

Okra

Mallow family (Malvaceae): *Abelmoschus esculentus*

Planting and Culture

Well-drained, fertile, silt loam soils are most desirable; however, okra will grow on a wide range of soil types. Prepare a firm, friable seedbed as for other vegetable crops.

Seed okra only after the soil has warmed up (65°F) in the spring to allow good seed germination (see Appendix J). Plant four to six seeds per foot in rows 28 to 36 inches apart; thin plants to 10 to 18 inches apart in rows. Ten to 12 pounds of seed is required to plant an acre. Seed should be planted 1 1/2 to 2 inches deep. Planet Jr.-type planters work well for direct seeding. In addition, very high yields have been obtained with transplanted okra using black plastic mulch and drip irrigation.

Fertilizing

Apply P₂O₅, K₂O, and lime according to soil test results. A total of about 80 to 90 pounds N per acre is used, with about half that amount applied prior to planting. Fertilizer should be applied broadcast and disked in prior to seeding. A sidedressing of nitrogen applied after the first harvest will help to prolong the harvesting period (see "Fertilizer" table). Soil pH should be 6.0 to 6.5.

Harvesting and Handling

Harvesting under favorable conditions should start about six days after flowering.

FERTILIZER: Okra

Soil Test Results (lb/A)	Fertilizer Needed (lb/A)	
	Phosphorus	Phosphate (P₂O₅)
Low	<31	181-240
Medium	31-60	91-180
High	61-80	1-90
Very High	>80	0
	Potassium	Potash (K₂O)
Low	<201	151-200
Medium	201-300	101-150
High	301-450	1-100
Very High	>450	0
	Nitrogen	N
Apply 40 to 50 lb nitrogen (N)/A before planting seed. After harvest begins sidedress plants with an additional 35 to 40 lb N/A.		

INSECT CONTROL: Okra¹

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
Aphids			
Admire Pro	7 to 14 fl oz	14 fl oz	Soil application, see label for methods.
Admire Pro	1.3 to 2.2 fl oz	6.7 fl oz	Foliar application. Allow 5 days between applications. Not during bloom.

VARIETIES: Okra

Variety	Days to Maturity From Seeding	Comments
Annie Oakley II	48	Hybrid; medium green, ridged; remain tender up to 4.5 inch, smaller plants.
Jambalaya	50	compact plant, uniform pods.
Burgundy	60	Dark Red Pods, flowers are edible and may be stuffed.
Clemson Spineless	55	Heavy yields—almost spineless pods.

Harvesting of the pods should be done on a regular basis (about every two days) so that the pods do not become over-mature. Regular picking increases yield. Old pods should be removed and discarded, because mature ones retard future pod set. The pods should be harvested when 2 to 3 1/2 inches long. Move harvested pods to a shady, cool area as soon as possible to maintain good quality. Fresh market okra is usually graded into the following sizes:

- Fancy: pods up to 3 1/2 inches long
- Choice: pods 3 1/2 to 4 1/2 inches long
- Jumbo: pods over 4 1/2 inches long but still tender

Pods should be harvested from the plant with a sharp knife to make a smooth, neat cut.

Okra can be kept for fresh consumption for two weeks at a temperature of 50°F and a relative humidity of 90 to 95 percent. Okra chilled below temperatures of 50°F will turn dark and decay.

Potential yields of 12,000 pounds per acre are possible; however, 8,000 to 10,000 pounds per acre is considered more realistic. A bushel of okra weighs approximately 30 pounds.

Common Diseases/Management

Seed rot, damping-off. Plant fungicide-treated seed (Captan 40WP at 1 teaspoon per pound of seed). Planting okra in warm soil that is well drained is critical. Turn cover crops under early to ensure they are well rotted before planting. Where disease pressure is high, azoxystrobin can be applied at planting to help reduce losses to disease.

Foliar diseases and fruit rots. Take steps to aid drying of the fruit, such as avoiding low, wet areas and fog pockets; do not plant okra between taller bordering plants such as corn. Removing several larger upper leaves to aid sunlight penetration and air circulation is also helpful. Fungicides

PESTICIDE SAFETY: Okra

	Signal ¹	Re-entry (hrs)	Harvest (days)
INSECTICIDES			
Acramite 50 WS	C	12	3
Admire Pro	C	12	21
Avaunt 30 DG	C	12	3
Belt SC	C	12	1
Bt products	C	12	0
Coragen 1.67 SC	-	4	1
Courier 40 SC	W	12	1
Intrepid 2 F	C	4	1
Kanemite 15 SC	C	12	1
Knack 0.86 EC	C	12	1
Malathion 8	C	12	1
Movento 2 SC	C	24	1
Portal 0.4 EC	W	12	1
Provado 1.6 F	C	12	0
Radiant SC	C	4	1
Requiem 25 EC	C	4	0
Rimon 0.83 EC	W	12	1
Sevin XLR	C	12	3
Zeal 72 WP	C	12	7
Restricted Use			
Brigade 2 EC	W	12	7
Hero 1.14 EC	W	12	7
Mustang Max	W	12	1
FUNGICIDES			
Ariston	C	12	3
Chlorothalonil ²	C	12	3
Fixed coppers ²	W	24/48	0
Microthiol Disperss	C	24	0
Quadris	C	4	0
Rally 40 WSP	W	24	0
Tebuconazole ²	C	12	3
Vivando	C	12	0

¹ W: Warning, C: Caution, D: Danger, P: Poison

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

may also be applied to manage these diseases.

Fusarium wilt, Verticillium wilt. Practice crop rotation. A general soil fumigant (see page 16) should be considered in fields with a history of these diseases. Avoid solanaceous crops in the rotation (potatoes, tomatoes, tobacco, eggplant, peppers).

Nematodes. Practice crop rotation (two to three years away from solanaceous crops). Fumigants (page 16) may be required.

(continued on next page)

INSECT CONTROL: Okra (continued)

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
Malathion 8	1.5 pt	5 applications	Before pod set only. Allow 7 days between applications.
Movovento 2 SC	4 to 5 fl oz	10 fl oz	Allow 7 days between applications.
Requiem 25 EC	2 to 4 qt	-	-
Corn Earworms			
Avaunt 30 WG	3.5 oz	14 oz	Allow 5 days between applications.
Belt 4 SC	1.5 fl oz	4.5 fl oz	Allow 3 days between applications.
Bt products	See labels		
Brigade 2 E	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Coragen 1.67 SC	3.5 to 5 fl oz	15.4 fl oz	Allow 5 days between applications.
Intrepid 2 F	10 to 16 fl oz	64 fl oz	-
Mustang Max	2.24 to 4 fl oz	24 fl oz	Allow 7 days between applications.
Radiant SC	5 to 10 fl oz	34 fl oz	Allow 4 days between applications.
Sevin XLR	1 to 1.5 qt	6 qt	Allow 6 to 8 days between applications.
Vetiva 2.66	12 to 17 fl oz	38 fl oz	Allow 5 days between applications.
Japanese Beetles			
Brigade 2 E	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Malathion 8	1.5 pt	5 applications	Before pod set only. Allow 7 days between applications.
Stink bugs			
Brigade 2 EC	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Hero 1.24 EC	4 to 10.3 fl oz	27.38 fl oz	Allow 7 days between applications.
Mustang Max	3.2 to 4 fl oz	24 fl oz	Allow 7 days between applications.
Rimon 0.83 EC	12 fl oz	36 fl oz	For immatures only. Allow 7 days between applications.

¹ Generic products available (Appendix E).

WEED CONTROL: Okra

Product Amt/A	Lb A.I./A	Comments
0.5-1.6 fl oz Aim 1.9 EW	0.008-0.025 carfentrazone	For contact post-emergence 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 post-emergence 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.
1-2 pt Dual Magnum	0.95-1.9 s-metolachlor	24(C) Special Local Need Label see label for use and restrictions. Grower assumes all risk of crop injury, yield reductions, and crop loss.
2-4 pt Gramoxone Inteon	0.67-1.35 paraquat salt	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply preplant, pre-emergence, or before transplanting in min. 20 gal of water/A. Apply banded or broadcast. Use higher rate for heavy weed infestations. Use non-ionic surfactant 0.25% v/v. PHI = 21 days.
1.5 pt Poast 1.5 E	0.28 sethoxydim	For control of actively growing grasses only. Use high rate on Johnson grass. PHI = 14 days. Max. rate of 1.5 pt/application and 5.5 pt/season.
16-22 fl oz Roundup Weather-Max 5.5L	0.69-0.94 glyphosate-salt	For non-selective post-emergence 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.
1.25-2 pt Treflan HFP 4 E	0.62-1 trifluralin	For pre-emergence control of annual grasses and broadleaf weeds. Apply as preplant soil incorporated. Can also be applied before or immediately after planting.

DISEASE CONTROL: Okra

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Foliar Diseases (Anthracnose, Leaf Spots, Powdery Mildew)					
Ariston	M/27	3	2.0 - 2.4 pt	17.5 pt	Anthracnose only. Apply before disease onset, continue every 7 to 14 days.
Azoxystrobin ⁴					Apply before disease onset, continue every 7 to 14 days.
Azoxy 2SC	11	0	6 to 15.5 fl oz ⁴	4 apps	
AzoxyStar	11	0	6 to 15.5 fl oz ⁴	4 apps	
Quadris	11	0	6 to 15.5 fl oz ⁴	4 apps	
Satori	11	0	6 to 15.5 fl oz ⁴	4 apps	
Chlorothalonil ⁴					Only liquid formulations are labeled.
Bravo Weather Stik	M	3	1.5 pt	12 pt	Apply every 7 to 10 days.
Fixed coppers					
Badge SC	M	0	0.75 to 1.8 pt		-
Badge X2	M	0	0.75 to 1.75 lb		OMRI-listed.
Kentan DF	M	0	0.5 to 1.5 lb		Apply every 5 to 10 days when conditions favor disease.
Kocide 2000	M	0	1.5 to 3 lb		Apply every 5 to 10 days when conditions favor disease. See label for mixing instructions and tank-mix precautions.
Kocide 3000	M	0	0.75 to 1.75 lb		-
Nu-Cop 50DF	M	0	1 to 2.1 lb		OMRI-listed.
Mastercop	M	0	0.5 to 1 pt		Apply every 5 to 10 days when conditions favor disease.
Microthiol Disperss	M	0	3 to 10 lb	n/a	Apply every 14 days. Phytotoxicity may occur when sulfur is applied when temperatures exceed 90°F.
Rally 40 WSP	3	0	2.5 to 5 oz	4 apps	Powdery mildew only. Apply every 14 days when conditions favor disease.
Tebuconazole ⁴	3	3			Cercospora leaf spot only. Apply preventively. Use lowest listed rate of surfactant to improve coverage.
Vivando	U8	0	15.4 fl oz	3 apps	Powdery mildew only. Begin applications prior to disease onset and continue every 7 to 14 days. No curative activity.

