

PEP-Carboxylase Activity Supports Organic Acid Metabolism of Maize (*Zea mays*) under Salt Stress

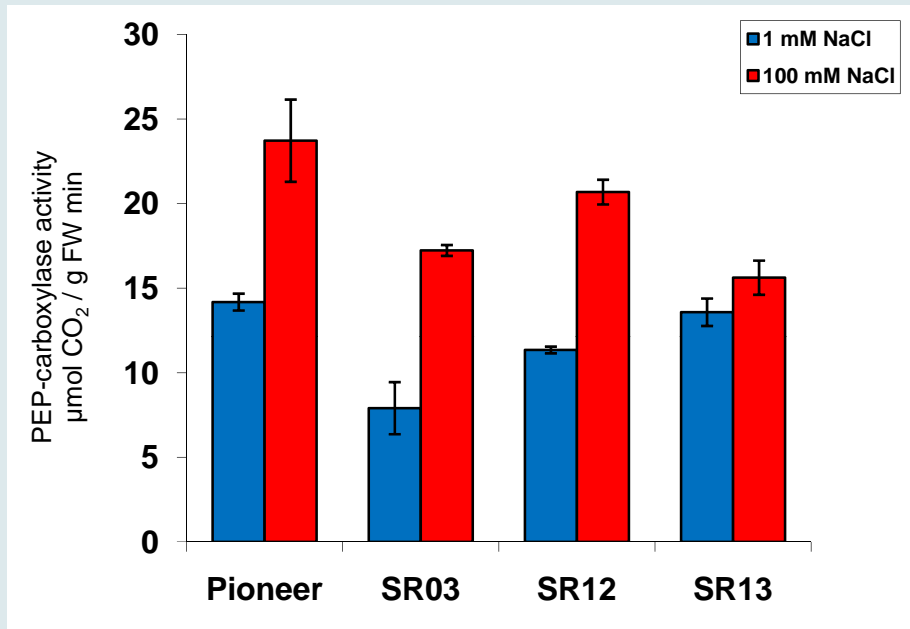
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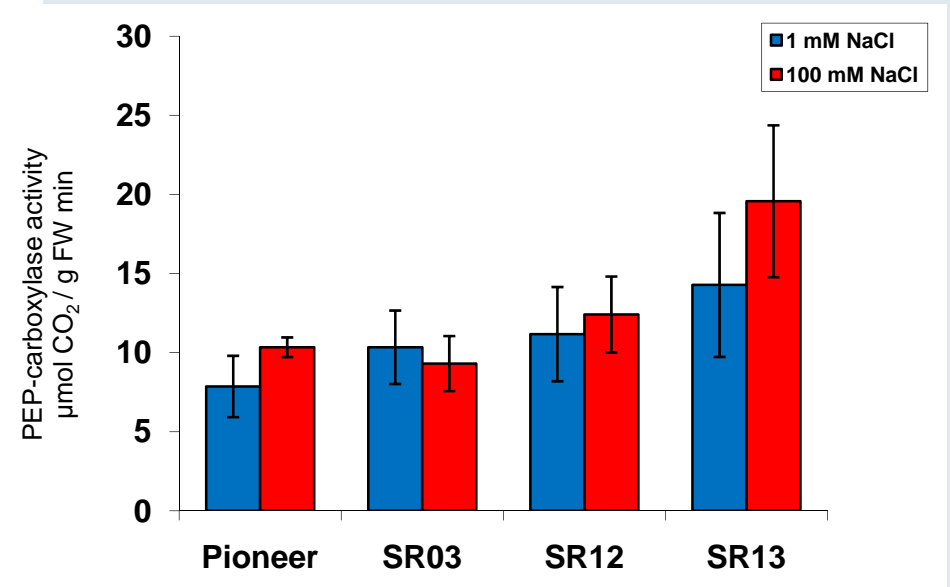
<http://www.uni-giessen.de//plant-nutrition//>

