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THE POWER OF SCIENCE

Many perspectives on our world

ABSTRACT BOOK

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Non-targeted NMR analysis of salads from aquaponic systems

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Abstract body

This study aimed to investigate the differences in bioactive substances between aquaponic and hydroponic plant cultivation, with focus on lettuce. The experiment involved growing the lettuce using four different cultivation technologies in three replicates (aeroponic, expanded clay, raft technology, and substrate). Irrigation was provided with either an aquaponic or hydroponic nutrient solution. The cultivation lasted for 29 days. After harvest, the samples were weighed and lyophilized. Each sample was homogenised by crushing and extracted with methanol for analysis using untargeted ^{1}H NMR spectroscopy. ^{1}H NMR analysis was performed using the 1D NOESY method, and then the spectra were adjusted in the ChenomX program. The signals of the spectra were assigned to twenty-one substances, quantified, and exported in exact concentrations for further statistical processing. A principal component analysis was performed, which revealed the first differences. Statistically significant differences between hydroponics and aquaponics were revealed for three substances: glutamine, GABA and sucrose. Samples of lettuce were also analysed for dry weight and fresh weight and also nutrient solutions were analysed for electrical conductivity, pH, temperature and O_2 levels.

The amino acid glutamine exhibited the most significant difference, showing lower levels in samples cultivated with the aquaponic solution. Glutamine plays a role as a nitrogen reservoir and regulator of plant growth, and its increased abundance can serve as an indicator of nitrogen deficiency stress. This hypothesis gains support from additional statistically significant variations in the content of other substances, specifically sucrose and GABA, which were also found in lower quantities in aquaponic samples. Significant differences were also found between aquaponic and hydroponic nutrition according to fresh weight and dry matter. Whereas aquaponics showed lower level of dry matter percentage, higher level of fresh weight was observed. The results showed a significant distinction between aquaponics and hydroponics, suggesting that aquaculture may potentially improve the resilience of the crops. To further support this hypothesis additional studies are needed. This research can aid in the development of more sustainable cultivation practices not only for lettuce. Overall, these findings highlight the promising potential of aquaponics as an intriguing ecosystem for future sustainable cultivation.

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