

Grower Summary

HNS/PO 192

Herbicide screening for
ornamental plant production
(nursery stock, cut flowers and
wallflowers)

Final 2015

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Project Number: HNS PO 192

Project Title: Herbicide screening for ornamental plant production (nursery stock, cut flowers and wallflowers)

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Grower Summary Hardy Nursery Stock Trials

Headlines

- New herbicides HDC H22, HDC H25 and HDC H27 were found to be safe to a range of 33 shrub and 20 herbaceous species subjects when applied after potting. Some species suffered temporary damage but grew away from it.
- Springbok (dimethenamid-p + metazachlor) which can be used on outdoor ornamentals under the LTAEU was also safe to most subjects when applied shortly after potting to a range of 33 shrub species – it was not tested on the herbaceous species because previously it has been found to be damaging.
- The new liverwort and moss control product Mosskade was found to be safe when applied six weeks after potting to a range of 33 shrub species and when applied immediately after potting to 20 herbaceous species.

Background

The HNS (Hardy Nursery Stock) industry is currently relying on relatively few herbicides to control weeds, leading to an increasing concern about the development of resistance. With the loss of Ronstar 2G and other products containing oxadiazon, there are very few summer treatments left that are available to the HNS industry to control a wide range of weeds on container-grown plants after potting and during the growing season. Restrictions on the use of straight metazachlor products (e.g. Butisan S) have only complicated the situation further. Once supplies of Ronstar 2G (and other products) have run out, the industry will be heavily dependent upon Flexidor 125 (isoxaben) for summer herbicide applications. Unfortunately Flexidor 125 does not control groundsel, willowherb or grasses and the reliance on one herbicide increases the likelihood of weeds developing resistance.

Results from HNS 139 and HNS 139a demonstrated how Dual Gold (S-metolachlor) could help improve control of weeds, however the current EAMU only permits use during May leaving a gap in control measures during the summer and autumn. HDC H22 from the SCEPTRE CP 77 programme has the characteristics (residual weed control with minimal contact activity) that could make it useful in ornamental production. Springbok (dimethenamid-p + metazachlor) was first trialed in a small scale in HNS 139 but it wasn't developed further

for container-grown shrubs as it did not offer any advantage over Butisan S. However, as Springbok has a lower metazachlor content than Butisan S, together with the active dimethenamid-p, it can be used at an appropriate application rate without exceeding the limit for metazachlor. Earlier results from HNS 166 demonstrated that a number of herbaceous crops could be damaged. Therefore Springbok was not included in the herbaceous trial within this project. Three further new products were made available for testing in 2014, including granular product HDC H25 for general weed control and a liverwort and moss control product Mosskade. HDC H27 was included as an alternative granular product to be tested. This product is widely used in arable systems as a grass herbicide with efficacy against annual meadow grass and some broad leaved weeds.

All herbicide treatments were also included in a second shrub nursery trial and evaluated for weed control spectrum under project CP 86 HDC/EMT/HTA Weeds Fellowship. Results from these trials are summarised in this grower section for information. Full details of these trials will be included in the annual report for CP 86 available in 2015.

The aim of this project was to determine crop safety of the new herbicides when applied as a summer treatment shortly after potting. The industry standard, Flexidor 125, and an untreated control were also included in the treatment list to allow comparisons to be made. The subjects were monitored for phytotoxicity and any effects were recorded. These findings will allow recommendations for future treatment.

Summary

The trials were carried out on two commercial nurseries; shrub species at Darby Nursery Stock, Norfolk and herbaceous species at Hawkesmill Nurseries, Webbs of Wychbold site. The aim was to cover a range of hardy nursery stock and herbaceous subjects that are commonly grown on commercial nurseries in the UK and assess their susceptibility or tolerance to applications of the new herbicides.

The trials were carried out in summer 2014. Treatments were applied with the exception of Mosskade on 19 and 20 May 2014 to the shrub species (Darby Nursery Stock), all treatments were applied to the herbaceous subjects on 20 June 2014 (Hawkesmill Nurseries) as a treatment over the foliage after potting on (**Table 1**). Mosskade was applied 30 June 2014 at Darby Nursery Stock as this is a contact acting liverwort herbicide so would not be applied as a residual at potting. Mosskade was applied on the same date as other treatments at Hawkesmill Nurseries as this would test phytotoxicity when plants were at their most

susceptible growth stage. HDC H25 was used at two rates (the expected label rate and half rate) in the trial on herbaceous subjects at Hawkesmill Nurseries as there was concern that the full label rate may be damaging to herbaceous stock. The plots were assessed for any damage or growth effects two, six and twelve weeks after treatment. Weed assessments were also carried out at these times although the primary focus of the trials was to assess crop safety.

