

Abstract

Ongoing climate change is one of the biggest challenges, which agriculture is facing today. The intensification of greenhouse gas emissions, the associated temperature increase, and the occurrence of extreme weather events make it extremely important to find ways of adapting crops to climate change. One possible solution is using antitranspirants (AT) - products that reduce plant transpiration. AT are mainly used on fruit and vegetable crops, whereas their use in grassland areas has not received much attention.

This study aimed to determine the effect of application of silicon-containing antitranspirant on the yield and net exchange of carbon dioxide fluxes in a three-cut meadow with a subirrigation system. Field studies were conducted on a meadow in Racot (Wielkopolskie Voivodeship) in 2021-2022. For the duration of the experiment in the subirrigation system, a closed valve on the ditch was left, thus obtaining two study sites: one with a high groundwater level and the other with a lower groundwater level. Within each, two plots (one with and one without AT application) were separated. CO₂ fluxes were measured using the dynamic closed chamber method. Furthermore, the yield obtained was assessed during each cut.

This study showed that applying an antitranspirant with silicon reduced the yield of the meadow in each cut in both the sites with high and lower groundwater levels. The annual reduction was 11.1-17.8%. It was also observed that in the first year of measurements (2021), net CO₂ emissions predominated in the meadow, while in the second year (2022), net CO₂ assimilation dominated. There was a positive effect of the AT application on increasing gross primary production (GPP), but only in the site with high groundwater levels. The cumulative annual net ecosystem exchange (NEE) values indicate that the AT with silicon application positively improves the meadow carbon balance (by reducing net emissions or increasing net assimilation depending on the year) in the site with a high groundwater level.

Key words: meadow, silicon, antitranspirant, carbon dioxide, yield

A handwritten signature in black ink, appearing to read 'J. Kowalski', with a long horizontal flourish extending to the right.