Surprising result



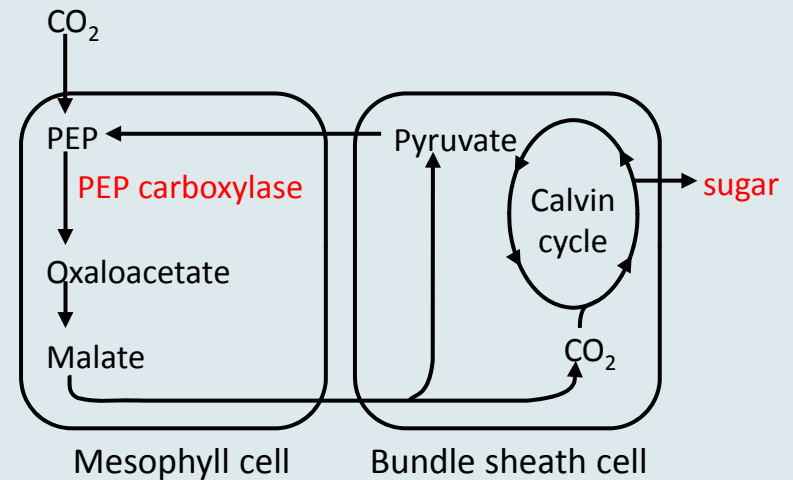
Effect of salt stress on the PEP-carboxylase activity in young shoots of various maize hybrids

Effect of salt stress on the PEP-carboxylase activity in old shoots of various maize hybrids

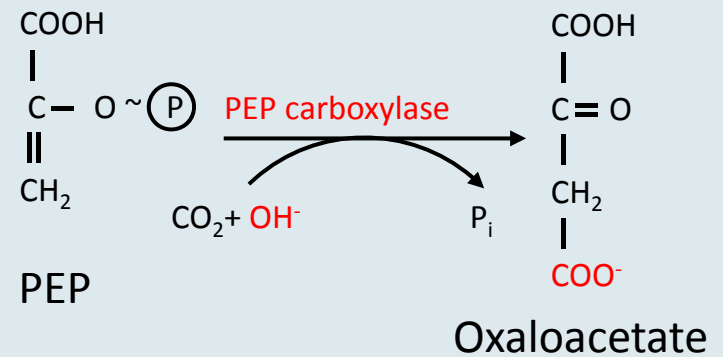


Hypotheses

- Enhanced PEP-carboxylase activity in young shoots increases **sugar concentrations**



- Enhanced PEP-carboxylase activity in young shoots increases **organic acid concentrations**



Experimental approaches

- Comparison of maize (*Zea mays* L. hybrid SR 03) as a C₄ plant with wheat (*Triticum aestivum* L. cv. Thasos) as a C₃ plant
- Effect of two different light intensities on the concentrations of sugars and organic acids in young shoots



Material and Methods

Material:

- Maize (*Zea mays* L. hybrid SR 03*)
- Weizen (*Triticum aestivum* L. cv. Thasos)

Plant cultivation:

- growth chamber 330 W m⁻² and 200 W m⁻²
26°C, 16 h (day); 18°C, 8 h (night)
- standard nutrient solution (± salt)

Salt treatment 100 mM NaCl

- 13th day: 25 mM NaCl
- 14th day: 50 mM NaCl
- 15th day: 75 mM NaCl
- 16.- 20th day: 100 mM NaCl, 20th day: harvest

***Information on the development and salt resistance of maize hybrid SR 03:**

Schubert et al.: Plant Sci. 177, 196-202 (2009)

Pitann et al.: J. Plant Nutr. Soil Sci. 172, 535-543 (2009)



