

# Plant polyphenol content, soil fertilization and agricultural management: a review

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Received: 27 September 2016 / Revised: 26 October 2016 / Accepted: 12 November 2016 / Published online: 7 January 2017  
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**Abstract** The review deals with polyphenol content of vegetables and fruits under different experimental conditions. The effect of fertilizers, mainly nitrogen containing fertilizers, on qualitative and especially quantitative content of the polyphenols mixture, was reviewed. Soil nitrogen affects both anthocyanins and flavonoids content, and generally, a higher polyphenolic content is observed when less nitrogen fertilizer is added to the soil. Also the effect of different agricultural management (conventional, organic, biodynamic, integrate) is reviewed with respect to polyphenols. In this case, a major effect has pointed out in the case of vegetables, while agricultural practice affects in a minimal way fruits polyphenols content. The effect of different management is, however, hardly pointed out, since many environmental factors are involved and affect polyphenols biosynthetic pathway.

**Keywords** Flavonoids · Anthocyanins · N-fertilization · Conventional management · Organic management · Biodynamic management

## Introduction

The great number of reviews, published in the last 20 years, substantiates the importance of polyphenols and the

relevance of scientific studies on this subject. Taking into account the reviews published since 2008, a general overlook on the research topics can emphasize the main current fields in which the research is presently developed. The different subjects which may be inferred are: problems in the analytical assays of polyphenols [1–5], polyphenols composition of fruits and vegetables [6–10], the fate of polyphenols in postharvest technology [11, 12], chemistry and biochemistry [13–16], polyphenols and food [17–21], polyphenols and health [22–28]. From this short survey which takes into account only partly the last years, the great number and variety of researches on these plants metabolites can be pointed out. There is a lack of reviews on the relations between polyphenols content, fertilization and agriculture practice, with the exception of a recent review on the possibility of differentiating organic practice by means of secondary plant metabolites in carrots [29], and the review of Stefanelli et al. [18] focused on horticulture quality under minimal nitrogen and water supply.

The aim of this review is concerned with the relationships between polyphenols content, fertilization and agricultural practice correlated to soil management.

## Effect of nitrogen and/or potassium fertilization

As summed up by Nguyen and Niemeyer [30], the carbon/nitrogen balance (CNB) pathways can be taken into account when studying the effect of nitrogen fertilization on phenolic content. Phenylalanine is the rate-limiting precursor for phenylpropanoid synthesis (e.g., lignin, flavonoids and condensed tannins), and at the same time, it is an essential amino acid for protein synthesis. Plant growth is heavily dependent on protein synthesis for the manufacture of photosynthetic, biosynthetic and regulatory enzymes, as well as for structural protein, and phenolic synthesis

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