Organic Substrates: Are They a Realistic Alternative?©

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Choice of growing medium and nutritional strategy are the greatest challenges when a grower considers changing to organic ornamental production. Potted plants need continued access to plant nutrients during their development. Thus, production routines allowing both functional input of nutrients before start of plant production and supplemental nutrition with water-soluble organic nutrients during production are needed. The first steps in making an organic potted plant production system possible could be to test the available and certified organic growing media on the market and integrating the know how on mycorrhiza, composting technology, and the use of nutrient buffers (e.g., Hansen and Nielsen, 1999; Jensen and Leth, 1998; Nielsen and Rasmussen, 2000). The aim should be to develop uniform, heterogeneous, and high quality organic substrates. At the same time water and nutrition technologies should be adapted to the special demands of an organic production, since organically bound nutrients are released in a different way than inorganic nutrients and the water retention is often changed also.

MATERIALS AND METHODS

In an experiment with *Pentas lanceolata* the aim was to test the ability of the plants to exploit the plant nutrients present in an organic growing medium. Three cultivars 'Mars', 'Venus', and 'Polaris' were tested. Here we only show the results for 'Mars'. The other cultivars responded in a similar way as seen in 'Mars'. In this experiment we used "Alternative Soil" (Alternativjord, Svalöf Weibull, Sweden) peat based and composted with cow manure for 2 years, thereafter combined with chicken manure and composted for an additional year. This compost was combined with light Swedish peat, clay, perlite, gypsum, lime, and dolomitic lime. In addition to this we added the following components to the substrate: blood meal, Pholin (lava based magnesium and micronutrients), chicken manure, or ground alfalfa straw in order to test the effect of additional organic material. The experiments were carried out on ebb-flood benches where irrigation to each bench was handled individually.

Table 1. Content of plant available nitrate (NO_3-N) in the growing media measured at the start of the experiment and at the beginning of flowering.

Number	Treatment	Start NO_3-N ($mg \cdot litre^{-1}$)	Flowering NO_3-N ($mg \cdot litre^{-1}$)
1	Control substrate (Pindstrup special mix)	145	275
2	Alternative soil (basic mix)	197	47
3	Alternative soil (+ 2 kg blood meal m^{-3})	407	154
4	Alternative soil (+ 0,5 kg Pholin m^{-3})	271	108
5	Alternative soil (+ 3 kg chicken manure m^{-3})	221	43
6	Alternative soil (+ 5 kg ground alfalfa straw m^{-3})	228	36

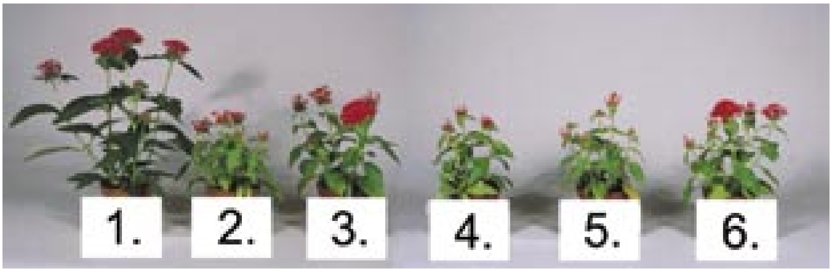

Figure 1. Plants from the different treatments (see Table 1) at start of flowering (still organic).

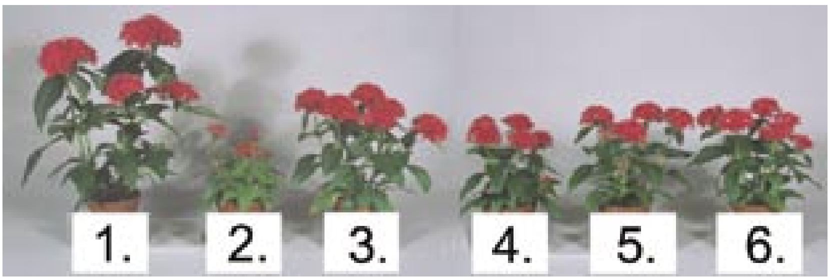

Figure 2. The same plants as shown in Figure 1 after 14 days of irrigation with standard inorganic fertilizer.

The older the plants were, the more pronounced the difference was between the control plants grown in conventional substrate (Pindstrup special mix, Pindstrup Mosebrug A/S, Denmark) and fertigated with a standard mix of inorganic fertilizers compared to plants grown in "Alternative soil" and irrigated with rain water without added fertilizers.

From start of flowering all treatments received the same standard mix of inorganic fertilizers as the control plants. Thereafter the plants could not be considered organic. The aim of this late fertigation was to investigate if it would be possible to use the declining nutrient availability, as an alternative method for growth regulation. We wanted to find out if the nutrient stress that was evident in the plants, leading to nitrogen and sulphate deficiency symptoms, could be corrected late in the production process.

RESULTS AND DISCUSSION

Fourteen days after onset of standard fertigation the plants had recovered from their nutrient stress symptoms. It was also clear that the plants, which had received standard fertigation throughout the production period, were way too tall and should have received chemical growth regulation (Figs. 1 and 2). The plants grown in "Alternative Soil" and irrigated with rainwater until beginning of flowering and hereafter fertigated with the standard mix of inorganic fertilizers had developed into plants with an acceptable compact quality without chemical growth regulation. We are not yet able to produce and organic potted plant product, but we are closer to the target. The results show a clear need for a certified organic water soluble fertilizer, that the grower can use as a supplement to the organic nutrients in the growing medium, e.g., "Alternative Soil", at the beginning of flowering. A range of water-soluble organic fertilizers available on the market was tested at the Danish Institute of Agricultural Sciences, Department of Horticulture. In general the nitrate content was low. Among these products a fish blood/fish bone product (Nu-Gro, Brøste A/S, Denmark) was different from the rest. It contained more nitrate and the ammonium content was low (10%) compared to nitrate. A product with a relatively high amount of nitrate and a relatively low ammonium content and acceptable sulphate content would solve the nutritional disorders we saw in this experiment. Nu-Gro is still not certified for organic use in Denmark, but when this happens trials with organic potted plants can be started. Many challenges still remain ahead before an organic production of high quality potted plants can be initiated, but a functional strategy for the nutrition of organic potted plants could be an important step in this direction.

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Increased Cation Content in Recirculating Nutrient Solutions as a Means for Controlling Dissemination and Attack of Root Rot in Glasshouse Crops©

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INTRODUCTION

The use of recirculating nutrient solutions for irrigation and fertilization of greenhouse crops has been gaining importance for Scandinavian potted plant production. The systems utilize the "ebb-flood" principle and they are economically as well as environmentally advantageous, but they introduce a risk for spreading of root pathogens. Pathogenic soil-dwelling organisms, predominantly fungi can be disseminated with zoospores and cause infections in many greenhouse plants. Therefore alternative control measures are needed.

Previous experiments have shown that infections by *Phytophthora cryptogea* in *Gerbera jamesonii* grown in ebb-flood systems could be reduced by increasing salt concentration (EC) in the water (Thinggaard and Andersen, 1995; Toppe and Thinggaard, 1998). Copper ions (Cu) are generally known to act as fungicides toward *Phytophthora* and the purpose of the experiments presented here was to examine the effects of different concentrations of Cu in the recirculating nutrient solutions on the development of root-related diseases in potted plants inoculated with different species of *Phytophthora*.