



# Stigma Yield of Saffron (*Crocus sativus* L.) using Different Growing Systems

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## Background

Recently, new growing systems were used including vertical and hydroponic saffron (*Crocus sativus* L.) farming to improve saffron yield. This type of farming is ideal for those who want to grow saffron at uncommon locations or increase yield in a smaller space compared to traditional soil farming due to unsuitable natural environmental conditions like the case in KSA. Several environmental parameters may affect flower induction in saffron. Among these, temperature plays a crucial role (Molina et al., 2005). According to the literatures, flower induction requires an incubation of the corms at high temperature ( $^{\circ}27-23C$ ), followed by a period of exposure at moderately low temperature ( $^{\circ}17C$ ) for flower emergence. The aim of this study was to evaluate saffron production using two new intensive growing systems (vertical and hydroponic saffron farming) in comparison with traditional soil cultivation under controlled environmental conditions.

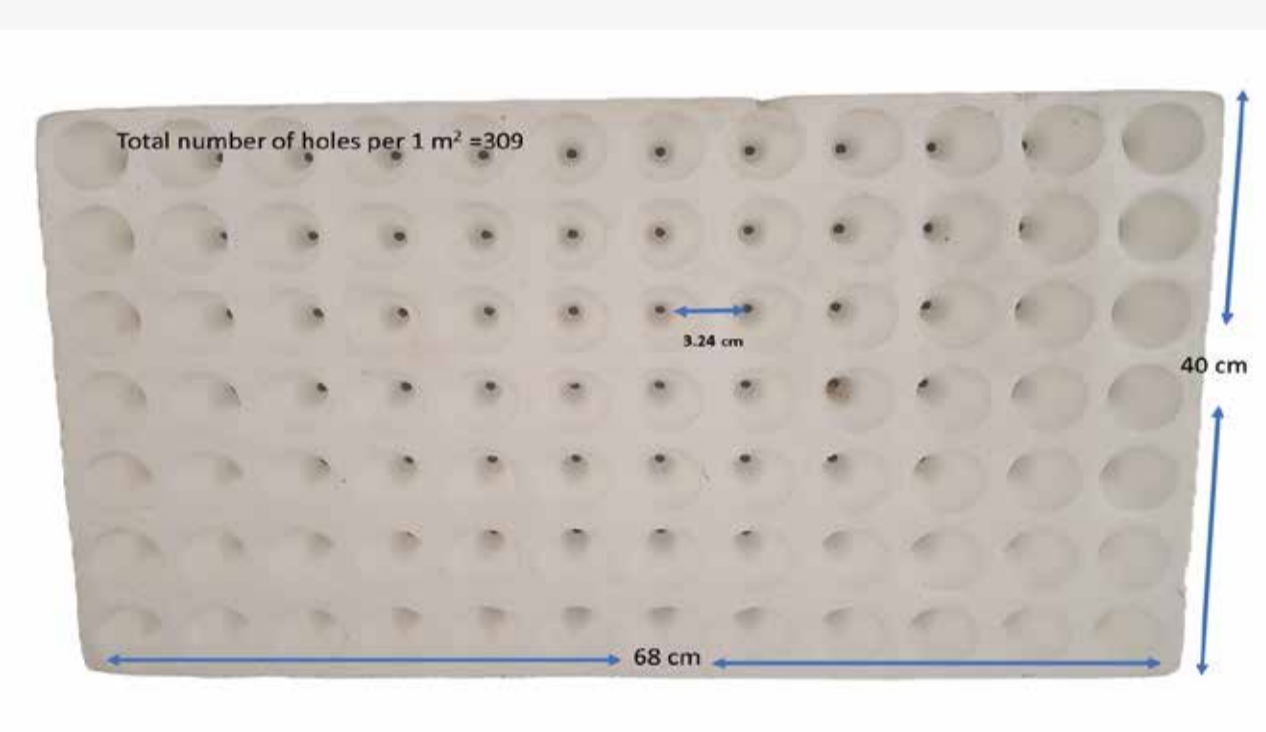
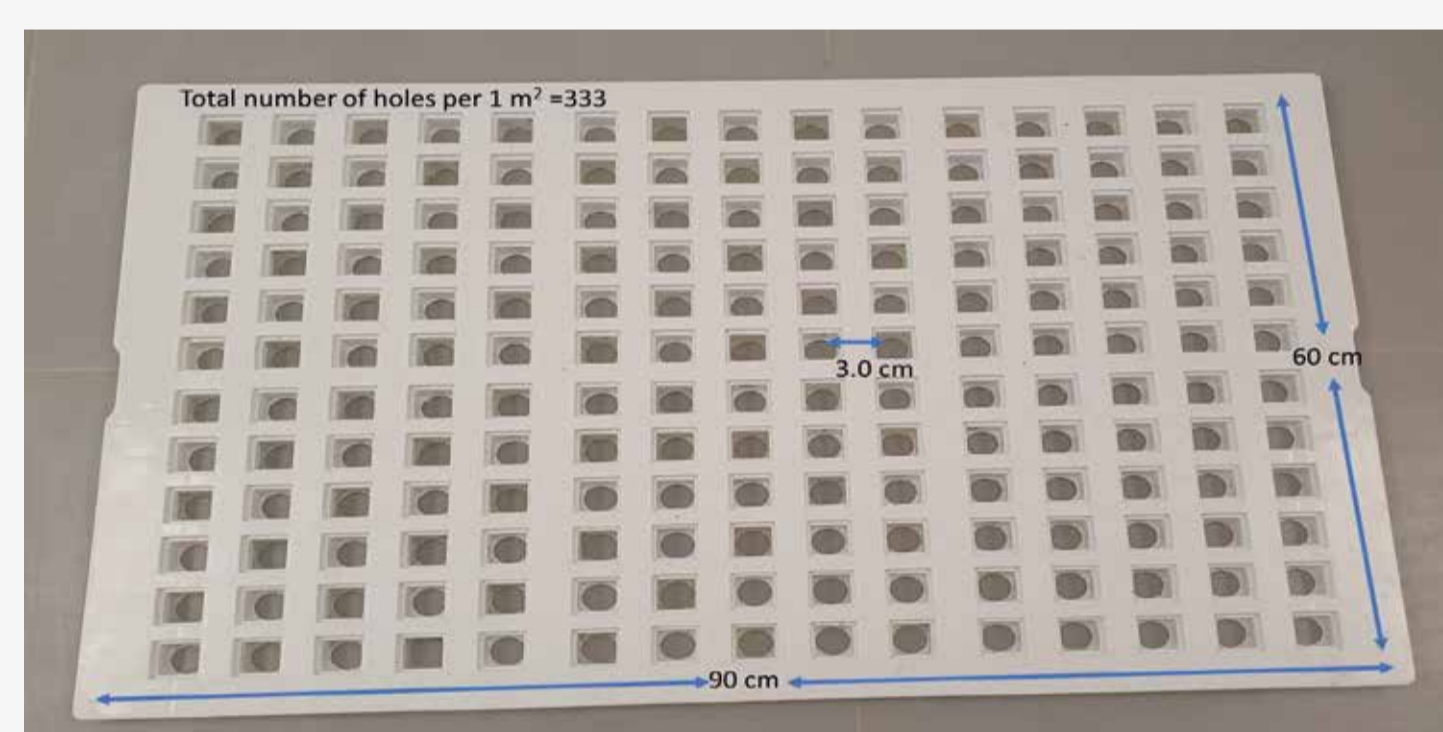
## Objective

