

# Greens: Mustard, Turnip, Collard and Kale

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## Culture

Greens are grown for the tops only. The proper size at harvest varies with the crop and growing conditions. Kale is allowed to grow to take two cuttings off one seeding. Some growers continue to strip kale leaves as the plants grow, thereby extending the harvest season for some time. Greens are usually on a constant field rotation to avoid club-root infestation in the soil. Field seeding begins in early April and ends in early August.

## Varieties

### Mustard (curly)

South Giant Curled (fall)

### Slick Mustard

Florida Broadleaf

### Turnip

Seven Top  
Topper

### Collards

Champion  
Top Bunch  
Flash

### Kale

Vates  
Blue Dwarf Curl  
Winterbor

## Lime and Fertilizer

Maintain soil pH at 6.0-6.6.

Broadcast and disk all fertilizer prior to planting.

For mustards and turnips, apply per acre: 100-120 lb N, 100-120 P<sub>2</sub>O<sub>5</sub> and 100-120 lb K<sub>2</sub>O.

For kale and collards, apply per acre: 120-150 lb N, 100-150 lb P<sub>2</sub>O<sub>5</sub>, and 120-150 lb K<sub>2</sub>O.

If soils are low in phosphorus, band half the fertilizer 2 inches below and 2 inches to the side of the seed.

## Spacing and Seeding

Rows: 14-20 inches apart.

Transplanted collards: 6 inches between plants, 14-16 inches between rows.

Seeding rates: collards and kale, 2-4 lb/A, mustard and turnips, 4-6 lb/A.

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# Disease Control

## Damping Off

Buy seed commercially treated with Thiram or Maxim 4FS.

## White Rust

Space rows to allow for good aeration and drying. Avoid overhead irrigation late in the day. If disease threatens, apply one of the following fungicides. Alternate fungicides as prescribed on the labels.

**Reason** 8.2 fl oz/A (2 days-PHI).

**Manex** 1.2 qt/A (10 days-PHI).

**Quadris** 6.2-15.4 fl oz/A (0 days-PHI) (maximum three applications per year).

Fixed copper fungicides as directed on label.

## Alternaria Leaf Spot, Powdery Mildew

**Quadris** 6.2-15.4 fl oz/A (0 days-PHI).

**Manex** 1.2 qt/A (10 days-PHI).

**Switch 62.5WG** 10-12 oz/A (powdery mildew); 11-14 oz/A Alternaria leaf spot (7 days-PHI).

## For kale only

Apply **Aliette/Maneb** 2+2 at 4 lbs/A when environmental conditions are favorable for disease development. Do not exceed 2 applications/cutting or 7 applications/season (10 days-PHI). Alternatively, apply **Maneb 75 DF** or **80 WP**, 1.5-2.0 lb/A (10 days-PHI).

## Downy Mildew (Mustard Greens, Collards, Kale)

Practice crop rotation with at least 2 years between brassica crops. When conditions are favorable for downy mildew development (high moisture, low-moderate temperatures), apply one of the following according to label instructions:

**Aliette** WDG 2.0-5.0 lbs/A (3 days-PHI). Do not tank mix with copper fungicides.

**Revus** 8.0 fl oz/A (1 day-PHI). Begin applications prior to disease development; limit of two sequential applications before alternating with a fungicide with a different mode of action.

**Quadris** 6.0-15.5 fl oz/A (0 days-PHI); limit of one application before alternating with a fungicide with a different mode of action.

**Reason** 5.5-8.2 fl oz/A (2 days-PHI).

**Ridomil Gold EC** may be applied under an EPA Section 24(c) Registration (OH04004)—see label for restrictions.

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# Insect Control

See the table on the next page for overview of insecticides used to control greens pests.

