

# Root Crops

## Beet, Carrot, Parsnip, Radish, Rutabaga, and Turnip

### Spacing

**Beets:** Rows 18 to 24 inches apart. Seed 8 to 10 pounds per acre for bunching.

**Carrots:** Rows 16 to 30 inches apart. Plant 20 to 30 per foot for slicing/fresh market; 10 to 20 plants per foot for dicing.

**Parsnips:** Rows 18 to 24 inches apart. Seed 2 to 3 pounds per acre.

**Radishes:** Rows 15 inches apart. Plant 12 to 15 per foot of row. Seed 10 to 15 pounds per acre.

**Turnips:** Rows 14 to 18 inches apart. Plant 2 to 3 inches apart in row. Seed 1 to 2 pounds per acre.

### Fertilizing

**Lime:** To maintain a soil pH of 6.0 to 6.8; for beets, 6.5 to 7.0.

**Preplant:** N: 60 pounds per acre. P<sub>2</sub>O<sub>5</sub>: 20 to 160 pounds per acre. K<sub>2</sub>O: 0 to 200 pounds per acre. Adjust according to soil type, previous management, and soil test results for your state. If soil tests indicate that a high amount of K is necessary, plow down at least half the requirement. Beets also respond to boron when grown on sandy soils, light-colored silt and clay loams, and alkaline, dark-colored soils. Boron may be omitted on acid, dark-colored soils. Based on a boron soil test, include boron at 2 1/2 to 5 pounds per acre applied over the row at planting. Do not contact with seed. Boron is toxic to many vegetables, particularly beans, peas, and cucurbits. Thus, rotational plans may have to be adjusted. For carrots grown on muck soil with a soil pH greater than 6.0, add 6 pounds of manganese per acre.

### Sidedress N

**Beets, carrots, parsnips:** for soils with more than 3 percent organic matter and following soybeans, alfalfa or a grass-legume hay crop, apply 30 pounds N per acre 4 to 6 weeks after planting. For soils with less than 3 percent organic matter and the above rotation, apply 45 pounds N per acre. Following corn, rye, oats, wheat, or a vegetable crop, apply 60 pounds N per acre.

**Radish, turnip:** none needed.

### Pesticide Use in Greenhouses

Before using any pesticide, always read the product label for mention of greenhouse restrictions. See Selected Information About Recommended Fungicides (page 79), Selected Information About Recommended Herbicides (page 69), and Selected Information About Recommended Insecticides (page 54).

### Disease Control

#### Recommended Controls

##### **Cavity Spot of Carrots - Pythium Fungus**

Cavity spot can affect root quality and yield.

**Presidio® (fluopicolide)** Carrot 4 fl. oz. per acre. Labeled for in-furrow applications. Use 5-10 gallons of water per acre. REI: 12-hour. PHI: 7-day

**Ranman 400SC® (cyazofamid)** Carrot 6 fl. oz. per acre. REI: 12-hour. PHI: 14-day PHI.

**Reason 500SC® (fenamidone)** Carrot 8.2 fl. oz. per acre. REI: 12-hour. PHI: 14-day.

**Ridomil Gold Bravo SC® (mefenoxam, chlorothalonil)** Carrot 1.5-2.5 pts. per acre. REI: 48-hour. PHI: 7-day.

**Ridomil Gold SL® (mefenoxam)** Carrot See application notes. Preplant incorporation or soil spray: 0.5-1.3 pts. per acre. Postplant chemigation, shanked in, or directed spray: 0.25-1 pt. per acre. REI: 48-hour. PHI: 7-day.

**Ultra Flourish® (mefenoxam)** Carrot See application notes Preplant incorporation or soil spray: 1-2.6 pts. per acre. Postplant chemigation, shanked in, or directed spray: 0.5-2 pts. per acre. REI: 48-hour. PHI: 7-day.

##### **Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens**

Conditions that favor rapid seedling germination may limit damping-off severity. Avoid excessive irrigation and poorly drained soils.

**Presidio® (fluopicolide)** Beet, Parsnip, Radish, Turnip 3-4 fl. oz. per acre. Pythium damping-off only. REI: 12-hour. PHI: 7-day.

**Quadris 2.08SC® (azoxystrobin)** *Beet, Parsnip, Radish, Turnip* 0.4-0.8 fl. oz. per 1,000 row-feet. REI: 4-hour. PHI: 0-day.

**Reason 500SC® (fenamidone)** *Beet, Parsnip, Radish, Turnip* 8.2 fl. oz. per acre. Pythium damping-off only. REI: 12-hour. PHI: 14-day.

**Uniform® (mefenoxam, azoxystrobin)** *Beet, Parsnip, Radish, Turnip* 0.34 fl. oz. per acre per 1,00 ft. of row. Make one application per crop season. REI: 0-hour. PHI: NA

### **Leaf Blight of Carrots - Xanthomonas Bacteria**

Copper products that are labeled for *Cercospora* may be helpful; however, bacteria may become resistant to copper products. Early bacterial leaf blight symptoms may mimic *Alternaria* leaf spot.

