Crop Profile for Carrots in Texas

Prepared: August, 2001
Revised: May, 2003

Basic Commodity Information

- State Rank: 5
- % U.S. Production: 3%
- Acres Planted: 4500
- Acres Harvested: 4300
- Cash Value: $13,000,000
- Yearly Production Costs: $1800/Acre

Production Regions: Approximately one half of the Texas carrot production is in the lower Rio Grande Valley, a third is in the Winter Garden area (South West of San Antonio) and the balance is on the Plains (Lubbock).
Cultural Practices

Carrots can be produced in a wide range of soil types but grow best in a deep well-drained sandy loam with no hardpan. Frequently planted varieties include TX Gold Spike, Caro-spike, Caro-choice, Orlando Gold, Blazer, Navajo and Cheyenne. Carrot seed are small (23,000/oz), often precision planted (1/8"-1/4" deep) July through November and harvested from December through May. The most critical water requirement period is just after planting when seed beds must be kept moist. Over a typical growing season 10-15" of water will be required. Fertilizer (80-80-100 actual per acre) is applied preplant followed by 1-2 side-dressings depending on growing conditions.

Most of Texas commercial carrots are machine harvested. Those grown for fresh market may be hand harvested but are generally dug mechanically. In the packing shed the carrots are moved and sorted by machine with hand grading. Freshly harvested carrots must be cooled to aide in shelf life. Secondary processing occurs for various cut carrot consumer items such as slices, wedges and 'baby carrots.'

Commodity Destination(s):

- Fresh Market 50%
- Processing 50%

Insect Pests

Foliage Feeding Insects
Aphids, armyworms, flea beetles, leafhoppers and mites

Frequency of Occurrence: Foliage feeding insects are occasional pests of carrots.

Damage Caused: Foliage feeding insects destroy carrot plant stems and leaves. Specific type of damage will depend on the pest species.

% Acres Affected: 30%

Pest Life Cycles: Specific pests are most often damaging in specific phases of their life cycles. Aphids and mites can damage as both immature and adults. Those causing damage as immatures include armyworms and cutworms. Flea beetles will cause most of their damage as adults but immatures can harm roots.

Timing of Control: Initiation of foliage feeder pest control in carrots depends on pest population levels. However, because of abundant foliage, large numbers of pests are required before economic damage occurs.
**Yield Losses:** Yield losses are slight except with heavy leaf destruction.

**Biological Control Practices:** Naturally occurring parasites and predators can play an important role in controlling leaf feeding pests.

**Post-Harvest Control Practices:** Post harvest control techniques are generally not an option with foliage feeders in carrots.

**Chemical Controls:**

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>%/A Trt.</th>
<th>Type of Appl.</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl</th>
</tr>
</thead>
<tbody>
<tr>
<td>esfenvalerate (Asana)</td>
<td>27</td>
<td>ground and air</td>
<td>.03 lb ai/A</td>
<td>Apply on an as needed basis for control of leafhoppers, cutworms, armyworms and weevils.</td>
<td>2</td>
</tr>
<tr>
<td><strong>Use in IPM Programs:</strong></td>
<td></td>
<td></td>
<td></td>
<td>Used in IPM programs on an as needed based on infestation levels.</td>
<td></td>
</tr>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td></td>
<td></td>
<td></td>
<td>Important as an alternative chemistry.</td>
<td></td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td></td>
<td></td>
<td></td>
<td>Can cause aphid outbreaks if used too frequently. Not as efficacious as methyl parathion or methomyl.</td>
<td></td>
</tr>
<tr>
<td><em>Diazinon</em> (diazinon)</td>
<td>5</td>
<td>air and ground</td>
<td>.5-1.5 lbs ai/A depending on pest</td>
<td>Apply as pests occur, taking care not to follow a schedule.</td>
<td>2</td>
</tr>
<tr>
<td><strong>Use in IPM Programs:</strong></td>
<td></td>
<td></td>
<td></td>
<td>Used in IPM programs based on infestation levels.</td>
<td></td>
</tr>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td></td>
<td></td>
<td></td>
<td>Important in resistant management programs as an alternative chemistry.</td>
<td></td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td></td>
<td></td>
<td></td>
<td>No known efficacy issues in carrots. No current replacement for soil insecticides.</td>
<td></td>
</tr>
</tbody>
</table>

