

Influence of Sucrose Concentration on Long-term Sweet Potato Cultures

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Abstract

Virus-free sweet potato plants are being maintained in culture to supply clean plantlets to local growers. However, between requests for plant material a system was needed to control growth and increase the intervals between transfers. Long-term in vitro maintenance, on MS medium containing 0-12% sucrose, was used to evaluate shoot growth over time on four sweet potato cultivars. Sucrose levels from 2-12% had no influence on controlling in vitro growth and development over time. Having no sucrose in the medium resulted in minimal growth but was lethal to 50% or more of the cultures. The rate of root growth and leaf development was significantly reduced on sucrose levels from 0.1-0.3%. These low sucrose levels controlled the rate of growth and extended the interval between transfers from monthly, on 3% sucrose, to 8-12 months on 0.1-0.3% sucrose. Shoots actively grew when transferred back to a 3% sucrose medium. Low sucrose concentrations can be used to control growth of sweet potato and extend the intervals between transfers in vitro.

Materials and Methods

Virus-free sweet potato plants, obtained from the USDA Germplasm Repository, were grown and maintained in vitro. The four sweet potato cultivars used were 'Francia', 'Mojave', 'Papino' and 'Viola'. Single nodal cuttings from these plants were transferred to fresh Murashige & Skoog media (MS) (1962) containing 0 to 12% sucrose with 0.8% agar. Shoots were grown in a 28°C growth room with a 16 hour photoperiod. Data on root and leaf development were collected twice weekly. A second trial involved sucrose levels from 0 to 1% on MS medium gelled with agar after the higher sucrose levels didn't retard the rate of sweet potato growth in vitro. Data was again collected twice weekly over time and included number of leaves and roots for the lower sucrose trial. Data was analyzed with ANOVA and averages plotted over time.

