

Asparagus

Lily family (Liliaceae): *Asparagus officinalis*

Planting and Culture

New asparagus plantings can be started from seed, transplants, or crowns. Fields to be planted to asparagus should be well drained, fairly level, free from rocks, and relatively weed-free.

Using 10- to 12-week-old transplants that have been started in the greenhouse is a good method for establishing a new planting. One-year-old crowns purchased from a plant producer also work well. Direct seeding into the field is not recommended because heavy rains can move enough soil to smother small seedlings. Furrows 5 to 6 inches deep are prepared for crowns or transplants. Problems associated with heavy rains filling in the furrows and smothering small transplants or direct-seeded plants make 1-year-old crowns the most reliable method.

One-year-old crowns should be planted in furrows with the buds up and 6 inches below the soil surface. Cover crowns with 1½ to 2 inches of soil at time of planting. Furrows are gradually filled in as the spears begin growing.

Space crowns or transplants 18 inches apart in the furrow. Furrows should be 5 to 6 feet apart. You will need 5,808 plants per acre at a 5-foot row spacing and 4,840 plants per acre at a 6-foot spacing.

Crowns should be planted in March or early April (see Appendix H). Transplanting should be done in late April or early May. See *Commercial Asparagus Production* (HO-66) for additional information.

Fertilizing

Apply fertilizer based on soil test results. Broadcast and disk in before establishing a new planting. Continue to apply fertilizer each year if needed. Apply animal manure or plow under a green manure cover crop before planting. Apply lime to bring the soil pH to 6.5 to 6.8 and to supply calcium. Asparagus does not tolerate acid soils. Deeply incorporate lime if needed prior to planting. Apply 200 lb per acre of triple superphosphate (0-46-0) in the bottom of the trench just before planting. This is 2.3 lb per 100 feet of row at a 5-foot spacing and 2.8 lb per 100 feet of row at a 6-foot row spacing. This is in addition to the phosphorus applied based on the soil test. Topdress an annual application of 70 to 75 lb of nitrogen about two weeks before the end of the harvest season. Soil

magnesium should be checked before planting and every three to four years after establishment.

Harvest only five to six spears per plant the first year. After two years of growth, harvest for about two months in the spring in order to allow fern growth to develop for the rest of the season. Harvest spears when 5 to 10 inches long. Harvest during early morning hours and place in a cool place as soon as possible.

Cut asparagus spears to uniform length, tie in 2- to 2½-lb bunches and pack them in pyramid crates for the wholesale market.

Ferning out or feathering of the head of the asparagus spear indicates poor quality with a high fiber content. High temperatures will cause the tips of shoots to fern out at a shorter height.

After Harvest

After the final harvest, a herbicide can be applied to help keep fern growth free from weed competition late in the season. It is important to keep the plants growing well after harvest until frost. The tops can then be mowed down with a rotary mower in the early spring before spear emergence.

Immerse spears in ice water (hydrocool) to preserve quality. Dipping spears in ice water for approximately two minutes can lower the temperature by about half. Store spears at 32° to 36°F at 90 to 95 percent relative humidity.

Common Diseases/Management

Fusarium root and crown rot. Site selection and cultural practices are important management tools. Jersey hybrids have some tolerance, although none are resistant. Select well-drained sites that have not been previously planted in asparagus. Alternatively, use a site rotated out of asparagus for eight or more years. Use disease-free crowns or transplants produced from bleach-treated seed. See tables for chemical control options.

Phytophthora crown and spear rot. Avoid planting in poorly drained sites, and take steps to improve surface and internal drainage. Phytophthora is favored by standing water and a high soil pH. See tables for chemical control options available to asparagus producers.

Rust and Cercospora leaf blight. Burning of old ferns during the winter to help

VARIETIES: *Asparagus*

Jersey Gem	Jersey Knight
Jersey Giant	Jersey Supreme
Jersey King	

FERTILIZER: *Asparagus*

Soil Test Results (lb/A)		Fertilizer Needed (lb/A)
Phosphorus		Phosphate (P₂O₅)
Low	<31	121-240
Medium	31-60	61-120
High	61-80	21-60
Very High	>80	0 to 20
Potassium		Potash (K₂O)
Low	<201	201-300
Medium	201-300	101-200
High	301-450	51-100
Very High	>450	0-50
Nitrogen		N
		75

PESTICIDE SAFETY: *Asparagus*

	Signal ²	Re-entry (hrs)	Harvest (days)
Insecticides			
Bt products	C	12	0
Dimethoate 4	W	48	180
Fulfill 50 WDG	C	12	170
Lorsban 75 WP	W	24	1
Radiant SC	C	4	60
Sevin XLR	C	12	1
SpinTor 2 SC	C	4	60
RESTRICTED USE			
Lannate 90 SP	DP	48	1
Lorsban 4 E	W	24	1
Pounce 3.2 EC	C	12	1
Fungicides			
Azoxystrobin ¹	C	4	100
chlorothalonil ¹	C	12	190
Mancozeb ¹	C	24	180
Nova 40 W	C	24	180
Ridomil Gold 4 EC	C	48	1
Sulfur ¹	C	24	0

¹ Several formulations are marketed. See the general introduction for more details on fungicides.

² W: Warning, C: Caution, D: Danger; P: Poison

reduce overwintering inoculum of these pathogens is recommended, or cut or mow stubble and remove it from the planting. Rust-resistant varieties are available but are only partially effective; preventive fungicide sprays are usually needed in commercial plantings. See tables for products and rates, and use directions. The Jersey hybrids, because of their vigorous dense growth, appear to be very susceptible to *Cercospora* leaf blight.

INSECT CONTROL: *Asparagus*

Insecticide	Product Amt/A	Comments and Seasonal Limits
SPEAR TREATMENTS		
Armyworms		
Sevin XLR	1 to 2 qt	Limit 3 applications before harvest and 5 times per crop.
Bt products	See labels	
Asparagus Beetles (Only the common asparagus beetle (blue and brown with white spots) injures the plants. Monitor plants in the early afternoon when beetles are active. Treat when 10% of the plants are infested with the beetles.)		
Lorsban 4 E	2 pt	Limit 1 pre-harvest application and 2 post-harvest applications.
Lorsban 75 W	1.33 lb	Limit 1 pre-harvest application and 2 post-harvest applications.
Pounce 3.2 EC	2 to 4 fl oz	Limit 16 fl oz/A.
Sevin XLR	1 to 2 qt	Limit 3 applications before harvest and 5 times per crop.
Cutworms		
Lorsban 4 E	2 pt	Limit 1 pre-harvest application and 2 post-harvest applications.
Pounce 3.2 EC	2 to 4 fl oz	Limit 16 fl oz/A.
Sevin XLR	1 to 2 qt	Limit 3 applications before harvest and 5 times per crop.
FERN TREATMENTS		
Asparagus Beetles		
Dimethoate 4	1 pt	Limit 5 applications.
Lorsban 75 W	1.33 lb	Limit 2 post-harvest applications.
Pounce 3.2 EC	4 fl oz	Controls Japanese beetle. Limit 16 fl oz/A.
Radiant SC	4 to 8 fl oz	For post-harvest use only. Limit 24 fl oz/A.
Sevin XLR	2 to 4 qt	Controls Japanese beetle. Limit 5 applications per year to spears and ferns combined.
SpinTor 2 SC	4 to 6 fl oz	Controls asparagus beetle. Limit 3 applications. For post-harvest only.

WEED CONTROL: *Asparagus*

Product Amt/A	Lb A.I./A	Remarks
Established Beds		
8 to 16 fl oz Clarity 4L	0.25 to 0.5 dicamba	For control of broadleaf weeds. Do not cultivate within 7 days after application. Apply to actively growing weeds in 40 to 60 gal water immediately after a harvest but at least 24 hours before the next harvest. Use high rate for perennial weeds. Can be used in tank mix with 2,4-D or Roundup for control of Canada thistle or field bindweed. Discard crooked spears after harvest. Maximum of 1 pt/A/year.
8 lb Devrinol 50 DF	4 napropamide	For control of annual grasses and broadleaves. Apply as a surface applied or incorporated treatment in 10 to 50 gal water/A to stands established at least 1 season. Do not allow contact with crop foliage. Apply before crop emergence in the spring and incorporate 1 to 2 inches before rainfall, or irrigate.
1.5 to 2 qt Formula 40 3.67L	1.38 to 1.84 2,4-D	For selective postemergence control of broadleaf weeds only. Apply in 60 gal water/A to actively growing weeds, usually in April or May. If spears are present, treat immediately after cutting. Make no more than 2 applications (spaced at least 1 month apart) during harvest season. For post-harvest application, use drop nozzles to avoid spraying the fern.
2 to 4 lb Karmex 80 DF	1.6 to 3.2 diuron	For preemergence control of annual grasses and broadleaf weeds. Apply after disking or chopping fern in the spring at least 4 weeks before spears emerge. A second application may be made at the end of the harvest season if rainfall is expected. Max. rate of 6 lb/A/year. 6 to 8 weeks of residual activity.
1.5 to 2 pt Reglone 2 EC	0.38 to 0.5 diquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply as a preplant or as a directed spray on non-bearing asparagus only in min. 15 gal water/A. Do not use for food or feed for 1 yr after application.
16 to 22 fl oz Roundup Weather- Max 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Solicam + Roundup tank mix has been very effective against a broad spectrum of weed species. PHI = 14 days. Min. 30 days before replanting with any non-labeled crop. May be applied following final spring harvest, when all asparagus is cut to ground level over the entire planting, to help control both annual and perennial weeds.
1.3 to 2.6 lb Sencor 75 DF	1 to 2 metribuzin	For control of annual grasses and broadleaf weeds. Apply in 10 to 40 gal water/A before spear emergence. Do not use on young plants during the first growing season. Can also be applied as a split application of preemergence (0.6 to 1.3 lb/A) and after final harvest (1.3 to 2 lb/A) with a max. rate of 2.6 lb/A/season. PHI = 14 days.
1.5 lb Sinbar 80 WP	1.2 to 1.6 terbacil	For control of annual grasses and broadleaf weeds. Apply before spear emergence. Can be applied immediately after clean cutting.
3.75 to 5 lb Sollicam 80 DF	3 to 4 norflurazon	For control of annual grasses and broadleaf weeds and suppression of yellow nutsedge. Allow newly planted fields to become established for 1 season before 1st application. Apply as broadcast preemergent in min. 20 gal water/A. Apply in fall after chopping fern or in spring before fern emergence. PHI = 14 days. Apply only once/season.
3 to 4 pt Treflan HFP 4 E	1.5 to 2 trifluralin	For control of annual grasses and broadleaf weeds. Can be applied to dormant asparagus after fern has been removed or after last harvest. For split application, use 1.5 to 2 lb/A each time.
Established Beds and New Seedlings		
1 to 1½ pt Fusilade DX 2E	0.25 to 0.38 fluzafop-p	For selective postemergence control of annual grasses and suppression of perennial grasses. Include 1% v/v crop oil or 0.25% v/v non-ionic surfactant/A. PHI = 1 day. Repeat application must be at least 14 days apart. Max. rate is 48 fl oz/A and 24 fl oz/application.
1.7 to 2.7 pt Gramoxone Max 3 L	0.64 to 1 paraquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply as a band treatment over the row or as broadcast preemergence in min. 10 gal water/A. In new seedlings apply before, during, or after planting but before emergence of the crop. In plantings established at least 2 yr, apply min. 6 days before crop emergence or after last harvest. Use with non-ionic surfactant 0.25% v/v. Max. 3 applications/season.
1 to 2 lb Lorox 50 DF	0.5 to 1 linuron	For control of annual grasses and broadleaves. Make 1 application preemergence at least 1 day before harvest. If used postemergence, make 1 to 3 applications of 1 to 2 lb/A on weeds <4 inches tall. At the fern stage, apply 1 application of 4 lb/A as a directed spray to base of ferns. For newly planted crowns, use as preemergence application of 2 to 4 lb/A after planting. Activated charcoal as a band over the planted row is needed for protection of the newly planted crowns. For postemergence, use 1 to 2 applications of 1 to 2 lb/A when ferns are 6 to 18 inches tall and weeds <4 inches tall.
0.5-2.5 pt Poast 1.5 E	0.09-0.49 sethoxydim	For control of actively growing grasses only. Use high rate on johnsongrass. Apply over the top of bearing asparagus with min. 1 day before harvest. Max. rate of 2.5 pt/application and 5 pt/season.

WEED CONTROL: Asparagus

Product Amt/A	Lb A.I./A	Remarks
16 to 22 fl oz Roundup Weather-Max 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Solicam + Roundup tank mix has been very effective against a broad spectrum of weed species. PHI = 14 days. Min. 30 days before replanting with any non-labeled crop.
0.5 to 1 oz Sandea 75 DF	0.023 to 0.047 halosulfuron	For weed control of broadleaf weeds and yellow nutsedge. May be applied postemergence broadcast during the harvesting season. After harvest, direct application below the ferns for complete weed coverage and avoid contact with the fern. Max. 2 applications/season and 2 oz/A/season. PHI = 1 day. For first year transplants, apply at least 6 weeks after fern emergence.
1-10% Scythe 4.2L	pelargonic acid	For non-selective contact control of annual grasses and broadleaf weeds. Use in min. 10 gal water/A if mixed with other herbicides or a min. 75 gal if used alone. Do not allow contact with crop foliage. Can be mixed with Roundup. See label for amount of Scythe to use depending on the desired spray volume.
9-16 fl.oz. Select 2 EC	0.14-0.25 clethodim	Apply to actively growing grasses. Use NIS at 0.25% v/v. PHI = 1 day. Do not apply more than 16 fl oz/A in a single application and no more than 64 fl oz/A (0.5 lb ai/A) per season. For repeat applications make on a minimum of a 14 day interval.

DISEASE CONTROL: Asparagus

Product	Amt/A	Seasonal Limits/A	Comments
Cercospora Blight, Rust			
Chlorothalonil		9 lb ai	Apply after harvest of spears. Apply on a 14- to 28-day schedule when symptoms are first observed or when conditions favor disease.
Bravo Ultrex	1.8 to 3.6 lb	11 lb	
Bravo WeatherStik	2 to 4 pt	12 pt	
Echo 720	2 to 4 pt	12 pt	
Equus 720 SST	2 to 4 pt	12 pt	
Equus DF	1.8 to 3.6 lb	11 lb	
Mancozeb		6.4 lb ai	Apply after harvest of spears. Apply on a 10-day schedule when symptoms are first observed or when conditions favor disease.
Dithane DF Rainshield	2 lb	8.5 lb	
Dithane F-45 Rainshield	1.6 qt	6.4 qt	
Dithane M-45	2 lb	8 lb	
Manzate 75 DF	2 lb	8.5 lb	
Manzate Flowable	1.6 qt	6.4 qt	
Manzate Pro-Stick	2 lb	8 lb	
Penncozeb 4 FL	1.6 qt	6.4 qt	
Penncozeb 75 DF	2 lb	8.5 lb	
Penncozeb 80 WP	2 lb	8 lb	
Nova 40 W	5 oz	6 apps	RUST. Apply after harvest of spears. Apply with a spray adjuvant. Treat on a 7- to 14-day schedule when symptoms are first observed or when conditions favor disease.
Sulfur	10 to 35	n/a	RUST. Apply after harvest of spears. Apply on a 7- to 10-day schedule when symptoms are first observed or when conditions favor disease. Phytotoxicity may occur when sulfur is applied when air temperatures exceed 90°F.
Fusarium Root Rot			
chlorine bleach	10% vol:vol	n/a	Soak seed for 40 min in bleach solution, with continuous agitation. Dry seed immediately after treatment and plant promptly.
Fusarium Crown Rot			
Mancozeb		1 app	Wash crowns before treatment. Pack crowns loosely in a burlap bag and dip in mancozeb solution for 5 min, agitating gently and continuously. Drain and plant immediately.
Dithane DF Rainshield	2 lb ²		
Dithane F-45 Rainshield	1.6 qt ²		
Dithane M-45	2 lb ²		
Manzate 75DF	2 lb ²		
Manzate Flowable	1.6 qt ²		
Manzate Pro-Stick	2 lb ²		
Penncozeb 4FL	1.6 qt ²		
Penncozeb 75DF	2 lb ²		
Penncozeb 80WP	2 lb ²		
Phytophthora Crown/Spear Rot			
Ridomil Gold EC	1 pt	2 apps	CUTTING BEDS: Apply as a broadcast spray over beds in 10 gal/A of water. Make first application 30 to 60 days before first cutting; make a second application, if necessary, just before harvest. NEW PLANTINGS: Apply immediately after planting seedlings or covering 1-year crowns. See label for plantback restrictions.
Ridomil Gold SL	1 pt		
Ultra Flourish	2 pt		
Stemphylium Purple Spot			
Azoxystrobin ¹		4 apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Amistar	2 to 5 oz		
Quadris	6.0 to 15.5 fl oz		

¹ Do not make back-to-back applications or rotate with other QoI inhibitors (FRAC Group 11). Fungicides with the same Group number have the same mode of action. Do not tank-mix products with the same Group number, and rotate among fungicides with different Group numbers to discourage resistance development.

² Per 100 gallons of water.

Beans

Pea family (Fabaceae): *Phaseolus vulgaris*—snap bean, *P. lunatus*—Lima bean, *Glycine max*—soybean

Planting and Culture

Begin first plantings after danger of frost (see Appendix H). Successive plantings of bush snap beans at two- to three-week intervals may be desirable for roadside markets, U-pick, farmer's markets, and shipping.

Bush Beans. Plant in rows 24 to 30 inches apart. Plant seeds 2 to 3 inches apart in the row and 1½ inches deep in a well-prepared seedbed. See also "Production with Plasticulture" below.

Lima Beans. Plant in rows 24 to 30 inches apart. Space seeds 3 to 5 inches in the row, 1 to 2 inches deep.

Pole Beans. Plant seed in rows and thin plants to 6 to 8 inches apart in the row. Sow seed 1 to 2 inches deep. Space rows 5 feet apart, and prepare a wire trellis for plants to grow on.

Dry Beans (pea-beans). Plant seed in rows 28 inches apart with seed spaced 2 to 3 inches apart in the row and 1 inch deep. Beans will not withstand frosts and do not do well when planted in cold soils. The first plantings should be made after danger of the last killing frost in the spring. Beans planted in cold soil are more susceptible to rotting and slow growth. A seed treatment is highly recommended. Successive plantings of bush beans at two- to three-week intervals can be made until Aug. 15.

Seeding rate is partly determined by variety. Small seeded varieties require fewer pounds of seed per acre than large seeded varieties. The average amount of seed to plant is about 80 lb per acre.

There are no known detrimental effects on plant growth associated with inoculating seed prior to planting with *Rhizobium*. However, there are many different strains of *Rhizobium* and many factors are involved in determining if this will increase nitrogen fixation and help your crop. There will be no effect if the field has a recent history of being planted with beans because a large population of *Rhizobium* will already be present in the field.

Production with Plasticulture

Some Kentucky growers producing for roadside stands or farmer's markets have obtained extremely high yields and a cleaner harvest of bush beans and half runners using trellises and black plastic on raised beds with drip irrigation. Holes are punched in the plastic by hand or with a waterwheel setter and two to three seeds

VARIETIES: Beans

	Use			Seed Color	Maturity (days)	Comments
	Fresh Market	Canning	Shipping			
Snap Beans, Bush Plant Type						
Bronco	X	X	X	W	53	Round, 5.5 inches long, dark green pods, high yield potential, resistance to mosaic and seed transmission of bean common mosaic virus.
Hialeah	X	X	X	W	53	Round; high yield and recovery for machine harvested, fresh market beans.
Tema	X	X		DBr	53	Round pods, resistance to mosaic and seed transmission of bean common mosaic virus.
Tenderette	X	X	X	W	53	Round pods; concentrated set; tolerant to bean mosaic.
Benchmark	X		X		54	Round pods, 6 inches long, medium dark green, concentrated set; resistant to bean common mosaic and NY15 mosaic. Advertised as heat tolerant.
Magnum	X		X	LBr	55	Flat, medium light green, 6.9 inches long pods, resistance to mosaic and seed transmission of bean common mosaic virus.
White Seeded Provider	X	X	X	W	55	Resistant to common bean mosaic.
Blue Lake 274	X	X	X	W	58	Rust resistant.
Caprice	X		X	W	60	Round pods, 6 inches, dark green, resistant to bean common mosaic virus, anthracnose, halo blight, common blight, with some resistance to bacterial brown spot
Snap Beans, Pole Type						
Kentucky Blue	X	X	X		58	Round, medium green pod, 7 to 10 inches long, excellent flavor; resistant to bean common mosaic virus, rust.
White Kentucky Wonder 191	X	X	X	W	65	Round pod; rust resistant.
Others						
Roma II (snap bush Romano)	X			W	58	Resistant to common bean mosaic and NY15 mosaic. Flat pods.
State Half Runner (snap)	X	X		W	60	Some tolerance to common bean mosaic; beans have strings.
Maxibel	X			T/B	60	Long, thin, stringless 7 to 8 inches "French beans."
Goldkist (bush)	X			W	55	Round, yellow wax bean; resistant to bean common mosaic virus, NY15 mosaic, bacterial spot, rust, 5 to 6 inches long, excellent flavor.
Fordhook 242 (Lima, bush)		X	X	G	78	Large pod; sets blossom under adverse weather conditions.
Capitol (Navy, dry bean)		X	X	W	92	30 inches high plants; large seeded.
Vegetable Soybeans						
Garden Soy 22	X			Y	90	Medium-sized beans, good flavor.
Garden Soy 31	X			Y	94	Medium-sized beans; resistant to powdery mildew.
Garden Soy 41	X			Y	113	Large-sized beans, good flavor.
BeSweet 292	X			Y	85	Top commercial variety; powdery mildew resistant.

¹ W = white, DBr = dark brown, LBr = light brown, T/B = tan/brown, Y = yellow, G = greenish

are planted in each hole. Two rows about 15 inches apart are planted on each bed with spacings of 12 inches between planting holes in the row. A simple trellis can be constructed by stringing 3 horizontal rows of twine between tomato stakes spaced about 8 to 10 feet apart. Horizontal stringing is followed by weaving twine vertically between the top and bottom horizontal lines.

Pole beans require sturdier trellises. High-tensile wires are strung at 6 inches and 5 feet above the ground. Jute twine is then woven vertically between these two wires.

Fertilizing and Pollination

Snap bean fertilizer trials in Kentucky indicate that 50 lb of actual nitrogen per acre is adequate for good yields. For beans grown on plastic with drip irrigation, 8 to 10 lb of ammonium nitrate per acre can be fertigated weekly.

Zinc deficiency has been a limiting factor in some areas of the state. Where zinc levels are known to be low, up to 20 lb of elemental zinc or 55 lb per acre of zinc sulfate should be broadcast prior to seeding. (See also Appendix D.)

If air temperature rises above 90°F during the pollination period, pollen production and growth can be reduced. Unpollinated blossoms will drop off. Blossom drop can be reduced by maintaining adequate soil moisture and by keeping good leaf growth on the vines. Poor pollination can cause pods to be misshapen. Irrigation at the time of bloom will help ensure good pod set if soils are dry.

Harvesting and Storage

Harvest green snap beans and pole beans when the bean seed is about one-third developed for the best eating quality. Many snap beans are mechanically harvested (once-over harvest). Varieties that produce a concentrated set of pods should be grown where mechanical harvesters are used. Green beans for the fresh wholesale market are packed in bushel baskets or cartons.

Vegetable soybeans (edamame) are picked when the pods are nearly fully grown but before they begin to turn yellow. Shelling is made easier by dropping the pods in a pot of boiling water for 15 to 20 minutes.

Navy and kidney beans should be harvested and handled at the 17 to 18 percent moisture level to prevent splitting and seed coat damage. Pinto beans should be harvested at around 14 percent moisture.

Green beans are stored at 40° to 45°F and 90 to 95 percent relative humidity.

Common Diseases/Management

Seedling disease and seed rots. Seed planted when soil temperatures are below 65°F need a fungicide treatment. Those who buy untreated seed should apply Thiram 65 WP (2 oz/cwt) plus Chloroneb 65 (4 oz/cwt) or Apron XS LS (0.32 to 0.64 fl.oz/cwt). At-planting application of fungicides can reduce losses to seedling disease; see tables for chemical control options.

Anthracnose. In most situations, control measures consist of rotating for two years or longer to non-legume crops and planting disease-free seed. Deeply incorporate bean stubble promptly after harvest to limit pathogen survival. Do not work crops while foliage is wet, especially pole beans. Fungicides can be an important part of an integrated management plan (see tables for chemical control options).

Bacterial blights (halo blight, common blight, and brown spot). Plant certified, disease-free seed and rotate 2-3 years to non-leguminous crops. Do not work while plants are wet. Purchase seed that has been treated with streptomycin. Practice sanitation between fields. Plow under

FERTILIZER: Beans

Soil Test Results (lb/A)		Fertilizer Needed (lb/A)
Phosphorus		Phosphate (P₂O₅)
Low	<31	51-95
Medium	31-60	1-50
High	>60	0
Potassium		Potash (K₂O)
Low	<201	51-150
Medium	201-300	1-50
High	>300	0
Nitrogen		N
poor soils		50
heavily fertilized soils		20-30

bean stubble immediately after harvest to encourage rapid decline in bacterial populations. Fixed coppers may provide some control of these diseases; see tables for products and rates.

Nematodes. Root-knot, soybean cyst, and lesion nematodes are common to Kentucky. Rotate at least 2-3 years with grasses (corn, fescue, small grains), and control weeds. Do not rotate with alfalfa, soybeans, tomatoes, tobacco, or other hosts of any of these nematodes. Nematicides are available, but thresholds for their use have not been established in Kentucky. See "Soil Fumigants for Control of Nematodes and Soilborne Diseases" on page 18.

Root Rots. *Pythium*, *Fusarium*, *Rhizoctonia*, and *Thielaviopsis* cause root diseases in Kentucky. Seed treatments reduce losses, but at-planting applications of fungicide may be warranted in some situations. A band or furrow treatment at seeding time with fungicides can be helpful; see tables for a list of registered materials. Sod and/or cover crops should be incorporated early to promote thorough decomposition before planting. Soil temperatures at planting should be at least 65°F.

Rust. Rust-resistant varieties are available, including Dade, Kentucky Wonder, Opus, Roma, and Spurt. Fungicide sprays can be especially valuable with fall plantings. See tables for chemical control options.

