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A device to study the growth of fruit. Depressive effect of high external sucrose concentration on detached tomato fruit in the cell expansion phase.



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Introduction

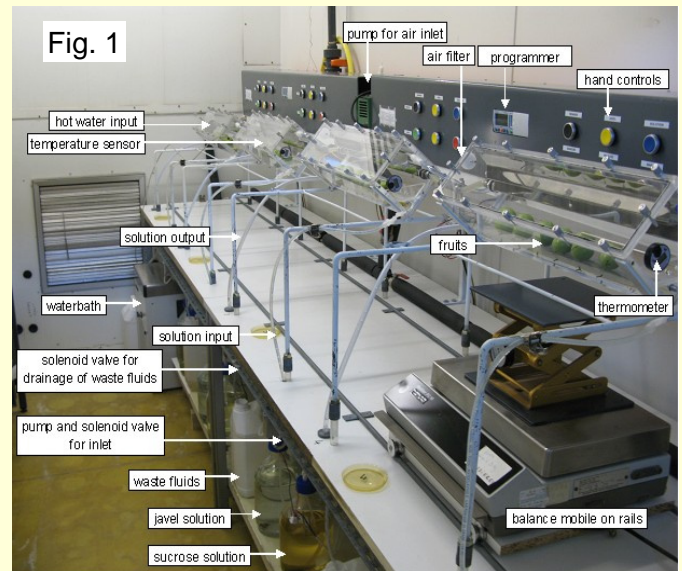
Sucrose is the main component of the sap entering the tomato fruit and its concentration varies over the development period, during the day and according to the growth conditions (3 to 13 %, Ho et al., 1987). However, the effect of sap concentration on the tomato fruit expansion is poorly known. Generally, the fruit is larger when the fruit / leaf ratio is decreased, likely because of a higher number of cells (a). However, high dry matter contents are generally associated with smaller fruits because the water import rate is lower when the difference between stem water potential and fruit osmotic potential is lower. Based on a previous work (b), an hypothesis is the existence of a sucrose concentration threshold above which the effect of concentration has a depressive effect during the cell expansion phase. Therefore, we aimed to assess the effect of high sucrose concentration on cell expansion in detached fruits during the cell expansion phase. As there are difficulties in this culture system to maintain the sterile medium and to assess the fruit weight along the culture period, a new open device named Casafruit was built.

Materials and methods

Fruits weighting about 25 g were taken from plants grown in green house. They were disinfected by ethanol at 70  for 30 s.

The device in Fig. 1 was built. It is made of four identical boxes. In each box (Fig. 2), six fruits are put on a support with holes to insert the pedicels. These are immersed in the sterile nutrient solution composed of MS medium and of sucrose (see below). The solution is daily renewed after a rapid treatment by javel water. This is automatised by a programmer, solenoid valves and pumps. Temperature is controlled.

Fig. 2



Two treatments were applied. The sucrose concentration was either maintained to 5% over the culture period (control) or maintained to 5% over 7 or 9 days and then increased to 15%.

At various times, the mean fruit weight in each box was estimated by weighting the whole box after draining the solution and based on the weight of the pedicel and calyx of the fruits estimated from their final weight. Five replications were made.

Results

No contamination occurred. The increases in fruit weight (Fig. 3) and the estimated growth rate per unit area of fruit due to the water import (Fig. 4), were smaller when the sucrose concentration was increased from 5% to 15%.

Discussion - conclusion

These experiences indicated that a very high sucrose concentration has a depressive effect on the fruit expansion, likely because of a decreased water potential of the nutrient solution and of the sap viscosity on which water import rate depends (c, d). Future experiences should indicate i) the effect of each of these factors, ii) the threshold below which the fruit expansion increases with the sucrose concentration and above which it decreases and iii) the effect of changes in sucrose concentration of the nutrient solution which occur during daytime.

The new device should be very useful for such studies and others to better understand fruit growth in relation to external and endogeneous factors.

(a) Bertin N. 2005. Annals of Botany 95:439-447; (b) Bussi eres et al., 2008. First Symposium in Horticulture, Vienne; (c) Bussi eres P. 1994. Annals of Botany 73:75-82; (d) Bussi eres P. 1995. Annals of Botany 75:469-476