**Note on aphid management:** Examine 30 randomly selected plants per field and categorize the aphid population on each plant into one of the following seven categories:

0	(none)	if no aphids found
1	(trace)	if 1 to 3 aphids found
2	(low)	if 4 to 10 aphids found
3	(moderate)	if 11 to 30 aphids found
4	(moderate/high)	if 31 to 100 aphids found
5	(high)	if 101 to 300 aphids found
6	(very high)	if 301 or more aphids found

Treatment is suggested if the average rating is 2 or higher, for plants beyond the seedling stage. Treatment is suggested if the average rating is 1 or higher during the seedling stage. If the average aphid rating is less than category 2, but any plants were rated as 4 or higher, then the field should be scouted again in three days.

## Insecticides for Use on Greens in Ohio

(E = excellent; G = good; F = fair; P = poor; ✓ = pest listed on label but efficacy uncertain; - = pest not on label; rating in parentheses = pest not on label but product known to provide some control)

Pest >>	Pre-harvest interval (days)	Flea beetles	Caterpillars	Aphids	Leafminers	Impact on beneficial insects
<i>How often an insecticide has been needed on Ohio farms for this pest in the past&gt;&gt;</i>		every year, often	every year, often	every year, especially late season	rare	
<b>ORGANOPHOSPHATES</b>						
diazinon	10	✓	F	F	-	moderate
Dibrom (naled)	1	-	✓	✓	-	moderate/disruptive
dimethoate (Cygon)	14	-	-	G	✓	disruptive
Lorsban (chlorpyrifos)	21		G	F	-	moderate
malathion (Cythion)	7	G	F	F	-	low/moderate
<b>CARBAMATES</b>						
Lannate (methomyl)	10	-	F	-	-	disruptive
Sevin (carbaryl)	14	G	P	-	-	disruptive
<b>PYRETHROIDS</b>						
Ammo (cypermethrin)	1	G	G	-	-	disruptive
Asana (esfenvalerate)	7	G	G	-	-	disruptive
Baythroid (cyfluthrin)	0	G	G	-	-	disruptive
Brigade (bifenthrin)	7	✓	✓	✓	-	disruptive
Mustang (z-cypermethrin)	1	G	G	-	-	disruptive
<b>NEONICOTINOIDS (CHLORONICOTINYLS)</b>						
Actara (thiamethoxam)	7	✓	-	✓	-	low/moderate
Admire (imidacloprid)	21	-	-	G	-	low/moderate
Assail (acetamiprid)	7	G	-	G	-	low/moderate
Platinum (thiamethoxam)	30	✓	-	✓	-	low/moderate
Provado (imidacloprid)	7	-	-	G	-	low/moderate
<b>OTHER INSECT NERVE POISONS</b>						
Avaunt (indoxacarb)	3	-	✓	-	-	low/moderate
Beleaf (flonicamid)	0	-	-	✓	-	-
Fulfill (pymetrozine)	7	-	-	G	-	low
Proclaim (emamectin benzoate)	7	-	✓	-	✓	low/moderate
Pyronyl, PyGanic (pyrethrins)	0	G	G	✓	✓	moderate
Radiant (spinetoram)	1	-	✓	-	✓	-
SpinTor (spinosad)	1	-	G	-	✓	low
Thionex (endosulfan)	21	G	G	G	-	moderate
<b>INSECT GROWTH REGULATORS</b>						
Confirm (tebufenozide)	7	-	G	-	-	low
Esteem (pyriproxyfen)	7	-	-	-	-	low/moderate
Intrepid (methoxyfenozide)	1	-	G	-	-	low
Neemix, Aza-Direct (azadirachtin)	0	-	✓	✓	✓	low/moderate
Trigard (cyromazine)	7	-	-	-	✓	low/moderate
<b>MISCELLANEOUS</b>						
<i>Bacillus thuringiensis</i> (B.t.)	0	-	G	-	-	very low
Coragen (chlorantraniliprole)	3	-	✓	-	-	low
cryolite (Kryocide)	14	✓	✓	-	-	low
Oberon (spiromesifen)	7	-	-	-	-	-
soap (M-Pede)	0	-	-	F	-	low
Synapse (flubendiamide)	1	-	✓	-	-	low

**Note on worm management:** Treatment is suggested when 15% of the stand is infested by any caterpillar species. For example, if 30 randomly selected plants are examined per field, treatment would be indicated if 5 infested plants are found.