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DISEASE CONTROL: *Okra (continued)*

Product	FRAC Code	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Seedling Rot (Rhizoctonia)					
Azoxystrobin ⁴					
Azoxystrobin	11	0	0.4 to 0.8 fl oz ³	4 apps	Post-emergence. Apply broadcast in a 7-inch band with spray directed at lower stems and surrounding soil.
Azoxystar	11	0	0.4 to 0.7 fl oz ³	1 app	In-furrow. Apply in 5 to 15 gal/A, with nozzle directed to spray in-furrow just before seed are covered.
Quadris	11	0			
Satori	11	0			

¹ Products with numerical FRAC codes must be alternated or tank-mixed with products that have a different FRAC code to discourage resistance development. See product label for maximum number of consecutive applications allowed. Refer to the table on page 13 for more information on FRAC codes.

² Pre-harvest interval.

³ Per 1,000 row-feet.

⁴ Generic products available (Appendix F). Amounts and seasonal limits per acre are product dependent.

Onions

Onion family (Alliaceae): *Allium cepa* Cepa group

Planting and Culture

Due to weed pressure, it is recommended that onion producers use transplants or sets for planting. The easiest way to grow green bunching onions is by using sets. Sets should be planted by mid-March for best results (see Appendix J).

Typically, transplants can be planted into the field about 8 to 10 weeks after seeding. At this time the base of the plants should be ¼ to ½ inch in diameter. Transplants can be planted into raised beds on rows 8 to 12 inches apart with in-row spacing between 6 and 8 inches. Some growers have had success using black or white plastic; however, growing onions on plastic can also increase the incidence of bacterial diseases in bulbs, particularly in hot or wet weather. If using plastic mulches, white-colored mulch is preferred for onion production due to the lower soil temperatures that occur. Use drip irrigation, as onions have poor root systems and will not achieve maximum size without adequate moisture. A well-drained soil is essential for good onion production. A soil pH between 6.0 and 6.8 is most desirable for onions.

Many growers produce onions for direct market sales. Often consumers at these markets are looking for sweet “Vidalia”-type onions. In order to produce mild tasting onions for fresh consumption, growers must have the correct combination of both variety and environment. Sweet, mild varieties bred specifically for fresh consumption should be chosen. In addition, onions grown with low levels of sulfur in soils or irrigation water will tend to be milder than those grown in a high sulfur environment. Growers should also be careful to choose the correct varieties for Kentucky. Intermediate or “day-neutral” type varieties perform well at this latitude.

VARIETIES: Onions—Green and Bulb

Variety	Days to Maturity	Comments
GREEN (bunching/scallions)		
Ishikura	60-65	Long very slim white stems
Evergreen White Bunching	65-70	Hardy, will overwinter, non-bulbing, white stems
BULB		
Olympic	88 (300) ¹	Medium to large bulbs, very early, yellow, mild, some success overwintering
Gunnison	100 (300) ¹	Medium bulbs, some success overwintering, for storage, hot and pungent.
Super Star	100	Large (¾ lb) bulbs; white, pungent, stores well; AAS winner.
Red Burgermaster	105	Large red bulbs, not for storage.
Red Beauty	105	Red, medium bulbs, uniform and early
Candy	110	Large bulbs, sweet mild flavor, not for storage.
Expression	110	Large bulbs, sweet mild, similar to Candy
Red Wing	110-115	Red, medium bulbs, uniform, long day type will mature later.
Walla Walla	125 (300) ¹	Very large, sweet and mild, some success overwintering, stores poorly.
Sweet Spanish	130	Yellow, very large, globe-shaped, long-day onion will mature mid-late summer.

¹ Days to maturity if overwintering.

Harvesting, Curing, and Storing

Onions should be harvested when at least 70 percent of the bulbs in the field have gone “tops-down” (foliage has fallen). Irrigation can be stopped about one week prior to harvest. At harvest, bulbs should be undercut and pulled by hand, with foliage and roots removed, and put in shallow trays inside for drying. Onions can be cured outside on a dry surface for one week prior to storing as long as they are protected from rain. Throw out diseased or injured bulbs. A temperature of 35°F and a relative humidity of 70 to 75 percent is the most desirable for storing onions for long periods. Do not store bulbs at a high relative humidity, as is appropriate for many other vegetables. Good ventilation is essential.

Green-bunching onions should be pulled and put into bunches (containing five to seven plants) when they are ½ to 1 inch in diameter. To achieve the long white shoulders desired on green onions, the soil is hilled around plants two to three weeks before harvest.

FERTILIZER: Onions

Soil Test Results (lb/A)	Fertilizer Needed (lb/A)	
Phosphorus		
	Phosphate (P₂O₅)	
Low	<31	181-240
Medium	31-60	61-180
High	61-80	1-60
Very High	>81	0
Potassium		
	Potash (K₂O)	
Low	<201	176-250
Medium	201-300	101-175
High	301-450	1-100
Very High	>450	0
Nitrogen		
	N	
Apply 90 to 100 lb of nitrogen (N)/A to soils of relatively low fertility; broadcast and disk before planting. Decrease nitrogen application according to soil fertility. On heavily fertilized soils, apply 50 to 60 lb N/A. Once bulbing starts sidedress with 25 lb N/A every two weeks for a total of four applications.		

Common Diseases/Management General Practices

Onions are very susceptible to a wide range of diseases. Use production practices that maintain good air circulation in the crop. Dry onions and green onions are not always covered by the same pesticide labels because the residue risk is much higher

with green onions (the leaves are eaten in addition to the bulb). Examine labels carefully to ensure the crop/stage is covered.

Bacterial leaf blights, bacterial soft rots, and Botrytis neck rot. Control leaf diseases through use of fixed coppers tank-mixed with mancozeb; neck rot is suppressed by some fungicides. *Plants may be immediately topped and dried under shelter, or should be gathered into windrows and topped after several days; neck tissues should be thoroughly dry before storage.* Harvest promptly and avoid damage during handling to limit problems with bacterial rots. In storage, cure rapidly using forced air; heat (not above 100°F) may be required for up to five to seven days during humid weather.

Damping-off, seedling blight, and smut. Purchase fungicide-treated seed or treat with either Captan 50 WP at 1 teaspoon per pound of seed. If planting bulbs (sets), apply mancozeb at 1 pound per 25 gallons of water for 10,000 linear feet as a coarse spray into the planting furrow. For control of Pythium damping-off, apply mefenoxam or metalaxyl either preplant or banded as a soil-surface spray after planting.

Downy mildew. Apply fungicides when conditions are favorable for disease; a number of products are available.

Botrytis leaf blight, purple blotch, Stemphylium blight. Rotate away from onions for three to four years to reduce these diseases. Steps taken to improve air movement within the crop will aid in management, but fungicide sprays are usually needed on commercial plantings in Kentucky. Apply fungicides weekly beginning when disease first appears.

PESTICIDE SAFETY: Onions

	Signal ¹	Re-entry (hrs)	Harvest (days)
INSECTICIDES			
Admire Pro	C	12	21
Assail 30 SG	C	12	4
Coragen 1.67 SC	C	4	1
Exirel 0.83SE	C	12	1
Intrepid 2 F	C	4	16
Knack 0.83 EC	C	12	3
Lorsban 15 G	C	24	AP ²
Malathion 8	C	12	3
Movento 2 SC	C	24	3
Radiant SC	C	4	1
Requiem 25 EC	C	4	0
Scorpion 3.5 SL	C	12	AP/1
Restricted Use			
Agri-Mek 0.15 EC	W	12	30
Battalion 1.5 EC	DP	12	1
Diazinon AG 500	C	24	14
Diazinon 50 W	C	24	14
Lannate 90 SP	DP	48	7
Lorsban 4 E	W	24	AP ²
Mustang Max	W	12	7
PennCap-M	W	96	15
Permethrin 3.2 EC	C	12	1
Proaxis 0.5 EC	C	24	14
Venom 70 SG	C	12	1
Warrior II	W	24	14
FUNGICIDES			
Actigard 50WG	C	12	7
Aliette WDG ³	C	12	7
Ariston	C	12	7
Botran 75-W	C	12	14
Cabrio EG	C	12	7
Chlorothalonil ⁴	D	12	7/14 ⁵
Cuprofix MZ Dispers ⁴	C	24	7
Endura	W	12	7
Fixed coppers ⁴	D	24/48	0
Fontelis	C	12	3
Forum SC	C	12	0
Inspire Super	C	12	7
Iprodione 4L AG	W	24	7

PESTICIDE SAFETY: Onions

	Signal ¹	Re-entry (hrs)	Harvest (days)
Mancozeb ⁴	C	24	7
ManKocide	D	24	7
MetaStar 2EC AG	W	48	0
Meteor	W	24	7
Nevado 4F	W	24	7
Omega 500F	W	48	7
Presidio	C	12	2
Pristine	C	12	7
Propiconazole ⁴	W	12	14
Quadris	C	4	0
Quadris Opti	W	12	7
Quadris Top	C	12	7
Quilt	C	12	14
Quilt Xcel	W	12	0
Reason 500 SC	C	12	7
Revus	C	4	7
Ridomil Gold EC/SL	C	48	0
Ridomil Gold Bravo SC	W	48	7/21 ⁵
Ridomil Gold Copper ⁴	D	48	7/10 ⁵
Ridomil Gold MZ	W	48	7
Rovral 4 Flowable	W	24	7
Revus	C	4	7
Scala	C	12	7
Sulfur ⁴	C	24	0
Switch	C	12	7
Tanos	C	12	3
Tebuconazole ⁴	C	12	7
Ultra Flourish	W	48	0
Zampro	C	12	0
Zing!	C	12	7

¹ W: Warning, C: Caution, D: Danger, P: Poison
² AP: At planting
³ 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.
⁴ Several formulations are marketed. See the general introduction for more details on fungicides.
⁵ Dependent on type of onion (green, bulb or dry), see label.