Bacteria may occur on seed and can survive on carrot debris in soil. Bacteria spread within a field by rain or overhead irrigation. Under dry conditions, low levels of bacterial leaf blight may not result in significant crop loss. Under hot and wet conditions, high levels of bacterial blight may develop and lead to premature defoliation and an inability to harvest the roots via a mechanical harvester. Work under blighted fields as soon as the crop is harvested so the infected foliage can decompose rapidly, which will reduce the survival of the bacteria in the soil.

**copper formulations (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide)**

*Carrot* Copper products labeled for *Cercospora* may provide some control. REI: see label.

### **Leaf Blight of Root Crops - Alternaria Fungus**

Practice a 3-4 year crop rotation. Scout fields to initiate a spray program when foliar blights are first detected (trace of disease). TOM-CAST with 15 disease severity values (DSVs) can help carrot farmers time their fungicide applications for control of foliar blights. See Disease Forecasting Systems for details. *Cercospora* leaf spot is sometimes known as early blight. *Alternaria* leaf blight is sometimes known as late blight.

**azoxystrobin formulations (azoxystrobin)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 6-15.5 fl. oz. per acre. *Alternaria* (late blight) diseases only. REI: 4-hour. PHI: 0-day.

**Cabrio EG® (pyraclostrobin)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 8-12 oz. per acre. REI: 12-hour. PHI: 0-day

**chlorothalonil formulations (chlorothalonil)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* See label. REI: 12-hour.

**Endura® (boscalid)** *Carrot* 4.5 oz. per acre. REI: 12-hour. PHI: 0-day.

**Flint® (trifloxystrobin)** *Beet, Carrot, Parsnip, Turnip* 2-3 oz. per acre. Carrot, beet, Parsnip and turnip only. REI: 12-hour. PHI: 7-day.

**Fontelis® (penthiopyrad)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 16-30 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

**Gem 500SC® (trifloxystrobin)** *Beet, Carrot, Parsnip, Turnip* 1.9-2.9 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**iprodione formulations (iprodione)** *Carrot* 1-2 pts. per acre. Iprodione 4L AG®, Rovral 4 Flowable®, and Meteor® are some formulations. REI: 24-hour. PHI: 0-day.

**Luna Sensation® (fluopyram, trifloxystrobin)** *Carrot* 4-7.6 fl. oz. per acre. *Alternaria* leaf blight on carrot only. REI: 12-hour. PHI: 7-day.

**Luna Sensation® (fluopyram, trifloxystrobin)** *Parsnip, Radish, Turnip* 5-5.8 fl. oz. per acre. *Alternaria* leaf blight of parsnip, radish, turnip only. REI: 12-hour. PHI: 7-day.

**Luna Tranquility® (fluopyram, pyrimethanil)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 8-11.2 fl. oz. per acre. REI: 12-hour. PHI: 7-day

**Merivon® (fluxapyroxad, pyraclostrobin)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 4-5.5 f. oz. per acre. REI: 12-hour. PHI: 7-day.

**Omega 500F® (fluazinam)** *Carrot* 1 pt. per acre. *Alternaria* (late blight) on carrot only. REI: see label. PHI: 7-day.

**Pristine 38WG® (boscalid, pyraclostrobin)** *Carrot* 8-10.5 oz. per acre. REI: 12-hour. PHI: 0-day.

**Propimax EC® (propiconazole)** *Carrot* 4 fl. oz. per acre. REI: 12-hour. PHI: 14-day.

**Quadris Opti® (azoxystrobin, chlorothalonil)** *Carrot* 2.4 pts. per acre. Carrot only. REI: 12-hour. PHI: 0-day.

**Quadris Top® (azoxystrobin, difenoconazole)** *Carrot* 12-14 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**Quilt® (azoxystrobin, propiconazole)** *Carrot* 14 oz. per acre. Carrot only. REI: 12-hour. PHI: 14-day.

**Quilt Xcel® (azoxystrobin, propiconazole)** *Carrot* 14 fl. oz. per acre. Carrot only. REI: 12-hour. PHI: 14-day.

**Switch 62.5WG® (cyprodinil, fludioxonil)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 11-14 oz. per acre. Do not exceed 2 applications to radish. REI: 12-hour. PHI: 7-day.

**tebuconazole formulations (tebuconazole)** *Beet* 3-7.2 fl. oz. per acre. Tebuconazole formulations include Monsoon®, Onset 3.6L®, Orious 3.6F®, Tebuzol 3.6F®. REI: see label. PHI: 7-day.

**Tilt® (propiconazole)** *Carrot* 4 fl. oz. per acre. Alternaria (late blight) on carrot only. REI: 12-hour. PHI: 14-day.

### **Leaf Spot of Radish - Septoria Fungus**

Practice a 3-year crop rotation. Plow residue as soon as possible after harvest. Avoid volunteer plants and cruciferous weeds.

