Europ.J.Hort.Sci., **68** (1), 38–44, 2003, ISSN 1611–4426.

Long Term Effects of Sodium Chloride Salinity on Growing *in Vitro*, Proline and Phenolic Compound Content of Jojoba Explants

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Abstract

Jojoba (*Simmondsia chinensis* L.) explants were cultured *in vitro* under four levels of sodium chloride salinity (0, 0.33, 0.66 and 0.99% w/v) during the proliferation stage. Explant growth was seriously affected by salinity treatments. The mean shoot number and the total mean shoot length per explant were significantly reduced under high salt concentration. Fresh and dry weight of explants were increased till the medium level of salinity and decreased at the high one. Proline and phenolic compound contents of explants were determined in relation to salinity treatments. At the high salt level, proline content was increased while the total phenol and o-diphenol content was higher in explants deriving from control treatment. Ferulic acid and 4-coumaric acid contents decreased at the high salt levels. There were no significant differences between treatments, during most of the time at the proliferation stage, concerning vanillic acid and protocatechuic acid content.

Zusammenfassung

Langfristige Wirkungen des Salzgehalts auf die *in vitro* Entwicklung, den Gehalt an Prolin und phenolischen Verbindungen von Jojoba-Explantaten. Jojoba- (*Simmondsia chinensis* L.) Explantate wurden während der *in vitro* Proliferationsphase bei vier verschiedenen Natriumchlorid-Konzentrationen (0, 0.33, 0.66 and 0.99% w/v) kultiviert. Das Explantatwachstum wurde durch den Salzgehalt deutlich beeinflußt. Die durchschnittliche Sprosszahl und die durchschnittliche Sprossgesamtlänge pro Explantat war bei dem hohen Salzgehalt statistisch nachweisbar reduziert. Das Frisch- und Trockengewicht der Explante nahm mit steigendem Salzgehalt bis zur mittleren Stufe zu und mit weiterer Zunahme (hoher Salzgehalt) wieder ab. Auch der Gehalt an Prolin und phenolischen Verbindungen in den Explanten war durch den Salzgehalt bestimmt. Beim hohen Salzgehalt war der Prolingehalt erhöht, während der Gesamtphenol- und der o-Diphenol-Gehalt in der Kontrollbehandlung am höchsten war. Der Gehalt an Ferula- und 4-Cumarsäure nahm bei der hohen Salzkonzentration ab. Hinsichtlich Vanillin- und Protokatechinsäure war während der Proliferationsphase zumeist kein signifikanter Unterschied zwischen den Behandlungen nachweisbar.

Key words. Jojoba – *in vitro* – phenolic compounds – proline – salinity

Introduction

Jojoba (*Simmondsia chinensis*) is an industrial crop with increasing interest, especially in arid and semi-arid regions, as it is considered to tolerate fairly high levels of salinity and water stress (BOTTI et al. 1998). For this crop to be an economically profitable alternative for arid and semi-arid zones, it is necessary to select plants of high productivity under stress conditions.

Salt stress affects many physiological and biochemical processes in plants, resulting in the alteration of some metabolic pathways (FRECHILLA et al. 2001). The nature of salt tolerance is complex and not well understood, but may be attained through salt compartmentation in the cell and within the plant (KHAN et al. 2000). In response to salt stress, many plants synthesize and accumulate osmotically active, low molecular weight compounds such as proline, polyols, carbohydrates, amino acids and organic acids (FRECHILLA et al. 2001; GIRIJA et al. 2002).

Proline through its function as osmoprotectant makes an environment compatible with macromolecular structure and function (GIRIJA et al. 2002) Moreover proline accumulation may reduce stress-induced cellular acidification and proline itself may act as a substrate for respiration, which might provide energy, needed for recovery from stress (AZIZ et al. 1999).

Phenolic compounds are a large group of secondary metabolites, which can play a role in virtually any interaction a plant can have with its environment (WATERMAN and MOLE 1994). These compounds have been implicated to stress resistance against biotic and abiotic factors (BERGMANN et al. 1994, COHEN et al. 1994, WATERMAN and MOLE 1994). On the other hand, there are not so many research data about their role against abiotic ones, such as drought or salt stress, except for their unquestionable role against UV radiation (WATERMAN and MOLE 1994).

Since screening germplasm in saline fields could be time and money consuming, a promising, efficient and simple alternative could be to screen organs or propagules *in vitro* (MILLS and BENZIONI 1992). There is evidence that *in vitro* nodal segments of jojoba respond to