Material and Methods

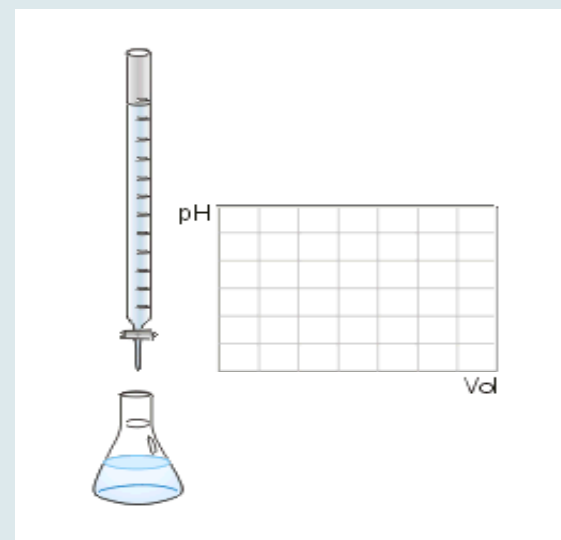
Parameters:

- Fresh weight
- PEP-carboxylase activity
- Glucose, fructose and sucrose concentrations
- Malate concentrations
- Alkalinity



Determination of alkalinity

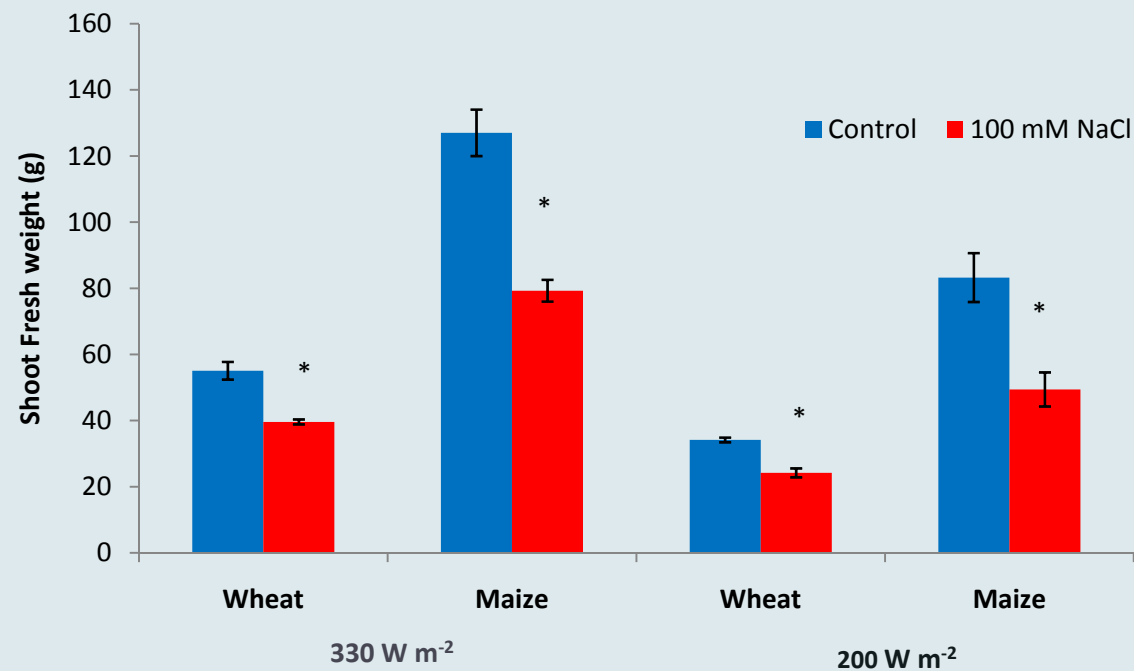
- Conversion of organic anions into carbonates by ashing at 500°C
- Solubilization of carbonates with excess acid
- Back-titration with NaOH for the determination of residual acid



