The Postharvest Life of Potted Roses - Grown under Different Regimes Resulting in Varying pH in the Rootzone

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Abstract

Peat quality can have profound effects on the growth and quality during production of pot plants. Changes in pH are suspected as being one of the main reasons. An experiment was set up with potted roses. The objectives of the experiment were: i) to record pH responses during the production of potted roses as affected by 2 types of peat with different densities, two liming rates, two sources of raw water and two ammonium percentages in the applied nutrient solution. ii) to determine the effect of pH responses on plant growth and postharvest quality.

The postproduction index used by The Poulsen Roses was used for evaluating the post harvest quality. This index ranges from 0 to 9.99. A satisfactory plant should have a postproduction index of at least 7.5 on day 18, 22 and 28 of the postharvest period. The parameters recorded are: number of open and damaged flowers, of healthy and damaged flower buds, of damaged leaves and incidence of damage by *Botrytis*, mildew or pests. pH in the root zone varied from 3.5 to 6.9 between treatments at the end of the production period. pH also varied during the production period within each treatment. Generally pH dropped between 1st and 2nd cut back and increased after 2nd cut back to the end of production. Plants from treatments resulting in a high pH (> 6.7) had fewer flower bearing shoots and fewer buds at the end of production. The production period also increased.

Some treatments did not pass the post production test at day 18, 22 or 28 (index<7.5). These treatments were characterised by having a low or high pH in the rootzone at the end of the production period. The poorer plant quality at the end of production in treatments resulting in high pH in the root zone, may have negatively influenced the postproduction index. There was no clear correlation between plant quality at the end of production and reduced postproduction index at low root zone pH's.

INTRODUCTION

Peat quality can have profound effects on the growth and quality during production of pot plants (Scharpf, 1997). The problems can be related to both physical and chemical changes in the substrate (Caron and Nkongolo, 1999; Scharpf, 1997; Nielsen and Starkey, 1999). Chemical properties such as the nutritional status in the root zone have been shown to affect the uptake and ratio between the nutrient elements (Nielsen and Starkey, 1999). Changes in pH i.e. by liming rate or ammonium concentration are suspected as being one of the main problems (Nielsen and Starkey, 1999).

The objectives of the experiment were to record pH responses during the production of potted roses as affected by 2 types of peat with different densities, two liming rates, two sources of raw water and two ammonium percentages in the applied nutrient solution. The different treatments were expected to result in large differences in pH in the root zone. Furthermore the aim was to determine the effect of pH responses on plant growth and post harvest quality.

MATERIALS AND METHODS

The treatments consisted of 16 treatments: two peat types (blond and dark) limed

to pH 5 and pH 6.5, and irrigated with either tap water or rain water, and with two ammonium concentrations 10 or 20 % of total N (Table 1 and 2). 150 liter perlite of coarse grading and 1 kg fertiliser (12 % N, 6 % P, 20 % K + micronutrients) were added per m^3 to each peat type. The experiment was a complete randomised block design with two replicates, 50 plants in each replicate.

Rose cuttings were used of the cultivar 'Leonie'® and started 28 August in a greenhouse at a temperature 20 °C and supplementary light 40 W m^{-2} (SON-T lamps). After rooting the irrigation was started as described above. The nutrient solution was recirculated and nutrients added, when necessary. The solution was replaced once. The nutrient solution was supplied at each irrigation during production. Samples of the nutrient solution were analysed several times during the production phase. The roses were cut twice: 24 September and 14 October in order to form the plants. The plants were ready for sale when more than 4 flowers in each plant had opened. At time of harvest number of flowers and buds was determined. Dry weight (DW) of the shoot, including buds and flowers, of 5 plants from each replicate, ~15 plants per treatment, was determined after drying at 70°C for 24 hours. Nutrient content of the shoot was analysed.

Postharvest Phase

At the time of sales-ready 15 plants from the treatment were used for post-harvest treatment. The post-harvest treatment was done as previously described (Willams et al., 1996). The postproduction index used by Poulsen Roses (www.parade.dk) was used for evaluating the post harvest quality. This index ranges from 0 to 9.99. A satisfactory plant should have a postproduction index of at least 7.5 on day 18, 22 and 28 of the postharvest period. The parameters recorded are: number of open and damaged flowers, number of healthy and damaged flower buds, number of damaged leaves and incidence of damage by *Botrytis*, mildew or pests.

Statistical Analysis

Analysis of variance procedures (General Linear Model procedure of SAS) and comparison of means using Duncan´s multiple-range test ($p<0.05$) were used to evaluate the effects of treatments. Post-harvest effect could not be analysed statistically.

RESULTS AND DISCUSSION

The different treatments did cause a range of pH values in the root zone. Hence pH in the root zone at the end of the production period varied from 3.5 to 6.9 between treatments, shown for the blonde peat in Table 2. pH also varied during the production period within each treatment. Generally pH dropped between 1st and 2nd cut back and, at the high liming rate, increased after the 2nd cut to the end of production (Fig. 1).

In the dark peat the plant growth and quality differed only slightly, whereas in the blonde peat there was generally a higher dry weight production, more buds and a shorter production time at the low liming rate (Table 2). The combination of liming to pH 5, rainwater and 10% ammonium resulted in the significantly highest dry weight and number of buds. Plants from the treatment resulting in a high pH (6.9) had significantly fewer flower buds at the end of production. The production period also increased considerably (Table 2).

