

# Adaptation of the metabolism of *Sesbania virgata* to the storage compounds of the seeds

Marco Aurélio S. Tiné

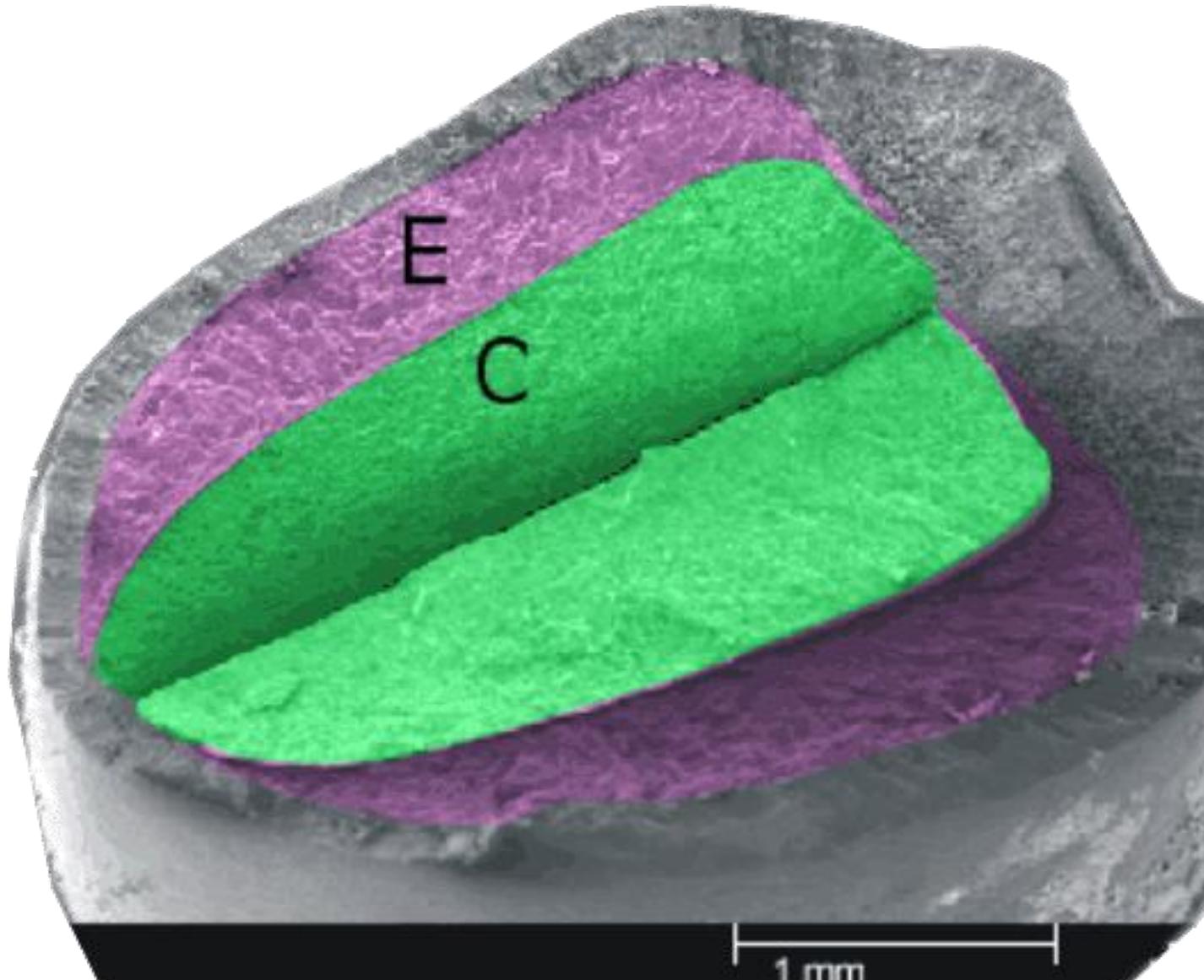
Instituto de Botânica,  
São Paulo, Brazil



