



# Apple tree growth and overall fruit quality under organic and conventional orchard management

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## ABSTRACT

Two apple (*Malus × domestica* Borkh.) orchards, a conventional and an organic one, were compared in terms of plant growth, marketable fruit quality attributes (fruit weight, shape, color, phenolic compound concentration, nutrients) and yield. The two orchards were located nearby, in order to exclude possible pedoclimatic influences on the measured variables. The two management systems resulted in similar new season's shoot growth and similar fruit quality attributes, in terms of total soluble solids, juice pH, titratable acidity and color indexes, while the conventionally grown trees produced almost twice the yield of the organically managed ones. The flesh plus peel portion of the conventionally produced fruits exhibited higher total flavonoid and o-diphenols concentration, while the flesh portion presented higher flavonoid concentration. Nitrogen concentration was higher in all portions of conventionally grown fruits, while potassium, calcium, sodium and manganese concentrations were higher in the flesh portion of organically produced fruits. Significant differences were observed between management systems concerning fruit nutrient ratios, but their values were within the desired ranges, under both conventional and organic management systems.

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## 1. Introduction

During the last decade the growing consumers' concern towards healthier and safer food along with environmental protection, emphasized the role of agronomic practices as one of the main determinants of food quality and environment protection (Stockdale et al., 2001; Bourn and Prescott, 2002). Agricultural systems are generally classified as organic, integrated or conventional. Organic farming is a form of agriculture which excludes the use of synthetic fertilizers and pesticides, plant growth regulators and genetically modified organisms (Stockdale et al., 2001; Singh et al., 2009). The key principles and practices of organic farm management aim to protect the long-term fertility of the soil, to supply plants with necessary nutrients through natural or organic fertilizers, to control weeds, pests and diseases through crop rotations, natural predators and limited chemical intervention and finally to minimize the negative impact on the wider environment (Peck et al., 2006; Herencia et al., 2007; Singh et al., 2009).

Differences in farm management affect soil dynamics and plant metabolism, potentially resulting in differences in plant produc-

tivity (both yield and quality attributes) (Condrón et al., 2000; Stockdale et al., 2001; Mäder et al., 2002; Herencia et al., 2007). The comparison between organic and conventional agricultural practices focuses on soil fertility and sustainability, on crop nutrition as well as on product quality (Reganold et al., 2001; Stockdale et al., 2001; Herencia et al., 2007). The use of manures and mulches improve soil fertility but it is difficult to estimate the overall input–output nutrient budget of the crop, due to the inconsistent composition of these organic supplements (Herencia et al., 2007). This may gradually result in lower yields and indirectly induce an increase of the products' value (Stockdale et al., 2001; Rembalkowska, 2007).

The aim of the present work was to compare organic and conventional management on an apple orchard in terms of plant growth, fruit set, mineral fruit content, and fruit quality attributes.

## 2. Materials and methods

### 2.1. Orchard site and cultural practices

The experiment took place on adjacent commercial apple orchards, one organic and one conventional, each approximately 1.0 ha, in order to avoid any pedoclimatic impact on the possible differences detected. The soil in both orchards was a clay loam – clay

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