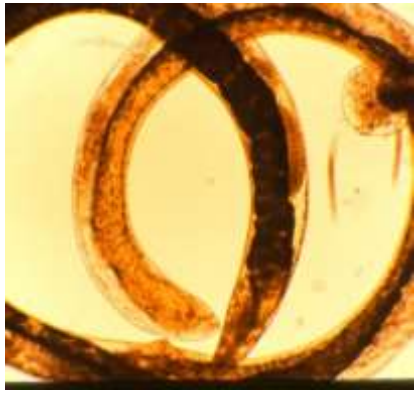







Building International Cooperation on Arid Zones Research

CONICYT-Wallonie- Bruxelles International, Délégation Santiago du Chili

Santiago
November 17, 2014

Effect of drought and salinity on growth, productivity and quality of crops

Dr. Juan Pablo Gabriel Martínez Castillo

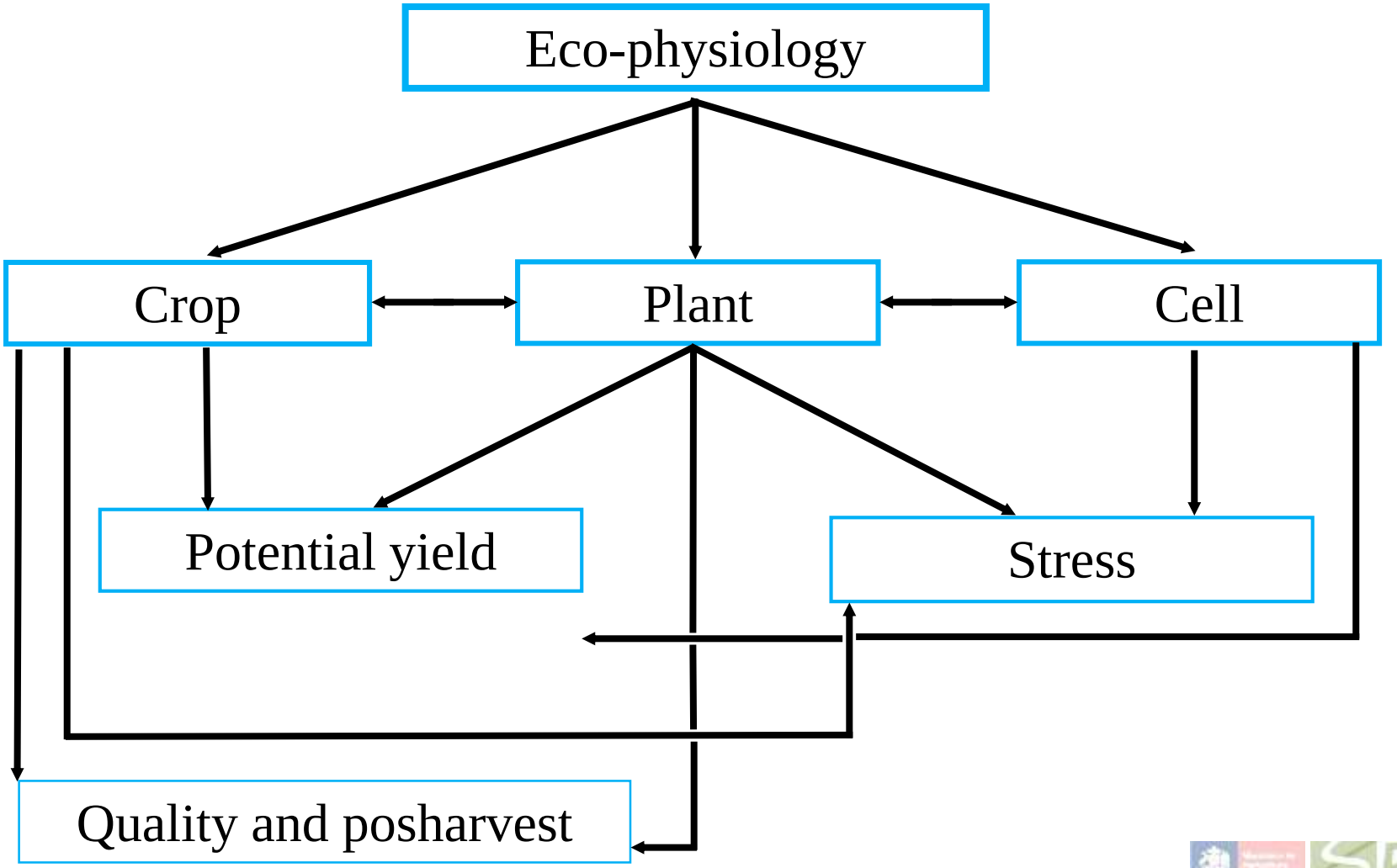
Santiago - Chile

17 Noviembre - 2014

Contents

- **Research lines**
  - Plant Physiology under salt stress
  - Crop and Vegetable Physiology under salt stress
  - Quality and safely of fruit
  - Tomato rootstock breeding under salt stress

