

Nutrient Uptake of *Miscanthus* in vitro Cultures

Szilárd Tóth – Pál Pepó

University of Debrecen, Centre of Agricultural Sciences,
Faculty of Agricultural Sciences,
Department of Genetics and Plant Breeding, Debrecen

SUMMARY

The large biomass production and the low necessary input fertilizer make *Miscanthus* an interesting, potential non-food crop with broad applications, e.g. for fuel and energy, for thatching, fiber production, for the paper and car industries, as well as for ethanol production.

Axillary buds of *Miscanthus x giganteus* were placed on a shoot inducing nutrient solution (modified Murashige and Skoog, 1962), basic medium supplemented with 0,3 mg l⁻¹ 6-Benzylaminopurin. After 40 days of culturing, the axillary buds produced three times more shoots than could normally be harvested. The nutrient content (N, P, K, Ca, Mg) was measured several times during culturing. The results showed that, after 35 days, nitrogen and phosphate were nearly completely taken up. From that time, shoot growth was not observed.

After shoot propagation, the plants were transferred into a nutrient solution for root formation (modified Murashige and Skoog, 1962), basic medium supplemented with 0,5 mg l⁻¹ Indole-3-Butyric acid, and could be potted in soil after about 14 days.

1. INTRODUCTION

Miscanthus is a temperate perennial cross-pollinating grass used commercially as an ornamental plant. Its large biomass production, and the low input of fertilizer needed make *Miscanthus* and *Arundo donax* interesting potential non-food crops with broad applications e.g. for fuel and energy, for thatching, as fiber for the paper and car industries, and for ethanol production (El Bassam, 1996). The species can be vegetatively propagated by rhizome division (Nielsen, 1987) or by in-vitro propagation using axillary shoots (Nielsen et al., 1995).

In species such *Miscanthus sinensis* and *Arundo donax*, which are difficult to multiply by seed and reproductive organs, the development of an efficient in-vitro culture system offers methods for propagation with the advantage that a large number of plantlets can be produced at reasonable, low cost, and can also be useful for breeding purposes.

2. MATERIALS AND METHODS

2.1. Axillary bud culture

2.1.1. Shoot induction

Plant material of 2 different *Miscanthus x giganteus* origins were obtained from field plants. The plant material was surface sterilized with 80% alcohol. Axillary buds were placed on a shoot, inducing nutrient solution. This medium a modified MS basal medium (Murashige and Skoog, 1962)

supplemented with 20 g l⁻¹ sucrose, and 0,3 mg l⁻¹ 6-Benzylaminopurin for the shoot induction. In the nutrient solution, the pH was adjusted to 5,7 prior to autoclaving. Explants were incubated with a day length of 16 h at 21 °C in glass culture dishes. Throughout the whole culture duration (10th-60th day, every 10th days), the nutrient content of the culture medium (N, P, K, Ca, Mg) of the 2 genotypes was determined by Kjeldahl-method, AAS and photometer.

2.1.2. Root induction

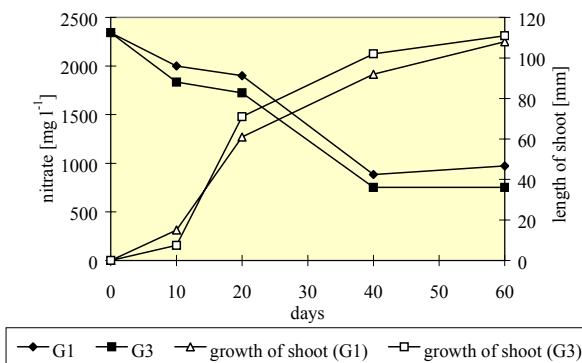
After shoot propagation, the plants were transferred into a nutrient solution for root formation. This solution was a modified MS basal medium (Murashige and Skoog, 1962) supplemented with 20 g l⁻¹ sucrose, and 0,5 mg l⁻¹ Indole-3-Butyric acid for root formation. The pH value was in the nutrient solution adjusted to 5,7 prior to autoclaving. Shoots were incubated in glass test tubes with a day length of 16 h at 21 °C.

3. RESULTS

After 40 days of culturing, three times more shoots originating from axillary buds were induced.

The results showed that, after 35 days, nitrogen and phosphate in the medium were nearly completely taken up. This means from that time on, no increase of shoot growth will occur. The nitrate content in the nutrient solution decreased steadily up to the 40th day, but stagnated afterwards. This was the same for both genotypes (Figure 1).

Figure 1: Change in nitrate content in the nutrient solution parallel with shoot-growth of two *Miscanthus* genotypes (G1, G3) during 60 day culturing

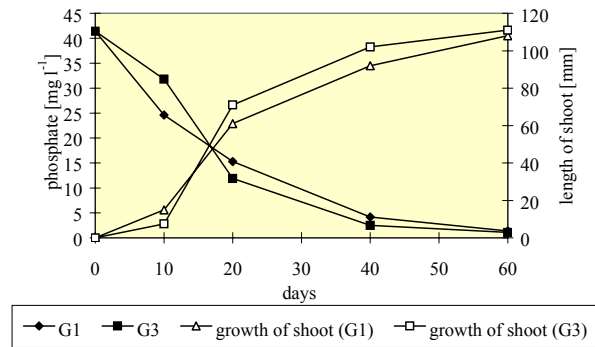


The phosphate content in the medium of both genotypes has already decreased from the beginning of the culture (Figure 2).

In conclusion, phosphate is obviously the limiting element of in-vitro propagation. During the first 20 days, potassium, calcium and magnesium were hardly taken up by the plants. However, after that time, a slow decrease in the uptake of these nutrients could be observed. Up to the 60th day, the plants had enough K, Ca and Mg for their development.

After shoot propagation, they were transferred into a nutrient solution for root formation. After about 14 days, the rooted shoots could be potted in soil.

Figure 2: Change in phosphate content in the nutrient solution in comparison with growth of shoot of two *Miscanthus* genotypes (G1, G3) during 60 day culturing



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