EVALUATION OF SIMULATED HAIL DAMAGE TO SEED CARROTS AND ONIONS IN CENTRAL OREGON, 1997

Marvin Butler

Abstract

This is the second year of a multiyear study to determine the effect of simulated hail damage on yield of seed carrots and onions. Timing and severity of damage were evaluated at early pollination with 33 and 66 percent damage and at post-pollination with 33 and 66 percent damage. Late season damage appeared to reduce yields compared to early season damage for both carrots and onions. The lowest yields were from plots with heavy damage (66 percent) compared to light (33 percent) damage. No differences in seed germination were observed.

Introduction

Vegetable seed production is an integral part of agriculture in central Oregon. Crops for the 1997 season included 2,500 acres of both carrots and garlic, 400 acres of onions, 200 acres of radishes, 450 acres of coriander, and 200 acres of both Chinese kale and flowers for a total acreage near 6,000. These high value crops are the backbone of profitable 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 accounts for 8-12 percent of production. Many carrot varieties continue to produce additional heads throughout the growing season.

Onions are largely 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 second year of a multiple year evaluation on the effect of simulated hail damage to seed carrots and onions. The study has been conducted in commercial fields using the male rows of hybrid seed production, so as not to reduce seed yield and grower income. Plots were a single bed (1 row of carrots, 2 rows of onions), replicated 3 times in a randomized complete block design. Plant were hand-thinned to 10 carrot plants per plot, and 30 onion plants per plot during late spring to reduce stand variability in the plots.

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 July 9 and August 14, 1997 just before and after the introduction and removal of bees for crop pollination. The five treatments included an untreated check, early light damage (33 percent), early heavy damage (67 percent), late light damage (33 percent), and late heavy damage (67 percent).

Onions plots were harvested August 25, and carrots were harvest August 27. In the untreated carrot plots, umbels were to be harvested separately by position to determine the percentage of each. Inadvertently, the primary and secondary umbels were grouped together, and the tertiary umbels were kept separate. Mature heads in each plot were harvested by hand and allowed to dry in open containers. 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 treatments on seed set for both carrots and onions is provided in Table 1 and 2. Carrot seed yields were not reduced with one third of the heads damaged at the beginning of pollination, but were reduced by 12 percent when two thirds of the heads were destroyed. One-third and two-thirds damage following pollination reduced seed yield by 14 and 42 percent, respectively. The early damage had less influence on yield than later damage, as the plant was able to recover from early damage by producing additional umbels.

The amount of carrot seed from primary, secondary, and tertiary umbels is shown in Table 3. Thirty-eight percent of seed yield is set by the primary and secondary umbels, while 62 percent came from the tertiary umbels. If the stage of development is known when hail damage occurs, knowing the percentage of total yield contributed by each umbel level can provide an additional indicator of the amount of yield loss one would expect.

Onion seed production was reduced by 14 and 32 percent with one-third and two-thirds of the heads destroyed at the beginning of pollination. At the end of pollination one-third and two-thirds damage reduced seed yield by 42 and 50 percent compared to the undamaged plots. Although the onion has no way of producing additional heads, it would appear that they are able to compensate for early damage, perhaps through increasing the size of remaining seed to increase weight.

Seed germination percentages were unaffected by simulated hail treatments for both carrots and onions.

Table 1. Effect of 33 and 67 percent simulated hail damage applied with a weed eater July 9 and August 14 on seed carrots near Madras, Oregon, 1997.

Treatment	Clean seed weight	Germination
	(g)	(%)
Untreated	678	80
Early light	774	82
Early heavy	596	77
Late light	581	79
Late heavy	397	82
	NS'	NS

'NS = no statistical difference between treatments with Student-Newman-Keuls (P<0.05).

Table 2. Effect of 33 and 67 percent simulated hail damage applied with a weed eater July 9 and August 15 on seed onions near Madras, Oregon, 1997.

Treatment	Seed weight	Germination
Untreated	105 a[1]	86
Early light	90 a	87
Early heavy	71 b	82
Late light	60 b	80
Late heavy	52 b	89
		NS

'Mean separation with Student-Newman-Keuls ($P < 0.05$)

Table 3. Portion of seed yield in untreated plots attributable to primary and secondary umbels compared to tertiary umbels near Madras, Oregon, 1997.

Umbel	Seed weight	% of Total
	(g)	
Primary/Secondary	895 a[1]	38
Tertiary	82 b	62

'Mean separation with Student-Newman-Keuls ($P < 0.05$).