Optimising Nutrition Of Containerised Nursery Stock

Project 4461

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Summary

Irish peat, used as a growing medium in horticulture, tends to have a higher state of decomposition and a higher potential buffering capacity than some of the younger peats from Scandinavian or Baltic countries. Particularly where hard water, with high bicarbonate content, is used for irrigation this could be an important property in giving the peat greater stability with respect to pH levels

throughout the cropping period. It may also influence the optimum rate of lime to be applied to adjust the pH prior to cropping.

The effect of peat type on the performance of nursery stock plants, *Azalea* and *Hebe* in 2-litre containers, was studied when irrigated with both soft and hard water and with different rates of lime in the peat growing medium.

When irrigated with hard water, the rate of pH increase was less with relatively decomposed Irish peat than with younger Baltic peats. Using Irish peat, a rate of dolomitic lime addition to the peat of 4 kg/m^3 was best for *Hebe* when irrigated with soft water. Irrigating with hard water the lime rate could vary between 2 and 4 kg/m^3 without affecting plant performance. With the Baltic peats, increasing the rate of lime addition above 2 kg/m^3 tended to reduce growth of *Hebe*.

Azalea gave better results when irrigated with soft water. In hard water areas therefore it is advisable, if possible, to collect rain water from a greenhouse roof for irrigation purposes. A zero rate of lime gave inferior results with *Azalea*. With hard water a rate of 1 kg/m^3 was optimum. With soft water this could be increased to 2 kg/m^3 without damage.

New formulations of the controlled release fertiliser (CRF) have been introduced recently. An experiment was carried out to evaluate the CRFs available in Ireland for the production of containerised nursery stock over a 12 month period. The effect of rate of CRF was also studied. Experiments were also located in the Colleges of Horticulture in Warrenstown and Kildalton.

All the CRFs in these experiments produced acceptable results in terms of plant performance. There were differences between the CRFs but these were not consistent between the experiments. The vigorous species *Lonicera pileata* and *Escallonia macrantha* responed positively to rates of CRF up to 8 kg/m^3. The conifer, *Thuja plicata* gave no response to rates above 6 kg/m^3.

In an experiment over two seasons using 20 nursery stock species, a liquid feeding system resulted in heavier plants of most species than did one based on a controlled release fertiliser.

The effect of peat type and rate of lime on the growth of nursery stock irrigated with hard and soft water

Introduction

Irish peat, used as a growing medium in horticulture, tends to have a higher state of decomposition and a higher potential buffering capacity than some of the younger peats from Scandinavian or Baltic countries. Particularly where hard water, with high bicarbonate content, is used for irrigation this could be an important property in giving the peat greater stability with respect to pH levels throughout the cropping period. It may also influence the optimum rate of lime to be applied to adjust the pH prior to cropping.

These experiments compared peats from three sources combined with a number of rates of dolomitic lime addition for the production of a calcifuge species, *Azalea japonica* Mme. Van Hecke and a non-calcifuge plant *Hebe pinguifolia* 'Sutherlandii' irrigated both with soft and hard water.

Methods

The three peat types used were Irish (H5-H6 on the van Post scale), Latvian and Lithuanian (both H2-H3 on the van Post scale). A controlled release fertiliser, Osmocote Plus (12-14 month) was added to each peat type at 4 kg/m^3 for the *Azalea* and 5 kg/m^3 for the *Hebe*. Dolomitic lime was added at three rates for each species, 0, 1 and 2 kg/m^3 for *Azalea* and 2, 3 and 4 kg/m^3 for *Hebe*. The peat type and lime rate treatments were combined in a 3 x 3 factorial design.

Separate experiments were carried out for each species on flood benches irrigated with hard or soft water. The hard water was well water with a bicarbonate level of 325 mg/l and the soft water was collected from the glasshouse roof.

The young plants were potted into 2-litre pots on June 16, 1998. The pots were placed on four flood benches in a glasshouse compartment and were grown on until June 23, 1999. The plants were then harvested and the fresh weight of each plants recorded. Samples of the growing medium were taken from each treatment at intervals through the experiment for determination of pH. There were eight replications of each of the nine treatments in each of the four experiments.

