



RESEARCH ARTICLE

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Production systems and methods affect the quality and the quantity of saffron (*Crocus sativus* L.)

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Abstract

Aim of study: To compare the flowering of saffron between open field and controlled environment and to study the possibility of saffron transplanting.

Area of study: University of Birjand (Iran)

Material and methods: In a first experiment, saffron yield and quality produced by traditional production system (TPS) and by soilless one (SPS) were compared. In a second experiment, the effects of the production method, by direct planting (DP) or by transplanting plant (TP) in open field were studied.

Main results: Percentage of flowering corms grown by SPS was 39% and 65%, while by TPS was 6% and 56% in 2018 and 2019, respectively. Flower and stigma yields were significantly higher by SPS than by TPS. Stigma obtained from SPS had higher *L* (lightness) and crocin. Safranal content was higher in stigma produced by TPS. Leaf and root numbers and corm weight were higher for SPS, but after transplanting there was better status for DP than for TP. At the end of the first growing season (2018-19), mean replacement corms weight (4.4 vs 3.0 g), replacement corms yield (21.3 vs 12.8 g per plant), weight of main replacement corm (11.7 vs 6.0 g) and number of large replacement corms (0.6 vs 0.1 corms per plant) for DP were significantly higher than for TP. However, during the second growing season (2019-20), the plants in TP plots improved their performances.

Research highlights: Saffron production was more favorable under controlled environment. Transplanting is possible, but there is a need to improve methods to gain more favorable results.

Additional keywords: crocin; flower; hydroponics; safranal; stigma; transplanting.

Abbreviations used: DP (direct planting); PM (production methods); PS (production systems); SPS (soilless production system); TP (transplanting); TPS (traditional production system)

Authors' contributions: MAS and HRF came up with the idea for the experiment. MAS, HRF and HS designed and performed the experiment. HK performed qualitative analysis of samples. HRF and HK analysed the data. HRF and FB coordinated the research project and paper writing. All authors read and approved the final manuscript.

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Introduction

Saffron (*Crocus sativus* L.) plant is native to the Mediterranean region and is cultivated mostly in Iran, which has near 90% of the world production (Behdani & Fallahi, 2015). Saffron growing zones are spread from 10°W to 60°E longitude and 29-42°N latitude, between

Central Asia in the east to Spain in the west. This plant can be cultivated in very diverse environmental conditions, but the best climate for its growing is the Mediterranean climate (Koocheki & Khajeh-Hosseini, 2020). Saffron stigma and corolla have many applications in cosmetic, food, health and medical industries (Koocheki *et al.*, 2019). Crocin (responsible for the colour) and picrocrocin