**Crop rotation** *Radish* Rotate between crop families to reduce disease inoculum buildup.

### **Leaf Spot of Root Crops - Cercospora Fungus**

Practice a 3-4 year crop rotation. Scout fields to initiate a spray program when foliar blights are first detected (trace of disease). TOM-CAST with 15 disease severity values (DSVs) can help carrot farmers time their fungicide applications for control of foliar blights. See Disease Forecasting Systems for details. Cercospora leaf spot is sometimes known as early blight. Alternaria leaf blight is sometimes known as late blight.

**azoxystrobin formulations (azoxystrobin)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 6-15.5 fl. oz. per acre. Alternaria (late blight) diseases only. REI: 4-hour. PHI: 0-day.

**azoxystrobin formulations (azoxystrobin)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 9-15.5 fl. oz. per acre. Cercospora (early blight) diseases only. REI: 4-hour. PHI: 0-day.

**Cabrio EG® (pyraclostrobin)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 8-12 oz. per acre. REI: 12-hour. PHI: 0-day

**chlorothalonil formulations (chlorothalonil)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* See label. REI: 12-hour.

**copper formulations (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* REI: see label.

**Flint® (trifloxystrobin)** *Beet, Carrot, Parsnip, Turnip* 2-3 oz. per acre. Carrot, beet, Parsnip and turnip only. REI: 12-hour. PHI: 7-day.

**Fontelis® (penthiopyrad)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 16-30 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

**Gem 500SC® (trifloxystrobin)** *Beet, Carrot, Parsnip, Turnip* 1.9-2.9 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**Merivon® (fluxapyroxad, pyraclostrobin)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 5.5 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**Quadris Opti® (azoxystrobin, chlorothalonil)** *Carrot* 2.4 pts. per acre. Carrot only. REI: 12-hour. PHI: 0-day.

**Quadris Top® (azoxystrobin, difenoconazole)** *Carrot* 12-14 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**Quilt® (azoxystrobin, propiconazole)** *Carrot* 14 oz. per acre. Carrot only. REI: 12-hour. PHI: 14-day.

**Quilt Xcel® (azoxystrobin, propiconazole)** *Carrot* 14 fl. oz. per acre. Carrot only. REI: 12-hour. PHI: 14-day.

**tebuconazole formulations (tebuconazole)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 4-7.2 fl. oz. per acre. Turnip only. REI: see label. PHI: 7-day.

### **White Mold (Timber Rot) of Multiple Crops - Sclerotinia Fungus**

Practice a 3-year crop rotation. Avoid rotating with beans, cucurbits, and late cabbage.

**Endura® (boscalid)** *Carrot* 7.8 oz. per acre. Carrot only. REI: 12-hour. PHI: 0-day.

**Fontelis® (penthiopyrad)** *Beet, Carrot, Radish, Turnip* 16-30 fl. oz. per acre. REI: 12-hour. PHI: 0-day.

**Luna Sensation® (fluopyram, trifloxystrobin)** *Beet, Parsnip, Radish, Turnip* 5.8 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**Luna Sensation® (fluopyram, trifloxystrobin)** *Carrot* 7.6 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**Luna Tranquility® (fluopyram, pyrimethanil)** *Beet, Carrot, Parsnip, Radish, Rutabaga, Turnip* 11.2 fl. oz. per acre. REI: 12-hour. PHI: 7-day.

**Omega 500F® (fluazinam)** *Carrot* 1 pt. per acre. REI: see label. PHI: 7-day.

### **White Rust of Brassicas - Albugo Fungus**

**Cabrio EG® (pyraclostrobin)** *Radish, Turnip* 8-16 oz. per acre. REI: 12-hour. PHI: 0-day.

**Ridomil Gold Copper® (mefenoxam, copper hydroxide)** *Radish* 1-2 lbs. per acre. Use as a foliar spray. REI: 48-hour. PHI: 7-day.

## Weed Control

Cultivation and hand hoeing are usually important components of weed control in root crops. Design bed and row spacing to match equipment that will be used. Use of a stale seedbed is helpful.

Prepare the seedbed several weeks in advance of planting, allow weeds to emerge, and kill weeds without bringing new weed seeds to the surface. This can be done with an herbicide labeled for the crop, flaming, or very shallow cultivation. It may be possible to plant without killing the weeds, and then kill them until just before the crop emerges.

If the time between seedbed preparation and planting is short, weed emergence can be sped up by putting a row cover over the soil. Weeds that emerge after seeding and before the crop can also be controlled with a labeled herbicide or flaming. For crops like carrots and parsnips that take a long time to emerge, controlling these weeds is especially useful, but it can also pay off for faster-emerging species like radishes or beets.

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops table.

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

## Recommended Controls

### **Burndown or Directed/Shielded Applications**

#### **Broadleaf and Grass Weeds**

**glyphosate formulations (glyphosate)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae per gal. (4 lbs. isopropylamine salt per gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae per gal. (5 lbs. potassium salt per gal.) at 0.66-3.3 qt. per acre. Broadcast before seeding, or apply between crop rows with wipers or hooded or shielded sprayers. Use lower rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. For carrot and rutabaga only wipers may be used over top of crop, see label. REI: 4-hour. PHI: 14-day for applications directed between rows, 7-day for wiper applications on carrot only.

