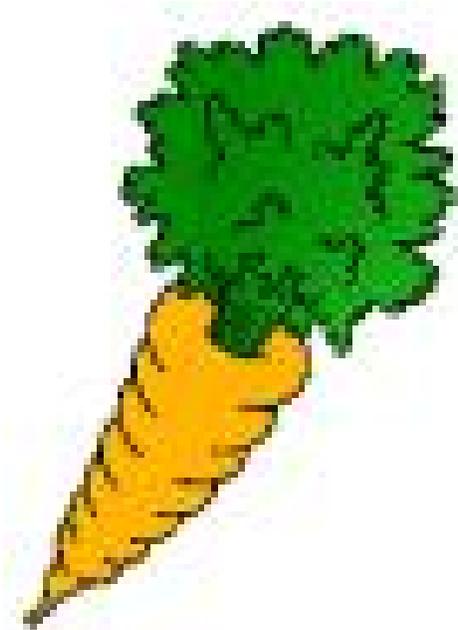


New England Carrot Pest Management Strategic Plan



New England Pest Management Network
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Table of Contents

	Page Number
Executive Summary	3
I. Introduction	3
Background: Carrots in New England	
Benefits to the New England Carrot Industry	
How this Plan was Created	
II. Summary of the Carrot PMSP	5
Key Pest Issues	
Pest Management Priorities	
Research Needs	
Regulatory Needs	
Education Needs	
Worker Exposure Issues	
III. Strategic Issues for Key Pests	7
Insects and Mites	
Diseases	
Weeds	
Vertebrates	
IV. Appendices	15
Pesticide Efficacy for Insect and Mite Pests	
Pesticide Efficacy for Diseases	
Pesticide Efficacy for Weeds	
V. Acknowledgements	16
Contributors and Reviewers	

Executive Summary

The Food Quality Protection Act (FQPA) has required the EPA to register and re-register pesticides in regard to health risk to consumers. The EPA is looking closely at organophosphate, carbamate and suspected B2 carcinogenic pesticides. Many of these products will not be reregistered and there is risk that many of the older pesticides that have been effective in controlling pest problems will lose registration status. Some pesticides with newer chemistries are becoming available and their efficacy is unknown. University extension research is needed to determine efficacy and the economic feasibility of these products to control current pest pressures. Representatives from the New England carrot industry met for two days in November 2004 to discuss strategic issues concerning carrot production in New England. The input from this meeting and commodity statistics were used to develop this report.

I. Introduction

Background: Carrots in New England

Carrots are a minor crop in New England and are grown by diversified fresh market vegetable producers. Based on the 2005 NASS data, the value of carrots in New England is 1.05 million dollars. Of the 212 farms reporting carrot production, 106 acres of carrots are harvested. The average yield is 10,530 pounds per acre with the price per pound averaging \$1.00 per pound. Sixty-three percent of carrots are grown for local retail fresh market, 13% are wholesaled, 2% are grown for pick-your-own markets, 1% are processed 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.

Benefits to the New England Carrot Industry

The New England Carrot Pest Management Strategic Plan (PMSP) identifies at-risk pesticides and proposes future research, regulatory, and educational needs in the event of pesticide registration loss. These priorities will be used to inform EPA and state agency decisions and outline a development path for pest management researchers and educators. Current pest management programs will be made more effective through implementation of actions proposed in this plan.

How this Plan was Created

A group of vegetable growers, researchers, and industry stakeholders throughout New England met for two days in November 2004 at the Grappone Conference Center in Concord, New Hampshire, to develop this strategic plan, based on the 2003 New England Pea, Bean, and Carrot Survey. The group's tasks were to assess the state of current pesticides and pest management recommendations as well as identify the regulatory, educational, and research issues impacting production of these crops.

The review group consisted of the following individuals:

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II. Summary of the Carrot Pest Management Strategic Plan

Key Pest Issues

Insects and Mites

The most serious insect pests affecting carrot production are the carrot weevil, carrot rust fly, and the leafhopper.

Diseases

Leaf blights are the most important disease group in carrot production.

Weeds

Maintaining low weed densities is essential for maximum carrot production. The typical grassy and broadleaf weeds were discussed as needing routine control in carrot crops. Methods of control range from stale seedbed preparation to preplant incorporated, pre-emergence, and post emergent controls.