Irrigation on the flood benches was controlled by a programmable timer. During irrigation the pots were flooded to a depth of 5 cm which was maintained for a 5 minute period and then the water was allowed to flow back to a reservoir underneath the bench.

Results

pH levels

The rates of lime used maintained distinct pH regimes in each of the four experiments (Figures 1 to 4). Where soft water was used for irrigation of *Azalea*, there was a fall in the pH during the autumn which stabilised during the winter and spring (Figure 1). The fall in pH was immediate where no dolomitic lime as added with a temporary recovery in the spring. When hard water was used, there was an initial fall in pH followed by stabilisation and then an increase in the spring towards the end of the experiment (Figure 2).

In the case of *Hebe*, where rates of lime from 2 to 4 kg/m^3 were used, there as a gradual decline in pH levels over the summer and autumn, with soft water irrigation, which then stabilised (Figure 3). Irrigating with hard water resulted in a large increase in pH in the latter half of the experiment (Figure 4) so that the pH at the end as well above the initial level.

The peat types had a significant effect on the pH level in the growing medium. This is illustrated in the case of *Hebe* in Figures 5 and 6. When irrigated with soft water the more decomposed Irish peat showed a gradual decline in pH through the experiment while pH in the two Baltic peats remained the same or increased slightly (Figure 5). With hard water irrigation there as a large increase in pH in the second half of the experiment in the case of the two Baltic peats (Figure 6). While an increase as also noted with the Irish peat, its magnitude was much less resulting in markedly lower pH in the Irish peat at the end of the experiment.

Plant growth

Where *Azalea* was irrigated with soft water, the zero rate of dolomitic lime addition did not perform as well as either the addition of 1 or 2 kg/m^3 (Table 1). There was no difference in plant performance between the lime rates and no significant interaction between peat type and lime rate.

Table 1 : Effect of peat type and lime rate on the fresh weight (g/plant) of *Azalea* irrigated with soft water.

Rate of lime (kg/m^3)	Peat type			Mean
	Irish	Latvian	Lithuanian	
0	126.0	123.0	94.7	114.6
1	132.0	138.0	142.6	137.5
2	127.6	144.3	139.2	137.0
Mean	128.5	135.1	125.5	

	F-test	S.E. (df=55)
Peat type	NS	5.56
Lime rate	*	5.56
Peat x Lime	NS	9.83

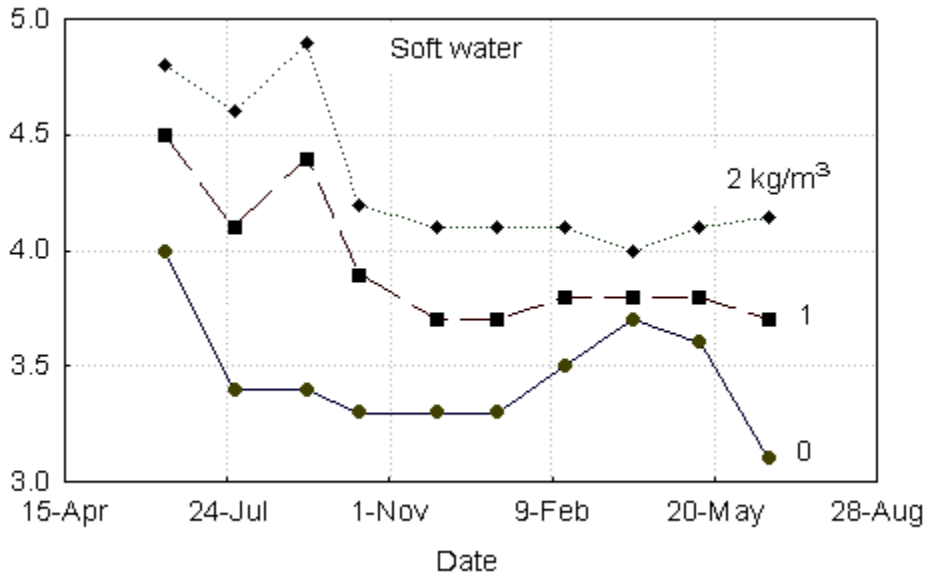

Figure 1 : The effect of rate of lime on the pH of a peat growing medium during the cultivation of *Azalea japonica* Mme. Van Hecke irrigated with soft water

