

Title: **Novel herbicides – crop safety screening in carrots**

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Project No.: FV 236

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Date Commenced: August 2001

Date Completed: 31 October 2001

Report date: November 2001

Key words: Carrots, herbicides, weed control, crop safety, phytotoxicity

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Authentication

The results and conclusions in this report are based on one experiment. The conditions under which the work was carried out and the results have been reported with detail and accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as the basis for commercial product recommendations.

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

Signature Date.....

J S Davies
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Report authorised by Date

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Background and Objectives

Many of the current herbicides approved on Carrot (eg Dosaflo (metoxuron), Gesagard (prometryn)) will disappear as a result of the ongoing EU Review programme. Some products have already been unsupported in Round 1 of the Review and are likely to be phased out by the current target date of 25 July 2003 if not earlier. It is anticipated that additional products will be revoked in subsequent rounds or phases of the review process, though it is not possible at this stage to predict which active ingredients will be lost. Even if a specific ai continues to be supported and achieves Annexe I listing (the EU positive list of Approved ai's) specific products or uses of products may disappear at the re-registration phase as manufacturers prioritise their efforts. It should be noted that the EU Review Programme is significantly behind schedule and it is possible that a 5 year extension to the Review process may be granted.

There is an opportunity to apply to the EU for a temporary derogation (referred to as an 'Essential Use' provision) though there is no guarantee of success and importantly it is necessary to demonstrate that work has been commissioned to find alternative means of control. Numerous such applications, including prometryn, have been made following a coordinated action by industry representatives via the BCPC Minor Uses Group. Unfortunately, in some cases applications have not been possible because information supplied by the manufacturers has indicated that the products will no longer be manufactured. Therefore, even if a temporary derogation was accepted, the products would not be commercially available for use. Final decisions on applications are unlikely to be made until Spring 2002 at the earliest.

Irrespective of the final outcome of the 'Essential Use' applications, the carrot industry will ultimately be presented with a major challenge in terms of weed control unless alternative products can be found.

The aim of this proposal therefore was to:-

- a. provide a primary crop safety or 'phytotoxicity' screen facility to identify alternative herbicides which can be used safely on Carrots
- b. to allow the industry to demonstrate to the EU that action has been taken in support of a temporary 'Essential Use' derogation.

Summary of Results

Carrots were drilled late (15 August) at the request of the sponsor to try and gain some useful information on the safety of various products in advance of the 2002 season. A range of herbicides selected by the project coordinator were applied on 6 October to assess their effect on crop safety or phytotoxicity eg growth and development of the emerging carrot seedlings. The herbicides evaluated included Dosaflo (3l/ha), Sencorex WG (0.5 and 1.0 kg/ha), Debut (15 and 30 g/ha) and Titus (15 and 30 g/ha). In addition Saltex (200 and 400 l/ha) and Tractor Vapour Oil (200 l/ha) were also applied and all were compared to an untreated control. The treatments

were applied to the carrots when they were at the 3 true leaf stage (6 October) in 200 l/ha water.

Plant stand was recorded immediately prior to treatment application and monitored for the following 4 weeks. There was no sign of any plant death as a result of application of any of the treatments and the foliage remained reasonably vigorous. Most plants reached the 6 to 7 true leaf stage by late October. Application of Sencorex WG at the higher rate and both rates of Titus caused a reduction in plant vigour but this was evident on only one replicate and only apparent after 14 days.

At the final assessment on 31 October the young plants were uprooted and inspected for signs of stunting or malformation which might have been caused by herbicide treatment. Roots were well formed on all plots except on the high rate Titus where roots appeared to be slightly thinner on one replicate. Although foliage colour was similar for all treatments there were 1-2 fewer leaves per plant where Sencorex WG at 1.0 kg and Titus at 30 g/ha were applied, but this was only observed on one replicate.

Whilst the purpose of the work was to evaluate crop safety the opportunity was taken to visually monitor the level of weed control in the experimental plots. Chickweed and Mayweed were the predominant weeds in the trial area and were controlled most effectively with the two rates of Sencorex WG and the higher rate of Titus.

