

**Project title:** Improving weed control in hardy nursery stock

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## **AUTHENTICATION**

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

John Atwood

Principal horticultural consultant

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Signature

Date 27 November 2017

### **Report authorised by:**

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Date .11 December 2017....

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## ***Grower Summary***

### **Headlines**

- Sencorex Flow proved safe and effective in a tank mix with Stomp Aqua + Flexidor 500 or Venzar Flowable when used post planting and post-heading back on rose rootstocks
- HDC H43 proved safe and effective when used post planting in a tank mix with Stomp Aqua + Flexidor 500 on rose rootstocks. A post-budding application in a tank mix with Flexidor 500 was also tolerated.
- HDC H42 provided particularly effective weed control when applied with standard products Stomp Aqua and Flexidor 500.
- Sunfire and Centurion Max were tolerated by 10 hardy nursery stock species when applied after potting. A few species showed short term symptoms but these were grown out of by 6 – 12 weeks.
- Sunfire and Centurion Max provided 100% control of annual meadow grass, pre-emergence and post-emergence respectively.
- Defy gave around 90% pre-emergence control of American willowherb and severe stunting post-emergence.

### **Background**

With a decreasing number of herbicides available to the Hardy Nursery Stock (HNS) sector, weed control has become critical as the sector has become over-dependent on few herbicides.

Since the last herbicide trial on roses in the UK was completed in 2008 (HNS 132), the key recommended products Ronstar Liquid (oxadiazon), Skirmish (terbuthylazine + isoxaben) and Artist (flufenacet + metribuzin) have been withdrawn or lost appropriate approvals. There is therefore an urgent need to test replacement products for rose production. The herbicides selected for inclusion are those for which appropriate EAMUs have recently been granted e.g. Logo (foramsulfuron + iodosulfuron-methyl-sodium), Sencorex Flow (metribuzin) and Springbok (metazachlor + dimethenamid-p), those where EAMUs exist but the products are of uncertain safety e.g. Samson Extra 6% (nicosulfuron) and those where new EAMUs could be sought e.g. HDC H42, and HDC H43. The aim of the budded rose herbicide trial which commenced in 2016 was to test the efficacy and crop safety of herbicide programmes including these new products for field rose production. This trial continued into 2017 as a two year herbicide programme. In 2017 the second budded rose herbicide trial was set up. The

aim of this trial was to build on knowledge gained from the 2016 rose trial and to include newly approved products such as Sencorex Flow.

For HNS container growers, following the final use up of the herbicide product Ronstar 2G (oxadiazon) in 2015 and restrictions on the use of Butisan S (metazachlor), there has been a gap in herbicides available to growers. Flexidor 500 - previously Flexidor 125 (isoxaben) - has become the main stay of weed control programmes in container HNS production but it doesn't offer control of annual meadow grass, groundsel, willowherb, moss or liverwort and only one application is now permitted per year. Research in the EMT/AHDB Horticultural/ HTA Fellowship project CP 86 'Weed control in ornamentals, fruit and vegetable crops – maintaining capability to devise suitable weed control strategies' and HNS PO 192 and 192a 'Herbicides screening for ornamental plant production (nursery stock, cut flowers and wall flowers)' have investigated promising new actives in screening trials, and reviewed cultural controls and as a result Dual Gold (s-metolachlor) and Springbok were developed as a container HNS treatments (although with limitations) and data on HDC H43 is available should an EAMU be possible in the future. Currently there are relatively few new residual herbicides with potential for container HNS available for testing, but two; Sunfire (flufenacet) and Defy (prosofocarb)) were selected for 2017 trials both for efficacy on key weeds and phytotoxicity on indicative nursery stock species. The withdrawal of the selective contact herbicide for grass control, Aramo (tepraloxydim) has had an impact across both field and container grown HNS. It has been widely used as a post-emergence control of a range of annual grasses, in particular annual meadow grass. A safe and effective replacement is urgently sought. Centurion Max (clethodim) was selected as the most promising candidate and included in the weed screening test (annual meadow grass only) and phytotoxicity screening on indicative nursery stock species

## Summary

Herbicide trials were carried out on field-grown roses, phytotoxicity testing on 10 container-grown HNS subjects, and weed control screening on common weeds of container production during 2017. **Table 1** lists the herbicides and rates used in each trial, along with the herbicides' approval status.