## • Preplant treatment

**Diazinon** (collards, kale, mustard only)

For cutworms, wireworms.

Diazinon 14G: 14-28 lb/A.

Diazinon 4EC: 2-4 qt/A.

## • At-planting or sidedress treatment

**Chlorpyrifos** (collard, kale)

For root maggots.

Lorsban 75WG: 1.1-1.8 oz per 1,000 ft of row.

**Imidacloprid** (21 days-PHI)

For aphids, whiteflies.

Admire 2F, Alias 2F: 10-24 fl oz/A. Limit 24 oz/A per year.

Admire Pro (4.6F): 4.4-10.5 fl oz/A.

**Thiamethoxam** (30 days-PHI, collards, kale, mustard greens)

For aphids, flea beetles, thrips, whiteflies.

Platinum 2SC: 5-11 fl oz/A as in-furrow spray, post-seeding drench or transplant drench.

## • Via drip (trickle) irrigation

**Thiamethoxam + chlorantraniliprole** (30 days-PHI for collards, kale, mustard greens)

For flea beetles, aphids, caterpillars, thrips, whiteflies.

Durivo 1.67SC: 10-13 fl oz/A.

## • Foliar treatment

**Acetamiprid** (7 days-PHI, collards, kale, mustard greens)

For aphids, whiteflies, flea beetles.

Assail 30SG: 1.8-4.0 oz/A.

**Bacillus thuringiensis (B.t.)** (0 days-PHI)

For cutworms, diamondback moth, imported cabbageworm, cabbage looper.

Agree (3.8% a.i.): 1-2 lb/A.

Biobit HP (6.4% a.i.): 0.5-2 lb/A.

CryMax WDG (15% a.i.): 0.5-1.5 lb/A.

DiPel DF (10.3% a.i.): 0.25-1 lb/A.

Javelin WG (6.4% a.i.): 0.25-1 lb/A.

Lepinox WDG (15% a.i.): 1-2 lb/A.

XenTari WDG: 0.25-1 lb/A.

**Bifenthrin** (7 days-PHI, collards, kale, mustard greens)

For flea beetles, caterpillars, thrips, aphids.

Brigade 2EC: 2.1-6.4 fl oz/A.

**Bifenthrin + imidacloprid** (7 days-PHI for collards, kale, mustard greens)

For caterpillars, aphids, thrips.

Brigadier 2EC: 4.24-6.1 fl oz/A.

**Carbaryl** (14 days-PHI)

For flea beetles, cabbageworm, leafhoppers.

Carbaryl 90DF: 0.6-1.1 lb/A for beetles; 1.1-2.2 lb/A for worms.

Carbaryl 4L; Sevin 4F; Sevin XLR Plus (4EC): 0.5-1 qt/A for flea beetles; 1-2 qt/A for cabbageworm; 0.5-1.5 qt/A for leafhoppers.

Sevin 50WP: 1-2 lb/A for flea beetles; 2-4 lb/A for cabbageworm; 1-3 lb/A for leafhoppers.

Sevin 80S: 0.7-1.25 lb/A for flea beetles; 1.25-2.5 lb/A for cabbageworm; 0.67-1.88 lb/A for leafhoppers.

**Chlorantraniliprole (Rynaxypyr)** (3 days-PHI)

For caterpillars.

Coragen 1.67SC: 3.5-5 fl oz/A. Limit 15.4 fl oz/A per crop.

**Chlorpyrifos** (21 days-PHI, collards and kale only)

For flea beetles, cutworms, cabbageworm, aphids.

Lorsban 75WG: 0.67-1.33 lb/A. Limit 3 applications of chlorpyrifos per crop, including at-planting.

Lorsban 50WP: 2 lb/A. Limit 6 applications per season.

**Cryolite** (14 days-PHI, collards only)

For caterpillars, flea beetles.

Kryocide (96% a.i.): 8-16 lb/A.