Action Points for Growers

- growers need to familiarise themselves regarding the likely impact of the EU Review programme in order to review their current weed control strategy for the carrot crop
- growers need to be aware that a number of the predominantly used products are likely to become unavailable for use in the near future and individually they need to plan their weed control strategy for the coming season with care.
- growers, through the BCGA, need to press for further work to be undertaken to find suitable alternative products to replace those which have or will subsequently be unsupported through the Review process
- The preliminary study reported here has identified a number of potential alternative products which would appear to be safe (non-phytotoxic) to the carrot crop at the rates used.
- Further work should be undertaken in Spring 2002 to further ensure crop safety of the most promising herbicides and, at the same time, gather evidence of their relative efficacy against the predominant weed species.
- It is likely that an Off-Label approval application will be required for any alternative product (unless the manufacturer can be persuaded to apply for an On-Label approval) and 2 years residues data would be required for this.

Practical and Financial Benefits from this Study

As a result of the wide-ranging EU pesticide review programme growers will lose a number of the key herbicides required for weed control in the carrot crop. This preliminary study ought to be of considerable practical and financial benefit to the UK industry as it identifies the relative crop safety of a number of potential alternative products. Further work will be required before any alternative products can be approved for use.

EXPERIMENTAL SECTION

Introduction

It is imperative that carrot growers have access to effective herbicides to control the full spectrum of weeds including volunteers from previous crops such as potatoes. In response to the disappointing outcome of the first phase of the EU Review Programme the carrot industry, through the BCGA, during summer 2001 quickly drew up a short-list of potential alternative herbicides. This was done with the aim of undertaking a preliminary crop safety screen during late summer.

The results from this initial study could then be used to justify an 'Essential Use' application and to determine which of the various proposed products are safe to use on carrot crops. Assuming that one or more of the products screened are safe on the crop it is anticipated that future studies would evaluate efficacy against various weed species with a view to On- or Off-Label Approval on the crop.

A short-list of 6 products applied at different rates (10 treatments in total) were drawn up by the BCGA and these were applied to a carrot crop at the 3 leaf stage in a late-sown crop during September 2001 at the STC. The treated crop was monitored regularly for evidence of crop damage (phytotoxicity), assessed as appropriate and a short summary report prepared.

Objectives

- To provide a primary crop safety or 'phytotoxicity' screen facility to identify alternative herbicides which can be used safely on Carrots
- To allow the industry to demonstrate to the EU that action is being taken in support of a temporary 'Essential Use' derogation.

Details

Study Location

The study was undertaken at Stockbridge Technology Centre, Cawood, Selby, North Yorkshire. The trial was sited on a sandy loam soil (Field 'L').

Treatments

The following treatments were drawn up by BCGA members and applied to a late-sown carrot crop at the 3-leaf growth stage.

- A. Dosaflo @ 3 l product/ha in 200 l/ha water
- B. Saltex @ 200 l/ha product applied undiluted
- C. Saltex @ 400 l/ha product applied undiluted
- D. Sencorex WG @ 0.5 kg product/ha in 200 l/ha water
- E. Sencorex WG @ 1.0 kg product/ha in 200 l/ha water

- F. Debut @ 15 g product/ha in 200 l/ha water
- G. Debut @ 30 g product/ha in 200 l/ha water
- H. Titus @ 15 g product/ha in 200 l/ha water
- I. Titus @ 30 g product/ha in 200 l/ha water
- J. Tractor Vapour Oil @ 200 l/ha applied undiluted
- K. Untreated control

Study Details

Carrots, cultivar Lagor, were drilled on 15 August using a Stanhay drill. Four rows at 30 cm apart were drilled per 1.83m bed to achieve a density of 80 plants per m² at harvest. The treatments were applied on 6 October except for treatment J which was applied on 8 October. The carrots were treated at the 3 true leaf stage.

Treatments were applied using a gas pressurised Oxford precision sprayer fitted with a 1.5 m boom with 4 nozzles (F110/0.80/3) operated at 2 bar pressure. Treatments B and C were applied using a single nozzle lance with the spray directed over the crop rows and treatment J was applied using a hand mister. The two water volumes were achieved by adjusting the forward walking speed.

Each plot was 4m long x 1 bed width (1.8m) with 2 replicates of each treatment.