Table 1. Treatments applied to plots during summer 2014 at 1000 L water/ha

Treatment	Active ingredient	Rate kg/ha or L/ha	Approval status
Untreated	-	-	-
Flexidor 125	Isoxaben (125 g/L)	1	Approved
Mosskade	Starch, proteins, oils	100	Outside scope
Springbok ¹	Dimethenamid-p (200 g/L) + metazachlor (200 g/L)	1.66	LTAEU
HDC H22	Confidential		Not approved
HDC H25	Confidential		Not approved
HDC H27	Confidential		Not approved

¹ Not used in the herbaceous trial

HNS shrub trial

Table 2 provides a summary of all the subjects assessed, showing the plants which are tolerant (T) to herbicide applications and the plants which are moderately susceptible (MS) or susceptible (S) to the herbicide applications. MS plants may have shown some initial damage caused by the herbicide but they grew on to be saleable plants. The majority of subjects tested showed little or no damage or growth defects caused by the different treatments.

Table 2. Tolerance of HNS subjects to applications of HDC H22, HDC H25, HDC H27, Springbok, Flexidor 125 and Mosskade (tolerant – T, moderately susceptible – MS, susceptible – S). This table also includes crop safety data for additional species tested within CP 86 at Wyevale Nurseries at similar rates and timings.

Varieties	H22	H25	H27	Springbok	Flexidor 125	Mosskade
<i>Abelia grandiflora</i> 'Goldsport'	T	T	T	T	T	T
<i>Azalea</i> 'Geisha Orange'	T	T	T	T	T	T
<i>Berberis darwinii</i>	T	T	T	T	T	T
<i>Buddleja davidii</i> 'Empire Blue'	MS	T	T	MS	MS	T
<i>Camellia japonica</i> 'Tristem Carlyon'	T	T	T	T	T	T
<i>Caryopteris clandonensis</i> 'Heavenly Blue'	T	T	MS	T	T	T
<i>Chamaecyparis Lawsoniana</i> 'Elwood's Gold'	T	T	T	T	T	T
<i>Choisya ternata</i>	T	T	T	T	T	T
<i>Cistus corbariensis</i>	T	T	T	T	T	T
<i>Clematis repens</i>	T	T	T	T	T	T
<i>Cornus sericea</i> 'Hedgerows Gold'	T	T	T	T	T	T
<i>Erica x darleyensis</i>	T	T	T	T	T	T
<i>Escallonia</i> 'Iveyi'	T	T	T	T	T	T
<i>Hebe topiaria</i>	T	T	T	T	T	T
<i>Hebe vernicosa</i>	T	T	T	T	T	T
<i>Hydrangea macrophylla</i>	T	T	T	T	T	T
<i>Hypericum moserianum</i>	T	T	T	T	T	T
<i>Jasminum officinale</i>	T	T	T	T	T	T
<i>Lavandula angustifolia</i> 'Imperial Gem'	T	T	T	T	T	T
<i>Ligustrum ovalifolium</i>	T	T	T	T	T	T
<i>Lonicera</i> 'Red Tips'	T	T	T	T	T	T
<i>Olearia macrodonta major</i>	S	T	T	S	T	T
<i>Phormium tenax</i>	T	T	T	T	T	T
<i>Potentilla</i> 'Primrose Beauty'	T	T	T	T	T	T
<i>Prunus laurocerasus</i>	T	T	T	T	T	T
<i>Rhododendron</i> 'Cary Ann'	T	T	T	T	T	T
<i>Sambucus nigra</i> 'Black Lace'	T	T	T	T	T	T
<i>Santolina chamaecyparissus</i>	T	T	T	T	T	T
<i>Spiraea japonica</i> 'Golden Princess'	T	T	T	T	T	T
<i>Thuja occidentalis</i> 'Rheingold'	T	T	T	T	T	T
<i>Viburnum tinus</i> 'Gwenllian'	T	T	T	T	T	T

Varieties	H22	H25	H27	Springbok	Flexidor 125	Mosskade
<i>Vinca minor</i>	T	T	T	T	T	T
<i>Weigela</i> 'Kosteriana Variegata'	T	T	T	T	T	T

Very little damage was observed over the course of the trial across the majority of species. Flexidor 125, H22 and Springbok showed some damage to *Buddleja* two weeks after treatment with some twisting, crinkling and curling to the leaves (**Figure 1**). The affected *Buddleja* grew away from the damage by six weeks after treatment.

