# EVALUATION OF SIMULATED HAIL DAMAGE TO SEED CARROTS AND ONIONS IN CENTRAL OREGON, 1998

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## Abstract

This is the third year of a multi-year study to determine the effect of simulated hail damage on yield of seed carrots and onions. Timing and severity of damage were evaluated at the time of bee introduction with 33 percent and 67 percent damage, and at bee removal with 33 percent and 67 percent damage. Late season damage caused greater yield reductions than early season damage for both carrots and onions. For carrots 16 percent of the seed came from primary umbels, 60 percent from secondary umbels, and 24 percent from tertiary umbels. There were no differences in seed germination between treatments for either carrots or onions.

## Introduction

Vegetable seed production is an integral part of agriculture in central Oregon. Crops for the 1998 season included 2,600 acres of garlic, 3,000 acres of carrots, 200 acres of onions, 35 acres of radishes, 860 acres of coriander, and 250 acres of Chinese brassicas for a total acreage over 7,000. These high value crops are the backbone of profitable agricultural production in the area.

Carrots are predominantly hybrid varieties grown in a single row per bed, with typically 4 rows of females and 2 rows of males with blank rows between. The primary (king) umbel is the first to develop, followed by the secondary umbels, and then the tertiary umbels. The primary umbel typically has the largest, most vigorous seed and which is expected to account for 8-12 percent of production. Many carrot varieties continue to produce additional heads throughout the growing season.

All onions grown during 1998 were hybrid varieties grown in double rows per bed, generally in a 6-row female, 2-row male configuration with blank rows between. Seed heads are generally 2-3 inches in diameter, and the plant has no way of producing additional heads to compensate for ones that are damaged or destroyed.

## Methods and Materials

This is the third year of a multiple year evaluation on the effect of simulated hail damage to seed carrots and onions. The study was conducted in commercial fields, and for the first time plots were placed in the female rows. In the past the male rows have been used so seed yield and grower income would not be reduced. Plots were a single row x 10 ft for carrots and a single row x 5 ft for onion. Plots were reduced in length from previous

years, but chosen from uniform portions of the row to reduce variability. Treatments were replicated 3 times in a randomized complete block design.

Variables evaluated in this study included timing and extent of damage. Treatments were applied with a weed eater held on edge to simulated hail damage from above. This was done June 25 and August 11, 1998 just prior to and following the introduction and removal of bees for crop pollination. The five treatments included an untreated check, early light damage (33%), early heavy damage (67%), late light damage (33%), and late heavy damage (67%).

Onions plots were harvested August 19, and the carrots were harvest August 20. Mature heads in each plot were harvested by hand, and allowed to dry in open containers. In the untreated carrot plots, umbels were separated by position to determine the percentage of seed from primary, secondary, and tertiary umbels. Samples were thrashed and cleaned at the seed-conditioning lab of the USDA-ARS National Forage Seed Production Research Center in Corvallis, Oregon.

## Results and Discussion

The effect of the simulated hail damage on seed yields for carrots is provided in Table 1. Significantly higher yields were observed following early light (672 g) and early heavy (621 g) damage compared to untreated (533 g) plots. In 1997 early light damage produced 774 g of cleaned seed compared to 678 g for the untreated, while yields were reduced to 596 g for early heavy damage. This increase in seed yields from light damage at the time of bee introduction was not supported by the 1996 data. Umbel damage following bee removal significantly reduced seed yield to 341 g for light damage, and another significant drop to 167 g for heavy damage.

For 1998 there were no statistically significant differences between simulated hail damage treatments on seed onions. However, there was a strong trend with untreated plots producing 860 mg of seed per head compared to 730 mg for early light damage and 520 mg for early heavy damage. Late light damage (700 mg) was similar to early light damage (730 mg), while late heavy damage (320 mg) yielded only about a third of the seed from untreated plots (860 mg).

The amount of carrot seed from primary, secondary and tertiary umbels is provided in Table 3. Primary umbels produced 16 percent of the seed, secondary umbels produced 60 percent, and tertiary umbels produced 24 percent. If the stage of development is known when hail damage occurs, having determined the percent of total yield contributed by each order of umbel could be an important indicator of yield loss.

Seed germination percentages were unaffected by simulated hail treatments for both carrots and onions. This is supported by data from the previous two seasons.

Table 1. Effect of 33 and 67 percent simulated hail damage to seed carrots applied with a weed eater June 25 and August 11 on seed carrots near Madras, Oregon, 1998.

| Treatment | Clean seed weight | Percent of untreated | Germination |
|---|---|---|---|
| | (g) | (%) | (%) |
| Untreated | 533 b | | 87 |
| Early Light | 672 a | 126 | 90 |
| Early Heavy | 621 a | 117 | 78 |
| Late Light | 341 c | 64 | 89 |
| Late Heavy | 167 d | 31 | 69 |
| | | | ns |

Table 2. Effect of 33 and 67 percent simulated hail damage to seed onions applied by hand June 25 and August 11 on seed onions near Madras, Oregon, 1998.

| Treatment | Seed weight per head | Percent of untreated | Germination |
|---|---|---|---|
| | (mg) | (%) | (%) |
| Untreated | 860 | | 91 |
| Early Light | 730 | 85 | 93 |
| Early Heavy | 520 | 60 | 92 |
| Late Light | 700 | 81 | 90 |
| Late Heavy | 320 | 37 | 89 |
| | ns | | ns |

Table 3. Portion of seed yield in untreated plots attributable to primary, secondary, and tertiary umbels near Madras, Oregon, 1998.

| Umbel | Seed weight | Percent of total |
|---|---|---|
| Primary | 84 c | 16 |
| Secondary | 318 a | 60 |
| Tertiary | 131 b | 24 |