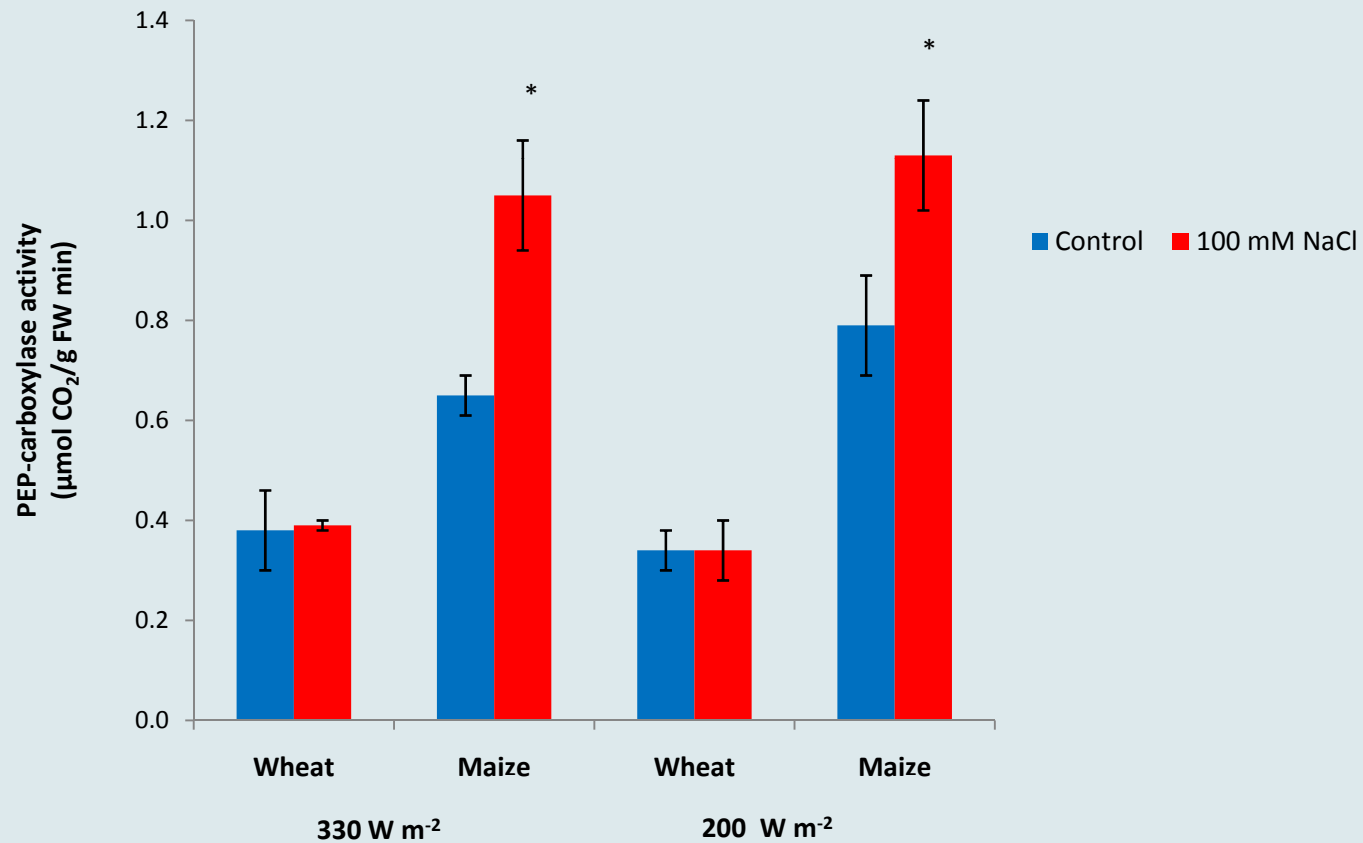
<http://upload.wikimedia.org/wikipedia/commons/8/8c/Titolazione.gif>



