Effects of Biological Fertilizers on Morphological traits in Bread wheat varieties under drought stress in Greenhouse

Yousef Alaei*, Elena Khabiri, Seyed sajjad Moosavi, Ali Mohammadpour Khanghah and Maryam Jafari

Department of Agronomy and Plant Breeding, Ardabil Branch, Islamic Azad University, Ardabil, Iran

Corresponding author: Yousef Alaei, Department of Agronomy and Plant Breeding, Ardabil Branch, Islamic Azad University, Ardabil, Iran
Email: yousef.alaei@gmail.com. Tel: +989143557024

Abstract: To study the effect of two biologic fertilizers containing amino acids on morphologic amount in 11 bread wheat cultivars in drought stress, a research was conducted in Ardabil IAU research greenhouse during 2011. The study design was factorial on base of completely randomized block in three replications. Factor A in two conditions (drought and normal), factor B in three levels (water, aminol-forte and fosnutren) and factor C included 11 wheat genotypes. According to the analysis of variance was observed between the genotypes studied the properties evaluated, there was no significant difference in the level of one percent. Data mean comparison results indicated that Sardari with a mean of 70.53 had the highest shoot length and Gascogne with a mean of 51.37 had the lowest shoot length among studied cultivars. Results to the fertilizer levels data mean comparison indicated that fosnutren liquid fertilizer which had the highest value in total length of root, root dry weight and root to shoot ratio. Aminol forte biological fertilizer had the highest mean in shoot dry weight traits. The results suggest that during the Sardari cultivar of shoot length, shoot dry weight and total claw was highest.
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Introduction

Triticum aestivum is the most important crop in the world. Extensive extent and high adaptation of this plant as well as its diverse consumptions in the human nutrition lead to presented as the most important cereal in the world, especially in developing countries and it can provided 20 percent food resources of the world people (Farzi and shakeri., 2010 a). According to evaluation which performed in the international bureau of food regulation, wheat demandrate in the world will increase significantly by 2010, while available resources to producing wheat has the limitations. So, it is predicted that there is lack of wheat supply about 100 million tone in the global market at 2020 (Farzi and shakeri., 2010 b). Wheat cultivation in semidry areas encountered drought stress more during last stages of growth. Drought stress may have an influence on growth and yield during difference stages of wheat growth, but it seems the most critical stage is from flowering period to complete formation of spikelets (Ahmadi et al., 2006). Dryness is the most important factor limiting the production of crops in the world Middle East, especially in semiarid Mediterranean (Samarah et al., 2009) such as Iran. This topic is more important in dry and semi-arid regions of the world (Kirigwi at al., 2004). Drought stress depends not only on the duration and intensity of water stress, but also on the developmental phase at which the stress was imposed. Drought stress at the grain filling period dramatically reduces grain yield (Ehdaie and Shakiba, 1996; Samarah et al., 2009; Alqudah et al., 2011). Since dry matter production after heading is the main source of grain yield in wheat (Saidi et al., 2008). This stage of plant growth has a critical importance in terms of drought (Alqudah et al., 2011). Yield is reduced mostlywhen drought stress occurs during the heading or flowering and soft dough stages (Sanjari et al, 2008). Wheat production is subjected to water deficit after anthesis in Ardabil region, Iran (Sanjari et al, 2008). Biofertilizers can add 20-200 kg N ha^{-1} (by fixation), liberate growthpromoting substances and increase crop yield by 10- 50%. They are cheaper, pollution free, based on renewable energy sources and also improve soil tilth (Mostara, 1995). Amino acids as organic nitrogenous compounds stimulated cell growth acting as buffers maintaining favorable pH value within the plant cell as well as synthesizing other organic compounds, such as protein, amines, purines and pyrimidines,

alkaloids, vitamins, enzymes, terpenoids and others (Goss, 1973). Slavik (Slavik, 2005) applied humiforte to stimulate shoot growth of Norway spruce. Humiforte is a high-tech soluble liquid nutrient, with rapidly absorption via leaves or roots, and a high concentration of free amino acids and biologically active oligopeptides, especially recommended for shock treatments. Thomas et al (2009) studied role of biologically active amino acid formulations such as Humiforte on quality and productivity of tea crop. Mostafa et al (2010) studied effect of Arginine on growth and yield of late sowing wheat. Some of biological stimuli, such as humiforte have been introduced to the market in order to deal with environmental stresses.