Research areas



Plant Physiology

Plant Physiology

Atriplex

Water stress

Heavy metals

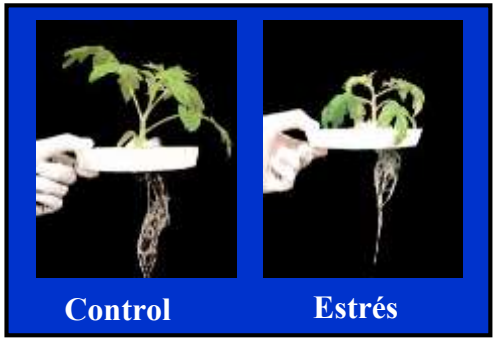
Tomate

Salt stress

Science of the Total Environment

Arsenic accumulation and distribution in relation to young seedling growth in *Atriplex atacamensis* Phil.

Delphine Vromman [a], Alejandra Flores-Bavestrello [a,b], Zdenka Šlejkovec [c], Stéphanie Lapaille [a], Carolina Teixeira-Cardoso [a], Margarita Briceño [b], Mahendra Kumar [d], Juan-Pablo Martínez [e], Stanley Lutts [a,*]



JOURNAL OF PLANT PHYSIOLOGY

Is osmotic adjustment required for water stress resistance in the Mediterranean shrub *Atriplex halimus* L?

Juan-Pablo Martinez[a,1], Stanley Lutts[a,*], André Schanck[b], Mohammed Bajji[a], Jean-Marie Kinet[a]

CSIRO PUBLISHING

Salt stress differently affects growth, water status and antioxidant enzyme activities in *Solanum lycopersicum* and its wild relative *Solanum chilense*

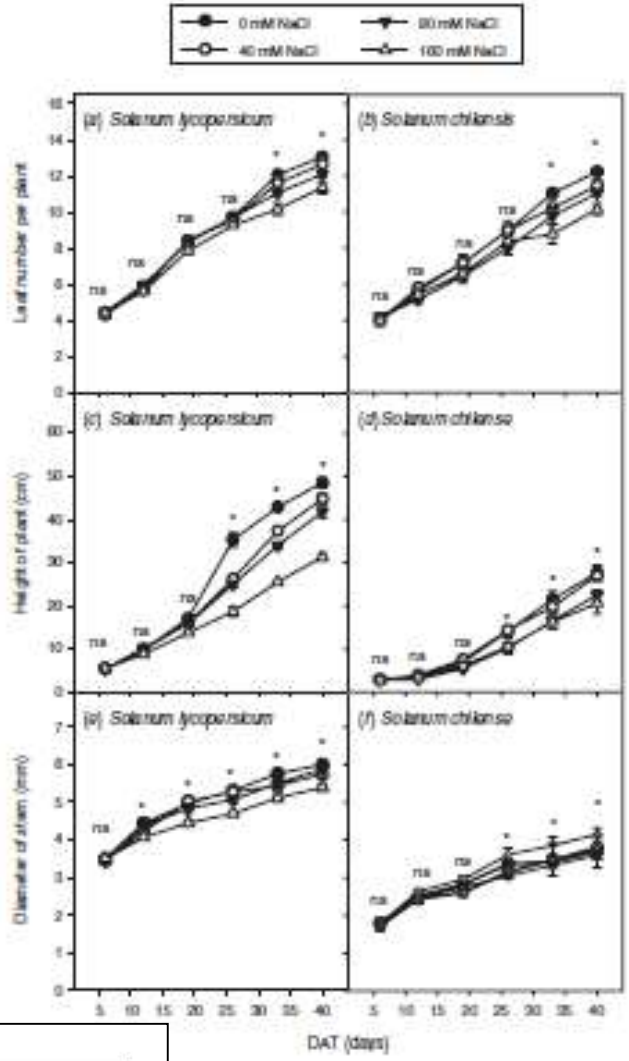
Juan Pablo Martínez[A,E,H], Alejandro Antúnez[B], Héctor Araya[C], Ricardo Pertuzé[D], Lida Fuentes[E], X. Carolina Lizana[F] and Stanley Lutts[G]

Plant Growth Regulation **41:** 63–73, 2003.

Effect of water stress on growth, Na^+ and K^+ accumulation and water use efficiency in relation to osmotic adjustment in two populations of *Atriplex halimus* L.