**Alternatives:**
### Alternatives and Efficacy

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulfil</td>
<td>A new material used on a limited basis for aphids</td>
</tr>
<tr>
<td>Malathion</td>
<td>Not as efficacious as Asana</td>
</tr>
<tr>
<td>Methyl Parathion</td>
<td>Good against armyworms and carrot weevil</td>
</tr>
<tr>
<td>Methomyl</td>
<td>Efficacious against fall armyworm</td>
</tr>
<tr>
<td>Oxamyl</td>
<td>Alternative to Asana</td>
</tr>
</tbody>
</table>

### Soil Insects

Carrot weevil, white grub, wireworm, fire ant and cutworm

**Frequency of Occurrence:** Soil insect pests are generally a minor problem in carrots. However, carrot weevils, white grubs, wireworms and cutworms occasionally cause economic loss.

**Damage Caused:** Soil inhabiting carrot insect pests destroy below ground plant parts, roots and stems. Some above ground feeding may be observed from cutworms. Wireworms and carrot weevil immatures bore into carrot tubers, destroying roots and providing entry ways for certain pathogens. White grubs feed on roots and reduce marketability.

**% Acres Affected:** 10%

**Pest Life Cycles:** Wireworms are the immature stage of click beetles which, as adults, do not harm plants. Cutworms are the beginning life stages of Noctuid moths but only cause damage as immatures. The carrot weevils cause damage as adults and immatures, tunneling into roots. White grubs are the damaging stage of June beetles. In insects, often the early immatures are the life stages that are most susceptible to control measures.

**Timing of Control:** Soil insecticides may be used where there is a history of wireworm or cutworm damage. Carrot weevil is controlled based on insect counts. All treatments are generally in early season.

**Yield Losses:** Yield losses are sporadic but can be serious in isolated situations.

**Cultural Control Practices:** Crop rotation is an effective control method but field inspections should be made.

**Biological Control Practices:** Natural enemies may offer a measure of control for carrot soil insect pests, particularly for cutworms, but research documentation is limited.

**Post-Harvest Control Practices:** Soil pests are not a post harvest problem in carrots.
### Diseases

**Leaf Fungal Diseases**

Leaf Blight - *Alternaria dauci*, Leaf spot - *Cercospora carotae*

**Frequency of Occurrence:** Leaf blight and Leaf spot occurrence in carrots is directly related to environmental conditions. Favored by wet, rainy weather, leaf blight and leaf spot infestations can occur anytime during a production cycle but are most damaging early in the season.

**Damage Caused:** Leaf blight on carrots appears as dark brown to black irregularly shaped lesions on petioles and leaf blades. The blight can cause root decay and severely damaged tops can hinder carrot harvest. Leaf spot infects young leaves first as spots that are small and round with tannish-gray to black centers and a yellow halo. Several spots on the same leaf may cause withering and death. Leaf spot lesions that develop on leaf stalks are pale centered, elliptical, tan spots.

**% Acres Affected:** 95% Leaf Blight, 10% Leaf Spot
Pest Life Cycles: Alternaria leaf blight is often considered to be the most devastating disease of carrots. Cercospora leaf spot is also a leaf blight and like Alternaria is influenced by warm humid conditions. These pathogens survive on crop residue and volunteer carrots and do not survive once crop residue has broken down. These fungi are transmitted by contaminated seed and can be carried by wind or water.

Timing of Control: Generally leaf disease control is initiated when symptoms first become evident and will continue on a cycle as long as favorable weather exists.

Yield Losses: Yield losses to leaf diseases, particularly Alternaria leaf blight, can be as high as 100% (actual about 10%) if no fungicide is applied.

Regional Differences: Often a problem in the more humid areas when inoculum are present and where irrigation is used, the potential for leaf disease damage is statewide.

Cultural Control Practices: Leaf blight of carrots can be reduced by crop rotation, and good crop residue destruction.

Biological Control Practices: No biological controls are available for leaf diseases in carrots.

Post-Harvest Control Practices: Crop residue destruction is a cultural control practice for leaf diseases in carrots.

