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Strategies of the Cashcrop Halophyte *Aster tripolium* to Survive at Saline Habitats under Ambient and Elevated CO_2

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Abstract

About 7 % of the world´s total land area and 19.5 % of the irrigated arable land are affected by salt. This leads to desertification, freshwater scarcity and to growth conditions unacceptable for most conventional crops. These problems "threaten the livelihood of over one billion people in more than 110 countries around the world" (Kofi Annan) and are even reinforced by global climate change due to rising atmospheric CO_2-concentrations. Halophytes are likely to benefit from elevated [CO_2] because one major constraint for plant growth in saline habitats is the restriction of CO_2-uptake. The sustainable use of cashcrop halophytes such as *Aster tripolium*, a vegetable and ornamental plant, can counteract the problems mentioned above.

Against this background, our study was aimed at obtaining detailed and reproducible information about the combined effects of NaCl-salinity and elevated [CO_2] on *A. tripolium.* Plants were irrigated with five different salinity levels (0 %, 25 %, 50 %, 75 % and 100 % seawater) in a quick-check-system in open-top chambers under ambient (ca. 370 ppm) and elevated (520 ppm) CO_2. The effects of the four major constraints of salinity on plant growth (water relations, gas exchange, ion toxicity and nutrial imbalance) were studied.

Salinity caused a reduction of net photosynthetic rate and therefore of growth and an osmotic adjustment, mainly due to Na^+- and Cl^--accumulation. Furthermore, the abundance of several proteins increased or decreased, respectively, and leaf anatomy and ultrastructure changed. Elevated CO_2 led to a distinct increase in net photosynthetic rate and water use efficiency which, however, was not employed for producing more biomass. Instead, the investment in salt resistance mechanisms was increased: We found a higher content of compatible solutes and an enhanced expression of certain proteins, leading to a higher survival rate.

The results show that *A. tripolium* is a promising cash crop halophyte. It allows the use of saline irrigation water and the reclamation of saline soils, and its sustainable use can help feeding the growing world population. Additionally, on the one hand Aster will clearly benefit from rising CO_2-concentrations in future, but on the other hand it can counter global climate change by sequestering CO_2.

Keywords: *Aster tripolium*, elevated CO_2, gas exchange, NaCl-salinity, sustainable use, water relations

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