HDC H27 also had some phytotoxic effect on *Caryopteris* at the two week assessment (**Figure 2**), the *Caryopteris* showing spotting on the leaves. This species grew away from this damage by the six week assessment and by 12 weeks after treatment had almost fully recovered.



Figure 1. *Buddleja* – phytotoxic effects of H22 two weeks after treatment



Figure 2. *Caryopteris* – phytotoxic effects of H27 two weeks after treatment

HDC H27 caused very slight damage six weeks after treatment on *Hydrangea* and Springbok caused very slight damage six weeks after treatment on *Lonicera*, in both cases plants were still commercially acceptable.

In the CP 86 trial at Wyevale HDC H22 and Springbok resulted in more marked damage on *Olearia* that was not considered commercially acceptable by 12 weeks after treatment.

HNS herbaceous trial

Some damage was noted on various species at the first assessment, two weeks after treatment with Flexidor 125 the most damaging treatment. However the majority of species grew away from initial damage by the second assessment, six weeks after treatment. By the time the final score was carried out at 12 weeks after treatment (**Table 3**) there was very little evidence of lasting damage with only *Eryngium planum* treated with HDC H22 and *Geranium* 'Rozanne' treated with HDC H27 showing signs of damage at this stage. The *Eryngium planum* were classed as susceptible to HDC H22. Damage to *Geranium* 'Rozanne' was less severe, and these and other species initially affected but which recovered sufficiently to be saleable, were classed as moderately susceptible in Table 3. HDC H25 proved to be very safe with little difference between rates, only *Veronica* 'Royal Blue' suffered slight initial damage at the full rate.

Table 3. Tolerance of herbaceous subjects to applications of HDC H22, HDC H25, HDC H27, Flexidor 125 and Mosskade (tolerant – T, moderately susceptible – MS, susceptible – S).

Varieties	H22	H25 full rate	H25 half rate	H27	Flexidor 125	Mosskade
<i>Anemone</i> 'White Swan'	T	T	T	T	MS	T
<i>Anthyrium felix-femina</i>	T	T	T	T	MS	T
<i>Astilbe</i> 'Visions in Red'	T	T	T	T	T	T
<i>Campanula</i> 'White Pouffe'	MS	T	T	T	MS	T
<i>Delphinium</i> 'Galahad'	T	T	T	T	MS	T
<i>Echinacea purpurea</i>	MS	T	T	T	T	T
<i>Echinops bannaticus</i> 'Blue Globe'	T	T	T	T	T	T
<i>Epimedium</i> 'Frohnleiten'	T	T	T	T	T	T
<i>Eryngium planum</i>	S	T	T	T	T	T
<i>Geranium</i> 'Rozanne'	T	T	T	MS	T	T
<i>Helenium</i> 'Helena Red Shades'	T	T	T	T	T	T
<i>Helleborus</i> 'Red Lady'	T	T	T	T	T	T

Varieties	H22	H25 full rate	H25 half rate	H27	Flexidor 125	Mosskade
<i>Hemerocallis</i> 'Burning Daylight'	T	T	T	T	T	T
<i>Heuchera</i> 'Melting Fire'	T	T	T	T	T	T
<i>Iris pseudacorus</i>	T	T	T	T	T	T
<i>Papaver</i> 'Pizzicato Globe'	T	T	T	T	T	T
<i>Pennisetum</i> 'Hameln'	T	T	T	T	T	T
<i>Sedum</i> 'Autumn Joy'	T	T	T	T	T	T
<i>Verbascum</i> 'Olympicum'	MS	T	T	MS	MS	T
<i>Veronica</i> 'Royal Blue'	T	MS	T	T	MS	T

Damage on *Eryngium planum* treated with HDC H22 resulted in poor growth and very small, weak flower stems whilst damage on *Geranium* 'Rozanne' treated with HDC H27 resulted in puckered, distorted leaves.

Weed distribution through both trials was very patchy and consisted of groundsel (*Senecio vulgaris*), hairy bitter cress (*Cardamine hirsute*), sowthistle (*Sonchus oleraceus*) and liverwort (*Marchantia polymorpha*). More weed was observed in the untreated plots but it was not possible to draw conclusions on weed control efficacy. However, a seeded pot weed screen was carried out within project CP 86.

Seeded pot weed screen

The main objective of this trial was to assess the weed control efficacy and spectrum of control of the four herbicides assessed for crop safety; HDC H22, HDC H25, HDC H27 and Springbok compared with Flexidor 125 as the industry standard.

