Al-Muthanna J. For Agric Sci Print ISSN: 2226-4086 Online ISSN:2572-5149
Vol. 9 , Issue. 02. 2022

https://muthjas.mu.edu.iq/ http://doi.org/10.52113/mjas04/9.2/22

Effect of bacterial inoculation population of vegetative properties of three barley cultivars (*Hordeum vulgare*.L)

Zahraa Haider Abbas **Ghanim Bahlol Noni**

[1,2]College of Agriculture, University of Al-Muthanna. Iraq

haiderzahraa895@gmail.com ghanem-bahlol@mu.edu.iq

Received on 25/09/2022 Accepted on 30/10/2022 Published on 15/12/2022

Abstract

The study was conducted in the winter season (2020-2021) in Al Bulatif area - Al Muthanna Governorate using a randomized complete block design with three replications in order to study effect of different population of the biological inoculum (0.5, 1, 1.5%) without applying (B1) and at a concentration of 0.5 kg.ha^{1} (B2) , and at a concentration of 1.0 kg H^{1} (B3), and at a concentration of 1.5 kg.H^{1} (B4), in some vegetative properties on the growth and yield of three cultivars of *Hordeum vulgare* L. (Al Buraq,A2 Ebaa 99, A3 Ebaa 265), and through the statistical analysis it was evaluated that the addition of different population of the bio-bacterial gave significant differences compared to the comparison treatment.

Treatment (B4) The highest percentage of increase in most of the studied properties was for barley plant (plant height, leaf area, grain yield) and the average properties were (96.57 cm, 16.570 cm2, 2.95 tons ha^{-1}) respectively compared to the control treatment (without applying the biofertilizer).

Keywords: *Hordeum vulgare* L., biofertilizer, cultivars, bacterial inoculation

Introduction

The use of natural materials such as organic fertilizers and bio-fertilizers is a suitable alternative to chemical fertilizers, and it is one of the modern technologies that have been used recently (Al-Wahaibi, 2008). The use of bio-fertilizers is a very successful method for agriculture because of it his very beneficial effect in increasing productivity in quantity and quality and at lower costs because it is simply micro-organisms compatible with micro-organisms that work to provide the nutrients necessary for plant growth, Bio-fertilizers contribute to improving the properties of the soil through the decomposition of waste materials (animals and plants) and the incorporation of the released products and elements with the soil.Furthermore They act as plant growth regulators, and their task is to secrete some antibiotics that work to resist many endemic diseases in the soil (Kumar, 2010).

The mechanism of bio-fertilization is basically changing the microbial content in the rhizosphere through pollination of soil , seeds or both with microorganisms isolated

from their natural environments, and then growing them in the laboratory and applying them to agricultural soils for different types of crops, and these organisms also contribute to dissolving elements associated with clay minerals, which maintain soil fertility and natural properties (Mazid and Khan, 2014) .

Barley is one of the most important strategic crops and ranks fourth among field crops after wheat, rice and maize in terms of area and production. The area planted with the crop globally reached 1.158 million hectares, with an average productivity of 134 million tons (Agricultural Statistics Directorate ,2019) .

Barley tolerates adverse environmental conditions, drought and salinity of irrigation water (Al-Dulaimi, 2015). The cultivated area in Iraq is estimated at 36% of the total area planted with grain crops, with a productivity of 303,114 tons annually. on 2019 the cultivated area was 930.25 thousand hectares, with a productivity of (1519) million tons (Agricultural Statistics Directorate, 2019). Therefore, this experiment was applied in order to find out the following:

1- Studying the effect of applying different population of bacterial inoculum on the growth and yield of barley and potential increasing of the availability of nutrients in the soil

2- Studying the effect of different cultivars of barley on growth and yield.

Materials and methods

Bio-fertilizer source

Imported bio-fertilizer was obtained (WHEAT & BARLEY Biozar)

(Nano Biological Fertilizer Biozar is a powerful combination of useful microorganisms and the micro nutrition and nanotechnology),(*Pseudomonas*, *Bacillus* and *Azospirillum*)

from the State of Iran and confirmatory tests were conducted on it for the purpose of verifying its effectiveness and knowing the appropriate recommendation that fits with the soil of Iraq.

Preparation of bacterial fertilizer concentrations

Three concentrations (0.5, 1, 1.5) kg hac^{-1} of the bacterial fertilizer were prepared for each of the bacteria (*Pseudomonas*, *Bacillus* and *Azospirillum*) separately by adding 0.5 kg of the bacterial fertilizer to 1000 ml of distilled water, and followed the same method with the other concentrations, and kept until use in subsequent experiments.

field experiment

The agricultural land was prepared by plowing, smoothing, leveling and dividing it into square panels with dimensions of (2*2) m^2, the panels were separated from each other by making 0.75 m^2 wide shoulders to prevent pollution from occurring during irrigation. Three cultivars of barley (Buraq A1, Ebaa 99 A2, Ebaa 265 A3) were planted after inoculating them with the bacterial suspension containing three concentrations (0.5, 1, 1.5%) and each concentrations separately, where 0.05 kg of seeds were contaminated in 1 liter of bacterial suspension for two hours before starting the cultivation process, after which it is dried for half an hour away from air and sunlight, After germination of seeds and reaching maturity, The following plant measurements were taken :

1- Plant height.cm^{-1} : Five plants were randomly selected from each experimental unit.

