2003 New England
Carrot Crop Profile

Compiled for the New England Pest Management Network
by Margaret Siligato
University of Rhode Island
Address: 3 East Alumni Ave. Kingston, RI 02881
Telephone: (401) 874-4997
Email: Siligato@uri.edu

Revised: August 2007

Note: This profile is a comprehensive list of pests that may be encountered by New England carrot growers, and the approved pesticides that may be used to control them. Only a few pests actually require treatment on an individual farm in a single year. For each pest all of the available effective options are listed. If treatment is needed, only one of those options would be used per application. Some pests require multiple applications for control; others only require a single application.

I. Production Facts

New England accounts for about 0.1% of U.S. carrot acreage. While not significant in terms of national production, New England carrots are an important component of the crop mix for diversified fresh market vegetable producers. Most carrots (63%) are grown for local retail fresh market, 13% are wholesaled, 2% are grown for pick-your-own markets, 1% are destined for processing, and the remaining are grown for other uses (home use, farm stands). Growers reported managing an average of 14 acres of carrots for the year 2002.

Of growers responding to a survey in 2003, 56% said they use IPM practices such as insect trapping and field sampling. Forty-two percent of growers scouted their carrot crop themselves, 9% had scouting done by a farm employee or family member; and 5% used a private IPM scout or consultant.

The most frequently used weather information for pest management decisions was: rain forecasts (69%), wind speed forecasts (52%), rainfall totals (47%), humidity (36%), and temperature (28%). Thirty nine percent

of growers said they would frequently based irrigation scheduling on weather information.

When choosing pesticides for use on their farms, the following portions of growers rated these as “Very Important” criteria: toxicity (67%), effectiveness (64%), phytotoxicity (59%), potential environmental impacts (59%), impacts on non-target organisms (52%), packaging (35%), and cost per acre (34%).

The following items received the highest rankings as “Very Important” sources for pest management decisions: other growers (47%), New England Vegetable Guide (46%), university/extension staff (43%), off-season educational meetings (42%), and newsletters (39%).

Of the growers surveyed, 44% classified their farm practices as organic, 30% as conventional, and 28% as IPM.

Cultural Information

The best carrot production is obtained from deep, well-drained sandy loam soils. Raised beds tend to increase the depth of tilled soil and can help provide good root shape. Some growers chisel plow before forming beds to loosen the soil and enhance root development. It is recommended practice to preserve soil structure by not overworking it or working it while wet. Some growers rototill to obtain deep, friable soil. Hilling soil over the shoulders of roots at the last cultivation can help reduce greening.

New England growers reported using the following horticultural practices: overhead irrigation, composted manure, drip irrigation, and fresh manure. Other practices include: commercial fertilizer, compost, raised beds, rotation, fish compost with sawdust, and organic practices. Sixty-four percent of farmers reported using soil samples to determine fertilizer needs. Of those, 29% had samples taken once a year, 10% every other year, and the remaining farmers every three years or more.

Worker Activities

Worker activities that may occur during the growing season include mulching, weeding, scouting, mowing, irrigation, fertilizing, pesticide application and harvesting.

II. Insect and Mite Pests

Fifteen percent of New England growers reported using insecticides each year. The remaining growers reported using no pesticides for control of insect pests.

The following insects were indicated as a routine or occasional problem: carrot rust fly (15%), carrot weevil (17%), and leafhoppers (20%). Other insect pests reported were: swallowtail larvae, wireworm, and cabbage maggots.