**Table 1.** Herbicides, approval status and rates used in hardy nursery stock trials carried out in 2017.

Product	Active	Approval status	Budded rose (L/ha or kg/ha)	HNS phyto and weed screen (L/ha or Kg/ha)
<b>Betanal Maxx Pro</b>	desmedipham 47 g/L + ethofumesate 75 g/L + lenacil 27 g/L + phenmedipham 60 g/L	LTAEU	1.5	
<b>Butisan S</b>	metazachlor 500 g/L	Label	1.5	
<b>Centurion Max</b>	clethodim 120 g/L	LTAEU		2.0
<b>Defy</b>	prosulfocarb 800 g/L	EAMU <sup>1</sup>		5.0
<b>Flexidor 500</b>	500 g/L isoxaben	Label	0.5	0.25
<b>HDC H42</b>		Not authorised		
<b>HDC H43</b>		Not authorised		
<b>Logo</b>	30% w/w foramsulfuron + 10% w/w iodosulfuron-methylsodium	EAMU	0.075 kg/ha <sup>2</sup>	
<b>Sencorex Flow</b>	600 g/L metribuzin	EAMU	440 ml/ha <sup>3</sup> 730ml/ha <sup>4</sup>	
<b>Springbok</b>	200 g/L metazachlor + 200 g/L dimethenamid-p	EAMU	1.25	
<b>Stomp Aqua</b>	455 g/L pendimethalin	EAMU	2.9	
<b>Sunfire</b>	flufenacet 500 g/L	EAMU		0.48
<b>Venzar Flowable<sup>5</sup></b>	lenacil 440 g/L	LTAEU	3.0	

<sup>1</sup>Pre-emergence only, <sup>2</sup>Mero adjuvant was added at 2 L/ha, <sup>3</sup>Post heading back, <sup>4</sup>Post planting, <sup>5</sup>Product no longer available.

### Budded rose trial 2016-17

The budded rose herbicide trial was set up at Whartons Nurseries Ltd. In Pulham St Mary, near Diss, on newly planted field-grown rootstocks. The trial consisted of 10 herbicide programmes (**Table 2**). Applications were made to rootstocks on four occasions; at planting (7 April 2016), after budding (21 July 2016), post-heading back (15 March 2017) and follow up (18 May 2017). The trial was set up as a fully randomised block design and treatments were replicated four times.

**Table 2.** Treatment list and timings for the budded rose herbicide trial, Pulham St Mary 2016-2017

Trt. no.	Planting treatment (07.04.16)	Rate (Kg/ha or L/ha)	Budding treatment (21.07.16)	Rate (Kg/ha or L/ha)	Heading back treatment (15.03.17)	Rate (Kg/ha or L/ha)	May treatment (18.05.17)	Rate (Kg/ha or L/ha)
1	Untreated	N/A	Untreated	N/A	Untreated	N/A	Untreated	N/A
2	Stomp Aqua + Flexidor 500 + Venzar Flowable	2.9 + 0.5 + 3.0	Flexidor 500 + Butisan S	0.5 + 1.5	Stomp Aqua + Flexidor 500 + Springbok	2.0 + 0.5 + 1.25	Untreated	N/A
3	Stomp Aqua + Flexidor 500 + Venzar Flowable	2.9 + 0.5 + 3.0	Logo + Mero (adjuvant)	0.075 + 2.0	Stomp Aqua + Flexidor 500 + Springbok	2.0 + 0.5 + 1.25	Untreated	N/A
4	Stomp Aqua + Flexidor 500 + HDC H43	2.9 + 0.5 +	Flexidor 500 + HDC H43	0.5 +	Stomp Aqua + Flexidor 500 + HDC H43	2.0 + 0.5 +	Untreated	N/A
5	Stomp Aqua + Flexidor 500 + HDC H42	2.9 + 0.5 +	Flexidor 500 + Butisan S	0.5 + 1.5	Stomp Aqua + Flexidor 500 + HDC H42	2.0 + 0.5 +	Untreated	N/A
6	Samson Extra 6%	0.75	Flexidor 500 + Butisan S	0.5 + 1.5	Stomp Aqua + Venzar Flowable + Sencorex Flow	2.0 + 2.0 + 0.44	Untreated	N/A
7	Flexidor 500 + Samson Extra 6%	0.5 + 0.75	Flexidor 500 + Butisan S	0.5 + 1.5	Stomp Aqua + Flexidor 500 + Sencorex Flow	2.0 + 0.5 + 0.44	Untreated	N/A
8	Flexidor 500 + Samson Extra 6% + HDC H42	0.5 + 0.75 +	Flexidor 500 + Butisan S	0.5 + 1.5	Stomp Aqua + HDC H42 + Sencorex Flow	2.0 + 1.5 + 0.44	Untreated	N/A
9	Logo + Mero (adjuvant)	0.15 + 2.0	Flexidor 500 + Butisan S	0.5 + 1.5	Stomp Aqua + Flexidor 500 + Springbok	2.0 + 0.5 + 1.25	Logo + Mero (adjuvant)	0.075 + 2.0
10	Flexidor 500 + Logo	0.5 + 0.15	Flexidor 500 + Butisan S 1.5	0.5 + 1.5	Stomp Aqua + Flexidor 500 + Springbok	2.0 + 0.5 + 1.25	Logo + Mero (adjuvant)	0.075 + 2.0

