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Effects of Two Biologic Fertilizers Containing Amino Acids on Leaf Chlorophyll Index in Bread Wheat Cultivars in Greenhouse

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Abstract: To study the effect of two biologic fertilizers containing amino acids and oligopeptide on chlorophyll 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. Results suggested that there is a significant relation between solutions based on leaf chlorophyll amount before and after applying drought stress at 1 percent. Also, there was a significant difference found between various genotypes on chlorophyll amount after applying drought stress at 5 percent. However, there was no significant difference found between genotypes before drought stress, genotype interaction and test conditions before and after applying drought stress on chlorophyll amount. Results to the studied genotypes means comparison indicated that Kuhdasht genotype with a mean of 42.747 had the highest chlorophyll amount after applying drought stress and Sardari genotype with a mean of 29.591 had the lowest chlorophyll amount. Gascogne, Saysonz, Zagros and Chamran genotypes formed one group. Rasad and Azar 2 formed one group and also Bezostaya, Cross Sabalan and MV 17 formed another and showed no difference in this trait. According to the data mean comparison on fertilizer levels, fosnutren liquid fertilizer was the best on chlorophyll amount before and after applying drought stress and normal water condition had the lowest mean based on chlorophyll amount. Results on data combined analysis between various research conditions indicated that fertilizer levels and genotypes, both, were significant at 1 percent. The research conditions interaction × Fertilizer levels were significant at 5 percent. Also, there was no significant difference found between research conditions and other conditions interactions.

***Keywords*:** wheat, chlorophyll, Fertilizer levels, stress, drought

INTRODUCTION

Various reports have been proposed in crops on various chlorophyll reactions to drought in weak and strong cultivars (Kulshreshtha et al., 1987) or lack of drought stress effect on chlorophyll density (Castrillo and Calcargo, 1989). Lack of relation between wheat drought tolerance and chlorophyll density changes under drought changes have been reported in some research (Ashraf et al., 1994). However, Ashraf et al (1994), have reported that drought stress decrease chlorophyll b density more than chlorophyll a. Drought stress is among the limiting environmental factors on plants photosynthesis (Malakouti et al., 2001). Photo System II (PS II) is highly sensitive to environmental inhibitor factors and drought stress damages the PS II reaction centers. There is evidence that drought stress decreases the leaf chlorophyll and the increase in chrolophyll amount in drought stress conditions could be considered as one of the main non-stomatal limiting factors (Bahra et al., 2002). Chlorophyll resistance is proposed as a drought tolerance criterion for choosing cultivars (Sio-Se Marde et al., 2004). To defeat the formed oxidative stress, plants obtain a high-performance defense system which could neutralize free radicals. This defense system includes the activity for superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX) and glutathione reductase (GR) enzymes. And non-enzymatic systems include ascorbate, tocopherol, carotenoids and other compounds (including flavonoids, mannitols and polyphones) (Blokhin et al., 2003). Environmental stresses lead to a vast range of reactions in plants, from gene expression and cell metabolism to growth speed and crop yield (Reddy et al., 2004). Drought stress limits the

plants growth more than any other environmental factor (Huang, 2000). Drought stress takes place when the water leaving the plant through the sweating process is more than the absorbed water through the roots (Shepherd et al., 2002). Shahryari and Khayatnejad (2011) conducted a research to study spraying humiforte effects on two wheat cultivars under late-season drought stress and calculated some traits and stress tolerance index. They came to this conclusion that humiforte has been effectively affected the crop yield, both with stress and without stress conditions. Their calculations on stress tolerance indices indicated that humiforte increase wheat cultivar tolerance to late-season drought.

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

MATERIALS 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, Saysonz, 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. Chlorophyll amount was measured twice; once before applying drought stress for normal, normal + aminol forte and normal + fosnutren in three replications and another time after applying drought stress for all the studied factors levels. To achieve this, CCM-200 Chlorophyll Content Meter (made by Opti-Science Company) was used which calculated chlorophyll content index (CCI). Data variance analysis and comparing their means were done by SAS software. Means were compared through Duncan's multiple-range test at 5%. To draw the diagrams, Excel software was used.

