

Productivity and nutritional and nutraceutical value of strawberry fruits (*Fragaria x ananassa* Duch.) cultivated under irrigation with treated wastewaters

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Abstract

BACKGROUND: Agriculture represents a productive sector typically characterized by a high water demand, whereas freshwater (FW) availability is a problem of increasing concern in the world and FW resources are becoming insufficient for sustaining agricultural irrigation. The reuse of treated wastewaters (TWWs) for crop irrigation could be an efficient tool for reducing water shortage. Hence, the present study evaluated the food quality of *Fragaria x ananassa* (cultivar Camarosa) fruits irrigated with four types of treated wastewaters (TWWs). Strawberries were analysed for yield, sucrose, fructose, glucose, total soluble polyphenols (TSP), total monomeric anthocyanins (TMA), and antiradical and antioxidant capacity. In addition, a targeted quantification of the most representative phenolic compounds of strawberry was performed.

RESULTS: TWWs complied the Italian ministerial decree 185/2003 for wastewater reuse, with very few exceptions, mainly represented by chloride concentrations (258–643 mg L⁻¹ versus a legal threshold of 250 mg L⁻¹). The reuse of TWWs reduced fruit yield (10–26%) compared to irrigation with tap water as a control. Irrigation with TWWs gave also rise to the decrease of total sugars (14–26%), TSP (2–10%) and TMA (29–49%). Individual phenolic acids, flavonols and flavanols were quite stable in response to the irrigation with TWWs, whereas anthocyanidins decreased significantly.

CONCLUSION: Although TWWs negatively affected fruit quality, the nutritional and nutraceutical parameters determined in the present study were in line with data previously reported for strawberries purchased in the market or cultivated in research orchards, thus suggesting that the use of TWWs does not prevent the fruit marketability.

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Keywords: fruit yield; sugars; polyphenols; wastewater reuse; circular economy

INTRODUCTION

Agriculture represents a productive sector typically characterized by a high water demand. According to the European Environment Agency, one-third of water use in Europe goes to the agricultural sector, most of it for crop irrigation,¹ and, as recently pointed out by the United Nations World Water Assessment Program,² approximately 70% of worldwide freshwater (FW) withdrawals are used for agricultural irrigation.

On the other hand, limited FW availability is a problem of increasing concern in the world and FW resources are becoming insufficient for efficiently sustaining agricultural irrigation, mainly as a result of climate-related conditions. Indeed, in most cases, water scarcity is a climate-bound regional problem and affects many areas worldwide, not only including the Middle East and North Africa,³ but also Southern Europe, including Italy.⁴

The reuse of non-conventional waters for irrigation, such as treated wastewaters (TWWs) of municipal or mixed municipal/

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