Relationship between Flag Leaf Characteristics and Main Yield Components in Oat (*Avena sativa* L.)

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Abstract

The objective of this study was to investigate relationships between leaf area index, leaf chlorophyll concentration, yield components and grain yield in oat (*Avena sativa* L.). Ten oat varieties were analyzed in field conditions regarding those traits. Flag leaf chlorophyll concentration range between 451.51 and 747.79 units of μmol of chlorophyll per m^2 . Also, leaf area index range between 13.68 to 32.84 cm^2 . Significant correlation indices were highlighted between yield components and leaf area index, yield/yield components and chlorophyll concentration of flag leaf.

Keywords: *Avena sativa*, flag leaf, yield components

Introduction

Common oat (*Avena sativa* L.) is one of the major crops in temperate climate zones used both for human and animal nutrition (Sadiq Butt *et al.* 2008). In cereals, grain yield is mainly dependent on photosynthetic source-sink relationship dictating changes in carbohydrate synthesis, accumulation and partitioning (Berwal *et al.*, 2017). Flag leaves and chlorophyll pigments occupies a unique role in the physiology, productivity and economy of green plants. Leaf area index (LAI) is an important structural property of vegetation, because leaf surfaces are the primary border of energy and mass exchange.

Materials and methods

The field experiments with oats were conducted in Agricultural Research and Development Station from Turda under normal crop conditions. The Apogee MC 100 was used to measure the amount of chlorophyll concentration (Chl C) in the flag leaf, by transmitting light from light emitting diodes (LED) through a leaf at wavelengths of 650

and 940 nm to estimate chlorophyll concentrations (units of μmol of chlorophyll per m^2) at GS 83 stage at the same time were determinate leaf area index (LAI) for cereal crop according to Quarrie and Jones equation where: Leaf area index = Length x Breadth x 0.75 (Aldesuquy *et al.*, 2014). Grain yield (GY) and its main components were estimated at harvest. In the analysis of the panicle components, there was a random collection of 10 oat panicles per experimental unit. The followings were measured: number spikelet per panicle (NSP, n), number of grains per panicle (NGP, n) and grain mass of panicle (GMP, g). The obtained results were statistically processed by MS Excel program package using the methods of descriptive statistics; arithmetic mean value and standard deviation were calculated for each measured and calculated parameter.

Results and Discussions

As a reflection of plant photosynthetic capacity, chlorophyll concentration values have ranged between 451.51 at V 2 to 747.79 units of μmol of

Table 1. The variability of studied traits of ten oat varieties

	V 1	V 2	V 3	V 4	V 5	V 6	V 7	V 8	V 9	V 10	CV %
NSP	41.4	37.1	31.2	<u>61.2</u>	48.9	27.8	54.1	35.6	42.5	42.5	24.3
NGP	78.2	55.6	53.8	<u>110.6</u>	90.2	46.1	97.6	72	77.5	68.2	27.2
GMP	2.35	1.73	1.49	<u>3.14</u>	2.33	1.38	2.72	2.05	2.46	1.97	25.41
Chl C	514	452	459	<u>748</u>	575	457	571	562	694	573	17.7
LAI	20.7	15.3	17.0	<u>32.8</u>	17.6	13.7	23.5	21.5	19.8	18.4	26.8
GY	4.7	3.45	2.98	<u>6.27</u>	4.66	2.76	5.43	4.11	4.92	3.95	25.41

Table 2. Correlation coefficient between main yield components and flag leaves

	NGP	GMP	Chl C	LAI	GY
NSP	0.96	0.94	0.77	0.82	0.94
NGP	-	0.97	0.80	0.86	0.97
GMP		-	0.85	0.88	0.99
Chl C			-	0.79	0.85
LAI				-	0.88

P 5%= 0.63 P 1%= 0.76

chlorophyll per m² at V 4 (Tab. 1); with an average value of 560.35 units of μmol of chlorophyll per m². Also, leaf area index of the flag leaf of studied oat varieties have ranged between 13.68 to 32.84 with a mean of 20.02 cm²/m². Regarding main yield components (number of spikelet's/panicle; number of grains/panicle; weight of grains/panicle and grain yield) these have a specific reaction as a results of their capacity to adapt to different climatic conditions.

Based on the coefficient of correlation between flag leaf characteristics and yield components (Tab. 2), the agronomic performance of oat variety can be appreciated together with chlorophyll concentration or leaf area index. The strong and positive correlation between morpho-biochemical leaf traits and main grain yield components shows that concur significative to improve the final grain yield manifestation. Siloriya *et al.* (2014) reported that between leaf area index and weight of grains per panicle is a positive relationship, highlighted also in our research by correlation coefficient ($r = 0.88$) between these two traits. Hisir *et al.* (2012) reported grain yield was positively and significantly correlated with leaf area index in a study regarding the grain yield performance and physiological traits of 17 oat genotypes in Mediterranean typical climate.

Conclusion

These study shows the importance of morpho-biochemical traits, such as Leaf Area Index and Chlorophyll Concentration, and their significant contribution on grain yield expression. Results of correlation showed that grain yield or main yield components are correlated significant and positive with flag leaf area and chlorophyll concentration.

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