Phytotoxicity and weed assessments were carried out at approximately 2, 6 and 12 weeks after treatment (WAT). Phytotoxicity was scored on a scale of 0 to 9, with 0 considered dead, 9 considered healthy, and 7 considered commercially acceptable. Weed cover was assessed as an overall percentage of the plot.

Of the treatments applied post-heading back, Stomp Aqua + Flexidor 500 + HDC H42 provided the best weed control in the trial, with zero weed cover when assessed at 6 WAT. Although HDC H42 proved safe in this trial, previous trials (HNS 132) have shown occasional phytotoxicity. All other treatments provided weed control better than the untreated control.

The rose maidens that received Logo + Mero at the follow up treatment applications showed severe phytotoxic symptoms, which persisted through to the 12 WAT assessment. Post-application assessments found no significant differences in percentage weed cover between the follow up treatments.

### Budded rose trial 2017-18

The budded rose herbicide trial was set up at Whartons Nurseries Ltd. in Pulham St Mary, near Diss, on newly planted field-grown rootstocks. The trial consisted of 9 herbicide programmes (**Table 3**). Applications were made to the rootstocks on three occasions; at planting (15 March 2017), a follow-up (18 May 2017) and after budding (30 June 2017). A further treatment will be applied post-heading back (this application will be carried out in February 2018). The trial was set up as a fully randomized block design and treatments were replicated four times.

**Table 3.** Treatment list and timings for the budded rose herbicide trial, Pulham St Mary, 2017

Trt. No.	Planting 15/03/2017	Rate (L/ha, ml/ha*)	Follow up 18/05/2017	Rate (L/ha)	Budding 30/06/2017	Rate (L/ha)
1	Untreated				Untreated	
2	Stomp Aqua + Flexidor 500 + Venzar Flo	2.9 + 0.5 + 3.0			Flexidor 500 + Butisan S	0.5 + 1.5
3	Stomp Aqua + Flexidor 500 + HDC H43	2.9 + 0.5 + 2.0			Flexidor 500 + HDC H43	0.5 + 2.0
4	Untreated				Flexidor 500 + Butisan S	0.5 + 1.5
5	Stomp Aqua + Flexidor 500 + Sencorex Flo	2.9 + 0.5 + 730*			Flexidor 500 + Butisan S	0.5 + 1.5

Trt. No.	Planting 15/03/2017	Rate (L/ha, ml/ha*)	Follow up 18/05/2017	Rate (L/ha)	Budding 30/06/2017	Rate (L/ha)
6	Stomp Aqua + Flexidor 500 + Sencorex Flo	2.9 + 0.5 + 730*	Logo + Mero (adjuvant)	0.075 + 2.0	Flexidor 500 + Butisan S	0.5 + 1.5
7	Stomp Aqua + Flexidor 500 + Sencorex Flo	2.9 + 0.5 + 730*	Logo + Mero (adjuvant) + Betanal Maxx Pro	0.075 + 2.0 + 1.5	Flexidor 500 + Butisan S	0.5 + 1.5
8	Stomp Aqua + Flexidor 500 + Sencorex Flo	2.9 + 0.5 + 730*	Betanal Maxx Pro	1.5	Flexidor 500 + Butisan S	0.5 + 1.5
9	Stomp Aqua + Venzar Flo + Sencorex Flo	2.9 + 3.0 + 730*			Flexidor 500 + Butisan S	0.5 + 1.5

Phytotoxicity and weed assessments were carried out at approximately 2, 6 and 12 weeks after treatment (WAT). Phytotoxicity was scored on a scale of 0 to 9, with 0 considered dead, 9 considered healthy, and 7 considered commercially acceptable. Weed cover was assessed as an overall percentage of the plot.