1. Carrot Rust Fly

Type of Pest: Insect
Frequency of Occurrence: 3% of growers surveyed reported routine problems with these pests.
Damage Caused: The carrot rust fly maggot damages plants by eating the small fibrous roots and by tunneling in larger roots. A rust-colored material develops in the tunnels, giving the insect its name. Affected plants may become yellow, stunted, and die, but usually the plant tops continue to look healthy. Maggots often continue to feed in stored carrots. Disease organisms may enter the feeding tunnels and cause them to rot.
Regional Differences: None
Cultural Control Practices: Floating row covers, delay seeding until mid-May, and harvest early in June before second generation flies appear. Harvest in blocks rather than selectively. Destroy alternate hosts and possible sources of infestation. Deep plowing in fall or spring, crop rotation. Carrot rust fly infestations can be thwarted by placing cones made of window screen over individual plants.
Timing of Control: Although no insecticides are currently registered for carrot rust fly, the procedure would be to apply a granular form in the seed furrow at planting time.
Alternative Control Practices: Sprinkle rock phosphate around the base of plants.
Post-Harvest Control Practices: None

INSECTICIDES	TRADE NAME	PHI	RATES	REI
No registered pesticides				

2. Carrot Weevil

Type of Pest: Insect
Frequency of Occurrence: 2% of growers surveyed reported routine problems with these pests.
Damage Caused: Adults are capable of laying eggs by mid- to late May. However, they do not attack the new crop of carrots until the first true leaf stage. Adult females chew small cavities in the petioles or crown of the carrots and deposit an average of two to three eggs in each sealing the cavity with black exudates. Eggs hatch after one to two weeks and the young larvae tunnel down into the root or leave the stalk and enter the roots from the soil. Some young plants may wilt and die as the slender root is tunneled by the developing larva. The damage is not otherwise conspicuous until the larvae are nearly mature.
Regional Differences: None
Cultural Control Practices: Scouting
Biological Control Practices: Bacillus thuringiensis var. tenebrionis
Post-Harvest Control Practices: None

INSECTICIDES	TRADE NAME	PHI	RATES	REI
cyfluthrin	Baythroid 2	0 days	2.8 oz/A	12 hrs
esfenvalerate	Asana XL	7 days	9.6 oz/A	12 hrs
oxamyl	Vydate L	14 days	2 to 4 pt/A	48 hrs

3. Leafhoppers

Type of Pest: Insect
Frequency of Occurrence: 11% of growers surveyed reported routine problems with these pests.
Damage Caused: Leafhopper nymphs and adults suck the sap from their host plants. During feeding, infected insects, principally aster leafhopper, can transmit aster yellows disease. Transmission of this disease to carrot results in hairy roots and leaves that are bunchy and discolored.
Regional Differences: None
Cultural Control Practices: Weed control, crop rotation, raised beds. As a supplement to other control strategies, removing weed hosts along field edges can reduce the number of leafhoppers in the area. Also, carrot cultivars vary in their susceptibility to the disease.

Biological Control Practices: Predators and parasites seldom give satisfactory control, especially where the LH is a disease carrier.
Post-Harvest Control Practices: None

INSECTICIDES	TRADE NAME	PHI	RATES	REI
azadirachtin	Neemix 4.5	0 days	7 to 16 oz/A	12 hrs
carbaryl	Sevin XLR PLUS	7 days	1 to 2 pts/A	12 hrs
cyfluthrin	Baythroid 2	0 days	1 to 2.8 oz/A	12 hrs
esfenvalerate	Asana XL	7 days	5.9 to 9.6 oz/A	12 hrs

III. Diseases and Nematodes

Fifteen percent of New England growers reported using chemical controls for disease and viruses each year. The remaining growers reported using no chemical controls. Over forty percent of growers surveyed suppressed diseases with cultural practices: crop rotation, cultivation, wider spacing, raised beds, and cover crops.

Of farmers surveyed, the primary disease was Leaf Bight, with 19% reporting it as an annual or occasional pest. Other diseases reported as annual or occasional problems were crown rot (9%) and root rot (8%).

1. Leaf Blight
Type of Pest: Fungus
Frequency of Occurrence: Seven percent of farmers surveyed treat crop for this fungus annually.
Damage Caused:
Cercospora Leaf Blight**:** Leaf spots caused by *Cercospora carotae* first appear along the margins of the leaves, often causing the leaves to curl. Spots inside the leaf edges are small, roughly circular, and tan or gray to brown with a dead center. As the lesions increase in number and size, the entire leaflet withers and dies. The fungus attacks younger leaves and plants in preference to older ones. In heavily infested fields, however, both older and younger leaves are subject to attack. The pathogen also produces lesions on the petioles and stems, characterized by dark brown borders and tan to gray centers. The lesions may merge and girdle the

stems, causing the leaves to die. Cercospora leaf blight develops rapidly in hot or humid weather.