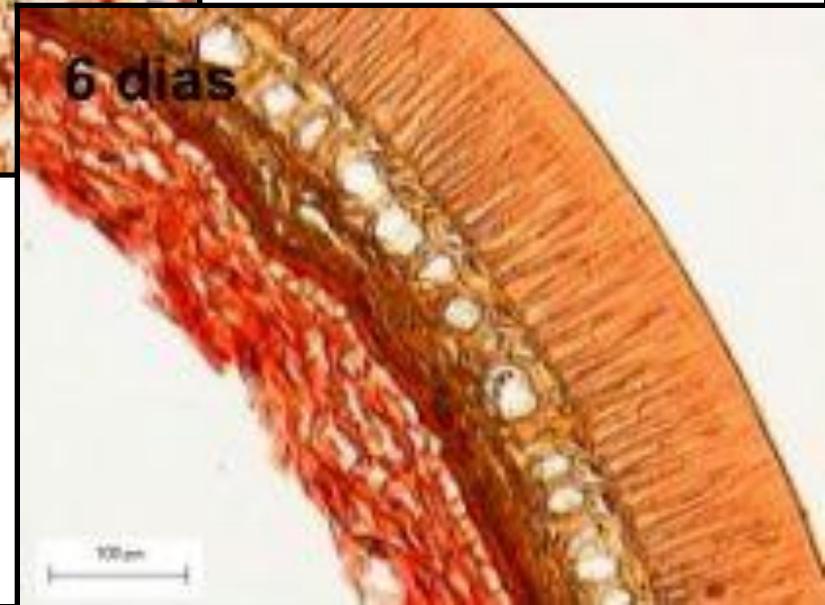
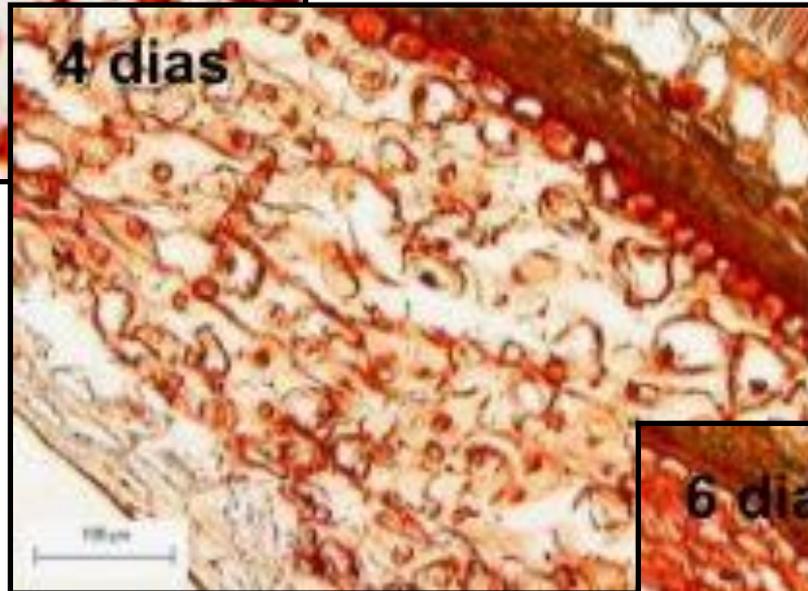
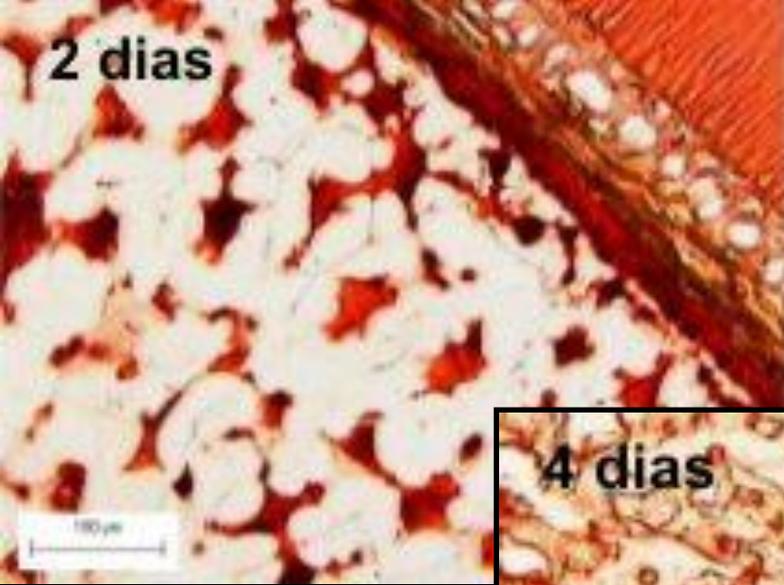
*Sesbania virgata*. (Cav.) Pers.



# Seed Morphology

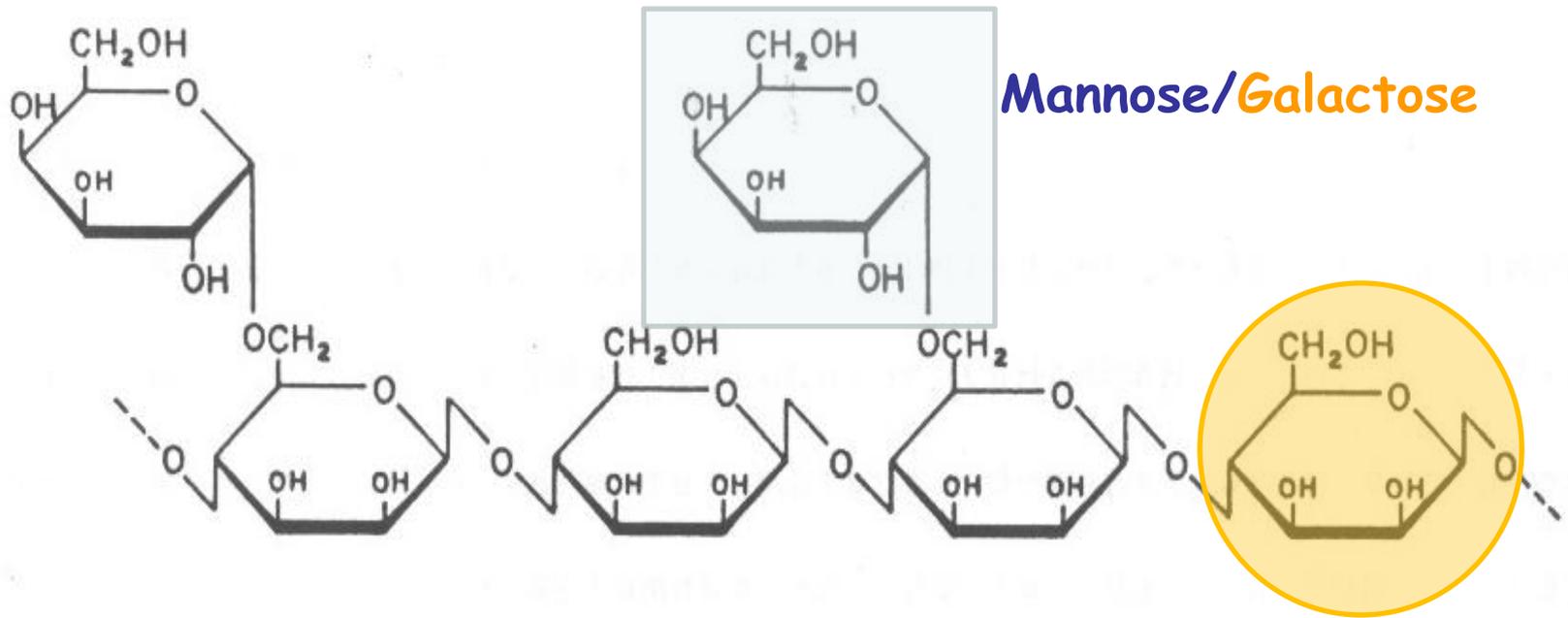


# Mobilisation of the storage galactomannan in seeds of *Sesbania virgata*.



Fotos: cortesia de Patricia P. Tonini.