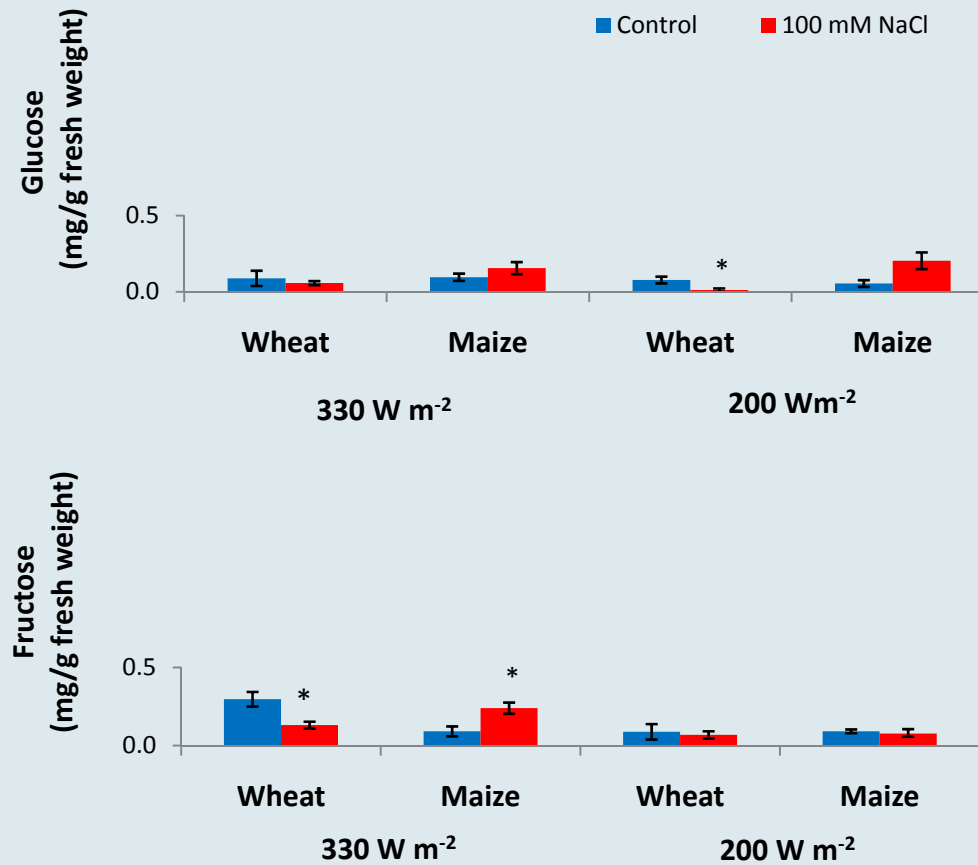
Effect of salt stress on the shoot fresh weights of wheat and maize under two different light intensities



