SmartFood: Engaging citizens in food diversity in cities

D4.6. Food quality report

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Responsible author	Łukasz Gontar (RIC)		
Contributors	Andżelika Drutowska (RIC) Rafał Majzer (RIC) Maksymilian Kochański (RIC) Katarzyna Korczak (RIC) Iwona Adamkiewicz (RIC)		
Reviewer(s)	Ewa Duda (MGU) Mari Hanssen Korsbrekke (WNRI)		
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Executive Summary

This report provides a comprehensive evaluation of hydroponic cultivation experiments aimed at optimizing plant growth, nutritional quality in SmartFood Cabins, and the integration of insect farming in SmartFood Insectarium (Insect Box). The analysis covers fertilisation, light demand, biofortification, and quality of insects as potential food product, offering valuable insights for advancing hydroponic and edible insect consumption practices in urban agriculture.

The fertilisation experiment investigated the impact of varying ratios of fertiliser components A (rich in macronutrients such as nitrogen and potassium) and B (containing phosphorus and micronutrients like iron, manganese, and zinc) on plant growth and quality. The study identified the 1:1 ratio of components A to B as the optimal formula for maximising both fresh and dry weights across multiple plant species. This ratio effectively supports plant growth while maintaining lower levels of nitrates and nitrites, thus ensuring food safety. The 2:1 ratio, although enhancing protein and ash content, was found to be less effective for overall plant biomass and led to higher nitrate and nitrite accumulation, posing potential health risks. The 3:1 ratio yielded intermediate results, proving less favorable for both growth and nutrient density. These findings stressed the necessity for precise nutrient balance in hydroponic systems to achieve optimal plant growth and nutritional quality.

The light demand experiment evaluated the effects of different light intensities on plant growth and nutritional parameters. Results indicate that maintaining light intensity at 50% of maximum lamp power (400 µmol/m²/s) is the most effective setting for balanced plant growth and nutrient accumulation. This moderate intensity supports biomass production and energy efficiency, making it the preferred choice for hydroponic cultivation in SmartFood Cabins. In contrast, lower light intensity (25%) resulted in suboptimal growth, while higher intensity (75%) induced light stress without significant benefits to plant growth, emphasizing the need for carefully controlled lighting conditions in hydroponic systems.

The biofortification experiment explored the effects of iodine supplementation on plant health and iodine content. The study found that a 3 mg/L iodine supplementation level is sufficient to enhance iodine content in plants without adverse effects on growth or quality in many plants. The results highlight the potential of iodine biofortification to address micronutrient deficiencies but stress the importance of precise dosing to avoid negative impacts on plant health.

Overall, the sequential experiments collectively provide a framework for optimizing hydroponic cultivation practices in SmartFood Cabins. The findings highlight the critical balance between nutrient ratios, light intensity, and micronutrient supplementation to achieve the best outcomes in plant growth and nutritional quality. The 1:1 ratio of fertiliser components A to B, 50% light intensity, and 3 mg/L iodine supplementation emerge as the optimal settings for SmartFood Cabins as hydroponic systems dedicated to home growers. These settings enhance plant productivity and nutritional value while ensuring food safety, contributing to the development of more efficient and sustainable urban farming solutions.

The insect research explored the effects of different feeding conditions on mealworm larvae, focusing on the nutritional quality of insects fed with plants grown under various experimental conditions. Mealworms fed with hydroponically grown plants displayed variations in protein, fat, and ash content depending on the plants' nutrient and light conditions. The integration of mealworm farming with hydroponic systems offers a sustainable approach to producing high-quality animal protein, utilizing off-quality plant parts as feed. However, feeding insects with vegetables that have low moisture content and high levels of aromatic compounds (such as those found in herbs) is less favourable compared to feeding them root vegetables like carrots, which were used as the control feed.

In conclusion, the presented insights contribute to the advancement of sustainable urban agriculture by providing practical solutions for maximizing plant and insect production while addressing nutritional and environmental goals.