The objective to the following research is to compare the effects of two biologic fertilizers containing amino acids on Morphologic Traits in 11 bread wheat genotypes in interaction with drought stress in greenhouse conditions.

Material and methods

To study the wheat genotypes responses to applying aminol-forte and fosnutren as two types of biologic fertilizers containing amino acids on 11 wheat cultivars, a research was conducted in Ardabil IAU research greenhouse (Located 5 km West of Ardabil), in summer 2011. The plant material included 11 bread wheat cultivars (Rasad, Kuhdasht, Gascogne, Bezostaya, Cross Sabalan, MV 17, Saissons, Sardari, Azar 2, Zagros and Chamran) which were provided by Ardabil Agriculture and Natural resources Research Center. The study design was factorial on base of completely randomized block in three replications. Factor A in two conditions (drought and normal), factor B in three levels (water, aminol-forte and fosnutren) and factor C included 11wheat genotypes. Mixing soil, gravel and sand in equal portions, greenhouse soil was prepared. 10 seeds with a depth of 4 cm were planted and watered, immediately. Biological fertilizers levels were applied on the seedling through spraying at 3 to 4-leaf stage, after watering. The aminol-forte and fosnutren consumption amount was 2 ml in 500 ml water, for each one. To apply drought treatment, polyethylene glycol 6000 was used to form a drought stress at greenhouse conditions. After finishing the research and applying treatments, initial roots, shoot length and length of root were measured. Subsequently, the shoot and roots were conveyed to the owen and left at 75 ° C for 24 hours. After the aforementioned period, samples dry weight were measured and recorded by scale. Data variances analysis and comparing their means were carried out by SAS and MSTATC softwares. Means were compared by Duncan's multiple range tests at 5%. Excel and Minitab 16 was used for graphs and Cluster drawing.

Results and Discussion

According to the analysis of variance (Table 1) was observed between the genotypes studied the properties evaluated, there was no significant difference in the level of one percent. Between fertilizer levels of traits, shoot dry weight and root dry weight at the 1% level, and also in terms of root length and root to shoot ratio was significant at the 5% level. Between irrigated conditions, the shoot length and root length was between 1% level, the interaction of cultivar × fertilizer levels on air quality during the 1% level, and root dry weight were significantly different at the 5% level. The other interactions were not significant for any of the parameters studied.

The analysis of variance showed that the effect on the average concentration during coleoptiles mean root length, mean of dry weight, germination, germination rate index, index of germination, final germination percentage and mean germination time was significant in 1% probability level (Alaei et al., 2010).

Data mean comparison results (Table 2) indicated that Sardari with a mean of 70.53 had the highest shoot length and Gascogne with a mean of 51.37 had the lowest shoot length among studied cultivars. Also, Kuhdasht with Chamran, Cross sabalan and Azar 2 with Zagros and Bezostaya with Sissons formed one group and showed no differences in this trait. On shoot dry weight, Sardari with a mean of 22.25 was the best and Zagros with a mean of 16.38 was the lowest mean. Cross saba;an with MV 17, Kuhdasht with Azar 2 formes in one group and Rasad, Gascogne and Sissons with Chamran formed in one group and showed no differences in this trait. On root dry weight, Gascogne with a mean on 2.41 was the highest and Azar 2 with a mean of 1.57 was the lowest mean. Bezostaya with Chamran, Kuhdasht and Cross sabalan with Sissons and also Sardari with Zagros formed in one group and showed no differences on this trait. On total claw, Sardari with a mean on 14.94 was the highest and Bezostaya with a mean of 7.46 was the lowest mean of total claw. Also Rasad with Kuhdasht and Gascogne with MV 17 formed in one group and showed no differences on this trait. MV 17 with a mean of 0.66 had the most and Sardari with mean of 0.44 had the least Root to shoot ratio. Gascogne with MV 17 formed one group and also Rasad, Kuhdasht, Cross sabalan and Zagros with Chamran formed another group and showed no differences on this trait.