The herbicides were trialled on eight common horticultural weeds, applied both as pre- and post-emergence sprays.

Table 4. Pre-emergence - percentage reduction in weed number in relation to the untreated control – ADAS Boxworth Summer 2014

Species	Percentage reduction in weed number in relation to the untreated control (100% = complete control, 0% = no control)				
	Flexidor 125	HDC H22	HDC H25	HDC H27	Springbok
Hairy bittercress	47.3	36.4	100	0.0	47.3

Species	Percentage reduction in weed number in relation to the untreated control (100% = complete control, 0% = no control)				
	Flexidor 125	HDC H22	HDC H25	HDC H27	Springbok
Flexuous bittercress	66.7	0.0	85.4	0.0	11.9
NZ bittercress	71.1	45.3	81.1	22.7	62.1
Pearlwort (heath)	100	86.2	100	0.0	89.7
Groundsel	9.3	12.5	73.6	0.0	31.0
American willowherb	0.0	63.8	94.6	0.0	42.6
Common chickweed	0.0	2.3	97.1	0.0	11.6
Annual meadow grass	0.0	32.4	89.7	89.7	29.4
Common mouse ear	0.0	31.6	90.6	60.1	13.2

* Percentages in **bold** show statistical significance at the 95% level

Table 5. Post-emergence (three true leaves) - percentage reduction in weed number in relation to the untreated control – ADAS Boxworth Summer 2014

Species	Percentage reduction in weed number in relation to the untreated control (100% = complete control, 0% = no control)				
	Flexidor 125	HDC H22	HDC H25	HDC H27	Springbok
Hairy bittercress	74.5	29.0	88.3	49.7	42.1
Wavy bittercress	51.0	7.8	86.3	16.7	15.7
NZ bittercress	73.1	7.7	86.5	21.2	23.1
Pearlwort (heath)	21.4	32.1	23.0	34.2	23.0
Groundsel	15.2	12.3	10.3	0.0	15.2
American willowherb	43.3	43.3	0.0	29.9	24.7
Common chickweed	0.0	0.0	0.0	0.0	5.0
Annual meadow grass	17.5	12.5	12.5	17.5	67.5

Common mouse ear	0.0	0.0	0.0	0.0	0.0
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* Percentages in **bold** show statistical significance at the 95% level

All the herbicides were more effective when applied as pre-emergence (**Table 4**). HDC H25 was the most effective herbicide and gave a significant reduction of all species pre-emergence including groundsel. Flexidor 125, the industry standard, gave a significant reduction in pearlwort (100%) and some reduction in the three bittercress species, particularly NZ bittercress. HDC H27 reduced annual meadow grass and common mouse ear chickweed. HDC H22 significantly reduced pearlwort (86.2%) and willowherb while Springbok effectively reduced the population of pearlwort (89.7%) and NZ bittercress.

Post-emergence, HDC H25 was again the most effective herbicide for the bittercress species with population reductions of 80% plus (**Table 5**). Other treatments were less effective post-emergence, with only Flexidor 125 showing any real reduction in the level of bittercresses; HDC H22 reduced the willowherb population to an extent while Springbok effectively reduced the annual meadow grass population.

The data strongly suggest that HDC H25 is crop safe to all subjects tested and provided the most complete weed control spectrum pre-emergence and some control of bittercress post-emergence.

Financial Benefits

An increase in options available for summer weed control will enable growers to produce weed-free container plants without excessive hand weeding costs. The cost of relying entirely on hand weeding is put at around £43,000 per ha per year including three weeding sessions and a cleanup at dispatch. Having more herbicides available for weed control would be beneficial to all container nursery stock growers.

Action Points

- The granular product HDC H25 will be a suitable replacement for Ronstar 2G for use after potting, being suitable for most shrub and herbaceous species with a very good weed control spectrum. It is anticipated that HDC H25 will be available as a commercial product with a label approval for outdoor ornamental plant production during mid-2016.
- Springbok could be used after potting for many shrub species but granular products

are preferred and Springbok may be better employed as a follow-up treatment. Springbok can currently be used in ornamental plant production under the LTAEU, but ultimately an EAMU will also be required for this herbicide.

- HDC H22 is further away from the market but when available could be a useful summer herbicide for growers providing an EAMU could be obtained.
- HDC H27 did not perform as well as HDC H25 in terms of weed control spectrum or safety and it seems unlikely that it will be possible to obtain a EAMU for use in ornamental plant production.
- Mosskade was not particularly damaging, where damage was seen plants rapidly grew away from any damage