

TESTING OF WHEAT GENOTYPES FOR SALT TOLERANCE AND LEAF RUST DISEASE CAUSED BY *PUCCINIA*

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ABSTRACT

Parameters that show a significant genotypic variation and are associated with salt tolerance may be used as rapid and economic screening criteria in breeding programs. The objective of this study was to test growth and yield components for evaluating the salt tolerance of wheat genotypes. Five genotypes of winter wheat (*Triticum aestivum* L.) were used in this study, that differ from their salt tolerance, which were grown in 28 dS/m saline soil, and irrigated by well water with a salinity 7.5 dS/m. The results showed that salt concentration in the soil was reduced with plant growth stages from 28 dS/m before sowing to 8, 7.5, and 7.6 dS/m for N1, N2, and N3 genotypes, respectively. Whereas approached 16 and 17 dS/m for Tumos2 and Mexipak, cultivars, respectively, at the maturity stage. Concerning germination percentage under saline conditions, wheat genotypes N1, N2, and N3 showed the highest percentages of 89, 90, and 90%, respectively, which was significantly different than wheat cultivars Tumos2 and Mexipak 79 and 83%, respectively. Statistical analysis of the data revealed that genotype N2 required a maximum days for germination 14 days, whereas cultivar Tumos2 required less days for germination 12 days. For spikes formation duration growth the genotype N3 was the late 119 days, whereas for physiological maturity N1 genotype was the latest 153 days. The number of spikes per 6 m², grains spike⁻¹, and grain weight were reduced significantly in sensitive cultivars Tumos2 and Mexipak. Higher grain yield with N2 genotype 2739.43 g with no significant differences with the genotypes N1 and N2, and with significant differences with the rest sensitive cultivars Tumos2 and Mexipak 346.61 and 242.98 g, respectively. Therefore, we conclude that the measurements of growth and yield components may be effective criteria for screening wheat genotypes for salt tolerance. Moreover, N1, N2, and N3 genotypes were identified as the most salt-tolerant genotypes in this study, they can be utilized through appropriate selection and breeding programs for further improvement in salt tolerance of Iraqi wheat genotypes.

Keywords: salt tolerance, genotypes

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INTRODUCTION

Wheat is one of the major food crops of the world. The crop has been established as a staple cereal food of Iraq. In addition to supplying carbohydrates, it provides protein, minerals, and other important vitamins. Soil salinity is a common phenomenon in the irrigator area of the dry and semi-dry areas of the world including Iraq. Salt-affected soils currently constitute 6.74 million ha in different agroecological regions, and the area is likely to increase to 16.2 million ha by 2050 (Srnutishree *et al.*, 2016). Soil salinity is a severe problem in agriculture which is reflected in the reduced productivity of sewage-cultivated soils. NaCl is the most harmful and prevalent in soil (Yamaguchi and Blumwald, 2005). The negative effects of salt by not the availability of water and nutrient availability cause insufficiency in growth, productivity, and ion toxicity to plants (Munns *et al.*, 2006). Three risks are associated with salinity. The salinity leads to the premature aging of the leaf (senescence), slow root growth, stopped elongation of sub root, and/or decrease in the absorption of elements as well as physiological effects, leaving cracking and symptoms of deficiency of nutrition (Ghulam *et al.*, 2013). In most provinces of Iraq especially southern provinces, salinity is a big growing problem, especially in irrigated agriculture, use of well and trocar water, and/or poor soil drainage. The mechanism of response to the growth of the genotype of wheat and barley to the salinity is in two stages: The first a decrease in the growth rate occurs due to the presence of salt around the roots.

The second: An additional decrease occurs due to the toxic levels of salts (Omid *et al.*, 2022). Soil salinity has reduced wheat yield usually when values of electrical conductivity were above 6 dS/m throughout the root zone (Munns *et al.* 2006). EL-Hendawy *et al.* (2005, 2011) reported that high salinity affects and delays the germination, rot weight, tiller

number per plant, spikelet number per spike, and biological yield. The number of tillers and panicles/plant and grain yield decreased by the salinity of 6 and 10 dS/m, where dry leaves increased with high salinity and the total number of leaves was not affected with salinity levels (Islam *et al.*, 2011). Increasing salinity from 0 to 12 dS/m decreased plant growth and yield of two wheat cultivars (Sadeghi and Emam, 2011). According to Flowers and Flowers (2005), about 75% of the earth is occupied by saline water. Salinity is still a great limitation to agriculture in all southern provinces of Iraq. Eliciting salinity tolerance genotypes is the most effective way to reduce the adverse effects of salinity on crop production (Pervaiz *et al.*, 2002).

One of the most effective methods is to select salt-tolerance among genotypes, which should be quick, not expensive, and trusted. Therefore, breeding new varieties is suitable for saline soils. Crops vary in salt tolerance according to growth stage (Mass and Grieve, 1994). Crops are the most sensitive to salinity during their vegetative and early reproductive stages, and less sensitive during the flowering and grain-filling stage (Mass and Poss, 1989).

Wheat rusts are one of the most important diseases that limit wheat production worldwide (Singh *et al.*, 2004). Wheat rust diseases are caused by fungi belonging to the class Basidiomycetes and order *Pucciniales* (Agrios, 2005). The three rust diseases of wheat are stem rust or black rust caused by *Puccinia graminis* Pers. f. spp. *tritici* Eriks.; stripe rust or yellow rust caused by *Puccinia striiformis* Westend. f. spp. *tritici* Eriks., and leaf rust or brown rust caused by *Puccinia triticina* Eriks. Rust pathogens differ in morphology, life cycle, and environmental preferences for growth and development. *P. graminis* f. spp. *tritici* develops well under hot and humid climatic conditions, whereas *P. striiformis* f. spp. *tritici* prefers a cooler climate. In contrast, *P. triticina*