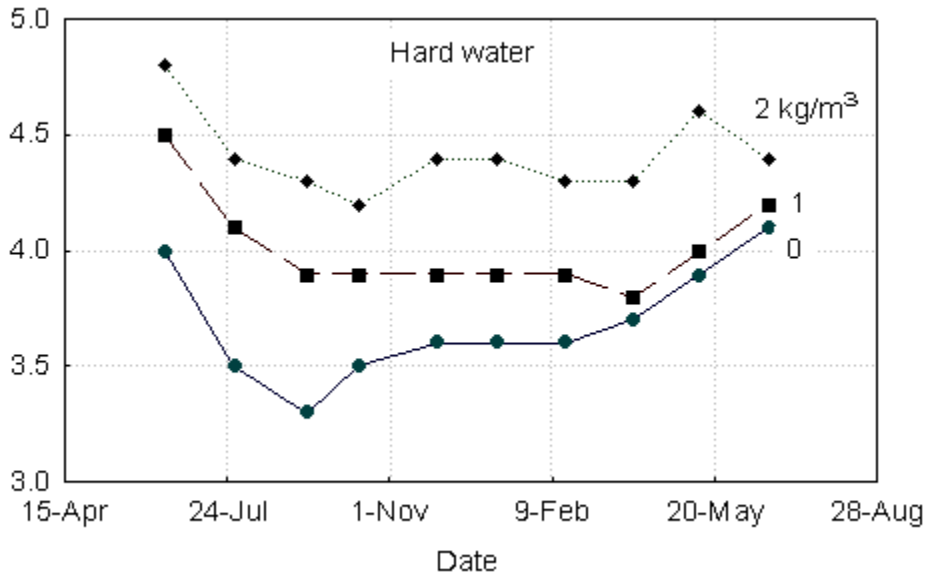

Figure 2 : The effect of rate of lime on the pH of a peat growing medium during the cultivation of *Azalea japonica* Mme. Van Hecke irrigated with hard water.

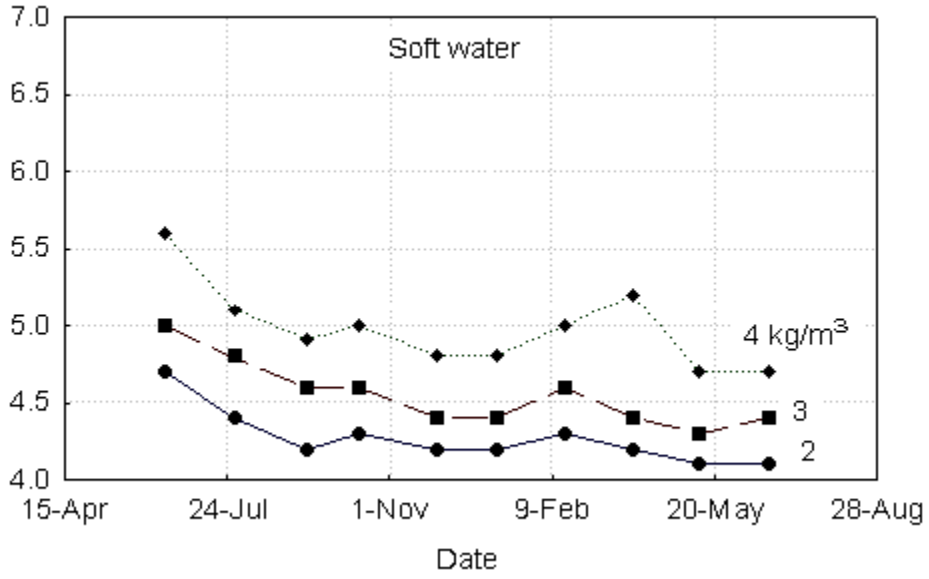

Figure 3 : The effect of rate of lime on the pH of a peat growing medium during the cultivation of *Hebe pinguifolia* 'Sutherlandii' irrigated with soft water.