Viruses (Mosaic). Avoid planting near weedy borders, clover, or other legumes, including older bean plantings, and control weeds in the field. Use certified disease-free seed. Staggered seeding dates increase the chances that some plantings will escape high aphid activity; however, sequential plantings can also harbor viruses. Increasing the seeding rate can help sustain yields when a high incidence of viruses occurs early. Reflective mulches may disturb aphid flights and reduce virus transmission. Use varieties resistant to bean common mosaic and bean yellow mosaic, such as Bush Blue Lake 274, Provider, Tendercrop, Cherokee, and Goldcup. In general, half runner and

PESTICIDE SAFETY: Beans

	Signal ³	Re-entry (hrs)	Harvest (days) ⁴
Insecticides			
Admire Pro	C	12	21
Bt products	C	12	0
Courier 40 SC	C	12	14
Dibrom 8	D	24	1
Dicofol 4 E	C	12	21
Dimethoate 4 E	W	48	0
Endosulfan 3 EC	DP	24	3
Malathion 8	C	12	1
Orthene 75 S	C	24	0/14 ¹
Provado 1.6 F	C	12	7
Radiant SC	C	4	3/28 ¹
Sevin XLR	C	12	3
SpinTor 2 SC	C	4	3
Trigard 75 WP	C	12	7
RESTRICTED USE			
Asana XL	W	12	3/21 ¹
Baythroid XL	W	12	7
Capture 2 EC	W	12	3
Diazinon 50 W	C	24	7
Di-Syston 8 E	DP	48	AP
Hero 1.24 EC	C	12	3
Lannate 90 SP	DP	48	1/14 ¹
Mustang Max	W	12	1/21 ¹
Proaxis 0.5 EC	C	24	7/21 ¹
Renounce 20 WP	C	12	7
Thimet 20 G	DP	48	60
Warrior T	W	24	7/21 ¹
Fungicides¹			
Azoxystrobin ²	C	4	0
Chlorothalonil ²	W	12	7/14 ¹
Endura	W	12	7/21 ¹
Fixed coppers ²	W	12/24 ¹	0
Headline	W	12	7/30 ¹
Maneb ²	C	24	30
PCNB ²	W	12	0
Proline 480 SC	C	48	7
Ridomil Gold EC/SL	C	48	0
Rovral 4 Flowable	C	24	0
lprodione 4L AG			
Sulfur ²	C	24	0
Thiophanate-methyl ²	C	12	14/28 ¹
SNAP BEANS ONLY			
Botran 75 W	C	12	2
Nova 40 W	C	24	0
DRY BEANS ONLY			
Quadris Opti	W	12	14

¹ Dependent on formulation, type of bean, and application rate; there are specific restrictions on feeding and grazing, so see label.

² Several formulations are marketed. See the general introduction for more details on fungicides.

³ W: Warning, C: Caution, D: Danger, P: Poison

⁴ AP: At planting

pole beans are highly sensitive to some of these viruses.

White Mold, Gray Mold. Avoid fields with a history of white mold. Deep-turning infested fields will encourage decomposition of survival structures (sclerotia). Rotate 2 to 3 years with grass crops; avoid canola, potatoes, tomatoes, and cabbage. No-till beans have increased potential for white and gray mold. Fungicides are available; see tables for chemical control options.

INSECT CONTROL: Beans

Insecticide	Product Amt/A	Comments and Seasonal Limits
PREPLANT INCORPORATED		
Cutworms (Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites.)		
Diazinon AG 500	2 to 4 qt	Incorporate Immediately.
AT PLANTING		
Aphids, Leafhoppers, Seedcorn Maggots (Seedcorn maggots damage newly planted seeds by feeding on seed contents. Shallow planting in well-prepared seedbeds and adequate soil temperature to promote rapid germination will aid in reducing problems. Heavy cover crops or manure should be plowed early to render fields less attractive for egg laying.)		
Admire Pro	7 to 10.5 fl oz	See label for application methods.
Thimet 20 G	4.5 to 7 oz/1,000 ft	Place band on each side of furrow.
Kernel Guard	2 oz/bu of seed	Planter box treatment
FOLIAR TREATMENTS		
Grasshoppers		
Asana XL	5.8 to 9.6 fl oz	Do not feed to livestock. Limit 38.4 fl oz/A. Not for use on Lima beans.
Baythroid XL	2.4 to 3.2 fl oz	Limit 3.2 fl oz per 14 day period and 6.4 fl oz per season.
Capture 2 EC	1.6 to 6.4 fl oz	Limit 12.8 fl oz/A.
Dimethoate 4 E	0.5 to 1 pt	
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27 fl oz/A. Allow 5 days between applications.
Mustang Max	3.2 to 4.0 fl oz	Limit 24 fl oz/A. Allow at least 5 days between applications.
Aphids, Leafhoppers		
Asana XL	2.9 to 9.6 fl oz	Do not feed to livestock. Limit 38.4 fl oz/A. Not for use on Lima beans. For leafhoppers only.
Baythroid XL	0.8 to 1.6 fl oz	Limit 3.2 fl oz per 14 day period and 6.4 fl oz per season.
Capture 2 EC	1.6 to 6.4 fl oz	Limit 12.8 fl oz/A.
Dimethoate 4 E	0.5 to 1 pt	Do not spray during bloom.
Endosulfan 3 EC	1.33 qt	Aphids only. Limit 3 applications. Not for use on Lima beans.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27 fl oz/A. Allow 5 days between applications.
Lannate 90 SP	0.5 to 1 lb	
Malathion 8	1.5 pt	
Mustang Max	2.72 to 4.0 fl oz	Allow at least 5 days between applications. Limit 24 fl oz/A.
Orthene 75 S	0.67 to 1.33 lb	Limit 2.67 lb/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Provado 1.6 F	3.5 fl fl oz	Allow 7 days between sprays. Limit 10.5 fl oz/A.
Sevin XLR	1 qt	Leafhoppers only. Limit 4 applications, allow 7 days between sprays.
Warrior T	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Corn Earworms		
Asana XL	5.8 to 9.6 fl oz	Do not feed to livestock. Limit 38.4 fl oz/A. Not for use on Lima beans.
Baythroid XL	2.4 to 3.2 fl oz	Limit 3.2 fl oz per 14 day period and 6.4 fl oz per season.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27 fl oz/A. Allow 5 days between applications.
Mustang Max	2.72 to 4.0 fl oz	Allow at least 5 days between applications. Limit 24 fl oz/A.
Orthene 75 S	1 to 1.33 lb	Limit 2.67 lb/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Radiant SC	4 to 8 fl oz	Limit 12 fl oz/A. Allow 4 days between applications.
Sevin XLR	0.5 to 1.5 qt	Limit 4 applications, allow 7 days between sprays.
SpinTor 2 SC	4 to 6 fl oz	Limit 12 to 29 fl oz/A based on bean type.
Warrior T	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Cutworms		
Baythroid XL	0.8 to 1.6 fl oz	Limit 3.2 fl oz per 14 day period and 6.4 fl oz per season.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27 fl oz/A. Allow 5 days between applications.
Mustang Max	1.28 to 4.0 fl oz	Allow at least 5 days between applications. Limit 24 fl oz/A.
Orthene 75 S	0.67 to 1.33 lb	Limit 2.67 lb/A.
Proaxis 0.5 EC	1.92 to 3.2 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Warrior T	1.92 to 3.2 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Japanese Beetles		
Baythroid XL	2.4 to 3.2 fl oz	Limit 3.2 fl oz per 14 day period and 6.4 fl oz per season.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27 fl oz/A. Allow 5 days between applications.
Mustang Max	2.72 to 4.0 fl oz	Allow at least 5 days between applications. Limit 24 fl oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Sevin XLR	0.5 to 1 qt	Blister beetles and flea beetles also. Limit 4 applications, allow 7 days between sprays.
Warrior T	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Mexican Bean Beetles, Bean Leaf Beetles (Treat for Mexican bean beetle if populations exceed 0.5 adults per plant or if egg mass number is greater than 1 per foot of row.)		
Asana XL	2.9 to 5.8 fl oz	Do not feed to livestock. Limit 38.4 fl oz/A. Not for use on Lima beans. Bean leaf beetle only.
Baythroid XL	2.4 to 3.2 fl oz	Limit 3.2 fl oz per 14 day period and 6.4 fl oz per season.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Bean leaf beetle only.
Dimethoate 4 E	0.5 to 1 pt	
Endosulfan 3 EC	1.33 to 2.67 pt	Mexican bean beetle only. Limit 3 applications. Not for use on Lima beans.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27 fl oz/A. Allow 5 days between applications.
Malathion 8	1.5 pt	
Mustang Max	2.72 to 4.0 fl oz	Allow at least 5 days between applications. Limit 24 fl oz/A.
Orthene 75 S	0.67 to 1.33 lb	Limit 2.67 lb/A.

INSECT CONTROL: Beans

Insecticide	Product Amt/A	Comments and Seasonal Limits
Proaxis 0.5 EC	1.92 to 3.2 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Warrior T	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Spider Mites		
Capture 2 EC	5.12 to 6.4 fl oz	Limit 12.8 fl oz/A.
Dibrom 8	1 pt	Limit 1 application. Do not feed treated vines.
Dicofol 4 E	1 to 3 pt	
Dimethoate 4 E	0.5 to 1 pt	
Stink Bugs		
Baythroid XL	1.6 to 2.4 fl oz	Limit 3.2 fl oz per 14 day period and 6.4 fl oz per season.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A.
Endosulfan 3 EC	1.33 to 2.67 pt	Limit 3 applications. Not for use on Lima beans.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27 fl oz/A. Allow 5 days between applications.
Mustang Max	3.2 to 4.0 fl oz	Allow at least 5 days between applications. Limit 24 fl oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Warrior T	2.56 to 3.84 fl oz	Limit 15.36 fl oz/A. Allow 5 days between sprays.
Thrips, Whiteflies (<i>Thrips damage to small seedlings is uncommon and plants usually recover without treatment. Although whiteflies are common in beans, they are not usually a serious problem.</i>)		
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A.
Courier 40 SC	8.7 oz	Apply before bloom, allow 5 days between sprays. Limit 17.4 oz/A.
Orthene 75 S	0.67 to 1.33 lb	Limit 2.67 lb/A.
Provado 1.6 F	3.5 fl oz	Allow 7 day between sprays. Limit 10.5 fl oz/A. For whiteflies only.

WEED CONTROL: Beans

Product Amt/A	Lb A.I./A	Remarks
Lima, Snap Beans		
0.5 to 1.5 fl oz Aim 1.9 EW	0.008 to 0.023 carfentrazone	For contact postemergence control of annual broadleaf weeds and suppression of annual grasses. Can be applied as a preplant, pre-transplant burndown, or before crop emerges to actively growing weeds up to 4 inches tall. Can also be applied postemergence as a directed hooded application between crop rows. Use min. 10 gal water/A and crop oil 1% v/v. Max. rate 6.1 fl oz/A. PHI = 0 days.
1 to 2 pt Basagran 4S	0.5 to 1 bentazon	Use postemergence for control of annual broadleaves and suppression of yellow nutsedge. Do not apply until the first trifoliate bean leaf is fully expanded. Some injury may occur but plants will grow out of it. Do not apply more than 4 pt/A/year.
0.4 to 0.67 pt Command 3ME	0.15 to 0.25 clomazone	Use preemergence for suppression of annual grasses and broadleaf weeds. Apply once in min. 10 gal water/A. PHI = 45 days.
6 to 14 pt Dacthal 6 F	4.5 to 10.5 DCPA	For preemergence control of annual grasses and broadleaves. Apply at time of planting. Can be preplant incorporated
1.3 to 1.7 pt Dual II Magnum 7.6 E	1.3 to 1.6 s-metolachlor	For control of most annual grasses and certain broadleaves. Apply preplant surface or incorporated or preemergence. Small grains may be planted 4½ months following this treatment. See label for other rotational crops.
0.8 to 1.3 pt Gramoxone Max 3 L	0.3 to 0.5 paraquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply as a leaf desiccant in min. 20 gal water/A. Apply when crop is mature or at least 80% pods are yellowing and mostly ripe. Use with non-ionic surfactant 0.25% v/v. Max. 2 applications/season.
2.5 to 3 qt Micro-Tech 4 E	2.5 to 3 alachlor	For control of annual grasses and broadleaf weeds and yellow nutsedge. Max. 1 application/year or 3 qt/A. Apply preplant incorporated within 7 days before planting or surface application before or after planting.
0.5 to 2.5 pt Poast 1.5 E	0.09 to 0.49 sethoxydim	For control of actively growing grasses only. Use high rate on johnsongrass. PHI = 15 days. Max. rate of 2.5 pt/application and 4 pt/season.
1.8 to 3.6 pt Prowl 3.3 E	0.74 to 1.49 pendimethalin	For control of annual grasses and broadleaf weeds. Apply before planting and incorporate 1 to 2 inches up to 60 days before planting and incorporate within 7 days of application. Do not apply surface preemergence or serious crop injury can result.
3 fl oz Pursuit 2L	0.05 imazethapyr	For control of annual grasses and broadleaf weeds. Can be applied preplant incorporated within 1 week before planting. Can be applied preemergence within 3 days after planting. Can be applied postemergence to plants at least 3 inches tall but before 5 nodes and before flowering. Add non-ionic surfactant 0.25% v/v.
0.75 to 1.5 pt Reflex 2 EC	0.18 to 0.36 fomesafen	For postemergence control of broadleaves and suppression of grasses, apply broadcast to actively growing weeds. Use COC as adjuvant 0.5-1% v/v. Max rate is 1.5 pt/acre/season. Do not use hay or straw for animal feed or bedding. Check label for plantback restrictions. Timely cultivation 1 to 3 weeks after applying Reflex may assist weed control. PHI = 45 days.
16 to 22 fl oz Roundup WeatherMax 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Min. 30 days before planting any non-labeled crop.
0.5 to 1 oz Sanda 75 DF	0.023 to 0.047 halosulfuron	For control of broadleaf weeds and yellow nutsedge. Apply after planting but before cracking in min. 15 gal water/A. PHI = 30 days. Max. 1 oz/A/crop and 2 oz/A/season.
0.5 to 1 oz Sanda DF + 3.5 to 4.5 pt Eptam 7 E	0.023 to 0.047 halosulfuron + 3 to 4 EPTC	For control of broadleaf weeds, grasses, and yellow nutsedge. Apply and incorporate to a depth of ½ to 2" just before planting. Max. rate 1 oz Sandea/season and 7 pt Eptam/season. Do not use Eptam on flat-podded beans except Romano.
1 to 10% Scythe 4.2L	pelargonic acid	For non-selective contact control of annual grasses and broadleaf weeds. Use in min. 10 gal water/A if mixed with other herbicides or a min. 75 gal if used alone. Do not allow contact with crop foliage. Can be mixed with Roundup. See label for amount of Scythe to use depending on the desired spray volume.
1 to 2 pt Treflan HFP 4 E	0.5 to 1 trifluralin	For control of annual grasses and broadleaf weeds. Apply and incorporate in spring before planting or in fall in advance of spring planting.
Snap, Dry Beans		
5 to 12 fl. oz. Assure II 0.88L	0.033 to 0.08 quizalofop	For selective postemergence control of annual grasses and suppression of perennial grasses. Apply to actively growing grasses in 10 to 15 gal water/A. Include 1% v/v crop oil concentrate or 0.25% v/v non-ionic surfactant. Snap beans: 15 day pre-harvest interval and 14 oz/A/season max. Dry Beans: 30 day pre-harvest interval and maximum of 28 oz/A/season.

WEED CONTROL: Beans

Product Amt/A	Lb A.I./A	Remarks
3.5 pt Eptam 7 E	3 EPTC	For control of annual grasses and broadleaf weeds and suppression of yellow nutsedge. Apply before planting and incorporate into soil 2 to 4 inches immediately. Can be applied as a directed lay-by application to soil at the base of the plants before pods start to form. Gives good nutsedge suppression.
1 to 2 pt Goal 2XL	0.25 to 0.5 oxyfluorfen	For preemergence and postemergence control of certain annual grasses and most broadleaves. For fallow bed preparation only. Best if used with glyphosate for control of winter annual broadleaf weeds. Min. 60 days between application and planting.
0.8 to 1.3 pt Gramoxone Max 3 L	0.3 to 0.5 paraquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply as a leaf desiccant in min. 20 gal water/A. Apply when crop is mature or at least 80% pods are yellowing and mostly ripe. Use with non-ionic surfactant 0.25% v/v. Max. 2 applications/season.
14 to 18 fl oz Outlook 6 E	0.65 to 0.84 dimethenamid-P	For control of annual grasses and broadleaf weeds and suppression of seedling johnsongrass. Can be applied preplant surface or incorporated, preemergence or postemergence to dry beans at 1-3 trifoliolate stage. PHI = 70 days.
0.5 to 2.5 pt Poast 1.5 E	0.09 to 0.49 sethoxydim	For control of actively growing grasses only. Use high rate on johnsongrass. PHI = 30 days. Max. rate of 2.5 pt/application and 4 pt/season.
1.8 to 3.6 pt Prowl 3.3 E	1 to 2 pendimethalin	For control of annual grasses and broadleaf weeds. Apply before planting and incorporate 1 to 2 inches up to 60 days before planting and incorporate within 7 days of application. Do not apply surface preemergence or serious crop injury can result.
4 fl. oz. Raptor 1EC	0.031 imazamox	For control of annual grasses and broadleaf weeds. Some varieties are sensitive and injury can occur. Apply postemergence to actively growing dry beans with at least 1 fully expanded trifoliolate leaf. Max. 1 application/season.
0.75 to 1.5 pt Reflex 2 EC	0.18 to 0.36 fomesafen	For postemergence control of broadleaves and suppression of grasses, apply broadcast to actively growing weeds. Use COC as adjuvant 0.5-1% v/v. Max rate is 1.5 pt/acre/season. Do not use hay or straw for animal feed or bedding. Check label for plantback restrictions. Timely cultivation 1-3 weeks after applying Reflex may assist weed control. PHI = 45 days.
16 to 22 fl oz Roundup WeatherMax 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Min. 30 days before planting any non-labeled crop.
0.5 to 0.66 oz Sanda 75 DF	0.023 to 0.031 halosulfuron	For control of broadleaf weeds and yellow nutsedge. Apply broadcast after planting but before cracking in min. 15 gal water/A. PHI = 30 days. Max. of 0.66 oz/A/crop and 2 oz/A/season.
0.5 to 2/3 oz Sanda DF + 3.5 to 4.5 pt Eptam 7 E	0.023 to 0.03 halosulfuron + 3 to 4 EPTC	For control of broadleaf weeds, grasses, and yellow nutsedge. Apply and incorporate to a depth of 1/2 to 2" just before planting. Max. rate 2/3 oz Sandea/season and 7 pt Eptam/season. Do not use Eptam on flat-podded beans except Romano.
6 to 16 fl. oz. Select 2E	0.1 to 0.25 clothodim	For selective postemergence control of annual grasses and suppression of perennial grasses. Add crop oil 1% v/v or 1 to 2 qt/A liquid fertilizer or AMS to enhance control of difficult grasses. PHI = 30 days.
1 to 10% Scythe 4.2L	pelargonic acid	For non-selective contact control of annual grasses and broadleaf weeds. Use in min. 10 gal water/A if mixed with other herbicides or a min. 75 gal if used alone. Do not allow contact with crop foliage. Can be mixed with Roundup. See label for amount of Scythe to use depending on the desired spray volume.
7.5 to 11.5 lb Sonalan 10G	0.75 to 1.15 ethalfuralin	For preemergence control of annual grasses and broadleaves. Apply and incorporate before planting.
1 to 2 pt Triflan HFP 4 E	0.5 to 1 trifluralin	For control of annual grasses and broadleaf weeds. Apply and incorporate in spring before planting or in fall in advance of spring planting.

DISEASE CONTROL: Beans

Product	Amt/A	Seasonal Limits/A	Comments
Anthraxnose			
Azoxystrobin ¹		4 foliar	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Amistar	2 to 5 oz		
Quadris	6 to 15.5 fl oz		
Chlorothalonil		6 lb ai	Dry beans only. Apply at disease onset, repeat at 7 to 10 day intervals (min. retreatment interval is 7 days).
Bravo Ultrex	1.25 to 1.8 lb	7.3 lb	
Bravo WeatherStik	1.375 to 2 pt	8 pt	
Echo 720	1.375 to 2 pt	8 pt	
Echo 90 DF	1.125 to 1.625	6.7 lb	
Equus 720 SST	1.375 to 2 pt	8 pt	
Equus DF	1.25 to 1.8 lb	7.2 lb	
Fixed coppers		n/a	Apply on a 5 to 10 or 7 to 14 day schedule, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.
Basic Copper 53	2 to 4 lb		
C-O-C-S WDG	2 to 4 lb		
COC DF	2 to 4 lb		
COC WP	2 to 4 lb		
Headline	6 to 9 fl oz	2 apps	Apply before disease onset, continue on a 7- to 14-day schedule. Do not make back-to-back applications. Use higher rates when pressure is severe.
Maneb		9.6 lb ai/A/ season	Dry beans only. Apply when plants are small, spray on a 5- to 7-day interval.
Maneb 75 DF	1.5 to 2 lb	12.8 lb	
Maneb 80 WP	1.5 to 2 lb	12 lb	
Manex	1.2 to 1.6 qt	9.6 qt	
Quadris Opti	1.6-2.4 pt	see comments	Dry beans only. Apply before disease onset, continue on a 7- to 14-day schedule. Resistance management guidelines for QoI inhibitors (FRAC Group 11) must be observed, along with seasonal limits for chlorothalonil.

DISEASE CONTROL: Beans

Product	Amt/A	Seasonal Limits/A	Comments
Thiophanate-methyl			Apply when 10 to 30% of plants have at least one open bloom OR when conditions favor disease, continue on a 4- to 7-day schedule (no later than peak bloom). Do not make back-to-back applications.
Thiophanate-Methyl 85 WDG	0.8 to 1.6 lb	3.2 lb	
Topsin 4.5 FL	20 to 40 fl oz	80 fl oz	
Topsin M 70 WP	1 to 2 lb	4 lb	
Topsin M WSB	1 to 2 lb	4 lb	
T-Methyl 70W WSB	1 to 2 lb	4 lb	
Bacterial Blights (i.e. Halo Blight, Common Blight, Brown Spot)			
Fixed coppers		n/a	Apply on a 5 to 10 or 7 to 14 day schedule, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.
Badge SC	0.9 to 2.8 pt		
Basic Copper 53	2 to 4 lb		
C-O-C-S WDG	2 to 4 lb		
Champ DP	0.67 to 2		
Champ Formula 2 FL	0.67 to 2 pt		
Champion WP	1 to 3 lb		
COC DF	2 to 4 lb		
COC WP	2 to 4 lb		
Copper-Count-N	2 to 6 pt		
Cuprofix Dispers	1.5 to 3.5 lb		
Cuprofix Ultra 40 Dispers	0.75 to 2 lb		
Kocide 101	1 to 3 lb		
Kocide 2000	0.75 to 2.25 lb		
Kocide 3000	0.5 to 1.25 lb		
Kocide DF	1 to 3 lb		
Kocide 4.5 LF	0.66 to 2 pt		
Nu-Cop 50 WP	1 to 3 lb		
Nu-Cop 3 L	0.66 to 4 pt		
Nu-Cop 50 DF	1 to 3 lb		
Tenn-Cop 5 E	3 pt		
Gray Mold, White Mold			
Botran 75 W	2.25 to 4 lb	n/a	SNAP BEANS ONLY for control of white mold. Use low rate for bush varieties, high rate for pole varieties. Apply when conditions favor disease and continue on a 7-day interval during favorable periods.
Chlorothalonil			Snap beans only. Use highest rate for gray mold. Apply at early bloom or when conditions favor disease.
Bravo Ultrex	1.25 to 2.7 lb	7.3 lb	
Bravo WeatherStik	1.375 to 3 pt	8 pt	
Echo 720	1.375 to 3 pt	8 pt	
Echo 90 DF	1.125 to 2.5 lb	6.7 lb	
Equus 720 SST	1.375 to 3 pt	8 pt	
Equus DF	1.25 to 2.7 lb	7.2 lb	
Endura	8 to 11 oz	2 apps	Apply at the beginning of flowering or before disease onset.
Proline 480 SC	4.3 to 5.7 fl oz	3 apps	Dry beans only for control of white mold. Apply at the first sign of disease, continue on a 5 to 14 day schedule if conditions remain favorable for disease. Use the highest rate for severe disease pressure. Do not spray back to back or tank-mix with other Group 3 fungicides.
Rovral 4 Flowable	1.5 to 2 pt	2 apps	Apply when 1 to 10% of plants have at least one bloom; make a 2nd application (if necessary) 5 to 7 days later, but no later than full bloom.
Iprodione 4L AG Fungicide			
Thiophanate-methyl			Apply when 10 to 30% of plants have at least one open bloom OR when conditions favor disease, continue on a 4- to 7-day schedule (no later than peak bloom). Do not make back-to-back applications.
Thiophanate-Methyl 85 WDG	0.8 to 1.6 lb	3.2 lb	
Topsin 4.5 FL	20 to 40 fl oz	80 fl oz	
Topsin M 70 WP	1 to 2 lb	4 lb	
Topsin M WSB	1 to 2 lb	4 lb	
T-Methyl 70W WSB	1 to 2 lb	4 lb	
Rhizoctonia Web Blight, Pod Rot			
Azoxystrobin ¹		4 foliar apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Amistar	2 to 5 oz		
Quadris	6 to 15.5 fl oz		
Quadris Opti	1.6 to 2.4 pt	see comments	DRY BEANS. Resistance management guidelines for QoI inhibitors (FRAC Group 11) must be observed, along with seasonal limits for chlorothalonil.
Nova 40 W	4 to 5 oz	1.25 lb	Snap beans only. Apply as pods begin to develop; continue on a 7- to 10-day schedule. Do not spray back to back or tank-mix with other Group 3 fungicides.
Rust			
Azoxystrobin ¹		4 foliar apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Amistar	2 oz		
Quadris	6 fl oz		
Quadris Opti	1.6-2.4 pt	see comments	DRY BEANS. Resistance management guidelines for QoI inhibitors (FRAC Group 11) must be observed, along with seasonal limits for chlorothalonil.

