Abstract

Agriculture is one of the sectors sensitive to the availability of water. As a result of ongoing climate change and the related changes in the temporal and spatial distribution of precipitation, new adaptation solutions to new conditions are being sought. Drainage systems associated with agricultural areas can be helpful as single-function drainage networks. It is possible to change the current function by using a simple solution that allows stopping drainage outflows, the practice of controlled drainage.

The aim of this doctoral dissertation was to determine the impact of the use of controlled drainage outflow on selected elements of soil water management and the quality of drainage water outflows flowing into nearby surface waters. Field research was carried out at the Ostrowo Szlacheckie drainage facility in drainage section 42 in 2019-2020. Two drainage subdivisions were allocated to two different drainage practices, including conventional drainage, also called free drainage (FD) in the literature, and controlled drainage (CD). Based on measurements and field tests, physical and chemical analyzes of soils and drainage runoff, and chamber work, input data for modeling were determined. The recorded groundwater levels were used to calibrate and validate the DRAINMOD model. Several variants of CD operation were established for modeling, taking into account several variable meteorological conditions, the initial depth of groundwater, and the CD start date.

The obtained modeling results showed that the date of starting CD practice has a significant impact on its effectiveness. Based on the research performed, it was shown that March 1 is the appropriate date. It allows for a significant extension of the period during which the groundwater table remains above the level of drain placement, and an increase in the average number of days is also anticipated in the near future. Starting CD at this date allows for a significant reduction in drainage outflows and reducing the amount of nutrient loads carried away.

Keywords: agriculture; climate change; drainage water management; subsurface drainage; DRAINMOD

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