Grower Summary

HNS 175

Liverwort control using novel techniques

Final 2012

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Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number:	HNS 175
Project Title:	Liverwort control using novel techniques
Project Leader:	Dr Jill England
Contractor:	ADAS UK Ltd
Industry Representative:	John Richards, John Richards Nurseries Dr Neal Wright, Micro Propagation Services
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Headline

- Mulch application of *Brassica napus* and *Sinapis alba* 'Braco' seed meal can significantly reduce liverwort establishment
- Seed meal in combination with bark mulch can improve liverwort reduction.

Background and expected deliverables

Liverwort growing on the surface of growing media is a major problem to the horticulture industry, affecting both protected and outdoor grown hardy nursery stock. The cost of moss, liverwort and weed control at despatch alone is estimated at up to 3p per 3 L pot, equating to £5,625 per hectare based on 2012 figures, depending on the weed control regime in place (hand weeding, herbicide programme etc.) (Hewson, A. 2012). Zero tolerance of liverwort in certification schemes and a lack of approved chemical products make its control a technical priority for growers.

There are currently no herbicides approved for use over plants under protection that will control liverwort. Additionally, ensuring even distribution of pot toppers, such as bark remains a challenge for the industry, particularly for liner crops (i.e. those grown in small pot sizes).

The aim of this project has been to build on work completed in HDC projects HNS 126 and HNS 93c by investigating further the herbicidal effect of glucosinolate (GSL) hydrolysis products found in oil seeds on liverwort, and the suppression of liverwort growth by unknown biological or physical factors within certain growing media components.

GSLs and their hydrolysis products (isothiocyanates, ITCs) are responsible for the distinctive pungent smell and hot taste of cabbages, mustards and other brassicas and are known to have toxic effects against plants, root knot nematodes and fungal species; brassicas are successfully used in biofumigation of soils against weeds and diseases. GSLs could potentially be used to control weeds in containers; each brassica variety has a distinctive profile of one or more glucosinolates, each of which could have a different effect on liverwort.

In years 1 and 2 of this project, trials investigated the effect of different brassica oil seeds (*Brassica carinata, Sinapis alba* 'Albatross', *Sinapis alba* 'Braco'*, Camelina sativa*, *Brassica napus* 'RMF' and *Brassica napus* '00'), and growing media amendments (Melcourt Sylvafibre®, Melcourt Growbark®, Perlite, Vital Earth Green Compost and sterilised loam) on liverwort establishment. *Sinapis alba* 'Albatross', *Sinapis alba* 'Braco', *Brassica napus* '00' and *Camelina sativa*, and growing media amendment with Sylvafibre® and sterilised loam significantly reduced liverwort establishment.

The expected deliverables from this work include the development of an effective novel control for liverwort infestation based on:

- Growing media amendment with seed meal or a combination of seed meals to reduce liverwort establishment (either through herbicidal effect and/or any natural barrier effect).
- Growing media amendment with materials to provide natural microbial suppression of liverwort in addition to any physical effect.

Summary of the project and main conclusions

Two trials were carried out during 2011/12: 1) investigating the suppressive effect of mulch application of two seed meal varieties *Sinapis alba* 'Braco' (mustard) and *Brassica napus* (oilseed rape) to control liverwort at a single dose rate, and 2) investigating the effect of applying seed meal over the crop and removing the deposits using different methods.

Half of the seed meal was kept intact for the trial, and the rest was processed to a fine meal and the oil extracted. The trials were set up on 8 June 2011. For both trials, each pot was planted with a plug of *Clematis* 'Ernest Markham', which were grown according to commercial practice. Liverwort inoculum was provided by one 'spreader' pot per plot containing liverwort.

The results of several trial plots in both trials were excluded from statistical analysis following the accidental application of gluten by nursery staff on 22 September 2011, including the majority of the control treatment with bark, therefore these results are not reported for liverwort cover. The gluten also appeared to attract rats, which caused damage to a number of other pots.