In this study, the effect of three growing systems (vertical, hydroponic and traditional soil cultivation) on saffron stigma yield was evaluated under controlled environmental conditions in KSA.

## Methods

This study was carried out during 2023/2022 growing season at the National Research and development Center for sustainable Agriculture, KSA. Imported saffron corms from Bloembollenbedrijf. J.C. Koot, Netherlands with an average weight 25 g/corm were used in this experiment. The corms were planted on Sep.2022, 17 using three growing systems: vertical units with six layers, in a hydroponic system in a closed cell with LED lighting (duration 8 hours/day, capacity of  $170 \mu\text{mol}/(\text{m}^2/\text{s})$ ; with hydroponics in one layer and traditional soil cultivation both in a traditional greenhouse. The hydroponic systems (both vertical unit and the greenhouse) consisted of DFT system (Recirculating hydroponic system) with floating plastic and polystyrene planting trays. Table below shows plant density and spacing in each growing system.

Growing system	Vertical units with six layers	Hydroponic units	Soil cultivation
Plant density (Plant /m <sup>2</sup> )	2000	309	100
Plant density ( per layer /m <sup>2</sup> )	333	309	100
Plant spacing (cm)	3.0 x 3.0	3.24x 3.24	10 x10



Growing Saffron in vertical units with six layers (ESTIDAMAH)



## Results

Results showed that in vertical system, the plants started to flower 20 days from corm planting followed by hydroponic system (43 days). Those grown in soil need more time to emerge from the soil and therefore, flower induction was delayed to 56 days (Figure 1).

