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# Salt tolerance analysis of chickpea, faba bean and durum wheat varieties II. Durum wheat

N. Katerji[a], J.W. van Hoorn[b,*], A. Hamdy[c], M. Mastrorilli[d], M.M. Nachit[e], T. Oweis[e]

[a]*INRA, Unité de Recherche,Environnement et Grandes Cultures, 78850 Thivernal-Grignon, France*
[b]*Sub-department Water Resources, Wageningen University, van Limburg Stirumweg 2, 6861 WL Oosterbeek, The Netherlands*
[c]*Istituto Agronomico Mediterraneo, 70010 Valenzano (Bari) Italy*
[d]*Istituto Sperimentale Agronomico, 70125 Bari, Italy*
[e]*ICARDA, P.B. 5466, Aleppo, Syria*

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**Abstract**

Seven varieties of durum wheat (*Triticum turgidum*), provided by ICARDA, were tested in a greenhouse experiment for their salt tolerance. Afterwards two varieties, differing in salt tolerance, were irrigated with waters of three different salinity levels in a lysimeter experiment to analyse their salt tolerance.

The characteristics of the salt tolerant variety compared to the salt sensitive variety are:

- a shorter growing season and earlier senescence;
- a higher pre-dawn leaf water potential;
- a stronger osmotic adjustment;
- a better maintenance of the number of productive stems per plant.

Salt tolerance of durum wheat corresponds with drought tolerance because the tolerance is caused by earlier senescence and stronger osmotic adjustment, both reducing the transpiration of the plant.


*Keywords:* Drought tolerance; Durum wheat; Osmotic adjustment; Pre-dawn leaf water potential; Salt tolerance

* Corresponding author. Tel.: +31 26 3335570; fax: +31 317 484885.

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## 1. Introduction

More than 85% of the world durum wheat (*Triticum turgidum*) production is located in the Mediterranean basin because the climatic conditions are favorable for the grain quality (Nachit, 1998). The durum breeding research to improve dry-land productivity has been entrusted by world mandate to ICARDA. An abundant literature bears evidence of its research effort. Stress caused by drought, by temperature and, recently, by salinity is the major abiotic constraints and account for a large yield variation (Rekika et al., 1998; Amiri et al., 1998). Saline stress, however, is the least studied subject as appears from the synthesis of publications (Clarke, 1987; Acevedo, 1987; Nachit, 1998; Araus et al., 1998). Therefore no classification of durum wheat varieties is actually available with respect to salt tolerance in contrast with those on drought tolerance (Sinha, 1987; Ghanem, 1998; Eser, 1998) and on biotic stress (Mamluk and Makouk, 1998; Ezzahiri, 1998). Although wheat is considered as a salt tolerant crop, it appears useful to improve the knowledge on salt tolerance of durum wheat varieties in view of the increasing use of saline water.

The objective of the wheat variety experiment at the Mediterranean Agronomic Institute at Bari, southern Italy, was the same as in the case of the grain legumes chickpea and faba bean: to analyse the salt tolerance of varieties differing in drought tolerance and to find out whether salt tolerance corresponds with drought tolerance. The experiment consisted of two parts:

- a greenhouse experiment for the salt tolerance classification of seven durum wheat varieties provided by ICARDA;
- a lysimeter experiment with two varieties, clearly differing in salt tolerance according to the greenhouse experiment, to study the physiological and agronomic parameters associated with the observed salt tolerance. The parameters refer to different adaptations of wheat to water stress (Austin, 1987; Turner and Nicolas, 1987; Araus et al., 1998) and include short-term observations (pre-dawn leaf water potential, stomatal conductance), middle-term observations (osmotic adjustment, development of phenological stages, leaf area and dry matter) and long-term observations (yield, evapotranspiration and water use efficiency).

## 2. Experimental procedure

### 2.1. Greenhouse experiment

#### 2.1.1. Set-up

The set-up consisted of 63 tubes of polyvinyl chloride with a diameter of 0.4 m and a depth of 0.6 m sealed at the bottom with a 0.2 mm mesh and filled with 5 cm coarse gravel on the bottom and then 50 cm of the same clay as used in the lysimeter experiment.

Three water qualities were used for irrigation: fresh water as a control with an EC of 0.9 dS/m and two saline waters with an EC of 4 and 8 dS/m, obtained by adding equivalent amounts of NaCl and $CaCl_2$ to fresh water. Water was applied in excess when the moisture content decreased to 70% of the available water in the root zone and drainage water was collected.