

## Organic vs Conventional Farming of Wheat: Influence on Metabolite Profiles

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The increasing popularity of organic farming and organic food leads to a great economic interest in finding discriminating analytical methods to ensure the authenticity of organic labeled products. Using a metabolite profiling approach, we set out to identify biomarkers capable of distinguishing organic and conventional wheat.

Wheat grown under the well controlled conditions of the long term DOK-field trial of the Research Institute of Organic Agriculture (FiBL) and the research station Agroscope Reckenholz-Tänikon (ART), Switzerland was chosen for analysis. In the DOK-field trial organic and conventional cultivation is performed in four plot replications at the same location. We analysed 11 different wheat varieties of the harvest year 2007 to assess the influence of a diverse genetic pool on the spread of analytical results. Additionally, samples of the wheat variety "Runal" were taken over three harvest years in order to account for influence of seasonal variations. Metabolite profiles were generated with GC-MS from derivatised methanol extracts of finely ground whole wheat grains. Employing these techniques on the variety "Runal", we were able to identify 48 metabolites and additionally to detect 245 not identified metabolites (TAGs). In this pool of biomolecules, three metabolites showed significant differences in normalised peak areas in all three harvest years of "Runal". Across all 11 varieties of the 2007 harvest year, 5 metabolites and 11 TAGs with significant differences in peak areas between the cultivation forms were detected, using Student's t-tests. PCA performed on data for the individual varieties revealed a clustering according to the cultivation forms. However, PCA of metabolites and TAGs of combined data of all 11 varieties did not result in a clustering.

Based on individual varieties, metabolite profiling has shown promising results with respect to discriminate organic and conventional wheat. Results viewed across all 11 varieties indicated a higher influence of the variety and seasonal effects than the cultivation form on metabolite concentration. Further work will prove, if significant differences of concentrations in individual metabolites and TAGs can be used to discriminate between cultivations forms across multiple wheat varieties. This work is conducted as part of the research project "Advancement and recommendation for the use of selected methods applicable to differentiate organic and conventional products" (Project No 08OE023 and 08OE044), funded by the German Federal Ministry of Food, Agriculture and Consumer Protection within the „Bundesprogramm Ökologischer Landbau und andere Formen nachhaltiger Landwirtschaft“.