The post harvest quality was also influenced by the treatments. Some treatments did not pass the post production test at day 18 (index<7.5). These treatments were characterised by having a low or high pH in the root zone at the end of the production period. This was more pronounced in the blonde peat (Fig. 2). The poorer plant quality at the end of production in treatments resulting in high pH in the root zone may have negatively influenced the postproduction index. There was no clear correlation between plant quality at the end of production and reduced postproduction index at low root zone pHs.

The concentration of calcium in the plant top at the end of production was higher at the high liming rate (results not shown). However there was no significant positive

effect of liming rate on the post harvest quality of potted roses. The calcium concentration in especially the flowers of roses has been shown to influence the post harvest life mainly due to an effect on *Botrytis* (Starkey and Pedersen, 1997). In the present experiment there was no recording of calcium concentration in the flowers and it was not possible to define *Botrytis* as the main post harvest problem.

The results presented here underline the importance of a close monitoring and control of pH during the production of potted roses to ensure a good quality sales plant.

Literature Cited

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Tables

Table 1. Peat characteristics and liming rates at the beginning of the experiment.

Peat	Dry matter G per l	Air filled porosity %	Liming to pH 5.0 kg	Liming to pH 6.5 kg
Blonde	55-75	19.6	1 (Limestone) + 0.5 (Dolomite)	4.4 (Limestone) + 2.2 (Dolomite)
Dark	95-115	13.2	2 (Limestone) + 1 (Dolomite)	10 (Limestone) + 5 (Dolomite)

Table 2. Production data and pH for the different treatments in blonde peat.

Liming (pH)	Rawwater	Ammonium (%)	Buds [1)] (No.)	Dry weight [1)] (g)	pH[3)]	Production time [2)]
6.5	Borehole	10	3.7 gh	5.7 d	5.9, 6.9	10
6.5	Rain	20	5.4 ef	5.7 d	5.1, 5.9	3
6.5	Borehole	20	6.5 cde	5.9 cd	5.4, 6.5	3
5.0	Borehole	10	7.7 bc	6.0 bcd	5.3, 5.9	0
6.5	Rain	10	4.9 fg	6.7 abc	5.7, 6.5	3
5.0	Borehole	20	5.9 def	6.7 abc	4.1, 4.3	3
5.0	Rain	10	10.8 a	7.2 a	4.4, 4.5	0
5.0	Rain	20	8.6 b	7.2 a	3.9, 3.6	3

[1] At the 2. December when the first treatments were ready for sale

[2] 0=2. December and a higher number indicates the extra production time needed to reach sales quality.

[3.] Measured after 2nd cut back and at the end of production.

Figures

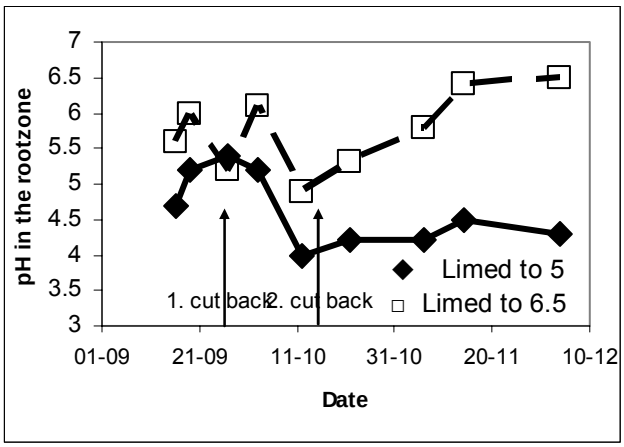

Fig. 1. Dynamics of pH in the root zone in blonde peat limed to 5 or 6.5. The time of cutting back the roses is indicated on the date axis.

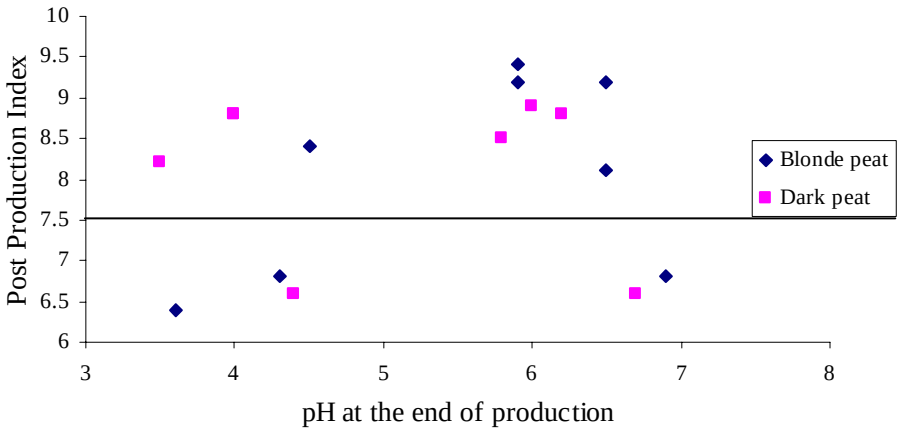

Fig. 2. The postproduction index in blonde and dark peat on day 18 of the postharvest period in relation to pH in the root zone at the end of the production period. The postproduction index of 7.5 is indicated on the figure.