INSECT CONTROL: Onions¹

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
PREPLANT/PLANTING			
Onion Maggots: Problems with onion maggots are often associated with soils that are high in organic matter or amended with manure. Continuous planting of onions on the same ground will increase onion maggot problems. When possible, rotate with other crops. Eliminate culls and volunteer onions after harvest to reduce the overwintering population.			
Diazinon 50 W	4 to 8 lb	-	Incorporate immediately.
Lorsban 4 E	1.1 oz/ 1,000 row-feet	1 application	Dry bulb onions only, incorporate.
Lorsban 15 G	3.7 oz/ 1,000 row-feet	1 application	Dry bulb only.
Malathion 8	1.56 pt	2 applications	-
FOLIAR TREATMENTS			
Thrips: In general, red onions are more susceptible to thrips injury. Monitor for thrips regularly, especially during hot, dry weather. When needed, treat during early bulb stage and use 10 to 25 thrips per plant as a guideline for treatment.			
Admire Pro	14 fl oz	14 fl oz	Soil application only.
Agri-Mek 0.15 EC	8 to 16 fl oz	48 fl oz	Allow 7 days between applications.
Assail 30 SG	5 to 8 oz	32 oz	Limit 4 applications. Allow 7 days between applications.
Battalion 1.5 EC	1.5 to 2.4 fl oz	9.6 fl oz	-
Knack 0.83 EC	8 fl oz	16 fl oz	Target immatures.
Lannate 90 SP	1 lb	4 lb	-
Movento 2 SC	5 fl oz	10 fl oz	For thrips larvae. Allow 7 days between applications.
Mustang Max	2.88 to 4 fl oz	20 fl oz	Allow 7 days between applications.
Pounce 3.2 EC	6 to 12 fl oz	80 oz	Dry bulb only, not for green onions.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	30.7 fl oz	Allow 5 days between applications. Not for green onions.
Radiant SC	6 to 10 fl oz	30 fl oz	-

(continued on next page)

INSECT CONTROL: Onions¹ (continued)

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
Requiem 25 EC	1.5 to 3 qt		-
Scorpion 355L	5.25 to 7 fl oz	10.5 fl oz	Allow 7 days between applications.
Venom 70 SG	3 to 4 oz	6 oz	Foliar application. Allow 7 days between applications.
	5 to 6 oz	6 oz	Soil application.
Warrior II	1.28 to 1.92 fl oz	15.36 fl oz	Bulb and garlic only, not for green onions.

¹ Generic products available (Appendix E).

WEED CONTROL: Onion

Product Amt/A	Lb A.I./A	Comments
0.5-1.6 fl oz Aim 1.9 EW	0.008-0.025 carfentrazone	For contact post-emergence 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 post-emergence as a directed hooded application between crop rows. Use min. 10 gal of water/A and crop oil 1% v/v. Max. rate 6.1 fl oz/A. PHI = 0 days.
1-1.5 pt Buctril	0.25-0.38 bromoxynil	For selective post-emergence control of broadleaf weeds. Use in 50 to 70 gal of water/A. Apply when both soil and onion leaves are dry and when temperature is 70 to 85°F. Apply to onions with 2 to 5 leaves and when weeds are < 2 inches tall. Do not add surfactant. Do not irrigate within 2 days of a pre-emergence application or within 3 days of crop emergence.
2 oz Chateau 51 WDG	0.064 flumioxazin	Apply to transplanted onions (dry bulb) between the 2-leaf and 6-leaf stage and on direct seed onions (dry bulb) between the 3-leaf and 6-leaf stage. Apply to weed-free onions (dry bulb) for pre-emergence control of the weeds listed. For use on all soil types with up to 5% organic matter. Do not apply more than 2 oz of Chateau WDG per acre during a single application. Do not apply more than 3 oz of Chateau WDG per acre during a single growing season. PHI = 45 days. Min. 14 days between applications.
6-14 lb Dacthal W-75	4.5-10.5 DCPA	For pre-emergence control of annual grasses and small-seeded broadleaves. Can be broadcasted over transplants. Can be applied up to 14 weeks after planting at 14 pt/A rate. Do not preplant incorporate.
0.67-1.3 pt Dual Magnum	0.64-1.25 s-metolachlor	24(C) Special Local Need Label see label for use and restrictions. Grower assumes all risk of crop injury, yield reductions, and crop loss.
1 pt Fusilade-DX 2E	0.25 fluazifop-p	For selective post-emergence 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 = 45 days. Max. rate is 48 fl oz/A.
2-3 fl oz Goal 2XL	0.032-0.5 oxyfluorfen	For pre-emergence and post-emergence control of certain annual grasses and most broadleaves. For use on dry bulb onion only. Apply as a broadcast spray after onions have 2 to 4 true leaves. Spray during sunny warm weather. Applications made during or following cool, wet weather will result in more severe crop injury. Use 2 to 4 fl oz/A for seeded onion and 0.5 to 2 pt/A for transplanted onion in min. 40 gal of water/A. Apply within 1 day before or after transplanting. Max. rate = 2 pt/A per year. 45-day pre-harvest interval. Not trialed for use on plastic.
2-4 pt Gramoxone Inteon	0.67-1.35 paraquat salt	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply preplant, pre-emergence, or before transplanting in min. 20 gal of water/A. Apply banded or broadcast. Use higher rate for heavy weed infestations. Use non-ionic surfactant 0.25% v/v. PHI = 60 days.
10-21 fl oz Outlook	0.47-0.98 dimethanamid	For pre-emergent control of select annual grasses and broadleaf weeds. Apply to onions after the 2 leaf stage and after soil has settled around transplanted onions, or injury may be severe. Can be applied in a single or split application. PHI = 30 days.
0.5-1.5 pt Poast 1.5	0.09-0.27 sethoxydim	For control of actively growing grasses only. Use high rate on Johnson grass. PHI = 30 days. Max. rate of 1.5 pt/application and 4.5 pt/season.
5-6 qt Prefar 4 E	5-6 bensulide	For control of annual grasses and small-seeded broadleaves. Apply preplant incorporated to a depth of 1 inch or pre-emergence after planting. Irrigate immediately after pre-emergence application.
1.8-3.6 pt Prowl 3.3 E	0.74-1.49 pendimethalin	For control of annual grasses and broadleaf weeds. Apply in min. 10 gal of water/A to plants with 2 to 9 true leaf stage. Do not apply surface pre-emergence or serious crop injury can result. Not for use on leek or green bunching onion. PHI = 45 days.
2 pt Prowl H2O	0.95 pendimethalin	For control of annual grasses and broadleaf weeds. The label allows use of 2 pints pre-emergence and 2 pints after the two leaf stage. A maximum of 4 pints (1.9 lb ai) may be applied per crop. It should not be used on soils with less than 3% OM. PHI = 30-days.
16-22 fl oz Roundup Weather-Max 5.5L	0.69-0.94 glyphosate-salt	For non-selective post-emergence 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.
9-32 fl oz Select Max	0.07-0.24 clethodim	For selective post-emergence of actively growing annual grasses and suppression of perennial grasses. Add crop oil 1% v/v in min. 20 gal of water/A. Do not apply more than 32 oz per application. PHI = 45 days.
1-1.25 pt Treflan HFP 4 E	0.5-0.62 trifluralin	For pre-emergence control of annual grasses and broadleaf weeds. For dry bulb use only. Apply at lay-by to soil between onion rows.

DISEASE CONTROL: Onions—Dry and Spanish

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Bacterial Leaf Blight					
Fixed coppers					Apply every 5 to 10 days when plants reach 4 to 6 inches or before disease onset, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.
Badge SC	M	0	1.5 pt		-
Badge X2	M	0	0.75 lb		OMRI-listed.
Champ DP	M	0	0.67 to 1 lb		-
Champ Formula 2 FL	M	0	0.67 to 1 pt		-
Champ WG	M	0	2 lb		OMRI-listed.
Cuprofix Ultra 40 Disperss	M	0	1.25 to 3 lb		-
Kentan DF	M	0	1.5 to 2 lb		-
Kocide 2000	M	0	1.5 lb		-
Kocide 3000	M	0	0.75 lb		-
Kocide DF	M	0	1 to 1.5 lb		-
Mastercop	M	0	0.5 to 1 pt		-
Nu-Cop 50 WP	M	0	2 lb		OMRI-listed.

(continued on next page)

DISEASE CONTROL: Onions—Dry and Spanish (continued)

