

Effect of irrigation interval and water salinity on growth of madder (*Rubina tinctorum* L.)

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Abstract

Madder (*Rubina tinctorum* L.) is mainly cultivated in central part of I.R. of Iran that is an arid and desert area with scarce and saline water resources. Its root is used as herbal medicine and food additives and its shoot (top) is used as forage crop. However, little is known about its salinity tolerance and soil water limits for growth. The objectives of the present study were to investigate the limits of irrigation water salinity and soil water content for growth inhibition of madder. Furthermore, two different models were studied to describe the root water uptake and top and root growth under salinity and water stresses in a pot experiment. Irrigation treatments consisted of three irrigation intervals (2, 5, and 8-day). The salinity treatments of the irrigation water were 0.5 (tap water), 7.5, 15.5, and 23.5 dS m⁻¹. It is concluded that the critical volumetric soil water content equivalent to soil matric head of -1462.0 cm for madder growth is lower than 0.23 cm³ cm⁻³. The coefficient of readily available water for madder is at least 0.6. Furthermore, the vegetative growth response factor of madder to water is 0.33 and 0.42 for shoot and root dry weight, respectively. There were no difference in shoot and root growth tolerance to soil salinity and irrigation water salinity at different water stress levels. Furthermore, the threshold values of soil salinity and irrigation water salinity are 17.0 and 11.6 dS m⁻¹ for top growth, respectively, and 15.3 and 8.5 dS m⁻¹ for root growth, respectively. The growth reduction per unit increase in soil salinity and irrigation water salinity for top growth are 2.0, 3.7 % per dS m⁻¹, respectively. These values are 1.9, 3.1 % per dS m⁻¹, respectively for root growth. Therefore, top and root growth affected similarly by increasing the soil salinity and irrigation water salinity. It is indicated that the root water uptake coefficient (α) was predicted accurately by the used models. Furthermore, the estimated values of α accurately predicted the shoot dry weight successfully. However, Homaei and Feddes (1999) method is preferred for estimation of root dry weight.

Keywords: Matric head; Saline water; Soil salinity; Osmotic head; Critical soil water content; Iran

Introduction

The madder (*Rubina tinctorum* L.) is a perennial herbaceous plant (Gulhan et al., 1999). It is native to the Middle East region and is cultivated in south and southeast of Europe, Mediterranean area and central Asia (Derksen et al., 2002). It is used to be cultivated in