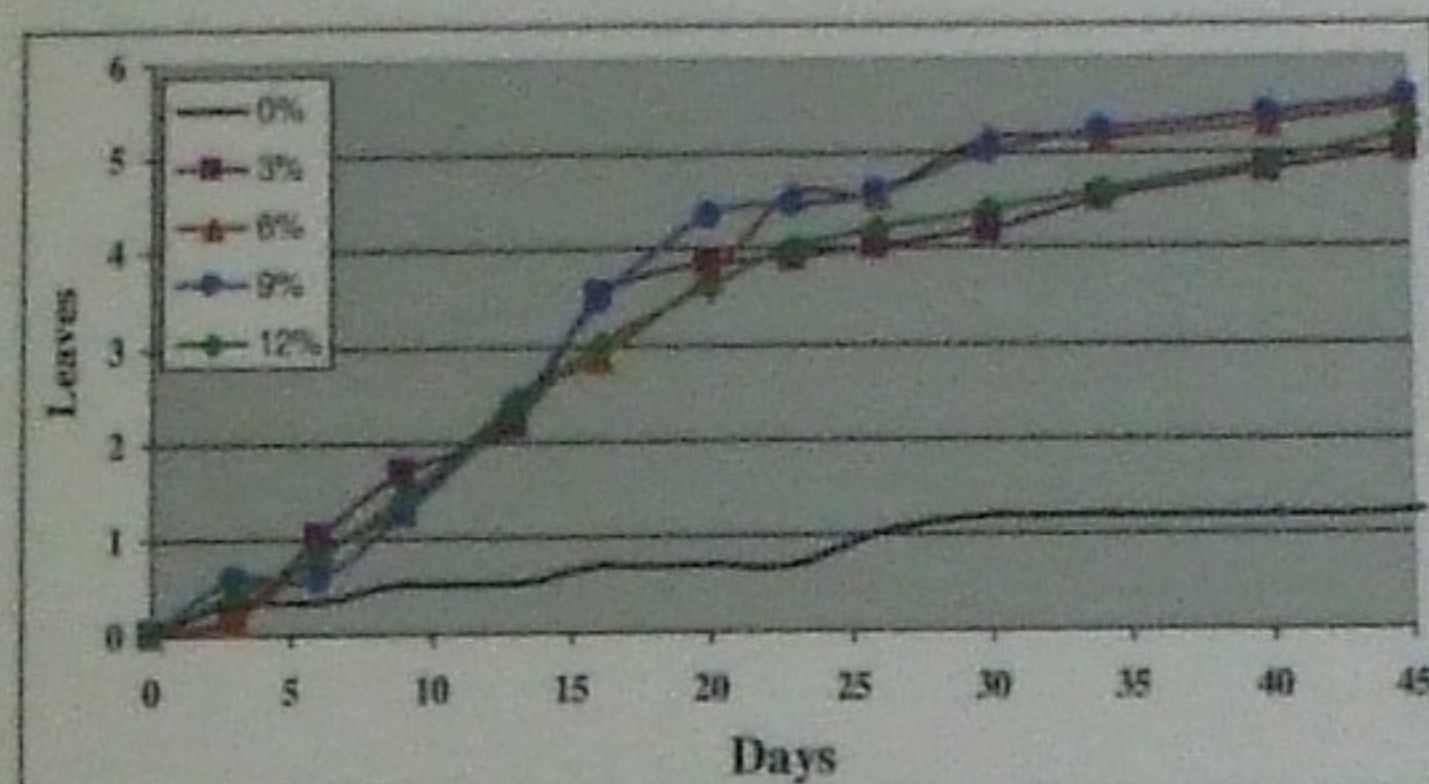


Figure 1 Average leaf development of four sweet potato varieties grown on 0-12% sucrose over time

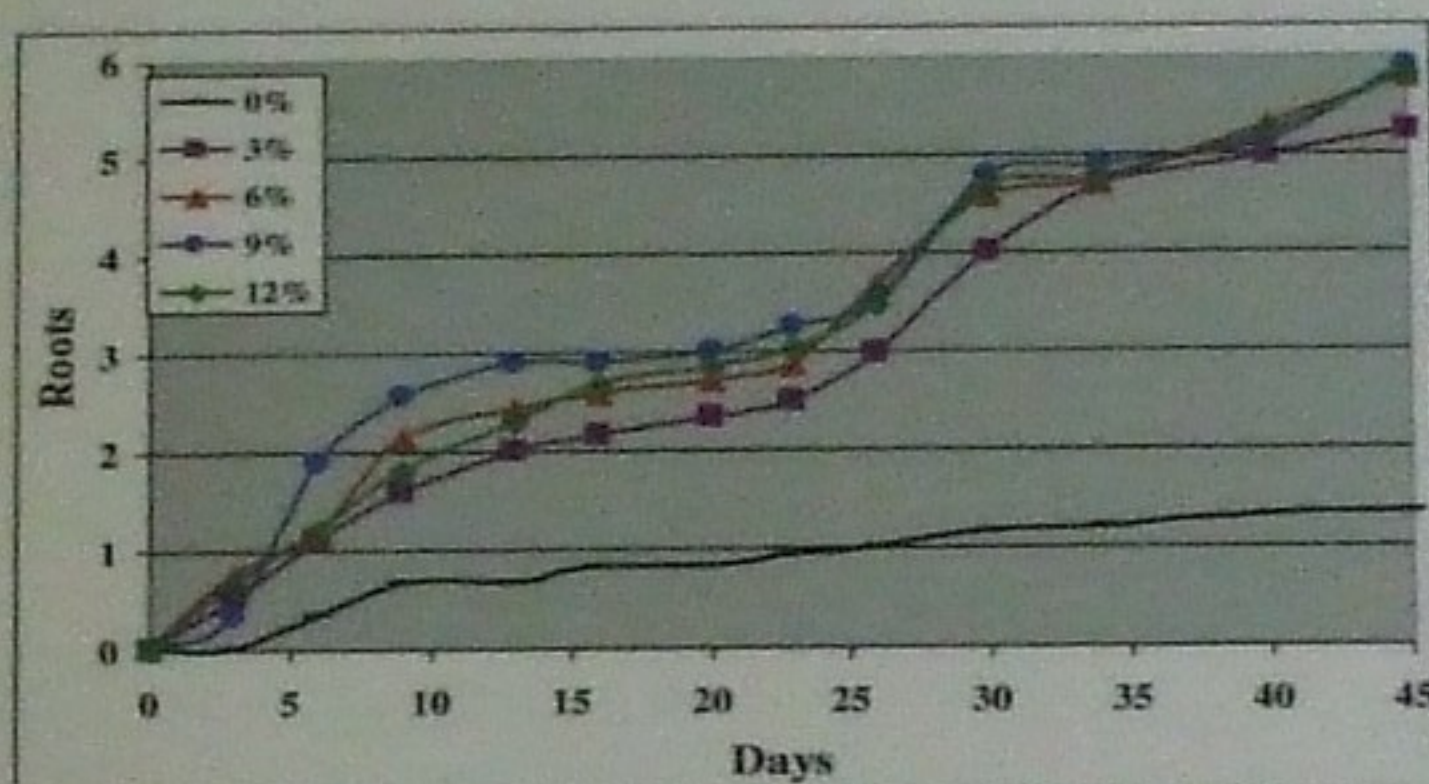


Figure 2 Average root development of four sweet potato varieties grown on 0-12% sucrose over time



Figure 3 Growth of 'Mojave' sweet potato grown on 0-1% sucrose after 45 days in vitro.