J.P. Martìnez[1,3], J.F. Ledent[2], M. Bajji[1], J.M. Kinet[1] and S. Lutts[1,*]

Effect of the salt stress on growth

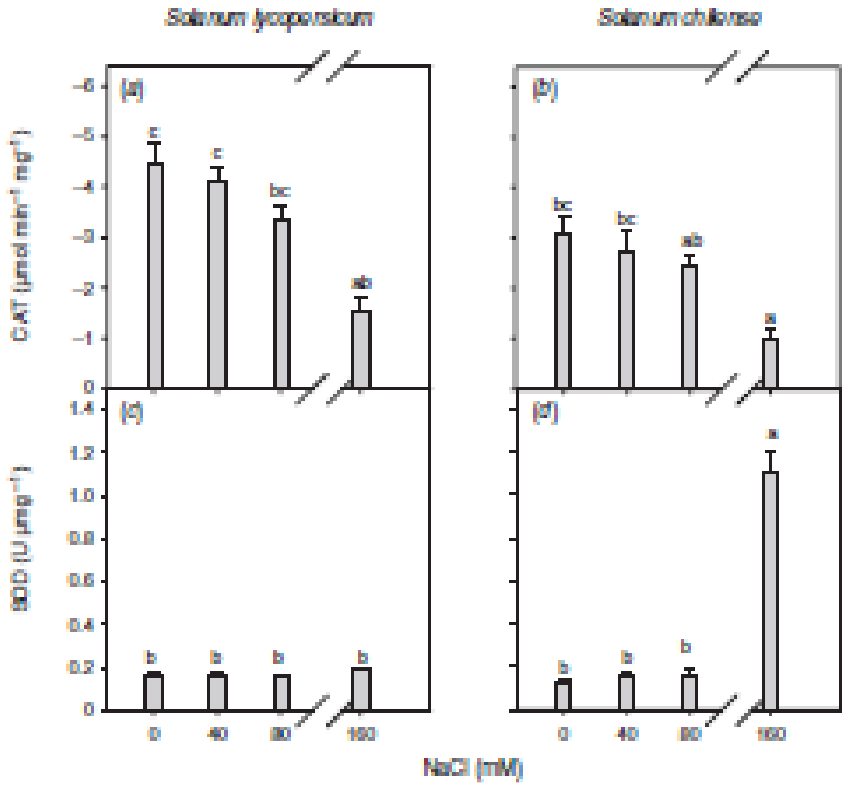


CSIRO PUBLISHING
Australian Journal of Botany, 2014, 62, 359–368
http://dx.doi.org/10.1071/BT14102

Salt stress differently affects growth, water status and antioxidant enzyme activities in *Solanum lycopersicum* and its wild relative *Solanum chilense*

Juan Pablo Martínez[A,E,H], *Alejandro Antúnez*[B], *Héctor Araya*[C], *Ricardo Pertuzé*[D], *Lida Fuentes*[E], *X. Carolina Lizana*[F] and *Stanley Lutts*[G]

Effect of the salt stress on antioxidant enzyme activity



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Crop physiology

Drought stress at the crop level

Common bean
(Phaseolus vulgaris L.)

Arroz Tuscola

Orfeo

Available online at www.sciencedirect.com
ScienceDirect
Europ. J. Agronomy 26 (2007) 30–38
European Journal of Agronomy
www.elsevier.com/locate/eja
ELSEVIER

Effect of drought stress on the osmotic adjustment, cell wall elasticity and cell volume of six cultivars of common beans (*Phaseolus vulgaris* L.)

J.P. Martínez[a,*], H. Silva[b], J.F. Ledent[c], M. Pinto[b]

