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HOW DO WE DETERMINE PLANT QUALITY OF ORGANIC CROPS?**S. Husted* & K.H. Laursen**

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Plants are photoautotrophic organisms being able to synthesize all metabolites and macro-molecules on the basis of light, CO₂, H₂O and 14 inorganic elements taken up from the soil. As plants are confined to the environment in which they germinate, this means that the plant ionome, metabolome and proteome are heavily influenced by soil mineralogy, climate and not least agricultural management.

Organic plant products within the European Union are produced according to a specific set of regulations, which e.g. implicate that organic plants are cultivated without pesticides and synthetically produced nitrogen (N) fertilizers. In addition, N fertilizers are often used in lower amounts relative to conventional agriculture. Over more than a decade it has been intensively studied whether these marked agronomical differences lead to systematic differences in the chemical composition of plant tissue and whether this has an impact on selected plant quality attributes. From a theoretical point of view the marked differences in fertilization strategies between organic and conventional agriculture will cause systematic differences in the chemical composition of plants. The differences are expected to be very large when comparing plants representing the extremes of organic and conventional agriculture. Thus, if synthetic fertilizers are used exclusively for conventional plant production and in high amounts relative to organic production based on animal manure, green manures, compost etc., the conventional plants are likely to differ from the organic ones. However, in most cases plants are not produced with such extreme fertilization strategies and differences are often masked by natural variation caused by e.g. geographical locations and growth season and thereby little difference in plant quality is usually observed.

Despite the fact that systematic differences in chemical composition between organic and conventional plants are usually overridden by natural variation it was recently found that the type of N fertilizers is reflected in the isotope ratios of plants and that the isotopic fingerprints are unbiased by geographical locations and growth season. However, the fundamental differences in isotope ratios are supposedly irrelevant regarding plant quality, but have shown to be a strong signature for authentication of organic plants products.

In this lecture we will further explain how the fertilization strategy can affect the underlying biochemical mechanisms controlling the chemical composition of plants and discuss how these are related to organic plant quality. Special attention will be given to N fertilizer forms and quantity, as fertilization generally appears to be the single-most parameter with the strongest impact on metabolism when comparing plants from organic and conventional agricultural systems.

Key words: chemical composition, isotopes, metabolites, organic agriculture, plant quality

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