Sphagnum Moss Production: Experience from Environmental Room Trials to Compare Growth of Two Species of Sphagnum Moss

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INTRODUCTION

Sphagnum moss is one of the world's most common plants with an almost universal distribution in lands where water is abundant. It grows under conditions of extremely low nutrition and has been used in the monitoring of both atmospheric and water pollution (Clymo, 1987; Wegener et al., 1992).

In the recent past its major use has been in the nursery industry for orchid production, fine-seed germination, and the transport of bare-root seedlings (Blain et al., 1987). This utilises the moss's ability to hold approximately 20 times its dry weight in water.

More recent uses include surgical dressings, sanitary pads, disposable napkins, bedding and stable litter, and as a packaging material. Each of these utilise this unique water-holding capacity.

The current New Zealand export value is approximately $18 million mainly to Japan, Taiwan, and Korea for use in their orchid industries.

Although a number of species grow and flourish in New Zealand, the market utilises mainly *Sphagnum cristatum* though this is frequently intermixed with and often indistinguishable in the dried form from *S. australe*.

Among the major reasons for New Zealand research is the collection of data to determine the sustainability of harvesting and frequency of harvest, as well as, to investigate the potential for protected-environment culture.

Overseas it has been reported from natural environments, that 15-cm growth has been achieved in periods varying from 1 to 30 years (Moore, 1989). Many factors appear to influence growth under New Zealand conditions but research to quantify these is relatively recent (Buxton et al, 1990, 1991a, b, 1992). Current New Zealand research by HortResearch, Landcare, and Waikato University, into the individual and combined effects of light, water, and temperature will enable a better understanding of the regenerative ability and overall suitability of *Sphagnum* harvesting practices.

Crop & Food Research are investigating conditions for culturing moss in artificial environments, to achieve quality *Sphagnum* particularly suitable for pharmaceutical use, as well as looking to reducing the overall costs associated with harvesting, sorting, and grading. Results to date indicate cultured moss dries very white and if experimental growth rates can be maintained then acceptable yields may be attainable. Commercial cultivation of *Sphagnum* in protected environments does not appear to have been attempted elsewhere in the world, although literature indicates laboratory experiments have successfully grown *Sphagnum* for experimental use (Baker and Boatman, 1985).

MATERIALS AND METHODS

Experimental Design. A 3 x 3 x 2 x 2 factorial split plot design with two complete replicates was used for the results reported. Treatments were:

Light levels. Full (no shadecloth), 50%, 35%. Shade levels imposed using neutral density shadecloth over the trolleys.

Propagule Types.

- Capitulum only—the tufted capitula removed from stems just behind the growing point.
- Capitulum + stem—as above with stem left attached so that the total length was 25 mm.
- Stem only—stem pieces taken from immediately behind the capitulum but not extending further than the first 100 mm of stem.

Species. *Sphagnum cristatum* and S. *australe.*

Moss Source. Burnbrae, Pell Stream.
Moss was harvested from both sites and transported back to Riwaka Research Centre where 80 propagules were used for each treatment and propagule type described above. Propagules were laid in plix trays and moistened with water collected from the Burnbrae site and transported to the HortResearch environment rooms at Palmerston North. Here they were placed on trolleys in rooms for 14 weeks from October 1994 until January 1995.

Temperature, relative humidity, and light for each treatment remained constant throughout the period. Daylength was constant at 12 h and carbon dioxide levels were unregulated. After an initial 3-week period of hand misting with water from two swamp sites, a misting system using bore water was set up. Water analyses were made regularly.

Moss extension growth was measured by placing a perspex lid onto the growing tray at measuring time and using a graduated pin pushed through three random holes in the perspex. This allowed growth to be measure at exactly the same point each time. Final measurements were made after transporting the trays back to Riwaka.

When moss began growing, it always grew vertically from the propagule allowing easy measurement of growth during the experiment. At the end of the experiment all new growth was separated and placed end to end to get the total growth made per treatment.

RESULTS

Total Extension Growth at Harvest. Total extension growth from capitula + stem collected from Burnbrae site was far superior to Pell Stream and to other propagule types.

	Burnbrae	Pell Stream
Capitula only	2340	1280
Capitula + stems	6810	2730
Stems only	2150	1370
sed	494	

Branching. The proportion of the original propagules which formed branches was highest where only the stems were used, and lowest where only the capitula were used.

Capitula only	10.4%
Capitula + stems	31.8%
Stems only	62.5%
sed	5.99%

Moss from Burnbrae showed a greater tendency to branch than that from Pell Stream. There was little evidence that either species impacted upon the proportion of the propagules that developed branches. A similar picture emerged when the actual number of branches was examined rather than the proportion of the original propagules to branch.

Dry Matter Accumulation. Dry matter accumulation was not affected by light level. However, Burnbrae moss accumulated more biomass than that of Pell Stream; *S. australe* accumulated more than*S. cristatum*; and the combined capitula + stems propagule type produced more than capitula alone which, in turn, produced more than stems alone.

The relative performance of the species did not differ between the two sites. However, although *S. australe* yielded higher than *S. cristatum* for all propagule types, it was when capitula + stems were used that it really excelled:

	Sphagnum australe	*Sphagnum cristatum*
Capitula only	1.55	1.32
Capitula + stems	3.79	2.70
Stems only	0.89	0.61
sed	0.197	

Similarly, it was when capitula + stems were used as initial propagules that moss from the Burnbrae site was clearly superior to that from Pell Stream:

	Burnbrae	Pell Stream
Capitula only	1.40	1.47
Capitula + stems	3.75	2.74
Stems only	0.81	0.69
sed	0.197	

DISCUSSION

The marked difference in performance of moss from the two sites has many implications. It suggests that there is potential for increasing growth by selecting the initial source of moss appropriately. Given the relative isolation of the two source swamps, it seems reasonable to speculate that the differences were at least partially of genetic origin. It is interesting that *S. australe* generally outperformed *S. cristatum* in terms of yield.

Although low light levels increased extension growth, the actual dry matter accumulation was not affected. It would appear that the low light effect was one of etiolation rather than optimising conditions. There is a market demand for long moss. However, long etiolated moss would probably be unacceptable. For good growth over a period of a few months, it would appear that capitula need to be included in the original propagule. Branching, however, appeared better when a reasonable portion of stem was present. If it is desirable to have the capitula in the marketed product, then it may be necessary to consider some preconditioning for stem segments to initiate these prior to their use in further growth studies.

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