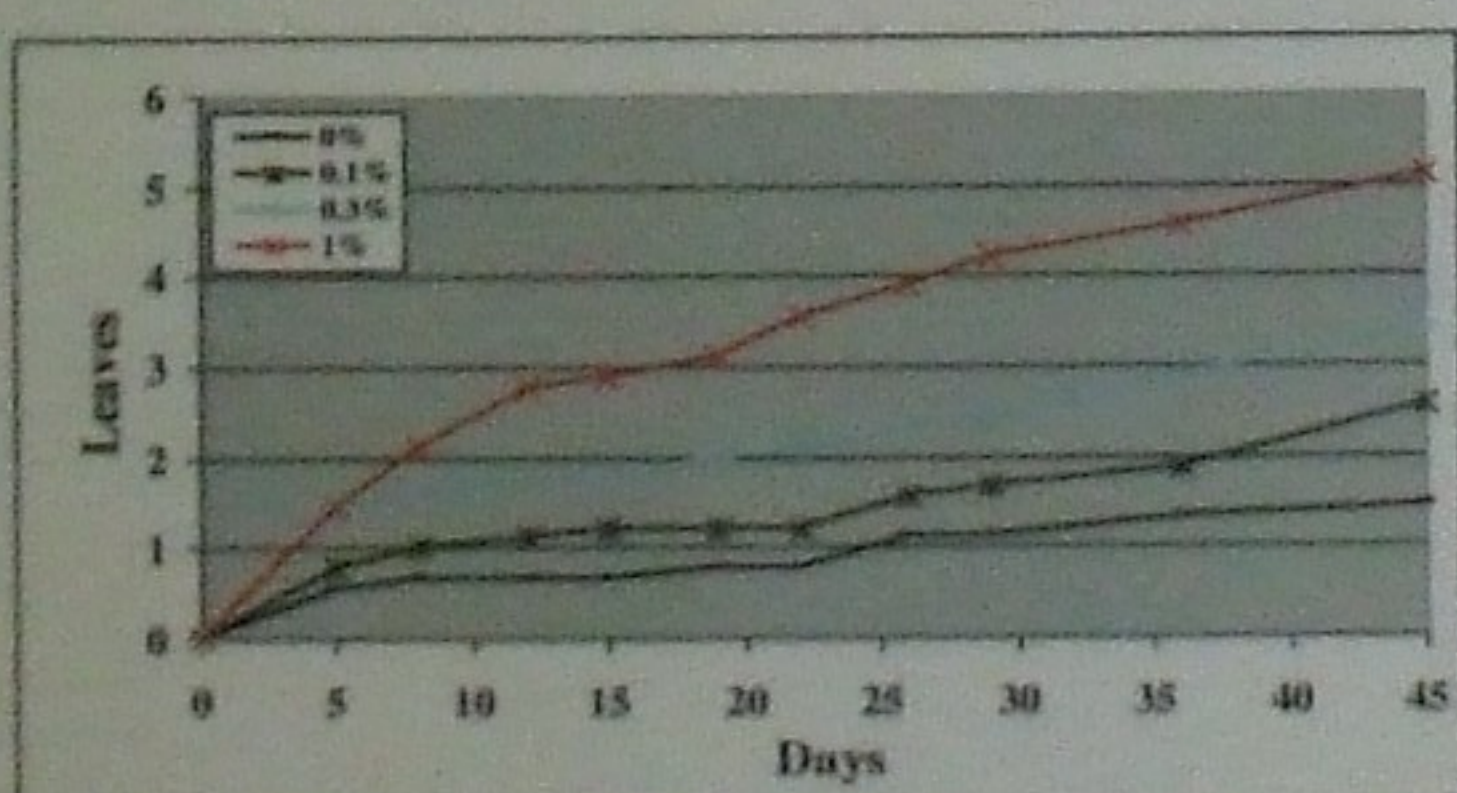


Figure 4 Average leaf development of four sweet potato varieties grown on 0-1% sucrose over time