Alternaria Leaf Blight: Alternaria leaf spots first appear at the margin of the leaflets and are dark brown to black and irregular in shape. Lesions produced on the petioles and stems are dark brown and often coalesce and girdle the stems. As the disease progresses entire leaflets may shrivel and die, appearing scorched. Alternaria leaf lesions are generally more prevalent on older foliage and plants than on young foliage. The disease spreads rapidly on the older leaves of a maturing crop after the rows have closed. Infected older leaves produce many spores which eventually infect younger leaves and may also wash to the ground and attack the roots (especially after mechanical injury). Root lesions are irregular, dark brown to black, and appear as a shallow, firm area of decay.

Bacterial Leaf Blight: Early symptoms of leaf blight caused by the bacterium *Xanthomonas carotae* appear on the leaflets as small yellow areas. The centers of young lesions become brown and dry and are often surrounded by a yellow halo. Well-developed symptoms appear on the leaves as irregular brown spots and on the petioles and stems as brown streaks. Mature foliar symptoms of bacterial leaf blight are indistinguishable from leaf blights caused by *Alternaria dauci* and *Cercospora carotae*.

Regional Differences: None
Cultural Control Practices: Crop rotation, fall plowing or disking, resistant seeds. **Biological Control Practices**: none.

FUNGICIDE	PHI	RATE	REI
chlorothalonil, (Bravo Ultrex 82 WDG)	7 days	1.4 to 1.8 lbs/A	12 hrs
pyraclostrobin (Cabrio EG)	0 days	8 to 12 oz/A	12 hrs

IV. Weeds

Eighty-five percent of New England growers reported using chemical controls for disease and viruses each year. The remaining growers reported using no chemical control. Farmers reported using cultural practices to control weeds, including cultivation, hoe/hand weeding, mowing, rototilling, flaming, crop rotation, and mulching. Growers reported the following weeds as routine or occasional problems: annual broadleaf weeds (94%) and

annual grasses (88%), perennial broadleaf weeds (81%) and perennial grasses (79%).

1. Stale Seed Bed

Fourteen percent of farmers surveyed reported treating carrot crop with stale seed bed applications.

PRODUCT	TRADE NAMES	PHI	RATE	REI
glyphosate	Roundup 4S	14 days	1 to 5 qts/A	12 hrs
paraquat	Gramoxone Max 3S	7 days	1.5 to 2.7 pts/A	12 hrs
pelargonic acid	Scythe 4.3	See label	3 to 10 gal/A	24 hrs

2. Preplant Incorporated -Transplants

Fifty-one percent of farmers surveyed reported treating carrot crop with preplant incorporated applications.

PRODUCT	TRADE NAMES	PHI	RATE	REI
trifluralin	Treflan 4EC	See label	1-1/2 pt/A	12 hrs

3. Preemergence

Ten percent of farmers surveyed reported crop treated with at planting applications.

PRODUCT	TRADE NAMES	PHI	RATE	REI
clethodim	Select 2EC	30 days	6 to 8 oz/A	24 hrs

4. Post Emergence

Twenty-two percent of farmers surveyed reported treating crop with post emergence applications.