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Nu-Cop 3 L	M	0	1.33 to 2.66 pt		-
Nu-Cop 50 DF	M	0	1 to 1.5 lb		OMRI-listed.
Nu-Cop 50 HB	M	0	1 lb		-
ManKocide2	M	7	1.5 to 2.25 lb	see footnote	Apply when disease appears and continue every 3 to 7 days as needed.
Botrytis Leaf Blight, Downy Mildew, Purple Blotch, Stemphylium Blight					
Actigard	21	7	0.75 to 1 oz	4 oz	Downy mildew only. Apply 7 to 10 days after thinning and make up to three additional applications every 7 to 10 days. Apply in a min of 20 gal/A of water. May cause phytotoxicity and yield reduction. Do not apply to stressed or injured plants.
Aliette WDG ⁶	33	7	2 to 3 lb	7 apps	Downy mildew only. Apply when conditions favor disease and continue every 7 to 14 days. Do not tank-mix with copper compounds.
Ariston	M/27	7	1.6 - 2.4 pt	14 pt	Downy mildew and purple blotch. Apply before disease onset, continue every 7 to 9 days.
Azoxystrobin⁴					
Azoxy 2SC	11	0	6 to 15.5 fl oz ⁵	4 apps	Use higher rates for downy mildew and Botrytis leaf blight. Apply before disease onset, continue every 7 to 14 days.
AzoxyStar	11	0	6 to 15.5 fl oz ⁵	4 apps	
Quadris	11	0	6 to 15.5 fl oz ⁵	4 apps	
Satori	11	0	6 to 15.5 fl oz ⁵	4 apps	
Botran 75 W	14	14	1.66 to 3.33 lb	5.33 lb	Botrytis only. Apply every 14 days.
Cabrio	11	7	8 to 12 oz ⁵	6 apps	Use higher rates for downy mildew and Botrytis leaf blight. Apply before disease onset, continue every 7 to 14 days.
Chlorothalonil⁴					
Bravo Ultrex	M	7/14	0.9 to 2.7 lb	18.2 lb	Apply before disease onset; continue every 7 days as needed.
Bravo WeatherStik	M	7/14	1 to 3 pt	20 pt	
Endura	7	7	6.8 oz	6 apps	
Fixed coppers					
Purple blotch and botrytis leaf blight only. Apply before disease onset, continue every 7 to 14 days.					
Purple blotch and downy mildew only. Apply every 5 to 10 days when plants reach 4 to 6 inches or before disease onset, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.					
Badge SC	M	0	1.5 pt		-
Badge X2	M	0	0.75 to 1.5 lb		OMRI-listed.
Basic Copper 53	M	0	1.9 lb		OMRI-listed.
C-O-C-S WDG	M	0	3 to 4 lb		-
Champ DP	M	0	1.33 lb		-
Champ Formula 2 FL	M	0	1.33 pt		-
Champ WG	M	0	2 lb		OMRI-listed.
COC DF	M	0	3 to 4 lb		-
COC WP	M	0	3 to 4 lb		OMRI-listed.
Copper-Count-N	M	0	4 pt		-
Cueva	M	0	0.5 to 2 gal		OMRI-listed. Mix in 100 gallons of water, use 50 to 100 gal/A of solution.
Cuprofix Ultra 40 Disperss	M	0	1.25 to 3 lb		-
Kentan DF	M	0	2 lb		-
Kocide 3000	M	0	0.75 lb		-
Kocide 2000	M	0	1.5 lb		-
Kocide DF	M	0	2 lb		-
Nordox 75 WG	M	0	1.25 to 2.5 lb		OMRI-listed.
Mastercop	M	0	0.5 to 1 pt		-
Nu-Cop 50 WP	M	0	2 lb		OMRI-listed.
Nu-Cop 3 L	M	0	1.33 to 2.66 pt		-
Nu-Cop 50 DF	M	0	2 lb		OMRI-listed.
Nu-Cop HB	M	0	1 lb		-
Fontelis	7	3	16 to 24 fl oz	72 fl oz	Botrytis leaf blight, botrytis neck rot, purple blotch. Apply before disease onset, continue every 7 to 14 days.
Forum SC	40	0	6 fl oz	5 apps	Downy mildew only. Must be tank-mixed with another downy mildew fungicide, excluding mfenoxam. Apply before disease onset, continue every 5 to 7 days.
Inspire Super	3/9	7	16 to 20 fl oz	80 fl oz	Botrytis leaf blight, purple blotch. Apply every 7 to 10 days.
Iprodione⁴					
Rovral 4 Flowable	2	7	1 to 1.5 pt	5 apps	Botrytis leaf blight, botrytis neck rot, purple blotch. Apply before disease onset and repeat every 14 days.
Mancozeb⁴					
Products include Dithane, Koverall, Manzate, Penncozeb.					
Dry formulations	M	7	2 to 3 lb	30-32 lb	
Liquid formulations	M	7	1.6 to 2.4 qt	24 qt	
ManKocide ³	M	7	2.5 lb	see footnote	Apply before disease appears and continue every 3 to 7 days as needed.
Omega 500F	29	7	1 pt	6 apps	Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch. Apply every 7 to 10 days. Do not use a spray adjuvant.
Presidio	43	2	3 to 4 fl oz	4 apps	Downy mildew. Apply every 7 to 14 days. Must be tank-mixed with a fungicide NOT in FRAC Group 43.
Pristine	7/11	7	14.5 to 18.5 oz	4 apps	Apply before disease onset, continue every 7 to 14 days. User lower rates for Botrytis leaf blight.
Propiconazole⁴					
Tilt	3	14	4 to 8 fl oz	16 fl oz	Purple blotch and botrytis leaf blight. Apply before disease onset, continue every 7 to 10 days.
Presidio	43	2	3 to 4 fl oz	12 fl oz	Apply every 7 to 14 days. Must be tank-mixed with a fungicide NOT in FRAC Group 43.
Quadris Opti	11/M	7	1.6 to 3.6 pt	3 apps	Bunch and dry onions only.
Quadris Top	11/3	7	12 to 14 fl oz	42 fl oz	Apply before disease onset, apply every 7 to 14 day schedule.
Quilt	11/3	14	14 to 27.5 fl oz	55.3 fl oz	Purple blotch, botrytis leaf blight. Apply before disease onset, continue every 7 to 10 days.

(continued on next page)

DISEASE CONTROL: Onions—Dry and Spanish (continued)

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Quilt Xcel	11/3	0	14 to 26 fl oz	56 fl oz	Use higher rates for downy mildew and Botrytis leaf blight. Apply before disease onset, continue every 7 to 14 days.
Reason	11	7	5.5 fl oz	22 fl oz	Downy mildew and purple blotch. Apply before disease onset, continue every 5 to 10 days.
Revus	40	7	8 fl oz	32 fl oz	Downy mildew. Apply every 7 to 10 days. Use a spreader/penetrant surfactant. Must be tank-mixed with a fungicide NOT in FRAC Group 40.
Ridomil Gold Bravo SC	4/M	7/21	2.5 pt	4 apps	Apply before disease onset, continue every 14 days. Rotate to another mode of action between applications of RG Bravo. Avoid late-season applications. Observe seasonal limits for chlorothalonil.
Ridomil Gold Copper	4/M	7/10	2 lb		Downy mildew only. Apply before disease onset, continue every 14 days. Rotate to another mode of action between applications of RG Copper. Avoid late-season applications. Limit 4 apps/season.
Ridomil Gold MZ ³	4/M	7	2.5 lb		Downy mildew only. Apply before disease onset, continue every 14 days. Rotate to another mode of action between applications of RG MZ. Avoid late-season applications.
Scala	9	7	9 to 18 fl oz	54 fl oz	Purple blotch and botrytis leaf blight only. Apply before disease onset, continue every 7 to 14 days.
Switch 62.5WG	9/12	7	11 to 14 oz	56 oz	Not for downy mildew. Apply every 7 to 10 days.
Tanos	11/27	3	8 oz	84 oz	Downy mildew, purple blotch. Must be tank-mixed with a multi-site inhibitor (FRAC Group M). Apply before disease onset, continue every 5 to 7 days.
Tebuconazole ⁴	3	7			Purple blotch only. Apply preventively. Use lowest listed rate of surfactant to improve coverage.
Zampro	40/45	0	14 fl oz	3 apps	Downy mildew. Apply before disease onset, treat every 7 days.
Zing!	M/22	7	30 fl oz	8 apps	Apply before disease onset and repeat every 7 days. Alternate with another FRAC code. Do not apply directly to bulbs.

Pythium Damping-off, Cottony Leak

MetaStar 2E AG	4	0	2 to 4 pt	1 app	Preplant. Apply to soil as a broadcast spray or in a 7-inch band; incorporate into the upper 2 inches of soil. At planting. Apply broadcast or banded, move into seed zone with 0.5 to 1 inch of irrigation if rainfall is not expected within 24 hours.
Ridomil Gold SL	4	0	0.5 to 1 pt		
Ultra Flourish	4	0	1 to 2 pt		

NOTE: Some of the chemicals listed above may not be labeled for green onions—check product labels carefully before use.

¹ Products with numerical FRAC codes must be alternated or tank-mixed with products that have a different FRAC code to discourage resistance development. See product label for maximum number of consecutive applications allowed. Refer to the table on page 13 for more information on FRAC codes.

² Pre-harvest interval.

³ Observe seasonal limits for mancozeb.

⁴ Generic products available (Appendix F). Amounts and seasonal limits per acre are product dependent.

⁵ Use higher rate when pressure is severe.

⁶ Restricted in some Kentucky counties. See fungicide safety table on page 20.

Peas

Pea family (Fabaceae): *Pisum sativum*

Planting and Culture

Early spring plantings are a must to ensure good yields in Kentucky. The earliest plantings should be made between February 20 and March 1 or by the time the soil temperature has reached 45°F (see Appendix J). Use seed treatments to avoid decay problems.

Select soils that are well drained and adjust the pH to 6.5. Lighter, sandy loam soils are preferred because they warm up sooner.

Seed may be planted in either double or single rows. Double rows should be spaced 6 to 8 inches between rows and 18 to 24 inches between pairs of rows or adjusted to the cultivating equipment that is available. Plants in double rows will support each other. For tall-growing, indeterminate varieties, plant supports will need to be constructed. Space single rows 24 to 36 inches apart. Seed within the row should be planted 1 to 1½ inches deep and spaced 1 inch apart. Peas requires between 60 and 100 pounds of seed per acre, depending on spacing.

VARIETIES: Peas—English, Edible Pod, Snap

Variety	Days to Maturity	Comments
ENGLISH (all are determinate)		
Spring	57	Large pods for an early cultivar; excellent quality.
Oregon Trail	61	Highly productive, 2 pods per node; very sweet; resistant to pea enation mosaic virus and powdery mildew.
Maestro	61	Heavy producer of 4 inch long pods; excellent quality; tolerance to Fusarium wilt, pea enation virus, bean yellow mosaic virus, and powdery mildew.
Legacy	67	Productive, 3.5 inch pods; 2.5 pods per node; resistant to Fusarium wilt and powdery mildew.
Green Arrow	68	Productive, Fusarium wilt and powdery mildew resistant.
Utrillo	71	Productive; 5 inch pods; very sweet peas; good for fall production planted in mid August.
EDIBLE POD¹		
Oregon Giant	69	Highly productive; sweet pods 4 inches long; resistant to Fusarium wilt, pea enation mosaic virus and powdery mildew.
Oregon Sugar Pod II	70	Highly productive; pods 3 inches long; Fusarium wilt resistance.
Mammoth Melting Sugar	74	Vine 34 to 40 inches tall, pods 4 inches long.
SNAP		
Sugar Ann	56	Resistant to Fusarium wilt race 1, very sweet.
Super Snappy	65	Highly productive; 5 inch long pods; vines may need support; tolerant to powdery mildew.
Cascadia	67	Very productive; 3 inch long pods; pods remain tender and sweet longer than other cultivars; very good disease tolerance.
Sugar Snap	72	Resistant to common pea wilt; an All American Selection all time winner; must be trellised; very heavy yielder.
Sugar Daddy	74	Stringless, tolerant to pea leaf roll virus and resistant to powdery mildew.