DISEASE CONTROL: Beans

Product	Amt/A	Seasonal Limits/A	Comments
Chlorothalonil			Apply at early bloom or when conditions favor disease
Bravo Ultrex	1.25 to 2.7 lb	7.3 lb	
Bravo WeatherStik	1.375 to 3 pt	8 pt	
Echo 720	1.375 to 3 pt	8 pt	
Echo 90 DF	1.125 to 2.5 lb	6.7 lb	
Equus 720 SST	1.375 to 3 pt	8 pt	
Equus DF	1.25 to 2.7 lb	7.2 lb	
Endura	8 to 11 oz	2 apps	Apply at the beginning of flowering or before disease onset.
Headline ¹	6 to 9 fl oz	2 apps	Use 5.5 to 8 fl oz for dry beans. Apply before disease onset, continue on a 7- to 14-day schedule as needed. User higher rates when pressure is severe.
Maneb			Dry beans only. Apply when plants are small & spray on a 5- to 7-day interval. Limit 9.6 lb ai/A/season.
Maneb 75 DF	1.5 to 2 lb	12.8 lb	
Maneb 80 WP	1.5 to 2 lb	12 lb	
Manex	2.4 to 3.2 pt	9.6 qt	
Nova 40 W	4 to 5 oz	1.25 lb	Apply when rust is first observed; continue on a 7- to 10-day schedule as needed. Limit 1.25 lb/A/season (0.5 lb ai).
Sulfur		n/a	Apply when rust is first observed; continue on a 7- to 14-day schedule as needed. Phytotoxicity may occur if applications are made when air temperatures exceed 90°F.
Pythium Damping-off, Seedling Diseases, Root Rot			
Ridomil Gold EC	0.5 to 1 pt	1 app	Apply pre- or post-planting as a broadcast or banded spray (7-inch band) in sufficient water to provide uniform coverage. Incorporate into the upper 2 inches of soil mechanically or by rainfall/irrigation. Can be tank-mixed with azoxystrobin or PCNB to provide additional protection against Rhizoctonia.
Ridomil Gold SL		1 app	
Ridomil Gold PC GR	12 oz ²	1 app	For pre-plant application only. Adjust equipment so that granules are mixed with soil before covering seed. Also provides control of Rhizoctonia.
Rhizoctonia Damping-off, Seedling Diseases, Stem/Root Rot			
Azoxystrobin ¹		1 app	AT PLANTING: Apply as an in-furrow spray in 0.3 to 1 gal water/1000 row feet (5 to 15 gal/A). Spray should applied to the furrow just before seed are covered.POST-EMERGENCE: Apply in a 7-inch (or less) band directed at the soil at the base of the plant. Arrange nozzles to provide good coverage of lower stems and soil at base of plants. Incorporation following application will improve distribution in soil. Foliar contact may occur; post-emergence sprays are considered foliar applications for resistance management purposes.
Amistar	0.125 to 0.25 oz ²		
Quadris	0.4 to 0.8 fl oz ²		
PCNB		1 app	Rates based on 36-inch row spacing. Apply at planting as an in-furrow spray in 0.5 to 0.7 gal water/1000 row-feet (8 to 10 gal/A). Spray furrow and covering soil; avoid direct application to seed to prevent injury or delayed emergence. Apply granular materials in-furrow at planting, directing material in the the furrow and soil used to cover seed.
PCNB 2E	4.4 to 6.6 fl oz ²		
Terraclor 2E	4.4 to 6.6 fl oz ²		
Terraclor Flowable	2.2 to 3.3 fl oz ²		
Terraclor 75 W	1.4 to 2.2 oz ²		
Turficide 10G	15 oz ²		
Terraclor 15G	8 to 11.2 oz ²		

¹ Do not make back-to-back applications or rotate with other QoI inhibitors (FRAC Group 11). Fungicides with the same Group number have the same mode of action. Do not tank-mix products with the same Group number, and rotate among fungicides with different Group numbers to discourage resistance development.

² Per 1000 row-feet.

Cole Crops

Mustard family (Brassicaceae): *Brassica* (broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, kohlrabi)

Planting and Culture

The ground for spring cole crops should be plowed in the fall in order to have crops ready for the early market. Cabbage should be transplanted to the field by mid-March in most parts of Kentucky; broccoli and Brussels sprouts should be in the field by the middle of April for the spring crop (see Appendix H). Avoid poorly drained fields; slightly rolling land is suitable. A good firm seedbed should be prepared by disking. Cole crops do well on ground that has been in tobacco. Fescue sod ground is also good if plowed early in the fall and allowed to decompose.

Cauliflower does not do well as a spring crop in Kentucky. Cabbage, broccoli, and cauliflower all do well as fall crops. Cabbage and cauliflower should be transplant-

ed by early August at the latest, whereas broccoli can be transplanted as late as mid-August. Cauliflower does very well when transplanted around July 15 to 20 for a fall crop. Irrigation is often critical for establishing the fall crop.

Use transplants for early market. Sort plants by size to have uniformity in the field. This is helpful at harvest time. A tobacco setter can be used to transplant. Space cabbage plants 12 to 14 inches in the row with rows spaced 36 inches apart. A plant population of 14,000 plants per acre is desirable. Brussels sprouts and cauliflower should be spaced 18 to 20 inches apart in the row with rows 36 inches apart. Broccoli should be spaced 12 to 14 inches apart to keep heads from becoming too large. A 10-inch spacing and double

rows 20 inches apart are used for smaller, bunching size broccoli heads.

A starter fertilizer dissolved in water and applied around the root system during transplanting is recommended. Use 3 lb of starter in 50 gal water and apply ½ pt/plant. Some insecticides can be added to starter solution to control soil insects. Refer to insecticide recommendations.

Fertilizing

Get a soil test and follow the recommendations. Lime should be applied if needed to bring the pH to around 6.5. Cole crops are heavy users of sulfur; soils prone to deficiencies can be amended by using one of the many sulfur-containing fertilizers to supply 10 to 20 lb actual sulfur per acre. Boron deficiencies have appeared in

FERTILIZER: Cole Crops

Soil Test Results (lb/A)		Fertilizer Needed (lb/A)
Phosphorus		Phosphate (P₂O₅)
Low	<31	121-180
Medium	31-60	61-120
High	61-80	31-60
Very High	>80	0-30
Potassium		Potash (K₂O)
Low	<201	101-150
Medium	201-300	51-100
High	301-450	1-50
Very High	>450	0
Nitrogen		N
Broadcast and plow under 50 lb N. Sidedress with 50 lb N when heads begin forming. A second sidedressing of 50 lb of N two weeks later should also be applied. Delaying N application may cause cabbage heads to burst. Too high levels of N may result in greater internal tip burn of cabbage. Calcium nitrate should be used where tip burn has been a problem. High nitrogen levels cause hollow stem in broccoli. Usually 100 lb total nitrogen is sufficient for broccoli.		

cabbage in several Kentucky counties. The addition of 2 lb per acre of actual boron is recommended where cabbage is to be planted. (Refer to Appendix D.)

Cold Tolerance, Harvesting, and Storage

The cold tolerance of cole crops varies somewhat with the weather conditions preceding the cold period. These minimum temperatures are usually tolerated by cole crops in the fall:

Broccoli	22 to 23°F
<i>sometimes damaged at 25°F</i>	
Brussels Sprouts	20°F
Cabbage	17 to 18°F
Cauliflower	22 to 23°F

Broccoli heads should be cut before any yellow petals show. Cut the heads with 6 to 8 inches of the stem attached. Later maturing lateral stalks should be cut in a similar manner. Broccoli is sold to the wholesale fresh market in cartons holding 14 bunches with two to three heads to the bunch.

Brussels sprouts should be harvested when they are 1 to 1¼ inches in diameter. The lower leaves of the plant should first be broken away and the sprouts cut off close to the stem with a sharp knife.

Fresh market cabbage should be cut when heads are firm. Cut 2.5- to 3.5-lb heads low enough to leave 2 to 3 loose wrapper leaves. Cabbage is usually marketed in 50-lb boxes or bags with 16 to 18 heads/bag. Allow 3 to 4 extra lb for shrinkage. For slaw market cabbage, cut 4- to 8-lb heads, remove wrapper leaves, and put in 20 bushel bins.

VARIETIES: Broccoli, Brussels Sprouts, Cauliflower

Note: see "Greens" chapter for broccoli raab varieties.

Variety	Hybrid	Maturity (days) ⁴	Comments
Broccoli¹			
Packman	X	48	Early and uniform
Everest	X	51	Good for bunching, refined head with good extension; downy mildew resistant.
Windsor	X	53	Large heads for crown cuts; large stems; downy mildew resistant.
Gypsy	X	59	Large, medium green heads; downy mildew resistant.
Green Magic	X	60	Large, blue-green heads; downy mildew tolerant.
Pinnacle	X	64	For fall crop, small bead size, good for bunching, downy mildew tolerant.
Emperor	X	65	Very uniform; good side shoot formation. Spring or fall. High yielding, excellent variety, use close spacing.
Green Belt	X	67	For fall crop, large head, shorter stalk, slow maturing; small bead size, good for bunching.
Arcadia	X	70	Spring or fall crop; large, blue-green tight-beaded heads; downy mildew tolerant.
Marathon	X	75	Large blue-green heads; excellent for bunching or crown cuts; downy mildew tolerant.
Brussels Sprouts²			
Jade Cross, E Strain	X	85	Plants grow to about 2 ft tall; medium sized sprouts; solid.
Cauliflower³			
Majestic		55	Early maturing, medium-compact plants, attractive heads.
Snow Crown	X	55	Early maturing; very uniform head development; Up to 8 in. diameter heads.
Early Glacier		72	Excellent fall crop, attractive.
White Sails		75	Excellent fall crop, attractive.
Candid Charm	X	75	Excellent fall crop, OK in spring, heat tolerant; large wrapper leaves. Heads up to 3 lb.
Violet Queen		65	Purple heads, used fresh, will turn a deep green when cooked.

¹ *Italica* Group

² *Gemmifera* Group

³ *Botrytis* Group

⁴ Days to maturity when transplanted.

VARIETIES: Cabbage¹

	Days to Maturity When Transplanted	Head Size (lb)	Yellows Resistant	Black Rot Tolerant	Tipburn Tolerant
Green					
Blue Vantage	72	3-4	X	X	X
Atlantis	72	3-5	X	X	
Blue Dynasty	75	3-5	X	X	X
Bronco	78	3-5	X		X
Cecile	80	3-4	X	X	X
Ramada	83	3-5	X	X	X
Bravo	85	3-4	X	X	
Cheers	85	4-6	X	X	
Red					
Red Rookie	75	2½-3			
Super Red 80	83	3-4			X
Savoy					
Savoy Ace	78	3½	X		

¹ *Capitata* Group (all are hybrids)

VARIETIES: Pak Choi, Chinese Cabbage, Kohlrabi

	Hybrid	Maturity (days) ⁴	Comments
Pak Choi¹			
Joi-choi	X	47	Slow bolting, very uniform.
Chinese Cabbage²			
Blues		57	Excellent for spring or fall, tolerant to virus, downy mildew, white spot, Alternaria leaf spot and bacterial soft rot—Napa type.
Yuki		62	Early slow bolting similar to China Express—Napa type.
Kasumi		64	Good spring or fall—Napa type.
Jade Pagoda	X	69	Excellent for spring crop—Michili type. Slow bolting.
Kohlrabi³			
Winner	X	45	Early maturing; slow to lose fine texture.

¹ *B. rapa, Chinensis* Group

² *B. rapa, Pekinensis* Group

³ *B. oleracea, Gongylodes* Group

⁴ Days to maturity from seeding.

Cauliflower should have the leaves pulled around the developing curd when the curd is about the size of a quarter. The head will be ready to harvest in about a week to ten days. When tying the curds, use rubber bands of different colors to represent different tying dates. Tie high enough so there is adequate air circulation around the heads, which will help reduce "riciness" and molding of the head. Tying the leaves up around the developing curd results in a white head. Heads should be cut before they become "ricy" in appearance. High temperatures may cause riciness to the head with very poor quality.

Cauliflower is packed in cartons containing 9 to 12 firmly wrapped heads.

Store cole crops at 32°F and 90 to 95 percent relative humidity.

Common Diseases/Management

Alternaria, Cercospora, and Cercospora Leaf Spots. To avoid introduction of these pathogens, use hot-water seed treatments. To reduce severity, avoid cruciferous (cabbage related) crops in 2- to 4-year (or longer) rotations. Apply protective fungicides, starting in seedbeds or shortly after transplanting in wet seasons; see tables for products and rates.

Black leg. Control centers on using disease-free seed/transplants and crop rotation. Hot-water seed treatment (see Appendix I) will improve control but will reduce seed germination and vigor. Locate transplant beds on well-drained and fumigated sites away from fields or gardens. Control wild mustard and related weeds near the beds. Purchase transplants from certified, disease-free sources. A crop rotation period of four years or more away from all cruciferous crops and related weeds is recommended for sites having a history of blackleg. See tables for chemical control options; read labels carefully as some products may not be labeled for all cole crops.

Black rot. The causal agent is seed-borne, so start with certified, disease-free seed and transplants. Hot-water seed treatment can reduce severity in infested seed lots. Plant into land that has been away from cole crops for 3-4 years, and avoid planting late crops in fields adjacent to earlier plantings of cole crops. Some cabbage and broccoli varieties have partial resistance to black rot that can greatly reduce losses. Spread of disease within the field can be slowed by removing infected plants and with applications of fixed coppers (begin at first signs of disease and continue on a regular schedule). See tables for a list of bactericides and rates.

Club root. Avoid poorly drained fields and those with a history of club root; be sure to have suspected cases confirmed through the county Extension office. Avoid introduction onto the farm by using only disease-free transplants. Maintain a high soil pH of 7.2 to 7.5, and use a 7-year rotation away from related crops. Fungicides are also available to manage club root; see tables for labeled materials and rates.

Downy mildew. Crop rotation with non-cruciferous plants and control of cruciferous weeds is recommended. Spring plantings of cole crops should be destroyed promptly to prevent them from serving as inoculum sources for the fall crops. Resistant varieties are an option for some cole crops. Regular applications of fungicides should provide adequate control; see tables for a list of registered materials.

Fusarium yellows (wilt). Resistant varieties should be planted in sites with a history of Fusarium yellows, or follow a long-term rotation (7+ years). Avoid introduction of the disease with transplants. Pre-plant fumigation of other crops in the rotation (staked tomatoes, for example) can aid greatly in controlling this disease.

Bacterial soft rot and bacterial head rot. Horticultural characteristics and production methods that lead to a *tight head with a dome* are important considerations in reducing losses. Broccoli varieties such as Green Defender, Pirate, and Shogun have tight and domed heads and generally have less disease. Reducing injuries and controlling insects, downy mildews, and foliage diseases are very important. Avoid working fields when plants are wet, and limit irrigation prior to harvest. A 2-year rotation away from cole crops should be used in fields with a history of bacterial head rot. Fixed coppers applied for control of black rot may also reduce incidence of head rots.

Nonpathogenic physiological disorders. Cole crops suffer from non-pathogenic disorders that can be confused with infectious diseases, including the following:

- *Tipburn* in cabbage is caused by inadequate supply of calcium at the time of leaf formation. Maintain uniform soil moisture so that calcium is supplied continuously to the plant.
- *Black petiole/stem* in cabbage is associated with poor fertility management, occurring in soils with very high phosphorus levels AND low potassium levels. *Black speck/pepper spot* appears to be caused by excessive fertilization, especially during temperature swings. Infectious diseases such as bacterial soft rot and *Alternaria* often occur on tissues damaged by these physiological disorders.

PESTICIDE SAFETY: Cole Crops

	Signal ⁴	Re-entry (hrs)	Harvest (days) ⁵
Insecticides			
Actara 25 WP	C	12	0
Admire Pro	C	12	21
Assail 30 SG	C	12	7
Avaunt 30 DG	C	12	3
Beleaf 50 SG	C	12	0
Bt products	C	12	0
Confirm 2 F	C	4	7
Dibrom 8	D	24	1
Dimethoate 4 E	W	48	7
Endosulfan 3 EC	DP	24	7/14 ¹
Fulfill 50 WDG	C	12	7
Intrepid 2 F	C	4	1
Larvin 3.2 F	W	12	7
Lorsban 50 W	W	24	21
Lorsban 15 G	C	12	AP
Malathion 8	C	12	3/7 ¹
Oberon 2 SC	C	12	7
Provado 1.6 F	C	12	7
Rimon 0.83 EC	W	12	7
Radiant SC	C	4	1
Sevin XLR	W	12	3/14 ¹
Spintor 2 SC	C	4	1
Venom 70 SG	C	12	1/21 ¹
RESTRICTED USE			
Ammo 2.5 EC	C	12	1
Asana XL	W	12	3
Baythroid XL	W	12	0
Capture 2 EC	W	12	7
Danitol 2.4 EC	W	24	7
Diazinon AG500	C	24	7/10/21 ¹
Diazinon 50 W	C	24	7/10/21 ¹
Di-syston 8	DP	48	14/30/40/42 ¹
Hero 1.24 EC	C	12	7
Lannate 90 SP	DP	48	1/3/10 ¹
Lorsban 4 E	W	48	AP
Mustang Max	W	12	1
Platinum 2 SC	C	12	30
Pounce 3.2 EC	C	12	1
Proaxis 0.5 EC	C	24	1
Proclaim 5 WDG	C	48	7
Renounce 75 WP	C	12	0
Warrior T	W	24	1
Fungicides²			
Actigard 50 WG	C	12	7
Aliette WDG ⁶	C	24	3
Azoxystrobin ³	C	4	0
Cabrio EG	C	12	0
Chlorothalonil ³	D	48	7
Endura	W	12	0
Fixed coppers ³	D	12/24 ³	0
Maneb ³	C	24	7-10
Ridomil Gold Bravo	D	48	7
Ridomil Gold Bravo SC	W		
Ridomil Gold EC/SL	C	48	0
Rovral 4 Flowable	W	12	0
Iprodione 4L AG			
Sulfur ³	C	24	0
Terraclor	W	12	0

¹ PHI depends on crop type and application method.

² None of these fungicides is labeled on all cole crops, so check labels carefully.

³ Several formulations are marketed. See the general introduction for more details on fungicides.

⁴ W: Warning, C: Caution, D: Danger, P: Poison

⁵ AP: At planting

⁶ The use of Aliette in the following Kentucky counties has certain restrictions to protect endangered freshwater mollusks and their habitat, so read labels carefully: Campbell, Green, Hart, Kenton, Logan, Marshall, Rockcastle, Todd, Warren, and Wayne counties.

- *Bolting* is the development of flower stalks, which can occur in most cole crops if they are exposed to long periods of warm weather early in their development. Transplant management is critical.

Phytophthora root rot & basal stem rot.

Phytophthora root rot is a newly reported problem in Kentucky and has caused significant losses under conditions that are ideal for the pathogen (warm, saturated soils). Control efforts should focus on managing soil moisture to avoid a saturated environment. Improve drainage where possible, and plant into raised beds. Crop rotation and burial of crop residues at season's end can be effective management tools; avoid planting cole crops in fields with a history of Phytophthora root

rot. Suppression of this disease can be obtained by applying mefenoxam (Ridomil Gold or Ultra Flourish) prior to or at planting; see tables for rates and applications methods.

Sclerotinia stem rot, white mold (raisin head). Rotate with grass or grain crops for three years (control broadleaf weeds during the rotation) and avoid canola, green beans, tomatoes, and potatoes; deep plow to bury fungal sclerotia. Chemical control options are limited; see tables for recommended rates of Endura.

Seedling damping-off. Always start plants in beds that have been sterilized with either steam or fumigation and practice good sanitation around the beds and greenhouses. See tables for control options in plant beds and greenhouses. At transplanting, application of fungicides

can reduce post-transplant damping-off and stem rots caused by *Pythium* and *Rhizoctonia*. See tables for materials and rates that are available.

Wire stem and bottom rot (*Rhizoctonia solani*). Raise seedlings in fumigated soils and use PCNB in the field as recommended in the disease control tables. Cover crops and sod should be plowed early enough to ensure they are well rotted before transplanting. Shallow setting of plants has been shown to reduce the incidence of this disease.

Virus diseases. Timely destruction of old crops and weeds is recommended. Maintain a weed-free border around fields. In cases where plants have been infected prior to transplanting, aphid control in transplant production is also important.

INSECT CONTROL: Cole Crops^{1,2}

Insecticide	Product Amt/A	Comments and Seasonal Limits
To prevent or reduce insect problems, destroy crop remnants immediately after harvest. When growing both spring and fall cole crops, allow for a 2- to 3-week period during midsummer without a cole crop. Always use a spreader/sticker to increase coverage on cole crops.		
PREPLANT INCORPORATED		
Cutworms, Root Maggots (Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites.)		
Diazinon 50 W	4 to 6 lb	Incorporate immediately.
Lorsban 15 G	4.6 to 9.2 oz/1,000 ft	Root maggots.
Lorsban 4 E	1.6 to 2.4 oz/1,000 ft	Root maggots.
TRANSPLANT WATER		
Root Maggots		
Diazinon AG 500	0.25 to 0.5 pt /50 gal	
SOIL APPLICATION		
Aphids (Do not use a foliar spray of Actara, Venom, Provado, or Assail following a soil application of Admire, Platinum, or Venom)		
Admire Pro	4.4 to 10.5 fl oz	Use as a 2 inch band during bedding, an in-furrow spray, a post-seeding drench, or a sidedress after plants are established.
Di-Syston 8 E	1.1 fl oz/1,000 row ft	
Platinum 2 SC	5 to 11 fl oz	See label for soil application methods.
Vemon 70 SG	5 to 6 oz	Limit 12 oz/A for soil applications.
FOLIAR TREATMENTS		
Aphids, Harlequin Bugs, Stink Bugs, Flea Beetles		
Actara 25 W	1.5 to 3 oz	Limit 11 oz/season and allow 7 days between applications.
Assail 30 SG	2 to 3 oz	Limit 20b oz/A. Allow at least 7 days between applications
Beleaf 50 SG	2.0 to 2.8 oz	Limit 8.4 oz/season and allow at least 7 days between applications.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 32 fl oz/A. Allow at least 7 days between applications.
Dimethoate 4 E	0.5 to 1 pt	Aphids only. Not for use on Chinese cabbage or Brussels sprouts.
Endosulfan 3 EC	1 to 1.33 qt	Limit 4 applications. Not for use on Chinese cabbage.
Fulfill 50 WDG	2.75 oz	Aphids only. Limit 5.5 oz/A. Allow at least 7 days between applications.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 46 fl oz/A. Allow 7 days between applications.
Malathion 8	1.5 to 2.5 pt	Aphids and flea beetles only.
Mustang Max	2.24 to 4.0 fl oz	Allow at least 7 days between applications. Limit 24 fl oz/A.
Provado 1.6 F	3.75 fl oz	Aphids and flea beetles only. Do not use following a soil application of Admire.
Radiant SC	5 to 10 fl oz	Limit 34 fl oz/A.
Sevin XLR	0.5 to 1 qt	Not for aphids. Limit 4 applications and allow at least 7 days between sprays.
Vemon 70 SG	1 to 4 oz	Limit 6 oz/A. Allow 7 days between sprays. Aphids only.
Warrior T	2.56 to 3.84 fl oz	Limit 1.92 pt/A/season. Stink bugs and flea beetles only.
Beet Armyworms (These are rarely serious pests of cole crops in Kentucky.)		
Confir 2 F	6 to 8 fl oz	Limit 56 fl oz/A.
Intrepid 2 F	4 to 10 fl oz	Limit 64 fl oz/A.
Larvin 3.2 F	16 to 32 fl oz	Limit 6 applications. For broccoli, cabbage, and cauliflower only.
Proclaim 5 WDG	2.4 to 4.8 oz	Limit 28.8 oz/A. Allow 7 days between applications.
Rimon 0.83 EC	6 to 12 fl oz	Limit 24 fl oz/A, target small larvae.