2- Grain yield, kg.dunum^{-1} : It was calculated on the basis of the square meter of the median lines of each experimental unit, and the yield was adjusted on the basis of 14% moisture (Briggs and Ytinfisu, 1980).

3- Leaf area cm^2: It was calculated from five plants taken randomly according to equation (Thomas ،1975).

Leaf area = leaf length x center width x correction factor (0.95).

Statistical Analysis

The data were statistically analyzed using Genstat program. The means were compared using the least significant difference (L.S.D) at the 0.05 level to know the nature of the differences between the treatments (Al-Rawi and Khalaf Allah, 2000).

Results

plant height (cm)

The results of the statistical analysis (Table 1) indicated the significant effect of different concentrations of bacterial inoculum and cultivars on the plant height trait, and the interaction between them did not show any significant effect on this trait.

Treatment (B4) significantly outperformed all treatments and gave the highest mean of 96.57 cm. It was noted that the use of different population of the bio-inoculum led to a significant increase in the plant height characteristic compared to the comparison treatment, and it did not differ significantly from the treatment B3 and B2, which were given averages of (95.23 cm, 93.33 cm) sequentially compared to the comparison treatment (B1) Which gave an average of 84.33 cm for this trait.

It was also found that there is a significant effect of the barley crop cultivars on the plant height trait, as an A2 grade is significantly outperformed by giving it the highest average for the plant height trait 96.95 cm with a percentage increase of 12.21% over the A3 variety, followed by the A1 variety with an average height of 93.75 cm , while the A3 variety recorded the lowest rate of plant height 86.40 cm.

Table (1) Effect of bio- inoculum and varieties and the interaction between them on plant height (cm).

inoculum / cultivars	**B1**	**B2**	**B3**	**B4**	Mean
A1	**79.00**	**95.30**	**100.10**	**100.60**	**93.75**
A2	**88.50**	**98.20**	**99.00**	**102.10**	**96.95**
A3	**85.50**	**86.50**	**86.60**	**87.00**	**86.40**
mean	**84.33**	**93.33**	**95.23**	**96.57**	
L.S.D 0.05	**Cultivars**	**Inoculum**	**interaction**		
	7.24	**9.35**	**N.S**		

leaf area (cm^2)

The results of the statistical analysis in Table (2) indicate the presence of a significant effect of the biological inoculum on the characteristic of the area of the flag leaf for the barley crop, while the varieties and the interaction between them did not appear to have any significant effect in this trait.

Treatment (B4) significantly outperformed all treatments and gave the highest mean of 16.570 cm^2. The use of different population of the bio- inoculum led to a significant increase in the trait of the area of the flag leaf compared to the control treatment , and did not differ significantly from the treatment B3 and B2, which were given averages of (15.110 cm^2, 15.350 cm^2) sequentially, compared to the comparison treatment (B1) which gave the lowest average for these The characteristic was 13,643 cm^2.

Table (2) The effect of the biological inoculum and the cultivars and the interaction between them on the characteristic of leaf area (cm2).

inoculum / cultivars	**B1**	**B2**	**B3**	**B4**	mean
A1	**12.650**	**16.210**	**14.730**	**16.580**	**15.042**
A2	**14.680**	**15.900**	**15.500**	**15.570**	**15.412**
A3	**13.600**	**13.940**	**15.100**	**17.560**	**15.050**
Mean	**13.643**	**15.350**	**15.110**	**16.570**	
L.S.D 0.05	**Cultivars**	**Inoculum**	**Interaction**		
	1.691	**2.182**	**N.S**		

grain yield (ton ha^{-1})

The results of the statistical analysis (Table 3) indicated the significant effect of the bacterial inoculation on the trait of grain yield ton ha^{-1}, while the cultivars and the interaction had no significant differences in this trait.

Treatment (B4) significantly outperformed all treatments and gave the highest average of 2.95 ton ha^{-1}. The use of different population of the biological inoculum led to a significant increase in the quality of grain yield compared to the control treatment, and it did not differ significantly from the two treatments (B3 and B2) that were given averages of (2.66 tons $ha^{-1}$and 2.45 tons ha^{-1}) sequentially compared to treatment The comparison (B1) that gave the lowest mean for this trait was 2.11 tons ha^{-1}.