Prokil Cryolite 96: 10-16 lb/A.

**Cyfluthrin and beta-cyfluthrin** (0 days-PHI)

For caterpillars, cutworms, flea beetles, thrips.

Baythroid 2EC: 0.8-3.2 fl oz/A. Limit 4 applications per year.

Baythroid XL 1EC: 0.8-3.2 fl oz/A.

**Cypermethrin** (1 day-PHI, collards, kale, mustard greens only)

For caterpillars, flea beetles, leafhoppers, thrips.

Ammo 2.5EC, Battery 2.5EC: 2.5-5 fl oz/A.

Ammo 38.7% WSB: 1-2 bags/A (0.3-0.6 lb/A).

**Cyromazine** (7 days-PHI)

For leafminers.

Trigard 75WP: 2.66 oz/A. Limit 6 applications per crop.

**Diazinon** (10 days-PHI, collards, kale, mustard)

For diamondback, cabbageworm, aphids, harlequin bug.

Diazinon AG600 WBC: 6.5-12.75 fl oz/A.

Diazinon AG500 (4EC): 0.5-1 pt/A.

Diazinon 50WP: 0.5-1 lb/A.

**Dimethoate** (14 days-PHI, kale, mustard greens, turnip greens only)

NOTE: Dimethoate use on collards was canceled in 2006 but use still allowed on other greens.

For aphids, leafhoppers, leafminers.

Dimethoate 4EC; Dimate 4E: 0.5 pt/A.

Dimethoate 2.67EC; Dimate 2.67: 0.75 pt/A.

**Emamectin benzoate** (7 days-PHI)

For caterpillars, leafminers.

Proclaim (5WDG): 2.4-4.8 oz/A. Limit 28.8 oz/A per year.

**Endosulfan** (21 days-PHI, collards, kale, mustard greens only)

Apply only once per season.

For flea beetles, diamondback, cabbageworm, looper, aphids, leafhoppers, whiteflies.

Thionex 3EC; Endosulfan 3EC: 1-1.33 qt/A.

Thionex 50WP: 1.5 lb/A.

**Esfenvalerate** (7 days-PHI, collards and mustard greens only)

For flea beetles, cutworms, cabbageworm, looper.

Asana XL 0.66EC, Adjourn 0.66EC: 5.8-9.6 fl oz/A. Limit 39 fl oz/A per season.

**Flonicamid** (0 days-PHI, mustard greens only)

For aphids.

Beleaf 50SG: 1.2-2.8 oz/A. Limit 3 applications per year.

**Flubendiamide** (1 day-PHI for collards, kale, mustard greens)

For caterpillars.

Synapse 24WG: 2 oz/A. Limit 4 oz/A per crop season.

**Imidacloprid** (7 days-PHI)

For aphids, flea beetles, whiteflies.

Provado 1.6F, Pasada 1.6F: 3.75 fl oz/A. Limit 18.75 fl oz/A per year. Do not apply if Admire used at-planting.

**Imidacloprid + cyfluthrin** (7 days-PHI)

For caterpillars, flea beetles, aphids, thrips.

Leverage 2.7SE: 3.8 fl oz/A.

**Indoxacarb** (3 days-PHI)

For caterpillars.

Avaunt 30WG: 2.5-3.5 oz/A. Limit 14 oz/A per year.

**Malathion** (7 days-PHI)

For aphids, imported cabbageworm, cabbage looper, flea beetles, harlequin bug.

Malathion 8EC, Malathion 8F: 1.5-2.5 pt/A for aphids, cabbageworm, looper, flea beetles.

Malathion 5EC, Malathion 57EC: 1-2 pt/A for aphids, cabbageworm, looper.

**Methomyl** (10 days-PHI)

For cutworms, diamondback moth, imported cabbageworm, cabbage looper.

Limit 8 applications/crop.

Lannate 90SP: 0.5-1 lb/A.

Lannate LV (2.4WSL): 1.5-3 pt/A.

**Methoxyfenozide** (1 day-PHI)

For looper and imported cabbageworm.