INSECT CONTROL: Cole Crops^{1,2}

Insecticide	Product Amt/A	Comments and Seasonal Limits
SpinTor 2 SC	4 to 10 fl oz	Limit 29 fl oz/A.
Cabbage Loopers (Treat when 20% of the plants are infested with looper larvae during the cotyledon stage, when 15% of the plants are infested up to the cupping stage, and when 5% of the plants are infested from cupping until harvest.)		
Ammo 2.5 EC	3.75 to 5 fl oz	Limit 30 fl oz/A/season.
Asana XL	5.8 to 9.6 fl oz	Limit 76.8 fl oz/A. Not for use on Brussels sprouts.
Avaunt 30 DG	2.5 to 3.5 oz	Limit 14 oz/A. Allow 3 days between applications.
Baythroid XL	1.6 to 2.4 fl oz	Limit 12.8 fl oz/A. Limit 3.2 fl oz per 7-day period.
Bt products	See labels	
Capture 2 EC	2.1 to 6.4 fl oz	Limit 32 fl oz/A. Allow 7 days between applications.
Confirm 2 F	6 to 8 fl oz	Limit 56 fl oz/A.
Danitol 2.4 EC	10.67 to 16 fl oz	Limit 42.6 fl oz/A. Allow 7 days between applications.
Endosulfan 3 EC	1 to 1.33 qt	Limit 4 applications. Not for use on Chinese cabbage.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 46 fl oz/A. Allow 7 days between applications.
Intrepid 2 F	4 to 10 fl oz	Limit 64 fl oz/A.
Mustang Max	3.2 to 4.0 fl oz	Allow at least 7 days between applications. Limit 24 fl oz/A.
Pounce 3.2 EC	2 to 4 fl oz	For broccoli, cauliflower, Brussels sprouts, and Chinese broccoli. Limit 32 fl oz/A.
	2 to 8 fl oz	For cabbage and Chinese cabbage only. Limit 40 fl oz/A.
Proclaim 5 WDG	3.2 to 4.8 oz	Limit 28.8 oz/A. Allow 7 days between applications.
Radiant SC	5 to 10 fl oz	Limit 34 fl oz/A.
Rimon 0.83 EC	6 to 12 fl oz	Limit 24 fl oz/A, target small larvae.
Spintor 2 SC	3 to 6 fl oz	Limit 29 fl oz/A.
Warrior 1 EC	1.92 to 3.2 fl oz	Limit 1.92 pt/A/season.
Cross-Striped Cabbageworms, Imported Cabbageworms (Treat when 20% of the plants are infested with any of these larvae during the cotyledon stage, when 15% of the plants are infested up to the cupping stage, and when 5% of the plants are infested from cupping until harvest.)		
Ammo 2.5 EC	2.5 to 5 fl oz	Limit 30 fl oz/A/season.
Asana XL	2.9 to 5.8 fl oz	Limit 76.8 fl oz/A. Not for use on Brussels sprouts.
Avaunt 30 DG	2.5 to 3.5 oz	Limit 14 oz/A. Allow 3 days between applications.
Baythroid XL	1.6 to 2.4 fl oz	Limit 12.8 fl oz/A. Limit 3.2 fl oz per 7-day period.
Bt products	See labels	
Capture 2 EC	2.1 to 6.4 fl oz	Limit 32 fl oz/A. Allow at least 7 days between applications.
Confirm 2 F	6 to 8 fl oz	Limit 56 fl oz/A.
Danitol 2.4 EC	10.67 to 16 fl oz	Limit 42.6 fl oz/A. Allow 7 days between applications.
Endosulfan 3 EC	1 to 1.33 qt	Limit 3 applications. Not for use on Chinese cabbage.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 46 fl oz/A. Allow 7 days between applications.
Intrepid 2 F	4 to 10 fl oz	Limit 64 fl oz/A.
Malathion 8	1.5 to 2.5 pt	
Mustang Max	3.2 to 4.0 fl oz	Allow at least 7 days between applications. Limit 24 fl oz/A.
Pounce 3.2 EC	2 to 4 fl oz	For broccoli, cauliflower, Brussels sprouts, and Chinese broccoli. Limit 32 fl oz/A.
	2 to 8 fl oz	For cabbage and Chinese cabbage only. Limit 40 fl oz/A.
Proaxis 0.5 EC	1.92 to 3.2 fl oz	Limit 30.72 fl oz. Allow 5 days between sprays.
Proclaim 5 WDG	2.4 to 4.8 oz	Limit 28.8 oz/A. Allow 7 days between applications.
Radiant SC	5 to 10 fl oz	Limit 34 fl oz/A.
Rimon 0.83 EC	6 to 12 fl oz	Limit 24 fl oz/A, target small larvae.
Sevin XLR	1 to 2 qt	Limit 4 applications and allow at least 7 days between sprays.
Spintor 2 SC	3 to 6 fl oz	Limit 29 fl oz/A.
Warrior T	1.92 to 3.2 fl oz	Limit 1.92 pt/A/season.
Cutworms (Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites.)		
Ammo 2.5 EC	2.5 to 5 fl oz	Limit 30 fl oz/A/season.
Asana XL	5.8 to 9.6 fl oz	Limit 76.8 fl oz/A. Not for use on Brussels sprouts.
Baythroid XL	0.8 to 1.6 fl oz	Limit 12.8 fl oz/A. Limit 3.2 fl oz per 7-day period.
Endosulfan 3 EC	1.33 qt	Limit 4 applications. Not for use on Chinese cabbage.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 46 fl oz/A. Allow 7 days between applications.
Mustang Max	2.24 to 4.0 fl oz	Allow at least 7 days between applications. Limit 24 fl oz/A.
Proaxis 0.5 EC	1.92 to 3.2 fl oz	Limit 30.72 fl oz. Allow 5 days between sprays.
Warrior T	1.92 to 3.2 fl oz	Limit 1.92 pt/A/season.
Diamondback Moth Larvae (Diamondback moth larvae are able to rapidly develop resistance to most major classes of insecticides. Do not tank mix insecticides with the same mode of action and frequently rotate among insecticides with different modes of action to discourage resistance. Treat when 20% of the plants are infested with diamondback larvae during the cotyledon stage, when 15% of the plants are infested up to the cupping stage, and when 5% of the plants are infested from cupping until harvest. IRAC Codes: Insecticides followed by the same number share the same mode of action.)		
Ammo 2.5 EC (3)	2.5 to 5 fl oz	Limit 30 fl oz/A/season.
Avaunt 30 DG (22)	2.5 to 3.5 oz	Limit 14 oz/A. Allow 3 days between applications.
Baythroid XL (3)	2.4 to 3.2 fl oz	Limit 12.8 fl oz/A. Limit 3.2 fl oz per 7-day period.
Bt products (11B2)	See labels	
Capture 2 EC (3)	2.1 to 6.4 fl oz	Limit 32 fl oz/A. Allow at least 7 days between applications.
Endosulfan 3 EC (2A)	1 to 1.33 qt	Limit 4 applications. Not for use on Chinese cabbage.
Hero 1.24 EC (3)	4 to 10.3 fl oz	Limit 46 fl oz/A. Allow 7 days between applications.
Mustang Max (3)	2.24 to 4.0 fl oz	Allow at least 7 days between applications. Limit 24 fl oz/A.
Pounce 3.2 EC (3)	2 to 4 fl oz	For broccoli, cauliflower, Brussels sprouts, and Chinese broccoli. Limit 32 fl oz/A.
	2 to 8 fl oz	For cabbage and Chinese cabbage. Limit 40 fl oz/A.
Proaxis 0.5 EC (3)	2.56 to 3.84 fl oz	Limit 30.72 fl oz. Allow 5 days between sprays.
Proclaim 5 WDG (6)	2.4 to 4.8 oz	Limit 28.8 oz/A. Allow 7 days between applications.
Radiant SC	5 to 10 fl oz	Limit 34 fl oz/A.
Rimon 0.83 EC (15)	6 to 12 fl oz	Limit 24 fl oz/A, target small larvae.

INSECT CONTROL: Cole Crops^{1,2}

Insecticide	Product Amt/A	Comments and Seasonal Limits
Sevin XLR (A)	1 to 2 qt	Limit 4 applications and allow at least 7 days between sprays.
Spintor 2 SC (5)	1.5 to 3 fl oz	Limit 29 fl oz/A.
Warrior T (3)	2.56 to 3.84 fl oz	Limit 1.92 pt/A/season.
Root Maggots		
Diazinon 50 W	1 to 1.5 lb per 200 to 300 gal water	Direct spray at base of plants. May result in stand reduction due to stress at transplanting.

¹ See *Kentucky Cabbage Insect Pest Management Scout Manual (IPM-11)* for additional information on cabbage pests and their control.

² To view color pictures of the pests, see: <http://www.uky.edu/Ag/IPM/picturesheets/colecropinsects.pdf>

WEED CONTROL: Cole Crops

Product Amt/A	Lb A.I./A	Remarks
0.5 to 1.5 fl. oz. Aim 1.9 EW	0.008 to 0.023 carfentrazone	For contact postemergence control of annual broadleaf weeds and suppression of annual grasses. Can be applied as a preplant, pre-transplant burndown, or before crop emerges to actively growing weeds up to 4 inches tall. Can also be applied postemergence as a directed hooded application between crop rows. Use min. 10 gal water/A and crop oil 1% v/v. Max. rate 6.1 fl oz/A. PHI = 0 days
0.67 to 1.3 pt Command 3ME (not labeled on Chinese vegetables)	0.25 to 0.5 clomazone	Cabbage only. Apply before transplanting and incorporate to a depth of 1 inch. Use a min. 10 gal water/A. Do not replant treated field with any crops inconsistent with rotational guidelines. PHI = 45 days.
6 to 14 pt Dacthal 6 F	4.5 to 10.5 DCPA	For preemergence control of annual grasses and broadleaves. Apply at seeding or transplanting. Can be broadcast over transplants. Can be preplant incorporated.
2 lb Devrinol 50 DF (not labeled on Chinese vegetables)	1 napropamide	For control of annual grasses and broadleaf weeds. Apply to weed free soil and incorporate 1 inch before seeding or transplanting or irrigate within 24 hours of application to soak soil to a depth of 2 to 4 inches. Do not plant rotational crops that are not specified on the label until 12 months after last Devrinol application. Most effective in combination with Goal.
0.5 to 1.3 pt Dual II Magnum 7.6 E	0.48 to 1.3 s-metolachlor	This special needs label is held by the Kentucky Vegetable Growers Assn., and you must be a member to use this herbicide on peppers and receive a copy of the label. To become a member, call the UK Department of Horticulture at 859-257-2909. Apply as a surface broadcast application before transplanting or within 48 hours after transplanting. Can be used as pre- or post-transplant directed, shielded spray to row middles. Use a min. 10 gal water/A. Use the high rate on silt and clay soils or high organic matter soils.
1 to 2 pt Goal 2XL	0.25 to 0.5 lb oxyfluorfen	For preemergence and postemergence control of certain annual grasses and most broadleaves. Apply to soil after final tillage but before transplanting. Do not use on direct seeded cole crops. If plants contact treated soil, some foliar burn may occur but plants generally outgrow symptoms. Do not use post-transplant. Do not use on Brussels sprouts. Max. rate is 2 pt/A.
1.3 to 2.7 pt Gramoxone Max 3 L	0.5 to 1 paraquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply preplant, preemergence, or before transplanting in min. 10 gal water/A. Apply banded or broadcast. Use higher rate for heavy weed infestations. Use non-ionic surfactant 0.25% v/v.
0.5 to 2.5 pt Poast 1.5 E	0.09 to 0.49 sethoxydim	For control of actively growing grasses only. Rate for Chinese Brassica vegetables is 0.5 to 1.5 pt. Use higher rate on johnsongrass. PHI = 30 days. Max. rate of 1.5 pt/application and 3 pt/season.
5 to 6 qt Prefar 4 E	5 to 6 bensulide	For control of grasses and broadleaf weeds. Apply preplant and incorporate to 1 to 2 inch depth. Apply preemergence only if it can be watered in within 36 hours. Max. rate of 6 qt/season.
16 to 22 fl oz Roundup Weather-Max 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Min. 30 days before planting any non-labeled crop.
6 to 8 fl oz Select 2E	0.09 to 0.12 clethodim	For selective postemergence of actively growing annual grasses and suppression of perennial grasses. Add crop oil 1% v/v. Max. 8 fl oz/application. Min. 14 days interval between applications. PHI = 30 days.
1 to 10% Scythe 4.2L	pelargonic acid	For non-selective contact control of annual grasses and broadleaf weeds. Use in min. 10 gal water/A if mixed with other herbicides or a min. 75 gal if used alone. Do not allow contact with crop foliage. Can be mixed with Roundup. See label for amount of Scythe to use depending on the desired spray volume.
1.25 to 2 pt Treflan HFP 4 E	0.6 to 1 trifluralin	For control of annual grasses and broadleaf weeds. Apply and incorporate in spring before transplanting. Check label for direct seeded cole crops. Rate for Chinese Brassica vegetables is 1 to 1.5 pt.

DISEASE CONTROL: Cole Crops

Product	Amt/A	Seasonal Limits/A	Comments
Alternaria Leaf Spot			
Azoxystrobin ¹		3 foliar apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Amistar	2 to 5 oz		
Quadris	6 to 15.5 fl oz		
Cabrio ¹	12 to 16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Chlorothalonil			Apply after transplanting or when conditions favor disease.
Bravo Ultrex	1.4 lb	14.5 lb	
Bravo WeatherStik	1.5 pt	16 pt	
Echo 720	1.5 pt	16 pt	
Echo 90 DF	1.25 lb	10.8 lb	
Equus 720 SST	1.5 pt	16 pt	
Equus DF	1.4 lb	14.5 lb	
Endura	6 to 9 oz	2 apps	Apply before disease onset, continue on a 7 to 14 day schedule.

DISEASE CONTROL: *Cole Crops*

Product	Amt/A	Seasonal Limits/A	Comments
Fixed coppers		n/a	Apply on a 7- to 10-day schedule after transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Badge SC	0.9 to 1.8 pt		
Champ DP	0.33 to 0.67		
Champ Formula 2 FL	0.33 to 0.67 pt		
Cuprofix Disperss	1.5 to 2.5		
Cuprofix Ultra 40 Disperss	0.75 to 1.25		
Kocide 101	1 to 2		
Kocide 2000	0.75 to 1.5		
Kocide 3000	0.5 to 0.75		
Kocide DF	1 to 2		
Kocide 4.5 LF	0.66 to 1.33 pt		
Nu-Cop 50 WP	2 lb		
Nu-Cop 50 DF	1 to 2 lb		
Tenn-Cop 5 E	1.5 pt		
Maneb			Apply when disease threatens and continue on a 7- to 10-day schedule. For loosehead Chinese cabbage, use 1 to 1.5 lb Maneb DF/WP or 0.8 to 1.2 pt Manex. Limit 7.2 lb ai/season for loosehead Chinese cabbage.
Maneb 75 DF	1.5 to 2 lb	12.8 lb	
Maneb 80 WP	1.5 to 2 lb	12 lb	
Manex	1.2 to 1.6 qt	9.6 qt	
Blackleg			
Cabrio ¹	12 to 16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Rovral 4 Flowable	2 pt	2 apps	BROCCOLI ONLY. Apply after thinning (2-4 leaf stage) as a directed spray targeting the base of the plant and adjacent soil surface; make a 2nd application (if necessary) no later than the day of harvest.
Iprodione 4L AG			
Black Rot			
Actigard	1 oz	4 apps	SUPPRESSION ONLY. Apply 7 to 10 days after thinning and make up to 3 additional applications on a 7-day schedule. Apply in a minimum of 20 gal/A of water. May cause phytotoxicity and yield reduction. Do not apply to stressed or injured plants.
Fixed coppers		n/a	Apply on a 7- to 10-day schedule after transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Badge SC	0.9 to 1.8 pt		
C-O-C-S WDG	3 to 4 lb		
Champ DP	0.33 to 0.67 lb		
Champ Formula 2 FL	0.33 to 0.67 pt		
Champion WP	2 lb		
Copper-Count-N	2 to 6 pt		
Cuprofix Disperss	1.5 to 2.5 lb		
Cuprofix Ultra 40 Disperss	0.75 to 1.25 lb		
Kocide 101	1 to 2 lb		
Kocide 2000	0.75 to 1.5 lb		
Kocide 3000	0.5 to 0.75 lb		
Kocide DF	1 to 2 lb		
Kocide 4.5 LF	0.66 to 1.33 pt		
Nu-Cop 50 WP	2 lb		
Nu-Cop 50 DF	1 to 2 lb		
Tenn-Cop 5 E	1.5 pt		
Clubroot			
PCNB		1 app	Rates based on 40-inch row spacing. Limit 30 lb ai/A/season.
Terraclor Flowable	3 pt ²		Apply 0.5 pt of solution/plant at transplanting. Agitate continuously to keep material in suspension.
	5.6 gal		Spray as a 12- to 15 inch band centered over the row before planting; incorporate to a depth of 4 to 6 inches.
	7.5 gal		Apply broadcast before planting and incorporate thoroughly to a depth of 4 to 6 inches with suitable equipment.
Terraclor 75 W	2 lb ²		Apply 0.5 pt of solution/plant at transplanting. Agitate continuously to keep material in suspension.
	30 lb		Spray as a 12- to 15-inch band centered over the row before planting; incorporate to a depth of 4 to 6 inches.
	40 lb		Apply broadcast before planting and incorporate thoroughly to a depth of 4 to 6 inches with suitable equipment.
Turfcide 10G	300 lb		Apply broadcast before planting and incorporate thoroughly to a depth of 4 to 6 inches with suitable equipment.
Terraclor 15G	125 lb		Spray as a 12- to 15-inch band centered over the row before planting; incorporate to a depth of 4 to 6 inches.
	200 lb		Apply broadcast before planting and incorporate thoroughly to a depth of 4 to 6 inches with suitable equipment.
Damping-off (Rhizoctonia)			
PCNB		1 app	CONTAINER-GROWN PLANTS ONLY. Apply as a drench to nursery- or greenhouse-grown plants. See label for specific application instructions.
Terraclor 400	6 to 12 fl oz ²		
Terraclor 75 W	4 to 8 oz ²		Apply as a drench to plants grown in containers or beds before transplanting. May be applied in nurseries, greenhouses, or the field. See label for specific applications instructions
Terraclor Flowable	6 to 12 fl oz ²		
Turfcide 10G	1 to 1.5 lb ³		
Terraclor 15G	0.7 to 1 lb ³		
CONTAINER-GROWN PLANTS ONLY. Incorporate thoroughly into growing media. Use low rate before seeding/transplanting and higher rate on older plants.			

DISEASE CONTROL: Cole Crops

Product	Amt/A	Seasonal Limits/A	Comments
Damping-off (Pythium)			
Ridomil Gold EC Ridomil Gold SL	0.25 to 0.5 pt	1 app	PRE-PLANT: Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil. Can be applied by drip irrigation.
	1 to 2 pt	1 app	AT-PLANTING: Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil with irrigation/rainfall. Can be applied by drip irrigation.
Ultra Flourish	0.5 to 1 pt	1 app	PRE-PLANT: Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil. Can be applied by drip irrigation.
	2 to 4 pt	1 app	AT-PLANTING: Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil with irrigation/rainfall. Can be applied by drip irrigation.
Downy Mildew			
Actigard	1 oz	4 apps	Apply 7 to 10 days after thinning and make up to 3 additional applications on a 7-day schedule. Apply in a minimum of 20 gal/A of water. May cause phytotoxicity and yield reduction. Do not apply to stressed or injured plants.
Aliette WDG	2 to 5	7 apps	Apply when conditions favor disease and continue on a 7- to 21-day schedule. Do not tank-mix with copper compounds.
Azoxystrobin ¹		3 foliar apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Amistar	2 to 5 oz		
Quadris	6 to 15.5 fl oz		
Cabrio ¹	12 to 16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule. User higher rates when pressure is severe.
Chlorothalonil			Apply after transplanting or when conditions favor disease.
Bravo Ultrex	1.4 lb	14.5 lb	
Bravo WeatherStik	1.5 pt	16 pt	
Echo 720	1.5 pt	16 pt	
Echo 90 DF	1.25 lb	10.8 lb	
Equus 720 SST	1.5 pt	16 pt	
Equus DF	1.4	14.5 lb	
Fixed coppers		n/a	Apply on a 7- to 10-day schedule after transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Basic Copper 53	1 to 3 lb		
Badge SC	0.9 to 1.8 pt		
C-O-C-S WDG	3 to 4 lb		
Champ DP	0.33 to 0.67 lb		
Champ Formula 2 FL	0.33 to 0.67 pt		
Champion WP	0.5 to 1 lb		
Copper-Count-N	1 to 2 pt		
Cuprofix Disperss	1.5 to 2.5 lb		
Cuprofix Ultra 40 Disperss	0.75 to 1.25 lb		
Kocide 101	1 to 2 lb		
Kocide 2000	0.75 to 1.5 lb		
Kocide 3000	0.5 to 0.75 lb		
Kocide DF	1 to 2 lb		
Kocide 4.5 LF	0.66 to 1.33 pt		
Nu-Cop 50 WP	0.5 to 1 lb		
Nu-Cop 3 L	0.33 to 1.33 pt		
Nu-Cop 50 DF	1 to 2 lb		
Tenn-Cop 5 E	1.5 pt lb		
Maneb			Apply when disease threatens and continue on a 7- to 10-day schedule. For loosehead Chinese cabbage, use 1 to 1.5 lb Maneb DF/WP or 0.8 to 1.2 pt Manex. Limit 7.2 lb ai/season for loosehead Chinese cabbage.
Maneb 75 DF	1.5 to 2	12.8 lb	
Maneb 80 WP	1.5 to 2	12 lb	
Manex	2.4 to 3.2 pt	9.6 qt	
Ridomil Gold Bravo	1.5 lb	4 apps	Apply before disease onset, continue on a 14-day schedule. Do not apply to loosehead Chinese cabbage. Observe seasonal limits for chlorothalonil.
Ridomil Gold Bravo SC	1.5 pt	4 apps	
Ridomil Gold EC	0.25 to 0.5 pt	1 pt	Apply before disease onset, continue on a 14-day schedule. Tank mix Ridomil Gold EC or SL with another fungicide labeled for downy mildew.
Ridomil Gold SL			
Phytophthora Root Rot, Basal Stem Rot			
Ridomil Gold EC	1 to 2 pt	1 app	PRE-PLANT: Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil. Can be applied by drip irrigation. Do not use in transplanter water.
Ridomil Gold SL			
Ultra Flourish	2 to 4 pt	1 app	AT-PLANTING: Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil with irrigation/rainfall. Can be applied by drip irrigation. Do not use in transplanter water.
Sclerotinia Stem Rot, Wirestem			
Endura	6 to 9 oz	2 apps	Apply before disease onset, continue on a 7 to 14 day schedule.
PCNB		1 app	Rates based on 40-inch row spacing. Do not exceed 30 lb/A of PCNB (ai)/season.
Terraclor Flowable	2.8 to 3.8 gal		BROADCAST DRENCH APPLICATION: Apply in 50 gal/A of water as a drench to soil before planting or immediately after seeding.
	1.9 to 2.8 gal		ROW DRENCH APPLICATION: Apply in 35 gal/A of water in an 8-inch band centered over the row at planting or immediately after seeding.
Terraclor 75 W	15 to 20 lb		BROADCAST DRENCH APPLICATION: Apply in 50 gal/A of water as a drench to soil before planting or immediately after seeding.
	10 to 15 lb		ROW DRENCH APPLICATION: Apply in 35 gal/A of water in an 8-inch band centered over the row at planting or immediately after seeding.
Terraclor 15G	75 to 100 lb		Apply in an 8-inch band centered over the row before seeding.

¹ Do not make back-to-back applications or rotate with other QoI inhibitors (FRAC Group 11). Fungicides with the same Group number have the same mode of action. Do not tank-mix products with the same Group number, and rotate among fungicides with different Group numbers to discourage resistance development.

² Per 100 gallons of water.

³ Per cubic yard of media.

Sweet Corn

Grass family (Poaceae): *Zea mays* subsp. *mays*

Types and Isolation Requirements

A confusing array of high-sugar sweet corn types are found in the most recent seed company catalogs. Varieties are often grouped under abbreviations for the types of genes they carry for sweetness (*su*, *se*, *sh2*, etc.) or under various trade names (TripleSweet™, Xtra Tender™, Sweet Generation™, etc.) that contribute to the confusion. Various types of sweet corn are strikingly different in terms of sweetness, eating quality, and suitability for mechanical harvest and shipping. Consider carefully which types are best suited to your marketing situation. Different types also have different isolation requirements (see below).

Traditional or standard sweet corn (*su*) varieties are characterized by their creamy corn flavor and mild sugars; these sugars quickly convert to starch so they are best consumed soon after harvest. Obviously, these varieties are most suitable for local sales.

Sugary enhanced (*se*) varieties have tender kernels and a creamy texture like standard varieties but have up to twice as much sugar. Consequently, they will remain sweet longer than standard sweet corn. Sugary enhanced varieties are very popular at farmers' markets and for local sales.

Supersweet or shrunken-2 varieties (*sh* or *sh2*) all have shrunken, wrinkled/shriveled seeds. They have very high sugar contents as well as slower conversion of

sugar to starch. This means they will remain sweeter much longer than other corn types. Supersweets also have kernels that hold up much better when mechanically harvested; however, these tougher kernels do not have the creamy texture and flavor of standard or sugary enhanced corn varieties. Most sweet corn varieties sold for processing and through wholesale market channels are supersweets.

Augmented supersweets are new and improved supersweet varieties that have tender kernels like *se* varieties while retaining the added sweetness and longer shelf life of supersweets. Ears of these varieties contain only a single type of kernel. These varieties are sold under several trade names including Xtra Tender™, Gourmet Sweet™, MultiSweet™, HQ, shQ, etc.

VARIETIES: Sweet Corn and Ornamental Corn

	Maturity (days)	Color ¹	Disease Resistance ²				Comments
			Rust	Stewart's	NLB	MDM	
Standard Sweet Corn (<i>su</i>)							
Sundance	69	Y	--	--	--	--	Good early producer, MDM tolerant.
Merit	80	Y	9	5	8	--	Long ears.
Silver Queen	95	W	8	3	3	9	Excellent.
Sugar Enhanced (<i>se</i>)							
Legend	68	Y	3	8	7	--	Excellent husk cover, attractive husk and ear, MDM tolerant.
Tuxedo	70	Y	3	3	2	9	Good husk cover and tip fill, slender ear, good quality.
Kandy Plus	79	Y	1-4	5	6	9	Attractive husk and ear, very sweet.
Incredible	80	Y	3	5	6	9	Good husk coverage, excellent flavor.
Miracle	82	Y	3	3	4	9	Outstanding quality, excellent husk cover.
Seneca Sensation	73	W	4	5	5	9	Good husk cover, attractive ear.
Silver Princess	75	W	6	5	6	8	Attractive husk and ear, snaps off easily.
Imaculata	78	W	4	2	3	9	Excellent husk cover, tip fill, attractive ear.
Silverado	79	W	5	3	4	9	Excellent husk cover, tip fill, and quality.
Argent	89	W	4	3	5	9	Excellent husk coverage.
Lancelot	80	BC	4	3	3	9	Excellent husk coverage, tip fill, and appearance.
Delectable	80	BC	4	3	5	9	Attractive husk and ear, good husk coverage.
Calico Belle	80	BC	4	4	6	--	Very good yield, attractive ear.
Supersweets (<i>sh2</i>)							
Saturn	75	Y	4	2	5	9	Attractive husk and ear, excellent flavor and yield.
Attribute WSS0966 ³	79	Y	--	--	--	--	Transgenic variety for insect (worm) resistance; attractive husk and ear; excellent husk cover, tip fill, flavor, and yield.
Bandit	80	Y	1-7	6	8	2	Attractive ear; excellent tip fill.
Morning Star	83	Y	1-6	5	1	5	Nice ears; excellent husk cover, tip fill, and yield.
Flagship II	84	Y	1-6	4	4	9	Excellent yield, husk coverage, tip fill, very sweet.
Max	85	Y	--	--	--	--	Small kernels, nice flavor
White Saturn	75	W	6	4	6	9	Nice plant and ears; excellent husk cover and tip fill.
Ice Queen	77	W	1	5	6	2	Healthy plants, beautiful ears; excellent husk cover, tip fill, and yield.
Attribute WSS 0987 ³	78	W	--	3	1	--	Attractive husk, deep kernels.
Gourmet Brand 378A	78	W	--	--	--	--	Attractive husk and ear, deep kernels.
Summer Sweet 8101R	81	W	5	--	3	--	Attractive ear and husk, excellent flavor.
Tahoe	81	W	1-6	6	3	9	Attractive husk and ear.
Summer Sweet 7631	84	W	5	7	4	9	Attractive ear, dark green husk, good flavor.
Sandy Corner	76	BC	1-9	6	7	3	Attractive; excellent yield and flavor, good late season variety.
Attribute BSS 0977 ³	79	BC	1	5	2	9	Transgenic variety for insect (worm) resistance; attractive husk and ear; excellent husk cover, tip fill, yield, and flavor.
Summer Sweet 8102R	81	BC	4	4	3	9	Excellent husk cover and tip fill.
Shooting Star	83	BC	1-7	1	1	2	Attractive husk and ear, short flags.

