



Horticultural
Development
Company

Grower summary

FV 256c

Solutions to the loss of active ingredients for weed control in vegetable crops (continuation)

Final Report 2010

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Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

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

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Headline

Potential alternative herbicides for the future, which appear to be safe (non-phytotoxic) to several vegetable crops have been identified and are worth further evaluation. The herbicides are confidential at the moment.

Background and expected deliverables

All conventionally grown outdoor field vegetables are dependent on herbicides to control weeds that cause loss of quality, yield and harvesting difficulties. Herbicides are used to avoid contamination of produce with weedy parts (some toxic) that could result in crop rejection thus incurring considerable financial loss. Without a range of herbicides to control a wide weed spectrum, growing UK vegetables could become uneconomic.

Growers have lost key herbicides that were not supported by Crop Protection Companies in the EC pesticide review (e.g. metoxuron). Some that were supported failed to achieve Annex 1 status - for example trifluralin (Treflan), in 2008 propachlor (Ramrod), in 2009 chlorthal-dimethyl (Dacthal). Use of triluralin and propachlor is no longer permitted and this will have a great impact on brassicas, lettuce and onions. Herbicide uses of chlorpropham (Comrade etc.) have also been revoked and it must not be used after 31 July 2010. The 'voluntarily withdrawn' List 3 actives are still to be assessed.

At product re-registration stage in the UK, dose rates of several herbicides included on Annex 1 were reduced (e.g. linuron, pendimethalin). In addition, (Butisan S etc.) metazachlor to 1000g a.i./ha to be applied only one year in three and this will have an impact on leaf and flower-head Brassica production.

The new EU regulation (EC1107/2009) may mean the loss of other key herbicide actives such as linuron, ioxynil in future.

Alternatives are therefore urgently needed.

A simple screening of new herbicides not previously tested in the UK, was done each year from 2004-2008 at Warwick HRI Kirton. The screen was at Elsoms Seeds site in 2010. The aim was:

- To identify candidate herbicides after consultation with crop protection companies, a search of literature, discussions with vegetable sectors in other European Member States and the USA IR-4 Project. Only herbicides on Annex 1 or supported in the Review are selected, but the future of many pesticides is uncertain as a result of the new EU regulation (1107/2009) and the Water Framework Directive.
- To test a range of vegetables for crop tolerance to new herbicides available for major crops or vegetables in other European Member States but whose development cannot be justified by the manufacturers for UK minor crop use.
- To find new solutions for weed control as rapidly as possible by further development, and obtain Specific Off-Label Approvals (SOLAs) through HDC.

Summary of the project and main conclusions

Main conclusions:

Vegetable crops in trial were: drilled bulb onion, leek, carrot, parsnip, coriander, vining pea, dwarf French bean, swede, mizuna, baby-leaf spinach; transplanted celery, cauliflower, lettuce, and planted asparagus crowns. No herbicide killed the "volunteer" potatoes but HDC H3 4.0 Kg/ha delayed emergence of shoots.

- HDC H3 at 2.0 Kg/ha (1200 g a.i./ha) applied before sowing or planting and soil-incorporated appeared safe to all crops except mizuna where it was safe at 1.0 Kg/ha,

but it was not safe to onion, leek or spinach. It could be a replacement for trifluralin in brassicas. It would be effective in dry soil conditions. HDC H3 controlled several species, importantly Polygonums and fat-hen, but not groundsel, shepherd's purse or mayweeds.

- HDC H1 at of 2.0L/ha applied pre-emergence of drilled crop and weed, and before transplanting has potential for use in carrot, parsnip, coriander, vining pea, dwarf French bean, baby leaf spinach and planted asparagus crowns. Weeds controlled included fat-hen, small nettle, shepherd's purse and mayweeds but it was less effective on groundsel and had weaknesses on Polygonums.
- HDC H4 at 25g/ha applied post-weed-emergence and post-emergence of drilled crops and post transplanting was only safe to onion and leek, dwarf French bean and possibly at 12.5g/ha to lettuce. Most weed species at this site were not susceptible and only shepherd's purse and a low population of mayweeds were controlled.

General Summary:

HDC H3, a residual herbicide, was applied before sowing or planting and soil-incorporated with the exception of asparagus where it was applied after planting but before spear emergence. HDC H1 another residual herbicide was applied pre-emergence of drilled crops but before transplanting of celery, cauliflower and lettuce. HDC H4, a sulfonylurea, was applied post-weed emergence and post planting.