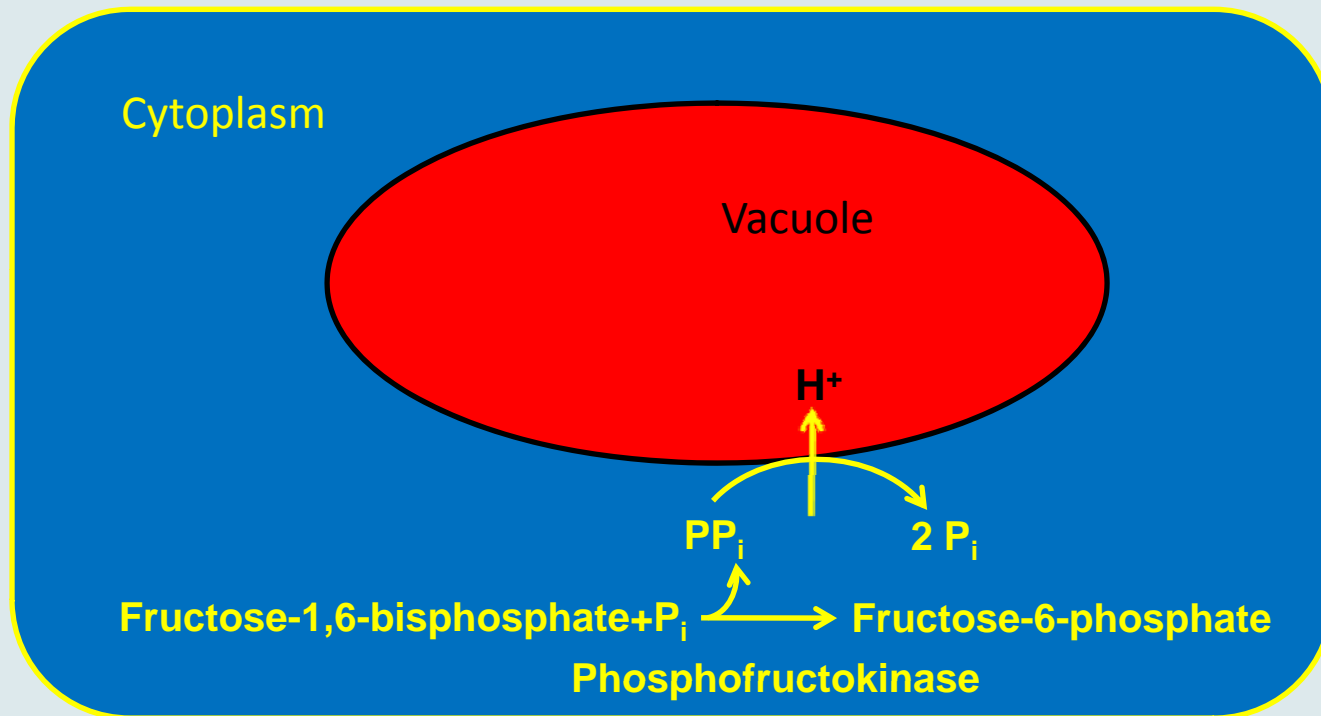
Effect of salt stress on the PEP-carboxylase activity in young shoots of wheat and maize under two different light intensities



Effect of salt stress on the glucose and fructose concentrations of young shoots of wheat and maize under two different light intensities



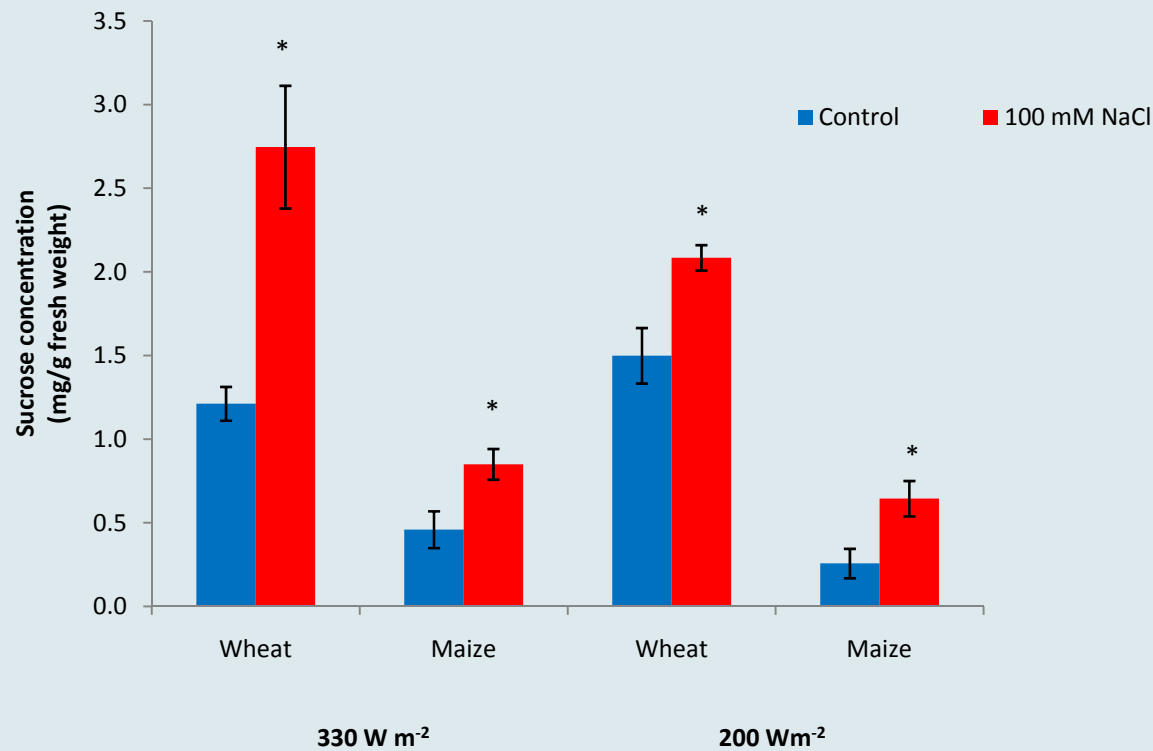
Regeneration of PP_i as substrate for the pyrophosphatase H^+ pump*



