2022).

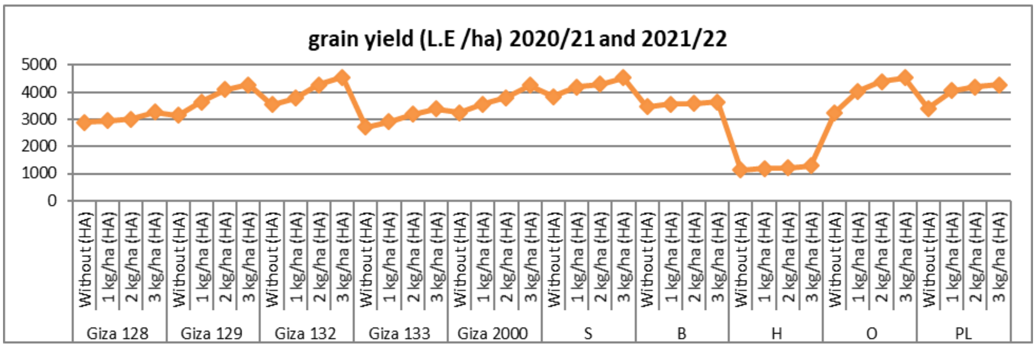

Figure 3. shows the interaction between several barley cultivars and the grain yield (kg/ha) of humic acid over the course of two seasons.

For net growth L.E/ha, barley cultivars and humic acid interacted in a very substantial way (Fig. 4). With an application rate of 3 kg/ha, the barley cultivar Giza 132 produced the maximum net gain (59208 L.E/ha). The lowest result (4174 L.E), however, was recorded in H without the use of humic acid. For net increase (L.E/ha), there is a significant interaction between the barley cultivars and humic acid levels. Accordant results were seen by (Abd El-Aziz and El Sahed. 2021 and Attia *et al*. 2022).

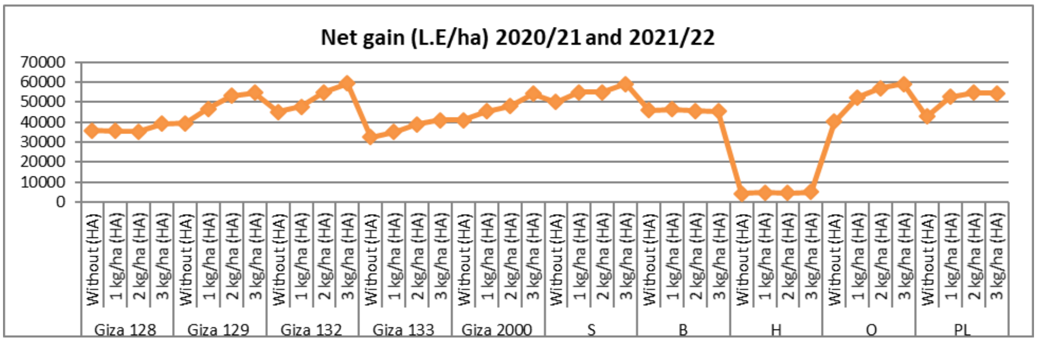

Fig. 4. shows the interaction between several barley cultivars and the net gain in humic acid over the course of two seasons.

CONCLUSION

The Siwa Oasis region of Egypt is regarded as one of the world's driest places since it receives an annual rainfall of just 25 millimetres, which is insufficient for any form of agriculture. To cultivate barley, which helped feed the Bedouins in these regions, which are located 1000 kilometres from Cairo, it was required to rely on groundwater with a salinity of 2700 PPM. It was found that the the barley cultivar Giza 132 with treatment of 3 kg/ha humic acid under the Siwa Oasis of Egypt generated the most economically.

ACKNOWLEDGMENTS

We appreciate the discussions with Prof. Dr. Hassan Auda Awaad Auda of the Crop Breeding Department at Zagazig University in Egypt.

