

Innovative integration of phenomics, genomics, and machine learning into dairy cattle breeding in Croatia
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In response to emerging challenges in animal breeding, we have launched a project to introduce cutting-edge technologies into dairy cattle breeding in Croatia. Our approach integrates the latest advancements in phenomics and genomics to explore innovative methodologies that could be routinely applied in dairy breeding programs. A key component of this project is low-pass whole genome sequencing (lpWGS) performed on milk samples. Beyond providing genomic SNP data, this approach enables the retrieval of complete mitogenomes, insights into milk microbiota composition (e.g., mastitis pathogen detection), and the estimation of mtDNA copy number, a potential novel phenotype associated with milk production and health. We also apply machine learning techniques to analyze large-scale FTIR spectral data, focusing on milk coagulation traits and key milk components. This approach offers a robust model for managing big data with direct applications in dairy breeding and cheese production. While the project has a strong applied focus on integrating novel breeding tools into Croatian dairy farming, we also investigate underexplored inheritance mechanisms, particularly the influence of sex chromosomes and mito-nuclear interactions on quantitative traits. The PhenoGeno-IP-2022-10-6914 project (<https://angen.agr.hr/en/group/112/PhenoGeno>) is funded by the Croatian Science Foundation.