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Effects of Cow Manure and Corm Weight on Saffron Yield Using a Response Surface Methodology

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Abstract

Saffron is considered to be as one of the most expensive spices in the world. Its specific compounds are including crocin (colouring agent), picrocrocin (a specific bitter taste), safranal (the main cause of odor). Optimisation of fertiliser and corm weight is a sustainable management approach to conserve resources and decline environmental pollutions. Response surface methodology (RSM) is a statistical method for optimisation of multiple factors which determine optimum process conditions by combining experimental designs. In this work, effects of cow manure and corm weight on stigma yield and qualitative criteria of saffron using RSM was done. An experiment was conducted using central composite design with 13 treatments and two replications at the Research Field of Ferdowsi University of Mashhad during the growing season of 2016–2018. The treatments were allocated based on low and high levels of cow manure (0 and 40 t.ha^{-1}, respectively) and corm weight (7 and 20 t.ha^{-1}, respectively). Stigma yield and crocin, picrocrocin and safranal contents were calculated as dependent variables and changes of these variables were evaluated by a regression model. The quality of the fitted model was judged using the determination coefficient (R^2). The results showed that the effect of linear component was significant ($p \leq 0.01$) on all studied characteristics. Effect of square component was significant ($p \leq 0.01$) on all studied criteria except for crocin content. Interaction effect of full quadratic was not significant on none of these traits. The range of R^2 was calculated from 79.28 to 94.30. The highest estimated and observed values of safranal (38.94 and 38.07 E_330$\hat{(}$1 %), respectively) and crocin (170.41 and 170.36 E_440$\hat{(}$1 %), respectively) contents were recorded for 40 t cow manure per ha^{-1} and 20 t corms per ha. The slope of stigma yield and qualitative criteria enhance by an increase in cow manure up to 40 t.ha^{-1} was higher under high levels than low levels. In general, it seems that resource use optimisation based on the RSM may be suitable cropping approach for sustainable production of saffron.

Keywords: Crocin , Response surface methodology, Safranal, sustainable production

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