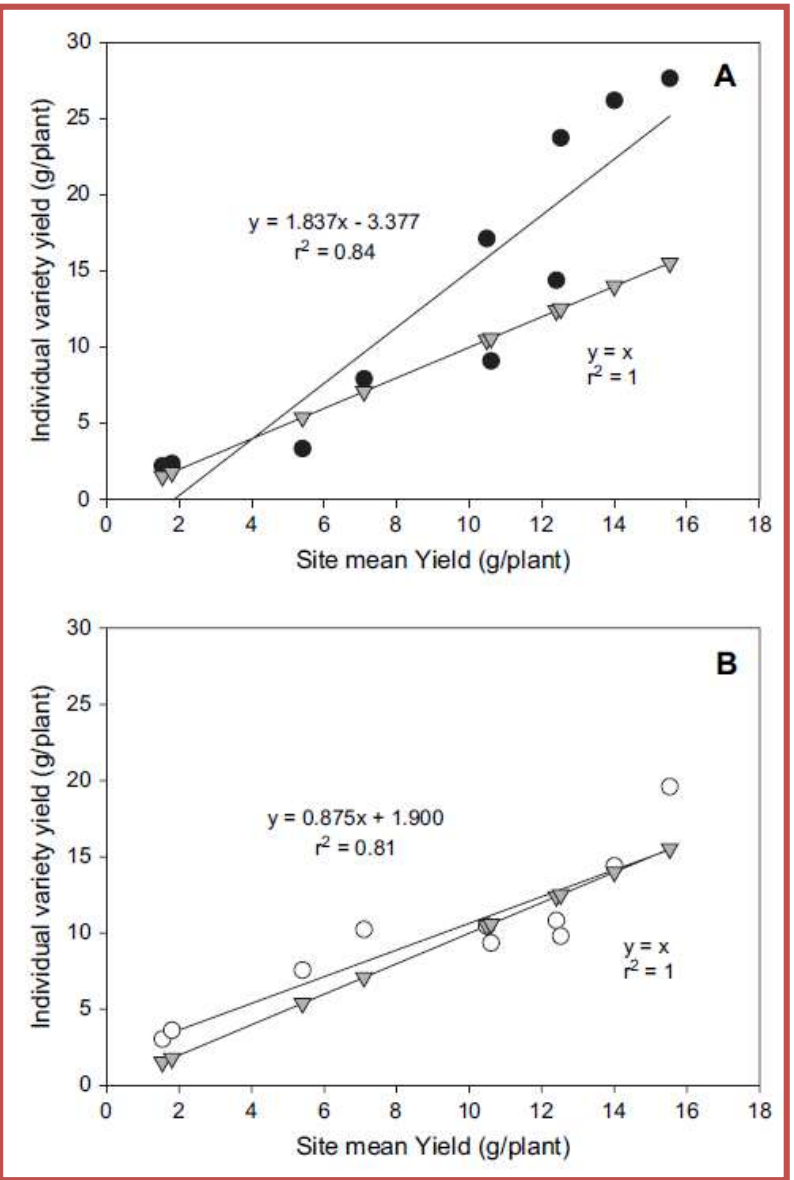
Journal of Experimental Botany, Vol. 57, No. 3, pp. 685–697, 2006
doi:10.1093/jxb/erj062 Advance Access publication 16 January, 2006
This paper is available online free of all access charges (see http://jxb.oxfordjournals.org/open_access.html for further details)
Journal of Experimental Botany
RESEARCH PAPER

Differential adaptation of two varieties of common bean to abiotic stress

I. Effects of drought on yield and photosynthesis

Carolina Lizana[1], Mark Wentworth[2], Juan P. Martínez[1], Daniel Villegas[1], Rodrigo Meneses[3], Erik H. Murchie[2], Claudio Pastenes[1], Bartolomeo Lercari[4], Paulo Vernieri[4], Peter Horton[2,*] and Manuel Pinto[1]

Yield stability



Arroz Tuscola

a) DOR 364

b) BAT 477

c) G3513

Orfeo

d) G21212

e) BAT881

Journal of Experimental Botany, Vol. 57, No. 3, pp. 685–697, 2006
doi:10.1093/jxb/erj062 Advance Access publication 16 January, 2006
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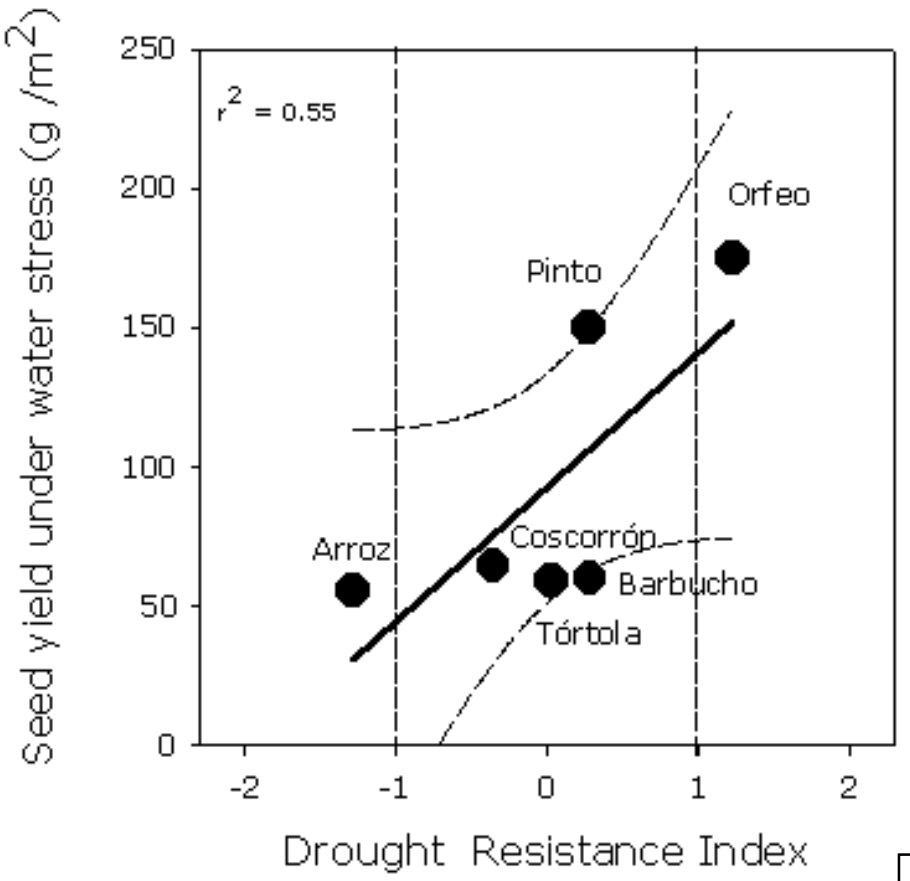
Drought index resistance (DRI)