Records/Assessments

The following records and assessments were undertaken following application of the various experimental treatments, the results of which are reported below.

- Weather after application
- Plant stand and plant vigour at application
- Plant vigour for 4 weeks after application
- Observations and notes on any phytotoxicity symptoms in the various plots
- Observations and notes on weed control achieved

Plant vigour assessments were based on the 2 middle rows with an overall score per row based on the foliage height, colour and general health.

Results and Discussion

The emergence of the carrots was good despite a heavy storm within 24 hours of drilling. The crop attained the target growth stage (3 true leaves) slightly later than anticipated in early October by which time some weeds had established in the plots.

The weather after treatment application was warm but there was a light shower 3 hours after application on 6 October.

Plant stands per plot row were recorded but as there was no reduction in plant numbers throughout the trial period they have not been presented. Plant vigour was assessed at approximately weekly intervals following treatment application and the results are presented in Table 1.

Table 1. Assessments of Plant Vigour Recorded during the Trial Period

Treatment	Plant vigour (0-10*)			
	8 October	17 October	24 October	31 October
Dosaflo	4.3	4.2	4.2	4.2
Saltex 200l	4.0	4.0	4.0	4.2
Saltex 400l	4.5	4.5	4.5	4.5
Sencorex 0.5 kg	4.5	4.5	4.5	4.5
Sencorex 1.0 kg	4.3	3.9	3.8	3.8
Debut 15g	4.5	4.5	4.5	4.5
Debut 30g	4.8	4.5	4.5	4.5
Titus 15g	3.9	3.9	3.7	3.9
Titus 30g	4.4	4.3	4.2	4.2
Tractor vapour oil	4.2	4.2	4.2	4.2
Untreated	4.2	3.9	3.9	3.9

* 1= poor vigour, 10 = excellent vigour.

Due to the cool wet weather throughout much of October the growth of the carrots was less than would have been expected if the treatments had been applied at the usual time of year following spring or early summer drilling.

Those treatments where there appeared to be some treatment effect included Sencorex WG when applied at 1.0 kg/ha and also Titus at 30 g/ha. At the final assessment on 31 October it was observed that there was 1-2 leaves fewer where these treatments had been applied, with plants on other treatments having 6 or 7 true leaves. These effects were only observed on one plot of each of these treatments.

Observations on root shape and development on 31 October showed that most treatments had no effect on root size except where Titus was applied at the higher rate where roots were thinner.

Weed control was variable as even where Dosaflo was used mayweed was only partially controlled, but the rate selected was lower than the recommended rate. Sencorex WG at both rates provided good control of annual meadow grass, mayweed and chickweed whereas Debut appeared to be relatively ineffective with some chickweed recovering and growing back.. Titus gave some partial weed control and with an actively growing crop might provide sufficient suppression. However, it must be considered that the primary aim of this study was to determine crop safety by identifying phytotoxic symptoms/effects rather than assessing their relative performance on the different weed species.

Conclusions

1. None of the treatments included in this study adversely affected plant stand.
2. Sencorex WG appeared to reduce plant vigour and this potential effect is mentioned on the current SOLA document for its use on parsnips. Further work would be required to determine if these effects are just short-term.
3. Titus, whilst causing a reduced vigour when applied at the 3 true leaf stage did appear to provide some weed control.
4. None of the other herbicides evaluated appeared to cause visible phytotoxicity symptoms at the rates and timings used.
5. Sencorex WG gave better weed control than the other herbicide treatments.
6. Debut was relatively ineffective in controlling the main weeds present.

Recommendations

Further work is required to identify other potential herbicides for use on carrots during the first 6 - 8 weeks after emergence. Also, for those herbicides tested in this study further investigation will be required to identify the optimal rate of each so as to maximise weed control whilst minimising any adverse effects on crop growth. Detailed counts of leaf numbers should be taken in any future trials using a commercially acceptable drilling date.

Acknowledgements

This work was funded by the Horticultural Development Council and the support of the Carrot industry through the HDC Vegetable Panel and members of the British Carrot Growers Association is gratefully acknowledged. A special thanks to Mr D Martin of Plant Systems and Mr J Kenyon, Huntapac for undertaking the role of HDC project coordinator and providing a short-list of candidate products to evaluate.