Of the treatments applied post-planting, the mixtures including Sencorex Flow provided the most effective weed control (Stomp Aqua + Venzar Flowable + Sencorex Flow, Stomp Aqua + Flexidor 500 + Sencorex Flow). Assessments following the post-budding herbicide application showed both treatments to be equally effective in weed control, with significantly lower weed cover compared to untreated plots.

None of the post-planting treatments caused visible phytotoxic effects, with no significant differences in plant quality observed between treated and untreated plots at any stage of assessment. However, rootstocks treated with Logo in the follow up treatment – applied both alone and in a mixture – were yellowed and stunted, phytotoxic symptoms which persisted through assessments for this treatment. Assessments following the post-budding herbicide application showed no phytotoxic effects from either treatment, with similar plant quality scores recorded for both treated and untreated plots.

### Hardy nursery stock trial

The hardy nursery stock trial was carried out at ADAS Boxworth on container grown plants. The trial consisted of 7 herbicide programmes (**Table 4**). Applications of post-potting treatments were made on 6 June 2017, and dormant treatments will be applied in December 2017. The trial was set up as a fully randomised block design and treatments were replicated three times.

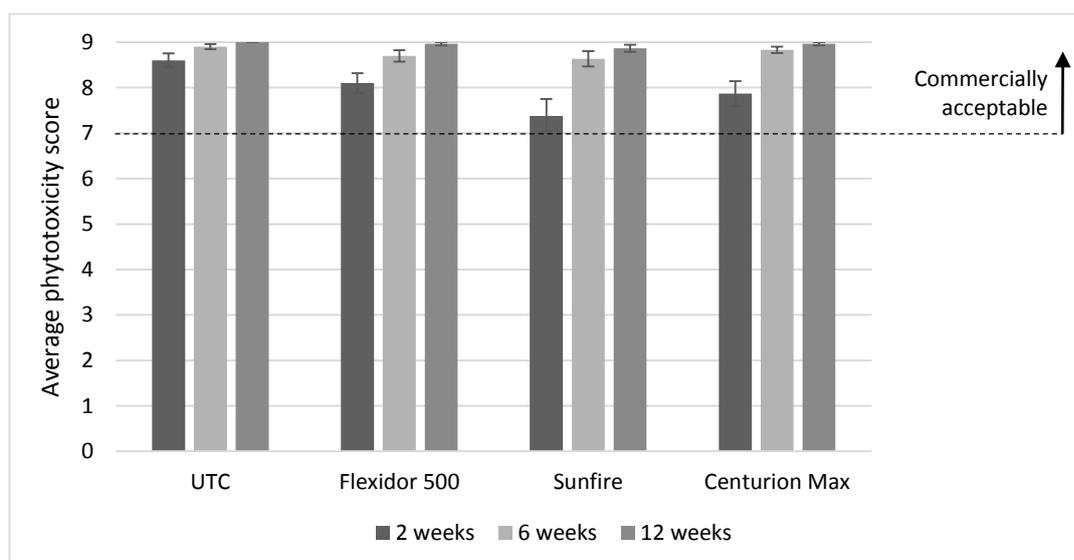
**Table 4.** Treatment list and timings for the hardy nursery stock herbicide trial, ADAS Boxworth, 2017

	Treatment	Active ingredient	Rate (L/ha)	Timing
1	Untreated	N/A	N/A	N/A
2	Flexidor 500	Isoxaben 500 g/L	0.25	June
3	Sunfire	flufenacet 500 g/L	0.48	June
4	Centurion Max	Clethodim 120 g/L	2.0	June
5	Flexidor 500	Isoxaben 500 g/L	0.25	December*
6	Sunfire	flufenacet 500 g/L	0.48	December*
7	Defy	Prosulfocarb 800 g/L	5.0	December*

\*not yet applied at time of reporting

Phytotoxicity assessments were carried out at approximately 2, 6 and 12 weeks after treatment (WAT). Phytotoxicity was scored on a scale of 0 to 9, with 0 considered dead, 9 considered healthy, and 7 considered commercially acceptable.

