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Effect of Irrigation Regimes on Water Status and Photosynthetic Parameters of Peach-Almond Hybrid (GF677) Seedlings and Cuttings

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Abstract. Almond is one of the drought resistant species suitable for growing in the dry lands of Iran. To evaluate the response of seedlings and cuttings of peach-almond hybrid (GF677) to different irrigation regimes, an experiment was conducted under greenhouse conditions in 2007. The stratified kernels and uniform rooted cuttings were planted in 20-L pots. After determination of field capacity (FC) of pot soils, irrigation treatments were imposed by daily irrigation to FC level or irrigation to FC at intervals 2, 4, or 8 days for 96 days. Stem water potential (SWP), relative water content (RWC), stomatal conductance, transpiration rate, photosynthetic rate, sub-stomatal CO_2, and water use efficiency were determined at 32 day intervals during the experimental period. Results showed that SWP at the three measurement times was lower in seedlings under 8 day irrigation intervals (-2.14 MPa) than in the cuttings (-1.95 MPa). The reduction of RWC throughout the experimental period was higher for seedlings (7.1%) than cuttings (5.1%). Therefore, cuttings of GF677, through better control of stomata, decreased transpiration, increased water use efficiency and appear to be more drought-resistant than their seedling counterparts.

Additional key words: drought, photosynthesis, rootstock, water potential, water stress

Introduction

The use of bitter almond seedlings as rootstocks has been a traditional method for almond orchard establishment in Iran (Rom and Carlson, 1987). Many growers believe that these rootstocks have the most tolerance to drought and soil pathogens. The origin of many of them is, however, unknown and this causes problems with severe orchard heterogeneity (Felipe et al., 1997).

The GF677, a peach-almond rootstock, has been widely used in the Mediterranean area since the 1980s to reduce heterozygosity (De Salvador, 2004). This rootstock has only recently been introduced to Iranian growers. If this rootstock performs well in the arid and semiarid climate of Iran, it can replace the bitter almond seedling rootstock.

The acceptable productivity of scions on bitter almond seedling rootstock, from a grower's view, is due to relatively poor growth in dry farming systems. However, when these species are grown under better conditions, differences in vigor, yield, precocity, etc., were observed (Felipe, 1989). Gomes-Laranjo et al. (2006) stated that unfavorable environmental conditions decrease the kernel yield in dry soils. Practices such as irrigation (Felipe, 1989) and utilization of resistant rootstocks (Connell et al., 2002; Godini and Palasciano, 1997) can enhance the yield. Decrease in water potential of almond due to drought has been reported by Torrecillas et al. (1989) and Castel and Fereres (1982). Drought also causes decreased tree growth, high defoliation rate, kernel weight reduction, discoloration of pericarp and decrease in stomatal conductance and carbon assimilation (Isaakidis et al., 2004).

Torrecillas et al. (1989) observed that water deficiency caused a decline of tree canopy development and, with this decreased photosynthetic efficiency, a reduction in yield. Gomes-Laranjo et al. (2006) observed an increase in dry weight due to irrigation treatment compared to drought treatments and suggested that the decrease in dry weight associated with drought was due to a decline in photosynthetic rate. Shackel et al. (1998) have shown that the physiological response of almond to water stress may be correlated to the water status of plants as measured by stem water potential at midday.

Although drought resistance of vegetative GF677 rootstock has been reported by several researchers such as Alarcon et al. (2002) and De Salvador (2004), there has not been any report on the comparison of drought resistance between cuttings and seedlings of GF677. The difficulty in rooting this hybrid rootstock has stimulated nurserymen to produce seedlings of GF677. In the present study, the responses of GF677 cuttings to water stress with regard to photosynthetic activity, stem water potential (SWP), and relative water content (RWC) were evaluated and compared with those of seedlings obtained from GF677 trees after self pollination.

Materials and Methods

Seeds of self-pollinated trees of GF677 were collected in October 2006 from the Estahban Fig Research Station in Fars Province, Iran. After separating seeds from fleshy parts of the fruits, they were treated with benomyl (5 $g \cdot L^{-1}$) and stored in

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