PRODUCT	TRADE NAMES	PHI	RATE	REI
fluazifop	Fusilade DX	45 days	6 to 16 fl oz/A	12 hrs
linuron	Lorox 50DF	See label	1-1/2 to	24

			3 lbs/A	hrs
metribuzin	Sencor 75DF	60 days	1/3 lb/A	12 hrs
pelargonic acid	Scythe 4.3	See label	3% to 10%	24 hrs

V. Vertebrate Pests

1. Deer
Type of Pest: Vertebrate
Damage Caused: 63% of growers report deer damage was common on farms.
Regional Differences: Each farm differs in pressure from deer.
Cultural Control Practices: 18% of growers of growers used various management strategies for **deer** including electric fences (6%), other fencing (5%), shooting (6%) and repellents (3%). Most growers reported "excellent" and/or "good" results. Control tactics also include predator urine, hunting, shooting, hair and soap, talk radio, flash tape, hot pepper, scarecrow, and mothballs. Electric fencing works well but is expensive.

2. Woodchuck
Type of Pest: Vertebrate
Frequency of Occurrence: occasional pressure
Damage Caused: 4% of the growers reported woodchucks as important pests.
Regional Differences: Each area differs.
Cultural Control Practices: shoot, trap, gas, dogs, and smoke bomb

3. Minor Vertebrate Pests:
Groundhogs, raccoons, mice, voles and rabbits are all minor pests in fields.

VI. Acknowledgements

References:

1. New England Vegetable Management Guide: 2004-2005. Cooperative project from University of Connecticut, University of New Hampshire, University of Maine, University of Rhode Island, University of Massachusetts and University of Vermont.

2. Census of Agriculture, 2002. USDA National Agricultural Statistics Service.

3. Farm Chemicals Handbook, 2003. R. T. Meister, G. L. Berg, C. Sine, S. Meister, and J. Poplyk, eds. Meister Publishing Co., Willoughby, OH.

4. Cornell University, Vegetable MD Online
http://vegetablemdonline.ppath.cornell.edu/factsheets/Carrot_LeafBlt.htm

Key Contacts and Resources:

Maine: Mark Hutton
University of Maine Cooperative Extension
Highmoor Farm
PO Box 179, Monmouth, ME 04259
Phone: 207-933-2100
FAX: 207-933-4647
mhutton@umext.maine.edu

Massachusetts: Ruth Hazzard
University of Massachusetts
Department of Entomology
301 Agricultural Engineering Bldg.
250 Natural Resources Rd.
University of Massachusetts Amherst
Amherst, Mass. 01003
TEL: (413) 545-3696
FAX: (413) 545-5858
E-Mail: rhazzard@umext.umass.edu

New Hampshire: George Hamilton
University of New Hampshire
468 Route 13 South
Spaulding Hall

38 College Road
Milford, NH 03055
(603) 882-9919
george.hamilton@unh.edu

Vermont: Ann Hazelrigg
Plant & Soil Science Department
Hills Agricultural Bldg.
105 Carrigan Drive
University of Vermont
Burlington, VT 05405-0082
(802) 656-0493
ann.hazelrigg@uvm.edu

State Approvals/Reviews:

Connecticut:
Candace Bartholomew
University of Connecticut Cooperative Extension
1800 Asylum Avenue
West Hartford, CT 06117
cbarthol@canr1.cag.uconn.edu
(860) 570-9067

Maine: Glen Koehler
University of Maine Cooperative Extension
Pest Management Office
491 College Avenue
Orono, ME 04473-1295
(207) 581-3882
gkoehler@umext.maine.edu

Massachusetts: Natalia Clifton
University of Massachusetts
Pesticide Education
212 Ag Engineering Bldg.
Amherst, MA 01003
(413) 545-1044
nclifton@ent.umass.edu

New Hampshire: William Lord
University of New Hampshire
Plant Biology Department
Spaulding Hall
38 College Road
Durham, NH 03824-3544
(603) 862-3203
william.lord@unh.edu

Rhode Island:
Margaret Siligato
University of Rhode Island Cooperative Extension
316 Woodward Hall
Kingston, RI 02881
(401) 874-5997
siligato@uriacc.uri.edu

Vermont: Ann Hazelrigg
Plant & Soil Science Department
Hills Agricultural Bldg.
105 Carrigan Drive
University of Vermont
Burlington, VT 05405-0082
(802) 656-0493
ann.hazelrigg@uvm.edu