None of the treatments applied after potting caused long term phytotoxic effects (**Figure 1**). However, growers should note that Flexidor 500 may cause short term scorch on *Hydrangea macropylla* 'Forever (R)' and *Weigela florida* 'Wine and Roses (R)'. Sunfire may have such an effect on *Buddleja davidii* 'Empire Blue', *Hydrangea macropylla* 'Forever (R)' and *Weigela florida* 'Wine and Roses', as may Centurion Max on *Hydrangea macropylla* 'Forever (R)' and *Spiraea japonica* 'Firelight'.



**Figure 1.** Hardy nursery stock plant quality scores, 2, 6 and 12 weeks after treatment (WAT) (scale of 0 - 9 where 9 is healthy, 0 is dead, 7 is commercially acceptable) – ADAS Boxworth, 2017

### Weed screening trial

The weed herbicide screens were carried out at ADAS Boxworth on container grown seedlings. The trial consisted of 4 herbicide programmes (5 for annual meadow grass) (**Table 5**). Applications were made on 4 occasions; pre-emergence, growth stage (GS) 11-12, GS 13-14 and GS1, 10. The trial was set up as a fully randomised block design and treatments were replicated four times.

**Table 5.** Treatment list and timings for the weed herbicide screens, ADAS Boxworth, 2017

Treatment	Active ingredient	Rate l/ha	Treatment timing			
			Pre-emergence	GS11-12 1-2 true leaves	GS13-14 3-4 true leaves	GS1,10 10 true leaves*
1 Untreated	Untreated	N/A	✓	✓	✓	✓
2 Flexidor 500	isoxaben 500 g/L	0.5	✓	✓	✓	✓
3 Sunfire	flufenacet 500 g/L	0.48	✓	✓	✓	✓
4 Defy	Prosulfocarb 800 g/L	5.0	✓	✓	✓	✓
5 Centurion Max*	clethodim 120 g/L	2.0	Not applied	✓	✓	✓

\*only applied to annual meadow grass

Phytotoxicity assessments and seedling counts were carried out at approximately 2, 4 and 6 WAT. Phytotoxicity was scored for plant health on a scale of 0 to 9, with 0 considered dead, and 9 considered healthy, comparable to the untreated.

### Annual meadow grass

Of the treatments applied pre-emergence, Sunfire and Defy reduced the emergence rate of annual meadow grass seedlings. Centurion Max applied to seedlings with 1-2 true leaves reduced their numbers to zero by 4 WAT. Sunfire applied at this growth stage also slightly reduced the number of seedlings, from the 4 WAT assessment onwards. At 3-4 true leaves, the application of Centurion Max or Defy treatments significantly reduced the number of annual meadow grass seedlings. The application of Centurion Max at 10 true leaves also reduced the number of seedlings.

Defy applied pre-emergence caused significant scorching to those annual meadow grass seedlings that did emerge. Of the treatments applied at 1-2 true leaves, only Centurion Max caused significant phytotoxic symptoms, scorching seedlings. When applied at 3-4 true

leaves, Centurion Max again caused severe scorching to seedlings, as did Defy. Applied at 10 true leaves, Centurion Max scorched seedlings, though its effects weren't observed until 4 WAT.

#### Wavy bittercress

Applied pre-emergence, Flexidor 500 gave superior control, with no wavy bittercress seedling emergence. Flexidor 500 applied at 1-2 true leaves was also the only treatment to reduce the number of seedlings. None of the treatments applied at 3-4 true leaves significantly reduced the number of seedlings.

Of the treatments applied pre-emergence, only Flexidor 500 had a phytotoxic effect with persistent symptoms – any seedlings that did germinate were severely scorched, and by 6 WAT were dead. Flexidor 500 also significantly scorched seedlings when applied at 1-2 true leaves. Of the treatments applied to wavy bittercress at 3-4 true leaves, Flexidor and Sunfire caused scorching by 2 WAT, though the condition of seedlings had begun to improve by the 6 WAT assessment.

