

Evaluation of innovative growing techniques for organic saffron production in the Mediterranean countries

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Abstract

Saffron (*Crocus sativus* L.) botanically is an annual species which in some countries such as Iran, as the main producer in the world, is grown as a perennial plant and in some other regions is re-cultivated every year. This plant is a suitable option to be cultivated in low-input systems of organic farming. The aim of this study was to evaluate some growing techniques supporting organic production, as such emergency irrigation during the pre-flowering stage and the use of some useful microorganisms. The experiment was carried out at a certified organic farm located in Sicily (37°24'32"N; 14°13'14"E). The corms were classified in three weight categories (G: >15 g; M: 5-15 g and P: <5 g), then were sown with a density of 60 corms m⁻² into a sandy soil, equipped by drip irrigation system. A randomized complete block design was used for evaluating three growing techniques: 1) emergency irrigation carried out by two times irrigation during the first two weeks after corm planting (4.28 L m⁻²); 2) organic nutrition based on aminoacids (Aminocomplex extra[®]) and microorganism belonging to *Frankia* spp., and *Pochonia chlamydosporia* (Maxy root[®]); and 3) control (no-emergency irrigation and no organic nutrition). In fact, the two described innovative growing techniques were compared to the ordinary growing techniques adopted in Sicily, which use no emergency irrigation and microorganism for increasing soil fertility and the quality of production. The emergency irrigation plus organic nutrition significantly increased two and about three times the flower and stigma yield, compared with the control treatment respectively. The nutrition protocol based on amino acids and microbial consortia also increased stigmas yield. Overall, it was concluded that pre flowering irrigations and organic nutrition are two main strategies for increasing saffron yield in Mediterranean regions.

Keywords: microorganisms, emergency irrigation, organic farming, stigma

INTRODUCTION

Crocus sativus L. (saffron) is a flowering plant belonging to the *Iridaceae* family (Gresta et al., 2016), it is one of the most expensive cash crops among the medicinal plants and it has been called "red gold". The price of the high-quality spice can reach 15,000-20,000 € kg⁻¹ (Maleki et al., 2017); the product is represented by dried red stigma and it is highly appreciated for its dye capacity and aroma, and for their multiple uses (Mzabri et al., 2019). Three main components of the stigma of saffron are picrocrocin, gives the bitter taste, safranal, responsible for the smell, and crocin, carotenoid pigment that provides its red colour (Ahmed et al., 2016). Furthermore, saffron extract exhibit anticancer, antidepressant, anti-hyperglycemic, hypoglycemic and memory-enhancing effects (Giorgi and Scheurer, 2015; Talaei et al., 2015). It has been known for more than 4000 years and has been used mainly in traditional medicine as an antidepressant drug (Shokrpour, 2019). This spice is widely cultivated in several countries such as Iran, Italy, Spain, Morocco, France, Greece, China, India and Mexico (Giorgi and Scheurer, 2015), with an annual production of about 376 t dry

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