Herbicides were applied at 2 x Normal (N), Normal, ½ Normal dose rates in all crops, except onion and leek, where Normal, ½ Normal, ¼ Normal dose rates were used. Assessments were made for any crop damage (phytotoxicity). Weed control was monitored to identify the potential of each product to control the target weeds.

Crop Safety

The following information is based on only one trial, on an irrigated, light, silt loam soil. For crop safety there should no, or negligible/transient damage at a recommended dose rate and no, or acceptable, effects at the overlap dose.

Table 1. Pre-sowing soil incorporated herbicide HDC H3; pre-weed-emergence herbicide HDC H1 applied pre-emergence of drilled crops and pre-transplanting: ✓ safe; X not safe, N normal

Herbicide 'Normal' dose/ha	Onion	Leek	Carrot	Parsnip	Coriander	Celery transplants	Cauliflower transplants	Lettuce transplants	Dwarf Bean	Vining Pea	Swede	Mizuna	Spinach	Asparagus
HDC H3	✓ ¼ N	✓ ¼ N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ ½ N	X	✓
HDC H1	✓ ½ N	✓ ½ N	✓	✓	✓	✓ ½ N	✓	X	✓	✓	X	X	✓	✓

Table 2. Post-weed-emergence herbicide: ✓ safe; x not safe, N normal

Herbicide 'Normal' dose/ha	Onion	Leek	Carrot	Parsnip	Coriander	Celery transplants	Cauliflower transplants	Lettuce transplants	Dwarf Bean	Vining Pea	Swede	Mizuna	Spinach	Asparagus
HDC H4	✓	✓	X	X	X	X	X	✓ ½N	✓	X	X	X	X	X

Weed species controlled

Appendix 1 shows Common and Latin weed names.

The main weed species were fat-hen, fig-leaved goosefoot, red dead-nettle, small nettle, shepherd's purse, chickweed and groundsel on this trial site. There were also some mayweeds, speedwells, annual meadow-grass, redshank, knotgrass and a few black bindweed.

HDC H3 applied pre-planting and incorporated at 4.0 Kg/ha delayed emergence of 'volunteer' potato shoots and reduced vigour. HDC H1 and HDCH4 had no effect on potatoes.

Table 3. Pre-sowing soil incorporated herbicide HDC H3; pre-weed-emergence herbicide HDC H1 applied pre-emergence of drilled crops and pre-transplanting: ✓ weed species controlled; x poor control or not controlled at various dose rates, variable, () low populations

Pre-weed-emergence Herbicide dose rate/ha	Small nettle	Shepherd's purse	Red dead-nettle	Groundsel	Chickweed	Mayweeds#	Fig-leaved goosefoot	Fat-hen	Black-bindweed	Knotgrass	Ivy-leaved speedwell	Field speedwell	Annual meadow-grass
HDC H3 4.0kg	✓	x	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓
HDC H3 2.0kg	✓	x	✓	x	✓	x	✓	✓	✓	✓	✓	✓	✓
HDC H3 1.0kg	x	x	✓	x	x	x	✓	✓	(x)	x	(x)	(x)	(✓)
HDC H3 0.5kg	x	x	x	x	x	x	x	x	x	x	x	x	x
HDC H1 4.0L	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	✓
HDC H1 2.0L	✓	✓	x	x✓	✓	✓	✓	✓	x	x	x	x	✓

HDC H1 1.0L	x	√	x	x	√	√	x√	x√	x	x	x	x	√
HDC H1 0.5L	x	x	x	x	x	x	x	x	x	x	x	x	x

mainly pineappleweed

Table 4. Post-weed-emergence herbicides: √ weed species controlled; x poor control or not controlled at various dose rates; (low population limited data)

Post-weed-emergence Herbicide dose rate/ha	Small nettle	Shepherd's purse	Red dead-nettle	Groundsel	Chickweed	(Mayweeds)#	Fig-leaved goosefoot	Fat-hen	(Redshank)	Knotgrass	Ivy-leaved speedwell	Field speedwell	Annual meadow- grass
HDC H4 50g	√ st	√	√ st	x	x	(√)	x	x	x	x	x	x	x
HDC H4 25g	x	√	√ st	x	x	(√)	x	x	x	x	x	x	x
HDC H4 12.5g	x	√	x	x	x	(x)	x	x	x	x	x	x	x

scented and scentless mayweed; st stunted

HDC H3 at 2.0 Kg/ha (1200 g a.i./ha), a residual herbicide, applied before sowing or planting and soil-incorporated, has potential for use in several crops and is effective in dry soil conditions. It appeared safe to drilled carrot, parsnip, coriander, vining pea (possibly), dwarf French bean, swede; transplanted celery, cauliflower and lettuce. It was also safe to mizuna at 1.0 Kg/ha. HDC H3 was not safe to onion and leek and caused severe damage to baby-leaf spinach. Efficacy was poor where it was not soil-incorporated - when applied post-planting of asparagus crowns. It controlled several species at 1200 g a.i./ha - importantly Polygonums, fat-hen and annual meadow-grass, but not groundsel, shepherd's purse or mayweeds.

