



# Effect of drip irrigation and fertilizer regimes on fruit quality of a pomegranate (*Punica granatum* (L.) cv. Rabab) orchard



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## ARTICLE INFO

### Article history:

Received 4 September 2014

Accepted 9 April 2015

### Keywords:

Partial root zone drying irrigation

Fruit quality

Foliar fertilizer

Titrateable acid

Maturity index

Total soluble solids

## ABSTRACT

We investigated the effect of different drip irrigation strategies including irrigating one side of trees with 50% and 75% of  $ET_c$  (DI50, DI75); irrigating alternate sides of trees with 50% and 75% of  $ET_c$  (PRD50, PRD75), and full irrigation (FI) that received 100%  $ET_c$  and three prevalent fertilizers type including manure (M), chemical (CF) and foliar (FF) fertilizers on quality of pomegranate fruit in a semi-arid area. Results showed that the values of measured attributes varied from 64.4 to 71.2% in aril, 28.8 to 35.6% in peel, 49.0 to 55.7% in juice percentage, 1.055–1.064 g cm<sup>-3</sup> in juice density, 12.4 to 15.7 in maturity index (MI), 1.14 to 1.53% citric acid in titrateable acidity (TA), 17.5 to 19.2° Brix in total soluble solids (TSS), 10.8 to 12.3 mg per 100 mL of juice in vitamin C and 3.12 to 3.26 in pH. On average, PRD strategies increased the juice percentage, MI and decreased the TA in comparison with FI while the results of DI strategies were in contrast to PRD. Furthermore, higher level of water stress (PRD50 and DI50) increased the TSS and decreased the vitamin C in comparison with other irrigation strategies. CF fertilizer showed the lower values in MI, TSS, peel percentage and juice density and the higher values in aril percentage, TA and vitamin C in comparison with other fertilizer types. Among the irrigation strategies, PRD50, PRD75 and DI75 strategies is recommend due to the positive impact on fruit quality attributes; however, it is important to consider the negative effect of PRD50 on fruit yields. For fertilizer types, the fertilizers including microelements (M and FF) are preferred in comparison with CF (including NPK). Based on the results, correct harvest maturity and ripening for pomegranate fruit can be determined when TA is reached lower than 1.32% citric acid, MI is increased to higher than 13.95 and TSS is greater than 18.25° Brix.

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## 1. Introduction

Pomegranate is a popular fruit of tropical and subtropical regions that is gaining great interest as a result of the beneficial effects on health (Lansky and Newman, 2007). Iran is the origin of pomegranate and is ranked high in the world for pomegranate cultivars, quality, cultivated area, production and export. Fars province is the largest producer in Iran with a cultivated area of 19,224 ha and production of 199631 Mg year<sup>-1</sup>. In Fars province, Neyriz with an area of 4000 ha and annual production of 55000 Mg year<sup>-1</sup> is a center of pomegranate production (Ministry of Jihad of Agriculture, 2010).

In recent years, reduction in groundwater resources and severe droughts has destroyed some of the pomegranate orchards in Neyriz (Parvizi et al., 2014). Therefore, proper irrigation water

management should be used to cope with the water resources reduction. Water scarcity in arid and semi-arid areas has led to development of new water saving techniques, such as partial root zone drying (PRD) and deficit (DI) irrigation. Pomegranate as a xeromorphic plant shows drought tolerance characteristics such as high leaf relative apoplastic water content and ability to confront the water stress by developing complementary stress avoidance and stress tolerance mechanisms (Rodriguez et al., 2012). Pomegranate is fairly drought resistant; however, it requires regular watering to produce high yield and large unit fruit weight (Holland et al., 2009). Some investigations showed that the water stress can have detrimental or beneficial effects on fruit quality of pomegranate (Khattab et al., 2011; Mellisho et al., 2012; Laribi et al., 2013; Mena et al., 2013). Laribi et al. (2013) showed that deficit irrigation, when applied late in the season, during ripening, resulted in an increase in total soluble solids (TSS). Considerable differences have been observed in the response of pomegranate fruits to deficit irrigation treatments by Mellisho et al. (2012) so that fruits from trees under moderate level of water stress showed a decrease in fruit growth,

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