Synergistic varieties are sold under several trade names including TripleSweet™, Sweet Generation™, Sweet Breed™, Table Sweet™, and seQ. Ideally, they have the seed vigor of standard varieties, the flavor and eating quality of *se* varieties, and the high sugar and long shelf life of *sh2* varieties. Most synergistics combine the best characteristics of sugary enhanced and supersweet varieties with seed vigor that is most similar to *se* types. What distinguishes this group is that *different types of kernels occur on the same ear*, i.e., most of these varieties have ears with ¾ sugary enhanced (*se*) type kernels and ¼ supersweet (*sh2*) kernels. These varieties may not have as long a shelf life as true supersweets and may not be suitable for mechanical harvest. The genetic combinations in these varieties differ widely and growers should try them on a small scale prior to growing large acreages.

Genetically modified or transgenic sweet corn varieties are available that express a toxin from the insect-killing bacteria *Bacillus thuringiensis* (Bt). Bt toxins

help control worms feeding on sweet corn and can result in considerable reductions in pesticide usage, especially late in the season. Any of the previously described sweet corn types can be modified in this way. Current transgenic sweet corn varieties are sold under the trade name Attribute™. While Bt toxins are harmless to humans, some wholesale and retail buyers will not accept transgenic products. *Transgenic varieties are also not allowed in organic production.*

Isolation Requirements

All sweet corn types must be isolated from field corn or popcorn to prevent cross pollination and loss of sweetness. A separation (isolation) distance of 700 feet will give complete isolation of white, yellow, or high-sugar varieties but may be impractical. A distance of 250 feet will result in some contamination but not enough to affect quality. Isolation can also be maintained by a 10 to 14 day difference in maturities of different types, although isolation by distance is more effective.

The different types of sweet corn described above can be placed in either of two major groups in terms of their isolation requirements. While each type within one of these groups may benefit from isolation from other types in the same group, the resulting cross pollination will not produce field corn type kernels. *Cross pollination between the two groups, however, will produce field corn kernels.* These lists may not include all the trade names currently available.

Sweet Corn Isolation Groups

Group 1	Standard varieties (<i>su</i>)
	Sugary enhanced (<i>se</i>)
	Synergistics
	Sweet Breed
	Table Sweet
	TripleSweet
	seQ, HQ
Group 2	Supersweets (<i>sh-2</i>)
	Augmented supersweets
	Crisp N Sweet
	Gourmet Sweet
	MultiSweet
	SummerSweet
	Xtra Tender
	shQ

VARIETIES: Sweet Corn and Ornamental Corn

	Maturity (days)	Color ¹	Disease Resistance ²				Comments
			Rust	Stewart's	NLB	MDM	
Augmented Supersweet							
Obsession	79	BC	1	4	3	9	Attractive husk and ear.
Synergistics							
Sugar Ace	83	Y	5	4	6	7	Excellent husk cover, yield, and eating quality.
Sweet Ice	74	W	7	5	6	9	Attractive ear, good flavor, husk snaps off easily.
Sweet Satin	77	W					Excellent husk cover and good tip fill; MDMV resistant; Stewart's Wilt tolerant.
Avalon	82	W					Excellent husk cover and tip fill; high yielding and tolerant to leaf spots/blight.
Providence	80	BC					Attractive, tight shuck cover; very sweet.
BC 0805 Attribute	83	BC	1	6	7	9	Excellent husk cover and tip fill; attractive husk and ear; transgenic insect (worm) resistance.
Ornamental Corn⁴							
Earth Tones Dent	90						Colors are soft earth tones, 8-10" ears.
Green and Gold Dent	95-100						Bright yellow and green kernels, 8-10" ears.
Little Bell Ornamental	100						Multicolored, small-medium size ears, attractive ears, red coloration in stalks, shucks helps sales as fodder shock, lodging tolerant.
Miniature Blue, Little Boy Blue, Cutie Blues	100						Shiny blue kernels, 2-4" ears, good stalks, popcorn.
Miniature Pink, Little Bow Peep, Cutie Pink, Little Miss Muffet	100						Shiny pink kernels, 2-4" ears, good stalks, popcorn.
Autumn Explosion	102						Multicolored flint corn, 8-9" ears, 25% red husks.
Autumn Splendor	105						Multicolored, large ears, excellent yield, plant health, ear fill, lodging resistance.
Indian Art 104	105						Multicolored, large ears, excellent yield, plant health, ear fill, lodging resistance.
Indian Fingers	110						Multicolored, 3 1/2" ears, small shiny kernels.
Pretty Pops Laser	110						Multicolored striped kernels, 5-6" ears, popcorn.
Pod Corn	110						Highly ornamental and variable with husks around each kernel.
Big Chief	120						Multicolored, nice, large ears, healthy plants, good tip fill, eye-catching, some lodging in wet soils because of height 5 feet or more to ear, good maze corn.

¹ Y = yellow; W = white; BC = bicolor

² Disease evaluations for common rust, Stewart's bacterial wilt, northern leaf blight, and maize dwarf mosaic virus conducted at the University of Illinois by J.K. Pataty. Hybrids are classified as 1 = resistant, 3 = moderately resistant, 5 = moderate, 7 = moderately susceptible, 9 = susceptible. A range in rust ratings indicates varying reactions to different races of the pathogen.

³ Growers should check current regulations for marketing and labeling of transgenic or "genetically modified" crops before planting; "Attribute" sweet corn seed may also have minimum purchase requirements.

⁴ See HO-81, Ornamental Corn Production in Kentucky, for production and more detailed variety information.

Planting and Culture

Sweet corn will do well in all areas of Kentucky, but well-drained soils are essential for good results. A well-prepared seedbed is critical for successful seed germination and good stands. Fescue sod is ideal prior to sweet corn production. Sweet corn makes a good rotational crop for other vegetable crops. Plowing should be done several weeks in advance of planting to allow the ground to settle and the grass to decompose. Disking the soil three to four times before planting will help in preparing a good seedbed. Plant seed in rows 30 to 40 inches apart with plants spaced 8 to 10 inches apart in the row. Ten to 15 lb of seed will usually be required to plant an acre. If plants are spaced closer, thin to 8 inches within row spacing. Ears will be smaller if planted too close together.

For best results, sweet corn seed should be planted after the soil temperature has reached 60°F. In most parts of Kentucky, the earliest plantings can be made from April 20 to May 1 (see Appendix H). The harvest period for sweet corn can be extended by planting early, midseason, and late-maturing varieties or by making successive plantings at weekly intervals. Late planted sweet corn will have more insect and disease problems. Cultivars with tolerance or resistance to leaf blights and viruses should be selected when planting in June, especially in river bottoms and humid areas in the state (see varieties table).

Seed germination percentages of some supersweet varieties (or other varieties with shrunken seed) can be poor to fair, particularly under cold soil conditions. Make sure the soil is warmer than 60°F before planting these varieties. The germination of sugary enhanced corn is much better than that of shrunken types but not quite as good as standard sweet corn. At present, use standard varieties for very early plantings intended for early markets. Most high sugar corn varieties are also more attractive to insects, birds, groundhogs, and raccoons and more susceptible to heat and drought stresses than standard sweet corn.

Irrigation is usually required to ensure high quality in both standard and high-sugar corn types. While solid set sprinkler systems and traveling guns are still in use, it is also relatively easy to irrigate (and fertigate) sweet corn simply by running **drip irrigation** lines down the rows on bare ground with lines placed no more than about 4 inches from the plants.

FERTILIZER: Sweet Corn

Soil Test Results (lb/A)		Fertilizer Needed (lb/A)
Phosphorus		Phosphate (P₂O₅)
Low	<31	121-180
Medium	31-60	61-120
High	61-80	1-60
Very High	>80	0
Potassium		Potash (K₂O)
Low	<201	151-200
Medium	201-300	101-150
High	>300	100
Nitrogen		N
Apply 80 to 100 lb actual nitrogen (N)/A pre-plant; apply at least 40 to 50 lb N/A as sidedressing when plants are knee high.		

Production with Plasticulture

A number of Kentucky growers have successfully grown transplanted sweet corn on plastic mulch with drip irrigation. This system enables earlier harvests resulting in considerably higher market prices. Seeds are sown in 200-cell plastic or styrofoam plug trays in the greenhouse approximately 3 weeks before the projected transplanting date. Sweet corn plants are ready for transplanting as soon as they can be pulled from the trays and still retain the soil or media around the roots (usually at the two leaf stage). It is critical that corn transplants not be held over too long in the greenhouse as this results in stunting of the plants in the field. Also, *do not use early-maturing varieties (earlier than 75 days) as these are likely to tassel prematurely, resulting in stunted plants.*

Black plastic mulch on raised beds is most often used for transplanted corn. One popular system uses double rows (2 rows/bed) with 12 inches between transplants in the row and about 18 to 20 inches between the two rows. In the latter system two seeds are sown in each cell of the plug trays and therefore each hill will contain two plants in the field. Some growers have also direct seeded sweet corn under clear plastic and then cut the plastic open after the seedlings emerged. Using clear plastic, however, has resulted in problems with weed seed germination under the plastic.

Fertilizing

Make all lime and fertilizer applications based on soil test results. Sweet corn tolerates some soil acidity and can be grown in soils ranging in pH from 5.5 to 6.8; however, lime should be applied to bring the pH to 6.5 for best results. Where sweet corn is planted on sod ground, apply at least half of the fertilizer broadcast and plow down. The remaining fertilizer can be applied broadcast just before planting and disked in. If banding equipment is available, fer-

PESTICIDE SAFETY: Sweet Corn

	Signal ⁴	Re-entry (hrs)	Harvest (days) ⁵
Insecticides			
Avaunt 30 DG	C	12	3
Bt products	C	12	0
Concur	C	24	ST
Endosulfan 3 EC	DP	24	1
Intrepid 2 F	C	4	3
Larvin 3.2 F	W	12	0
Latitude	C	24	ST
Lorsban 15 G	C	24	35
Lorsban 75 WP	W	48	35
Malathion 8	C	12	5
Radiant SC	C	4	1
Sevin XLR	W	12	2
SpinTor 2 SC	C	4	1
RESTRICTED USE			
Asana XL	W	12	1
Aztec 2.1 G	W	0	AP
Baythroid XL	W	12	0
Capture 2 EC	W	12	1/30 ¹
Counter 15 G	DP	48	AP
Decis 1.5 EC	DP	12	1
Diazinon AG500	C	24	7
Force 3 G	C	0	AP
Fortress 2.5 G	DP	48	AP
Furadan 4 F	DP	48	AP
Hero 1.24 EC	C	12	3
Lannate 90 SP	DP	48	0
Lorsban 4 E	W	24	35
Mocap 15 G	W	48	AP
Mustang Max	W	12	3
PennCap-M	W	96	4
Pounce 1.5 G	C	12	1
Pounce 3.2 EC	C	12	1
Proaxis 0.5 EC	C	24	1
Renounce 20 WP	C	12	0
Thimet 20 G	DP	48	AP
Warrior T	W	24	1
Fungicides			
Azoxystrobin ²	C	4	7
Fixed coppers ²	D	12/24 ³	0
Headline	W	12	7
Mancozeb ²	C	24	7
Maneb ²	C	24	7
Propiconazole ²	W	24	14
Quilt	C	24	14
Tilt	W	24	14
FRESH MARKET ONLY			
Chlorothalonil ²	D	48	14

¹ Dependent on application type, see label.

² Several formulations are marketed. See the general introduction for more details on fungicides.

³ Re-entry period varies by product. See label for more information.

⁴ W: Warning, C: Caution, D: Danger, P: Poison

⁵ AP: At planting, ST: Seed treatment

tizer may be banded 2 to 3 inches to the side of seed and 2 to 3 inches deeper than the seed. The total amount of fertilizer that is banded should not exceed 45 lb per acre (total of N and K, to avoid root burn from salts). Sidedress with 50 lb of actual nitrogen (N) when plants are about knee high. High sugar varieties (supersweets, sugar enhanced and others) benefit from an additional late sidedressing of nitrogen to keep the husks dark green.

With plasticulture systems, apply all P and K and half to two-thirds of the nitrogen prior to planting. The remaining nitrogen requirement can be divided up into equal doses and fertigated weekly.

Sweet corn grown on high pH soils that are also very high in available phosphorus may show zinc deficiency in some years. However, many other factors including weather conditions and cool soil temperatures affect availability of soil zinc, making it difficult to predict a response to added zinc for a specific growing season. Zinc should be broadcast at 30 lb per acre (90 lb of zinc sulfate) or banded at 6 lb per acre (17 lb of zinc sulfate). A broadcast application should last from 4 to 6 years, whereas a band application should be made annually for 6 to 8 years. See also Appendix D.

Harvesting and Handling

Corn should be harvested at the milk stage of maturity for best quality. Sweet corn is usually marketed as 5 dozen ear units in bags or crates. Harvest in the early morning while the air is still cool. If the temperature of the ears is high when harvested, field heat should be removed by plunging them in ice water. To maintain top quality, sweet corn must be cooled to

as near to 32°F as possible. This prevents sugars from changing to starch. Crated corn can be cooled in ice water from about 86°F to around 41°F in about 80 minutes. Hydrocoolers are often used by larger producers for this purpose. Vacuum cooling is a much faster procedure but involves more expensive equipment.

Store sweet corn at 32°F and 90 to 95 percent relative humidity. The type of sweet corn grown also has a great impact on sweetness and shelf life.

Common Diseases/Management

Stewart's wilt, bacterial wilt. The causal agent (a bacterium) overwinters in and is spread by adult flea beetles. *Control is based on using either tolerant plants or management of the adult flea beetles with insecticides* (see insect control table). Where possible, use wilt-resistant hybrids (see variety list).

Damping-off, seed rot. Plant seed that has been commercially treated with fungicides, or apply Captan 50 W at 1 tsp/lb of seed if you purchase untreated seed. Plant at a shallow depth in warm, well-drained soils; raised beds improve drainage and help reduce losses. Avoid using float systems, if possible, in the production of transplants.

Leaf blights (gray leaf spot, Helminthosporium, and Anthracnose), rust. Crop rotation on a 2- to 3-year schedule, along with clean tillage, helps to reduce pathogen levels. Fungicides treatments may be necessary during rainy seasons, in foggy sites, and in late plantings (especially with corn following corn or in small plantings near older corn). See tables for recommended fungicides and rates. Rust fungicides may be warranted when the disease is active before the whorl stage of plant development; labeled materials are listed below. Several rust-resistant cultivars are available. Consider planting resistant cultivars for fall crops.

Smut. No fungicides are available, and there are only a few tolerant hybrids. Rotation is the recommended control practice.

Virus complex. Maize Dwarf Mosaic Virus and Maize Chlorotic Dwarf Virus are the most common viruses of sweet corn in Kentucky. Infected corn crops and grassy weeds serve as hosts of the viruses/mycoplasmas. Control Johnson grass within and adjacent to sweet corn fields. Partial resistance to virus diseases is available in some cultivars; see list.

INSECT CONTROL: Sweet Corn^{1,2}

Insecticide	Product Amt/A	Comments and Seasonal Limits
PREPLANT INCORPORATED		
Wireworms (<i>Wireworms can be a potential problem where sweet corn follows grass or grass-legume sod.</i>)		
Lorsban 4 E	4 pt	
Lorsban 15 G	13.5 lb	
Cutworms (<i>Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites.</i>)		
Lorsban 4 E	2 to 4 pt	
Lorsban 15 G	6.75 to 13.7 lb	
PLANTING TIME		
Seedcorn Maggots, Rootworms, Seedcorn Beetles (<i>Corn rootworms are a potential pest where corn is grown year after year in the same field.</i>)		
Aztec 2.1 G	6.7 oz/1,000 row ft	Band, T-band or furrow.
Aztec 4.67 G	3 oz/1,000 row ft	Band, T-band or furrow.
Capture 2 EC	0.3 fl oz/1,000 row ft	Spray as T-band over open furrow.
Counter 15 G	8 oz/1,000 row ft	Band or furrow.
Force 3 G	4 to 5 oz /1,000 row ft	T-band controls cutworms as well.
Fortress 5 G	3 oz/1,000 row ft	T-band or furrow.
Furadan 4 F	2.5 fl oz /1,000 row ft	Spray as band over row.
Lorsban 15 G	8 oz/1,000 row ft	Band or furrow.
Mocap 10 G	12 oz/1,000 row ft	Band only. Rootworm control.
Thimet 20 G	6 oz/1,000 row ft	Band only. Rootworm control.
PLANTER BOX		
Seedcorn Maggots (<i>Seed treatments are recommended for fields that do not receive a soil insecticide at planting time. Seedcorn Maggots can be damaging to fields planted early.</i>)		
Concur	1.5 oz/42 lb	Imidacloprid-Metalaxyl
Kernel Guard	2 oz/bu	Captan-Lindane-Diazinon mixture
Latitude	1.5 oz/42 lb	Imidacloprid-Metalaxyl-Carboxin
FOLIAR TREATMENTS		
Armyworms		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Baythroid XL	1.6 to 2.8 fl oz	Limit 10 applications.
Decis 1.5 EC	1.5 to 2.4 fl oz	Limit 38.4 fl oz/A.

INSECT CONTROL: Sweet Corn^{1,2}

Insecticide	Product Amt/A	Comments and Seasonal Limits
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Intrepid 2 F	4 to 8 fl oz	Limit 64 fl oz/A.
Lannate 90 SP	0.25 to 0.5 lb	Limit 8 lb/A.
Mustang Max	2.8 to 4.0 fl oz	Limit 24 fl oz/A.
Radiant SC	3 to 6 fl oz	Limit 36 fl oz/A. Allow 2 days between applications.
Sevin XLR	1 to 2 qt	Limit 4 applications and allow at least 7 days between sprays.
SpinTor 2 SC	1.5 to 6 fl oz	Limit 29 fl oz/A.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Corn Earworms (Corn earworm is often the key insect pest attacking sweet corn. Egg laying occurs only while silks are still green, and sprays need to be repeated at 2- to 7-day intervals while silks are green. Time of planting, intensity of moth flight, and temperature will affect spray intervals. Pheromone traps are available for monitoring this pest and determining spray intervals. Pyrethroid insecticides are not as effective as in the past when used later in the sweet corn season.)		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Baythroid XL	1.6 to 2.8 fl oz	Limit 10 applications.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Do not graze livestock for 30 days.
Decis 1.5 EC	1.5 to 2.4 fl oz	Limit 38.4 fl oz/A.
Endosulfan 3 EC	2 qt	Limit 4 qt/A (3 applications). Allow 5 days between applications.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Lannate 90 SP	0.25 to 0.5 lb	Limit 8 lb/A.
Mustang Max	2.8 to 4.0 fl oz	Limit 24 fl oz/A.
Pounce 3.2 EC	4 to 8 fl oz	Limit 48 fl oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Radiant SC	3 to 6 fl oz	Limit 36 fl oz/A. Allow 4 days between applications.
SpinTor 2 SC	3 to 6 fl oz	Limit 29 fl oz/A.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Corn Leaf Aphids		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Endosulfan 3 EC	1.33 qt	Limit 4 qt/A (3 applications).
Malathion 8	1 pt	
Cutworms (Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites.)		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Baythroid XL	0.8 to 1.6 fl oz	Limit 10 applications.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Do not graze livestock for 30 days.
Decis 1.5 EC	1.0 to 1.5 fl oz	Limit 38.4 fl oz/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Lorsban 4 E	2 to 3 pt	
Mustang Max	2.24 to 4.0 fl oz	Limit 24 fl oz/A.
Pounce 3.2 EC	4 to 8 fl oz	Limit 48 oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
European Corn Borer, Southwestern Corn Borer (Treat if more than 15% of the whorls are infested with live larvae. Pheromone traps are available to monitor this pest. Corn borer control is frequently necessary when tassels begin to emerge from the whorl.)		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Avaunt 30 DG	2.5 to 3.5 oz	Limit 4 applications. Allow 3 days between applications.
Baythroid XL	1.6 to 2.8 fl oz	Limit 10 applications.
Bt products	See labels	
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Do not graze livestock for 30 days.
Decis 1.5 EC	1.5 to 2.4 fl oz	Limit 38.4 fl oz/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Intrepid 2 F	4 to 8 fl oz	Limit 64 fl oz/A.
Lannate 90 SP	0.25 to 0.5 lb	Limit 8 lb/A.
Mustang Max	2.8 to 4.0 fl oz	Limit 24 fl oz/A.
Pounce 3.2 EC	4 to 8 fl oz	Limit 48 oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Radiant SC	3 to 6 fl oz	Limit 36 fl oz/A. Allow 4 days between applications.
SpinTor 2 SC	3 to 6 fl oz	Limit 29 fl oz/A.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Fall Armyworms (Usually a serious pest only of sweet corn planted after June 1. Treat if more than 10% of the whorls are infested with live larvae. Pheromone traps are available to monitor this pest.)		
Avaunt 30 DG	2.5 to 3.5 oz	Limit 4 applications. Allow 3 days between applications.
Baythroid XL	2.8 fl oz	Limit 10 applications. First and second instars only.
Bt products	See labels	
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Do not graze livestock for 30 days.
Decis 1.5 EC	1.5 to 2.4 fl oz	Limit 38.4 fl oz/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Lannate 90 SP	0.25 to 0.5 lb	Limit 8 lb/A.
Larvin 3.2 F	20 to 30 fl oz	Limit 300 fl oz/A.
Mustang Max	2.8 to 4.0 fl oz	Limit 24 fl oz/A.
Pounce 3.2 EC	4 to 8 fl oz	Limit 48 oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Radiant SC	3 to 6 fl oz	Limit 36 fl oz/A. Allow 4 days between applications.
SpinTor 2 SC	1.5 to 6 fl oz	Limit 29 fl oz/A.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.

INSECT CONTROL: Sweet Corn^{1,2}

Insecticide	Product Amt/A	Comments and Seasonal Limits
Flea Beetles		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Do not graze livestock for 30 days.
Decis 1.5 EC	1.0 to 1.5 fl oz	Limit 38.4 fl oz/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Mustang Max	2.24 to 4.0 fl oz	Limit 24 fl oz/A.
Pounce 3.2 EC	4 to 8 fl oz	Limit 48 fl oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Sevin XLR	1 to 2 qt	Limit 4 applications and allow at least 7 days between sprays.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Grasshoppers		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Baythroid XL	2.0 to 2.8 fl oz	Limit 10 applications.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Do not graze livestock for 30 days.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Lorsban 4 E	0.5 to 1 pt	
Mustang Max	2.8 to 4.0 fl oz	Limit 24 fl oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Sevin XLR	0.5 to 1.5 qt	Limit 4 applications and allow at least 7 days between sprays.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Corn Rootworm Beetles, Japanese Beetle, Sap Beetle (Select sweet corn cultivars with good tip coverage. Treat when necessary.)		
Asana XL	5.8 to 9.6 fl oz	Limit 96 fl oz/A.
Baythroid XL	1.6 to 2.8 fl oz	Limit 10 applications.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Do not graze livestock for 30 days.
Decis 1.5 EC	1.5 to 2.4 fl oz	Limit 38.4 fl oz/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 3 to 5 days between applications.
Mustang Max	2.24 to 4.0 fl oz	Limit 24 fl oz/A.
Pounce 3.2 EC	4 to 8 fl oz	Limit 48 fl oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 3.84 pt/A.
Sevin XLR	1 to 2 qt	Limit 4 applications and allow at least 7 days between sprays.
Warrior T	2.56 to 3.84 fl oz	Limit 3.84 pt/A.

¹ See also Kentucky Insect Integrated Pest Management Scout Manual (IPM-10) for more information on sweet corn pests and their control.

² To view color pictures of the pests, see: <http://www.uky.edu/Ag/IPM/picturesheets/sweetcorninsects.pdf>

WEED CONTROL: Sweet Corn

Product Amt/A	Lb A.I./A	Remarks
1 to 2 qt Aatrex 4L	1 to 2 atrazine	For control of annual grasses and broadleaf weeds. Apply after planting but before weeds are 1 inch tall. Best in combination with alachlor or s-metolachlor. Do not plant any crop but corn for 18 months if using 1 lb or more atrazine because of residual injury. Do not use atrazine exclusively because resistance has occurred in certain weed species. Restricted use pesticide.
0.33 to 1.33 oz Accent 75 DF	0.015 to 0.06 nicosulfuron	For postemergence control of grasses and broadleaves. Apply broadcast or with drop nozzles (post-direct) when corn up to 12" tall or V5 leaf stage. For corn 12 to 18" tall, apply only as post-direct. Max. 1 application/season.
0.5 to 1.5 fl oz Aim 1.9 EW	0.008 to 0.023 carfentrazone	For contact postemergence control of annual broadleaf weeds and suppression of annual grasses. Can be applied as a preplant, pre-transplant burndown, or before crop emerges to actively growing weeds up to 4 inches tall. Can also be applied postemergence as a directed hooded application between crop rows to corn with 8 to 14 leaf collars stage. Use min. 10 gal water/A and crop oil 1% v/v. Max. rate 2 fl oz/A.
1 to 2 pt Basagran 4L	0.5 to 1 bentazon	Use postemergence for control of annual broadleaves and suppression of yellow nutsedge. Use 2 applications for nutsedge control. Best if tank mixed with other corn herbicides. Do not graze treated corn before 12 days after application.
2.1 to 2.58 qt Bicep II Magnum	1.6 to 2 atrazine + 1.2 to 1.56 s-metolachlor	Apply preplant or preemergence for control of most annual grasses and broadleaves. Do not use if small grains are to be planted the same year or if vegetable crops or tobacco are to be planted the following year. Conduct a soil test analysis for atrazine residue before the second year planting. May be applied at 1.3 to 2.58 qt/A in min. 15 gal water as a postemergence directed treatment on weeds < 2 leaf stage.
3 to 3.75 qt Bullet 4 F or Lariat 4 F	3 to 3.75 alachlor + atrazine	For control of many annual grasses and broadleaves. Apply to soil surface immediately after planting. See label for further directions and restrictions. Max. rate is 6.4 qt/A/year or 2 applications/year.
3 to 7.7 fl oz Callisto 4L	0.08 to 0.24 mesotrione	For preemergence (6 to 7.7 fl oz/A) and postemergence (3 fl oz/A) control of annual broadleaves. Rainfall within 7 to 10 days is needed for activation. If no rain, a rotary hoe is suggested. Do not cultivate 7 days before or after application. Do not tank mix with organophosphate or carbamate insecticide or with a grass herbicide.
4 pt Camix 3.67 E	1.84 s-metolachlor + mesotrione	For preemergence control of annual grasses and broadleaves. Camix may be applied up to 14 days before planting or as a broadcast application before corn emerges.
1.3 to 1.7 pt Dual II Magnum 7.6 E	1.3 to 1.6 s-metolachlor	For control of most annual grasses and certain broadleaf weeds, and suppression of yellow nutsedge. Apply preplant surface or incorporated, preemergence, postemergence, or layby. See label for specific rates. Better control of seedling johnsongrass with higher rates. Small grains may be planted 4½ months following treatment. See label for other rotational crop restrictions.
4.75 to 7.33 pt Eradicane 6.7 E	4 to 6 lb EPTC	For preemergence control of annual grasses and broadleaf weeds and suppression of johnsongrass, bermudagrass, and nutsedge at the high rate. Check with your co-op manager or supplier; this product may be difficult to locate in Kentucky.