Average of traits for genotypes showed that genotype originated from nakhjavan3 (Azerbaijan) in coleoptile length, root length, the average fresh weight and mean dry weight was the maximum average. This genotype seems to be a good potential among genotypes has (Alaei et al., 2010).

Results to the fertilizer levels data mean comparison (Figure 1) indicated that fosnutren liquid fertilizer which had the highest value in total length of root, root dry weight and root to shoot ratio. Aminol forte biological fertilizer had the highest mean in shoot dry weight traits.

Alaei et al (2012) conducted a research to study the effect of two types of biological fertilizer containing amino acids on germination indices of wheat varieties under in vitro drought stress condition. They concluded that fosnutren biological fertilizer has been able to put a more positive effect on the studied indices.

For categorizing genotypes, cluster analysis by Ward method, using euclidean distance based on standardized mean morphological traits was evaluated in the greenhouse. The 11 genotypes were categorized in three groups by a cut at euclidean distance (Figure 2). To distinguish each groups traits based on studied traits, the mean to each cluster and the total mean for each trait was calculated. The following are the traits for each cluster:

The first group included genotypes of number 11, 1, 2, 5, 9 and 8 which had the highest value in shoot length, shoot dry weight and Total claw. On the other traits, they were in thired ranks. The second group included genotypes number 3, 4, 7 and 10 which had the first rank in root dry weight. The third group included genotype number 6 which had the first rank in root to shoot ratio. They were second and third in ranking. Hence, it could be concluded that among the above groups, the first group with genotypes of number 11, 1, 2, 5, 9 and 8 is the best group.

Table 1 - Results of variance analysis by morphological evaluation of different wheat cultivars in different experimental conditions in the Greenhouse

Source of Variations	df	Mean Square					
		Shoot length	Total length of root	Shoot dry weight	Root dry weight	Total claw	Root to shoot ratio
Condition	1	356.467 **	123.872 **	25.123 ns	0.299 ns	4.741 ns	0.0004 ns
Fertilizer levels	2	6.819 ns	54.008 *	373.850 **	2.435 **	14.036 ns	0.014 *
Genotype	10	709.085 **	50.472 **	61.855 **	1.053 **	98.055 **	0.094 **
C×F	2	24.593 ns	30.457 ns	7.377 ns	0.186 ns	7.771 ns	0.009 ns
C×G	10	37.354 ns	19.723 ns	33.917 ns	0.354 ns	13.830 ns	0.003 ns
G×F	20	72.631 **	16.635 ns	29.317 ns	0.541 *	5.078 ns	0.007 ns
C×F×G	20	13.447 ns	7.574 ns	6.152 ns	0.196 ns	8.520 ns	0.004 ns
Error	132	26.657	15.476	26.019	0.303	9.287	0.005
CV (%)	-	8.33	12.37	26.92	28.42	27.15	13.98

* and ** Significantly at $p < 0.05$ and < 0.01, respectively

Table 2 . Comparison of morphological traits studied in the Greenhouse for different wheat cultivars