¹ *P. sativum* var. *macrocarpon*

Harvesting

English peas should be picked as soon as pods are well filled but before they harden and fade in color. Two or three pickings can usually be made. Peas should be cooled and processed as soon as possible because the sugar content decreases rapidly after harvest. It is best to shell the peas just before cooking.

Edible pod or snow peas are harvested while the peas are immature. Pods reach a length of 3 to 5 inches within five to seven days after flowering. Consequently, pods should be harvested every other day to prevent the development of large seeds and tough pods. Edible pod peas in plastic bags will store 10 days under refrigeration without loss of quality.

Edible pod snap peas can be harvested from the time the peas begin to form until the pods are well filled.

Peas should be stored at 32° to 34°F and 90 to 95 percent relative humidity.

Common Diseases/Management

Fusarium wilt. Use resistant varieties in fields with a history of Fusarium wilt.

Anthraxnose, Ascochyta leaf spot and pod blight, leaf spots, powdery mildew. Several fungicide products are labeled. Some resistant varieties are available. Plant disease-free seed to reduce leaf spots and pod diseases. Rotate away from legumes for three to four years to reduce inoculum levels in soil.

Damping-off, root rot. Rotate fields with a history of root rot for four or more years to small grains, corn, or other grasses; avoid legumes during the rotation. Purchase seed that has been commercially

PESTICIDE SAFETY: Peas

	Signal ¹	Re-entry (hrs)	Harvest (days)
INSECTICIDES			
Acramite 4 SC	C	12	3
Admire Pro	C	12	7/21 ³
Assail 30 SG	C	12	7 ³
Belt 4 SC	C	12	1/14 ³
Blackhawk 36 WG	C	4	3/28 ³
Bt products	C	4/12	0
Coragen 1.67 SC	-	4	1
Dimethoate 4 E	W	48	0
Intrepid 2 F	C	4	7
Malathion 8	C	12	3
Movento 2 SC	C	24	1/7 ³
Radiant SC	C	4	3/28
Scorpion 1.67 SL	C	12	7/21 ³
Sevin XLR	W	12	3
Restricted Use			
Asana XL	W	12	3/21 ³
Baythroid XL	W	12	7
Brigade 2 EC	W	12	3
Brigadier 2	W	12	7
Danitol 2.4 EC	W	24	7 ³
Diazinon 50W	C	24	7
Hero 1.24 EC	C	12	3

PESTICIDE SAFETY: Peas

	Signal ¹	Re-entry (hrs)	Harvest (days)
Lannate 90 SP	DP	48	1 ³
Leverage 2.7	W	12	7 ³
Mustang Max	W	12	1/21 ³
Proaxis 0.5 EC	C	24	7/21 ³
Renounce 20 WP	C	12	7
Voliam Xpress	W	24	7/21 ³
Warrior II	W	24	7/21 ³
FUNGICIDES			
Fixed coppers ²	D	24/48 ⁴	0
Endura	W	12	7/21
Fontelis	C	12	0
Headline ³	W	12	7/21
MetaStar 2EC AG	W	48	0
Priaxor	C	12	7
Proline 480 SC	C	12	7
Quadris	C	4	0
Ridomil Gold SL	C	48	0
Sulfur ²	C	24	0
Ultra Flourish	W	48	0

¹ W: Warning, C: Caution, D: Danger, P: Poison

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

³ PHI depends on the type of pea, see label.

⁴ Depends on type of application and product.

treated, or treat with Captan at 1 teaspoon per pound of seed. Mefenoxam or metalaxyl can be applied at planting to suppress *Pythium*; azoxystrobin can be applied for control of *Rhizoctonia*.

White mold. Steps taken to reduce periods of wetness in the canopy are helpful, and a number of fungicides are labeled for this disease. Avoid fields with a history of the disease in any crop.

Viruses. Virus diseases occur in every planting every year. Practical controls are not available; avoid planting peas next to other legumes.

FERTILIZER: Peas

Soil Test Results (lb/A)	Fertilizer Needed (lb/A)
Phosphorus	
	Phosphate (P₂O₅)
Low	<31
Medium	31-60
High	61-80
Very High	>81
	0
Potassium	
	Potash (K₂O)
Low	<201
Medium	201-300
High	301-450
Very High	>450
	0
Nitrogen	
	N
Poor soils	50-60
Fertile soils	30-40

INSECT CONTROL: Peas¹

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
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 peas follow grass or grass-legume sod.			
Diazinon 50 W	4 to 8 lb		Incorporate immediately.
PLANTER BOX			
Seedcorn Maggots: Usually only a serious pest early in the season. 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.			
FOLIAR TREATMENTS			
Alfalfa Loopers, Green Cloverworms			
Asana XL	2.9 to 9.6 fl oz	38.4 fl oz	Do not feed vines.
Belt 4 SC	2 to 3 fl oz	6 fl oz	Allow 5 days between applications.
Blackhawk 36 WG	2.2 to 3.3 oz	20 oz	Allow 5 days between applications.
Bt products	See labels.	-	-
Brigade 2 EC	2.1 to 6.4 fl oz	12.8 fl oz	-
Intrepid 2 F	4 to 16 fl oz	64 fl oz	Allow 7 days between applications.
Lannate 90 SP	0.25 to 1 lb	3 lb	Wait 5 days to feed forage. Succulent peas only.
Mustang Max	2.72 to 4 fl oz	24 fl oz	Allow 5 days between applications.
Proaxis 0.5 EC	1.92 to 3.84 fl oz	15.36 fl oz	-
Warrior II	0.96 to 1.92 fl oz	7.68 fl oz	-
Aphids			
Admire Pro	7 to 10.5 fl oz	10.5 fl oz	Soil application.
Assail 30 SG	2.5 to 5.3 oz	16 oz	Limit 3 applications. Allow 7 days between applications. Not for dried peas.

(continued on next page)

INSECT CONTROL: Peas¹ (continued)

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
Brigade 2 EC	2.1 to 6.4 fl oz	12.8 fl oz	-
Malathion 8	1 pt	2 applications	Allow 7 days between applications.
Movento 2 SC	4 to 5 fl oz	10 fl oz	Allow 7 days between applications.
Sivanto 1.67 SL	7 to 10.5 fl oz	28 fl oz	Allow 10 days between applications.
Armyworms, Cutworms			
Asana XL	5.8 to 9.6 fl oz	38.4 fl oz	Do not feed vines.
Baythroid XL	0.8 to 1.6 fl oz	6.4 fl oz	Dry peas only. Limit 3.2 fl oz per 14-day period.
Belt 4 SC	2 to 3 fl oz	6 fl oz	Allow 5 days between applications.
Blackhawk 36 WG	2.2 to 3.3 oz	20 oz	Allow 5 days between applications.
Brigade 2 EC	2.1 to 6.4 fl oz	12.8 fl oz	-
Coragen 1.67 EC	3.5 to 5 fl oz	15.4 fl oz	For beet and fall armyworm. Allow 3 days between applications.
Intrepid 2 F	4 to 16 fl oz	64 fl oz	Allow 7 days between applications.
Mustang Max	2.72 to 4 fl oz	24 fl oz	Allow 5 days between applications.
Proaxis 0.5 EC	1.92 to 3.84 fl oz	15.36 fl oz	-
Sevin XLR	1 to 1.5 qt	6 qt	Limit 4 applications. Allow at least 7 days between applications.
Warrior II	1.28 to 1.92 fl oz	7.68 fl oz	-

¹ Generic products available (Appendix E).

WEED CONTROL: Peas

Product Amt/A	Lb A.I./A	Comments
0.5-1.6 fl oz Aim 1.9 EW	0.008-0.025 carfentrazone	For contact post-emergence 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 post-emergence as a directed hooded application between crop rows. Use min. 10 gal of water/A and crop oil 1% v/v. Max. rate 6.1 fl oz/A. PHI = 0 days.
1-2 pt Basagran 4S	0.5-1 bentazon	For post-emergence control of annual broadleaves and suppression of yellow nutsedge. Two applications are needed for nutsedge and Canada thistle control. Do not add crop oil. Apply after peas have at least 3 pairs of leaves (or 4 nodes) or severe crop damage may occur. PHI for dry peas is 30 days and for succulent peas is 10 days. Do not apply when peas are in bloom.
1.3 pt Command 3ME	0.5 clomazone	For pre-emergence control of annual grasses and broadleaf weeds. Apply once in a min. 10 gal of water/A. Apply and incorporate 2 to 3 inches before planting. Use in combination with other herbicides to broaden weed control spectrum.
1.3-1.7 pt Dual II Magnum 7.6 E	1.3-1.6 s-metolachlor	For control of most annual grasses and certain broadleaves. Apply preplant surface or incorporated or pre-emergence. Small grains may be planted 4½ months following this treatment. See label for other rotational crops.
2-4 pt Gramoxone Inteon	0.69-1.38 paraquat salt	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply preplant, pre-emergence, 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.
0.5-2.5 pt Poast 1.5	0.09-0.48 sethoxydim	For control of actively growing grasses only. Use high rate on Johnson grass. Dry and succulent peas. Max. rate 4 pt/A per year. Include 1% v/v crop oil. PHI = 15 days for succulent peas and 30 days for dry peas.
3 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 pre-emergence within 3 days after planting. Can be applied post-emergence to plants at least 3 inches tall but before 5 nodes and before flowering. Add non-ionic surfactant 0.25% v/v.
3 fl oz Raptor	0.018 imazamox	For control of annual grasses and broadleaf weeds. Some varieties are sensitive and injury can occur. Apply post-emergence to actively growing dry peas with at least 3 pairs of leaves and before bloom. Max. 1 application/season.
16-22 fl oz Roundup WeatherMax 5.5L	0.69-0.94 glyphosate-salt	For non-selective post-emergence 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.
9-16 fl oz Select Max	0.068-0.12 clethodim	For control grasses. Do not apply more than 16 oz/A in a single application. For peas apply before bloom, but no more than 21 days before harvest.
1-2 pt Treflan HFP 4 E	0.5-1 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: Peas

