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Summary of the dissertation entitled:

"Evaluation of production and environmental effects of digestate fertilization of plants used for biogas production"

Keywords: digestate, biogas, methane, anaerobic digestion, mineral fertilization, organic fertilization, triticale, corn, sorghum.

In the era of climate warming, which is caused, among others, by environmental pollution, alternative sources of energy are being considered, based on locally available raw materials, which will be able to fit into the closed-loop economy. Such a solution may be the production of biogas in the process of anaerobic fermentation, to which substrates will be energy-efficient plants, easy to grow and at the same time adapted to the changing climate conditions. Also important is the yield of these plants and their high quality is also important, which can be achieved by optimizing fertilization, not causing a risk to the environment.

In 2016, a three-year two-factor field experiment was established, where the first-order factor was the fertilization variant and the second order factor were the plant species (triticale, maize, sorghum). Fertilization was carried out at two dates: pre-sowing and topping. The first variant included of nitrogen fertilization exclusively mineral, in the second variant the pre-sowing plant were fertilized with digestate and the topping plant with mineral fertilizer, while in the third variant as a fertilizer used digestate at both dates. The production and environmental effects of fertilization with digestate were analyzed. The quality of biomass was also evaluated in terms of its chemical composition, as a raw material for biogas production. Selected physiological parameters were examined, i.e.: nutritional status of the plants, covering the ground surface by the canopy of these plants and the associated intensity of photosynthetic active radiation (PAR). An additional parameter, was the analysis of efficiency of methane fermentation and energy productivity per unit area. Another aspect of the research concerned the influence of the given fertilization variants on:

- chemical properties of soil,
- leaching of nitrogen deep into the soil profile,
- penetration resistance and soil moisture,
- number and weight of earthworms.

The use of the digestate from the agricultural biogas plant to fertilize triticale, corn and sorghum increases the possibility of environmental protection in terms of fertilizer management in a closed

circuit. The digestate from agricultural biogas plant, positively influences the production effects of cultivation of selected plants, used as substrate for biogas plant. Regardless of the applied variant of fertilization, the examined plants were equally well supplied with nitrogen. The same was in the case with PAR, which affects the photosynthesis of plants, and thus the yield of plants. Fertilization with digestate makes it possible to give up fertilization with mineral nitrogen, without affecting the physiological parameter of the plants and their yields. The applied variants of fertilization did not significantly differentiate the methane fermentation process efficiency of the biomass of the tested plant species. Analyzing different variants of fertilization, no significant differences were observed in the efficiency of methane fermentation process, while among the tested plant species, the highest productivity of methane and energy per unit area was obtained from maize silage, and the lowest for triticale.