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Salinity Tolerance Mechanisms in Barley and the Role of Vapour Pressure Deficit

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Abstract

Salt stress poses an increasing threat to barley production. Salt is taken up to and distributed within the plant via its transpiration stream and is thus directly related to stomatal responses to vapour pressure deficit (VPD), perceived as atmospheric drought signal. In this study, we seek to understand the morpho-physiological adaptation strategies in barley under salinity and VPD stress combination. Four spring barley accession differing in their genetic composition as well as responses to salinity and VPD (based on a preliminary screening at germination and early seedling establishment) were evaluated for dry matter accumulation, leaf area, ion (Na^+, K^+, Cl^-) uptake and distribution in the different organs of barley. The experiment was set up within a phenotyping facility in the green house of University of Hohenheim in a randomised complete block design with humidity levels as the fixed effect. Plants were hydroponically grown in a modified Hoaglands solution, at pH 7 under two salt treatments (0 and 150 mM NaCl) and two levels of VPD (0.73 and 1.85 kPa) for 36 days (18 days after transplanting, 28 days after sowing). Leaf appearance and elongation was scored every 3 days at the early vegetative phase. Routine harvesting was carried out to determine the rate of biomass accumulation and leaf area. Samples were analysed using flame photometer and auto chloride-analyser to determine the uptake and distribution of sodium, potassium and chloride (respectively) in the harvested organs. Preliminary results show differing genotype responses in biomass accumulation and leaf area measurements for the salt and VPD stress combinations. VPD had a strong influence on salt uptake within the roots, leaves and leaf sheaths however genotypic differences were observed. The baseline information obtained from this study is subject to further investigation towards understanding and exploring the interaction between salinity and VPD which is crucial for developing salt tolerant crop varieties.

Keywords: Atmosperic drought, *Hordeum vulgare*, ion uptake, salt tolerance, VPD

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