# Structure of the galactomannan



# Carbon metabolism and transport

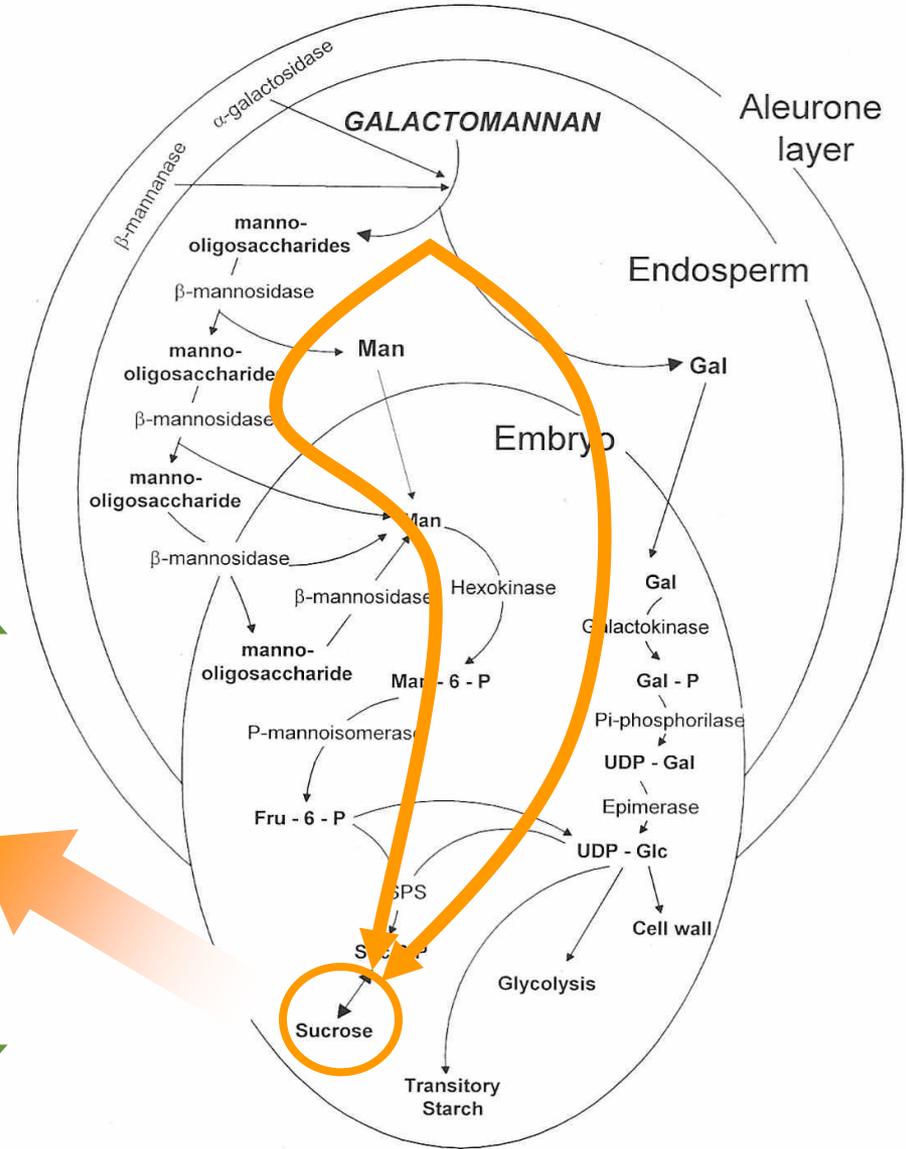


Transport

Sink

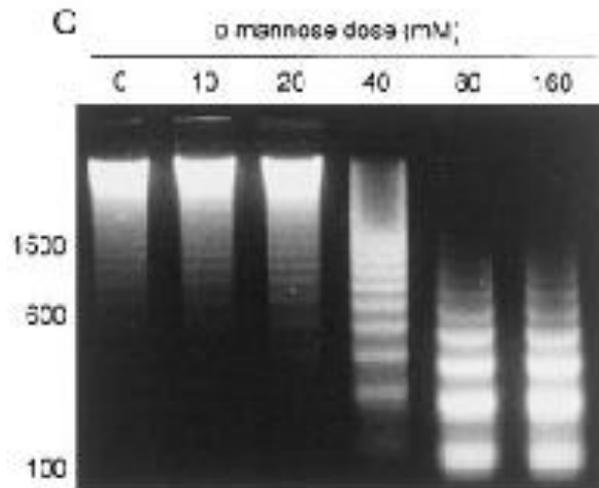
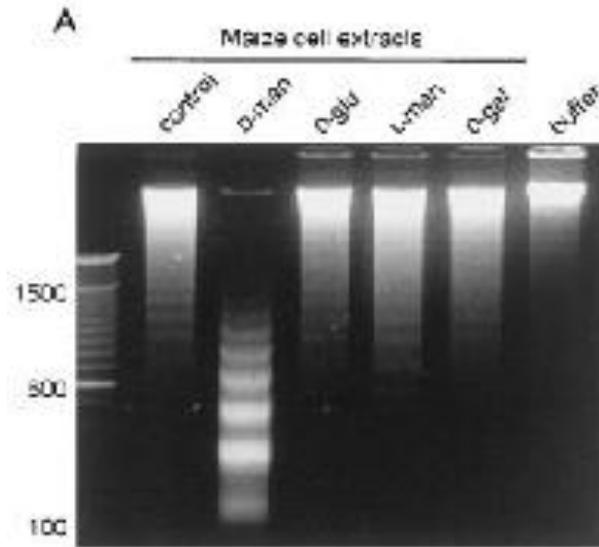
source

sink



# Mannose is described as toxic to some plants:

Induces cell death and DNA fragmentation in maize.



*Plant Physiology*, September 1999, Vol. 121, pp. 71–79, [www.plantphysiol.org](http://www.plantphysiol.org) © 1999 American Society of Plant Physiologists

## Mannose Induces an Endonuclease Responsible for DNA Laddering in Plant Cells

Joshua C. Stein<sup>1</sup> and Geneviève Hansen\*

Novartis Agribusiness Biotechnology Research, 3054 Cornwallis Road, Research Triangle Park, Durham, North Carolina 27709

# Mannose is described as toxic to some plants:

It also inhibits photosynthesis in maize.