Seed meal suppressive effect

This trial focused on two seed meal varieties, *Sinapis alba* and *Brassica napus*, applied at a single dose rate (6 g per pot), with six treatments, including two control treatments, seed meal only, a managed treatment, bark with seed meal, and a treatment using seed meal where the oil had not been extracted (whole seeds were ground just prior to setting up the trial). For the managed treatments a second application of seed meal was applied at the first sight of liverwort infestation on 1 August 2011, 9 weeks after treatment.

The most promising treatments from these trials were the seed meal with bark, and the managed treatment, where a second application of seed meal was applied (Figure 1). Of the two seed meals varieties tested, the *Brassica napus* provide greatest liverwort control; when mixed with bark less than 5% liverwort established in this treatment throughout the 33

weeks of the trial. Application of seed meal with bark would have the disadvantage of higher costs (including bark and its application). Liverwort cover was also low in the managed treatments, where a second application of seed meal was applied.

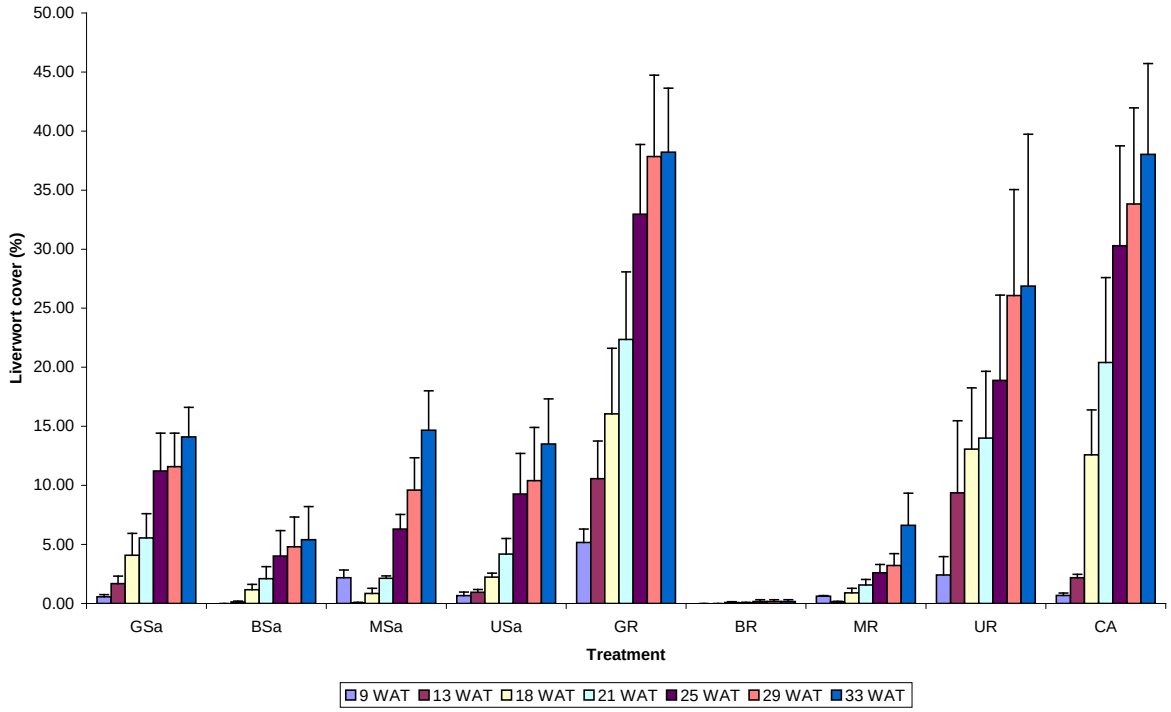

Figure 1. Percentage liverwort cover: GSa = Ground *Sinapis alba* 'Braco' seed meal*, BSa* = Ground *Sinapis alba* 'Braco' seed meal+bark, MSa = *Sinapis alba* 'Braco', managed treatment, USa = *Sinapis alba* 'Braco', unextracted seed meal, GR = Ground *Brassica napus* seed meal, BR = Ground *Brassica napus* seed meal+bark, MR = *Brassica napus*, managed treatment, UR = *Brassica napus*, unextracted seed meal, CA = No seed meal applied. WAT = weeks after treatment

Phytotoxicity was recorded in all treatments, although only treatments using *Sinapis alba* 'Braco' four weeks after treatment were not commercially acceptable. After 13 weeks all treatments scored above 4 and were commercially acceptable.