Vertebrates and other pests

The most important vertebrate pests are deer and woodchuck. Both can cause severe damage if no control measures are initiated. Growers identified these pests as variable in the damage they can cause.

Worker Activities

Workers are employed in several aspects of carrot production, beginning early in the season with field preparation and direct seeding into prepared fields. Cultivation begins in April and continues through July. Pesticides would be applied May through July and harvest generally begins in July and continues through August. Tasks such as scouting and irrigation occur throughout the season. Plowing under occurs in fall.

Pest Management Priorities

Research Needs:

Research is needed on

- the life cycle and favorable conditions for the development of the carrot weevil;
- cultural control measures, including the relationship between nutrition and foliar leaf blights
- the effect of light on pigweed seed germination under shallow cultivation;
- pre-emergent herbicides: using carrot oil, vinegar, mineral spirits, kerosene, other petroleum-based products, and liquid nitrogen.
- vertebrate repellents such as garlic and fish oil, especially the timing and application schedules; and
- cultural controls for storage rots: white mold, Sclerotinia, and Rhizoctonia.

Regulatory Needs:

The packaging size of pesticides is not appropriate in all cases for minor use crops. Many farms reported using products that they have on hand; these have a wide range of labeling. Sweet corn registration tends to be a driving factor in the selection of pesticides. Since Bravo® is labeled for disease control on tomatoes and several other vegetables, farmers may be selecting this product for carrots because of its availability on the farm rather than for efficacy on carrot diseases. The size of packaging and higher price of newer or safer products may be restrictive.

In response to USDA Organic Standards, there is increased interest in using organic carrot seed in New England, which is causing seed supply to come in with seed-borne diseases that could result in more crop loss or increased fungicide applications. As for weed control, growers are looking for label expansion on Sandea® for post emergence use. With an increase in vertebrate pressures affecting crops, growers seek help on controlling the problems they cause. Severe restrictions on geese and crow hunting are hampering control efforts and thus crop yields.

For weed management, growers would like more products available for pre-emergence use. Lorox® is registered as a pre-emergent on parsnips but not carrots, and growers wonder whether it could be registered for use on carrots. The Michigan label allows use of Linex® at labeled rates that may be needed here in New England for Lorox®.

Educational Needs:

Growers and extension educators would like to see an adaptation of Canadian information. Canada has a larger carrot production area than New England and has more information that could be modified for use in New England. Growers and researchers need to identify more cultural information to aid in the production of carrots.

Some growers need educational materials to help them identify the damage caused by leafhoppers and leaf blights and possible cultural controls. Educational materials about pre- and post-emergent materials would be helpful. Pre and Post-emergent terminology confused several growers. They were confused about whether emergence indicators were referring to weed emergence or crop emergence.

Worker Exposure Issues:

Workers can be employed in several aspects of carrot production from field preparation through the harvest. Planting, hand weeding, mechanical cultivation, and harvesting all can lead to exposure.

III. Strategic Issues for Key Carrot Pests

Insects and Mites

1. Carrot Weevil

Description of damage: insect chews around top of carrot, creating deeper wounds through tunneling. Adults overwinter in and around fields.

Yield Losses: Sporadic problem but there could be a significant loss when present.

Growers estimate a loss of 50% if infestation is heavy.

Currently Registered Pesticides

Pesticide	Effi-cacy *	Pros	Cons	Comments
Cyfluthrin Baythroid 2	G	Provides good control	Expensive	PHI 0 days
Esfenvalerate Asana XI	G	Provides good control	Expensive	PHI 7 days
Oxamyl Vydate	G	Fair control	organophosphate	PHI 14 days

Cultural and Biological Alternatives

Method	Pros	Cons	Comments
Crop rotation	Effective alternative	Loss of land to less valuable crops	
Plowing debris	Effective alternative	Labor intensive	
Row covers	Effective alternative	Costly to install	
Sanitation tillage	Effective alternative	Labor intensive	

2. Carrot Rust Fly

Acres Affected: Potentially all of the crop can be affected. Some control can be achieved through timing of the plantings. Later plantings have less of a problem with carrot rust fly.

Yield Losses: Sporadic problem but there could be a significant loss when it is present.

Growers estimate a loss of 50% if infestation is heavy.