RESULTS AND DISCUSSION

Considering leaf chlorophyll content index variance analysis results (Table 1), it was observed that there is a significant difference between solutions on leaf chlorophyll before and after applying drought stress at 1 percent. Also, there was a significant difference found between genotypes on leaf chlorophyll amount after applying drought stress at 5 percent. There was no significant difference found on chlorophyll amount between genotypes, before applying drought stress and genotype effect × before and after applying drought stress. Results from data mean comparison (Figure 1) on studied genotypes suggested that Kuhdasht with a mean of 42.747 had the highest chlorophyll amount after applying drought stress while Sardari with a mean of 29.591 had the lowest chlorophyll amount. Gascogne, Saysonz, Zagros and Chamran genotypes formed one group. Rasad and Azar 2 formed one group and also Bezostaya, Cross Sabalan and MV 17 formed another and showed no difference in this trait. According to the data mean comparison on fertilizer levels (Figure 2), fosnutren liquid fertilizer was the best on chlorophyll amount before and after applying drought stress and normal water condition had the lowest mean based on chlorophyll amount. Results on data combined analysis between various research conditions (Table 2) indicated that fertilizer levels and genotypes, both, were significant at 1 percent. The research conditions interaction × fertilizer levels were significant at 5 percent. Also, there was no significant difference found between research conditions and other conditions interactions.

Khayatnezhad et al (2011) reported that drought stress condition increased the leaf chlorophyll content in wheat genotypes. Shahriari (1999), stated that in the plants under the drought stress, the green tissues of chlorophyll in leaves of resistant cultivars are showing the increase. important factor in tolerant of drought stress (Khayatnezhad et al., 2011), that the genotypes with high leaf chlorophyll content are tolerant to stress conditions.

Table 1. Results Analysis of variance for chlorophyll content of wheat genotypes

Source of Variations	df	Mean Square	
		Chlorophyll levels before the drought stress	Chlorophyll levels after the drought stress
Fertilizer levels	2	214.331**	562.745 **
Genotype	10	74.337 *	128.754 ns
G×F	20	18.606 ns	21.0589 ns
Error	66	70.602	41.184
CV (%)	-	22.96	20.71

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

Table 2. Analysis of combined analysis of different experimental conditions studied

Source of Variations	df	Mean Square
		Chlorophyll
Condition	1	2.103 ns
Fertilizer levels	2	2425.234 **
Genotype	10	177.495 **
C×F	2	284.842 *
C×G	10	25.596 ns
G×F	20	22.955 ns
C×F×G	20	16.706 ns
Error	132	63.713
CV (%)	-	21.869

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

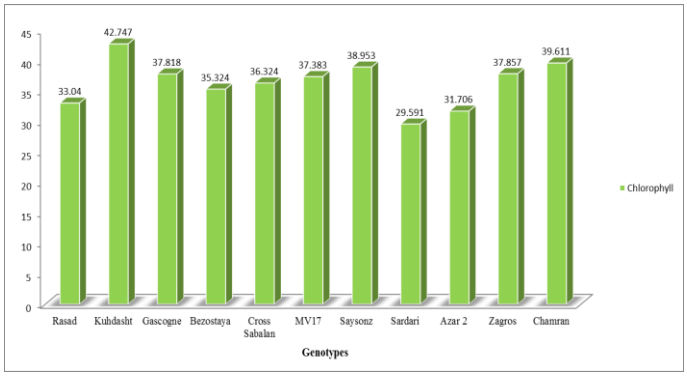

Figure 1. Comparison of chlorophyll content of wheat genotypes drought conditions

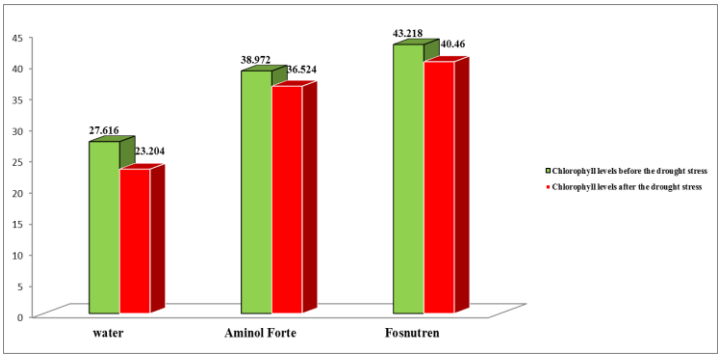

Figure 2. Comparison of different experimental conditions studied

CONCLUSION

Results to this research indicated that Kuhdasht genotype had the highest chlorophyll and also, using fosnutren liquid fertilizer could have positive effects on increasing chrlorophyll rate, comparing to other amino acids. Finally, it could be said that, using biologic fertilizers, such as fosnutren which contains free amino acids and oligopeptide, could play a great positive role on chlorophyll amount.

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