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Anthraxnose, Ascochyta Leaf Spot/Pod Blight, Leaf Spots, Powdery Mildew					
Azoxystrobin ⁴					Apply before disease onset, continue every 7 to 14 days.
Azoxystrobin 25C	11	0	6 to 15.5 fl oz ⁵	4 apps	
Azoxystrobin Star	11	0	6 to 15.5 fl oz ⁵	4 apps	
Quadris	11	0	6 to 15.5 fl oz ⁵	4 apps	
Satori	11	0	6 to 15.5 fl oz ⁵	4 apps	
Endura	7	7/21	6 to 11 oz	2 apps	Apply before disease onset, continue every 5 to 14 days.
Fontelis	7	0	14 to 30 fl oz	72 fl oz	Apply before disease onset, continue every 7 to 14 days.
Fixed coppers					
Badge SC	M	0	1 to 2.5 pt		Powdery mildew.
Badge X2	M	0	0.5 to 1.5 lb		OMRI-listed. Powdery mildew.
Basic Copper 53	M	0	1.5 lb		OMRI-listed. Powdery mildew.
Champ DP	M	0	1 to 2 lb		-
Champ Formula 2 FL	M	0	1 to 2 pt		-
Champ WG	M	0	1.5 to 3 lb		OMRI-listed.
COC DF	M	0	1.5 to 3 lb		-
COC WP	M	0	1.5 to 3 lb		OMRI-listed.
Cueva	M	0	0.5 to 2 gal		OMRI-listed. Mix in 100 gallons of water, use 50 to 100 gal/A of solution.

(continued on next page)

DISEASE CONTROL: Peas (continued)

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Cuprofix Ultra 40 Disperss	M	0	1 to 2 lb		-
Kentan DF	M	0	1 to 2 lb		-
Kocide 2000	M	0	1 to 2.25 lb		-
Kocide 3000	M	0	0.5 to 1.25 lb		-
Kocide DF	M	0	1.5 to 3 lb		-
Mastercop	M	0	0.5 to 1 pt		-
Nordox 75 WG	M	0	0.66 to 2.5 lb		OMRI-listed.
Nu-Cop 50 WP	M	0	1.5 to 3 lb		OMRI-listed.
Nu-Cop 3 L	M	0	1 to 4 pt		-
Nu-Cop 50 DF	M	0	1.5 to 3 lb		OMRI-listed.
Nu-Cop HB	M	0	0.75 to 1.5 lb		-
Headline	11	7/21	6 to 9 fl oz ⁵	18 fl oz	Apply before disease onset, continue every 7 to 14 days.
Headline SC	11	7/21			
Priaxor	7/11	7	4 to 8 fl oz	16 fl oz	Apply prior to development of disease, continue every 7 to 10 days.
Sulfur ⁴	M				Powdery mildew. Apply when disease is first observed; continue every 14 days as needed. Phytotoxicity may occur if applications are made when temperatures exceed 90°F. Some products are OMRI-listed; refer to labels.

Pythium Damping-off, Root Rot

MetaStar 2E AG	4	0	2 to 4 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.
Ridomil Gold SL	4	0	0.5 to 1 pt		
Ultra Flourish	4	0	1 to 2 pt		

Rhizoctonia Damping-off, Seedling Disease, Stem/Root Rot

Azoxystrobin ⁴					
Azoxy 2SC	11	0	0.4 to 0.7 fl oz ³	1 app	At-planting. Apply as an in-furrow spray in 0.3 to 1 gal water/1,000 row-feet (5- to 15-gal/A). Spray should be 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.
AzoxyStar	11	0	0.4 to 0.8 fl oz ³	4 foliar apps	
Quadris	11	0	0.4 to 0.8 fl oz ³	4 foliar apps	
Satori	11	0	0.4 to 0.8 fl oz ³	see label	

¹ Products with numerical FRAC codes must be alternated or tank-mixed with products that have a different FRAC code to discourage resistance development. See product label for maximum number of consecutive applications allowed. Refer to the table on page 13 for more information on FRAC codes.

² Pre-harvest interval.

³ Per 1,000 row-feet.

⁴ Generic products available (Appendix F). Amounts and seasonal limits per acre are product dependent.

⁵ Use higher rate when pressure is severe.

Peppers

Nightshade family (Solanaceae): *Capsicum annuum*

Planting and Culture

Peppers are grown primarily for the fresh market in Kentucky. To be successful it is important to begin by selecting a good field location. Low-lying fields next to creeks and rivers are subject to high humidity and moisture conditions that result in serious disease risks; these areas are especially prone to bacterial leaf-spot epidemics. Avoid poorly drained fields or fields where imazaquin or atrazine herbicides may have been used the previous season. Herbicide carryover (especially from corn and soybean herbicides) can cause serious injury to peppers (see "Weed Management" on page 9).

Growers also should locate pepper plantings as far away from tobacco plantings as possible because of the danger of aphid movement and virus disease spread from tobacco to peppers. Although tobacco ground may represent some

of the best land on a farm, it is also not advisable to grow peppers after tobacco, tomatoes, eggplants, potatoes, or vining crops for a period of three years, because these crops are susceptible to many of the same diseases.

Soils known to be high in residual nitrogen should also be avoided to prevent peppers from producing excessive foliage at the expense of fruit. Consider the previous crop when deciding how much nitrogen to apply; there will probably be some residual nitrogen following a crop that received heavy doses of nitrogen fertilizer during the previous season.

Potassium and especially phosphorus are likely to accumulate in most Kentucky soils following several years of heavy applications for vegetable crops. Make sure to get your soil tested in the fall or early winter so that you will know exactly what nutrients are required.

Plow soil 8 to 10 inches deep several weeks in advance of the transplanting date. Peppers do extremely well following fescue sod. Prepare a fine seedbed by disking or rototilling.

Fresh Market Bell Peppers Production with Plasticulture

Planting hybrid bell peppers on 6- to 8-inch-high raised beds covered with black plastic mulch and using drip irrigation has resulted in high yields of excellent quality peppers for fresh market sales. A bed shaper/plastic mulch layer and a setter that will transplant through plastic are essential for this production system. Two rows of peppers spaced 15 inches apart are planted on each bed; plants are spaced 12 to 15 inches apart within each row. The beds are usually 5 to 6 feet from center to center (approximately 14,500 plants per acre).

Since a portion of the fertilizer will be applied through the drip irrigation system (fertigation), uniform watering will ensure that plants receive adequate nutrients. Don't assume that because it has rained there will be water in the root zone under plastic. Also, while the consequences of under-watering (and therefore under-fertilizing) are obvious, many growers overlook the fact that over-watering will leach nutrients out of the root zone. Growers using trickle irrigation and plastic mulch

VARIETIES: Peppers

Variety	Days to Maturity	Comments
BELL (all are F1 hybrids and have resistance to several races of Bacterial spot)		
Socrates	64	Race 1, 2, 3 resistant, PVY, early blocky fruits.
Declaration	70	Race 1, 2, 3, 5 resistant, intermediate resistance to phytophthora, CMV, TSWV, high yields, little silvering.
Aristotle	70	Race 1, 2, 3 resistant, phytophthora tolerant.
Karisma	75	Race 1,2,3 intermediate resistant. Resistant to TMV, PVY 0, 1, 1-2. Intermediate resistance to PepMoV, PepYMV, and CMV. Blocky, large to extra large fruit.
Currier	73	Race 1, 2, 3 resistant, TMV, PVY 0, 1, 1-2, PepMoV, PepYMV, and intermediate resistance to CMV. Blocky, large to extra large fruit.
Bastille	75	Race 1, 2, 3, 4, 5, 7, 8, 9 resistant, TMV, and PepMoV. Blocky, large to extra large fruit.
Alliance	74	Race 1, 2, 3, 5 resistant, PVY 0, 1, 1-2, TMV, PepMoV, Pep YMV with intermediate resistance to CMV, high yields, light to medium green fruit, little silvering, top recommendation.
Revolution	74	Race 1, 2, 3, 5 resistant, CMV resistant, somewhat <i>Phytophthora</i> tolerant, light to medium green fruit, may flatten in very hot weather, top recommendation.
Colored Bell		
Mavras	68	TMV, large blocky deep purple fruit (for trial).
Blushing Beauty	70	Race 1, 2, 3 resistant, matures green to ivory to orange to red.
Early Sunstation	70	Race 1, 2, 3 resistant, PVY tolerant, green to golden yellow, blocky.
Ivory	70	TMV, creamy white to deep yellow, mostly three lobed fruit.
Valencia	72	Spot resistant, TMV, green to orange, blocky.
SPECIALTY		
Cherry		
Sweet Cherry Large	62	High yielding, sweet.
Red Cherry Large	75	Very hot, 1¼ inch diameter fruits.
Pimento		
Pimento Elite (hybrid)	87	Heart-shaped, 3 x 3 inches, tapered.
Jalapeño (all are F1 hybrids)		
El Rey	65	Race resistant 1,2,3, PVY 0,1,2, and TEV.
Ixtapa X3R	70	Race 1, 2, 3 resistant; some purpling in cool weather; susceptible to ozone injury.
Tormenta	72	Race 1, 2, 3 resistant, TEV, large upright plant with thick fruit, average heat.
Grande	70	Large fruits, thick walled; fruit 3.5 to 4 inches long, TEV, PVY tolerant.
El Jefe	72	Bacterial spot resistant (races 1, 2, 3); dark green.
Banana and Wax		
Inferno	60-65	Hot banana, thick walled fruits, yellow and red.
X3R Hot Spot	65-70	Race 1,2,3 resistant, hot banana, 2 x 6 inches.
Hungarian Yellow Wax	65-70	Yellow to orange red, medium hot, fruit 6 to 6.5 inches long, tapered.
X3R Sweet Spot	70	Race 1, 2, 3 resistant, banana, light yellow to red, 2 x 8 inches.
Santa Fe Grande	65	Very hot, pale yellow, jalapeño-like fruits.
Italian/Cubanelle		
Aruba	65	High yielding, 2 x 7.5 inches, light green to pale yellow.
Corno di Toro	70-75	Light to medium green, 8 inches long, tapered, large plant, heirloom type from Italy.
X3R Key West	70-75	Light green, 2.5 x 7.5 inches, bacterial spot resistant (races 1, 2, 3).
Carmen	75	Green to red, fruit 7 inches long, AAS winner.
Poblano/Ancho		
San Ardo	75	Dark green to red, early and productive.
Don Emilio	80	Uniform, blocky fruit, season long production.
Tiburón	80	Dark green, 2.5 x 5.5 inches, high yields, sturdy plant.
Anaheim		
Anaheim TMR 23	75	Thick walled, 8 inches long, TMV tolerant.
Anaheim 118	75	Thick fleshed, light green to red
Serrano		
Tuxtlas	70	Medium pungency, 0.5 x 3 inches, PMV, PVY, TEV.
Serrano del Sol	70-72	High yielding and attractive fruits, 0.5 x 3.5 inches, tolerance to PMV and PVY.
Don Picoso	75	Medium pungency, ¾ x 3 inches, sets well throughout season.

