The comparison of photosynthesis parameaters of different wheat (*Triticum aestivum L.*) varieties

Ilona VAGUSEVIČIENĖ[1], Sonata KAZLAUSKAITĖ[1], Irena PRANCKIETIENĖ[1], Gintarė SUJETOVIENĖ[2], Arvydas KANAPICKAS[2], Audronė ŽEBRAUSKIENĖ[3]

[1]Department of Agroecosystems and Soil Sciences, Faculty of Agronomy, Vytautas Magnus University

[2]Department of Environmental Sciences, Faculty of Natural Sciences, Vytautas Magnus University

[3]Department of Agricultural and Food Sciences, Faculty of Agronomy, Vytautas Magnus University

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Introduction

The aim of this study was to compare the content of photosynthetic pigments and leaf area index (LAI) in the leaves of different winter wheat varieties during vegetation.

Plant photosynthesis parameters are increasingly used to assess the effects of different varieties and various agrotechnical measures, stress factors on agricultural crops. Monitoring of photosynthesis parameters of crops during vegetation allows to react in time to the tendencies of formation of productivity elements and to adjust the applied technological measures. Observations of chlorophyll a, b content, chlorophyll a/b ratio, leaf area index provide the most information about crop condition.

Methodology

Field place and conditions. Field experiments were carried out at the Experimental Station of Vytautas Magnus University Agriculture Academy in Lithuania (54° 53' 3.26", 23° 50' 33.25") during 2017–2018. During the experiment, six winter wheat varieties were studied: Skagen (control), Julius, Edvins, Artist, Aron and Evina. Winter rape was grown before the crop. Seed rate - 4.5 million ha^{-1}.

Analysis of photosynthetic pigment content was performed in growth stages of BBCH 24–27, 32–34, 58–62, and 70–73. The content of photosynthetic pigments (chlorophylls a, b, and carotenoids) in the fresh leaf mass was determined using 96% ethyl alcohol according to the Wettstein spectrophotometry method.

Winter wheat leaf assimilation area was measured using a WinDIAS leaf area meter (Delta-T Devices).

Results

Table 1. Chlorophyll *a* content (mg g^{-1}) in the leaves of different winter wheat varieties at the different growth stages

Cultivar	Growth stage			
	BBCH 24-27 (Tillering)	BBCH 32-34 (Stem elongation)	BBCH 58-62 (Heading–anthesis)	BBCH 70-73 (Early milk maturity)
Skagen	0.93b	1.02c	1.76b	2.56
Julius	1.18ab	1.79a	2.23a	2.43
Edvins	1.21ab	1.34b	1.81b	1.79
Artist	1.13ab	1.72a	2.26a	2.67
Aron	1.30a	1.78a	2.10a	2.35
Evina	1.18ab	1.66ab	2.18a	2.48

Table 2. Chlorophyll *b* content (mg g^{-1}) in the leaves of different winter wheat varieties at the different growth stages

Cultivar	Growth stage			
	BBCH 24-27 (Tillering)	BBCH 32-34 (Stem elongation)	BBCH 58-62 (Heading–anthesis)	BBCH 70-73 (Early milk maturity)
Skagen	0.25b	0.32c	0.51b	0.79b
Julius	0.33a	0.54a	0.64a	0.76bc
Edvins	0.33a	0.46b	0.54b	0.59d
Artist	0.34a	0.56a	0.65a	0.86a
Aron	0.38a	0.57a	0.63a	0.74c
Evina	0.32ab	0.49b	0.66a	0.78b

Table 3. Carotenoid content (mg g^{-1}) in the leaves of different winter wheat varieties at the different growth stages

Cultivar	Growth stage			
	BBCH 24-27 (Tillering)	BBCH 32-34 (Stem elongation)	BBCH 58-62 (Heading–anthesis)	BBCH 70-73 (Early milk maturity)
Skagen	0.44b	0.49d	0.80b	0.89ab
Julius	0.65a	0.78a	0.87a	0.87b
Edvins	0.68a	0.61c	0.77b	0.77c
Artist	0.62a	0.74ab	0.90a	0.88ab
Aron	0.72a	0.77ab	0.87a	0.90a
Evina	0.67a	0.73b	0.86a	0.88ab

Table 4. Chlorophyll *a/b* ratio in the leaves of different winter wheat varieties at the different growth stages

Cultivar	Growth stage			
	BBCH 24-27 (Tillering)	BBCH 32-34 (Stem elongation)	BBCH 58-62 (Heading–anthesis)	BBCH 70-73 (Early milk maturity)
Skagen	3.72a	3.19abc	3.45a	3.24a
Julius	3.58a	3.31ab	3.48a	3.20a
Edvins	3.67a	2.91c	3.35b	3.03b
Artist	3.32a	3.07bc	3.48a	3.10b
Aron	3.42a	3.12abc	3.33b	3.18a
Evina	3.69a	3.39a	3.30b	3.18a

Table 5. Leaf area index (LAI) of different winter wheat varieties at the different growth stages

Cultivar	Growth stage			
	BBCH 24-27 (Tillering)	BBCH 32-34 (Stem elongation)	BBCH 58-62 (Heading–anthesis)	BBCH 70-73 (Early milk maturity)
Skagen	0.5c	3.1a	5.7a	4.0a
Julius	0.7b	3.1a	5.4b	3.6ab
Edvins	0.7b	2.9a	5.8a	3.6ab
Artist	0.9a	2.5b	4.5c	3.6ab
Aron	0.5c	2.6b	5.9a	3.1bc
Evina	0.4c	1.5c	3.2d	2.8c

Note. Different letters within a column indicate significantly different means at the 95% confidence level

Conclusions

1.The amounts of photosynthetic pigments (chlorophylls *a*, *b* and carotenoids) in different winter wheat varieties varied. The winter wheat variety Aron accumulated the highest contents of photosynthetic pigments during the tillering and stem elongation stages, while during the heading – anthesis and early milky maturity stages - winter wheat varieties Artist and Skagen.

2.In the field experiment, LAI of different winter wheat varieties differed. Significantly higher LAI was found for the winter wheat variety Artist (0.9) after the regrowth (BBCH 24–27) and for Skagen (4.0) at the end of vegetation (BBCH 70–73). The highest LAI of winter wheat was determined during the heading - anthesis stage (varieties Aron, Edvins, Skagen). During the growing season, the lowest LAI was observed for winter wheat variety Evina.