The effect of different carbohydrates on the multiplication of *Hosta* cultivars

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Summary: The effect of seven concentrations of two carbohydrate sources were compared to determine the best source and the most suitable source and concentration for micropropagation of some *Hosta* cultivars: *H. 'Gold Haze'*, *H.* 'Gold Drop' and *H. 'Dew Drop'*. 0, 5, 10, 20, 30, 40 and 50 g/l sucrose or glucose were added to a MS basic medium supplemented with 3 mg/l kinetin and 0.1 mg/l IAA. For *'Gold Haze'* 40 g/l sucrose proved to be the best source and concentration, the proliferation ratio was 15 shoots per explant. Thirty g/l sucrose concentration was the optimum for *'Gold Drop'*, the proliferation rate was 14.6 shoots per explant. In *'Dew Drop,'* the best results were obtained with 30 g/l sucrose but 40 g/l sucrose gave good results too. Both cultivars rooted well on these media. On glucose containing media, very low propagation rates were found in all concentrations and all examined cultivars..

Key words: *Hosta*, micropropagation, carbohydrate, sucrose glucose

Introduction

The *Hosta* or plantain lily is a herbaceous plant of the *Liliaceae* family. *Hosta* species are often used as ornamental landscape groundcovers mainly in shady areas. Nowadays much attention is paid to the new cultivars, among which beautiful colour leaf cultivars can be found. The conventional propagation of the plantain lily by crown division is very slow. The in vitro propagation of different Hostas was started at our Department some years ago *(Szafián* et al., 1995). The micropropagation of Hosta fortunei was elaborated by *Szafián* et al. (1996, 1997).

The carbohydrates have a fundamental influence on in vitro organogenesis and it is very important to find the best type and the optimum concentration, mainly in the stage of multiplication *(Jámbor-Benczúr* et al., 1995, 1996, 1997). *Mielke & Anderson* (1989) proved that the carbohydrate type and concentration had great influence on the tuber multiplication of *Iris hollandica*. De *Bruyn & Ferreira* (1992) found that the best production of adventitious shoots and corms of *Gladiolus* occured at 60–90 g/l sucrose concentration in MS medium

Among *Hosta* cultivars, there are chimeral ones and it is very important to produce true to type shoots. *Samyn* (1995) published the successful propagation of the chimeral *Cordyline fruticosa 'Rosa'* with the use of high sucrose concentrations (3–4 %).

The aim of the present work was to investigate the effect of sucrose and glucose on proliferation and splitting of three *Hosta* cultivars: *'Gold Haze'*, *'Gold Drop'* and *'Dew Drop'*.

Material and method

For proliferation *Murashige & Skoog* (1962) basal medium (the macro elements in half concentration) with 3 mg/l kinetin and 7.5 g/l agar-agar was used. In order to compare the effect of sucrose and glucose, both were added to the basal medium in concentrations of 0, 5, 10, 20, 30, 40 and 50 g/l. The pH was adjusted to 5.6 in every cases using KOH and the media were sterilised at 10^5 Pa pressure for 30 minutes. The cultures were incubated at 18–25 °C in 8/16 hours dark/light cycles and illuminated with fluorescent lamps with an intensity of 40 mM/m^2/s. Test tubes were covered with Ongrofol plastic foil. Marking the results number and length of shoots and roots were measured, the length and width of the greatest leaf was registered. Data were analyzed statistically *(Ministat, Vargha & Czigler,* 1999).

Results

1. The effect of sucrose and glucose on the proliferation of *H. 'Dew Drop'*.

As *Figure 1* shows, best results were obtained with 30 g/l sucrose concentration, the average number of shoots was 3.8/inocule. Both the high and low concentrations inhibited the rapid shoot initiation. With the use of glucose, the best concentration was 40 g/l, in this case the average shoot number was 3,55. All the used glucose concentrations resulted in lower shoot proliferation. Highest sucrose

concentrations promoted root formation, on media with low sucrose content, no rooting could be observed *(Figure 2)*. The length and width of leaves didn't correlate with the sucrose concentration (data not presented).