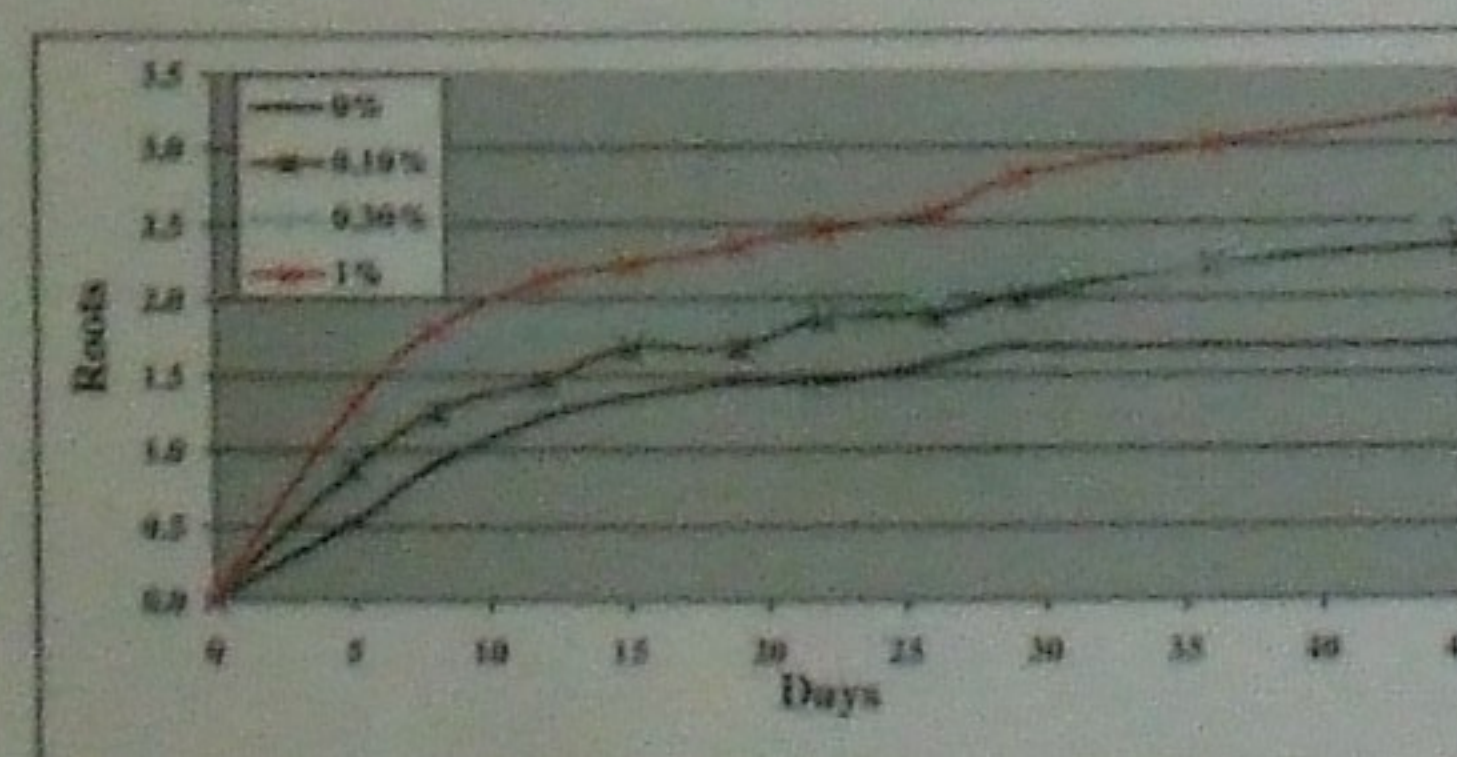


Figure 5 Average root development of four sweet potato varieties grown on 0-1% sucrose over time

Results and Discussion

We were trying to suppress sweet potato growth by increasing sucrose content as was possible with our work on cassava. However, increasing the sucrose content which raises the osmotic potential of the medium, did not suppress growth. Leaf development over time was similar for all four varieties containing sucrose (Figure 1). Shoots grown without sucrose was lethal to 10-45% of the shoots. Those that survived without sucrose did have reduced shoot growth. The high rate of shoot death doesn't make it a practical to use to suppress growth for long term in vitro maintenance. Root initiation and development at all sucrose levels was similar between sweet potato varieties with no significant difference between varieties or the media containing sucrose (Figure 2). It was concluded that sweet potatoes aren't influenced by sucrose levels between 3% and 12% over 45 days of growth in vitro. Because the elevated sucrose levels didn't suppress growth a follow-up experiment was conducted with lower sucrose levels.

At the lowest sucrose level of 0.1%, all explants survived. After 45 days in vitro, the size of the plant reflected the sucrose concentration it was grown on with increasing sucrose levels resulting in more growth and development but at a slower rate (Figure 3). The rate of leaf and root growth for the 0% - 1% sucrose concentrations was between the 0% - 3% rate previously observed in the high sucrose study (Figure 4 and 5).

Conclusion

Sucrose levels between 3%-12% had no influence in suppressing growth due to increased osmotic potential and plants grew similarly at these levels for four sweet potato varieties while 0% sucrose was lethal to 45% of the explants. However, using a sucrose concentration in the media at 0.1% - 0.3%, significantly reduced the rate of growth yet sustained the plants to recommend it for long-term sweet potato in vitro maintenance.

Reference

Murashige T and Skoog F (1962) A revised medium for rapid growth and bioassays with tobacco tissue cultures. *Physiology Plant* 15(3): 473-497.