REFERENCES

Abbas G, Rehman S, Siddiqui MH, Ali HM, Farooq MA, Chen Y. (2022). Potassium and humic acid synergistically increase salt tolerance and nutrient uptake in contrasting wheat genotypes through ionic homeostasis and activation of antioxidant enzymes. Plants 11:263. https://doi.org/10.3390/plants 11030263

Abou Tahoun, A.M.; El-Enin, M.M.A.; Mancy, A.G.; Sheta, M.H.; Shaaban, A. (2022). Integrative soil application of humic acid and foliar plant growth stimulants improves soil properties and wheat yield and quality in nutrient-poor sandy soil of a semiarid region. J. Soil Sci. Plant Nutr.22,851–858.https://pubmed.ncbi.nlm. nih. gov/ 35528198/

Abdelaal, K., Attia, K., Alamery, S., El-Afry, M., Ghazy, A.-H., Tantawy, D., Al-Doss, A., El-Shawy, E., Abu-Elsaoud, A., & Hafez, Y. (2020). Exogenous Application of Proline and Salicylic Acid can Mitigate the Injurious Impacts of Drought Stress on Barley Plants Associated with Physiological and Histological Characters. *Sustainability*, *12*, 1736. https://www.mdpi.com/2071-1050/12/5/1736

Abd El-Aziz, M.A and M. A. Attia (2022). Response of Peanuts to Biochar Treatments and Organic Fertilization under South Sinai Conditions. Egypt. J. of Appl. Sci., 37 (9-10):46-61. https://ejas.journals. ekb. eg/article_281669.html

Abd El-Aziz, M. A. and H. M. El Sahed (2021). Effect of plant density on some maize hybrids productivity under new reclaimed soil conditions at South Sinai. Future J. Agric., (3): 33-41. https://www. futurejournals. org/media/ ogwhakmh/ abd-el-aziz-and-el-shahed-33-41.pdf

Abd El-Aziz, M. A; A.H. Salem, R.M. Aly and M.Sh. Abd El-Maaboud (2018). Grain Quality and Protein Yield of Three Bread Wheat Cultivars as Affected by Some Humic Acid and Compost Fertilizer Treatments under Newly Sandy Soil Conditions. Zagazig J. Agric. Res., 45 (3):809-819. https://zjar.journals.ekb. eg/article_ 49118_ 70e26c42beee816ce0f45a1c3f02684d.pdf

Abd El-Aziz, M. A; A.H. Salem, R.M. Aly and M.Sh. Abd El-Maaboud (2017). The Role of Humic Acid and Compost in Maximizing Productivity of Some Wheat Cultivars Grown under Newly Reclaimed Sandy Soil at North Sinai, Egypt. Egypt. J. of Appl. Sci., 32 (9): 97-211. https://zjar. journals. ekb. eg/ article_49118_ 70e26c42beee816ce0f45a1c3f02684d.pdf

Ali, A. Y. A; Ibrahim MEH, Zhou G, Nimir NEA, Jiao X, Zhu G, Elsiddig AMI, Suliman MSE, Elradi SBM, Yue W. (2020). Exogenous jasmonic acid and humic acid increased salinity tolerance of sorghum. Agron J 112:871–884. https://doi.org/10.1002/agj2.20072

Amer, Kh. A; Kadria, M. EL A, F. A. Hellal, and A. H. A. Hassanein. (2020). Application of Nano-Silica to Mitigate the Effects of Drought on some Egyptian Barley Varieties. Fayoum J. Agric. Res. & Dev., Vol. 34, (2):123-139.https ://journals. ekb.eg/ article _189883. html

Asal M. Wali, Abdelaal Shamseldin, F. I. Radwan, E. M. Abd El Lateef and N. M. Zaki. (2018). Response of Barley (Hordeum vulgare) Cultivars to Humic Acid, Mineral and Biofertilization under Calcareous Soil Conditions. Middle East J. Agric. Res., 7(1): 71-82. ISSN: 2077-4605. https://www. Curresweb .com/ mejar/mejar/2018/71-82.pdf

Attia, M. A.; M. M. Abou El-Enin, A. M. Abou Tahoun, F. I.M. Abdelghany, R. S. El-Serafy. (2022). Productivity of some barley cultivars as affected by supplemental irrigation under rainfed conditions. AJCS 16(05):665-675. doi: 10.21475/ajcs.22. 16.0 5. p3647

Attia, M. A.; Omnia M. Wassif; Abdelnasser. A. Sh; M. A. Abd El-Aziz and Khaled M.H. Zaki. (2022). Effect of Potassium Silicate Foliar on Some Maize (zea mays l.) Hybrids Productivity Under Agricultural Buried Drains Tile Network in Saline Soil Conditions. Future J. Agric., (4): 34-44. DOI: 10.37229/fsa.fja. 2022. 10.20