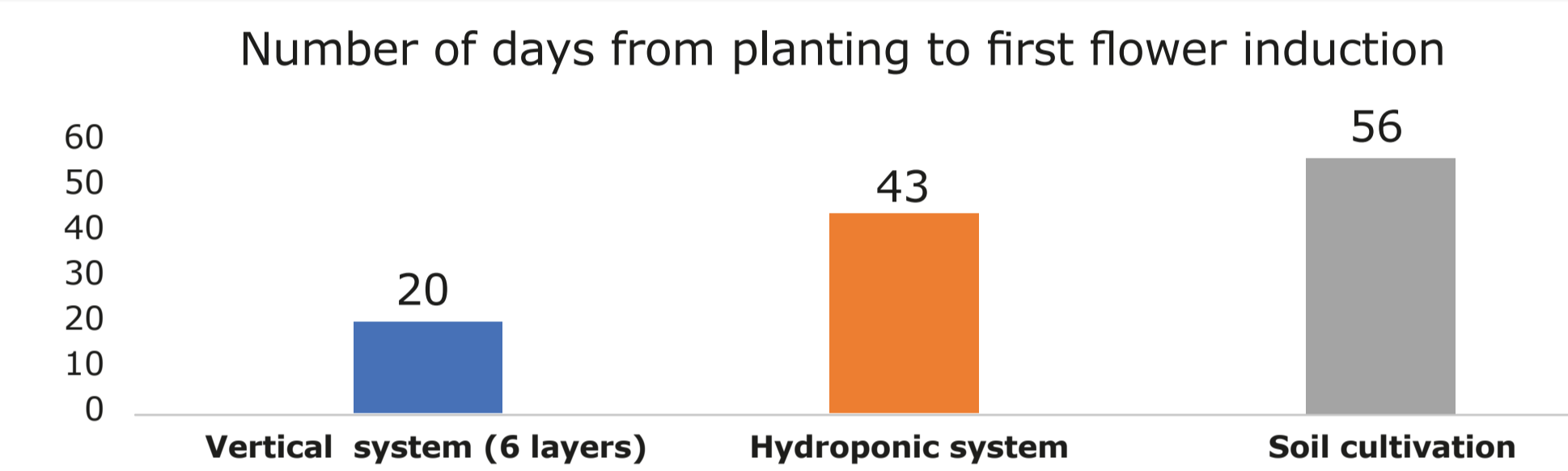


Figure 1. Effect of growing system on saffron flower induction.

Increasing plant density to 2000 plants per m<sup>2</sup> when using vertical system, the total number of flowers was increased to 4400 in m<sup>2</sup>, followed by the number (942 flowers /m<sup>2</sup>) when using hydroponic system (Figure. 2). The lowest flower number per unit area was produced from soil cultivation.