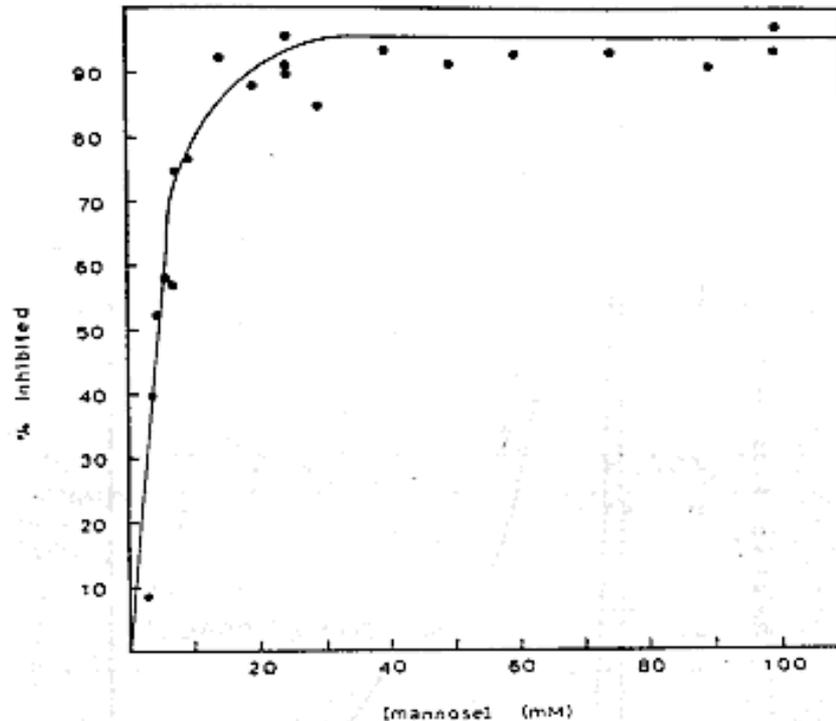


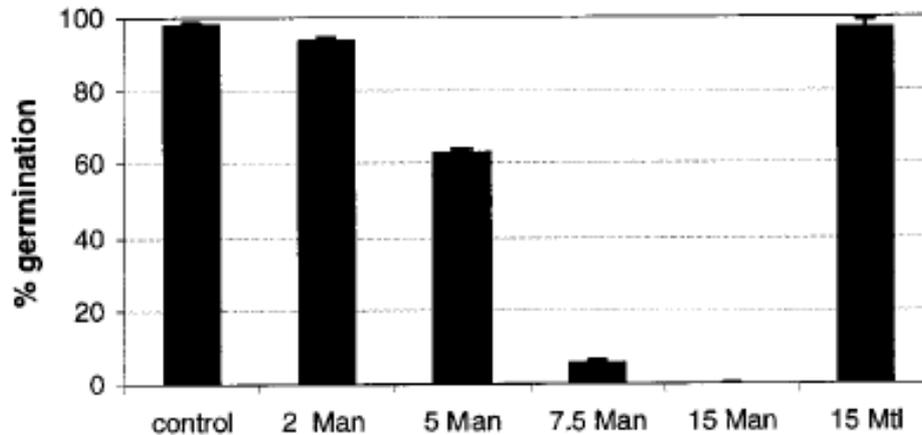
FIG. 4. Corn leaves which had reached a steady state of photosynthesis (conditions as described in Fig. 3) were fed various concentrations of mannose in the transpiration stream and allowed to decay to a new steady state of photosynthesis. The % inhibition of photosynthesis (relative to the rate prior to the addition of mannose) was plotted as a function of mannose concentration in the feeding solution.

Mannose metabolism in corn and its impact on leaf metabolites, photosynthetic gas exchange and chlorophyll fluorescence.

Harris, G.C., Gibbs, P.M., Ludwig, G., Un, A., Sprengnether, M. (1986). *Plant Physiol.* 82:1081-1089.

# Mannose is described as toxic to some plants:

And inhibits seed germination in arabidopsis.



**Figure 1.** Man represses germination of wild-type Arabidopsis seeds in a concentration-dependent manner. Seeds were plated in the absence of sugar (control) and on 2, 5, 7.5, and 15 mM Man. Fifteen millimolar mannitol (15 Mtl) was taken as an osmotic control. Approximately 200 seeds were used for each data point in each experiment. Values presented are the average of three independent experiments. Germination was scored at d 8.

*Plant Physiology*, March 1999, Vol. 119, pp. 1017–1023, www.plantphysiol.org © 1999 American Society of Plant Physiologists