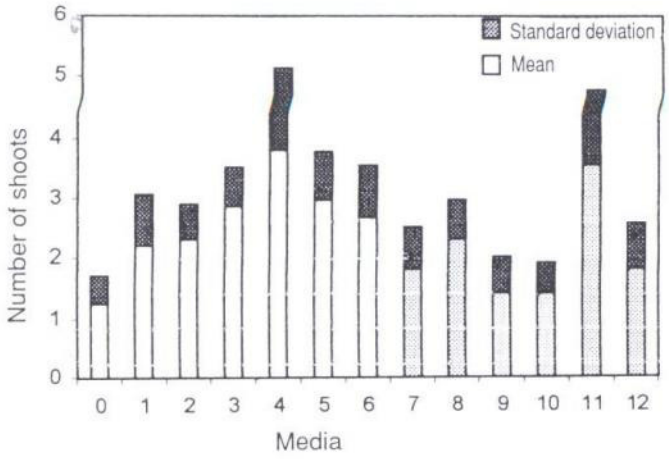

Figure 1 The effect of sucrose and glucose concentrations on shoot formation of *H. 'Dew Drop'*

0 : sugar-free medium

1 : 5 g/l sucrose	7 : 5 g/l glucose
2 : 10 g/l sucrose	8 : 10 g/l glucose
3 : 20 g/l sucrose	9 : 20 g/l glucose
4 : 30 g/l sucrose	10 : 30 g/l glucose
5 : 40 g/l sucrose	11 : 40 g/l glucose
6 : 50 g/l sucrose	12 : 50 g/l glucose

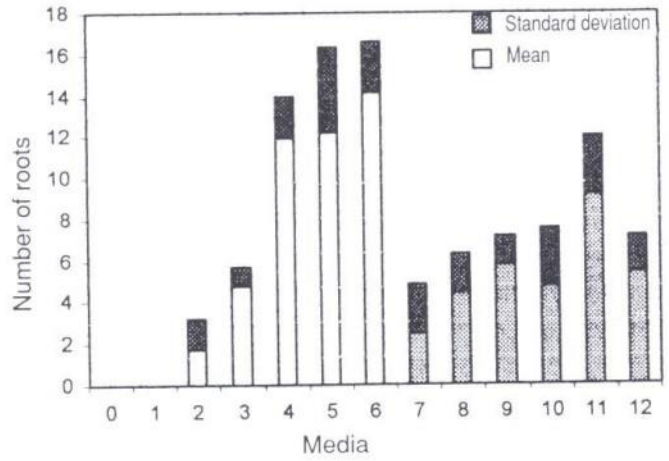

Figure 2 The effect of sucrose and glucose concentrations on root formation of *H. 'Dew Drop'* For explanation of numbers see in *Figure 1*

2. The effect of sucrose and glucose on the proliferation of *H. 'Gold Drop'*.

The highest number of shoots was measured with the use of 30 g/l sucrose in the culture medium *(Figure 3 & 4)*. The average number was 14.6/inoculum. Both the higher and lower concentrations gave worse results. Much slower growth was observed on glucose containing media, here the optimal concentration was 20 g/l. Similarly to *'Dew Drop'*, high concentrations of sucrose promoted and low concentrations inhibited root formation. The largest leaves developed on the medium containing 20 g/l sucrose. Leaf size correlated negatively with the concentration of sucrose used (data not shown). On glucose containing media, both proliferation and growth rate were lower compared to sucrose containing media.

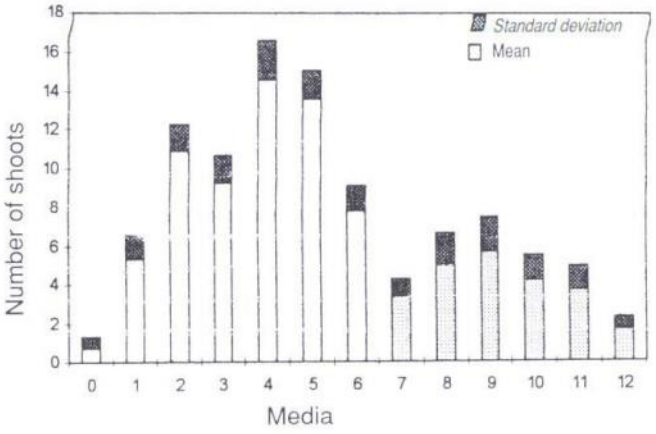

Figure 3: The effect of sucrose and glucose concentrations on shoot formation of *H. 'Gold Drop* For explanation of numbers see in *Figure 1*