Bijanzadeh, E., Naderi, R., & Egan, T. P. (2019). Exogenous application of humic acid and salicylic acid to alleviate seedling drought stress in two corn (Zea mays L.) hybrids. Journal of Plant Nutrition, 42(13), 1483-1495. https:// doi.org /10.1080 /01904167 .2019.1617312

Canellas, L. P., Canellas, N. O. A., Luiz Eduardo, L. E. S., Olivares, F. L., and Piccolo, A. (2020). Plant chemical priming by humic acids. Chem. Biol. Technol. Agric. 7, 12. doi: 10.1186/s40538-020-00178-4

Chen, X.; Wu, J.; Opoku-Kwanowaa, Y. (2020). Effects of returning granular corn straw on soil humus composition and humic acid structure characteristics in saline-alkali soil. *Sustainability, 12,* 1005. https://www.mdpi.com/2071-1050/12/3/1005

Dinçsoy, M.; Sönmez, F. (2019). The effect of potassium and humic acid applications on yield and nutrient contents of wheat (*Triticum aestivum* L. var. Delfii) with same soil properties. *J. Plant Nutr, 42*, 2757–2772. file:///C:/Users/ smart/ Downloads/ The effect of potassium and humic acid application sonyield and nutrient contents of wheat Triticum aestivumLvar Delfii with sames oi lproperties.pdf

Dulaimy, J.A. and El Fahdawi, W.A. (2020). Effect of humic acid on growth and yield of barley humic acid as interacted with row spacing. Indian J. Eco.,47: 62-65. file:///C:/Users/smart/Downloads/2020-%20(2).pdf

El-Hashash, E.F.; Agwa, A.M. (2018). Genetic parameters and stress tolerance index for quantitative traits in barley under different drought stress severities. Asian J. Res. Crop Sci, 1, 1–16. file:/// C:/Users /smart /Downloads/El-Hashash112017 AJRCS38702.pdf

El-Metwally, E. A.; N. M. M. Moselhy; E. A. Esmaeland M. A. Abd El-Aziz (2010). Effect of bio and mineral fertilization on naked barley under Rainfed and supplemental irrigation conditions at Matrouh area, Egypt. J.plant Prod. Mansoura Univ. Vol. 1 (10): 1385-1397. https:// jpp. journals. ekb.eg /article _86586.html

FAO/WFP. (2022). Ethiopia-FAO/WFP Crop and Food Security Assessment Mission. Special Report Food and Agriculture Organization: Rome. https://www. wfp.org /publications/ special- report- 2022- faowfp- crop- and-food-security-assessment-mission-cfsam-lao-peoples

Hegab, R.H.; Fawy, H.A.; Habib, A.A.M. (2020). Evaluates effect of amino acids, humic acid and antioxidants as foliar application on the biochemical content and productivity of wheat under North Sinai soils conditions. *Am. J. Agric. Forest. 8*, 167–174. file:/// C:/ Users/smart/ Downloads/Evaluates_ Effect_ of_ Amino_Acids_Humic_Acid_and_Ant.pdf

Hellal. F.A.; S.A.A El-Sayed, D. M. Abou Basha, C. Abdelly. (2020). Mineral Nutrient Status of some Mediterranean Barley Varieties as Affected by Drought Stress in Egypt. Iraqi J. Agri. Scie. (51):138-147. https://jcoagri. uobaghdad. edu.iq/index.php/intro/article/view/891

Júnior, G.A.; Pereira, R.A.; Sodré, G.A.; Gross, E. (2019). Humic acids from vermicompost positively infl uence the nutrient uptake in mangosteen seedlings. *Pesqui. Agropecuária Trop. 49*, 1–8. https://www.scielo. br/j/pat/a/gqFL3QQQp6FJW5ZJ3BbjP3K/

Junaid A.M.A. Dulaimy and Waleed A.T. El. Fahdawi. (2020). Effect of Humic Acid on Growth and Yield of Barley Humic Acid as Interacted with Row Spacing. Indian Journal of Ecology (2020) 47 Special Issue (10): 62-65. https:// www. Researchgate .net/ publication/340936001_Effect_of_Humic_Acid_on_ Growth_and_Yield_of_Barley_Humic_Acid_as_Int eracted_with_Row_Spacing

