Effect of saffron-mallow intercropping patterns in the third year on possible cooling of corms for climate change adaptation

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Abstract: Intercropping is a traditional agricultural approach which is the growing of multiple plant species at the same time in the same location. Traditionally, intercropping has been used to enhance plant yield and the efficiency of the resource as well decrease risk. Intercropping has been shown to decline the risk of plant failure by increasing the plant yield stability over time. Intercropping creates biodiversity in the agroecosystems, and it is considered to make the ecosystems more resilient against environmental perturbations, thus improving food security. The current study was aimed to investigate the effects of intercropping patterns of mallow as a perennial medicinal plant on stigma yield and quality characteristics of saffron affected as possible cooling of corms for climate change and global warming mitigation. The experiment was carried out at Faculty of Agriculture, Ferdowsi University of Mashhad, Iran. Treatments were 15, 30, 45 and 60-cm row spacings for saffron from mallow planting rows and sole saffron and mallow cultivations. The results revealed that the impact of intercropping patterns with mallow was significant on yield indicators of flower indicators of saffron. In comparison between sole cultivation and intercropped saffron revealed that the highest values for flower number, dried stigma yield and yield of daughter corms were recorded for sole saffron cultivation with 81 flowers.m−2 , 0.2115 g.m−2 and 26.51 g.m−2 , respectively. In comparisons amongst intercropping patterns, the highest value for dried stigma weight was related to 30-cm row spacings from mallow with 13.39 g.m−2 . However, corcin, picrocrocin and safranal contents were not significantly affected by mallow intercropping patterns. The maximum land equivalent ratio was calculated for 15-cm row spacing with 1.77.

Keywords: Crocin. Land equivalent ratio. Stigma yield

Introduction

Saffron (*Crocus sativus* L.) a member of the Iridaceae family, called red gold, is the costliest spice in the world (Koocheki & Khajeh-Hosseini, 2020). Saffron is a fall-flowering geophyte plant and grass-like leaves that seem on or shortly after flowering. It has an important role in agricultural economy, especially in semi-arid regions (Koocheki et al., 2016; Koocheki & Khajeh-Hosseini, 2020).

Therefore the current study was aimed to evaluate the effects of saffron and mallow intercropping flower and corm yield and quality of saffron.

Material & methods

This experiment was conducted based on a randomized complete block design with three replications at Agricultural Research Station, College of Agriculture, Ferdowsi University of Mashhad during 2015-2016, 2016-2017 and 2017-2018 growing seasons. Treatments were 15, 30, 45 and 60-cm row spacings for saffron from mallow planting rows and sole saffron and mallow cultivations.

Saffron mother corms were planted using basin method on 5th of Sep. 2012. Mallow seeds were sown in the first growing seasons on 1st of May 2015. In the third year, picking began on 9th of October and finished on 9th of November.

All the measured and derived data were subjected to the analysis of variance carried out by least significant difference (LSD) test (P≤0.05) using SAS 9.1 software.

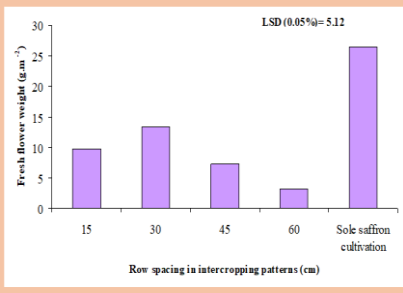

Fig. 1- Effect of row spacings for saffron from mallow planting on fresh flower weight of saffron

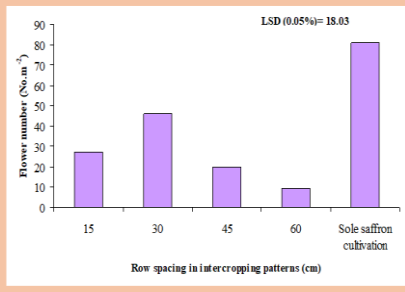

Fig. 2- Effect of row spacings for saffron from mallow planting on flower number of saffron

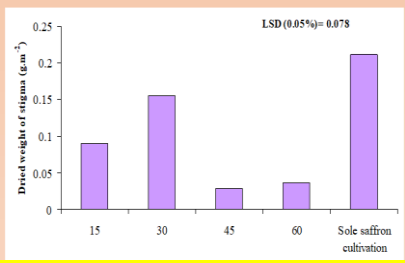

Fig. 3- Effect of row spacings for saffron from mallow planting on dried weight of stigma of saffron

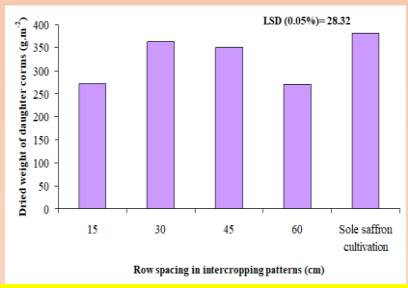

Fig. 4- Effect of row spacings for saffron from mallow planting on dried weight of daughter corms of saffron

Results & Discussion

The maximum fresh flower yield, flower number, stigma yield and dry weight of daughter corms of saffron were observed in its monoculture with 26.51 g.m^{-2}, 81 flowers.m^{-2} and 0.212 g.m^{-2} and 380.11 g.m^{-2}, respectively (Figure 1, 2, 3 and 4). In comparisons amongst intercropping treatments with mallow, the highest values for these criteria were recorded for 30-cm row spacings for saffron from mallow with 13.39 g.m^{-2}, 46 flowers.m^{-2}, 0.155 g.m^{-2} and 362.22 g.m^{-2}, respectively (Figure 1, 2, 3 and 4).

Intercropped saffron with mallow enhanced the flower number, stigma yield and daughter corm of saffron due to decreasing soil temperature which could be regarded as an alternative to the possible effect of soil warming for climate change adaptation.

The secondary metabolites synthesis in saffron is controlled by genetic characteristics and environmental conditions (Lage and Cantrell, 2009; Zarinkamar et al., 2011) rather than agronomic management.

Significant difference was recorded between row spacings for saffron from mallow planting in terms of land equivalent ratio (LER). The maximum LERs (with 1.77 and 1.56) were found in 15-cm and 30-cm row spacings for saffron from mallow planting (Fig. 5).

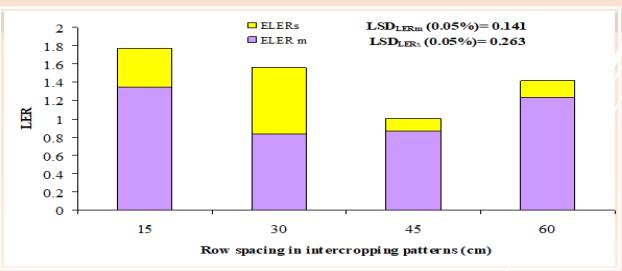

Fig. 5- Effect of row spacings for saffron from mallow planting on LER

conclusions

The conclusions section should come in this section at t According to the results, saffron–mallow intercropping increased fresh flower weight, flower number and flower number of saffron. Increase in growth and flower yield due to higher ability of mallow in decreasing soil temperature. Crocin, picrocrocin and safranal contents of saffron were not significantly affected by intercropping ratios with cumin. Hence, 30 cm-row spacings for saffron from mallow planting is recommended for saffron- mallow intercropping he end of the article, before the experimental/theoretical section.