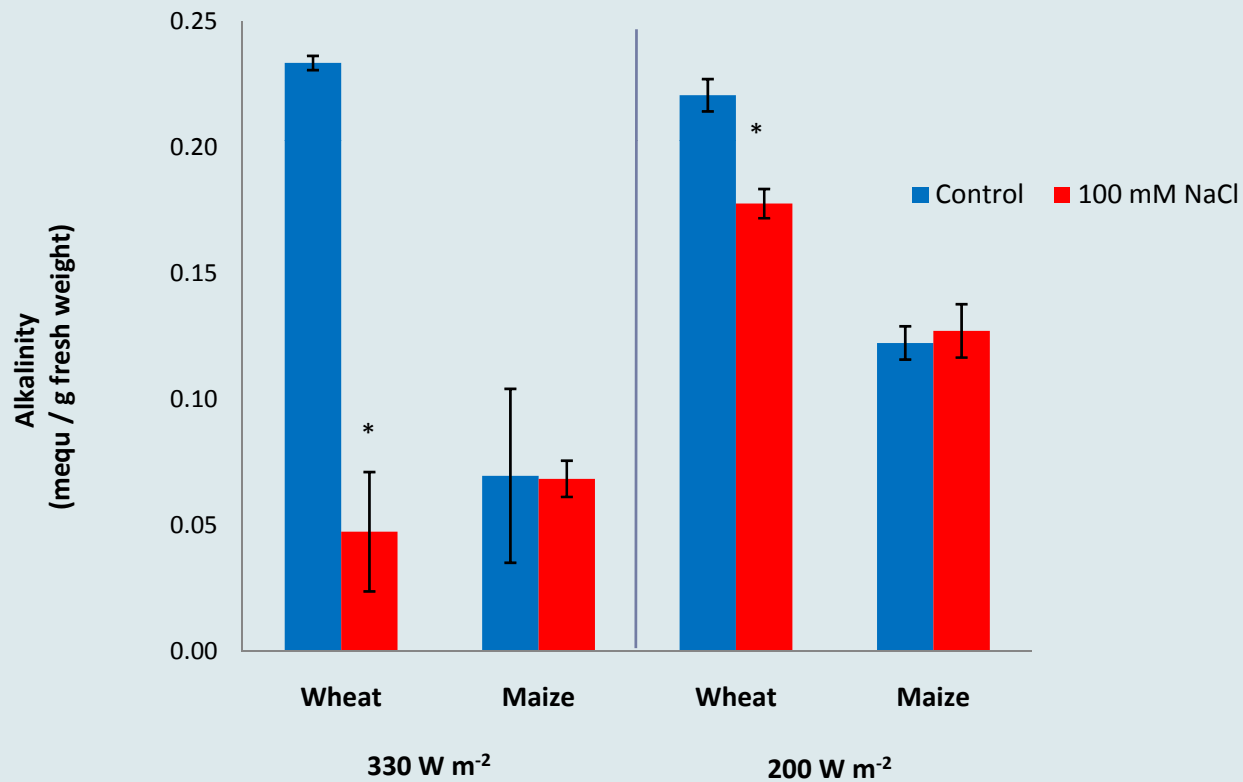
*Costa dos Santos et al.: Plant Physiol. 133, 885-892 (2003)