WEED CONTROL: Sweet Corn

Product Amt/A	Lb A.I./A	Remarks
6 to 7.5 pt Expert 9.45 E	6 to 10 atrazine + s-metolachlor + glyphosate	For preemergence control of grasses and broadleaves. Good coverage is essential for best results. Sprinkler irrigate a minimum of 2 hours after, but within 2 days of application. Apply ½ to 1 inch of water. If irrigation is not possible and rain does not occur within 2 days after application, weed control may be decreased.
5.4 to 6.6 pt Fultime 4 E	2.7 to 3.3 acetochlor + atrazine	For preemergence control of grasses and broadleaves. Apply preplant, preemergence incorporated or non-incorporated. Max. 1 application/season. 0.5" water can be used to incorporate the herbicide.
1.3 to 2.7 pt Gramoxone Max 3 L	0.5 to 1 paraquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply before, during, or after planting but before crop emergence banded or broadcast. Use higher rate for heavy weed infestations. Add non-ionic surfactant 0.25% v/v. Can be applied postemergence as a directed spray at 0.7 to 1.3 pt/A on corn at least 10 inches tall with nozzles arranged to spray the bottom 3 inches of the stalk. Shorter corn plants may be injured.
3 to 4 pt Guardman Max 5 EC	1.24 to 1.65 atrazine + 0.64 to 0.84 dimethenamid-P	Apply preplant surface or incorporated, preemergence, or postemergence for control of most annual grasses and many broadleaf weeds and suppression of nutsedge. Preplant applications for use in min. tillage or no-tillage (15 to 45 days). If incorporated, apply min. 2 weeks before planting. For preemergence, rainfall or irrigation is needed for activation. For early postemergence, apply to corn up to 12 inches tall.
0.75 fl oz Impact 2.8 E	0.016 topramezone	For postemergence control of broadleaves and grasses. Use MSO at 1 to 1.5% v/v. Max. 1 application/season. PHI = 45 days.
6 pt Lexar 3.7 E	2.7 atrazine + s-metolachlor + mesotrione	For preemergence control of broadleaves and grasses. Apply preplant or preemergence without incorporation. May be applied up to 14 days before planting. Max. 3.5 qt/season. Irrigation or rainfall is needed within 7 days for best results. PHI = 60 days.
2.5 to 3 qt Micro-Tech 4ME or 3.8 to 4.5 lb Partner 65 WDG	2.3 to 4 alachlor	For control of many annual grasses and broadleaves. Apply as preplant or preemergence. Use higher rate for control of lambsquarters, black nightshade, nutsedge, and seedling johnsongrass. Restricted use pesticide. Max. 1 application/year and 4 qt/A/year.
14 to 18 fl oz Outlook 6 E	0.65 to 0.84 dimethenamid-P	For control of annual grasses and broadleaf weeds and suppression of seedling johnsongrass. Can be applied preplant surface or incorporated, preemergence or postemergence to corn up to 12 inches tall. Outlook can be applied through chemigation or mixed with bulk dry fertilizer. Check label for exact rate for your soil type. PHI = 50 days. Max. rate is 21 fl oz/season.
0.67 oz Permit 75 WG or 0.66 to 1 oz Sanda 75 DF	0.031 to 0.046 halosulfuron	For annual broadleaves and yellow nutsedge control. Apply postemergence broadcast from the spike to lay-by stage. Avoid cultivation within 7 days of application. Apply again as directed spray if needed and avoid spraying the plant whorl. Include 0.5% v/v non-ionic surfactant. Not all corn varieties are tested, so use Permit with caution on newly released varieties. Do not apply to 'Jubilee' sweet corn or any corn under stress. Do not use with soil applied organophosphate insecticides and do not apply any organophosphate insecticide within 7 days before or 3 days after Permit application.
1 oz Priority 62W	0.04 carfentrazone + halosulfuron	For preemergence and postemergence control of broadleaves. Apply postemergence to actively growing weeds. Multiple applications are allowed with no time restrictions between applications.
4 pt Princep 4 E	2 simazine	For preemergence control of broadleaves and grasses. Apply preplant or preemergence with or without incorporation. Read label for rotation restrictions. Max. 1 application/season.
2.4 to 3.6 pt Prowl 3.3 E	1 to 1.49 pendimethalin	For control of annual grasses and broadleaf weeds. For use in conventional tillage only. Plant corn at least 1.5 inches deep. Apply preemergence after planting but before crop or weeds emerge. Apply postemergence to corn 20 to 24 inches tall or has 8 visible collars (V8). Max. 1 application/season.
16 to 22 fl oz Roundup WeatherMax 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Corn must be at least 12 inches tall. Application with hooded sprayers are allowed. Min. 30 days before planting any non-labeled crop.
0.6 to 1.3 pt Starane 1.5L	0.11 to 0.22 fluroxypyr	For postemergence control of broadleaf weeds. Apply broadcast or band to corn up to 4 leaf collars (V4). After V4 stage, apply only as a directed treatment with drop nozzles. Max. 2 applications or 1.3 pt/A/season. PHI = 31 days. See label for control of volunteer potato vine.
0.3 to 0.6 pt Stinger 3 L	0.12 to 0.25 clopyralid	For selective postemergence control of broadleaf weeds. Apply broadcast after corn emerges in 10 to 20 gal water/A. Apply to weeds up to 5 leaf stage. Make 1 to 2 applications with a min. 21 days between treatments. PHI = 30 days.
1.5 to 2.5 pt Surpass 6.4 E	1.2 to 2 acetochlor	For preemergence control of broadleaves and grasses and yellow nutsedge. Apply and incorporate up to 2 weeks preplant or anytime from 14-30 days prior to planting or after planting but prior to corn emergence.
1 to 3 pt Weedar 64 4L	0.5 to 1.5 2,4-D amine salt	For selective postemergence control of broadleaf weeds. Apply 7 to 14 days preplant at 1 to 2 pt/A. Apply 3 to 5 days after planting but before corn emerges at 2 to 3 pt/A. Apply on small weeds when corn is 8 inches tall using drop nozzle at 0.5 to 1.5 pt/A. Avoid drift to other crops. 2,4-D may injure some supersweet (sh2, SE) cultivars.

DISEASE CONTROL: Sweet Corn

Product	Amt/A	Seasonal Limits/A	Comments
Leaf Blights, Gray Leaf Spot, Rust			
Azoxystrobin ¹		6 apps	Use lower rates for rust. Apply before disease onset, continue on a 7- to 14-day schedule.
Amistar	2 to 5 oz		
Heritage	3.2 to 8 oz		
Quadris	6 to 15.5 fl oz		
Chlorothalonil		10.9 lb	NOT FOR PROCESSING SWEET CORN. Apply when conditions favor disease; continue on a 7-day schedule as needed. Limit 9 lb ai/A/season.
Bravo Ultrex	0.7 to 1.8 lb		
Bravo WeatherStik	0.75 to 2 pt		
Echo 720	0.75 to 2 pt		
Echo 90 DF	1.25 to 1.625 lb		
Equus 720 SST	0.75 to 2 pt		
Equus DF	1.25 to 2.7 lb	10.9 lb	

DISEASE CONTROL: *Sweet Corn*

Product	Amt/A	Seasonal Limits/A	Comments
Copper-Count-N	4 pt	n/a	Leaf blights only. Apply when conditions favor disease and repeat on a 7-day interval as needed.
Headline ¹	6 to 12 fl oz	6 apps	Apply before disease onset, continue on a 7- to 14-day schedule as needed. User lower rates for rust and gray leaf spot.
Mancozeb			Apply when disease appears and continue on a 4 to 7 day schedule as needed. Limit 18 lb ai/A/season.
Dithane DF Rainshield	1.5 lb	24 lb	
Dithane F-45 Rainshield	2.4 pt	36 pt	
Dithane M-45	1.5 lb	22.5 lb	
Manzate 75 DF	1.5 lb	24 lb	
Manzate Flowable	2.4 pt	36 pt	
Manzate Pro-Stick	1.5 lb	22.5 lb	
Penncozeb 4 FL	1.6 to 2.4 pt	36 pt	
Penncozeb 75 DF	1 to 1.5 lb	24 lb	
Penncozeb 80 WP	1 to 1.5 lb	22.5 lb	
Maneb			Apply when disease appears and continue on a 4 to 7 day schedule as needed. Limit 18 lb ai/A/season.
Maneb 75 DF	1.5 lb	24 lb	
Maneb 80 WP	1.5 lb	22.5 lb	
Propiconazole	2 to 4 fl oz	16 fl oz	Use higher rates for rust. Apply before disease onset, continue on a 7- to 14-day schedule. Do not make back-to-back applications.
Bumper 41.8 EC			
Propimax EC			
Tilt			
Quilt ¹	7 to 14 fl oz	56 fl oz	Premix of azoxystrobin and propiconazole. Use higher rates for rust & gray leaf spot. Apply before disease onset, continue on a 7- to 14-day schedule. Do not make back-to-back applications. Do not rotate with azoxystrobin or propiconazole..

¹ Do not make back-to-back applications or rotate with other QoI inhibitors (FRAC Group 11). Fungicides with the same Group number have the same mode of action. Do not tank-mix products with the same Group number, and rotate among fungicides with different Group numbers to discourage resistance development.

Eggplant

Nightshade family (Solanaceae): *Solanum melongena*

Planting and Culture

Eggplants need warm soil and warm air temperatures to yield well. After the danger of frost is past (see Appendix H), transplant into rows 36 to 42 inches apart with plants 18 to 24 inches apart in the rows. Plant on a well-drained loam soil for best results. Apply ½ pint of starter fertilizer solution to each plant when transplanting. Prepare the starter fertilizer by mixing 3 lb of 10-52-17 or similar analysis water-soluble fertilizer in 50 gallons of water. Flea beetles must be carefully monitored and treated if necessary immediately following transplanting. Yields of large-fruited varieties are in the range of 12 to 15 tons per acre of marketable fruit. Eggplant benefits from irrigation at flowering and fruit set if soil moisture is low.

Eggplants can be grown on black plastic with trickle irrigation to increase yields and earliness. Mulched beds are usually spaced 5 to 6 feet apart with individual plants spaced 18 to 24 inches apart within the row. The fertigation recommendations on the next page are based on a plant population of 4,356 plants per acre (beds on 5 foot centers and 24 inches between plants within rows). Fertigation should begin about two weeks after transplanting and continue throughout the season. Growers may need to modify these guidelines

VARIETIES: *Eggplant*

Variety	Maturity (days)	Comments
Nadia	62	Large tear-drop shaped fruit, deep purple-black skin; will set fruit in cool weather
Epic	64	Good yielder; strong upright plant; fruit teardrop shaped; deep purple-black skin.
Classic	76	Long, slim tapered fruit; early producer of dark glossy fruit.
Ghostbuster	80	White skinned, excellent flavor.
Orient Express	58	Elongated Oriental eggplant, sets fruit in cool and hot weather.
Little Fingers	66	Small, slender purple/black 6-inch long fruit; borne in clusters of 4 to 6 fruits.
Santana	80	Elongated oval shape, glossy purple/black, high yielding, green calyx, fewer stem spines.

slightly depending on soil type, previous crop, etc. Eggplants may benefit from staking similar to that used in tomatoes. Staking helps prevent late-forming fruit from pulling the branches over to the ground.

Fertilizing

Lime the soil to obtain a soil pH of 6.0 to 6.8 if needed. Too much early nitrogen results in large plants, delayed maturity, and stem breakage. For eggplants grown using plastic mulch and drip irrigation, apply all phosphorus and potassium and a portion of the total nitrogen requirement prior to laying plastic. The remaining N requirement can be fertigated in weekly doses (see fertigation table).

FERTILIZER: *Eggplant*

Soil Test Results (lb/A)		Fertilizer Needed (lb/A)
Phosphorus		Phosphate (P₂O₅)
Low	<31	181-240
Medium	31 to 60	121-180
High	61-80	61-120
Very High	>80	0-60
Potassium		Potash (K₂O)
Low	<201	101-150
Medium	201-300	51-100
High	301-450	1-50
Very High	>450	0
Nitrogen		N
Apply 75 lb nitrogen (N)/A before transplanting. Broadcast and disk well with other fertilizer. Sidedress plants with 35 to 40 lb of nitrogen (N) when first fruit appear. Too much N can delay fruiting and lead to large plants that fall over. See fertigation table for N recommendations using plastic mulch and drip irrigation.		

Harvesting

The time required from flowering to marketable fruit size is about three weeks. Large fruit should weigh in the range of ¾ to 1 lb. Oriental type fruit should weigh ½ to ⅓ lb. The principal market container is a 1-1.9 bushel fiber board carton, 18 to 21 fruit per box.

Harvest fruit when they reach a dark, glossy, uniform, purple-black color. They should be firm (non-wrinkled). Wipe fruit clean or wash. Frequent pickings will result in higher yields.

Cut the stem from the plant. The calyx and stem should be fresh green in color. For transit and storage, hold eggplants at a temperature of 45° to 50°F and 90 to 95 percent relative humidity. Handle fruit carefully, as they bruise easily.

Common Diseases/Management

Damping-off and seed-borne diseases. Hot-water seed treatment at 122°F for 25 minutes is helpful in reducing seed-borne diseases (see Appendix I). Treat seed with Thiram 75 WP at ⅓ tsp/lb of seed. Transplant into raised beds. Ridomil Gold and Ultra Flourish applied pre-plant incorporated are effective; see tables for rates.

Fruit rots, leaf spots (Anthracnose, Alternaria Early Blight, Cercospora, and Phomopsis). Use crop rotations of three years to grasses or crops not related to the nightshade family (tomatoes, peppers, potatoes, tobacco) to help control these diseases. Practice good weed control both during crop rotation and during crops of

eggplant. Fungicides applied on a 7- to 14-day schedule can be effective; see tables for available materials.

Phytophthora blight. Phytophthora blight affects stems and fruit of eggplant. See the “Phytophthora Blight” section in the “Peppers” chapter for information on control. Fungicide options are limited (see tables).

Powdery mildew. Powdery mildew has generally been a minor problem in Kentucky, mainly found very late in the season. Several fungicides are registered; see tables for rates.

Tomato spotted wilt. The key control is prevention. Use virus-free transplants. Do not produce transplants in greenhouses containing ornamental plants. Control thrips in the greenhouse.

Verticillium and fusarium wilts. Use hot-water seed treatment to reduce seed-borne introduction (see Appendix I). Tolerance has been reported in the following varieties: Black Pride, Epic, Classic, Early Bird, Elondo, Vernal, and Viserba. Avoid fields with a history of the disease, or use a general soil fumigant. Rotate with small grains or other grasses to prevent rapid buildup of the pathogen in soil. Crop rotation does not significantly reduce populations of this fungus after it has become established. Once a significant population exists, soil fumigation under plastic is needed to reduce the population. See “Soil Fumigants for Control of Nematodes and Soilborne Diseases” on page 18 for details. A list of fungicide products and rates can be found in the Disease Control tables.

FERTIGATION RECOMMENDATIONS: Eggplant

Based on a total season N recommendation of 120 lb actual N/A with 60 lb N/A applied preplant and the remaining N (120 - 60 = 60 lb) divided into equal amounts to be fertigated on a weekly basis (60 lb ÷ 10 weeks = 6 lb of N per week). For harvest seasons extending beyond 10 weeks from transplanting, a maintenance dose of 1 to 1.5 lb N (3 to 4.5 lb ammonium nitrate) per week is adequate. The doses listed for 1,000 plants are based on a plant population of 4,356 plants/A (i.e., rows on 5 foot centers and plants 24 in apart).

Total Fertigated N Requirement ¹	Actual N/wk (lb/A)	Ammonium nitrate (lb/A/wk)	Ammonium nitrate (lb/1,000 plants/wk)	Calcium nitrate (lb/A/wk)	Calcium nitrate (lb/1,000 plants/wk)
60/A	6 lb	18 lb	4 lb	38 lb 11 oz	8 lb 14 oz

¹ Fertigation can begin 10 to 14 days after transplanting and assumes 60 lb N/A was applied preplant and starter fertilizer was used.

PESTICIDE SAFETY: Eggplant

	Signal ⁴	Re-entry (hrs)	Harvest (days)
Insecticides			
Acramite 50 WS	C	12	3
Actara 25 W	C	12	0
Admire Pro	C	12	21
Assail 30 SG	C	12	7
Avaunt 30 DG	C	12	3
Beleaf 50 SG	C	12	0
Confirm 2 F	C	4	7
Dibrom 8 E	D	24	1
Endosulfan 3 EC	DP	24	1
Fulfil 50 WDG	C	12	0
Intrepid 2 F	C	4	1
Knack 0.86 EC	C	12	14
Malathion 8	C	12	3
Novodor FC	C	4	0
Oberon 2 SC	C	12	7
Platinum 2 SC	C	12	30
Provado 1.6 F	C	12	0
Radiant SC	C	4	1
Sevin XLR	W	12	3
Spintor 2 SC	C	4	1
Venom 70 SG	C	12	1/21 ²
RESTRICTED USE			
Agri-Mek 0.15 EC	W	12	7
Asana XL	W	12	7
Baythroid XL	W	12	0
Capture 2 EC	W	12	7
Decis 1.5 EC	DP	21	1
Hero 1.24 EC	C	12	7
Lannate 90 SP	DP	48	5
Mustang Max	W	12	1
Pounce 3.2 EC	C	12	3
Proaxis 0.5 EC	C	24	5
Proclaim 5 WDG	W	48	7
Renounce 20 WP	C	12	0
Vydate L	DP	48	1/7 ²
Warrior T	W	24	5
Fungicides			
Acrobat 50W	C	12	0
Forum SC			
Azoxystrobin ³	C	4	0
Cabrio EG	C	12	0
Endura	W	12	0
Evito 480 SC	C	12	3
Fixed coppers ³	D	12-24 ¹	0
Flint	C	12	3
Maneb ³	C	12	5-10 ¹
Ridomil Gold	W	12	7
Ultra Flourish	W	12	7

¹ Varies markedly by formulation, so check label carefully.

² PHI varies by type of application

³ Several formulations are marketed. See the general introduction for more details on fungicides.

⁴ W: Warning, C: Caution, D: Danger, P: Poison

INSECT CONTROL: Eggplant

Insecticide	Product Amt/A	Comments and Seasonal Limits
<i>AT PLANTING</i>		
Aphids, Flea Beetles, Whiteflies, Colorado Potato Beetle (Do not use a foliar spray of Actara, Assail, Provado, or Venom following a soil application of Admire, Platinum, or Venom.)		
Admire Pro	7 to 10.5 fl oz	Systemic control. See label for applications methods. Limit 1 application.
Platinum 2 SC	5 to 8 fl oz	Systemic control. See label for applications methods. Limit 1 application.
Venom 70 SG	5 to 6 lb	Limit 12 oz/season for soil applications.
<i>FOLIAR TREATMENTS</i>		
Aphids, Whiteflies		
Actara 25 W	2 to 5.5 oz	Limit 11 oz/season and allow 5 days between applications.
Assail 30 SG	2 to 4 oz	Limit 16 oz/A, limit 4 applications. Allow 7 days between applications.
Beleaf 50 SG	2 to 2.8 oz	Limit 8.4 oz/season and allow 7 days between applications. Use high rate for whiteflies.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Allow 7 days between applications.
Dibrom 8 E	1 to 2 pt	Limit 6 pt/A. Do not apply when temperature is over 90°F. Aphids only.
Endosulfan 3 EC	1.33 qt	Limit 2 applications. Limit 1-1/3 qt/A.
Fulfill 50 WDG	2.75 oz	Limit 5.5 oz/A. Allow 7 days between applications.
Knack 0.83 EC	8 to 10 fl oz	Limit 2 applications. Allow 14 days between sprays. Whiteflies only.
Lannate 90 SP	0.25 to 1 lb	Limit 5 lb/A.
Malathion 8	3/4 to 3-1/2 pt	Aphids only.
Venom 70 SG	1 to 4 oz	Limit 6 oz/season for foliar applications.
Colorado Potato Beetle (This is the key insect pest of eggplant. This pest has the ability to develop resistance to all major classes of insecticides. Do not tank mix insecticides with the same mode of action and frequently rotate among insecticides with different modes of action to discourage resistance. Treat when an average of more than 1 larva/adult is found per plant on plants less than 6 inches tall or when 2 or more larvae/adults are found on larger plants. IRAC Codes: Insecticides followed by the same number share the same mode of action.)		
Actara 25 W (4A)	2 to 3 oz	Limit 11 oz/season and allow 5 days between applications.
Agri-Mek 0.15 EC (6)	8 to 16 fl oz	Limit 48 fl oz. Allow 7 days between sprays.
Assail 30 SG (4A)	1.5 to 2.5 oz	Limit 16 oz/A, limit 4 applications. Allow 7 days between applications.
Asana XL (3)	5.8 to 9.6 fl oz	Limit 67.2 oz/A.
Capture 2 EC (3)	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Allow 7 days between applications.
Endosulfan 3 EC (2A)	1.33 qt	Limit 2 applications. Limit 1-1/3 qt/A.
Hero 1.24 EC (3)	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 7 days between applications.
Mustang Max (3)	2.24 to 4.0 fl oz	Limit 24 fl oz/A.
Novodor FC (11C)	1 to 4 qt	For larvae only.
Pounce 3.2 EC (3)	8 fl oz	Limit 16 applications.
Proaxis 0.5 EC (3)	2.56 to 3.84 fl oz	Limit 2.88 pt/A.
Provado 1.6 F (4A)	3.75 fl oz	Limit 18.75 fl oz/A. Allow 5 days between applications.
Radiant SC (5)	5 to 10 fl oz	Limit 34 fl oz/A. Allow 4 days between applications.
Sevin 80 S (1A)	1.25 to 2.5 lb	Limit 7 applications and allow at least 7 days between sprays.
Spintor 2 SC (5)	3 to 6 fl oz	Limit 29 fl oz/A.
Venom 70 SG (4A)	1 to 4 oz	Limit 6 oz/season for foliar applications.
Warrior T (3)	2.56 to 3.84 fl oz	Limit 2.88 pt/A.
Cutworms (Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites.)		
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 7 days between applications.
Mustang Max	2.24 to 4.0 fl oz	Limit 24 fl oz/A.
Proaxis 0.5 EC	1.92 to 3.2 fl oz	Limit 2.88 pt/A.
Sevin 80 S	2.5 lb	Limit 7 applications and allow at least 7 days between sprays.
Warrior T	1.92 to 3.2 fl oz	Limit 2.88 pt/A.
Flea Beetles (Monitor for flea beetles after setting plants. Treat when an average of 2 or more beetles are found on plants less than 3 inches, 4 or more beetles on plants that are 3 to 6 inches tall, or 8 or more beetles on plants larger than 6 inches.)		
Actara 25 W	2 to 3 oz	Limit 11 oz/season and allow 5 days between applications.
Asana XL	5.8 to 9.6 fl oz	Limit 67.2 oz/A.
Baythroid XL	2.8 fl oz	Limit 16.8 fl oz per season and allow 7 days between sprays.
Capture 2 EC	2.1 to 6.4 fl oz	Limit 12.8 fl oz/A. Allow 7 days between applications.
Dibrom 8 E	1 to 2 pt	Limit 6 pt/A. Do not apply when temperature is over 90°F.
Endosulfan 3 EC	1.33 qt	Limit 2 applications. Limit 1-1/3 qt/A.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 27.4 fl oz/A. Allow 7 days between applications.
Mustang Max	2.24 to 4.0 fl oz	Limit 24 fl oz/A.
Pounce 3.2 EC	4 to 8 fl oz	Limit 16 applications.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 2.88 pt/A.
Sevin 80 S	0.625 to 1.25 lb	Limit 7 applications and allow at least 7 days between sprays.
Venom 70 SG	1 to 4 oz	Limit 6 oz/ season for foliar applications.
Warrior T	2.56 to 3.84 fl oz	Limit 2.88 pt/A.
Mites		
Acramite 50 WS	0.75 to 1.0 lb	Limit 1 application
Agri-Mek 0.15 EC	8 to 16 fl oz	Limit 48 fl oz. Allow 7 days between sprays.
Capture 2 EC	5.12 to 6.4 fl oz	Limit 12.8 fl oz/A. Allow 7 days between applications.
Dibrom 8 E	1 to 2 pt	Limit 6 pt/A. Do not apply when temperature is over 90°F.
Oberon 2 SC	7.0 to 8.5 fl oz	Limit 3 sprays. Allow 7 days between applications.