Currently Registered Pesticides

Pesticide	Effi- cacy *	Pros	Cons	Comments
Diazinon	G	Soil drench at planting	Organophosphate	Check to see if registered. Used in NY

Cultural and Biological Alternatives

Method	Pros	Cons	Comments
Sticky traps	Inexpensive	Monitoring but not control	
Delay planting	Cool damp conditions favorable for insect	Crop harvest delayed	
Rotate with other crops	Effective	Loss of land to less valuable crop	
Turning over crop debris after harvest	Destroys alternate hosts.	Labor intensive	
Deep plow	Effective	Labor intensive	

3. Leafhoppers

Description of damage: Insect feeds on leaves and can also transmit aster yellows.
 Yield Losses: Sporadic problem but there could be a significant loss when present.
 Growers estimate a loss of 50% if infestation is heavy.

Currently Registered Pesticides

Pesticide	Effi- cacy *	Pros	Cons	Comments
Azadirachtin Neemix	G	Effective Control		
Carbaryl Sevin XLR Plus	G	Effective Control	Carbamate	
Cyfluthrin Baythroid 2	G	Effective Control	Expensive	PHI 0 days
Esfenvalerate Asana XI	G	Effective Control	Expensive	PHI 7 days

Cultural and Biological Alternatives: None identified.

*_Key: F=Fair; G=Good; E=Excellent; ?=Unknown

Diseases

1. Leaf Blights:

Alternaria and Cercospora bacterial leaf blights.

Description of damage: *Alternaria dauci* is a common fungal disease that causes brownish lesions that are often confused with bacterial blight. Moderate temperatures and prolonged leaf wetness favorable for development.

Cercospora blight affects younger foliage. Lesions begin as brown flecks.

Yield Losses: Sporadic problem in wet years or consistent problem all the time.

Currently Registered Pesticides

Pesticide	Effi-cacy *	Pros	Cons	Comments
Chlorothalonil Bravo Ultrex 82 WDG	G	Effective – standard fungicide	B-2 Carcinogen	PHI 0 days
Azoxystrobin (Quadris)	G	Effective		PHI 0 days
Pyraclostrobin (Cabrio)	G	Effective		PHI 0 days

*_Key: F=Fair; G=Good; E=Excellent; ?=Unknown

Cultural and Biological Alternatives

Method	Pros	Cons	Comments
Nitrogen may be beneficial	Helpful	If over-applied may cause hairy roots	
Disease-free seed if foliar blight is bacterial	Helpful	Limited selection of disease-free seed	
Use of resistant varieties	Helpful	Limited selection of seed	
Baby carrot production can escape some disease pressure	Helpful	Marketing issues	
Fall plowing of infected crop residues coupled with 2-3 year rotation	Helpful	Limits production of crop	
Elimination of host	Helpful	Difficult to identify hosts	
Sanitation	Helpful	Labor intensive	

Weeds

1. Weed control group: Stale seed bed and other preemergence

Currently Registered Pesticides

Pesticide	Effi- cacy *	Pros	Cons	Comments
Glyphosate, Roundup 4S	G-E	Effective on all weed species	Does not control seed stage. Corrosive in spray tanks. Drift issues	
Paraquat Gramoxone Max 3S	G-E	Works well with smaller weeds	Toxicity issues Not effective on larger weeds. Does not control seed stage. Drift.	
Pelargonic acid Scythe 4.3	F	Low toxicity.	Expensive. Does not control seed stage. Needs smaller weed size and bright sun. Offensive odor.	Sheep fat/ coconut flavored manure

*_Key: F=Fair; G=Good; E=Excellent; ?=Unknown

Cultural and Biological Alternatives

Method	Pros	Cons	Comments
Flaming	Works well on smaller weeds Cheaper than hand weeding	Timing critical, doesn't work well on smaller grasses or larger weeds	Safety issues. Applicator hazard, Brush fire danger, Equipment quality important. Propane gas, fire hazards
Shallow cultivation then plant seed	Lighter weight tractors not a compaction problem. Must be shallow cultivation	Must get weeds small, timing critical. More soil drying.	

2. Weed control group: Pre-plant incorporated

Currently Registered Pesticides

Pesticide	Effi-cacy *	Pros	Cons	Comments
Trifluralin Treflan	G-E	Labeled for several other crops. Broad range of crops on label saves on mixing additional tank loads.	Doesn't control mustard ragweed, nutsedge or galinsoga.	