Intrepid 2F: 4-16 fl oz/A. Limit 64 fl oz/A per year.

**Naled** (1 day-PHI, collards, kale only)

For diamondback, cabbageworm, looper, aphids.

Dibrom 8EC: 1 pt/A for aphids; 1-2 pt/A for caterpillars.

**Pymetrozine** (7 days-PHI)

For aphids, whiteflies.

Fulfill 50WDG: 2.75 oz/A.

**Pyriproxyfen** (7 days-PHI)

For whiteflies.

Esteem 35WP: 2.5-3 oz/A. Limit 2 applications or 6 oz/A per season.

**Spinetoram** (1 day-PHI)

For caterpillars, thrips, leafminers.

Radiant 1SC: 5-10 fl oz/A. Limit 6 applications per year.

**Spinosad** (1 day-PHI)

For diamondback, imported cabbageworm, cabbage looper, armyworms.

SpinTor 2SC: 1.5-8 oz/A. Limit 29 oz/A/year.

Entrust (80WP): 0.5-3 oz/A.

**Spiromesifen** (7 days-PHI)

For whiteflies.

Oberon 2SC: 7.0-8.5 fl oz/A. Limit 3 applications per crop season.

**Tebufenozide** (7 days-PHI)

For imported cabbageworm, cabbage looper.

Confirm 2F: 6-8 oz/A for small plants; 8-16 oz/A for larger plants and heavy infestation. Limit 56 fl oz/A per year.

**Thiamethoxam** (7 days-PHI, collards, kale, mustard greens)

For aphids, flea beetles, thrips, whiteflies.

Actara 25WDG: 1.5-3 oz/A for aphids, flea beetles; 3-5.5 oz/A for thrips, whiteflies. Limit 11 oz/A per growing season.

**Zeta-cypermethrin** (1 day-PHI)

For caterpillars, flea beetles, thrips.

Mustang 1.5EW: 2.4-4.3 fl oz/A.

Mustang Max (0.8EC): 2.24-4.0 fl oz/A.

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## Weed Control

### Preplant Incorporated For collards, mustard greens, and kale only

**Prefar 4E:** Controls germinating annual grasses and certain broadleaf weeds. Apply 5-6 qt/A Prefar 4E and preplant incorporate before planting. Preemergence applications are effective only if followed by irrigation within 36 hours to provide incorporation.

**Trifluralin:** Preplant incorporated, 2-3 inches deep within 8 hours after application.

**Albaugh Trifluralin 4EC, Gowan Trifluralin 4EC, Riverside Trifluralin 4EC, Treflan HFP, Trilin 4EC:** 1-1.5 pt/A.

**Gowan Trifluralin 5EC, Trilin 5EC:** 0.8-1.2 pt/A.

**Trific 60DF:** 0.8-1.33 lb/A.

**Gowan Trifluralin 10G, Trilin 10G, Wilbur-Ellis Trifluralin 10G:** 5-7.5 lb/A.

### Preemergence

**Dacthal 75W:** Controls germinating annual broadleaf weeds and grasses. Apply 10.6-13.3 lb/A Dacthal 75W. Apply at seeding for annual weed control. Irrigation or rain soon after applying Dacthal improves weed control. Dacthal does not control emerged weeds.

### Postemergence For mustard greens and turnips only

**Stinger:** For control of labeled weeds, apply 0.25-0.5 pt/A when weeds are actively growing. A second application is permissible, with a maximum combined rate for both applications of no more than 0.5 pt/A/season. PHI for mustard greens is 30 days. PHI for turnip tops is 15 days. PHI for turnip roots is 30 days.

### For Leafy Brassica Greens

**Poast 1.5E:** For control of grasses apply 1.0-1.5 pt/A. Include COC at 1% V/V or 1 qt/A. Multiple applications permissible to a maximum of 3 pt/A/season (30 days-PHI).

**Select 2E:** For control of grasses apply 0.5 pt/A. Include COC at 1% V/V (14 days-PHI).