WEED CONTROL: Eggplant

Product Amt/A	Lb A.I./A	Remarks
0.5 to 1.5 fl oz Aim 1.9 EW	0.008 to 0.023 carfentrazone	For contact postemergence control of annual broadleaf weeds and suppression of annual grasses. Can be applied as a preplant, pre-transplant burndown, or before crop emerges to actively growing weeds up to 4 inches tall. Can also be applied postemergence as a directed hooded application between crop rows. Use min. 10 gal water/A and crop oil 1% v/v. Max. rate 6.1 fl oz/A. PHI = 0 days.
8 to 14 pt Dacthal 6 F	6 to 10.5 DCPA	For preemergence control of annual grasses and small-seeded broadleaves. Over the top application 4 to 6 weeks after transplanting is safe to plants. Plants should be well established.
2 to 4 lb Devrinol 50 DF	1 to 2 napropamide	For control of annual grasses and broadleaf weeds. For use with transplants only. Apply before transplanting and incorporate 1 to 2 inches. See incorporation directions on label. To avoid injury to crops not specified on the label, do not replant within 12 months if using the 4-lb rate. The low rate is for coarse sandy soil and the high rate for heavy clay soil.
1.3 to 2.7 pt Gramoxone Max 3 L	0.5 to 1 paraquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply preplant, preemergence, or before transplanting in min. 10 gal water/A. Apply banded or broadcast. Use higher rate for heavy weed infestations. Use non-ionic surfactant 0.25% v/v.
0.5 to 1.5 pt Poast 1.5 E	0.09 to 0.27 sethoxydim	For control of actively growing grasses only. Use high rate on johnsongrass. PHI = 20 days. Max. rate of 1.5 pt/application and 4.5 pt/season.
5 to 6 qt Prefar 4 E	5 to 6 bensulide	For control of grasses and broadleaf weeds. Apply preplant and incorporate to 1 to 2 inch depth. Apply preemergence only if it can be watered in within 36 hours. Max. rate of 6 qt/season.
16 to 22 fl oz Roundup Weather-Max 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Min. 3 days before seeding and min. 30 days before planting any non-labeled crop.
0.5 to 1 oz Sanda 75 DF	0.023 to 0.047 halosulfuron	For control of annual broadleaf weeds and yellow nutsedge. Can be applied in row middles of direct-seeded or transplanted eggplant. Avoid contact with the crop or with plastic if plastic mulch is used. Max. 2 applications/crop and 2 oz/A/season.
6 to 8 fl oz Select 2E	0.09 to 0.12 clethodim	For selective postemergence of actively growing annual grasses and suppression of perennial grasses. Add crop oil 1% v/v. Max. 8 fl oz/application. Min. 14 days interval between applications. PHI = 20 days.
1 to 10% Scythe 4.2L	pelargonic acid	For non-selective contact control of annual grasses and broadleaf weeds. Use in min. 10 gal water/A if mixed with other herbicides or a min. 75 gal if used alone. Do not allow contact with crop foliage. Can be mixed with Roundup. See label for amount of Scythe to use depending on the desired spray volume.
1 to 1.5 pt Treflan HFP 4 E	0.5 to 0.75 trifluralin	For preemergence control of annual grasses and broadleaf weeds. Apply and incorporate before transplanting. Can also be applied post-transplant as a directed spray between rows and beneath plants and incorporate. Eggplant tolerance is marginal.

DISEASE CONTROL: Eggplant

Product	Amt/A	Seasonal Limits/A	Comments
Alternaria, Anthracnose, Leaf Blights, Phomopsis Fruit Rot			
Azoxystrobin ¹		4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Amistar	2 to 5 oz		
Heritage	3.2 to 8 oz		
Quadris	6 to 15.5 fl oz		
Cabrio ¹	8 to 12 oz	6 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Endura	2.5 to 3.5 oz	6 apps	Apply before disease onset, continue on a 7- to 14-day schedule. No more than 2 sequential applications of Endura can be made before rotating to another mode of action.
Evito 480 SC	3.8 to 5.7 fl oz	4 apps	Apply before disease onset & continue on a 7 to 10-day interval. Alternate with a product with a different mode of action (avoid FRAC Group 11 products).
Fixed coppers		n/a	Apply before disease onset, continue on a 5- to 10-day schedule, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.
Basic Copper 53	3 to 4 lb		
Badge SC	1.8 pt		
C-O-C-S WDG	2 to 4 lb		
Champ DP	1.33 lb		
Champ Formula 2 FL	1.33 pt		
Champion WP	2 lb		
COC DF	3 to 4 lb		
COC WP	3 to 4 lb		
Copper-Count-N	4 pt		
Cuprofix Disperss	2.5 lb		
Cuprofix Ultra 40 Disperss	1.25 lb		
Kocide 101	2 lb		
Kocide 2000	1.5 lb		
Kocide 3000	0.75 lb		
Kocide DF	2 lb		
Kocide 4.5 LF	1.33 pt		
Nu-Cop 50 WP	2 lb		
Nu-Cop 3 L	1.33 pt		
Nu-Cop 50 DF	2 lb		
Flint ¹	2 to 4 oz	5 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Maneb			Apply at first fruit cluster and continue on a 7-to 10-day schedule as needed. Limit 11.2 lb ai/A/season.
Maneb 75 DF	1.5 to 2 lb	14.9 lb	
Maneb 80 WP	1.5 to 2 lb	14 lb	
Manex	1.2 to 1.6 qt	11.2 qt	

DISEASE CONTROL: Eggplant

Product	Amt/A	Seasonal Limits/A	Comments
Phytophthora Blight			
Acrobat 50 WP	6.4 oz	5 apps	Must be tank-mixed with another Phytophthora fungicide. Apply before disease onset, continue on a 5- to 10-day schedule. Rotate to another fungicide after 2 consecutive applications. SURFACE APPLICATION (pre-plant or at planting): Apply to soil as a broadcast spray or in a 12- to 16-inch band; incorporate mechanically before planting into the upper 2 inches of soil or at-planting with 0.5 to 1 in of irrigation if rainfall is not expected within 24 hours. Make 2 additional 1-pt/A applications at 30-day intervals, directing spray at the base of plants and surrounding soil. DRENCH APPLICATION: Apply pre-plant or at planting in 20 gal/A of water; make 2 supplemental applications at 2 to 4 oz/A beginning 14 days after initial treatment and continuing on a 14-day schedule.DRIP APPLICATION: apply 1 pt/A at planting; inject into irrigation system. Make up to two additional applications at 1 pt/A at 30-day intervals after initial application.
Forum SC	6 fl oz	5 apps	
Ridomil Gold EC	0.5 to 1 pt	3 pt	
Ridomil Gold SL			
Ultra Flourish	2 to 4 pt	6 pt	
Powdery Mildew			
Azoxystrobin ¹		4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Amistar	2 to 5 oz		
Heritage	3.2 to 8 oz		
Quadris	6 to 15.5 fl oz		
Cabrio ¹	8 to 16 oz	6 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Sulfur	20 to 35 lb	n/a	Apply on a 7- to 10-day schedule, beginning when symptoms are first observed or when conditions favor disease. Phytotoxicity may occur when sulfur is applied when air temperatures exceed 90°F.
Pythium Damping-off			
Ridomil Gold EC	1 pt	1 app	SURFACE APPLICATION (pre-plant or at planting): Apply to soil as a broadcast spray or in a 12- to 16-inch band; incorporate mechanically before planting into the upper 2 inches of soil or at-planting with 0.5 to 1 in of irrigation if rainfall is not expected within 24 hours. DRENCH APPLICATION: apply pre-plant or at planting in 20 gal/A of water. DRIP APPLICATION: Apply 1 pt/A at planting; inject into irrigation system. Make up to two additional applications at 1 pt/A at 30-day intervals after initial application.
Ultra Flourish	2 pt	1 app	
Verticillium/Fusarium Wilt			
Chloropicrin	22 to 36.5 gal	1 app	Inject pre-plant (minimum of 4 weeks before planting) with chisels set to 6 to 8 in depth and spaced no wider than 12 in apart. Rate listed is for broadcast application; bed applications can be made, but rate must be adjusted for smaller application area.
metam sodium 42%	37.5 to 75 gal	1 app	Products include Vapam HL, Metam CLR 42%, and Sectagon-42. Rates listed are per treated acre. Apply a minimum of 14 days before planting. May be drenched, injected, sprayed and incorporated, or applied through sprinkler irrigation systems. See label for application instructions and precautions.
Telone C-35	13 to 20.5 gal	1 app	Inject pre-plant (minimum of 4 weeks before planting) with chisels set to 8 to 10 in depth and spaced 12 to 24 in apart. Rate listed is for broadcast application. Rate listed is per treated acre.

¹ Do not make back-to-back applications or rotate with other QoI inhibitors (FRAC Group 11). Fungicides with the same Group number have the same mode of action. Do not tank-mix products with the same Group number, and rotate among fungicides with different Group numbers to discourage resistance development.

Greens

Collards, Kale, Lettuces, Mustards, Spinach, Swiss Chard, Turnip, and others

Leafy greens or salad greens are consumed daily by most Americans and nearly all types can be grown profitably in Kentucky. In fact, Kentucky was once known throughout the country for its “Bibb” or “Limestone” lettuce, named after Major John (Jack) Bibb, who, after fighting in the War of 1812, grew it in his garden in Frankfort. The large group of vegetable crops included under the broad term “greens” includes crops from several families: lettuces (Romaine, leaf, bibb/ Boston, iceberg, etc.), mustards (mustard greens, arugula, turnip greens), crucifers (collards, kale, broccoli raab, flowering or Chinese kale), spinach (flat leaf and savoy), composites (endive, escarole, radicchio, chicory, dandelion), and others including Swiss chard and beet greens. Various mixtures of green leafy vegetables (“Mesclun”) and immature “baby greens” are also very

popular. Production guidelines for cole crops such as cabbage, broccoli, and some of the Asian vegetables are found in the chapter on cole crops.

Most greens are cool season crops that do best in the spring and fall, but heat tolerant varieties for summer plantings are also available for some types. Many types of greens have also been successfully grown from September until June on beds in unheated greenhouses or high tunnels in Kentucky, although most lettuce plantings should be avoided from mid-December to the first week of February (see Appendix H).

Production Systems

Production systems for this group are as varied as the crops themselves. Although greens have traditionally been grown as row crops at wide spacings in Kentucky,

many growers are now planting at higher densities using raised beds with multiple rows per bed. Many of the crops in this group are most productive using raised beds with plastic mulch and drip irrigation. Greens are also grown on raised beds without plastic; however, weed control with hand/mechanical cultivation or with herbicides is critical when plastic mulch is not used. Black plastic mulch is used for spring plantings, and white mulch can be used for late summer plantings. Bed shaping machines commonly used in Kentucky will form a 6-inch-high raised bed 30 to 32 inches wide at the top with 5 to 6 feet between centers of the beds. Depending on the crop and the between-row spacings, 2 to 3 rows can be used per bed. Growers in the northeast make wider (4½ to 5½ feet), lower (4 to 5 inches high) beds on bare ground using a “meeker harrow” or roller

and plant 4 to 6 rows of greens per bed, depending on the crop. This system relies heavily on the use of herbicides and overhead irrigation; similar systems are used in California but with drip irrigation.

Greens are either direct seeded and thinned or transplanted into either bare ground or plastic-mulched beds with drip irrigation. Pelleted seed is normally used for direct seeding using a simple "Planet Junior" type seeder or vacuum seeder. Transplanting will usually result in an earlier crop less exposed to insect damage, drought, or other early season stresses. Some Kentucky growers have also produced leafy greens in tobacco "float beds" in the same way that tobacco transplants are grown. Keep in mind that few chemicals are available to manage diseases of greens grown in this manner. Going a step further, growers can produce high-quality bibb lettuce and other greens in traditional greenhouses using a hydroponic production system.

If transplants are used, crops are seeded in 128- to 288-cell plug trays in the greenhouse four to six weeks prior to going to the field. Harden the transplants by moving them outside the greenhouse for a few days prior to transplanting. Most greens are transplanted by hand or with a waterwheel setter onto raised beds with plastic mulch. One Kentucky grower has fabricated a 3-row/bed waterwheel for this setter (8 inches within-row and 10 inches between rows) which has worked well for mustard and turnip greens. It should also be possible to use this wheel for leaf or bibb lettuce. See the following table for plant spacings used in the field for different types of greens.

Optimum in-row and between-row spacings for greens; most crops can be transplanted to 2 rows/bed using a waterwheel setter using two wheels for 9 or 12 inch spacings.

Crop	In-row (in.) ¹	Between-row (in.)	No. rows/bed ²
Collards	12-18	15-36	1-2
Kale	9-12	12-24	2
Mustard	9-15	12-15	2
Turnip			
for roots	3-4	12-18	2
for leaves	1/2-3	12-18	2
Broccoli raab	6-12	15-18	2
Lettuce			
leaf/bibb	9-12	12-18	2
romaine	12-15	12-18	2
Endive/Escarole	12-18	15-18	2
Spinach	3-6	9-18	3-4
Swiss Chard	6	18-24	2

¹ Final spacing after thinning or transplanting.

² Raised beds formed by Rainflo or similar bed shaper.

VARIETIES: Greens

	Maturity (days) ¹	Comments
Collards²		
Top Bunch	70	Uniform hybrid that is 5 to 10 days earlier than Vates.
Flash	73	Vigorous uniform hybrid (Vates type); slow bolting.
Vates	75	Blue-green leaves; compact and uniform.
Champion	76	Slow bolting, good hardiness.
Georgia/Southern	80	Blue-green leaves; produces under adverse temperatures.
Kale²		
Winterbor	50-55	Hybrid, finely curled dark green leaves; frost tolerant.
Darkibor	50-55	Hybrid, finely curled, blue-green leaves, slow bolting.
Redbor	55	Hybrid, finely curled, dark red and taller version of Winterbor.
Red Russian	50	Purple stems, green, flat "oak-leaf" pattern leaves; used in salad mixes.
Blue Knight	45-55	Curled, dark blue-green, spring and fall.
Blue Armor	47-57	Finely curled, fringed, deep blue-green, spring and fall.
Vates (blue curled)	57	Dark blue-green finely curled leaves; 15 to 20 inches tall.
Mustard²		
Savannah	35	Very early maturing, drought tolerant.
Tendergreen	40	Large, thick but tender leaves; cold resistant, mild flavor.
Southern Giant	45	Large plants, bright green leaves with crumpled frilled edges; for spring and fall.
Green Wave	45	Large plants, deeply frilled and finely cut leaves; heat tolerant and slow bolting.
Florida Broadleaf	50	Large plants, spreading oval, serrated dark green leaves.
Turnips/Turnip Greens²		
Purple Top White Globe	57	Open-pollinated; grown for the underground portion: roots are purple on top and white beneath, 5 to 6 inches diameter.
Seven Top	60	Open-pollinated; for greens only.
Topper	35	Hybrid 'Seven Top' type; dark green, upright leaves, mildew tolerant; for greens only.
Southern Green	40	Hybrid, very dark green, upright leaves, slow bolting.
Broccoli Raab (rapini)²		
Sessantina Grossa	35	For trial. More like regular broccoli but less heat tolerant than Spring Raab.
Spring Raab	42	For trial. Versatile variety for spring and summer harvests.
Zamboni	60	For trial. Large flower buds and uniform bud set; for spring and summer production.
Lettuce³		
<i>Leaf/Looseleaf</i>		
Grand Rapids	43	Early, old standard open-pollinated variety; light green leaves.
Red Sails	45-55	AAS winner; ruffled and fringed red leaves with green background; slow bolting and tip burn tolerant.
Tango	45	Pointed, deeply cut leaves (like endive), used in salad mixes.
Black-seeded Simpson	46	Early, old standard open-pollinated variety; light green leaves.
SaladBowl	46	Oak-leaf type; light green, deeply lobed leaves; heat tolerant.
New Red Fire	48	Dark red, wavy, ruffled leaf margins; slow to bolt.
Xena	48	Dark green, glossy leaves; tip burn tolerant.
Green	53	Dark green, "blistered" leaf type; heat and tip burn tolerant.
Simpson Elite	53	More ruffled and slower to bolt than Black-seeded Simpson.
Royal Green	55	Medium green, broad, smooth leaves, tip burn tolerant.
<i>Bibb/Butterhead/Boston</i>		
Ermosa	48	Dark green; heat tolerant, slow bolting, and tip burn tolerant.
Nancy	52	Medium green leaves, large "heart;" mildew and virus resistant.
Esmeralda	55	Early, slow bolting and tip burn tolerant.
Bennett	60	Firm-headed, fast growing, slow bolting.
<i>Romaine/Cos</i>		
Jericho	57	Light green, lightly savoyed leaves; heat tolerant.
Parris Island Cos	70	Medium green, lightly savoyed leaves; tall, erect plants.
Ideal/Ideal Cos	73	Dark green leaves smoother and heavier than Parris Island Cos.
Green Towers	74	Dark green, lightly savoyed leaves.
Endive³		
Neos	45	Extra frilly, deep hearted, medium-sized heads; self blanching; for spring and fall.
Lorca	90	Large, deep, blanched heads, tip burn resistant.
Escarole³		
Natacha	48	replaces 'Nataly'; very large heads; slow bolting, tip burn and bottom rot tolerant.

Fertilizing and Cover Crops

A soil test should be made in the fall or early spring prior to planting. Soil pH should be in the 6.0 to 6.8 range and lime applications made in the fall if necessary. Manure is often beneficial (5 to 10 tons per acre) and should be incorporated in the fall prior to the next season's plantings. *E. coli* contamination of greens is a very serious health and legal concern, and manure use should be very carefully regulated.

Cover crops add organic matter and reduce weed pressure. Legume cover or green manure crops can also provide significant amounts of nitrogen. Winter cover crops include winter rye, wheat, ryegrass, or a mixture of winter rye and hairy vetch. Although this practice can delay planting, hairy vetch plowed under at 20 percent flowering in the spring (mid-May) provides up to 135 lb per acre of nitrogen to the following crop. Sudan grass or sorghum-Sudan grass hybrids ("Sudex") are used as summer cover crops on otherwise fallow land.

Apply all phosphorus and potassium according to soil test report recommendations prior to planting. Leafy vegetables require quick, continuous growth for best quality; greens are high users of nitrogen. Most crops require a total of 100 to 150 lb of nitrogen per acre. Apply 50 percent of the nitrogen together with phosphorus and potassium prior to planting. The remaining nitrogen is applied in two sidedressings on bare ground or is divided up and fertigated (injected) in equal weekly doses for plastic-mulched, drip-irrigated crops.

FERTILIZER: Greens

Soil Test Results (lb/A)		Fertilizer Needed (lb/A)
Phosphorus		Phosphate (P₂O₅)
Low	<31	121-180
Medium	31-60	1-120
High	>60	0
Potassium		Potash (K₂O)
Low	<201	101-150
Medium	201-300	51-100
High	301-450	1-50
Very High	>450	0
Nitrogen		N
Apply 100 to 150 lb of actual nitrogen (N)/A. Apply 25 to 50% broadcast with other fertilizer before seeding or transplanting and disk in well. The remainder can be divided up into one or more sidedressings.		

Tipburn and Bolting

Tipburn is a common and serious problem in lettuce and cole crops. Symptoms are brown leaf margins on the youngest leaves (sometimes concealed within the heads). It most often occurs during periods

VARIETIES: Greens

	Maturity (days) ¹	Comments
Spinach⁴		
<i>FLAT LEAF</i>		
Space	40	(for trial) Hybrid; smooth, dark green leaves; downy mildew resistant, slow to bolt.
<i>SAVOY</i>		
Springer	40	Hybrid; dark green, semi-savoy type; downy mildew resistant; slow to bolt.
Spinner	40	Hybrid; dark green, semi-savoy type; downy mildew resistant; slow to bolt.
Tyee	42	Hybrid; dark green, semi-savoy type; downy mildew resistant; heat tolerant and slower bolting than 'Spinner'.
Bloomsdale Long Standing	43	Open-pollinated; very hardy; savoyed dark green leaves; slow bolting.
Melody	45	Hybrid; deep green, semi-savoy type; downy mildew and mosaic tolerant, slow to bolt.
Swiss Chard⁴		
Bright Lights	55	All America Selections winner; stalks of various colors.
Fordhook Giant	55	Very tall; dark green savoyed leaves with white stems/veins; heat tolerant.
Ruby Red	55	Deep green savoyed leaves with bright red rhubarb-like stems.
Silverado	60	Compact plants; dark green, deeply savoyed leaves with broad white stems.

¹ From seeding. Days to maturity vary widely in seed catalog descriptions making comparisons difficult.

² (Brassicaceae)—mustard family

³ (Asteraceae)—sunflower family

⁴ (Chenopodiaceae)—goosefoot family

of drought followed by abundant moisture from rain or irrigation. In these cases the supply of calcium (which moves with the flow of water in plants) cannot keep up with the needs of rapidly growing new plant tissue. The calcium-deficient tissue collapses and turns brown, resulting in an unmarketable product.

Liming according to soil test results will help reduce the risk of tipburn as will any practice which ensures a regular moisture supply to plant roots. As is the case with blossom end rot, tipburn is more the result of lack of water than a soil calcium deficiency. Excess application of ammonium nitrate can damage roots and cause tipburn as will deep cultivation, flooding, or drought. Plastic or organic mulches with drip irrigation also help reduce the risk of tipburn. Lastly, some varieties are less susceptible to the problem (see variety table).

Bolting is the formation of a flower stalk while the plant is still small or immature. Any stresses that slow vegetative growth can cause young plants to begin flowering. Generally for cool season crops such as lettuce, favorable cool spring temperatures followed by periods of hot weather will lead to bolting. Lettuce should be harvested as soon as possible in spring crops to avoid excess heat and subsequent bolting. Seedlings subjected to low temperatures or water stress in the greenhouse prior to transplanting are also susceptible to

bolting, as are transplants which are too old. The practices discussed to reduce tipburn will also help reduce the risk of premature bolting. Variety selection is also important.

Harvesting and Handling

All fresh market leafy greens are hand harvested in Kentucky. Multiple harvests are possible from most types of greens. Baby greens are grown at closer spacings and are ready for market in a little more than half the time required to produce mature greens. Turnip, mustard, collards, and kale are harvested when stalks are fairly young and tender. Rubber bands can be used to bunch loose greens but larger wholesale buyers may require labels or bands with price look up (PLU) codes. Turnip, mustard, collards, and kale are bunched with three to five stalks per bunch. Lower leaves that are discolored or dying are removed when bunching. Lettuces and spinach are often packed in cello bags. Greens can be field packed and top iced in waxed corrugated cardboard boxes or wooden crates. Greens have high respiration rates and should be washed, packed, and sold as quickly as possible. Vacuum cooling to 34° F is the preferred method of precooling, although forced air cooling is also possible. Greens are not usually stored for very long, although lettuce and other crops can be stored for two weeks at 32° F.

Common Diseases/Management Mustard, Turnips, Collards, Kale

Anthraxnose, downy mildew, powdery mildew, leafspots, and blights. Cultural practices are especially important in disease control of cole crops. Reduce the length of time the foliage is wet by selecting sites for good air movement and by using open plantings (wider spacings and/or thinner stand). Maintain timely harvests. Avoid overhead irrigation late in day or at night. Rotate away from related crops for three years. See tables for registered fungicides and rates; some

products may not be registered for all crops in this group—read label carefully.

Botrytis gray mold. Increase plant or row spacings to improve light penetration and aid drying. No effective fungicides are labeled.

Damping-off. Purchase fungicide-treated seed or treat seed with thiram (see labels). Mefenoxam is also labeled on certain cole crops; see tables below for rates.

Viruses. Destroy earlier crops as soon as possible after harvest has been completed; control weeds and maintain a weed-free border around crops.

Lettuce

Bottom rot. Cultural practices and rotation are important tools to manage this disease. Do not plant lettuce after beans, and turn under grass and other crops early to ensure thorough rotting before planting. Avoid wet sites and plant on well-shaped, raised beds to improve air circulation and drainage. Shallow seeding will also reduce severity of bottom rot. Fungicides are available; see tables for rates.

Downy mildew. Fungicides are effective for management of downy mildew; see tables for available products and rates.

PESTICIDE SAFETY: Greens

	Signal ⁵	Re-entry (hrs)	Harvest Interval (days)					
			Collards	Kale	Lettuce	Mustard	Spinach	Turnips
Insecticides								
Actara 25 WP	C	12	7	7	7	7	7	-
Admire Pro	C	12	21	21	21	21	21	21
Assail 30 SG	C	12	7	7	7	7	7	-
Avaunt 30 DG	C	12	-	-	3	-	-	-
Beleaf 50 SG	C	12	-	-	0	0	0	-
Bt products	C	12	0	0	0	0	0	0
Confirm 2 F	C	4	7	7	7	7	7	7
Courier 40 SC	C	12	-	-	7	-	-	-
Dimethoate 4 E	W	48	14	14	14	14	14	14
Endosulfan 3 EC	DP	24	21	21	14	21	21	-
Fulfill 50 DF	C	12	7	7	7	7	7	7
Intrepid 2 F	C	4	1	1	1	1	1	1
Knack 0.86 EC	C	12	7	7	-	7	-	-
Lorsban 75 WP	W	24	21	21	-	-	-	-
Malathion 8	C	12	7	7	14	7	7	-
Oberon 2 SC	C	12	7	7	7	7	7	-
Platinum 2 SC	C	12	30	30	30	30	30	-
Provado 1.6 F	C	12	7	7	7	7	7	7
Pyrethrin	C	12	0	0	0	0	0	0
Radiant SC	C	4	1	1	1	1	1	3
Sevin XLR	W	12	14	14	14	14	14	-
Spintor 2 SC	C	4	1	1	1	1	1	1
Trigard 75 WP	C	12	7	7	7	7	7	7
Venom 70 SG	C	12	-	-	7/21 ¹	-	7/21 ¹	-
RESTRICTED USE								
Agrimek 0.15 EC	W	12	-	-	7	-	7	-
Asana XL	W	12	7	-	-	7	-	-
Baythroid XL	W	12	-	-	0	0	0	0
Capture 2 EC	W	12	-	-	7	-	40	-
Daizinin AG500	C	24	10	10	14	10	14/21	-
Diazinon 50 W	C	24	4	4	14	4	3	-
Dimilin 2L	C	12	7	7	-	7	-	7
Disyston 8 E	DP	48	-	-	60	-	-	-
Hero 1.24 EC	C	12	-	-	7	-	-	-
Lannate 90 SP	DP	48	10	10	10	10	7	10
Marvin 3.2 F	W	48	-	-	14	-	14	-
Mustang Max	W	12	1	1	5	1	-	-
Pounce 3.2 EC	C	12	1	-	1	-	1	1
Proaxis 0.5 EC	C	24	-	-	1	-	-	-
Proclaim 5 WDG	C	48	14	14	7	14	7	14
Renounce 20 WP	C	12	0	0	0	0	0	-
Warrior T	W	24	-	-	1	-	-	-

- Indicates crop does not appear on label.
¹ PHI depends on the method of application
² Head only

PESTICIDE SAFETY: Greens

	Signal ⁵	Re-entry (hrs)	Harvest (days) ¹
Fungicides			
<i>MUSTARD, TURNIPS, COLLARDS, KALE</i>			
Acrobat 50 WP	C	12	0
Forum SC			
Actigard 50 WG	C	12	7
Aliette WDG ⁶	C	12	3
Azoxystrobin ⁴	C	4	0
Cabrio EG	C	12	3
Endura	W	12	14
Fixed coppers ⁴	D	12/24	0
Maneb ²	C	12	10
Ridomil Gold EC/SL	C	48	0
Rovral 4 F	C	24	14
Iprodione 4L AG			
Sulfur	C	12	0
Ultra Flourish	C	48	0
<i>LETTUCE</i>			
Acrobat 50 WP	C	12	0
Forum SC			
Aliette WDG ⁶	C	12	3
Azoxystrobin ⁴	C	4	0
Botran 75 W	C	12	14
Cabrio EG	C	12	0
Endura	W	12	14
Maneb	C	24	10
Fixed coppers ⁴	D	12/24	1
Ridomil Gold EC/SL/GR	C	48	0
Previcur Flex	C	12	6
Rovral 4 FL	C	24	14
Sulfur ⁴	C	24	0
Tanos	C	12	3
<i>SPINACH</i>			
Actigard 50 WG	C	12	7
Aliette WDG ⁶	C	12	3
Azoxystrobin ⁴	C	4	0
Cabrio EG	C	12	0
Ridomil Gold EC/SL/GR	C	48	21
Ridomil Gold Copper	D	48	21
Sulfur ⁴	C	24	0
Fixed coppers ⁴	D	12/24 ³	0
Ultra Flourish	W	48	21

¹ See the Insect Control table.