Most of these have been tested at two or more locations by the University of Kentucky. We recommend that only bacterial spot resistant varieties be used. See "Common Diseases and Management" for more information on management of this important disease.

should carefully monitor soil moisture using tensiometers. Check these instruments daily. For more details on how to set up a trickle irrigation system with fertilizer injection, contact your county Extension agent or irrigation supply representative.

In Kentucky, pepper plants should be transplanted to the field after danger of frost, usually around the second week of May (see Appendix J). A 7- to 8-week-old transplant is best.

Greenhouse container-grown plants are recommended for planting with mulch and trickle irrigation. Trays with 72-128 cells are considered economical but large enough to produce large and vigorous transplants. Using a larger transplant container (larger cell size) will usually result in better transplant survival and earlier yields.

Seed should be treated by the seed company or treated with chlorine bleach

by the grower to help reduce seed transmission of bacterial leaf spot (see Appendix H). Bacterial spot remains a serious risk to pepper plantings in many parts of the state, and most growers should use resistant varieties as well as early-season sprays containing fixed copper plus manzate to reduce ephytic populations of leaf spot bacteria. Bare root transplants are not recommended for fresh market pepper production.

When transplanting, use 4 to 8 ounces of a starter solution around the roots of each plant. Use 3 pounds of a 10-52-17 or similar analysis fertilizer in 50 gallons of water for the starter mix.

Poor fruit set and deformed fruit may result when nighttime temperatures drop below 60°F or when daytime temperatures exceed 90°F. Varieties differ considerably in their response to temperature extremes.

Most types of hot and specialty peppers can be grown using the same techniques and spacings as for bell peppers; however, some types require staking and tying. Serrano peppers, anaheims, poblanos, and some cubanelle varieties should be staked and tied when using plasticulture and high plant populations. Tomato stakes are placed every 6 to 10 feet on each side of the double-row beds. Tomato twine is looped and tightened around each stake at 7 to 9 inches above the soil to “fence-in” the plants. Second and third stringings can be used higher on the stakes as needed during the season. To reduce sunburn to fruit, shorter (2½ to 3 feet) stakes are sometimes also used for very tall bell pepper varieties or where bell pepper plantings are exposed to high winds.

(Note: See *Kentucky Pepper Integrated Crop Management Grower Manual* (IPM-13), uky.edu/Ag/IPM/manuals/ipm13pep.pdf, for more detailed information on bell pepper production and pest management. Growers and cooperatives are strongly advised to use UK’s degree-day model, pheromone traps, and regular scouting to monitor second generation European corn borer populations in July. The degree-day model is available on the Web at www2.ca.uky.edu/entomology/entfacts/ef106.asp.

Peppers for Processing

There are few processing peppers being produced in Kentucky. Peppers grown for processing are usually transplanted 16 inches apart in single rows 36 to 42 inches apart, which will require about 10,000 plants per acre. If pimento peppers are grown, space plants 18 to 22 inches apart in rows 40 to 42 inches apart (7,500 plants per acre). Although processing peppers have traditionally been grown on bare ground in Kentucky, several growers in recent years have doubled their profits by using higher plant populations, hybrid varieties, and black plastic mulch with drip irrigation.

Given the higher cost of the raised bed/plasticulture production system, most processors do not object to growers selling a portion of the crop as fresh greens.

In fact, it has become very common for growers to sell the first harvests as green peppers for the fresh market and sell later-maturing fruits as red peppers for processors. Yields can be dramatically increased with plastic and drip irrigation, especially in a dry season.

Techniques (including double-row spacings) for using this system with processing peppers are the same as those described for fresh market peppers (see page 66).

Growers contracting with a processor, however, are advised to check with the processing company regarding varieties. Due to the devastating nature of bacterial leaf spot on peppers in Kentucky it is advised that growers use a hybrid variety with leaf spot resistance. Some processors may supply open-pollinated, non-resistant varieties. The risks of using a non-resistant variety are too great for large wholesale growers in Kentucky and should be avoided.

Fertilizing

For fresh-market bell pepper production on most medium-textured soils where plastic mulch and drip irrigation are being used, we recommend that all of the phosphorus, all the potassium, and 50 percent of the nitrogen requirement be applied prior to bedding and laying plastic.

Consider the previous crop when deciding how much nitrogen to apply; there will probably be some residual nitrogen following a crop that received heavy doses of nitrogen fertilizer during the previous season. The fertigated portion of the total nitrogen requirement can be divided into equal amounts (remaining nitrogen requirement divided by the number of weeks until final harvest) and injected weekly as in the “Fertigation” table (based on 14,500 plants per acre). Growers with very sandy soils should also consider applying 50 to 60 percent of their potassium requirement in weekly increments through the drip system in addition to nitrogen.

FERTILIZER: Peppers

Soil Test Results (lb/A)		Fertilizer Needed (lb/A)
Phosphorus		Phosphate (P₂O₅)
Low	<31	81-100
Medium	31-60	61-80
High	61-80	1-60
Very High	>80	0
Potassium		Potash (K₂O)
Low	<201	81-100
Medium	201-300	61-80
High	301-450	1-60
Very High	>450	0
Nitrogen		N

Peppers use approximately 100 to 150 lb of N/A. Apply 25 to 50 lb of N/A preplant. Rate to use will vary depending on previous crop and general fertility of the soil. Following sod, apply 50 lb of N prior to planting. After fruit begin setting, sidedress with another 30 to 50 lb of N/A. Two weeks later, make an additional application of 30 to 50 lb of N/A. For N fertigation, see comments in text and specific recommendations in the “Fertigation” table.

Growers should always have annual soil test results on which to base phosphorus and potassium applications. Potassium and especially phosphorus are likely to accumulate in most Kentucky soils following several years of heavy applications for vegetable crops or tobacco. A pH range of 6.5 to 7.0 is best for peppers, and liming may be required if soil pH falls below 6.0. For bare ground plantings apply 50 pounds of nitrogen per acre preplant. Apply one-half at plowing and one-half just prior to transplanting, and disk into the soil.

For processing bell pepper production where plastic mulch is not used, sidedressing or banding additional nitrogen to either side of the plant when the first fruit begin setting is essential for good yields. Apply 30 pounds of nitrogen per acre at the first sidedressing. A second sidedressing of 30 pounds of nitrogen two weeks later should also be applied.

Harvesting

Mature green peppers ready for harvest will be firm and will have attained their maximum size. Fresh market green pep-

FERTIGATION: Bell Peppers¹

Moderate Rate	Total amount/season:	125 lb/A (moderate rate) 150 lb/A (high rate)
Actual N/week: 6 lb 4 oz/A	Preplant amount:	50 lb/A
Calcium 40 lb/A	Fertigated amount:	75 lb/A (moderate rate) 100 lb/A (high rate)
Nitrate 3 lb/1,000 plants	Growing season:	12 weeks
High Rate	Fertigation should begin about 2 weeks after transplanting.	
Actual N/week: 8 lb 5 oz/A	The dose for 1,000 plants is based on a plant population of 14,500 plants/A (i.e., double rows on 6 foot centers with plants 12 inches apart in the rows).	
Calcium 54 lb/A	For seasons extending beyond 12 weeks, a maintenance dose of 1 to 1.5 lb N/week is adequate.	
Nitrate 4 lb/1,000 plants		

¹ All recommendations assume starter fertilizer was used.

pers are normally harvested when firm and before they lose their dark green color. Harvest peppers for processing when red ripe.

Peppers should be handled carefully when picking and dumping to avoid bruising and punctures. Hard and rough picking containers may cause skin breakage or punctures and should be avoided. Do not use plastic bags, because peppers will heat up and quickly decay.

Pack only clean, undamaged, insect- and disease-free peppers. Peppers are graded into "U.S. Fancy" (not less than 3 inches in diameter and not less than 3½ inches long) and U.S. No. 1 (not less than 2½ inches in diameter or length).

All grades must have similar varietal characteristics, be firm, fairly well shaped, and free from damage caused by freezing injury, hail, scars, sunburn, disease, insects, or mechanical or other means. Free copies of USDA standards for grades of peppers and other fruit and vegetables are available on the Web at ams.usda.gov/AMSV1.0/freshmarketvegetablestandards.

Storage

Cool peppers to 45° to 50°F by putting them in the cooler as soon as possible after harvest; cool rooms with forced-air equipment will greatly speed the process and extend shelf life. Once fruit are precooled, hold them at 45° to 50°F with a relative humidity of 90 to 95 percent. Peppers suffer chilling injury when stored at temperatures below 40°F. Symptoms of chilling injury are browning at the calyx end and surface pitting. Peppers are usually packed in 1½ bushel waxed corrugated cartons (30 to 33 pounds) or in bushel crates (28 to 30 pounds) according to the preference of your particular market.

Common Diseases/Management

General Practices

Diseases are a major factor in pepper production in Kentucky. Select varieties with resistance to bacterial leaf spot. The most important diseases targeted with a spray program are bacterial leaf spot,

MARKETING CONTAINERS: Peppers

Pepper Type	Container Weight	Volume	No. Fruit/Container
Long hot	30 lb	1 bu	variable
Jumbo bells	30 lb	1½ bu	40-45
Extra Large bells	30 lb	1½ bu	55-65
Large bells	30 lb	1½ bu	65-75
Medium bells	30 lb	1½ bu	75-90
Cubanelle	30-32 lb	1½ bu	variable
Specialty hot peppers ¹	16 lb	½ bu	variable

¹ Including most of the small-fruited hot and specialty peppers in the "Varieties" table.

