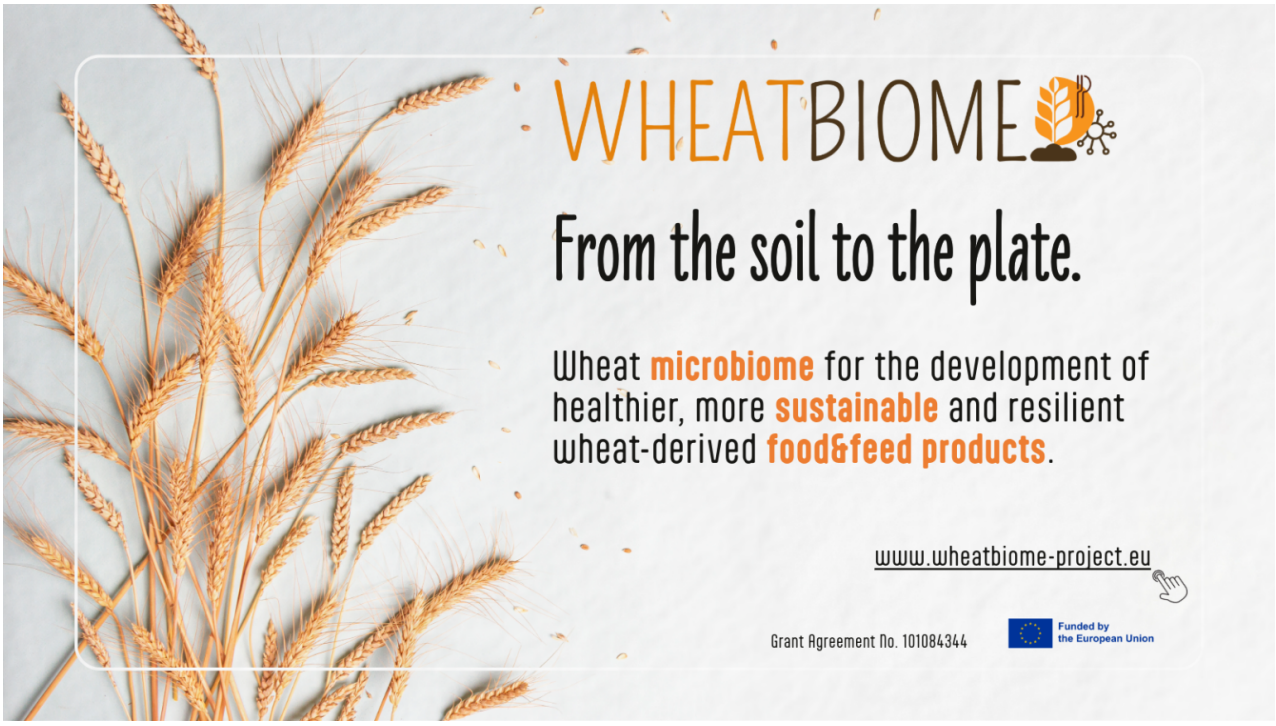
Microbiomes for the future of sustainable wheat production

openaccessgovernment.org/article/microbiomes-for-the-future-of-sustainable-wheat-production/177686

3 June 2024



Researchers from the WHEATBIOME project joined forces to address several challenges related to sustainable wheat production and consumption, revealing the role of microbes in shaping the Future of Healthy Food

Food systems are facing unprecedented challenges due to the increase in the world population, climate change, and geopolitical instability, which threaten food security and prices. Additionally, systemic inefficiencies and massive food waste from crop harvest to consumption have been observed. This scenario imposes an urgent unification of different scientific research areas to advance knowledge on a future-proof agrifood system.

Wheat is a staple crop facing stagnant production in Europe due to increasing biotic and abiotic stresses exacerbated by climate change. Its nutritional importance spans human and animal consumption, yet its immunogenicity poses health risks like gluten sensitivity and celiac disease.

Understanding and mitigating these risks is critical for the development of novel wheat-based foods. Beneficial microbes offer potential solutions, playing crucial roles in agricultural and environmental health, including on wheat growth and quality. Improving sustainable wheat production and addressing human health concerns require

interdisciplinary efforts aligning agronomic, nutritional, and technological considerations. Settled on a collaborative network, WHEATBIOME aims to address agrifood challenges with a unique perspective from soil to plate.