Table (3) Effect of biological inoculum and cultivars and the interaction between them on grain yield.

inoculum	**B1**	**B2**	**B3**	**B4**	mean

cultivars					
A1	**1.81**	**2.09**	**2.67**	**2.90**	**2.36**
A2	**2.13**	**2.62**	**2.76**	**3.13**	**2.66**
A3	**2.38**	**2.64**	**2.54**	**2.82**	**2.59**
Mean	**2.11**	**2.45**	**2.66**	**2.95**	**2.54**
L.S.D 0.05	**Cultivars**	**Inoculum**	**interaction**		
	0.52	**0.67**	**N.S**		

Discussion

The reason for the superiority of the biological inoculum treatment in the plant height is attributed to the merit of the pollen mixed with bacteria (*Azospirillum spp.* and *Bacillus spp.*) and its ability to provide nitrogen and phosphorous in a ready-made form to the plant, this improves the growth of the plant and its functional performance, Also, the participation of nitrogen and phosphorous elements with amino acids, which encourages the effectiveness of meristems, then increases the height of the plant as a result of the optimum utilization of nutrients, which leads to an increase in the rates of carbon representation, therefore positively affects the vegetative growth (Naseri *et al*., 2013 ; Al Shammari, 2018).

The addition of the bacterial inoculum led to an increase in the leaf area of the plant. This explains why the B4 treatment was superior to its ability to provide nutritional support with nitrogen from the beginning of cultivation until the flowering stage, which is the period during the emergence and growth of the leaf occurs, as nitrogen is necessary in the metabolic processes that occur inside the plant Generally, as the increase in nitrogen increases the chlorophyll pigment in the leaves and then increases the efficiency of the photosynthesis process, which is positively reflected in the leaf area. This result agreed with what was indicated by (Abd *et al* , 2016 ; Bashan and De-Bashan ,2005).

The reason for the existence of significant differences in the yield of grains may be due to the increase in the nitrogen content of the plant, which may increase the vital processes, as a result of increasing its absorption. The superiority of the bio-inoculum treatment (B4) is due to the fact that this treatment stimulated the plant to grow optimally during the vegetative growth stage and to form a good vegetative group, which achieved the highest increase in yield with this treatment, and this is what was the study found (Faraj and Khudair , 2015).

References

Abd, Yarub Mayouf, Hassan Ali Abdel Reda and Hamid Ali Hadwan. (2016). Effect of biofertilizer produced from local isolates of Pseudomonas putida and Pseudomonas flourescens bacteria on some soil properties and wheat yield. Triticum aestivum L. Iraqi Journal of Agricultural Sciences 47 (6): 1404 -1412.

Agricultural Statistics Directorate (2019). Estimated wheat and barley

production. Ministry of Planning. Central Statistical Organization, Iraq.

Al-Dulaimi. Ola Mowaffaq Sabri. (2015). Evaluation of the efficiency of isolates of Bacillus spp. In dissolving phosphates under different salt levels, growth and yield of barley. Master's thesis. College - University of Baghdad.

Al-Rawi, Mahmoud and Abdel Aziz Muhammad Khalaf Allah. (2000). Design and analysis of agricultural experiments. faculty of Agriculture. University of Al Mosul . Second Edition . Ministry of Higher Education and Scientific Research. The Republic of Iraq.

Al-Shammari, Asma Salim Hussain Majid (2018). Evaluation of the use of a local isolate of Bacillus mucilaginosus and Glomus mosseae as a bio-fertilizer in the growth and yield of maize and its content of phosphorous and potassium. PhD thesis. College of Agriculture - University of Baghdad.

Al-Wahaibi, Mohammed bin Hamad. (2008). Root ocean bacteria activating plant growth. Saudi Journal of Microbiology Sciences. Volume (15) number (3).

Bashan, Y. and de- Bashan, L.E.(2005). Fresh –weigth measurement of root provide inaccurate estimates of the effects of plant growth- promoting bacteria on root growth :a critical examination .Soil Biology &Biochemistry 37:1795-1804.

Briggs, k. G., & Ytinfisu, A. A. (1980). Relationships between Morphological characters above the flyleaf and grain yield in spring wheat Title. Crop Science, 20, 350–354.

Faraj, Hamza Talib and Khudair Abbas Jadoua (2015). Effect of nitrogen levels and its added fractionation on barley grain yield. Iraqi Journal of Agricultural Sciences -46(6):934-942.

Holt, J.G., Krieg, N.R., Sneath, P.H.A., Stanley, J.T. and William, S.T. (1994). Bergey's Manual of Determinative Bacteriology. Williams and Wilikins, Baltimore, 786-788.

Kumar, Vivek. (2010). A lecture on biological plant fertilizers, the optimal alternative to chemical fertilizers, Public Authority for Agricultural Affairs, Kuwait. Al-Qays Newspaper, Issue 13464.

Mazid,M.and Khan,T.A.(2014). Future of bio-fertilizers in Indian agriculture:an overiew.Inter.J.of Agri.And food Res.3(3):10 -23.

Naseri, R .R.; Azadi ,S .; Rahimi ,J.M. ; Maleki ,A. and Mirzaei ,A. (2013). Effects of Inoculation with *Azotobacter Chroococcum* and *Pseudomonas* Putrid on yield and some of the important agronomic traits in barley (*Hordeum vulgar* L). International J. of Agronomy and Plant Production. Vol., 4 (7) , 1602-1610.

Thomas, H. (1975). The growth response of weather of simulated vegetative swards of single genotype of Lolium perenne .J.Agric.Sci.Camb.84:333-343.