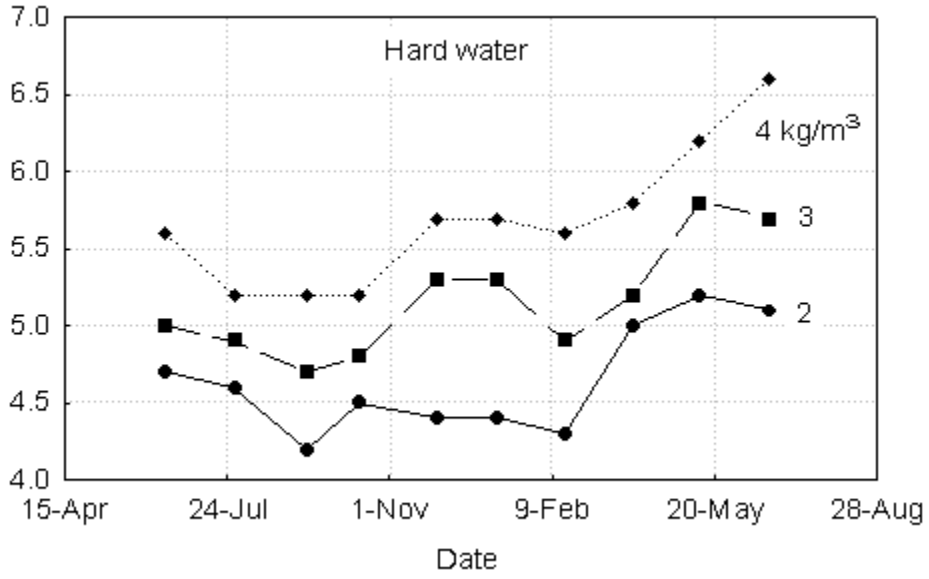

Figure 4 : The effect of rate of lime on the pH of a peat growing medium during the cultivation of *Hebe pinguifolia* 'Sutherlandii' irrigated with hard water.

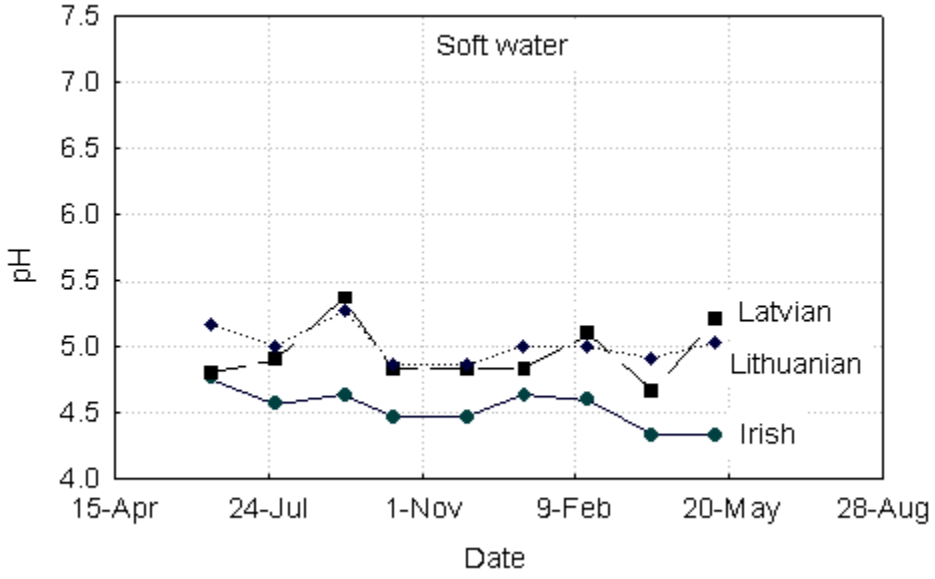

Figure 5 : Effect of peat type on the pH of the growing medium during the culture of *Hebe pinguifolia* 'Sutherlandii' irrigated with soft water.