HDC H1 at of 2.0 L/ha, a residual herbicide, also appeared very promising. It was applied pre-emergence of drilled crop and weed, and before transplanting and has potential for use in carrot, parsnip, coriander, vining pea, dwarf French bean, baby-leaf spinach and planted asparagus crowns. It may also be safe at 1.0 L/ha to transplanted celery, drilled onion and leek. HDC H1 killed lettuce, swede and mizuna, but surprisingly it appeared safe to transplanted cauliflower. HDC H1 gives good control of volunteer oilseed rape (data from other trials). Weeds controlled included fat-hen, small nettle, shepherd's purse, annual meadow-grass and a low population of mayweeds but it was less effective on groundsel and had weaknesses on Polygonums, red dead-nettle, and speedwells.

No adverse effects were observed on carrot or parsnip roots from HDC H3 or HDC H1. HDC H4, 25 g/ha a sulfonylurea, applied post-weed-emergence and post-emergence of drilled crops and post transplanting was safe to onion and leek at the N (normal) dose of 25g/ha, (and at 50 g/ha 2xN), at 25g/ha to dwarf French bean and possibly at 12.5g/ha to lettuce. Other crops were severely damaged, exhibiting symptoms of yellowing, severe stunting and production of multiple shoots. Most weed species at this site were not

susceptible including Polygonums, fat-hen, fig-leaved goosefoot, groundsel and annual meadow-grass therefore weed control was poor. Here it was only effective on shepherd's purse and a low population of mayweeds, but it would control volunteer oilseed rape. It could be useful post-emergence for onion and leek where shepherd's purse and mayweeds are a problem.

HDC H3 and HDC H1 are potential alternative residual herbicides.

HDC H3 could be a direct replacement for trifluralin in brassicas and in crops where pre-emergence weed control is a problem under dry soil conditions. A follow-up with another herbicide will be needed for species that escape control.

HDC H1 pre-emergence controls mayweeds – a problem in carrots and parsnips and it would be an alternative to linuron. However, tank-mix partners will be needed - possibly pendimethalin to control Polygonums and clomazone for groundsel. Further work on HDC H1 in spinach is worth investigation.

Herbicides: Current Approval Status (August 2010)

Herbicide Product & timing	Company	active substance (a.i. formulation)	EC Review status	N rate product/ha	Registered now or in future?
HDC H3 pre-sowing/pre-transplant soil incorporated	Confidential	Confidential	Annex 1	2.0 kg/ha (1200 g a.i./ha)	No UK registration yet.
HDC1 pre-emergence, pre-transplant	Confidential	Confidential	Not yet on Annex 1	2.0 L/ha	No EU registration yet
HDC H4 post-plant, early post-weed-em	Confidential	Confidential	Annex 1	25 g/ha	No UK registration yet

Financial benefits

As a result of the 91/414/EEC pesticide review programme, vegetable growers have lost key herbicides. Weeds cause yield loss, harvesting difficulties and, importantly, contamination of produce with weedy parts (some toxic) that could result in crop rejection thus incurring considerable financial loss. All conventionally grown outdoor field vegetables are dependent on herbicides and without a range of herbicides to control a wide weed spectrum, vegetable growing could become uneconomic in the EU.

Herbicides that appear to be safe (non-phytotoxic) to several vegetable crops and the potential for SOLAs have been identified in this early stage screening trial in 2010. However, the herbicides are not yet registered in the UK and it will take time before they are available to the grower. The study also identified herbicides that are too damaging in certain crops, and the type of symptoms that would render them unmarketable.

Action points for growers

- Continue this early stage screening system to evaluate new herbicides when available.

- Need to be aware that there may be further losses if important actives in List 3 of the 91/414/EEC review fail to achieve Annex 1 listing. For active ingredients included on Annex 1 there may be restrictions on timings and dose rates at product re-registration stage. The future of many herbicides is now uncertain as a result of the new EU Regulation (EC1107/2009) and the Water Framework Directive.
- Potential alternative residual herbicides for the future that appears to be safe (non-phytotoxic) to several crops has been identified in 2010 and further work may be needed to assess crop safety, efficacy and programmes.
- Where no data are available, two years residues trials may be required for a SOLA (Specific Off-Label Approval) application.