## Mannose Inhibits Arabidopsis Germination via a Hexokinase-Mediated Step<sup>1</sup>

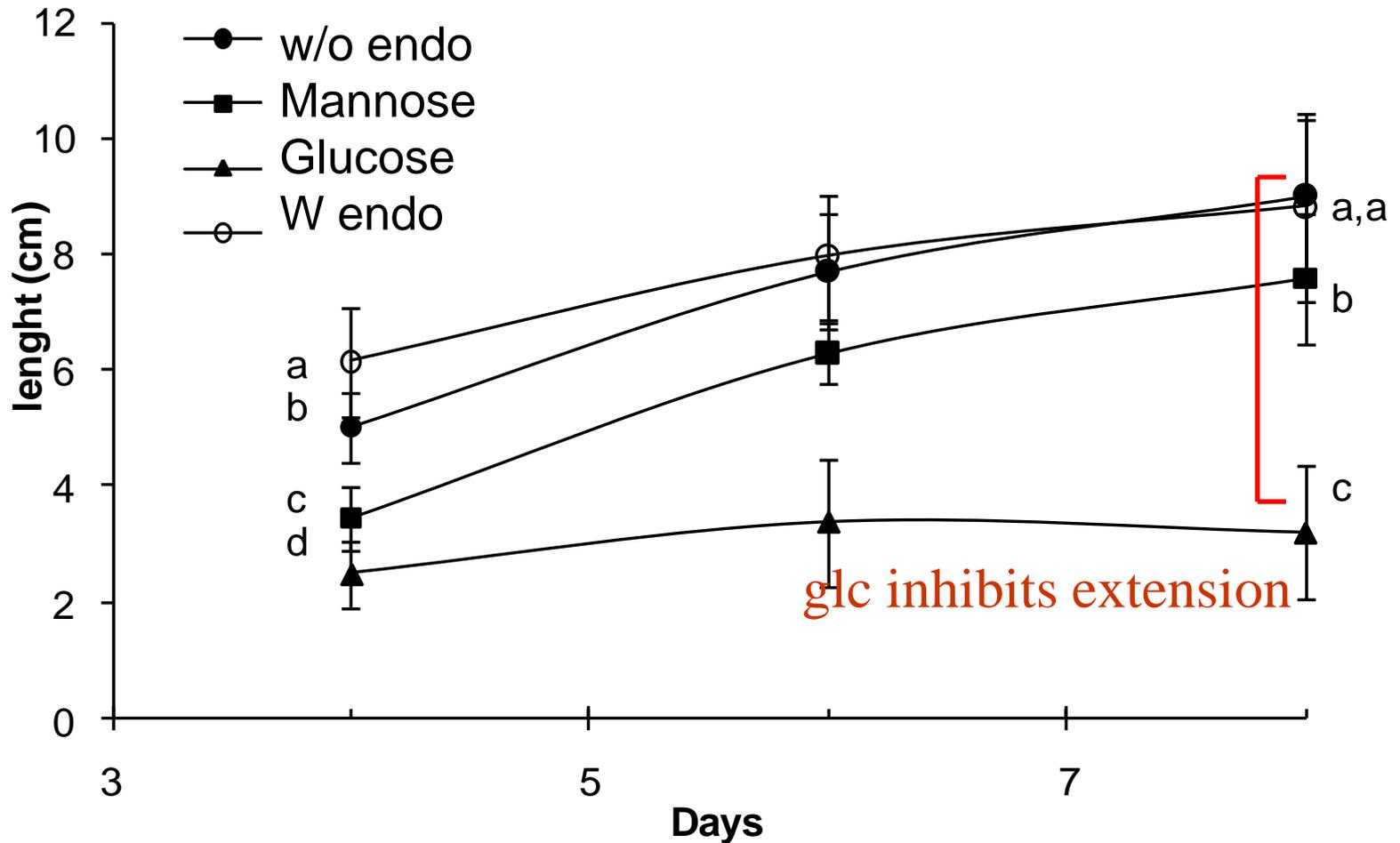
Jónatas V. Pego\*, Peter J. Weisbeek, and Sjef C.M. Smeekens

Department of Botanical Ecology and Evolutionary Biology (J.V.P., S.C.M.S.), and Department of Molecular