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J.P. Martínez[a,*], H. Silva[b], J.F. Ledent[c], M. Pinto[b]

Osmotic adjustment and cell wall elasticity

Effect of water stress on the leaf full turgor osmotic potential ψ_S^{100} and the elasticity module (ε) in different cultivars of bean

Cultivar	ψ_S^{100} (MPa)		ε (MPa)	
	Control	Water stress	Control	Water stress
Arroz Tuscola	−1.3 ± 0.20 a[a]A[b]	−1.4 ± 0.20 abA	3.0 ± 0.10 bA	3.5 ± 0.18 abA
Barbucho	−1.6 ± 0.25 aA	−2.1 ± 0.30 cA	6.5 ± 0.15 aA	5.3 ± 0.16 aB
Coscorrón	−1.2 ± 0.15 aA	−1.9 ± 0.20 bcB	3.3 ± 0.10 bA	3.7 ± 0.11 abA
Orfeo	−1.6 ± 0.22 aA	−1.6 ± 0.32 abcA	3.7 ± 0.11 bA	2.4 ± 0.05 bB
Pinto	−1.6 ± 0.24 aA	−1.7 ± 0.30 abA	5.3 ± 0.13 abA	3.5 ± 0.10 abB
Tórtola	−1.4 ± 0.18 aA	−1.8 ± 0.27 abcA	4.6 ± 0.09 abA	2.0 ± 0.05 bB
Average	−1.5 ± 0.20 A	−1.7 ± 0.28 A	4.4 ± 0.10 A	3.4 ± 0.08 B

Each value represents mean ± S.E. ($n = 4$).

[a] Lower case letters indicates differences between cultivars.

[b] Upper case letters indicate differences ($P \leq 0.05$) between treatments.

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J.P. Martínez[a,*], H. Silva[b], J.F. Ledent[c], M. Pinto[b]