² For use on kale only.

³ Varies by formulation. Check labels carefully.

⁴ Several formulations are marketed. See the general introduction for more details on fungicides.

⁵ W: Warning, C: Caution, D: Danger, P: Poison

⁶ The use of Aliette in the following Kentucky counties has certain restrictions to protect endangered freshwater mollusks and their habitat, so read labels carefully: Campbell, Green, Hart, Kenton, Logan, Marshall, Rockcastle, Todd, Warren, and Wayne.

Drop, gray mold. Fungicides are registered for both field and greenhouse use. See tables for products and rates.

Seed rot, damping-off. Purchase treated seed or dust with Thiram at 1 tsp/lb of seed. Mefenoxam applied pre-plant incorporated is labeled for damping-off due to *Pythium* (see table for rates and application instructions).

Virus complex, aster yellows. Avoid transplant production in greenhouses with ornamental plants. Take steps to control aphids, leafhoppers, and thrips, especially early in the season. Do not place later plantings near older plantings. Maintain

strict weed control around plantings and destroy older plantings immediately after harvesting is complete.

Spinach

Damping-off, seed rot. Treat seed with thiram at 5.33 oz/100 lb of seed or in small lots at 1 tsp/lb of seed. For excellent control of *Pythium* in this complex, apply mefenoxam pre-plant or at planting (see tables for rates). This treatment will also aid with control of white rust.

Downy mildew, white rust. Resistance is available in spinach cultivars. A pre-plant soil application of mefenoxam listed previ-

ously for damping-off control will provide early season control for 21 to 60 days depending on the weather. See tables for registered products and rates.

Leaf spots. Fungicides applied regularly are effective tools; see tables for available materials.

Virus complex. CMV-resistant varieties are available. If a series of plantings is used, place the first downwind from the later plantings to reduce aphid movement from the older plantings into the others. Control broadleaf weeds within 200 ft of the planting.

INSECT CONTROL: Greens

Insecticide	Product Amt/A	Comments and Seasonal Limits
PREPLANT INCORPORATED		
Cutworms, Wireworms (Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites. Wireworms can be a potential problem where greens follow grass or grass-legume sod.)		
Diazinon AG 500	4 to 8 pt	Incorporate immediately.
AT PLANTING		
Aphids, Whiteflies (Do not use a foliar spray of Actara, Assail, Provado or Venom following a soil application of Admire, Platinum, or Venom.)		
Admire Pro	4.4 to 10.5 fl oz	Systemic control. See label for various application methods. Limit 1 soil application.
Platinum 2 SC	5 to 11 fl oz	Limit 1 soil application.
Venom 70 SG	5 to 6 oz	Limit 12 oz/A for soil applications.
FOLIAR TREATMENTS		
Aphids (Excessive nitrogen application favors increased aphid reproduction. Use no more nitrogen than is necessary. Eliminate remnants of fall crops to reduce numbers of overwintering eggs.)		
Actara 25 W	1.5 to 3 oz	Limit 11 oz/season, allow 7 days between applications.
Assail 30 SG	2 to 3 oz	Limit 20 oz/A. Allow 7 days between applications.
Beleaf 50 SG	2.0 to 2.8 oz	Limit 8.4 oz /season, allow 7 days between applications.
Dimethoate 4 E	0.5 pt	
Endosulfan 3 EC	1 qt	Limit 1 application. Mustard and spinach only.
	1 to 1.33 qt	Limit 2 applications. Lettuce only.
Fulfill 50 DF	2.75 oz	Limit 5.5 oz/A. Allow 7 days between applications.
Lannate 90 SP	0.5 to 1 lb	For lettuce and spinach only. Limit 10 lb/A (lettuce), 4 lb/A (spinach).
Malathion 8	1.5 to 2.5 pt	
	2 pt	Lettuce and spinach only.
Provado 1.6 F	3.75 fl oz	Limit 18.75 fl oz/A. Allow 5 days between applications.
Venom 70 SG	1 to 3 oz	Allow 7 days between sprays. Limit 6 oz/season.
Flea Beetles		
Ammo 2.5 EC	2.5 to 5 fl oz	Limit 30 fl oz/A. Head lettuce only.
Endosulfan 3 EC	1 qt	Limit 1 application. For kale and spinach only.
Hero 1.24 EC	4 to 10.3 fl oz	Limit 46 fl oz/A. Allow 7 days between applications.
Mustang Max	2.24 to 4 fl oz	Limit 24 fl oz/season.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 2.4 pt/A.
Sevin XLR	0.5 to 1 qt	Limit 4 applications and allow at least 7 days between applications.
Warrior T	2.56 to 3.84 fl oz	Limit 2.4 pt/A.
Grasshoppers, Leafhoppers, Leafminers		
Ammo 2.5 EC	2.5 to 5 fl oz	Limit 30 fl oz/A. Head lettuce only.
Dimethoate 4 E	0.5 pt	
Lannate 90 SP	0.5 to 1 lb	For lettuce and spinach only. Limit 10 lb/A (lettuce), 4 lb/A (spinach).
Mustang Max	2.24 to 4 fl oz	Limit 24 fl oz/season. Leafhoppers only.
Pounce 3.2 EC	2 to 8 fl oz	Limit 40 fl oz/A.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	Limit 2.4 pt/A.
Sevin XLR	0.5 to 1 qt	Leafhoppers only. Limit 4 applications and allow at least 7 days between applications.
Trigard 75 WP	2.66 oz	Allow 7 days between sprays. Limit 6 sprays. Leafminer only.
Warrior T	2.56 to 3.84 fl oz	Limit 2.4 pt/A.
Whiteflies		
Actara 25 W	3 to 5.5 oz	Limit 11 oz/season, allow 7 days between applications.
Beleaf 50 SG	2.8 oz	Limit 8.4 oz/season, allow 7 days between applications. Greenhouse whitefly only.
Courier 40 SC	9 to 13.6 fl oz	Limit 2 applications per crop cycle, allow 7 days between applications.
Knack 0.86 EC	8 to 10 oz	Limit 2 applications, allow 14 days between applications.
Oberon 2 SC	7 to 8.5 fl oz	Limit 3 sprays. Allow 7 days between applications.
Venom 70 SG	1 to 3 oz	Allow 7 days between sprays. Limit 6 oz/A.

WEED CONTROL: Greens

Product Amt/A	Lb A.I./A	Remarks
0.5 to 1.5 fl oz Aim 1.9 EW	0.008 to 0.023 carfentrazone	For contact postemergence control of annual broadleaf weeds and suppression of annual grasses. Can be applied as a preplant, pre-transplant burndown, or before crop emerges to actively growing weeds up to 4 inches tall. Can also be applied postemergence as a directed hooded application between crop rows. Use min. 10 gal water/A and crop oil 1% v/v. Max. rate 6.1 fl oz/A. PHI = 0 days.
6 to 14 pt Dacthal 6 F (not labeled on spinach and lettuce)	4.5 to 10.5 DCPA	For preemergence control of annual grasses and small-seeded broadleaves. Apply at seeding. Can be pre-plant incorporated.
1 to 2 pt Goal 2XL (not labeled on turnip greens)	0.25 to 0.5 oxyfluorfen	For preemergence and postemergence control of certain annual grasses and most broadleaves. For fallow bed preparation only. Best if used with glyphosate for control of winter annual broadleaf weeds. Min. 90 days at 1 pt/A and 120 days at 2 pt/A between application and seeding.
1.3 to 2.7 pt Gramoxone Max 3 L (not labeled on spinach, kale, and mustard greens)	0.5 to 1 paraquat	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply preplant, preemergence, or before transplanting in min. 10 gal water/A. Apply banded or broadcast. Use higher rate for heavy weed infestations. Use non-ionic surfactant 0.25% v/v.
2 to 4 lb Kerb 50 WP (labeled on lettuce only)	1 to 2 lb pronamide	For control of grasses and certain broadleaf weeds. Apply before or after seeding but before crop and weeds emerge. Moisture is necessary to activate. Label rates vary depending on variety, rainfall, and soil texture. Can be incorporated or watered in.
0.5 to 1.5 pt Poast 1.5 E (not labeled on turnip greens)	0.09 to 0.27 sethoxydim	For control of actively growing grasses only. Use high rate on johnsongrass. PHI = 15 days. Max. rate of 1.5 pt/application and 3 pt/season.
5 to 6 qt Pferar 4 E (not labeled on spinach and turnip greens)	5 to 6 bensulide	For control of grasses and broadleaf weeds. Apply preplant and incorporate to 1 to 2 inch depth. Apply preemergence only if it can be watered in within 36 hours. Max. rate of 6 qt/season.
16 to 22 fl oz Roundup WeatherMax 5.5L	0.69 to 0.94 glyphosate-salt	For non-selective postemergence control of annual and perennial grasses and broadleaf weeds. Use only AMS 1 to 2% v/v. Adding a non-ionic surfactant can reduce weed control effectiveness. Min. 3 days before seeding and min. 30 days before planting any non-labeled crop.
6 to 8 fl oz Select 2E	0.09 to 0.12 clethodim	For selective postemergence of actively growing annual grasses and suppression of perennial grasses. Add crop oil 1% v/v. Max. 8 fl oz/application. Min. 14 days interval between applications. PHI = 14 days.
1 to 10% Scythe 4.2L	pelargonic acid	For non-selective contact control of annual grasses and broadleaf weeds. Use in min. 10 gal water/A if mixed with other herbicides or a min. 75 gal if used alone. Do not allow contact with crop foliage. Can be mixed with Roundup. See label for amount of Scythe to use depending on the desired spray volume.
0.25 to 0.5 pt Stinger 3 L (not labeled on lettuce)	0.09 to 0.18 clopyralid	For selective postemergence control of broadleaf weeds. Apply to spinach in 2- to 5-leaf stage in 10 to 20 gal water/A. Make 1 to 2 broadcast applications but don't exceed a total of 0.5 pt/A/season. PHI = 21 days for spinach and 15 days for collards, kale, mustard, and turnip..
1.5 pt Treflan HFP 4 E (not labeled on spinach and lettuce)	0.75 trifluralin	For control of annual grasses and broadleaf weeds. Use on turnip greens used for processing only. Apply as a preplant soil incorporated treatment.

DISEASE CONTROL: Greens

Product	Amt/A	Seasonal Limits/A	Comments
<i>MUSTARD, TURNIP, COLLARDS, KALE</i>			
Alternaria, Cercospora, Cercosporiella Leaf Spots			
Azoxystrobin ¹		3 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Amistar	2 to 5 oz		
Quadris	6 to 15.5 fl oz		
Cabrio ¹	8 to 12 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Endura	6 to 9 oz	2 apps	NOT FOR TURNIP GREENS. Apply before disease onset, continue on a 7- to 14-day schedule.
Fixed coppers		n/a	PRODUCTS ARE CROP-SPECIFIC—CHECK LABELS FOR LIST OF REGISTERED CROPS IN THIS SUB-GROUP. Apply on a 7- to 10-day schedule after seeding/transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Badge SC	0.9 to 1.8 pt		
Champ DP	0.33 to 0.67 lb		
Champ Formula 2 FL	0.33 to 0.67 pt		
Cuprofix Disperss	1.5 to 2.5 lb		
Cuprofix Ultra 40 Disperss	0.75 to 1.25 lb		
Kocide 101	1 to 2 lb		
Kocide 2000	0.75 to 1.5 lb		
Kocide 3000	0.5 to 0.75 lb		
Kocide DF	1 to 2 lb		
Kocide 4.5 LF	0.66 to 1.33 pt		
Nu-Cop 50 DF	1 to 2 lb		
Maneb		4.2 lb/4 lb/3.2 qt	
Maneb 75 DF	1.5 to 2 lb		
Maneb 80 WP	1.5 to 2 lb		
Manex	2.4 to 3.2 pt		

DISEASE CONTROL: Greens

Product	Amt/A	Seasonal Limits/A	Comments
Black Rot			
Actigard	1 oz	4	NOT FOR TURNIP GREENS, SUPPRESSION ONLY. Apply 7 to 10 days after thinning and make up to 3 additional applications on a 7-day schedule. Apply in a min of 20 gal/A of water. May cause phytotoxicity and yield reduction. Do not apply to stressed or injured plants.
Fixed coppers		n/a	PRODUCTS ARE CROP-SPECIFIC—CHECK LABELS FOR LIST OF REGISTERED CROPS IN THIS SUB-GROUP. Apply on a 7- to 10-day schedule after seeding/transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Badge SC	0.9 to 1.8 pt		
Champ DP	0.33 to 0.67 lb		
Champ Formula 2 FL	0.33 to 0.67 pt		
Champion WP	2 lb		
Copper-Count-N	2 to 6 pt		
Cuprofix Disperss	1.5 to 2.5 lb		
Cuprofix Ultra 40 Disperss	0.75 to 1.25 lb		
Kocide 101	1 to 2 lb		
Kocide 2000	0.75 to 1.5 lb		
Kocide 3000	0.5 to 0.75 lb		
Kocide DF	1 to 2 lb		
Kocide 4.5 LF	0.66 to 1.33 pt		
Nu-Cop 50 DF	1 to 2 lb		
Bottom Rot, Basal Stem Rot, Root Rot (<i>Rhizoctonia</i>)			
Azoxystrobin ¹		4 apps (3 foliar)	BANDED APPLICATIONS: Counts as a foliar application. Apply before disease onset, continue on a 7- to 14-day schedule. May be applied in a 7-inch band with spray directed at lower stems and surrounding soil. IN-FURROW: Apply in 5 to 15 gal/A, with nozzle directed to spray in furrow just before seed are covered. Does not count as a foliar application.
Amistar	0.125 to 0.25 oz ²		
Quadris	0.4 to 0.8 fl oz ²		
Cabrio ¹	12 to 16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Endura	6 to 9 oz	2 apps	NOT FOR TURNIP GREENS. Apply before disease onset, continue on a 7- to 14-day schedule.
Damping-off (<i>Pythium</i>)			
Ridomil Gold EC	0.25 to 0.5 pt	1 app	PRE-PLANT: Apply to soil as a broadcast spray or in a 7-in band; incorporate into the upper 2 in of soil mechanically or with irrigation if rainfall is not expected within 24 hrs of treatment.
Ridomil Gold SL			
Ultra Flourish	0.5 to 1 pt		
Downy Mildew			
Acrobat 50 WP	6.4 oz	5 apps	NOT FOR TURNIP GREENS. Must be tank-mixed with another downy mildew product. Apply before disease onset, continue on a 7-day schedule. Rotate to another fungicide after 2 consecutive applications.
Forum SC	6 fl oz		
Actigard	1 oz	4 apps	NOT FOR TURNIP GREENS. Make first application 7 to 10 days after thinning and make up to 3 additional applications on a 7-day schedule. Apply in a minimum of 20 gal/A of water. May cause phytotoxicity and yield reduction. Do not apply to stressed or injured plants.
Aliette WDG	2 to 5 lb	7 apps	NOT FOR TURNIP GREENS. Apply when conditions favor disease and continue on a 7- to 21-day schedule. Do not tank-mix with copper compounds.
Cabrio ¹	12 to 16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Fixed coppers		n/a	PRODUCTS ARE CROP-SPECIFIC—CHECK LABELS FOR LIST OF REGISTERED CROPS IN THIS SUB-GROUP. Apply on a 7- to 10-day schedule after seeding/transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Badge SC	0.9 to 1.8 pt		
Champ DP	0.33 to 0.67 lb		
Champ Formula 2 FL	0.33 to 0.67 pt		
Champion WP	0.5 to 1 lb		
Copper-Count-N	1 to 2 pt		
Cuprofix Disperss	1.5 to 2.5 lb		
Cuprofix Ultra 40 Disperss	0.75 to 1.25 lb		
Kocide 101	1 to 2 lb		
Kocide 2000	0.75 to 1.5 lb		
Kocide 3000	0.5 to 0.75 lb		
Kocide DF	1 to 2 lb		
Kocide 4.5 LF	0.66 to 1.33 pt		
Nu-Cop 50 WP	0.5 to 1 lb		
Nu-Cop 3 L	0.33 to 1.33 pt		
Nu-Cop 50 DF	1 to 2 lb		
Maneb			KALE ONLY. Apply when disease threatens and continue on a 7- to 10-day schedule. Manex can be used on collards and kale.
Maneb 75 DF	1.5 to 2 lb	4.2 lb	
Maneb 80 WP	1.5 to 2 lb	4 lb	
Manex	2.4 to 3.2 pt	3.2 qt	
Powdery Mildew			
Azoxystrobin ¹		3 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Amistar	3 to 5 oz		
Quadris	9 to 15.5 fl oz		
Cabrio ¹	8 to 12 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Endura	6 to 9 oz	2	NOT FOR TURNIP GREENS. Apply before disease onset, continue on a 7 to 14 day schedule.
Sulfur	3 to 10 lb	n/a	Apply on a 14-day schedule, beginning when symptoms are first observed or when conditions favor disease. Phytotoxicity may occur when sulfur is applied when air temperatures exceed 90°F.

DISEASE CONTROL: Greens

Product	Amt/A	Seasonal Limits/A	Comments		
Sclerotinia Stem Rot					
Cabrio ¹	12 to 16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.		
Endura	6 to 9 oz	2 apps	NOT FOR TURNIP GREENS. Apply before disease onset, continue on a 7 to 14 day schedule.		
LETTUCE					
Bottom Rot (Rhizoctonia)					
Azoxystrobin ¹					
Amistar	0.125 to 0.25 oz ²	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule. May be applied in a 7-inch band with spray directed at lower stems and surrounding soil.		
	0.125 to 0.188 oz ²		IN-FURROW: Apply in 5 to 15 gal/A, with nozzle directed to spray in furrow just before seed are covered. RESISTANCE MANAGEMENT: In-furrow treatment does not count as a foliar application.		
Quadris	0.4 to 0.8 fl oz ²	2 apps	See comments for Amistar.		
	0.4 to 0.7 fl oz ²		IN-FURROW: See comments for Amistar.		
Endura	8 to 11 oz	2 apps	Apply immediately after emergence/transplanting or before disease onset.		
Rovral 4 Flowable	1.5 to 2 pt	3 apps	Apply beginning at the 3-leaf stage to just after thinning. Repeat applications can be made at 10-day intervals.		
lprodione 4L AG					
Damping-off (Pythium)					
Previcur Flex	2 pt	8 pt	Apply after transplanting or plant emergence using nozzles directed to the lower portion of plants and surrounding soil. Previcur may be applied by drip or sprinkler irrigation. Approved for greenhouse use.		
Ridomil Gold EC	1 to 2 pt	1 app	Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil mechanically (pre-plant) or with irrigation (pre- and at-planting) if rainfall is not expected within 24 hours of treatment. Ridomil Gold EC or SL, and Ultra Flourish can be applied through drip irrigation.		
Ridomil Gold SL					
Ridomil Gold GR	20 to 40 lb				
Ultra Flourish	2 to 4 pt				
Downy Mildew					
Acrobat 50 WP	6.4 oz	5 apps	Must be tank-mixed with another downy mildew product. Apply before disease onset, continue on a 5- to 10-day schedule. Rotate to another fungicide after 2 consecutive applications.		
Forum SC	6 fl oz				
Aliette WDG	2 to 5	7 apps	Apply when conditions favor disease and continue on a 7- to 21-day schedule. Do not tank-mix with copper compounds.		
Azoxystrobin ¹					
Amistar	4 to 5 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.		
Heritage	6.4 to 8 oz				
Quadris	12 to 15.5 fl oz				
Cabrio ¹	16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.		
Fixed coppers					
Basic Copper 53	1 to 3 lb	n/a	Apply on a 3- to 10-day schedule after seeding/transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions. Some products are approved for greenhouse use – refer to label.		
C-O-C-S WDG	1 to 3 lb				
Champ DP	0.67 to 1.33				
Champ Formula 2 FL	0.67 to 1.33 pt				
Nu-Cop 50 WP	1 to 2 lb				
Nu-Cop 3 L	0.66 to 2.66 pt				
Nu-Cop 50 DF	1 to 2 lb				
Tenn-Cop 5 E	1.5 to 3 pt				
Maneb					
Maneb 75 DF	1.5 to 2 lb			12.8 lb	Apply when disease threatens and continue on a 7- to 10-day schedule.
Maneb 80 WP	1.5 to 2 lb	12 lb			
Manex	1.2 to 1.6 qt	9.6 qt			
Previcur Flex	1.33 to 2 pt	8 pt	Apply when disease threatens and continue on a 7- to 10-day schedule. Approved for greenhouse use.		
Tanos ¹	8 oz	3 apps	Tanos must be tank-mixed with a multi-site inhibitor (FRAC Group M) appropriate for the target disease. Apply before disease onset, continue on a 5- to 7-day schedule.		
Drop, Gray Mold					
Botran 75 W	2 to 5.33 lb	5.33 lb	Rates are timing dependent (pre-emergence, thinning, and post-thinning). See label for application instructions. Approved for greenhouse use.		
Endura	8 to 11 oz	2 apps	Apply immediately after emergence/transplanting or before disease onset.		
Rovral 4 Flowable	1.5 to 2 pt	3 apps	NOT LABELED FOR GRAY MOLD. Apply beginning at the 3-leaf stage to just after thinning. Repeat applications can be made at 10-day intervals.		
lprodione 4L AG					
SPINACH					
Damping-off (Pythium)					
Ridomil Gold EC	1 to 2 pt	1 app	Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil mechanically (pre-plant) or with irrigation (pre- and at-planting) if rainfall is not expected within 24 hours of treatment.		
Ridomil Gold SL					
Ridomil Gold GR	20 to 40 lb				
Ultra Flourish	2 to 4 pt				
Downy Mildew, White Rust					
Actigard	0.75 oz	3 apps	Apply after thinning and make up to 2 additional applications on a 7- to 10-day schedule. Apply in a minimum of 20 gal/A of water. Do not apply to stressed or injured plants.		
Aliette WDG	2 to 5 lb	7 apps	Apply when conditions favor disease and continue on a 7- to 21-day schedule. Do not tank-mix with copper compounds.		

DISEASE CONTROL: Greens

Product	Amt/A	Seasonal Limits/A	Comments
Azoxystrobin ¹		4 apps	Use higher rates for downy mildew. Apply before disease onset, continue on a 7- to 14-day schedule.
Amistar	2 to 5 oz		
Heritage	3.2 to 8 oz		
Quadris	6 to 15.5 fl oz		
Cabrio ¹	8 to 16 oz	4 apps	Use highest rate for downy mildew. Apply before disease onset, continue on a 7- to 14-day schedule.
Fixed coppers		n/a	Apply on a 7- to 10-day schedule after seeding/transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Badge SC	1.8 to 2.8 pt		
Basic Copper 53	2 to 4 lb		
C-O-C-S WDG	1 to 3 lb		
Champ Formula 2 FL	1.33 to 2.67 pt		
Copper-Count-N	3 pt lb		
Cuprofix Disperss	2.5 to 4 lb		
Cuprofix Ultra 40 Disperss	1.25 to 2 lb		
Kocide 101	2 to 3 lb		
Kocide 2000	1.5 to 2.25 lb		
Kocide 3000	0.75 to 1.25 lb		
Kocide DF	2 to 3 lb		
Kocide 4.5 LF	1.33 to 2 pt		
Nu-Cop 50 WP	2 to 4 lb		
Nu-Cop 3 L	1.33 to 2.67 pt		
Nu-Cop 50 DF	2 to 3 lb		
Tenn-Cop 5 E	3 to 4 pt		
Ridomil Gold EC	0.25 pt	3 apps	Not for foliar application. POST-PLANT SIDE-DRESS APPLICATION: See label for instructions.
Ridomil Gold SL			
Ridomil Gold GR	5 lb		
Ultra Flourish	0.5 pt		
Ridomil Gold Copper	2.5 lb	2 apps	Apply 21 days after at-planting treatment with Ridomil Gold EC or GR and continue on a 14-day schedule. Avoid late-season applications.
Leaf Spots (Anthracnose, Cercospora)			
Azoxystrobin ¹		4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Amistar	2 to 5 oz		
Heritage	3.2 to 8 oz		
Quadris	6 to 15.5 fl oz		
Cabrio ¹	12 to 16 oz	4 apps	Apply before disease onset, continue on a 7- to 14-day schedule.
Fixed coppers		n/a	Apply on a 7- to 10-day schedule after seeding/transplanting or when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Basic Copper 53	2 to 4 lb		
Badge SC	1.8 to 2.8 pt		
C-O-C-S WDG	1 to 3 lb		
Champ Formula 2 FL	1.33 to 2.67 pt		
Copper-Count-N	3 pt		
Cuprofix Disperss	2.5 to 4 lb		
Cuprofix Ultra 40 Disperss	1.25 to 2 lb		
Kocide 101	2 to 3 lb		
Kocide 2000	1.5 to 2.25 lb		
Kocide 3000	0.75 to 1.25 lb		
Kocide DF	2 to 3 lb		
Kocide 4.5 LF	1.33 to 2 pt		
Nu-Cop 50 WP	2 to 4 lb		
Nu-Cop 3 L	1.33 to 2.67 pt		
Nu-Cop 50 DF	2 to 3 lb		
Tenn-Cop 5 E	3 to 4 pt		

¹ Do not make back-to-back applications or rotate with other QoI inhibitors (FRAC Group 11). Fungicides with the same Group number have the same mode of action. Do not tank-mix products with the same Group number, and rotate among fungicides with different Group numbers to discourage resistance development.

² Per 1000 row-feet.