#### New Zealand bittercress

Flexidor 500 was the only pre-emergence treatment to reduce the emergence of New Zealand bittercress. None of the treatments (Flexidor 500, Sunfire or Defy) applied at subsequent applications (1-2 or 3-4 true leaves) caused any significant reduction in the number of seedlings.

As a pre-emergence treatment, Flexidor 500 caused severe scorching for the few New Zealand bittercress seedlings that had emerged 2 WAT. Flexidor 500 applied at 3-4 true leaves also caused scorching, and Defy applied at this growth stage had a growth-slowing phytotoxic effect on seedlings.

#### Common mouse ear chickweed

Of the treatments applied pre-emergence, only Flexidor 500 significantly reduced the number of common mouse ear chickweed seedlings that emerged. None of the treatments (Flexidor 500, Sunfire or Defy) applied at subsequent applications (1-2 or 3-4 true leaves) caused any significant reduction in the number of seedlings.

Despite Flexidor 500's impact on seedling emergence, it did not cause any significant phytotoxic effects to the seedling that did emerge. None of the treatments (Flexidor 500, Sunfire or Defy) applied at subsequent applications (1-2 or 3-4 true leaves) caused any significant phytotoxic effects.

### American willowherb

Applied pre-emergence, Defy was the only treatment that significantly reduced the number of willowherb seedlings that emerged in the trial. None of the treatments (Flexidor 500, Sunfire or Defy) applied at subsequent applications (1-2 or 3-4 true leaves) caused any significant reduction in the number of seedlings.

Significant phytotoxic effects were caused by the pre-emergence Sunfire and Defy treatments, with both resulting in severe stunting and Sunfire shrivelling leaves. At 6 WAT, phytotoxic symptoms of Defy treatment persisted. Of the treatments applied at 1-2 true leaves, both Defy and Sunfire caused initial phytotoxic effects, though only symptoms caused by Defy persisted through to 6 WAT. All treatments (Flexidor 500, Sunfire, Defy) applied at 3-4 true leaves caused significant phytotoxic effects; symptoms persisted to 6WAT for both Sunfire and Defy treatments, with growth distortion and foliar discoloration.

### Common chickweed

Flexidor 500 was the only treatment that had a significant effect on chickweed seedling numbers. This was the case whether applied pre-emergence or at 1-2 true leaves. None of the treatments applied at 3-4 true leaves caused a notable reduction in the number of chickweed seedlings.

None of the pre-emergence treatments produced phytotoxic symptoms in the emergent seedlings. Of the treatments applied at 1-2 true leaves, Flexidor significantly stunted the seedlings, though symptoms did not persist to 6 WAT. Applied at 3-4 true leaves, both Flexidor and Defy reduced seedling quality, with effects still seen at 6 WAT.

### Groundsel

When applied pre-emergence, none of the treatments reduced the number of groundsel seedlings that emerged or caused significant phytotoxicity.

None of the treatments reduced the number of groundsel seedlings or caused significant phytotoxicity when applied at the 1-2 or 3-4 true leaf stage.

### Procumbent pearlwort

The only significant reduction in pearlwort seedling numbers was seen with pre-emergence application of Flexidor or Sunfire – treatments applied at 1-2 or 3-4 true leaf stages did not significantly reduce the seedling count.

With regards to the phytotoxic effect of the treatments, no treatments applied pre-emergence caused any significant phytotoxic effects. Applications of Flexidor or Defy at 1-2 true leaves

caused persistent phytotoxic effects, with reduced plant quality observed at 6 WAT. The same was true for the Flexidor and Defy treatments when applied at the 3-4 true leaf stage.

## **Discussion**

Results confirmed that the standard, Flexidor 500, continues to give good pre-emergence control of the majority of weeds of container grown nursery stock. The exceptions are annual meadow grass and American willowherb, confirming earlier findings (Atwood 2009). It is interesting that Flexidor 500 gave good control of early post-emergence (1-2 true leaf) and some stunting of 3-4 true leaf of wavy bittercress but no significant post-emergence control of New Zealand bittercress.