Genotypes	Characters				
	Shoot length	Shoot dry weight	Root dry weight	Total claw	Root to shoot ratio
Rasad	69.379 ab	17.939 bc	2.005 bc	11.352 cde	0.456 de
Kuhdasht	65.871 bc	20.039 abc	1.938 bcd	11.481 cde	0.480 de
Gascogne	51.379 e	17.278 bc	2.411 a	9.352 efg	0.628 a
Bezostaya	57.732 d	17.367 bc	2.083 abc	7.462 g	0.542 bc
Cross Sabalan	63.426 c	20.778 ab	1.800 bcd	14.149 ab	0.483 de
MV 17	54.750 de	20.456 ab	2.188 ab	9.406 efg	0.668 a
Saissons	55.462 d	18.056 bc	1.872 bcd	8.926 fg	0.569 b
Sardari	70.537 a	22.257 a	1.738 cd	14.944 a	0.443 e
Azar 2	64.943 c	20.139 abc	1.572 d	13.037 abc	0.501 cd
Zagros	62.259 c	16.389 c	1.677 cd	10.648 def	0.486 de
Chamran	65.814 bc	17.711 bc	2.027 abc	12.684 bcd	0.482 de

Differences between averages of each column which have common characters are not significant at probability level of 5%

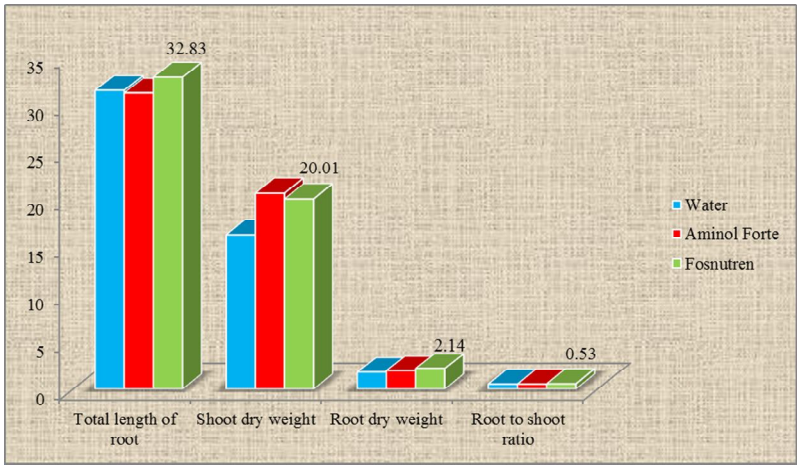

Figure 1 . Average morphological traits studied in different experimental conditions in different wheat cultivars in the Greenhouse

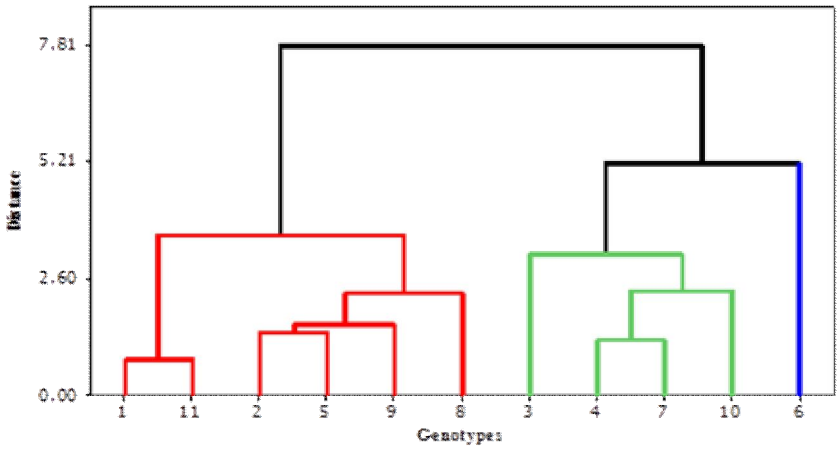

Figure 2. the dendrogram resulting from cluster analysis of the minimum variance method (Ward) based on morphological traits

Conclusion

The results suggest that during the Sardari cultivar of shoot length, shoot dry weight and total claw was highest. Also fosnutren biological fertilizers other than shoot dry weight across the highest average yield in the compound fertilizer and biological fertilizer on top of the traits themselves. Finally, it could be concluded that biologic and organic fertilizers, such as fosnutren, could play a great role in improving morphological traits of wheat cultivars.

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