



SUSTAINABLE AGRONOMIC TECHNIQUES AND FOOD TECHNOLOGIES IN NATIVE SICILIAN LEGUMES

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State of art

Faced with growing challenges such as resource depletion and exponential growth in the global population, finding alternative protein sources is a forward-looking way to ensure a sustainable and secure food system. In recent years, the European Union has promoted initiatives to identify and enhance the consumption of alternative and sustainable plant-based protein sources, including the recovery and revaluation of traditional and local crops. **Sicily** is an important biodiversity hotspot in the Mediterranean area, with 20% of its agricultural land dedicated to legume cultivation. However, some ecotypes of Sicilian legumes, such as **"black chickpea"** and **"black lentil"** despite having a high nutritional profile have been abandoned over time for various reasons, such as their dark color and atypical shape. Additionally, their high fiber content requires long preparation times, which are not compatible with the changing lifestyles that offer less and less time for cooking.



In the literature, several studies report that the addition of legume flours in food production enhances nutritional and functional values. Turfani et al. (2017) demonstrated that legume flours used as protein-enriching agents in baked products increase lysine, dietary fiber, and phenolic compounds, and improve antioxidant activity, whereas Imam et al. (2024) reported that gluten-free pasta made with legume flours positively impacts celiac patients by enhancing nutritional quality. Recently, Tang et al. (2024) reported that green and mild extraction technologies, such as pulsed electric fields, ultrasonic and microwave-assisted, and enzyme-assisted extraction, have been applied to obtain ingredients from legumes. These methods reduce energy consumption compared to traditional techniques.

The aim of the research project

This PhD project aims to exploit different ecotypes and local populations of Sicilian neglected grain legumes as sources of alternative and sustainable proteins. Grain legumes will be produced from experimental field trials using sustainable agronomic techniques that support biodiversity. The legumes will be transformed into flour or ingredients through emerging technologies, which will be used to create enriched and sustainable foods. Given the high protein and fiber content of legumes, they will be tested in the formulation of foods for sports nutrition, such as protein bars and supplementary drinks.

PhD Thesis Objectives and Milestones

Activity Mounts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A1) Selection of neglected legume varieties																								
1) Recovery and selection of legumes																								
2) Cultivation, harvesting and evaluation of agronomic parameters																								
A2) Legume flour production																								
1) Pre-milling treatments and milling process																								
A3) Legume flour characterization																								
1) Chemical analyses																								
2) Physico-chemical analyses																								
3) Techno-functional analyses																								
A4) Development of food ingredients																								
1) Emerging technologies for ingredient extraction																								
2) Antinutrients and FODMAPs reductions																								
A5) Production of innovative sportspeople foods																								
1) Protein bars																								
2) Supplements drinks																								
A6) Sensory analyses and acceptability																								
1) Quantitative Descriptive Analysis (QDA)																								
2) Consumers science test																								
A7) Thesis and Paper Preparation																								

Selected Reference

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