The new residual herbicides Sunfire and Defy only offered control of two of the key weeds tested. Both gave good pre-emergence control of annual meadow grass. Sunfire gave some suppression of emerged annual meadow grass at the 1-2 true leaf stage. Defy gave good suppression at the 3-4 true leaf stage but not at the earlier stage. Sunfire gave some pre-emergence control of pearlwort but inferior to Flexidor 500. Defy gave good control of American willowherb pre-emergence and marked stunting of emerged seedlings. However once emerged the seedlings were not completely eliminated so in practice weeding would still be required. Sunfire did not control American willowherb pre-emergence but caused some stunting to emerge seedlings, although less severe than with Defy and again, weeding would be required in practice.

The selective, contact grass herbicide Centurion Max performed well on emerged annual meadow grass, giving superior control to the other treatments and gave significant control up to the 10 true-leaf stage

## **Conclusions**

- Flexidor 500 was confirmed as giving good pre-emergence control of wavy bittercress, New Zealand bittercress, mouse ear chickweed, common chickweed and pearlwort. Annual meadow grass, groundsel and American willowherb were resistant.
- Defy gave good pre-emergence control of annual meadow grass and American willowherb and so could supplement Flexidor 500, but is only likely to be safe as a dormant season treatment.
- Defy could be a partial alternative to Devrinol (napropamide) as a winter treatment for container-grown hardy nursery stock if an EAMU for the latter was not available, but if an authorisation for Devrinol on ornamentals was restored this would be preferred to Defy because of groundsel control.

- Sunfire gave good control of annual meadow grass and some control of pearlwort. Control of other weeds was disappointing. It may be useful as a supplement to Flexidor 500 but only where annual meadow grass and pearlwort is a problem.
- Centurion Max gave good control of emerged annual meadow grass including larger seedlings.

## Financial Benefits

Hand weeding field-grown crops such as roses three times during the growing season is estimated to cost in the region of £30,000 per hectare. Any reduction in hand weeding or reduction in direct contact herbicide applications that can be achieved with residual herbicides will help to reduce this cost significantly, contributing to grower profitability. For example herbicide mixtures of standard products with Sencorex Flowable or HDC H43 gave slightly improved weed control compared to the standard treatment Stomp Aqua + Flexidor 500 + Venzar Flowable. However Venzar Flowable is now only be available at a much reduced rate. The loss of this component is likely to reduce the effectiveness of the standard treatment and it is estimated that substitution with Sencorex Flow or HDC H43 is likely to reduce the need for hand weeding, compared with no substitution, by around £10,000 per hectare.

New herbicides Sunfire, Defy and Centurion Max were evaluated for container-grown hardy nursery stock production. At present there is no financial benefit for Defy because an improved EAMU permitting use over wood and foliage of dormant crops would be required.

The financial benefit of Sunfire and Centurion Max arise largely from improved control of annual meadow grass, pre-emergence and post-emergence respectively. These products can already be used by growers though EAMU and LTAEU authorisations respectively. Although annual meadow grass is not a predominant weed it can be occasionally troublesome and the availability of pre and post-emergence treatments is estimated to reduce hand-weeding requirements for container-grown hardy nursery stock by £1000 per ha on average.

## Action Points

- For budded rose production in the field, a herbicide programme of Stomp Aqua + Flexidor 500 + Sencorex Flow after planting, Butisan S after budding and Stomp Aqua + Flexidor 500 + Sencorex Flow after heading back can be recommended.
- Betanal Maxx Pro is adequately safe to use as a selective contact herbicide to remove seedling weeds in rose stocks during May

- When an EAMU is available, HDC H43 can be used to supplement herbicide programmes in roses either post planting, post-budding or post heading back.
- If an EAMU can be obtained HDC H42 can be used to supplement herbicide programmes in roses either post planting, or post heading back. There may be some risk of temporary phytotoxicity with this product.
- The selective contact grass herbicide Centurion Max is effective for control of emerged annual meadow grass. Where used on container grown hardy nursery stock some species may show temporary scorch symptoms but these usually grow out.
- The residual herbicide Sunfire can be used for pre-emergence annual meadow grass control. Where used on container grown hardy nursery stock some species may show temporary scorch symptoms but these usually grow out.
- If an improved EAMU can be obtained Defy could be a partial alternative to Devrinol (napropamide) as a winter treatment for container-grown hardy nursery stock if an EAMU for the latter was not available, but if an authorisation for Devrinol on ornamentals was restored this would be preferred to Defy because of groundsel control.