This project also includes knowledge transfer to farmers on strategies towards high-quality sustainable wheat production. The final goal is to advance novel and tasty wheat-based products with reduced immunogenicity while ensuring their quality and safety through integrative processing technologies advocating consumers' demands for healthy and sustainable food products.

Soil-plant microbiota crosstalk, where the food begins

Embracing eco-conscious agriculture and addressing soil quality and health is pivotal for environmental stewardship and long-term food security. Soil harbours a vast microbial diversity vital for ecosystem functions such as nutrient cycling and plant growth promotion. Moreover, plant microorganisms (endophytic or epiphytic) also play a role in improving water and nutrient uptake and enhancing plant tolerance.

Plant-microbe interactions are dynamic, impacting plant health and soil fertility. However, agricultural practices can also alter microbial diversity. Understanding soil microbiota's influence on plant nutritional health and deciphering how environmental factors and agronomic practices shape soil and plant microbial communities is crucial to predicting how the symbiotic microbiome-plant ecosystem impacts plant-based food production and quality. Moreover, these beneficial microorganisms can be highly relevant to developing bioformulations targeting plant resilience to different stresses.

WHEATBIOME aims to explore soil and plant microbiomes' impact on plant metabolism and nutritional quality. This interdisciplinary approach seeks to understand how plants recruit microbiomes, influencing food composition and the level of bioactive compounds.

Food processing, matrix interactions, and microbiota in novel food design

Balancing consumer demands for healthier, sustainable, and ethically produced food options aligned with appealing sensory properties is essential. The concept of the food matrix effect, considering molecular interactions within food structures, is gaining prominence in food processing, nutrition, and health. Understanding these interactions is pivotal for designing novel foods and advancing novel food processing technologies.

Microbial communities are key players in creating sustainable, healthy, and tasty foods. These microorganisms can metabolize several (bio) chemical components in food matrices, generating new compounds that shape the sensory attributes, nutritional properties, and safety of fermented food. Microbiota, food processing, and matrix interactions can influence the nutritional quality, immunogenicity, and bioactive compound levels of food products. For instance, wheat sourdough fermentation shows promise in reducing immunogenic peptides in food, which are associated with gluten intake-related diseases. Phenolic compounds present in food can also affect gluten immunogenicity by binding to gluten-derived proteins, facilitating gluten detoxification.

WHEATBIOME seeks to understand the impact of food matrix-microbiota interactions on designing sustainable, healthy, and tasty microbial-based foods, addressing both consumer preferences and nutritional concerns.

From prototypes to novel food: regulation and policies for fermented foods

Producers embarking on developing new applications of fermentation processes face a complex labyrinth of regulations covering food safety, novel ingredients, and labelling.

Wheat-based fermented foods have been produced since ancient times. However, the potential use of autochthonous wheat microbiota remains unexplored. Wheat microbiome can offer a unique source of microbial communities, most of which have probiotic activities, which can be used in the design of novel functional foods.

A hygienic environment is imperative throughout food production, including prototype development. This will ensure that hazards such as mycotoxins, pesticides, heavy metals, and microbial contaminants like *Salmonella and Listeria* are addressed to prevent public health issues.

The use of microbes in food processing and production poses an extra risk for contamination with harmful bacteria or toxigenic pathogens. EFSA defines the Qualified Presumption Safety status of the microorganisms as a pre-assessment in market authorization applications, with full safety assessments if concerns arise. The use of novel microbes in food production requires a product's pre-market authorization that is governed by the Novel Food Regulation (Regulation (EU) 2015/2283).

New fermented products may fall under the Novel Food Regulation if they lack significant EU consumption history before May 15, 1997. The developers must provide all data to the EFSA for risk assessment, and precedents aid decisions.

The correct labelling of these novel food products poses further challenges, especially concerning nutrition and health claims, labelling of potential allergens like gluten, and avoiding consumer misinformation.

Please Note: This is a Commercial Profile