Khan, R.U.; Khan, M.Z.; Khan, A.; Saba, S.; Hussain, F.; Jan, I.U. (2018). Effect of humic acid on growth and crop nutrient status of wheat on two different soils. *J. Plant* Nutr, 41, 453–460. https://www.tandfonline.com/doi/ abs/ 10.1080/01904167.2017.1385807? tab= permissions & scroll=top

Kumar, H.; M. D. Reddy, G. Pandey and A. Kumar. (2020). Response of barley (Hordeum Vulgare L.) varieties to different levels of Sulphur. J. Phar. Phyt; 9(2): 1762-1765. https://www.phytojournal.com/archives/ 2020. v9.i2.11112/response-of-barley-hordeum-vulgare-l-varieties- to-different-levels-of-sulphur

Lakew B, Semeane Y, Alemayehu F, Hailu G, Grando S, Van Leur JAG, Ceccarelli S. (1997). Exploiting and diversity of barley landraces in Ethiopia. Genet Resour Crop Evol; 44: 109–16. file:/// C:/ Users/ smart/ Downloads/ Berhaneetal.1997.pdf

Li, Y., Fang, F., Wei, J., Wu, X., Cui, R., Li, G.(2019). Humic acid fertilizer improved soil properties and soil microbial diversity of continuous cropping peanut: A three-year experiment. Sci. Rep. 9, 1–9. doi: 10.1038/s41598-019-48620-4

Mauromicale, G., M.G.L. Angela and A.L. Monaco, (2011).The effect of organic supplementation of solarized soil on the quality of tomato. Sci. Hort., 129(2): 189-196. https:// www. Academia .edu/ 16787832/The_effect_of_organic_supplementation_of_solarized_soil_on_the_quality_of_tomato_fruit

Mekdad, A.A.; El-Sherif, A.; Rady, M.M.; Shaaban, A. (2021). Culture management and application of humic acid in favor of *Helianthus annuus* L. oil yield and nutritional homeostasis in a dry environment. *J. Soil Sci. Plant Nutr*, *22*, 71–86. file:///C:/Users/smart/Downloads/Mekdad2021_Article_CultureManagementAndApplicatio1.pdf

Moustafa, E.S.; El-Sobky, E.S.E.; Farag, H.I.; Yasin, M.A.; Attia, A.; Rady, M.O. (2021). Sowing date and genotype influence on yield and quality of dual-purpose barley in a salt-affected arid region. Agron., 11: 717. https://www.mdpi.com/2073-4395/11/4/717

Mikkelsen, R.L. (2005). Humic materials for agriculture, Davis, California, USA. Better Crops with Plant Food, 89(3): 6-7. https:// scirp. org/ reference/ referencespapers. aspx? Referenceid=1360694

Mohamed, A., A. Bakry, Y.R.A. Soliman and S.A.M. Moussa, (2009). Importance of micronutrients, organic manure and biofertilizer for improving maize yield and its components grown in desert sandy soil. Res. J. Agric. & Bio. Sci., 5(1): 16-23. https://www.researchgate.net/publication/267703606_Importance_of_Micronutrients_Organic_Manure_and_Biofertilizer_for_Improving_Maize_Yield_and_its_Components_Grown_in_Desert_Sandy_Soil

Nardi, S., D. Pizzeghello and S.G. Pandalai, (2004). Rhizosphere: A communication between plant and soil. Recent Res. Development in Crop Sci., 1(2): 349-360. https:// www. Cabdirect .org /cabdirect /abstract/20053067365

Nardi, S., D. Pizzeghello, A. Muscolo and A. Vianello, (2002). Physiological effects of humic substances in plant growth. Soil Biol. Biochem., 34(11): 1527-1536. https:// www .sciencedirect. com/ science /article/ abs/pii/S0038071702001748

Newton, A. C. ; T. A. Valentine, B. M. McKenzie, T. S. George, D. C. Guy and C. A. Hackett. (2020). Identifying Spring Barley Cultivars with Di_erential Response to Tillage. Agronomy. (10):1-18. doi:10.3390/ agronomy 10050686

Pačuta, V.; Rašovský, M.; Michalska-Klimczak, B.; Wyszyňski, Z. (2021). Grain yield and quality traits of durum wheat (*Triticum durum* Desf.) treated with seaweed- and humic acid-based biostimulants. *Agronomy*, *11*, 1270. https:// www.mdpi.com/ 2073-4395/11/7/1270

