Thesis title: Evaluation of carbon dioxide gas exchange in the cultivation of selected agricultural crops and basket willow.

Keywords: carbon dioxide gas exchange, wheat, triticale, rapeseed, basket willow

SUMMARY

The aim of the study was to determine the CO_2 gas exchange in the cultivation of three winter crops and the basket willow for energy purposes, and to evaluate the impact and relationships of weather, production, soil and physiological factors on this exchange.

The research was carried out in 2016-2018 on the fields of RZD "Kępa-Puławy", in Sadłowice, in the triticale, rapeseed and wheat and in the basket willow crop. Measurements of CO_2 gas exchange between soil and atmosphere were carried out using an automated ACE chamber system. In the study, the yield of grain/seed and straw of the plants, yield structure (plant density, weight of one thousand grains/seeds), and plant height were determined. In addition, the value of the leaf area index - LAI was determined, and the nitrogen content of the plants was evaluated with the SPAD test. Based on the collected data, significance analysis of differences, Spearman's rank correlation analysis and principal component analysis - PCA were carried out.

The basket willow crop had a significantly lower (16%) gas exchange of CO_2 from the soil than the compared winter agricultural crops (wheat, triticale and rapeseed). The highest intensity of CO_2 gas exchange, especially for agricultural crops, was noticed in the second half of May.

Cumulative CO_2 efflux from the soil in wheat and willow crops followed a very similar pattern, while it was higher in rapeseed and triticale crops than for willow.

Spearman's rank correlation analysis showed that LAI and SPAD indices and soil temperature were the parameters most positively correlated with CO_2 gas exchange in willow cultivation, while PAR index, SPAD index, soil temperature and precipitation were the most positively correlated parameters in agricultural crops. In addition, the parameter negatively correlating with CO_2 gas exchange was soil moisture, regardless of plant type.

The scatter projection of parameter weights in the PCA analysis showed that soil CO_2 gas exchange positively correlated with plant density, soil and air temperature, and PAR radiation.

Negative correlations were with precipitation, plant phosphorus content, LAI index in the 0 cm layer and humus content.

On the basis of PCA analysis, different characteristics of the formation of parameters were shown for agricultural plants and willow, which would confirm the second research hypothesis.

The PCA analysis also made it possible to separate two groups by survey period, one covering 2016 and 2018 and the other containing 2017.

As a result of the principal component analysis, the best fit of CO_2 gas exchange measurements was recorded for triticale in 2016, in the crop of which the highest values of this exchange were determined.

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