**Gramoxone SL 2.0® (paraquat)** *Carrot, Turnip* 2-4 pts. per acre. Use 1 qt. of COC or 4-8 fl. oz. of NIS per 2.5 gals. of spray solution. Apply before or after seeding but before crop emerges. REI: see label. RUP.

### **Preemergence Broadleaf and Grass Weeds**

#### **Dual Magnum® (s-metolachlor)**

*Carrot* 0.5-2.0 pts. per acre. Illinois, Indiana, Michigan, Minnesota, and Ohio only — applicators must have 24c label. Illinois label expires December 31, 2024. Michigan and Ohio labels expire December 31, 2021. Minnesota label expires Dec 31, 2022. Apply as broadcast after planting but before carrots emerge at 0.5-1.0 pt. per acre on mineral soils or 1.33-2.0 pts. per acre on muck soils. Or, apply as a postemergence broadcast application after carrots have 3-5 true leaves for residual control of weeds at 0.67-1.33 pt. per acre on mineral soils or 1.33-2.0 pts. per acre on muck soils. Do not apply both pre and postemergence. Only the postemergence application is allowed in Ohio. REI: 24-hour. PHI: 64-day.

*Beet, radish, and turnip root in Illinois, Indiana, Michigan and Ohio only; Parsnip and Rutabaga in Illinois, Indiana, and Michigan only.* Applicators must have 24c label. 0.67-1 pt. per acre on mineral soils, or up to 1.3 pts. per acre on muck soils. Apply before planting with or without incorporation, or apply after seeding before crop emerges. Risk of crop injury is generally greater with preplant incorporated applications than with preplant or preemergence applications. Risk of crop injury is greater on coarse-textured soils with less than 1.5% organic matter. Do not exceed 1.3 pts. per acre per crop or 1 application per crop. REI: 24-hour.

*Horseradish:* 1.0-1.33 pts. per acre. Apply after planting and before weeds emerge. Do not apply more than once per crop. REI: 24-hour.

#### **Lorox DF® (linuron)**

*Carrot* In Minnesota only, apply 1-2 lbs. per acre after planting but before carrots emerge. In Michigan and Ohio only, apply 1-3 lbs. per acre per acre after planting but before carrots emerge. Use low rate on coarse soils and higher rate on heavy soils and muck. Do not use on sand, loamy sand, or soils with less than 1% organic matter. In all states, apply 1.5-3 lbs. per acre as a broadcast spray after carrots are over 3 inches

tall. Will provide some residual control of non-emerged weeds. Do not apply if temperature is over 85 F. Repeat applications are allowed but must not exceed 4 lbs. per acre per season. REI: see label. PHI: 14-day.

**Celeriac** 1.5-3.0 lbs. per acre. Make a single application as a broadcast spray after celeriac has been transplanted and established, but before celeriac is 8 inches tall. Use low rate on coarse soils and higher rate on heavy soils and muck. Do not use on sand, loamy sand, or soils with less than 1% organic matter. Do not add surfactants, nitrogen (or other fertilizers), or other pesticides to the spray mix. REI: see label. PHI: 60-day.

**Horseradish** 1-3.0 lbs. per acre. Make a single application as a broadcast spray after planting or during dormancy, but before leaves emerge in spring. After planting irrigate before applying if it does not rain. Use lower rate on coarse soils and higher rate on heavy soils. Do not use on sand, loamy sand, or soils with less than 1% organic matter. REI: see label.

**Parsnip** 1.5-3.0 lbs. per acre. Make a single application as a broadcast spray after parsnip has been planted, but before emergence. Plant at least 0.5 inch deep. Use low rate on coarse soils and higher rate on heavy soils and muck. Do not use on sand, loamy sand, or soils with less than 1% organic matter. REI: see label.

**Nortron SC® (ethofumesate)** *Beet* Preemergence: 60 fl. oz. per acre. Apply at (or soon after) seeding, and before weeds germinate. Early postemergence: 5.25 fl. oz. per acre. Apply when beets have 2-4 true leaves. Postemergence: 10.5 fl. oz. per acre. Apply when beets have 6-8 true leaves. May cause temporary leaf fusion. May injure stressed plants. Use on mineral soils only. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour.

**Outlook® (dimethenamid-p)** *Horseradish* 12-21 fl. oz. per acre. Apply from 2-leaf stage to 8-leaf stage of horseradish. Cold, wet conditions at application may stunt horseradish. Will not control emerged weeds. REI: 12-hour. PHI: 40-day.

**Prowl H2O® (pendimethalin)** *Carrot* 2 pts. per acre. Apply within 2 days after seeding and before crop and weeds emerge. Or apply at layby as a directed spray between rows. Do not allow spray to contact carrot plants. Will not control emerged weeds. Do not exceed 2 pts. per acre per season. REI: 24-hour. PHI: 60-day.

**trifluralin formulations (trifluralin)** *Carrot, Radish* 0.5-0.75 lb. a.i. per acre. Use 4EC formulations at 1-1.5 pts. per acre. Use 10G formulations at 5-7.5 lbs. per acre. Apply and incorporate 1-2 inches before planting. Use low rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils. REI: 12-hour.