Effect of the salt stress on yield and fruit quality

Effect of the salt stress

Tomate cherry

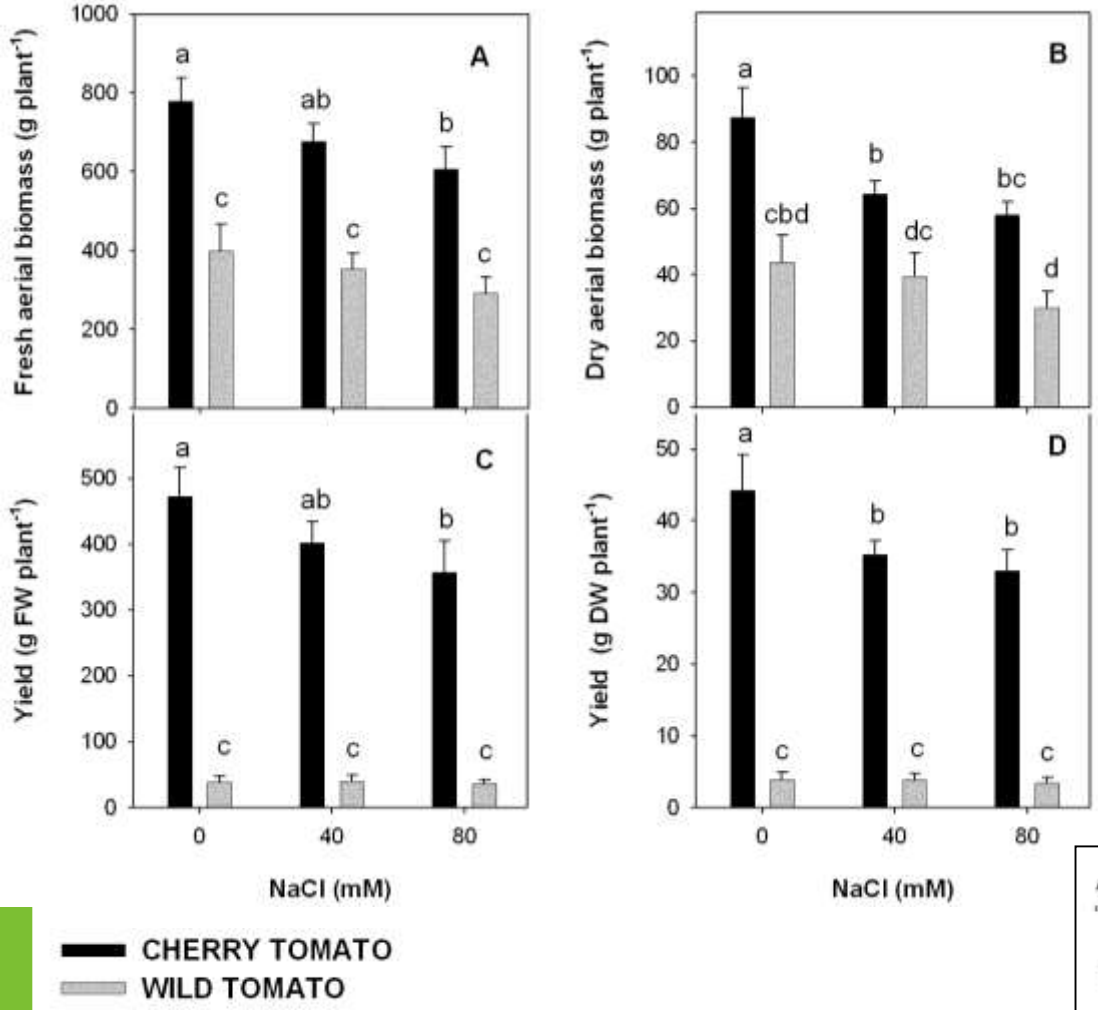
Tomate silvestre

Expl Agric. (2012), volume 48 (4), pp. 573–586 © *Cambridge University Press 2012*
doi:10.1017/S001447971200066X

EFFECTS OF SALINE WATER ON WATER STATUS, YIELD AND FRUIT QUALITY OF WILD (*SOLANUM CHILENSE*) AND DOMESTICATED (*SOLANUM LYCOPERSICUM* VAR. *CERASIFORME*) TOMATOES

By JUAN-PABLO MARTÍNEZ†, ‡,§, ALEJANDRO ANTÚNEZ¶, RICARDO PERTUZÉ††, MARIA DEL PILAR ACOSTA†, XIMENA PALMA‡‡, LIDA FUENTES†, ‡, ANIBAL AYALA†, HECTOR ARAYA‡‡, §§, ‡ *and* STANLEY LUTTS¶¶

Biomass and productivity



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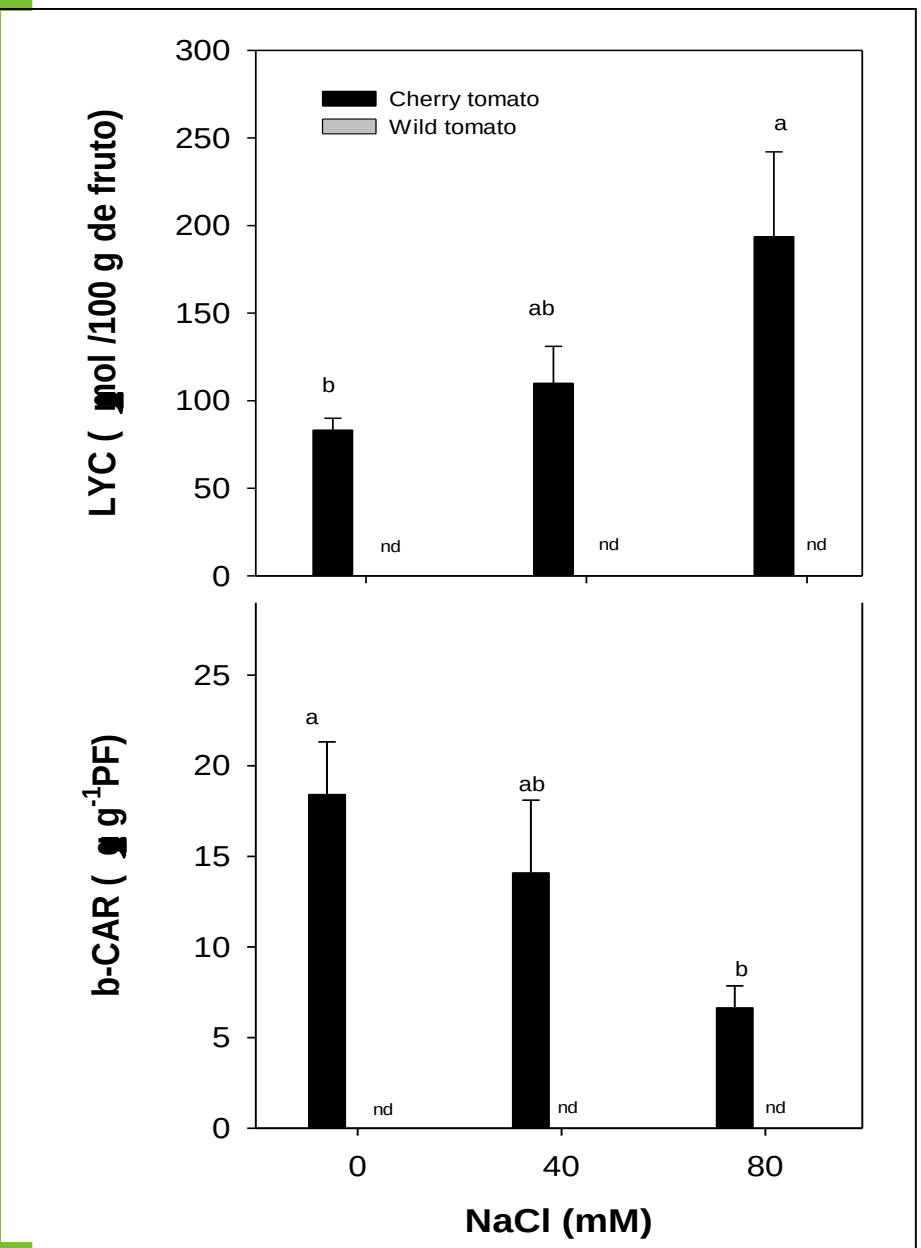
Functional quality of fruit