Roozbahani, A. (2015). Effect of soil application of humic acid and fluvic acid on agronomic traits of barley. Journal of Crop Nutrition Science 1(2): 12-17. https://journals.iau.ir/article_523044.html

Salwa M.A.I. and A.M. El-Sanatawy. (2022). Impact of Humic Acid and Nitrogen Fertilization Treatments on Productivity and Grain Quality of Some Barley Varieties. SINAI Journal of Applied Sciences 11 (1): 001-022.https://sinjas.journals.ekb.eg/article_225511_b05d0cbfaf8cd4713a1ccdeebdc59976.pdf

Saheed. S., Halala Rahman Qader ,Dalshad Azeez Darwesh. (2021). Effect of Humic Acid on Tolerance indexes of Barley plant to Cadmium Toxicity. Z. J. P. A. S, 33(3);12-17.DOI:http://dx.doi.org/10.21271/ZJPAS.33.3.2

Seadh , S. E.; A. T. El- Kassaby ; M. Mansour and M. M. M. El-Waseef. (2022). Response of Some Barley Cultivars to Different Sowing Dates, N-Fertilizer and Seeding Rates. J. of Plant Production, Mansoura Univ., 13 (1):9 -15. https://sinjas.journals.ekb. eg / article_225511_b05d0cbfaf8cd4713a1ccdeebdc59976.pdf

Shen, J.; Guo, M.J.; Wang, Y.G.; Yuan, X.Y.; Wen, Y.Y.; Song, X.; Dong, S.Q.; Guo, P.Y. (2020). Humic acid improves the physiological and photosynthetic characteristics of millet seedlings under drought stress. *Plant Signal. Behav. 15*, 8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8570710/

Wali, M. Asal; A. Shamseldin, F. I. Radwan, E. M. Abd El Lateef and N. M. Zaki. (2018). Response of Barley (Hordeum vulgare) Cultivars to Humic Acid, Mineral and Biofertilization under Calcareous Soil Conditions. Middle East J. Agric. Res., 7(1): 71-82. ISSN: 2077-4605. https:// www. Curresweb .com /mejar /mejar/2018/71-82.pdf

Zahraa, A. Al-Muhja and S. I. Al-Refaiy. (2022). Response of some growth traits and yield of barley genotypes Horde-um vulgare L. to planting dates. Journal of Kerbala for Agricultural Sciences Issue 4 (9): 217-226. DOI: https://journals.uokerbala.edu.iq/ index. php/Agriculture/article/view/107

إستجابة بعض أصناف الشعير لحمض الهيوميك تحت ظروف الأراضي الملحية–واحة سيوة

محمود عبدالسلام عبدالعزيز

قسم الانتاج النباتى- شعبة البيئة وزراعات المناطق الجافة- مركز بحوث الصحراء

الملخص

أجريت تجربتين حقليتين تحت ظروف الاراضى الرملية المستصلحة حديثا بمنطقة واحة سيوة، مرسى مطروح خلال موسمى 2021/2020 و 2022/2021 على التوالى وذلك بهدف دراسة تأثير حامض الهيوميك على انتاجية بعض أصناف الشعير. وكانت معاملات الدراسة كما يلى: 1-عشرة اصناف من الشعير: الاصناف المصرية (جيزة 128 – 129 – 132 – 133 – 2000) . 2- اربعة معاملات ارضية بحمض الهيوميك: (بدون اضافة ، 1 كجم / هكتار ،2 كجم / هكتار واخيراً 3 كجم / هكتار) .أظهرت النتائج ما يلى :زادت جميع الصفات بشكل كبير باستخدام حمض الهيوميك 3 كجم / هكتار. حقق صنف الشعير جيزة 132 أقصى إنتاج للحبوب على مدار موسمين 4297 كجم / هكتار في الأول و 4135 كجم / هكتار في الثانى. أخيراً ، توصى هذه الدراسة أهمية صنف الشعير جيزة 132 عند الاضافة الارضية بحمض الهيوميك 3 كجم / هكتار بمنطقة واحة سيوة قد انتج أكثر كمية مجدية اقتصاديًا من حبوب الشعير والقش. توفر هذه النتائج فهماً شاملاً للمزايا التي يوفرها حمض الهيوميك لإحداث زراعة مستدامة.