### **Preemergence Broadleaf Weeds**

#### **Caparol 4L® (prometryn)**

*Carrot* 1-2 pts. per acre. May stunt carrot. Use lowest rate on sandy soils. Do not apply after carrots have 6 leaves. Do not exceed 8 pts. per acre per year. REI: 12-hour. PHI: 30-day.

*Celeriac* 1.6-4 pts. per acre. Apply after transplanting after crop has 6-8 leaves. Use low rate on light soils. REI: 12-hour. PHI: 60-day.

**GoalTender® (oxyfluorfen)** *Horseradish* 1 pt. per acre for GoalTender 4SC®, or 2 pts. per acre for Goal 2XL®. Apply after planting prior to crop emergence. REI: see label.

**Spartan 4F® (sulfentrazone)** *Horseradish* Spartan 4F® at 2.25-8.0 fl. oz. per acre., or **Spartan Charge® (sulfentrazone and carfentrazone)** at 2.9-10.2 fl. oz. per acre. Spartan Charge® has postemergence contact activity. Broadcast in the spring before planting or after planting but at least 5 days before crop emergence; or band into row middles after crop emergence. Applications made in the spring shortly before planting may be incorporated, but do not incorporate at other times. Rainfall or irrigation is required to move herbicide into the soil when not incorporated. Do not broadcast if sprouts are close to soil surface, or over top of emerged crop. Do not use on sandy soils with less than 1% organic matter. Do not exceed 8 fl. oz. of Spartan 4F® per 12-month period. Do not exceed 10.2 fl. oz. of Spartan Charge® per 12-month period. REI: 12-hour.

### **Preemergence Grass Weeds**

**Ro-Neet® (cycloate)** *Beet* 0.5-0.67 gals. per acre. Apply before planting and incorporate immediately. Use on mineral soils only. REI: 48-hour.

### **Postemergence Broadleaf and Grass Weeds**

**glyphosate formulations (glyphosate)** See details above for Burndown or Directed/Shielded Applications Broadleaf and Grass Weeds.

**Lorox DF® (linuron)** *Carrot, Celeriac.* See details above for Preemergence Broadleaf and Grass Weeds.

**Nortron SC® (ethofumesate)** *Beet* See details above for Preemergence Broadleaf and Grass Weeds.

**Herbicides for Root Crops: Beet, Carrot, Horseradish, Radish and Turnip<sup>1</sup>**

Products (REI/PHI)	Common Name	Timing and Application Location Relative to Crop <sup>2</sup>				Incorporated	Timing Relative to Weeds		Weed Groups Controlled		Crops <sup>3</sup>					
		Before seeding/planting	After seeding / planting before emergence	Postemergence -between rows only	Postemergence		Preemergence	Postemergence	Annual grasses	Small-seeded broadleaves	Broadleaves	Beet	Carrots	Horseradish	Parsnip	Radish
Aim EC <sup>®</sup> (12h)	carfentrazone			X			X		X	X		X		X		X
Caparol <sup>®</sup> (12h/30d)	prometryn		X				X		X							
Dual Magnum <sup>®</sup> (24h/variable)	s-metolachlor	X	X					X			X			X		X
Goal <sup>®</sup> (12h/-)	oxyfluorfen		X				X		X		X					
Gramoxone <sup>®</sup> (12h to 24h)	paraquat	X	X					X	X		X					
Lorox 50DF <sup>®</sup> (24h/14d)	linuron	X	X				X		X					X		
Nortron SC <sup>®</sup> (12h/-)	ethofumesate	X	X				X		X		X					
Outlook <sup>®</sup> (12h/5-)	dimethenamid-P						X		X		X					
Poast <sup>®</sup> (12h/14d to 60d)	sethoxydim						X		X					X	X	X
Prowl <sup>®</sup> (12h/60d)	pendimethalin		X					X			X					
Ro-Neet <sup>®</sup> (12h/-)	cycloate	X							X		X					
Roundup <sup>®</sup> , others (12h/14d)	glyphosate	X		X				X	X		X			X	X	X
Select Max <sup>®</sup> , others (12h/15d to 30 d)	clethodim						X		X		X			X	X	X
Sencor <sup>®</sup> (12h/60d)	metribuzin						X		X		X					
Spartan <sup>®</sup> (12h/-)	sulfentrazone	X	X					X			X					
Spartan Charge <sup>®</sup> (12h/-)	sulfentrazone + carfentrazone	X	X					X			X			X		
Spin-Aid <sup>®</sup> (12h/60d)	phenmedipham							X			X					
Stinger <sup>®</sup> (12h/30d)	clopyralid						X		X		X					X
Treflan <sup>®</sup> , others (12h/-)	trifluralin	X									X					X
Upbeet <sup>®</sup> , (4h/30d)	trisulfuron						X		X		X					

<sup>1</sup>For effectiveness against specific weeds, see Relative Effectiveness of Herbicides for Vegetable Crops (page 68), and read label. This table does not include all label information. Be sure to read and follow all instructions and precautions on the herbicide label. Herbicides can cause serious crop injury and yield loss if not used properly.  
<sup>2</sup>X=permitted for at least one crop.  
<sup>3</sup>X=may be used for that crop; check label for application methods permitted.