Salt stress



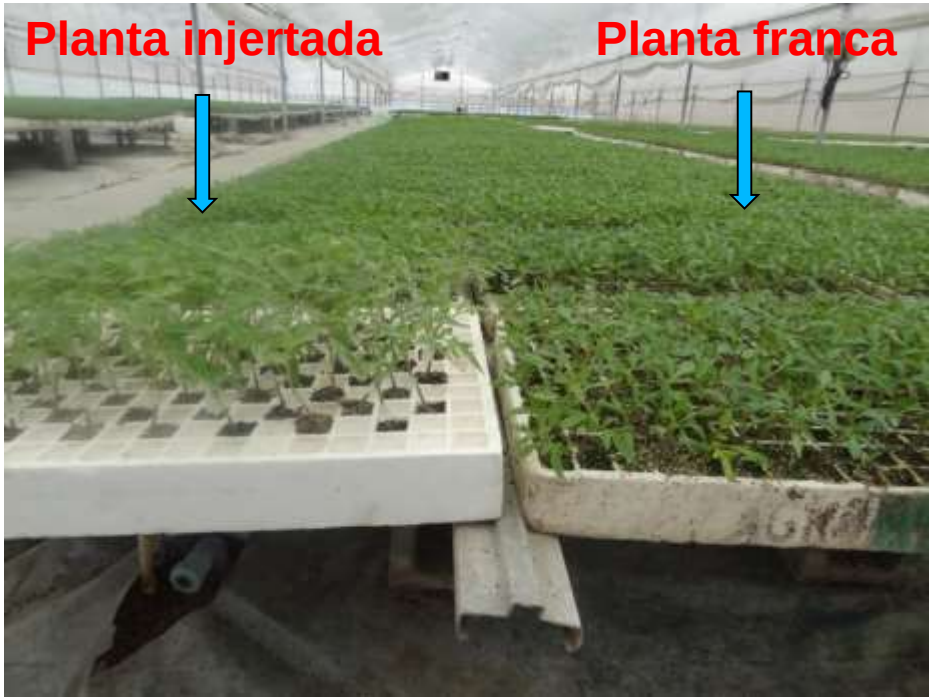
Artículo en preparación:

JP Martínez et al. .*Effect of saline stress on antioxidant compounds in fruits of two tomato genotypes: wild type and cherry cultivar.* Postharvest Biology and Technology.

Effect of rootstock on productivity and fruit quality

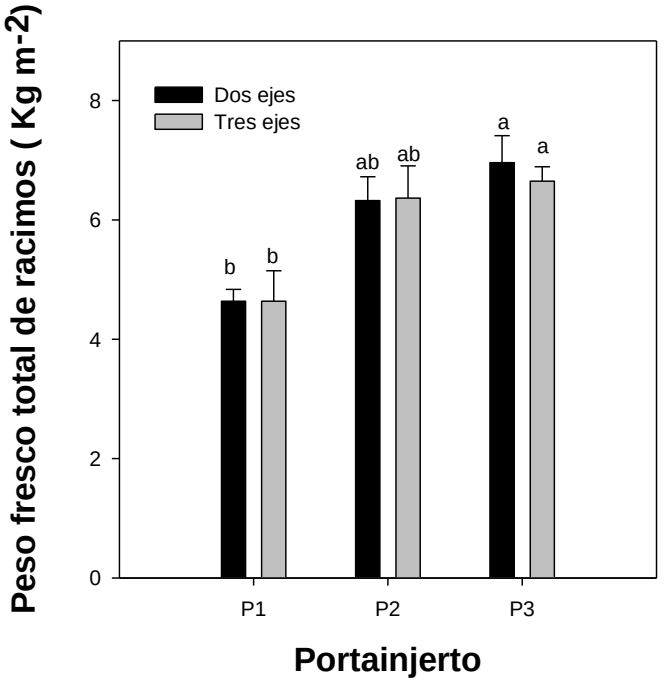
Fuente: Juan Pablo Martínez, INIA La Cruz