Chemical Controls:

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>%/A Trt</th>
<th>Type of Appl.</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>iprodione</td>
<td>1</td>
<td>ground</td>
<td>1-2 pints of Rovral 4F</td>
<td>Typically applied at first signs of leaf blight and spot disease and continue at regular intervals as needed.</td>
<td>2</td>
</tr>
</tbody>
</table>

Use in IPM Programs: Iprodione use in carrots is not part of an IPM program. There are some disease forecasting models available.

Use in Resistance Management: May alternate with chlorothalonil.

Efficacy Issues: Environmental conditions may enhance need for leaf blight control.
<table>
<thead>
<tr>
<th><strong>Chlorothalonil (Bravo)</strong></th>
<th>35</th>
<th>ground</th>
<th>1 lb</th>
<th>Typically applied at first signs of leaf blight and spot disease and continue at regular intervals as needed.</th>
<th>1.5</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Use in IPM Programs:</strong></th>
<th>May be used based on disease forecasting.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td>Can alternate chlorothalonil with iprodione.</td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td>No known efficacy issues related to the use of chlorothalonil in carrots.</td>
</tr>
<tr>
<td><strong>pyraclostrobin (Cabrio EG)</strong></td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Use in IPM Programs</strong></th>
<th>Should be used prior to disease development.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use in Resistance Management</strong></td>
<td>May be alternated with Bravo.</td>
</tr>
<tr>
<td><strong>Efficacy Issues</strong></td>
<td>Possible not as efficacious as some of older materials.</td>
</tr>
</tbody>
</table>

**Bacterial Blight**  
*Xanthomonascampestris* pv. *carotae*

**Frequency of Occurrence** Heavy rain and resulting water soaking favors blight

**Damage Caused:** The disease first manifests itself as irregular brown spots on leaves, often beginning on the margins. Lesions initially have an irregular, yellow halo that may appear watersoaked. These will ultimately come together as dark brown streaks and cause a leaf blight. Floral parts may also be affected. A diagnostic sign of the disease is a sticky amber-colored bacterial exudate, which may be seen flowing downward on leaves, petioles and flower stalks.

**% Acres Affected:** 10%

**Pest Life Cycle:** The bacterial blight pathogen is seed borne, and can survive in crop debris. The plant to plant spread is by splashed rain and irrigation water. During periods of leaf wetness, spread can be caused by insects and equipment movement. A certain bacterial population threshold is required before disease epidemics can occur. Seed lots with low bacterial populations do not lead to disease problems.
**Timing:** Avoid bacterial infected seed or treat with hot water.

**Yield losses:** Actual loss is 1%, potential loss is 20%.

**Regional Differences:** More problems in humid areas and with overhead irrigation.

**Cultural control practices:** Crop rotation, furrow irrigation and crop residue distruction.

**Biological Controls:** None

**Post-Harvest:** Plow up plant residue.

**Chemical Controls:** There are no registered chemicals for this disease but copper will reduce damage.

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**Powdery mildew**  
*Erysiphe polygoni*

**Frequency of Occurrence:** Powdery mildew is generally not a serious Texas pest except in late carrots. It is controlled with leaf blight control applications.

**Damage Caused:** Powdery mildew effects carrot by turning the leaves white.

**% Acres Affected:** 10%

**Pest Life Cycles:** Powdery mildew overwinters on carrots and alternate hosts. Powdery mildew spores are spread by the wind. Disease development is favored by high humidity and warm temperatures below 90 degrees Fahrenheit.

**Timing of Control:** Control applications are not made until disease is detected.

**Yield Losses:** In heavily infested fields crop loss can be significant.

**Regional Differences:** Often more of a problem in furrow irrigated fields in South Texas and the Winter Garden.

**Cultural Control Practices:** Cultural control practices include field sanitation and crop rotation.

**Biological Control Practices:** A naturally occurring biocontrol agent called *Ampelomyces quisqualis*, sold commercially as AQ10 has shown promise against powdery mildew in some crops but little is
known about the product under Texas conditions.

**Post-Harvest Control Practices:** Post harvest control practices for powdery mildew in carrots centers around field sanitation and destruction of alternative hosts.