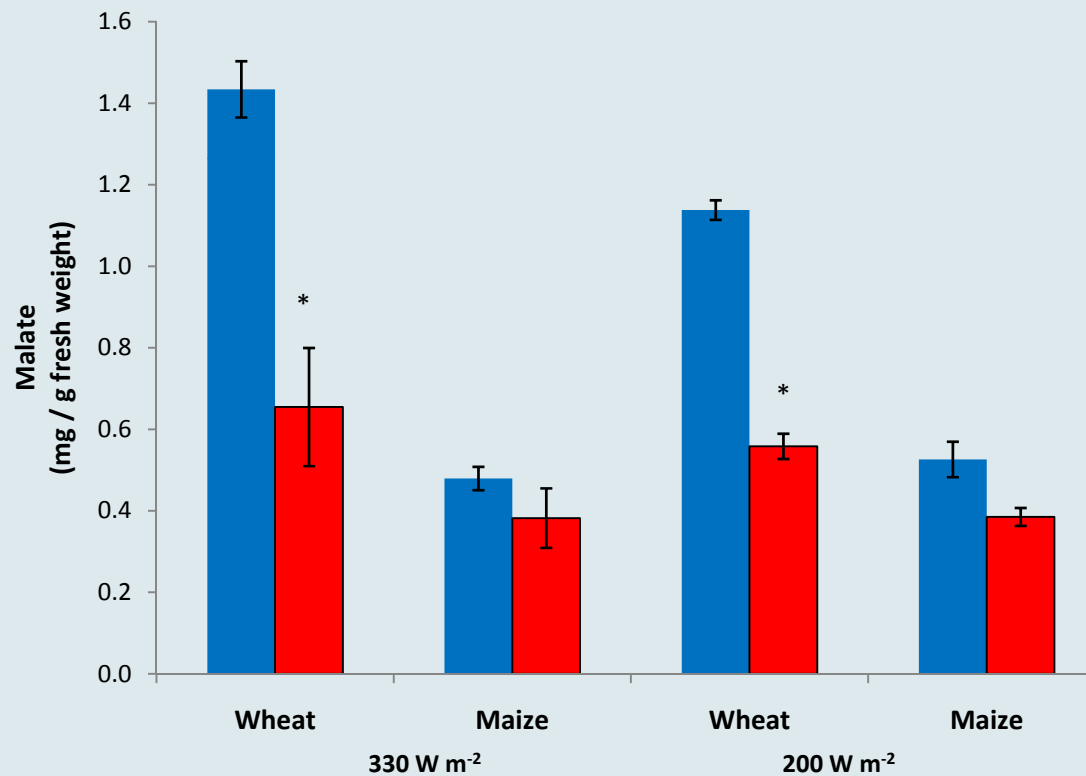
Effect of salt stress on the sucrose concentrations of young shoots of wheat and maize under two different light intensities



Effect of salt stress on the alkalinity in young shoots of wheat and maize under two different light intensities



Effect of salt stress on the malate concentrations in young shoots of wheat and maize under two different light intensities



Conclusions

- Enhanced PEP-carboxylase activity in young shoots of maize under salt stress **does not** increase sugar supply via the C₄ pathway. This is in agreement with the finding that osmotic adjustment does not limit growth*.
- Enhanced PEP-carboxylase activity in young shoots of maize maintains organic acid metabolism under salt stress**.

* De Costa et al.: *Physiol. Plant.* 131, 311-321 (2007)

** Hatzig et al.: *J. Agron. Crop Sci.* (accepted)



Acknowledgment

We thank Anita Langer and Christa Lein
for excellent technical assistance