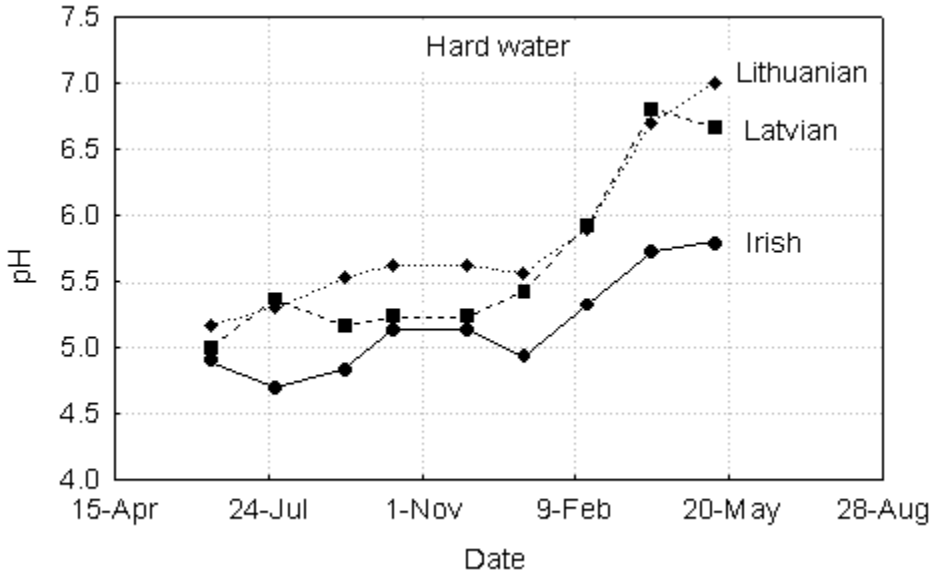

Figure 6 : Effect of peat type on the pH of the growing medium during the culture of *Hebe pinguifolia* 'Sutherlandii' irrigated with hard water.

When the *Azalea* plants were irrigated with hard water the optimum rate of lime addition was 1 kg/m^3. Both the zero rate and a rate of 2 kg/m^3 had a deleterious effect on plant growth. As in the previous table, peat type had no effect on plant performance. Plant size in the hard water experiment was markedly smaller than those irrigated with soft water.

Table 2 :Effect of peat type and lime rate on the fresh weight (g/plant) of Azalea irrigated with hard water.

Rate of lime (kg/m^3)	Peat type			Mean
	Irish	Latvian	Lithuanian	
0	93.1	63.7	84.7	80.5
1	107.4	102.0	96.3	101.9
2	87.4	93.9	78.2	86.5
Mean	96.0	86.5	86.4	

	F-test	S.E. (df=48)
Peat type	NS	5.38
Lime rate	*	5.38
Peat x Lime	NS	7.99

During the experiment a number of the *Azalea* plants showed symptoms of chlorosis and yellowing. Branches on some plants died back with a number of plants succumbing entirely. An assessment, using a subjective scoring system on a scale of 0 to 5, of the incidence and severity of these symptoms was carried out and the results are shown in Table 3.

Table 3 : Effect of rate of lime on the colour score and degree of die-back in *Azalea* irrigated with soft and hard water.

Rate of lime	Colour[1]		Die-back[2]	
(kg/m^3)	Soft water	Hard water	Soft water	Hard water
0	3.7	2.9	4.0	2.6
1	4.5	3.4	4.8	3.9
2	4.7	2.9	4.8	3.5
F-test	*	NS	*	*
S.E. (df=63)	0.23	0.22	0.24	0.36

1. 5- dark green healthy foliage, 0 – 100% chlorotic
2. 5- vigorous normal plant, 0- plant dead

The problems were much more prevalent in the experiment irrigated with hard water with the plants at the 1 kg/m^3 lime rate having the best scores. In the soft water experiment, only the plants at the zero rate of lime exhibited symptoms. There were no significant differences between the peat types in the incidence of these symptoms.

When *Hebe* was irrigated with soft water neither the overall effect of peat type or rate of lime was significant (Table 4). There was however a significant interaction. In the case of Irish peat the rate of lime could be increased fro 2 to 4 kg/m^3, whereas with the two Baltic peats, increasing the lime rate reduced plant performance.

In the hard water experiment with *Hebe*, although the overall of peat type and lime rate were significant, there was again a significant interaction between them. As in the soft water experiment Irish peat performed well at all rates of lime.

Table 4 : Effect of peat type and lime rate on the fresh weight (g/plant) of *Hebe* irrigated with soft water.