## Postemergence Broadleaf Weeds

**Aim EC® (carfentrazone)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* 0.5-2.0 fl. oz. per acre. Apply with hooded sprayers as a directed application between crop rows. Use COC or NIS. Weeds must be actively growing and less than 4 inches tall. Do not allow spray to contact crop. Do not exceed 6.1 fl. oz. per acre per season. REI: 12-hour.

**Caparol 4L® (prometryn)** *Carrot, Celeriac* See details above for Preemergence Broadleaf weeds.

**metribuzin formulations (metribuzin)** *Carrot* Use 0.5 pt. per acre for 4F metribuzin formulations, 0.33 lb. per acre for 75DF metribuzin formulations. Broadcast after carrots have 5-6 true leaves and when weeds are less than 1 inch tall or across. Do not apply within 3 days of cool, cloudy weather, or other pesticide application, or when temperature is above 85°F. Do not exceed 1 application per season if carrots are rotated with onions; otherwise do not exceed 1 pt. of 4F products per acre per season, or 0.66 lb. of 75DF products per acre per season. REI: 12-hour. PHI: 60-day.

**Spin-Aid® (phenmedipham)** *Beet* 1.5-3 pts. per acre in 10-20 gals. of water. Apply to beets with at least 4 true leaves to avoid injury. Do not apply if beets are stressed. Does not control pigweed. Do not exceed 3 applications. REI: 12-hour. PHI: 60-day. *RUP*.

**Stinger® (clopyralid)** *Beet, Turnip* 4-8 fl. oz. per acre. Apply to beets when crop has 2-8 true leaves. Controls primarily composites and nightshade. Do not exceed 8 fl. oz. per acre per crop for beet. Do not exceed 1 application per crop for turnip. REI: 12-hour. PHI: 30-day.

**UpBeet® (triflurosulfuron)** *Beet* 0.5 oz. per acre. Apply postemergence when beets have 2-4 and 4-6 leaves to control velvetleaf and mustards. Suppresses lambsquarters, pigweed, nightshade, ragweed, smartweed, and wild buckwheat. Add 8 fl. oz. NIS per 25 gals. spray solution. Do not exceed 1.5 oz. per acre per season. REI: 4-hour. PHI: 30-day.

## Postemergence Grass Weeds

**clethodim formulations (clethodim)** *Beet, Carrot, Celeriac, Horseradish, Parsnip, Radish, Rutabaga, Turnip* Use 2EC formulations at 6-8 fl. oz. per acre with 1 qt. of COC per 25 gals. of spray solution (1% v/v). Use Select Max® at 9-16 fl. oz. per acre with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. Do not exceed 32 fl. oz. of 2EC formulations or 64 fl. oz. of

Select Max per acre per season. REI: 24-hour. PHI: 15-day for radish, 30-day for other listed crops.

**Fusilade DX® (fluazifop-P)** *Carrot* 10-12 fl. oz. per acre. Use 1-2 pts. of COC or 0.5-1 pt. of NIS per 25 gals. of spray solution. Spray on actively growing grass. REI: 12-hour. PHI: 45-day.

**Poast® (sethoxydim)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 1.0-1.5 pts. per acre. Use 1 qt. of COC per acre. Spray on actively growing grass. Do not exceed 5 pts. per acre per season for beet and carrot or 2.5 pts. per acre per season for other listed crops. REI: 12-hour. PHI: 30-day for carrot, 60-day for beet, 14-day for other listed crops.

## Insect Control

### Recommended Controls

#### Aphids

**M-Pede® (potassium salts of fatty acids)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 1-2% by volume. Must contact aphids to be effective. REI: 12-hour. PHI: 0-day. *OMRI-listed*.

**Neemix® (azadirachtin)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 5-7 fl. oz. per acre. REI: 4-hour. PHI: 0-day. *OMRI-listed*.

**Actara® (thiamethoxam)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 1.5-3.0 oz. per acre. Do not exceed 4.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day.

**Admire Pro® (imidacloprid)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 0.31-0.74 fl. oz. per 1,000 ft. of row. Apply as chemigation through drip, as an in-furrow spray, shanked in to seed trench, or as a narrow banded spray over eventual row within 14 days of planting. REI: 12-hour. PHI: 21-day.

**Ambush® (permethrin)** *Turnip* 3.2-6.4 oz. per acre. Illinois and Indiana only. Do not exceed 8 applications per season. REI: 12-hour. PHI: 1-day. *RUP*.

**Beleaf 50SG® (flonicamid)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 2.0-2.8 oz. per acre. Do not exceed 8.4 oz. per acre per year. Allow 7 days between applications REI: 12-hour. PHI: 3-day

**bifenthrin formulations (bifenthrin)** *Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* There are many bifenthrin pesticides, including Bifenture®, Brigade®, Capture®, Discipline®, Fanfare®, Tundra®, and Sniper®. For 2EC formulations: Apply 5.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. Allow 7 days between applications. For WSB formulations:

Apply 12.8-16.0 oz. per acre. Do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for beet; 21-day carrot, celeriac, parsnip, radish, rutabaga, and turnip. *RUP*.