**Chemical Controls:**

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>%/A Trt.</th>
<th>Type of Appl.</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sulfur</strong> <em>(Sulfur 92w, Spray Sulfur, Sulfa 80)</em></td>
<td>1</td>
<td>Ground application</td>
<td>10-30 lbs sulfur /A</td>
<td>Applications are made as disease begins to appear.</td>
<td></td>
</tr>
</tbody>
</table>

**Use in IPM Programs:** Sulfur treatment for powdery mildew in carrots is not part of an IPM program.

**Use in Resistance Management:** Powdery mildew has not been shown to be resistant to sulfur.

**Efficacy Issues:** Efficacy of sulfur on powdery mildew is good.

<table>
<thead>
<tr>
<th>pesticide</th>
<th>%/A Trt.</th>
<th>Type of Appl.</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>pyraclostrobin <em>(Cabrio)</em></td>
<td>10</td>
<td>ground</td>
<td>1 pt</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

**Seedling Diseases**

**Frequency of Occurrence:** Generally not a problem because of treated seed. Occurrence could be up to 100% without seed treatment.

**Damage Caused:** Kills young roots. Can cause multiple root formation and root length may be effected.

**% Acres Affected:** 100%

**Pest Life Cycles:** Usually only affects very young plant tissue. Fungi are spread by contaminated soil and crop residue movement. Worst in cool, wet weather due to wide host range.

**Timing of Control:** Critical to time control measures at planting.

**Yield Losses:** Yield losses can be high because of young plant destruction early in season.

**Regional Differences:** The occurrence of seedling diseases is wide spread, particularly where sound
Cultural Control Practices: Cultural control includes field sanitation. Plant seed in debris free beds that allow for good drainage.

Biological Control Practices: There are currently no biological control practices in place for seedling diseases of carrots.

Post-Harvest Control Practices: Post harvest control includes proper handling of harvested material.

Other Issues: Over watering can increase the chances of seedling disease occurrence.

Chemical Controls:

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>%/A Trt.</th>
<th>Type of Appl.</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captan (Captan 75)</td>
<td>100</td>
<td>seed treatment</td>
<td>9 oz /100 lb seed</td>
<td>Applied at planting.</td>
<td>1</td>
</tr>
</tbody>
</table>

Use in IPM Programs: Seed treatments may be an important part of an IPM Program.

Use in Resistance Management: Resistance management is not an issue with Captan seed treatments.

Efficacy Issues: There are no known efficacy problems with Captan treated carrot seed.

Alternatives:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mefenoxam soil treatments is an alternative</td>
<td>Controls only pythium and phytophthora but not Rhizoctonia sp.</td>
</tr>
</tbody>
</table>

Weeds

Frequency of Occurrence: Annual and perennial broadleaf and grass weeds are a common problem in carrots where as many as 50 different plants are capable of causing economic loss.

Damage Caused: Weeds compete with carrots for space, nutrients and moisture. This competition is most serious early in the season when crop seedlings are becoming established.
% Acres Affected: 100%

Pest Life Cycles: Annual plants begin each growing season from seed and perennials continue from year to year as established plants. Some weeds such as purple nutsedge reproduce from tubers. Other weeds that have a tap root not only compete with the carrot, but the root as well as the above ground plant can interfere with harvest. Winter annual broadleaves are a particular problem in carrots because of similar growth habits. Any plant other than a carrot growing in a carrot field would be considered a weed. Of the more than 50 weed species known to occur in carrots the most common is pigweed (Amaranthus spp). Nutsedge (Cyperus spp) is of concern because of control difficulties. Dodder, a parasitic plant, can be a problem because it entangles the carrot making harvest difficult.

Timing of Control: Preplant treatments are applied to control the major populations and flushes of weeds. Once a crop has emerged some post emergence herbicides are applied over the top to kill escaping weeds. Applications made prior to planting are the most critical. It is generally very important to stay ahead, however, of any potential weed problem. Once a weed becomes established, control can be very difficult.

Yield Losses: Yield loss will depend on weed density. Losses can be as high as 100% where weed populations are extremely high.

Regional Differences: Individual weed species occurrence will vary from location to location but are generally managed with broad spectrum herbicides.

