

Data of Supervisors of the Doctoral School at WPUT

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Scientific Discipline(s):	Agriculture and Horticulture; Biology
Research Areas (max. 2000 characters):	Nutrient deficiencies in soil are one of the main challenges in modern agriculture. They affect plant growth, development, and yield. Nitrogen (N) and potassium (K) are elements of particular importance. Their deficiency, both individually and in combination, significantly limits the plants' adaptive capacity to unfavorable environmental conditions. In the course of the ongoing research, the response of different rye genotypes (open-pollinated cultivars, hybrid cultivars, inbred lines etc.) to nitrogen, potassium, and nitrogen-potassium deficiencies in the soil is analyzed. The studies are conducted using <i>in vitro</i> rye mature embryo cultures. This approach allows for precise control over environmental conditions, thus enabling accurate determination of seedling responses to induced stress. Similar to other methods, we aim to demonstrate the correlation between plant stress tolerance in the seedling phase, determined in mature embryo cultures, and in the adult plant phase. Genotypes that tolerate stress at the seedling stage may retain this trait in the adult plant phase, though this is not always the case. They are often more sensitive than mature plants. However, if seedlings effectively activate adaptive mechanisms—such as gene expression responsible for nutrient uptake or morphological root changes (e.g., elongation) - the plant may maintain tolerance in later developmental stages as well. This aspect is also the subject of parallel research. We focus on preparing research materials for genetics, genomics, and comparative transcriptomics (F2 progenies, sets of RILs). We are refining a methodology for inducing a precisely measured concentration gradient in the medium, starting with nitrogen ions and later potassium ions, to trigger and subsequently measure different stress states in the plant in real time. This methodology is being developed based on our own solutions, some of which are already patented. In statistical analyses, we apply advanced statistical methods, including multiblock data analysis with the use of a regularization hyperparameter (τ).
Keywords (max. 10):	rye, abiotic stresses, mature embryo cultures, mapping populations, molecular markers, genes, multi-block data