**Malathion 5EC® (malathion)** *Beet, Parsnip, Radish, Rutabaga, Turnip* 1-2 pts. per acre for turnip. 1.5-2.0 pts. per acre for beet and parsnip. 1.6 pts. per acre for rutabaga. Do not exceed 3 applications per season. REI: see label. PHI: 7-day.

**Platinum 75SG® (thiamethoxam)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 5.0-12.0 fl. oz. per acre for beet, carrot, parsnip, rutabaga, and turnip. 5.0-6.5 fl. oz. per acre for radish. Apply as in-furrow spray at planting, as an overhead application immediately after planting with sufficient irrigation to incorporate, or through drip irrigation. Do not exceed 12.0 fl. oz. per acre per season. REI: 12-hour.

**Sivanto 200SL® (flupyradifurone)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 7.0-10.5 fl. oz. per acre. Do not exceed 28.0 fl. oz. per acre per season. Allow 10 days between applications. REI: 4-hour. PHI: 7-day.

## Armyworm Caterpillars

**bifenthrin formulations (bifenthrin)** *Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* There are many bifenthrin pesticides, including Bifenture®, Brigade®, Capture®, Discipline®, Fanfare®, Tundra®, and Sniper®. For 2EC formulations: Apply 5.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. Allow 7 days between applications. For WSB formulations: Apply 12.8-16.0 oz. per acre. Do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for beet; 21-day carrot, celeriac, parsnip, radish, rutabaga, and turnip. *RUP*.

**Coragen® (chlorantraniliprole)** *Rutabaga* 3.5-7.5 fl. oz. per acre. Do not exceed 15.4 fl. oz. per acre per crop, or 16.4 fl. oz. per acre per year. Allow 3 days between applications. REI: 4-hour. PHI: 1-day.

**Radiant 1SC® (spinetoram)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 6-8 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season for radish, rutabaga, and turnip. Do not exceed 28 fl. oz. per acre per season for carrot and parsnip. Do not exceed 32 fl. oz. per acre per season for beet. Allow 7 days between applications. REI: 4-hour. PHI: 3-day for carrot, parsnip, radish, rutabaga, and turnip; 7-day for beet.

**Sevin XLR Plus® (carbaryl)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 1-2 qts. per acre. Do not exceed 6 qts. per acre. REI: 12-hour. PHI: 7-day.

## Cabbageworm Caterpillars

**bifenthrin formulations (bifenthrin)** *Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* There are many bifenthrin pesticides, including Bifenture®, Brigade®, Capture®, Discipline®, Fanfare®, Tundra®, and Sniper®. For 2EC formulations: Apply 5.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. Allow 7 days between applications. For WSB formulations: Apply 12.8-16.0 oz. per acre. Do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for beet; 21-day carrot, celeriac, parsnip, radish, rutabaga, and turnip. *RUP*.

## Cutworm Caterpillars

Treatment is warranted when 25% of plants are infested.

**Asana XL® (esfenvalerate)** *Carrot* 5.8-9.6 fl. oz. per acre. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. *RUP*.

**Baythroid XL® (beta-cyfluthrin)** *Carrot, Radish* 1.6-2.8 fl. oz. per acre. Do not exceed 14.0 fl. oz. per acre per season. Do not harvest tops for human consumption. REI: 12-hour. PHI: 0-day *RUP*.

**bifenthrin formulations (bifenthrin)** *Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* There are many bifenthrin pesticides, including Bifenture®, Brigade®, Capture®, Discipline®, Fanfare®, Tundra®, and Sniper®. For 2EC formulations: Apply 5.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. Allow 7 days between applications. For WSB formulations: Apply 12.8-16.0 oz. per acre. Do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for beet; 21-day carrot, celeriac, parsnip, radish, rutabaga, and turnip. *RUP*.

**diazinon formulations (diazinon)** *Beet, Carrot, Radish* Broadcast and incorporate preplant. For 50W formulations: 4-8 lbs. per acre. Do not exceed one application per year. For 500W formulations: 2-4 qts. per acre. Do not exceed 4 qts. per acre per season. For 600W formulations: 51-102 fl. oz. per acre. Do not exceed 102 fl. oz. per acre per season. PHI: NA *RUP*.

**Lannate LV® (methomyl)** *Beet, Carrot* 0.75-1.5 pts. per acre for carrot. 1.5 pts. per acre for beet. Do not exceed 21 pts. per acre per season for carrot. Do not exceed 12 pts. per acre per season for beet. REI: 48-hour. PHI: 0-day for beet roots, 10-day for beet tops, 1-day for carrot. *RUP*.