*_Key: F=Fair; G=Good; E=Excellent; ?=Unknown

3. Weed control group: Pre-emergence

Currently Registered Pesticides

Pesticide	Effi-cacy	Pros	Cons	Comments
None available				

Pre-emergence

Cultural and Biological Alternatives

Method	Pros	Cons	Comments
Flaming	No residues.	Timing is critical to kill weeds without harming young crop plants. Doesn't work well on grasses.	12-hour window
Planting in fields without serious annual weeds the previous year.	Carrots very sensitive to weed pressure.		Weed maintenance is critical for carrot growth. Slow crop.
Weed surveys on fields.	Planning for future field use.		

4. Weed control group: Post emergence

Acres Affected: all

Yield Losses: Importance on carrot production cannot be overstated because we don't have pre-emergence products.

Currently Registered Pesticides

Pesticide	Effi-cacy *	Pros	Cons	Comments
Fluazifop Fusillade DX	G	Works well on summer annual grasses	Works only on grasses	
Linuron Lorox 50DF	G	Broad spectrum of weed control. Better on annual broadleaf.	Label requires at least 3" high carrot plants, at which time weeds are often beyond controllable size.	Needs earlier application timing
Metribuzin Sencor 75 DF	G	Broad spectrum. Better control on annual broadleaf weeds	Complicated label for carrots. Weak on some grasses. Label is conflicting to actual application timing.	
Pelargonic acid Scythe 4.3	G	Relatively nontoxic, wide range of crop registration.	definitely needs shielded spray may damage carrot crop	
Clethodim Select 2 EC	G	Used on grasses Better activity on cool season and perennial grasses	Works only on grasses	Use oil in mix. Can use non-ionic surfactant also.

*_Key: F=Fair; G=Good; E=Excellent; ?=Unknown

Cultural and Biological Alternatives

Method	Pros	Cons	Comments
Hand weeding essential in rows even with herbicide applications.	Some weeds slip through herbicide application. Can be done any time less weather dependent.	Can be prohibitively expensive. Timing issues to deal with.	Hand weeding in rows. Efficacy of herbicide is weather dependent, timing dependent.
Weed surveys	Can help avoid fields with high weed seed bank	Must be done during growing season, record keeping	

Cultivation	Effective between rows	Weather dependent and timing	Between rows
Baby Carrots	More dense plantings can reduce weed incidence		

Vertebrates

Deer and Woodchucks

Acres Affected: Varies yearly depending on pressure, control measures, and other crops in area.

Yield Losses: Up to 100% possible

Currently Registered Pesticides

None identified

Cultural and Biological Alternatives

Method	Pros	Cons	Comments
Fencing permanent wire	Effective	Expensive and impractical	
Shooting (crows, deer, geese, woodchuck)	Target guilty individuals	Safety concerns. Legal restrictions on timing.	Needs increased hunting permitting
Trapping	Woodchuck	Limited effectiveness, rabies exposure, unable to relocate. Labor intensive.	
Temporary electric	More affordable alternative for Deer	Requires weed-free strip.	
Smoke bombs in burrows	Effective for Woodchuck	Needs repeat applications	
Garlic and fish oil	Effective for Deer	Needs repeat applications	
Dogs trained to control wildlife problems	Effective	Training of animals	

IV. Appendices

Pesticide Efficacy for Insect and Mite Pests

Active ingredient	Brand name(s)	CW	CRF	LH
Cyflutherin	Baythroid 2	G		G
Esfenvalerate	Asana XL	G		G
Oxamyl	Vydate L	G		
Carbaryl	Sevin SLR			G
Azadirachtin	Neemix 4.5			G
Diazinon	Diazinon		G	

Pesticide Efficacy for Diseases

Active ingredient	Brand name(s)	Leaf Blight
Chlorothalonil	Bravo Ultrex 82 WDG	G
Pyraclostrobin	Cabrio EG	F
Azoxystrobin	Quadris	F

Pesticide Efficacy for Weeds

Active ingredient	Brand name(s)	Stale	Pre Plant	Pre Merge	Post
Glyphosate	Roundup 4s	G			
Paraquat	Gramoxone Max 3S	G			
Pelargonic acid	Scythe 4.3	G			
Trifluralin	Treflan 4 ED		G		
Fluazifop	Fusillade DX				G
Linuron	Lorox 50DF				G
Metribuzin	Sencor 75DF				G
Pelargonic acid	Scythe 4.3				G
Clethodim	Select 2EC				G

V. Acknowledgements

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