Cell Biology (J.V.P., P.J.W., S.C.M.S.), University of Utrecht, Padualaan 8, 3584 CH Utrecht, The Netherlands

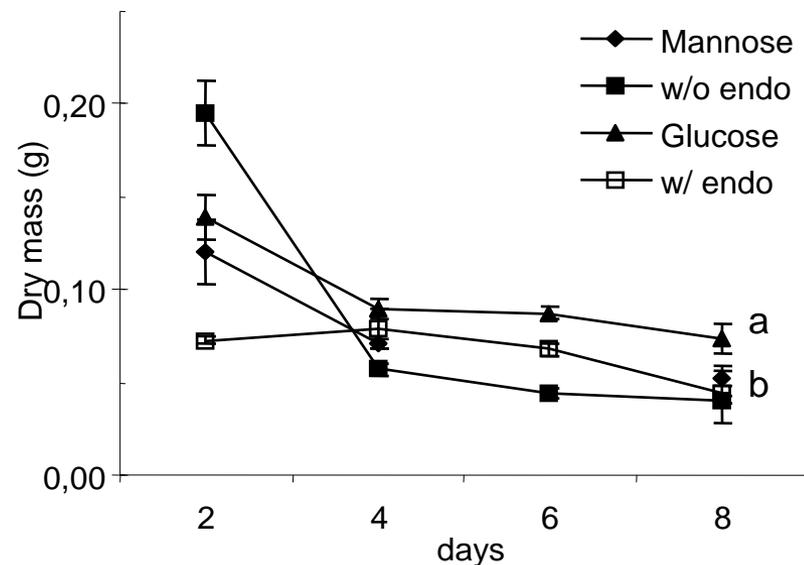
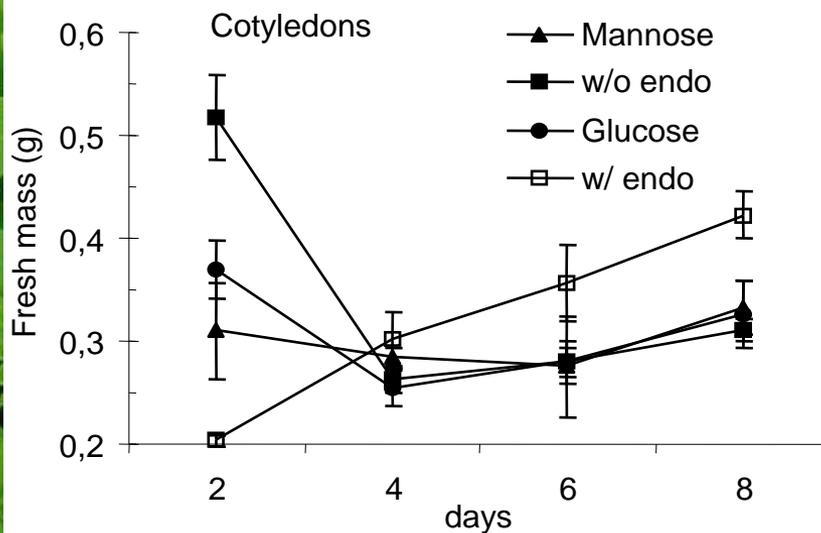
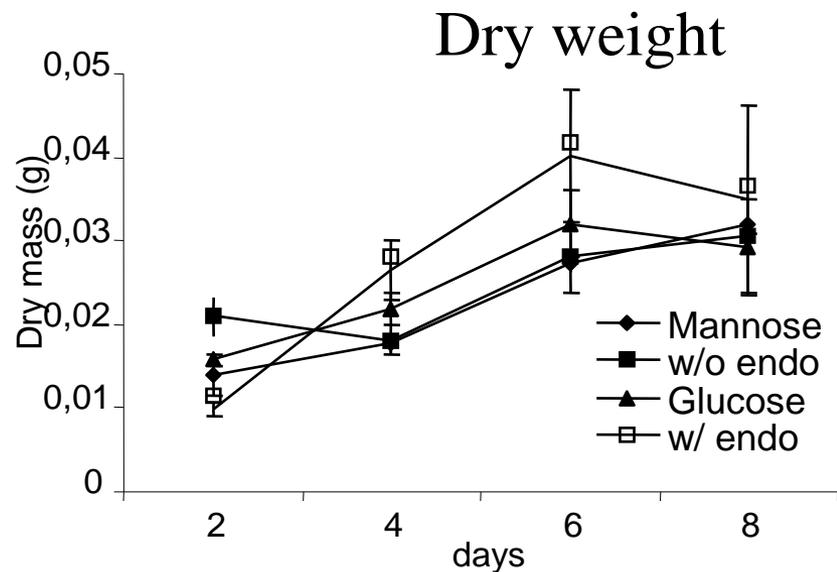
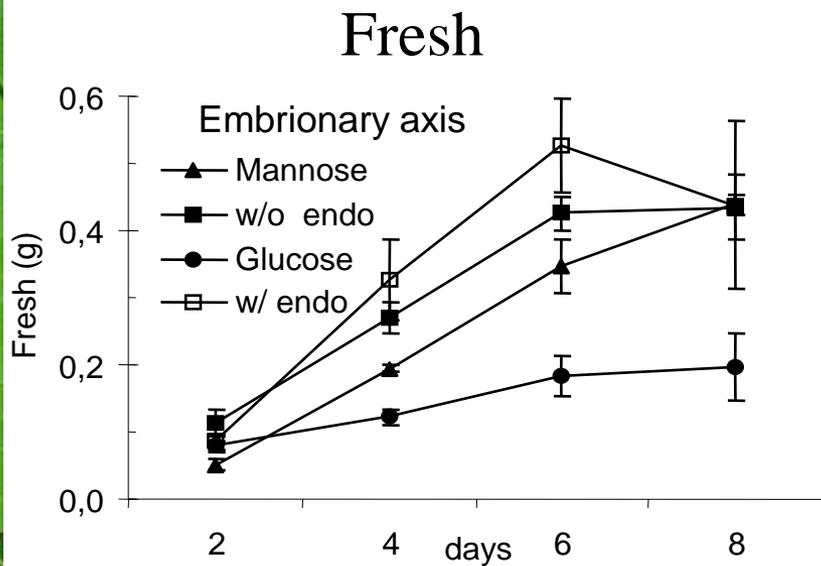
# Procedure