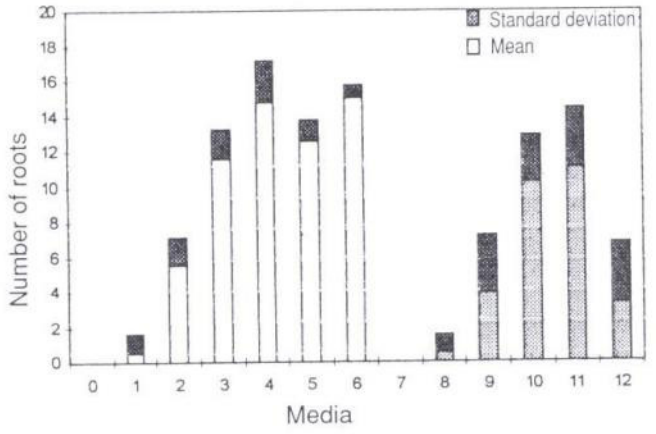

Figure 4: The effect of sucrose and glucose concentrations on root formation of *H. 'Gold Drop'* For explanation of numbers see in *Figure 1*

3. The effect of sucrose and glucose on the proliferation of *H. 'Gold Haze'*.

The number of shoots increased with the rise of sucrose concentration in culture medium. Best results (14.9/inoculum) were obtained with the use of 40 g/l sucrose. Glucose inhibited shoot proliferation at this cultivar. The most rapid root formation was observed at 10 g/l sucrose and 50 g/l glucose concentrations. Considering the leaf size, there wasn't significant difference between the treatments using sucrose in the medium (data not shown). Adding glucose to the medium, the highest shoot multiplication results were obtained with the use of 30 g/l.

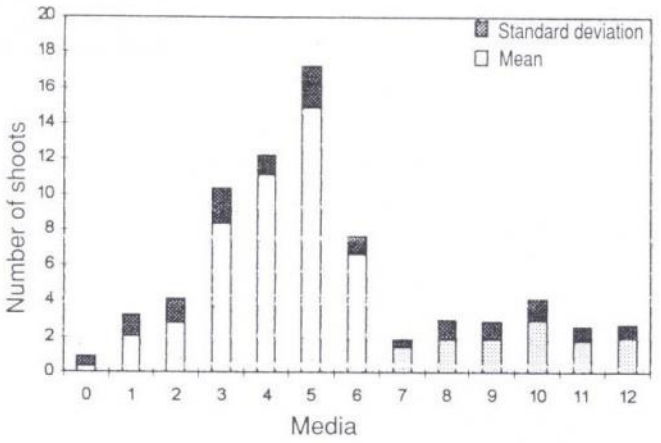

Figure 5: The effect of sucrose and glucose concentrations on shoot formation of *H.* '*Gold Haze*'. For explanation of numbers see in *Figure 1*

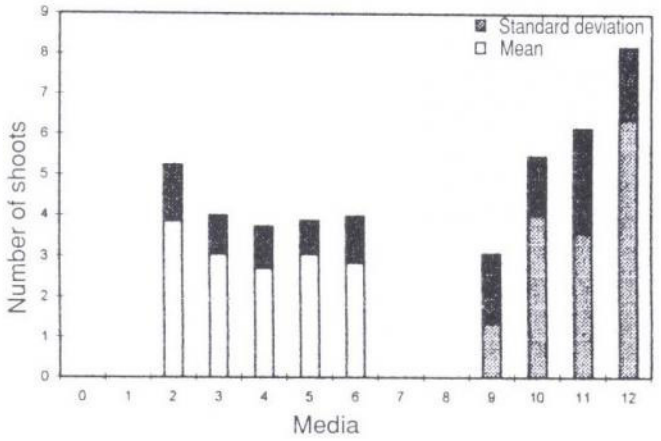

Figure 6 The effect of sucrose and glucose concentrations on root formation of *H.* '*Gold Haze*' For explanation of numbers see in *Figure 1*

Summarizing, the effect of carbohydrates on the proliferation and rooting of 3 cultivars was different. Sucrose proved to be the most favourable for every cultivar. According to Samyn (1995) with the use of higher sugar concentrations the number of shoots was reduced. With the use of 4% sucrose he was able to save the genotype of the cultivar. In our experiment with cultivar *'Dew Drop'* splitting was found in spite of using higher concentrations of carbohydrates.

Acknowledgement

This work was supported by OTKA, project number F 29415.

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