Cultural Control Practices: Cultural weed control is an important part of carrot production management practices but is often not a viable postemergence option. There are cultural control techniques that can be used in carrots but with the large fields found in commercial production, this is not economically feasible. Irrigation management, hand weeding, field selection, plant dates and cultivation are all cultural practices that can be applied in carrots but each has its limitations.

Biological Control Practices: Biological control of weeds in carrots is not a production option.

Post-Harvest Control Practices: Keeping fields weed free after harvest can reduce weed problems the following season.

Chemical Controls:

<table>
<thead>
<tr>
<th>Pesticide</th>
<th>% A Trt.</th>
<th>Type of Appl.</th>
<th>Typical Rates</th>
<th>Timing</th>
<th># of Appl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linuron (Lorox)</td>
<td>95</td>
<td>ground and/or air</td>
<td>.25-1 lb ai/Acre</td>
<td>preplant</td>
<td></td>
</tr>
<tr>
<td><strong>Use in IPM Programs:</strong></td>
<td>Linuron use in carrots is currently not part of an IPM program.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td>Resistance management can be practiced by using alternative chemistry.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td>Efficacious against a broad range of broadleaf and grass weeds.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trifluralin (Treflan)</strong></td>
<td>70</td>
<td>ground</td>
<td>.5-1 lb ai/acre</td>
<td>preplant incorporated</td>
<td></td>
</tr>
<tr>
<td><strong>Use in IPM Programs:</strong></td>
<td>Treflan use in carrots is not part of an IPM program.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td>Resistance potential can be managed with alternative chemistry.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td>Treflan can only be used preplant.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>fluazifop-P-butyl (Flusilade)</strong></td>
<td>25</td>
<td>ground/air</td>
<td>.09-.375 ai/a</td>
<td>Post-emergence</td>
<td>2</td>
</tr>
<tr>
<td><strong>Use in IPM Programs:</strong></td>
<td>Possible use in lieu of a preventative preplant or pre-emerge application on an as needed basis.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td>Offers an alternative chemistry option.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td>Not as effective as Linuron.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>metribuzin (Sencor)</strong></td>
<td>10</td>
<td>ground</td>
<td>.1-.2 lb ai/acre</td>
<td>Post-emergence</td>
<td>1</td>
</tr>
<tr>
<td><strong>Use in IPM Programs:</strong></td>
<td>Can be used where only broadleaf weeds are a problem.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td>Offers an alternative chemistry option.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td>Effective against broadleaf weeds only.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sethoxydin (Poast)</strong></td>
<td>5</td>
<td>ground</td>
<td>.2-.25 lb ai/A</td>
<td>Post-emergence</td>
<td>1</td>
</tr>
<tr>
<td><strong>Use in IPM Programs:</strong></td>
<td>Can be used in situations where only grasses are a problem.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Use in Resistance Management:</strong></td>
<td>Offers an alternative chemistry option.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Efficacy Issues:</strong></td>
<td>Effective only against grasses.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Contacts

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References

Appendix

Texas Carrot requests currently in the IR-4 system

Diseases

IR4 No. 07034 -azoxystrobin; alternaria, cercospera, septoria blight, leafspots, downy mildew
IR4 No. 07090 -cyprodinil + fludioxonil; alternaria, cercospora IR4 No. 07094 -fluazinam; foliar diseases, alternaria, cercospora
IR4 No. 07457 -fludioxonil; damping off due to rhizoctonia
IR4 No. 07631 -pyraclostrobin; alternaria, cercospora, powdery mildew

Insects

IR4 No. 07089 -bifenthrin; fire ants, foliar pests, carrot weevil
IR4 No. 08643 -diflubenzuron; carrot weevil
IR4 No. 06887 -fipronil; root maggots, fleabees
IR4 No. 08644 -thiacloprid; carrot weevil
IR4 No. 07468 -thiamethoxam; soil dwelling insects, carrot weevil
Weeds

IR4 No. 01431 - metribuzin; grasses, broadleaf weeds
IR4 No. 03754 - oxamyl; root knot
IR4 No. 04084 - pendimethalin; broadleaf weeds & annual grasses
IR4 No. 01243 - glyphosate; annual, perennial weeds