The length of the embryo is also reduced when glucose is present in the surroundings.

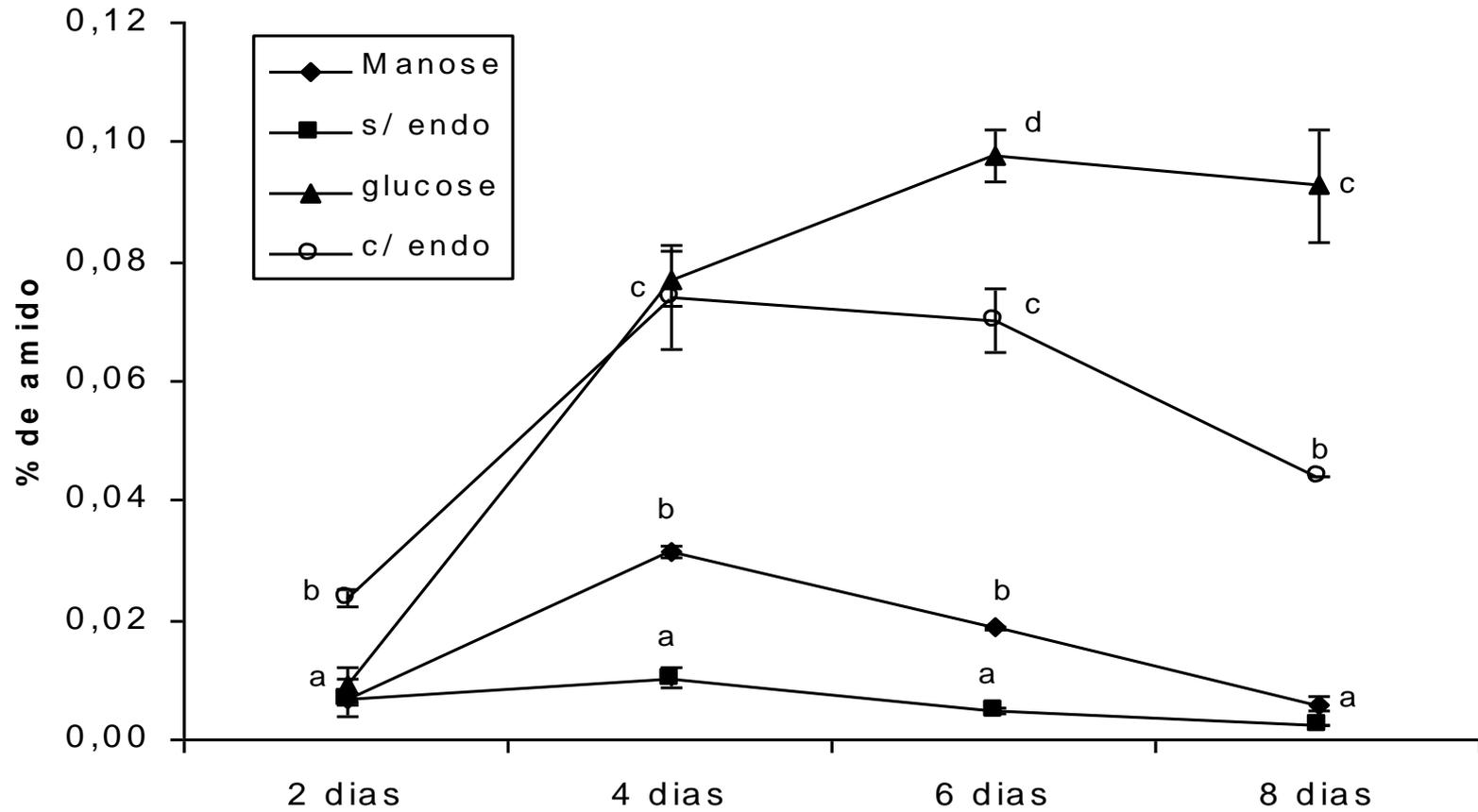


# Analyzing the weight: Glucose interferes in water uptake, but mannose does not.

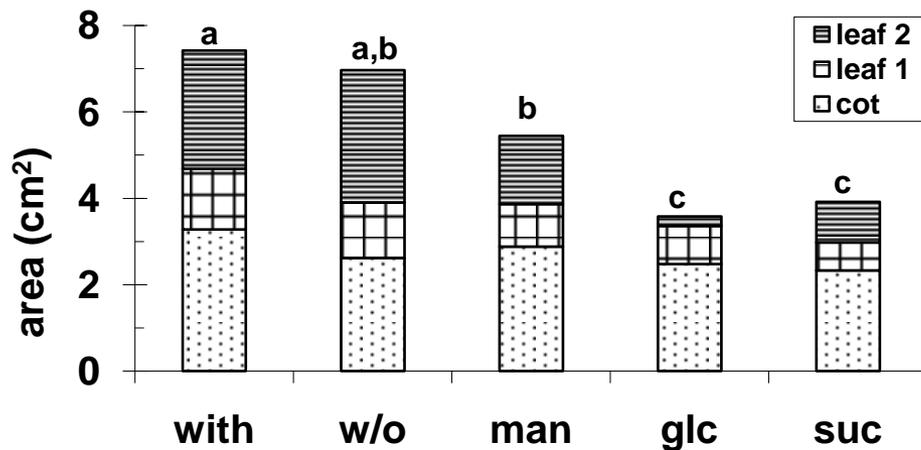


# Starch analysis:

Glucose induces the accumulation of starch.

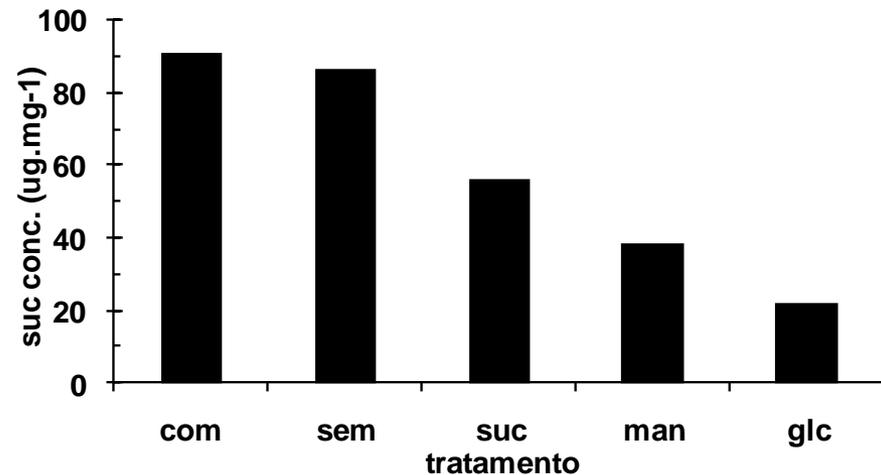


After 21 days, there is a correlation between the sucrose content in the source (cotyledons) and the leaf area.



	cotyledon	1 <sup>st</sup> leaf	2 <sup>nd</sup> leaf
sucrose	0.496	0.717	0.910

Treatment with glucose reduces leaf area.



