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## **Evaluation of Chlorophyll Content as Selection Criteria for Drought Tolerance in Wheat**

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**Abstract**: Drought and water deficit are two major limiting factors in wheat production. The genotypes having high chlorophyll content express a good photosynthesis rate and ability to tolerate different level of drought. As such, the evaluation of chlorophyll content can be an effective method of selecting tolerant wheat genotypes. The goal of this work was to assess the performance and improvement potential for chlorophyll content in case of 21 F1 hybrids between seven wheat varieties, genetically and ecologically differentiated. For most of the combinations the inheritance of chlorophyll content was controlled by over dominance effects, associated generally with a decrease of this trait. For Fundulea 4 x Apache and Alex x Apache the incomplete dominance leads to a decrease of chlorophyll content. For Xenos x Alex the complete dominance is acting with a negative effect in the inheritance of this trait, while for Fundulea 4 x Xenos the dominance effects are very low. The hybrids Fundulea 4 x GKKapos, Fundulea 4 x Alex and Xenos x Turda 2000 showed the highest potential to improve the chlorophyll content in wheat. In this regard, those combinations can be used as genitors or as selection material.

### Introduction

Under the global climate change the frequency of droughts periods increase, having a negative impact of food security. Water stress is one of the main factors restricting growth, yield and quality of wheat. The mechanisms of drought adaptations in wheat vary in accordance with developmental stage, intensity and duration of stress. Drought affects the growth of wheat throughout the growing season, but during the reproductive and grain-filling phases the highest yield losses are recorded. Chlorophyll is one of the major components of chloroplasts, so that the chlorophyll content is positively correlated with the rate of photosynthesis. Reduction of chlorophyll content under dry conditions is considered a typical symptom of oxidative stress which may be the result of photo-oxidation of pigments and chlorophyll degradation. The goal of this work was to assess the performance and improvement potential for chlorophyll content in case of 21 F1 hybrids between seven wheat varieties, genetically and ecologically differentiated.

Potency ratio	for chlorophyll	content (SPAD)	) in	wheat	crosses
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No	Crosses	PR	No	Crosses	PR
1	Fundulea 4 x Xenos	-0.06 cd	12	GKKapos x Turda 2000	-3.24 hi
2	Fundulea 4 x GKKapos	4.43 a	13	GKKapos x Alex	-2.20 fgh
3	Fundulea 4 x Turda 2000	5.39 a	14	GKKapos x Apache	-2.42 ghi
4	Fundulea 4 x Alex	5.15 a	15	GKKapos x Apullum	1.38 bc
5	Fundulea 4 x Apache	-0.47 de	16	Turda2000 x Alex	-1.63 efg
6	Fundulea 4 x Apullum	1.56 b	17	Turda2000 x Apache	-3.84 i
7	Xenos x GKKapos	-1.52 defg	18	Turda2000 x Apullum	-1.26 defg
8	Xenos x Turda 2000	2.54 b	19	Alex x Apache	-0.78 def
9	Xenos x Alex	-1.06 defg	20	Alex x Apullum	-1.40 defg
10	Xenos x Apache	2.05 b	21	Apache x Apullum	-1.35 defg
11	Xenos x Apullum	-2.52 ghi			

The highest mid parent heterosis and heterobeltiosis associated with a high chlorophyll content was recorded in Turda 2000 x Apache, Turda 2000 x Apullum, followed by the crosses Apache x Apullum and Xenos x Apullum. In the case of following crosses: Fundulea 4 x GKKapos, Xenos x Turda 2000, Fundulea 4 x Alex, negative values for both type of heterosis were recorded, associated with low chlorophyll content and tolerance to drought.

## Material and method

The biological material consisted of seven wheat varieties genetically and ecologically differentiated, such as: Fundulea 4, Alex, Apullum, Turda 2000, GKKapos, Apache, Xenos, alongside with their 21 half-diallel crosses, studied using a randomized block design on three replications. The leaves chlorophyll content was determined using portable chlorophyllmeter SPAD-502 (Konica Minolta), measuring the absorbance at 650 nm, being a non-destructive method. On

each flag leaf were performed three readings, the results being expressed in SPAD units.

### **Results and Discussions**

Taking into account the values of potency ratio, we can see that for most of the crosses the inheritance of chlorophyll content was controlled by over dominance effects, associated generally with a decrease of this trait. In the case of Fundulea 4 x Turda 2000, Fundulea 4 x Alex, Fundulea 4 x GKKapos, Xenos x Turda 2000, Xenos x Apache, Fundulea 4 x Apullum and GKKapos x Apullum, the over dominance cause an increase of chlorophyll content. For Fundulea 4 x Apache and Alex x Apache the incomplete dominance leads to a decrease of chlorophyll content. For Xenos x Alex the complete dominance is acting with a negative effect in the inheritance



Chlorophyll content (SPAD) for F<sub>1</sub> crosses groups with the same recurrent parent

#### Conclusions

The crosses Fundulea 4 x GKKapos, Fundulea 4 x Alex and Xenos x Turda 2000 showed the highest potential to improve the chlorophyll content in wheat. In this regard, those



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