**Mustang Maxx® (zeta-cypermethrin)** *Beet, Carrot, Celeriac, Parsnip, Radish, Rutabaga, Turnip* 1.28-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per

*OMRI-listed indicates that the product is listed by the Organic Materials Review Institute (OMRI.org) and therefore may be acceptable for use in organic production. Check with your certifier before use.*

season. Allow 4 days between applications. Leaves cannot be used for food or feed. REI: 12-hour. PHI: 1-day. *RUP*.

**Sevin XLR Plus® (carbaryl)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 1-2 qts. per acre. Do not exceed 6 qts. per acre. REI: 12-hour. PHI: 7-day.

### Flea Beetles

**Actara® (thiamethoxam)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 1.5-3.0 oz. per acre. Do not exceed 4.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day.

**Asana XL® (esfenvalerate)** *Radish, Turnip* 5.8-9.6 fl. oz. per acre. Do not exceed 77 fl. oz. per acre per season for turnip. Do not exceed 19.4 fl. oz. per acre per season for radish. REI: 12-hour. PHI: 7-day. *RUP*.

**Baythroid XL® (beta-cyfluthrin)** *Carrot, Radish* 1.6-2.8 fl. oz. per acre. Do not exceed 14.0 fl. oz. per acre per season. Do not harvest tops for human consumption. REI: 12-hour. PHI: 0-day *RUP*.

**bifenthrin formulations (bifenthrin)** *Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* There are many bifenthrin pesticides, including Bifenture®, Brigade®, Capture®, Discipline®, Fanfare®, Tundra®, and Sniper®. For 2EC formulations: Apply 5.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season. Allow 7 days between applications. For WSB formulations: Apply 12.8-16.0 oz. per acre. Do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 1-day for beet; 21-day carrot, celery, parsnip, radish, rutabaga, and turnip. *RUP*.

**Platinum 75SG® (thiamethoxam)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 5.0-12.0 fl. oz. per acre for beet, carrot, parsnip, rutabaga, and turnip. 5.0-6.5 fl. oz. per acre for radish. Apply as in-furrow spray at planting, as an overhead application immediately after planting with sufficient irrigation to incorporate, or through drip irrigation. Do not exceed 12.0 fl. oz. per acre per season. REI: 12-hour.

**Sevin XLR Plus® (carbaryl)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 0.5-1 qts. per acre. Do not exceed 6 qts. per acre. REI: 12-hour. PHI: 7-day.

### Leafhoppers

*Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* Use an insecticide to control leafhoppers that transmit the disease. Controlling leafhoppers early in the season is essential. Leafhoppers must be controlled before they feed.

**Actara® (thiamethoxam)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 1.5-3.0 oz. per acre. Do not exceed 4.0 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day.

**Admire Pro® (imidacloprid)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 0.31-0.74 fl. oz. per 1,000 ft. of row. Apply as chemigation through drip, as an in-furrow spray, shanked in to seed trench, or as a narrow banded spray over eventual row within 14 days of planting. REI: 12-hour. PHI: 21-day.

**Asana XL® (esfenvalerate)** *Carrot* 5.8-9.6 fl. oz. per acre. Do not exceed 96 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. *RUP*.

**Baythroid XL® (beta-cyfluthrin)** *Carrot, Radish* 1.6-2.8 fl. oz. per acre. Do not exceed 14.0 fl. oz. per acre per season. Do not harvest tops for human consumption. REI: 12-hour. PHI: 0-day *RUP*.

**Lannate LV® (methomyl)** *Carrot* 1.5-3.0 pts. per acre. Do not exceed 21 pts. per acre per crop. REI: 48-hour. PHI: 1-day. *RUP*.

**Platinum 75SG® (thiamethoxam)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 5.0-12.0 fl. oz. per acre for beet, carrot, parsnip, rutabaga, and turnip. 5.0-6.5 fl. oz. per acre for radish. Apply as in-furrow spray at planting, as an overhead application immediately after planting with sufficient irrigation to incorporate, or through drip irrigation. Do not exceed 12.0 fl. oz. per acre per season. REI: 12-hour.

**Sevin XLR Plus® (carbaryl)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 0.5-1 qts. per acre. Do not exceed 6 qts. per acre. REI: 12-hour. PHI: 7-day.

**Sivanto 200SL® (flupyradifurone)** *Beet, Carrot, Celery, Parsnip, Radish, Rutabaga, Turnip* 7.0-10.5 fl. oz. per acre. Do not exceed 28.0 fl. oz. per acre per season. Allow 10 days between applications. REI: 4-hour. PHI: 7-day.

### Seed and Root Maggots

**diazinon formulations (diazinon)** *Rutabaga* See below. Broadcast and incorporate preplant. For 50W formulations: 4-6 lbs. per acre. Do not exceed one application per year. For 500W formulations: 2-4 qts. per acre. Do not exceed 4 qts. per acre per season. For 600W formulations: 51-102 fl. oz. per acre. Do not exceed 102 fl. oz. per acre per season. PHI: NA. *RUP*.

**Lorsban 15G® (chlorpyrifos)** *Radish, Rutabaga, Turnip* 4.6-9.2 oz. per 1,000 ft. of row. Apply as an in-furrow drench at planting. Do not exceed 15 lbs. per acre per crop. REI: see label.