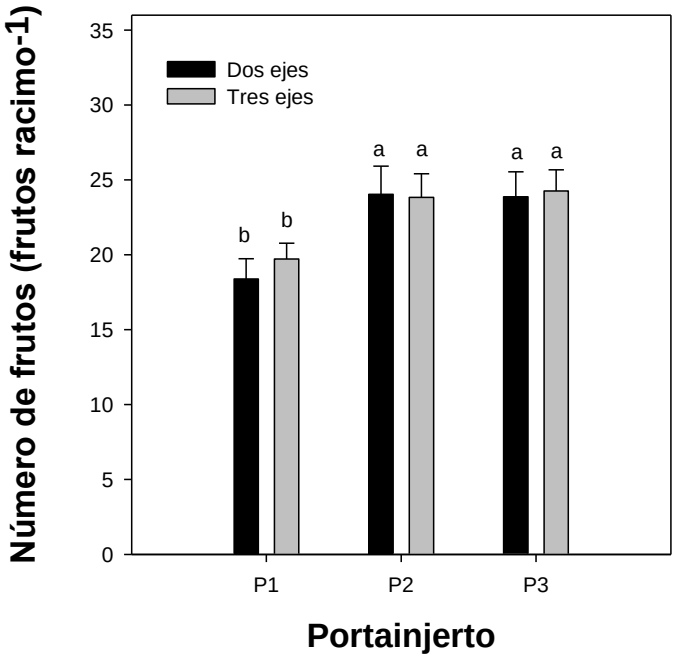
Rootstock



Fuente: Juan Pablo Martínez, INIA La Cruz

Yield





VIII Reunión de Biología Vegetal

PS82

EFFECT OF ROOTSTOCK ON GROWTH, PRODUCTIVITY AND FRUIT QUALITY OF CHERRY TOMATO

Juan Pablo Martinez[1,2], Luis Salinas[1], Alejandro Antúnez[3], Aníbal Ayala[1], Lida Fuentes[2,4], Stanley Lutts[5], Francisco Pérez-Alfocea[3]

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[1]Instituto de Investigaciones Agropecuarias, INIA-La Cruz, La Cruz, [2]Instituto de Investigaciones Agropecuarias, INIA-La Platina, Santiago [3]Centro Regional de Estudios en Alimentación y Salud (CREAS), Valparaíso, Chile; [4]Université catholique de Louvain, Laboratoire d'Ecologie des Grandes Culture, Louvain-la-Neuve, Belgium. [5]CEBAS-CSIC, Departamento Nutrición Vegetal, Murcia, España.

Artículo en preparación

Fresh weight of the first fruit

Conduction system	*Solanum lycopersicum. var cerasiforme*		
	P1 (g fruit^{-1})	P2 (g fruit^{-1})	P3 (g fruio^{-1})
Two axes	13,28 ± 0,29 b	14,64 ± 0,32 a	15,24 ± 0,45 a
Three axes	12,708 ± 0.29 b	14,44 ± 0.30 a	15,17 ± 0,37 a
Average	14,53 ± 0,22 B	15,19 ± 28 A	12,93 ± 0,21 A

Martínez et al. (data no published)

Long of fruit (cm)

Conduction system	*Solanum lycopersicum. var cerasiforme*		
	P1 (cm)	P2 (cm)	P3 (cm)
Two axes	3,72 ± 0,04 ab	4,07 ± 0,04 a	4,07 ± 0,05 a
Three axes	3,73 ± 0.03 b	3,98 ± 0.04 a	3,97 ± 0,04 a
Average	3,73 ± 0,02 B	4,02 ± 0,03 A	4,006 ± 0,03 A

Martínez et al. (datos no publicados)

Firmness of fruit

Conduction system	*Solanum lycopersicum. var cerasiforme*		
	P1 (Lb)	P2 (Lb)	P3 (Lb)
Two axes	1,13 ± 0,05 ab	1,36 ± 0,05 a	1,38 ± 0,06 a
Three axes	1,22 ± 0,03 b	1,24 ± 0,04 ab	1,34 ± 0,03 ab
Average	1,26 ± 0,03 B	1,29 ± 0,03 A	1,35 ± 0,03 A

Martínez et al. (data no published)

Conclusion

- It is necessary to improve and obtain the cropped varieties more resistant to drought and salt stress conditions.
- The use of the grafted tomato increase the productivity (Kg m^2; Nº fruits per bunch y fresh weight of bunch) and fruit quality (fruit fresh weight, size firmness).

Acknowledgement

- Wallonie- Bruxelles International, Délégation Santiago du Chili.

- CONICYT

- Grant project INIA-CSIC N° 501736-70 (Ministerio de Agricultura, Gobierno de Chile).

- Grant project FONDECYT Nº 1090405 on tomato.

Acknowledgement

Grupo de Fisiología y Biología Molecular Vegetal (INIA La Cruz)