There was a clear overall difference in plant height due to seed meal variety, with greater height recorded in the *Brassica napus* treatments. Plant height was greatest in the bark treatments, and treatments where the oil had not been extracted; the greatest adverse effect on plant height was due to the managed *Sinapis alba* 'Braco' treatments. No adverse effect on root development was recorded due to any of these treatments.

The seed meal with bark treatment showed greatest promise in terms of least liverwort cover with high plant quality and height, and low phytotoxicity. Bark mulch would be more expensive to apply, and it is recognized that it is difficult to achieve an even mulch layer in a commercial setting. Nevertheless, this treatment would make hand weeding generally more acceptable to nursery workers through the reduction of liverwort establishment.

The managed treatments (seed meal only) also showed good liverwort control, and could more easily be applied alone through a granular applicator, but the risk of phytotoxicity would be increased.

Effects of seed meal deposit removal method

This small scale, unreplicated, trial investigated seed meal application; the results were not statistically analysed. Seed meal was applied over the plant leaves and then any deposits were removed by shaking or washing them off, or the deposits were left in place. Two control treatments were ground seed meal applied as a mulch and no seed meal, the results for which were collected from control treatments within the seed meal suppressive effect trial. For the treatment where the deposits were allowed to remain on the plants, the growing media was watered and the foliage allowed to dry before treatment, so that seed meal did not stick to wet foliage.

Least liverwort established in the treatments where seed meal deposits were left on the leaves, but greatest phytotoxicity and smaller plants were also recorded in these treatments. Seed meal was easily removed from plants, however the recommendation would be to apply seed meal to dry foliage and tap off to avoid any fungal or phytotoxicity problems due to any seed meal sticking to the foliage or lodging in leaf axils. If commercially adopted, seed meal may be quicker to apply over the crop using mechanised applicator than by mulch application.

Financial benefits

Potential financial benefits of using seed meal to control liverwort:

- The cost of moss, liverwort and weed control at despatch is estimated at 3p per 3 L pot, within a hand weeding regime, equating to £5,625 per hectare based on 2012 figures.
- There are currently no herbicides approved for use over plants under glass that will control liverwort.
- Seed meals have the potential to reduce the cost of liverwort control by reducing manual removal.
- Provision of plants to customers free from liverwort infestation.

Cost benefit analysis

Data (Table 11) for the cost of hand weeding, herbicide and loose-fill mulch application are based on 187,500 pots (3 litre, 19 cm diameter)/ha at 1.25 spacing (25 pots / m^2), allowing 25% non-cropped area for roads and general access (Hewson, A. 2012).

This study is aimed at hardy nursery stock grown as liners, therefore the analysis assumes 750,000 pots (9 cm)/ha, using a conversion factor of four to calculate the number of pots. The time involved in the operations described has been assumed to be the same for 9 cm pots as 3 L pots in this scenario. Figures are based on average costs and are for guidance only; there will be variations depending on situation, labour cost, and prevailing weed pressure.

Seed meal application would not replace a standard herbicide application as it is primarily for liverwort control. In recent trials at ADAS Boxworth, as part of the HDC Fellowship programme, seed meals gave good control of groundsel and annual meadow grass, which were used as test species. It may be possible, therefore, to substitute at least one application of Ronstar 2G with seed meal.

Action points for growers

- Further development of seed meal application, and refinement of dose rates on liverwort and phytotoxic effects on crop plants is required before any specific recommendations can be made for growers.
- Growers could consider including a proportion of Sylvafibre® or sterilised loam in potting mixes to aid liverwort reduction, particularly in short term crops (refer to Year 1 Annual Report for details