## Evaluation of Ethofumesate (Nortron) and Asulam (Asulox) for Weed Control in Carrot Grown for Seed

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### Introduction

Ethofumesate (Nortron®) has recently been registered for use on carrots grown for seed. However, the utility of this herbicide in the existing weed control program is not clear. Ethofumesate is fairly expensive and will not be worth the cost of trying if it offers little improvement beyond current practices.

Asulam (Asulox®) is a relatively old herbicide that may be registered on specialty crops. Currently asulam is only registered on sugarcane. Research conducted on peppermint nearly 30 years ago indicates that asulam is effective on some weeds in the family Asteraceae, like common groundsel (*Senecio vulgaris*) and tansy ragwort (*Senecio jacobaea*) (Arnold Appleby, personal communication). Asteraceae weeds such as horseweed (*Conyza canadensis*) and prickly lettuce (*Lactuca serriola*) are persistent problems in carrot seed production. If asulam was safe on carrots it could be a good tool for managing these weeds.

### Methods and Materials

Two field trials were conducted in commercial fields of hybrid carrot grown for seed, one near Culver, Oregon and the other near Madras, Oregon. The trial near Culver consisted of 10-ft by 28-ft plots and the trial near Madras consisted of 10-ft by 20-ft plots; both were arranged in randomized complete blocks replicated four times. Herbicides were applied with a $CO_2$-pressurized backpack sprayer delivering 20 gal/acre at 40 psi at the rates and timings shown in Tables 1 and 2. Crop injury and weed control were evaluated visually with a 0 to 100 percent rating scale.

### Results and Discussion

Carrots in the trial near Culver did not survive well through the winter. The carrot stand was highly variable by the spring, which made it difficult to get spring injury data at that location. Also, we did not apply asulam in the spring because there would not have been good crop safety data to collect.

Ethofumesate did not injure carrots at either location and it partially controlled spring-emerging kochia (*Kochia scoparia*) and black nightshade (*Solanum nigrum*) from the September 24 application (Table 1). Ethofumesate did not control the volunteer bluegrass in the Madras trial. The Madras field had been rotated out of Kentucky bluegrass seed production and the volunteer grass in this trial was growth from old rhizomes and not from seed; control with ethofumesate was not expected in this situation.

Asulam applied in September caused no visual injury to the carrots at either location (Table 1). In the Madras trial asulam applied in September partially controlled the volunteer bluegrass. In the Culver trial, asulam applied in September did not control the spring-emerging kochia and black nightshade. Furthermore, at Madras there was no visual injury to the carrots in the spring following asulam applied in September. However, the June applications of asulam were not safe on the carrots at either rate tested and injury symptoms continued to develop as long as the carrots continued growing (Table 2).

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Table 1. Carrot injury and weed control from fall application of ethofumesate (Nortron), asulam (Asulox), and linuron (Lorox) near Culver and Madras, Oregon, 2007-2008.

| | Rate | Culver[2] | | | | Madras[3] | | | |
|---|---|---|---|---|---|---|---|---|---|
| Treatment[1] | (lb ai/acre) | Carrot 01/Oct/07 | Carrot 19/Oct/07 | Kochia 04/Jun/08 | Bl. Nightshade 04/Jun/08 | Carrot 01/Oct/07 | Carrot 18/Oct/07 | Vol. bluegrass 18/Oct/07 | Carrot 05/Jun/08 |
| | | ----- % injury ----- | | ------ % control ------ | | ----- % injury ----- | | % control | % injury |
| Linuron | 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 73 | 0 |
| Ethofumesate | 2.0 | 0 | 0 | 35 | 38 | 0 | 0 | 0 | 0 |
| Ethofumesate + linuron | 2.0 + 1.0 | 0 | 0 | 65 | 53 | 0 | 0 | 73 | 0 |
| Asulam | 1.65 | 0 | 0 | 0 | 5 | 0 | 0 | 68 | 0 |

[1] Applied 24 September 2007 at both locations. All treatments except for ethofumesate alone included R-11 nonionic surfactant at 0.25% v/v. Linuron = Lorox 50 DF. Ethofumesate = Nortron 4 SC. Asulam = Asulox 3.3 L.
[2] At time of application carrots near Culver had two to four leaves. Treatments were applied preemergence to kochia and black nightshade.
[3] At time of application carrots near Madras had one to three leaves. Treatments were applied when volunteer bluegrass had two to four leaves.

Table 2. Carrot injury from spring application of asulam (Asulox) near Madras, Oregon, 2007-2008.

| Rate[1] | 20/Jun/08[2] | 03/Jul/08[3] | 05/Aug/08[4] |
|---|---|---|---|
| (lb ai/acre) | ---------- % injury ---------- | | |
| 1.65 | 1 | 2 | 38 |
| 3.3 | 10 | 33 | 55 |

[1] Applied 12 June 2008 when carrots were bolting but flowers were not yet open. Treatments included R-11 nonionic surfactant at 0.25% v/v. Asulam = Asulox 3.3 L.
[2] Carrots were at the early flower stage.
[3] Carrots were fully flowered.
[4] Carrots were at the late flower stage.