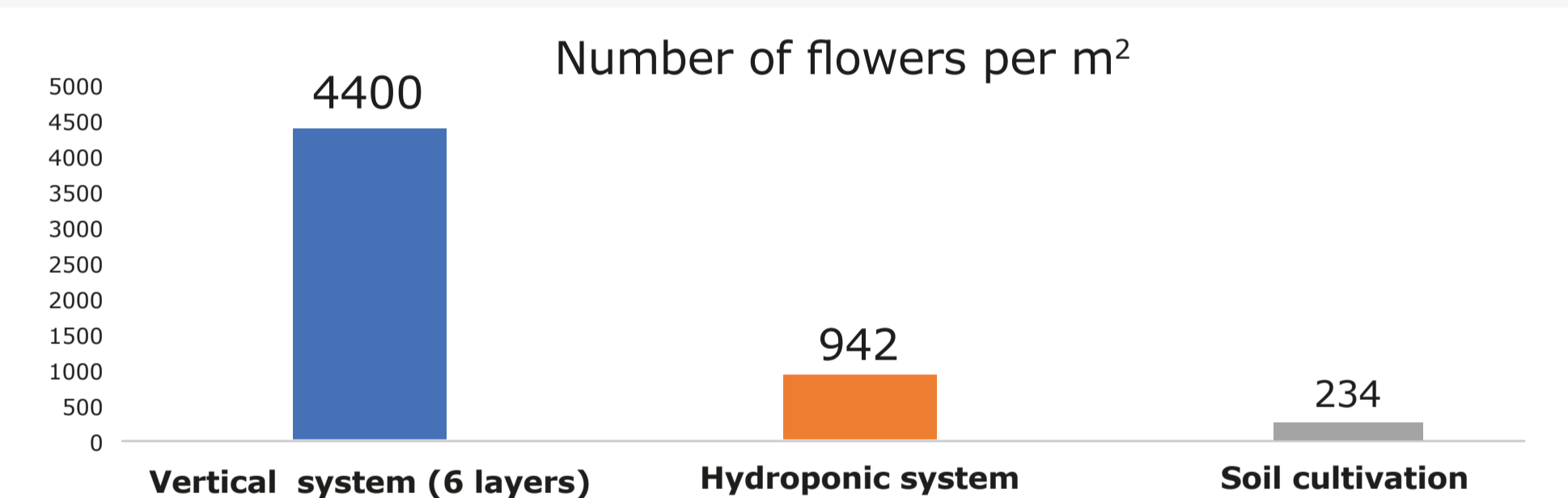


Figure 2. Effect of growing system on number of flowers per m<sup>2</sup>.

According to our results, using vertical farming with six layers increase saffron dry stigma yield meter up to 41.2 g/m<sup>2</sup> and to 9.0 g /m<sup>2</sup> when using hydroponic system, while the yield of soil cultivation was only 2.2 g/m<sup>2</sup> (Figure 3).

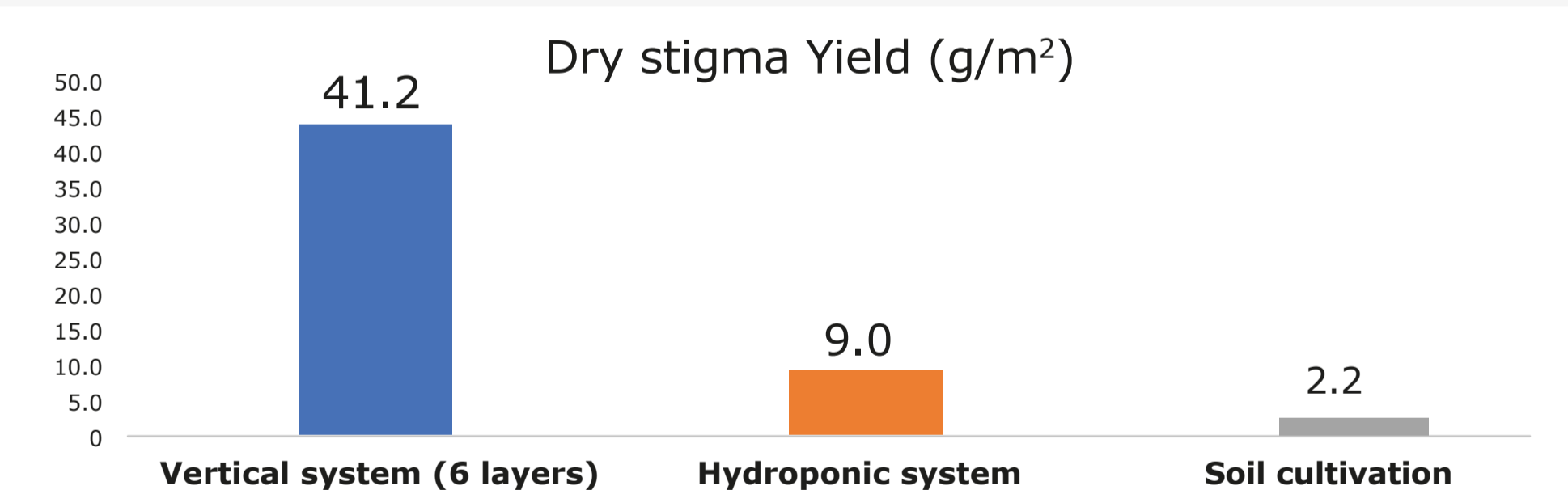


Figure 3. Effect of growing system on Saffron dry stigma yield per m<sup>2</sup>.

## Discussion and conclusion

Using six layers of vertical system shortens saffron cropping cycle for flower production and multiplied saffron yield up to 19 times as compared with soil cultivation, while using hydroponic system with one layer multiplied the yield up to 4 times. However, the plant density per layer in the two hydroponic systems were 3 times higher than in soil, which likely would have affected the vegetative growth and eventually the corm production. This study focused on just the stigma production; corm production is not reported in this poster.

