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ORIGINAL PAPER

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The effect of water salinity on growth and physiological stages of eight Canola (*Brassica napus*) cultivars

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Abstract Laboratory/greenhouse and field experiments were conducted to evaluate the effects of salinity levels ranging from 1 to 12 dS/m on germination rate, 8 leaf seedling dry matter, seed yield, and seed oil content of the 8 Canola (*Brassica napus*) cultivars: ACSN1, Falcon, Shirali, Ceres, Tower, Cobra, Global, and Oyerka. Statistical results revealed that the factors: salinity, cultivar, and their interaction had significant ($P < 0.01$) effect on germination rate and 8 leaf seedling dry matter. Based on statistical analysis seed yield was significantly influenced by both salinity and cultivar at the 5% significance level; while the cultivar factor had a significant effect on seed oil content, salinity did not show any effect on seed oil content. Analytical results, using the well-known sigmoid or S-shape salinity response function gave reliable results for determining tolerant and sensitive cultivars to salinity. Applying an existing model on canola response to salinity levels in different growth stages, the values of C_{50} and P parameters were developed for local canola cultivars. Results showed that the response of cultivars to salinity levels vary in different growth stages. While a cultivar is tolerant in a growth stage, it may be sensitive to salinity in another growth stage. Based on observed data and ANOVA analysis, we concluded that ACSN1, Shiraly, and Falcon can be ranked as salt-tolerant, and Global and Oyerka as the salt-sensitive cultivars.

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Introduction

Salinity is a well-known problem in most or all arid and semi-arid regions of the world especially in irrigated areas. Salinity limits productivity of irrigated soils in vast areas of the world (Corwin et al. 1996; Homaee et al. 2002b). Over 400 Mha across the world is affected by either salinity or sodicity which accounts for about 6% of the world's land. Of the current 230 Mha of irrigated land in the world, 45 Mha are salt-affected (19.5%), and of the 1,500 Mha under dryland agriculture 32 Mha (2.1%) are salt-affected to varying degrees (Ghassemi et al. 1995).

Out of the total 15 Mha of cropped area in Iran 6 Mha is irrigated cropland of which 30% is salt affected, i.e., 1.7 Mha (Ghassemi et al. 1995). It shows that a major concern of agriculture in Iran is salinity which is a serious threat in many parts of the country to the sustainability of crop production. Cropping in these regions is highly at risk and introducing salt-tolerant crops to farmers are necessary.

More than 90% of edible oil required by Iran is annually imported, and increasing the cultivated area of oil seeds to particularly overcome import oil has been a great concern. Fars province, south of Iran, has been the leading region in producing oil seed crops. However, many parts of Fars province suffer from soil and/or water salinity that lead to low crop yield. So, the major aim of this research is to introduce some salt-tolerant canola cultivars.

Due to the differences in salt tolerance at growth stages, some investigators have reported about selection for tolerance by imposing salt stress over the entire growth cycle so that particularly salt-sensitive growth stages can be identified (Epstein et al. 1980; Jones and Qualset 1984). A few studies were conducted about the effects of salinity on canola. He and Cramer (1992) investigated the effects of seawater salinity on six *Brassica* species and reported that *Brassica napus* (canola) was the most tolerant to salinity among the other species