Micropropagation of Sphagnum Moss for Peat Land Regeneration©

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INTRODUCTION

The author has been involved in micropropagation since 1976. He undertook a PhD in the technique at Nottingham University before starting his own laboratory and nursery in partnership with his wife, Barbara and, as an IPPS member for all that time, has shared most of the supposed "secrets" of micropropagation.

Micropropagation is labour intensive and is now largely undertaken in regions with cheap labour such as Eastern Europe, India, and China. However, with very careful management and integration into niche markets, there is still a place for it in the U.K. The basics of micropropagation have not changed much over the last 30 years but there has always been a need to control costs and, in the traditional IPPS manner, low investment innovations have been developed by the author both for the laboratory and nursery at Micropropagation Services. These include home-made sterile air cabinets and alternatives to scientific apparatus wherever possible, and the use of gantry mounted mowers for trimming plug plants to improve bushiness and uniformity. Early adoption of innovations, such as the Evaposensor for mist control in weaning has also proved essential to maintain an edge over the competition.

The business undertakes micropropagation of many different species including woody and herbaceous ornamentals, forest trees, and edible crops. Very careful management of production, order processing, stock and cost control are essential, achieved by the use and development of an in-house database programme which also enables complete traceability from original stock plant to delivery.

Niche markets have been developed and any very large scale production has been passed to laboratories overseas, so competition with producers with access to cheap labour is minimised.

One niche market; the production of native species for vegetation restoration in The Peak District, Derbyshire, has lead to the development of a unique product. Novel propagules produced using in vitro techniques and encapsulated in a gel (BeadaMoss™) provided the opportunity to "re-seed" large areas economically. The business is now propagating Sphagnum moss on a large scale to re-establish it on degraded areas of peat bogs to restore them to the fully-functioning carbon sequestering ecosystems that they should be.

PEATLAND REGENERATION

Re-establishment of sphagnum moss is key to restoring degraded ombrotrophic bogs to functioning ecosystems. In the Peak District and South Pennine bogs of England where sphagnum was almost wiped out after the Industrial Revolution, recovery of peatlands is limited by low numbers of actively growing local Sphagnum populations for regeneration or propagation.

Propagation of Sphagnum

In areas where restoration of sphagnum is desirable there is very little material available as a source, either because it has been degraded or is legally protected by conservation laws. A rapid propagation method was developed and has proved suitable for 12 species tested so far. Large quantities of sphagnum plants can now be routinely produced.

Distribution of Sphagnum Propagules onto the Bog

Sphagnum is very difficult to handle and distribute, when removed from the growing medium surface. It behaves like a wet blanket and it is difficult to separate individual

plantlets. A method has been developed to encapsulate sphagnum plantlets, a few millimetres in size allowing easy separation and planting onto the bog surface (Fig. 1). The beads produced by this system (termed BeadaMoss™) are tolerant of tough in vivo conditions enabling handling with air-seeding machines and distribution from a helicopter, thus making large scale planting viable and achievable (Fig. 2). They can equally be handled and planted by ground based machines on suitable surfaces, such as that on a peat bog which has been cut over to provide peat for horticultural growing media.

Fig. 1. BeadaMoss™: Inside each bead are numerous tiny propagules, each with the potential to grow into a sphagnum plant.

Fig. 2. Helicopter mounted seeder applying BeadaMoss™.

Growth Trials

Sphagnum plantlets in beads (BeadaMoss™) produced recognisable sphagnum growth within 2 to 3 weeks of being placed onto a commercial peat growing medium in a glasshouse at approximately 20°C. Within 8 to 10 weeks these had grown and spread to approximately 10 mm diameter (Fig. 3). The beads have been tested for their ability to grow if buried in substrate, and the sphagnum was found to be able to grow to the surface within 8 to 10 weeks from a depth of 30 mm.

Fig. 3. BeadaMoss™ after 8-10 weeks in glasshouse.

Cold tolerance was also tested. At temperatures down to 0°C there was no deterioration in growth rate or survival. At -5°C 70% of the beads had produced sphagnum growth after 10 weeks, but growth was delayed by 2 to 3 weeks compared with that from beads sown at temperatures above 0°C.

Field Trials on Degraded Bog

A series of permanent 0.5×0.5 m quadrats containing sphagnum beads was set up on two sites in the Southern Pennines (Black Hill restoration site and Holme Moss site with bare peatland), The quadrats were placed at random in three blocks at each site. The plots were first examined in Autumn 2011. All growing pieces of sphagnum were counted and then marked with thin canes for future monitoring. Survival on bare areas has been lower than for restored areas where the surface has been stabilised (Fig. 4).

Fig. 4. A forest of canes marking 62 visible sphagnum plants of the original 90 propagules planted.

Trials on Cut-Over and Harvested Bogs

The best results were produced in areas with a stabilised peat surface (using brash, grass seed, or cotton grass plugs) (Fig. 5).

BeadaMoss™ was applied in spring to plots of bare peat and to peat surfaces stabilised with brash. For the plots where the surface was stabilised using cotton grass (*Eriophorum angustifolium*), cotton grass plugs were planted in spring and beads were applied 4 months later.

Fig. 5. Harvested bog: Early stages of sphagnum growth in cotton grass restored area.

Small sphagnum plants established well on cotton grass stabilised surfaces as the grass acted as an effective "nurse crop" (Fig. 6). Sphagnum grows through coarse chopped brash but finely chopped brash can crust and inhibit sphagnum growth. Without anything to prevent frost heave and surface movement on the bare plots, no sphagnum could establish.

Fig. 6. Established sphagnum from bead.

DISCUSSION

Sphagnum beads (BeadaMoss™) can establish and grow into significant robust patches of moss that can survive harsh winters and even the moderately severe drought in Spring 2010. Given sufficient time a very large percentage of beads can produce sphagnum patches more than 2 years after planting.

Sphagnum establishment from beads on vegetation stabilised surfaces, such as at the Black Hill site, was evident more quickly than on the bare peat (Holme Moss). However, even on bare peat with ground conditions previously thought too severe, sphagnum beads can colonise with a good degree of success, given time.

The survival rate of beads even in fairly severe conditions means that a good sphagnum cover can be achieved over large areas, by seeding with BeadaMoss™. The real possibility of restoring a fully functioning sphagnum bog back to the Derbyshire Peak District and other degraded cut-over bogs is therefore becoming a reality.