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UPWr Base of Knowledge - link:	https://bazawiedzy.upwr.edu.pl/info.seam?id=UPWrff1cfbc9cb68405b8c59ee2da687abc5&affil=&lang=pl
Researchgate:	
Personal website / Working group website:	
Participation in projects in last 5 years (chronological; with distinction into PI (kierownik) and RF (wykonawca)):	Spectroscopic and chemical properties of soil humin fraction in relation to their interaction with pesticides 2019-2022; RF; Soil management effects on soil organic matter properties and carbon sequestration (SOMPACS) 2022-2024; RF
Do you plan to engage support of second supervisor or auxiliary supervisor?	YES
	Auxiliary supervisor
Name and surname:	Jakub Bekier
Academic Degree:	dr inż. (Dr. Eng.)
Faculty, Institute/Department:	Faculty of Life Sciences and Technology, Institute of Soil Science, Plant Nutrition and Environmental Protection
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ORCID:	https://orcid.org/0000-0001-7793-8396
UPWr Base of Knowledge - link or most important publications from last 3 year (JCR) / patents from last 3 years (maximum 5):	https://bazawiedzy.upwr.edu.pl/info.seam?id=UPWr51b970e370f24b26aebc54dc5a9f7ed7&affil=&lang=en
Researchgate:	
Personal website / Working group website:	
Projects in last 5 years (chronological; with distinction into PI (kierownik) and RF (wykonawca)):	Spectroscopic and chemical properties of soil humin fraction in relation to their interaction with pesticides; 2019-2022 RF; Determination of the intensity and directions of humification during co-composting of wood-based biomass under conditions of stimulation with microbiological preparations 2022-2023; PI
PhD topic:	Turnover of organic matter enhanced by microbial stimulation during composting of lignocellulosic biomass
Research discipline in Doctoral School:	Agriculture and Horticulture
	Peat resources are of key importance in reducing the greenhouse effect as a result of CO2 sequestration and water retention, and therefore their use is limited. Exploitation of peat from very sensitive ecosystems (peat bogs), which regenerate very slowly, contributes to the degradation of natural habitats and adversely affects biodiversity and the functionality of peatlands. Currently, its exploitation and use for heating purposes are prohibited in Poland. For gardening purposes, the requirements for peat are specified in the national standard PN-78/G-98016. In many countries, efforts are being made to limit the use of peat and coconut fiber in horticulture by using alternative substrates. In accordance with the principles of sustainable horticulture, it is advisable to replace these substrates with other organic materials obtained locally. This arouses increasing interest in finding new solutions in the field of horticultural substrates. One proposal may be the production of compost based on readily available plant materials that is physico-chemically appropriate, pathogen-free, and environmentally friendly. Many studies confirm the possibility of using compost as a substrate for vegetable crops without causing a negative impact on the environment. Willow (Salix sp.) is a native species used for many centuries as a braiding plant, medicinal plant, or for strengthening the banks of water courses. In recent years, the use of this species has been extended; cut willow shoots (chips) are a valuable biomass used for energy purposes. This was mainly due to the energy and climate policies aimed at reducing CO2 emissions and reducing the greenhouse effect and climate warming. The EU has set a long-term task to develop a resource-efficient and low-carbon economy by 2050. Due to the competition of forest biomass as well as imported biomass, the decrease in the value of the so-called green certificates meant that producers of willow biomass had a problem with its sale. One of the methods of willow's biomass management is aerobic biostabilization - composting. Composting is a part of the oxidative processes of biological and biochemical transformations that occurs under strictly defined temperature, humidity, and pH conditions, as well as the C/N ratio. The influence of these factors affects the creation of suitable conditions in the composted material for microorganisms carrying out a cycle of transformation processes. The most important aspect of the production of compost is to ensure the proper course of the organic matter transformation process so that the product obtained does not pose a threat when it is introduced into the environment and brings tangible benefits in the form of a positive impact on soil properties, plant growth, and development. To achieve these goals, monitoring compost maturation and its quality is undoubtedly the highest priority in

Short description of the research problem to be solved in the PhD (minimum 1000 characters):	research supporting agronomy and environmental sciences. The direction of organic matter transformation during the process depends on the type of composted material. There is limited knowledge in the case of willow biomass composting. The purpose of the proposed thesis is to optimize the conditions of the composting process of willow (Salix sp.) sawdust to ensure the correct course of organic matter transformation. The addition of nitrogen to the willow biomass is necessary to accelerate the decomposition process due to the low content of this element in the plant. The first question will be: (1) Which form of additive—mineral or organic—will have a better effect on the acceleration of the decomposition process and the transformation of organic matter towards the formation of more stable humic substances? The second question will be: (2) To what extent will the introduction of micribial additives change the dynamics of organic matter decomposition? In the presented application, a new solution will be tested to improve the effectiveness of the composting process. A series of experiments will include: testing variants of chemical and biological additives in the biomass of willow chips; monitoring of the composting process; changes in microbiological activity during composting; biological tests (pot experiments and Petri dishes experiments); and pot experiments to ensure the safety of the product. Compost piles with the cut biomass of willow chips fraction will be prepared in the variants with the addition of organic and mineral materials, which will enrich the composted biomass in nitrogen (Chen et al., 1997) and accelerate the biotransformation of willow chips. The quality and stability of organic matter will be determined in various maturity stages on the basis of the fractional composition of humic substances (quantitative analysis), quality parameters like the elemental composition of humic substances, structural analysis and assessment of the antioxidant properties of willow chip composts and their mixtures with the substrate, as well as the quantitative and qualitative changes in the species composition of microorganisms. Compost samples from various stages of maturity will be taken for laboratory analysis. The pot experiment will allow us to estimate the quality, stability, and safety of compost. Planned analysis includes in the samples of compost in various stages of maturity: moisture content, EC, ash content, total organic carbon and total nitrogen content, content of mineral forms of nitrogen (N-NH4 and N-NO3), pH, total and water-soluble content of selected macro- and micronutrients, CEC; biological tests using Lepidium sativum L. and chemical composition of tested plants from the pot and field experiments; changes in the biological activity of composts; analysis of humic substances will include fractional composition of humic substances and extraction of HS to the detailed structural analysis. In the isolated humic and fulvic acids, the following will be performed: elemental composition, optical properties (UV-VIS, FTIR spectra, and 13C NMR spectra), EPR analysis, and antioxidant properties of compost. HPLC analyses for determining the hydrphobic and hydrophilic properties of humic substances will be performed. Results will allow for the determination of directions of organic matter transformation, their humification degree, stability, and properties of humic substances with their functional groups, as well as the degree of aliphaticity and aromaticity of the molecules. Assessment of the antioxidant properties of willow chip composts and their mixtures with the substrate and soil will be an interesting part of the organic matter characteristics. Expected results will contribute to limiting environmental degradation caused by the excessive exploitation of peatlands.
Professional skills for PhD candidate (e.g. master program, specializations, softwares, language, analytical techniques, minimum 500 characters):	Graduation in chemical, biological, agricultural, or environmental sciences. Good command of the English language in reading, writing, and talking. Basic knowledge in the field of soil science (in particular soil chemistry), botany, and environmental microbiology; experience working in a chemical laboratory; basic skills in chemical analyses. The ability to use the MS Office package and basic statistical tests. Knowledge of statistical software will be welcome. An analytical mind will be necessary. Candidates who have experience with the issues of the composting process will be preferred.
a) Project title:	0
b) Agreement number:	0
c) Number of months in the project to support PhD student (in months; starting from 1st of October 2024):	48
Project website:	