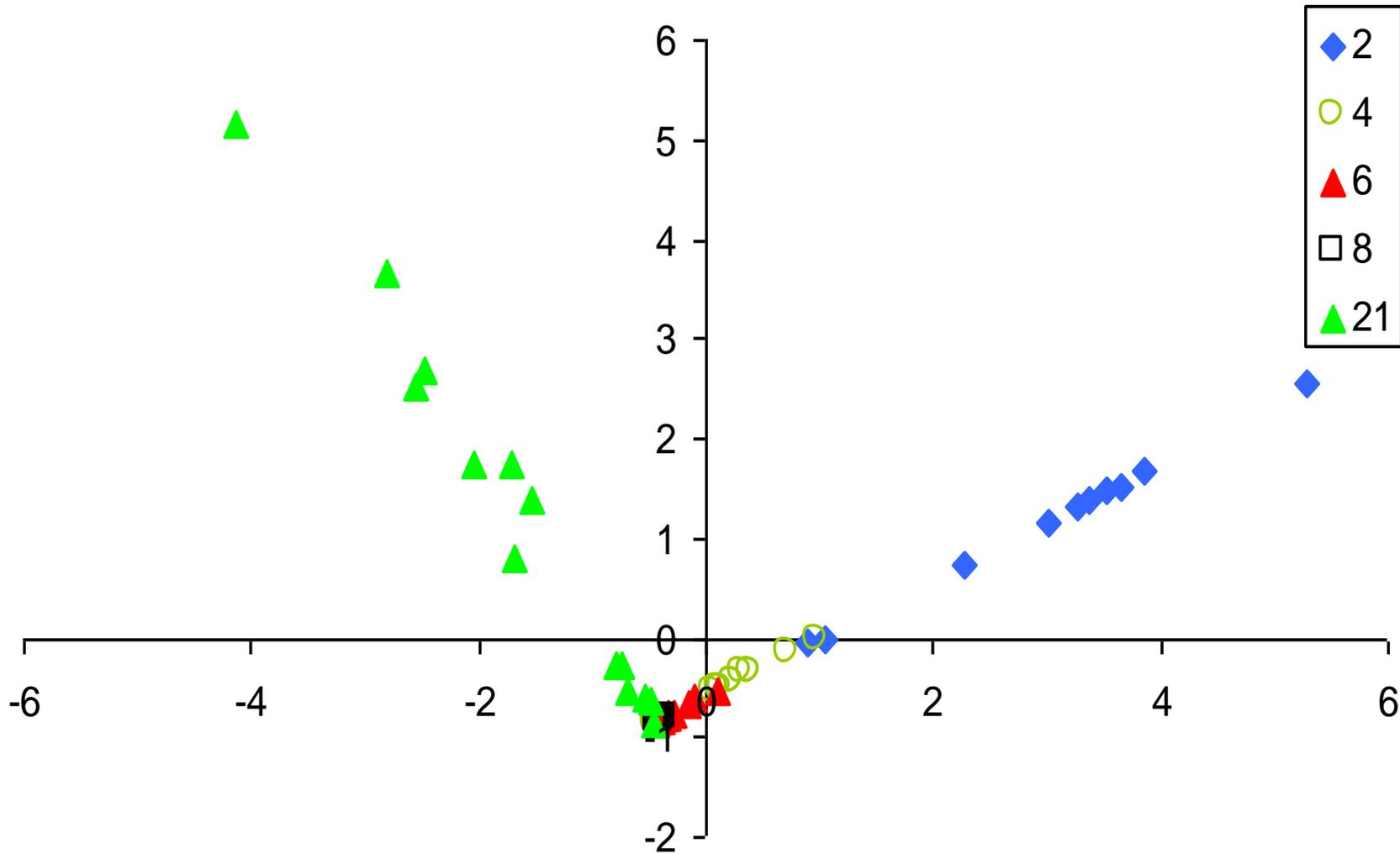


By adding increasing concentrations of monosaccharides we manage to saturate the “usual” pathways:

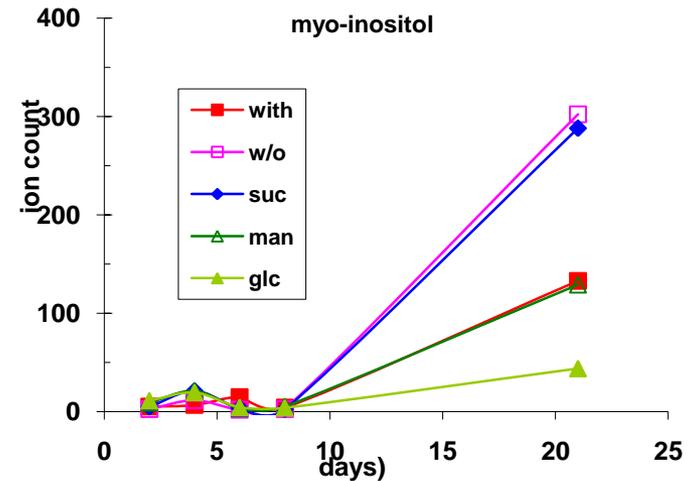
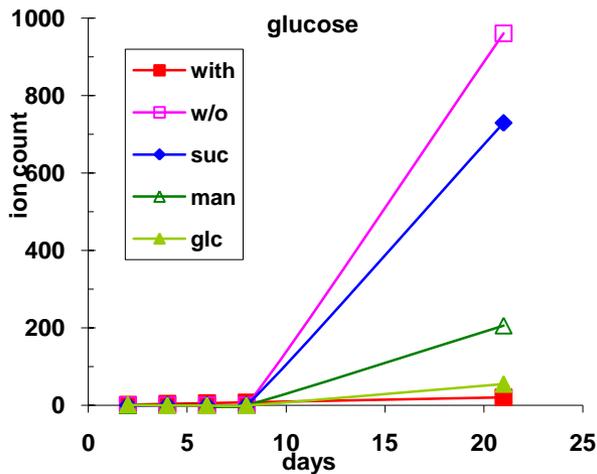
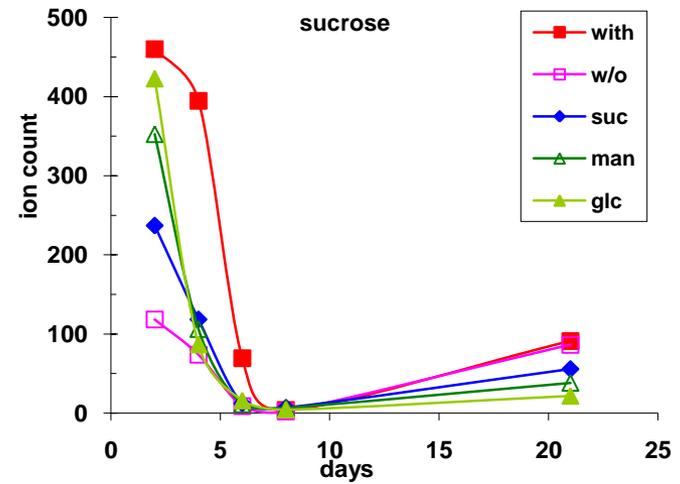
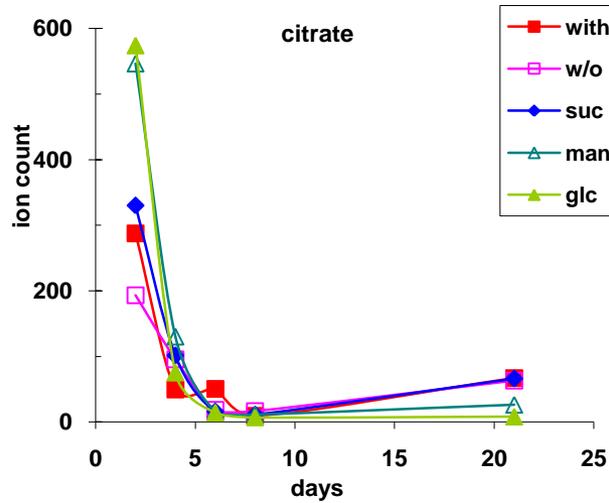
<b>When we add</b>	<b>We get (in the cotyledons)</b>
25 mM galactose	Galactonic acid
25 mM xylose	Xylonic acid
50 mM glucose or sucrose (cot)	Gluconic acid

But we never got mannonic acid. Even going up to 100 mM of mannose

# PCA of the metabolic profiles of the cotyledons in 20mM solutions of carbohydrates.



# Change in the amount of the four metabolites with higher loadings in the cotyledons.



## As a general pattern:

- Glucose inhibits embryo extension;
- Glucose induces accumulation of starch;
- Glucose reduces leaf expansion.

**which inhibits carbon assimilation. Mannose does not have these effects. So besides the function of protection against predators, the use of galactomannan also allows a system of signalling were:**

### **Mannose:**

**Storage compounds mobilisation.**

### **Glucose:**

**Photosynthesis stablished.**



**Thank you.**

Marco Aurélio S. Tiné  
Marco.tine@gmail.com