Rate of lime	Peat type			Mean
(kg/m^3)	Irish	Latvian	Lithuanian	
2	128.2	141.4	148.4	139.4
3	126.7	117.0	142.1	128.6
4	152.3	114.1	116.8	127.7
Mean	135.7	124.2	135.8	

	F-test	S.E. (df=63)
Peat type	NS	4.08
Lime rate	NS	4.08
Peat x Lime	***	7.07

However, plant performance in the Baltic peat tended to decline as the lime rate was increased above 2 kg/m^3. This is consistent with the results of the soft water experiment.

These results may be connected with the large increase in pH which took place in the latter half of the hard water experiment. During this time, the plants were larger and consequently the water usage would have been greater than earlier in the experiment. This may account for the greater effect of the hard water in

raising pH at this time. Plant growth was also at a maximum at this time and so if sub-optimal conditions occurred it might be expected that this would have an effect on plant weight.

Table 5 : Effect of peat type and lime rate on fresh weight (g/plant) of *Hebe* irrigated with hard water.

Rate of lime (kg/m^3)	Peat type			Mean
	Irish	Latvian	Lithuanian	
2	122.7	126.9	135.9	128.5
3	132.5	102.8	115.8	117.1
4	123.6	114.9	104.4	114.3
Mean	126.3	114.9	118.7	

	F-test	S.E. (df=63)
Peat type	*	2.34
Lime rate	***	2.34
Peat x Lime	***	4.06

When the plant weights from the soft and hard water *Hebe* experiments were combined and regressed against the pH values measured in the growing media on March 31, the relationship illustrated in Figure 7 was found. This shows that those treatments which had high pH values at that time produced the smallest plants and that the pH effect can account for a significant amount of the variation in plant weight.

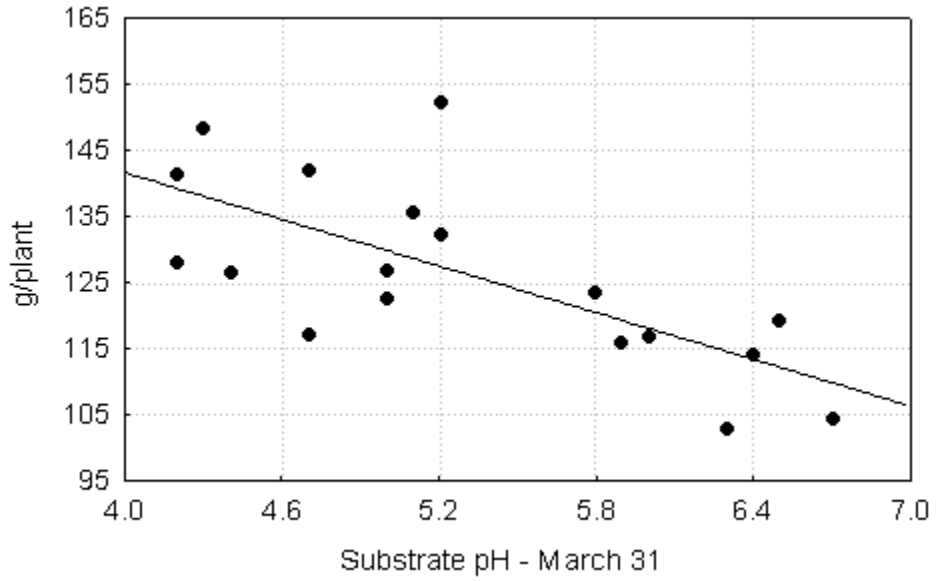

Figure 7 : Relationship between final plant weight of *Hebe* and pH of the growing medium on March 31.

Conclusions

- *Azalea* gave better results when irrigated with soft water. In hard water areas

therefore it is advisable, if possible, to collect rain water from a greenhouse roof for irrigation purposes.

- A zero rate of lime gave inferior results with *Azalea*. With hard water a rate of 1 kg/m^3 was optimum. With soft water this could be increased to 2 kg/m^3 without damage.
- The rate of pH increase with hard water irrigation was much higher in Latvian and Lithuanian peat than in Irish peat.
- Using Irish peat, a rate of dolomitic lime addition to the peat of 4 kg/m^3 was best for *Hebe* when irrigated with soft water. Irrigating with hard water the lime rate could vary between 2 and 4 kg/m^3 without affecting plant performance.
- With the Baltic peats, increasing the rate of lime addition above 2 kg/m^3 tended to reduce growth of *Hebe*.