SAMPLE FUNGICIDE PROGRAM: Field-grown Pepper

Refer to "Disease Control" table in this chapter for product rates; read product labels carefully before application.

At-transplant: Apply Actigard + mancozeb.

Post-transplant to harvest: Apply copper + mancozeb on a 7-day schedule during dry to normal conditions, and on a 3- to 5-day schedule during wetter-than-normal conditions or when disease pressure is severe.

Four weeks post-transplant: Apply Actigard + mancozeb.

Mid-late bloom to harvest: Alternate weekly (or twice weekly) sprays of copper + mancozeb with Quadris, Cabrio, or Tanos beginning prior to fruit set to suppress Anthracnose (apply on a 7- to 14-day schedule; limit of 4 applications of any combination of Quadris, Cabrio, or Tanos). Apply Ridomil Gold EC and Ridomil Gold/Copper or Forum SC if Phytophthora blight is a concern.

anthracnose, and (occasionally) Phytophthora blight. A sample fungicide spray program for peppers is included below.

Alternaria fruit rot, Anthracnose, leaf spots/blights. Use disease-free seed and/or transplants. Rotate for three to four years to crops not related to peppers and control solanaceous (nightshade family)

weeds during the rotation. Plow down crop residues immediately after harvest. Apply fungicides weekly. Maneb is no longer labeled or available for use on peppers.

Bacterial soft rot of fruit. Control insect pests (especially European corn borer) and spotting diseases to minimize wounding.

PESTICIDE SAFETY: Peppers

	Signal ¹	Re-entry (hrs)	Harvest (days)
INSECTICIDES			
Acramite 50 WS	C	12	3
Actara 25 WDG	C	12	0
Admire 2 F	C	12	0/21 ³
Assail 30 SG	C	12	7
Avaunt 30 DG	C	12	3
Belay 2.13 SC	C	12	21
Beleaf 50 SG	C	12	0
Belt SC	C	12	1
Bt products	C	4/12	0
Closer 2 SC	C	12	1
Confirm 2 F	C	4	7
Coragen 1.67 SC	-	4	1
Courier 40 Sc	W	12	1
Dimethoate 4 E	W	48	0
Exirel 0.83 SE	C	12	1
Fulfill 50 DF	C	12	0
Intrepid 2 F	C	4	1
Kanemite 15 SC	C	12	1
Knack 0.86 EC	C	12	4
Malathion 8	C	12	3
Movento 2	C	24	1
Oberon 2 SC	C	12	7
Orthene 75 S	C	24	7
Platinum 2 SC	C	12	30
Portal 0.4 EC	W	12	1
Radiant SC	C	4	1
Requiem 25 EC	C	4	0
Rimon 0.83 EC	W	12	1
Scorpion 3.5 SL	C	12	1/21 ³
Sevin XLR	W	12	3
Trigard 75 WP	C	12	0
Venom 70 SG	C	12	1/21 ³
Zeal 72 WP	C	12	7
Restricted Use			
AgriMek 0.15 EC	W	12	7
Asana XL	W	12	7
Battalion 1.5 EC	DP	12	1
Baythroid XL	W	12	7
Brigade 2 EC	W	12	7
Danitol 2.4 EC	W	24	3
Dimilin 25 W	C	12	7
Hero 1.24 EC	C	12	7
Lannate 90 SP	DP	48	3
Mustang Max	W	12	1

PESTICIDE SAFETY: Peppers

	Signal ¹	Re-entry (hrs)	Harvest (days)
Permethrin 3.2 EC	C	12	3
Proaxis 0.5 EC	C	24	5
Proclaim 5 WDG	C	48	7
Renounce 20 WP	C	12	0
Vydate L	DP	48	7
Warrior II	W	24	5
FUNGICIDES			
Actigard 50WG (chile only)	C	12	14
Aftershock	C	12	3
Ag Streptomycin, Agri-Mycin 17, Harbour	C	12	n/a
Ariston	C	12	3
Blocker 10G/4F	C	12	0
Bravo Weather Stik	C	12	3
Cabrio EG	C	12	0
Endura	W	12	0
Evito	C	12	3
Flint	C	12	3
Fixed coppers ²	D	24/48 ⁴	0
Fontelis	C	12	0
Forum SC	C	12	0
Inspire Super	C	12	0
Koverall	C	24	7
ManKocide	D	48	7
Manzate Flowable	C	24	7
Manzate Pro-Stick	C	24	7
Meta Star 2EC AG	W	48	7
Presidio	C	12	2
Priaxor	C	12	7
Quadris	C	4	0
Quadris Top	C	12	0
Ranman	C	12	0
Reason 500 SC	C	12	14
Revus	C	4	1
Ridomil Gold SL	W	48	7
Ridomil Gold Copper	D	48	7
Sulfur ²	C	24	0
Tanos	C	12	3
Ultra Flourish	W	12	7
Vivando	C	12	0
Zampro	C	12	4

¹ W: Warning, C: Caution, D: Danger, P: Poison

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

³ Depending on rate or type of application.

⁴ Formulations vary, so check label carefully.

Where acceptable, pack fruit without washing. If wash water is used in packing operations, it should contain 25 ppm of available chlorine. See "Post-Harvest Decays" on page 19. Fixed coppers applied for management of bacterial leaf spot during the harvest season can reduce the incidence bacterial soft rot.

Bacterial leaf spot (BLS). The bacterium causing this disease is seed-borne, transplant-borne, and overwinters on-site and nearby in weeds and crop residues. Control must focus on preventing introduction and slowing spread of the bacterium rather than eradication after it occurs. Fortunately, resistant varieties are available. General guidelines for control of BLS include:

- **Use resistant varieties.** Resistant varieties should be used where possible for both fresh market and processing. There are multiple races of the BLS pathogen. See the "Varieties" table for a list of suggested resistant cultivars.
- **Practice crop rotation.** Do not grow peppers after peppers or related crops (tobacco, tomatoes, eggplants, potatoes) for two to three years. Also exclude small grains from the rotation in the year before peppers are to be planted. Control broadleaf weeds during the rotation and around field borders.
- **Disk all crop residues into the soil promptly after harvest** to encourage more rapid decline of the bacterium. If cover crops are used, plow them under very early in the spring to minimize carryover.
- **Do not work wet plants.** Spraying wet plants with high pressure equipment may encourage disease spread by blowing bacteria around the field.
- **Use disease-free seed and transplants.** Select disease-free seed and treat with household bleach (see Appendix H). If transplants are grown in outdoor seedbeds, make frequent applications (every 3 to 5 days) of agricultural streptomycin (Agri-Mycin 17%) at 200 ppm or 2 teaspoons/gallon of water beginning at the first true leaf stage. Streptomycin is not labeled for this use in the greenhouse, but can be applied on plants that have been moved outside the greenhouse for hardening prior to transplanting. This product is not labeled for field use. Fixed copper is labeled for both outdoor and greenhouse transplant production. Do not expect the high degree of control with fixed coppers as is possible with streptomycin. Many bacterial strains are controlled by both materials; however, some strains are

resistant to streptomycin, while others are resistant to copper. Some strains have tolerance to both streptomycin and copper. Consequently, multiple tools are needed in the control program. If you purchase transplants, make sure that they are certified "disease-free."

- **Maintain proper fertility.** The disease can be minimized by maintaining adequate fertility while being careful not to over-fertilize with N.
- **Spray on a schedule** (see sample program). Chemical applications made before symptoms are evident are the key to keeping bacterial populations low. Start sprays immediately after transplanting using fixed copper plus Manzate. Continue at seven-day intervals during wet weather to reduce buildup and spread of the bacterium in the field.

Blossom end rot. Maintain uniform soil moisture throughout the growing season and avoid damaging roots by cultivation, fertilization, or by diseases. In general, foliar applications of calcium do not alleviate blossom end rot; however, calcium levels in soil should be maintained.

Phytophthora blight. An integrated management approach is required. Good soil drainage is critical to control; avoid wet fields, wet sites in fields, and fog pockets. Plant into well-drained soils on properly formed, raised beds to minimize soil moisture and the pooling of water around plants. Avoid excessive irrigation, and if possible, do not use surface water in irrigation systems, as the pathogen can be spread easily. Remove infected plants and destroy them immediately (bury or burn them) and practice sanitation (avoid moving both equipment and yourself between infested fields and "clean" fields). *Phytophthora capsici*, the causal agent of *Phytophthora* blight, has many hosts. Rotations of three to four years away from cucurbits and solanaceous plants (peppers, tomatoes, eggplant, potatoes, tobacco) can be effective in reducing pathogen populations. Where *Phytophthora* blight is common, make a preplant incorporated application of mefenoxam and follow up with additional applications at 30 and 60 days after transplanting. Several fungicides are effective against foliar and fruit phases of *Phytophthora* blight. A few *Phytophthora*-resistant pepper varieties are now available, including 'Paladin,' 'Revolution,' 'Conquest,' and 'Aristotle,' but horticultural characteristics and possible susceptibility to bacterial spot must also be taken into account (see "Varieties" table). Please note that the level of resistance to *Phytophthora* in these varieties

varies; no variety is immune to *Phytophthora* blight. For example, 'Paladin' has a high level of resistance to the crown rot phase of *Phytophthora* blight but very little resistance against foliar and fruit blight caused by *Phytophthora*. 'Aristotle' has moderate resistance to *Phytophthora* crown rot and low resistance to foliar and fruit rots caused by this pathogen.

Southern blight. Avoid fields with a history of this disease and rotate problem fields with sod crops. Deep plow to bury sclerotia and crop debris. Bury cover crops early to ensure they are well rotted before transplanting. Remove and destroy infected plants promptly. PCNB (Blocker) can be drenched around plants at transplanting or applied in-furrow to suppress Southern blight; Cabrio, fluoxastrobin (Evito or Aftershock), and Priaxor can be applied to soil.

Tomato spotted wilt virus (TSWV) and Impatiens necrotic spot virus (INSV). Ensure that transplants are from fields or greenhouses certified to be free of TSWV and INSV. Local transplant producers should take steps to reduce spread of TSWV and INSV by following recommended thrips control measures and by not producing pepper transplants in houses where ornamentals are being produced or sold. Maintain a good thrips control program in the field. TSWV-resistant varieties are also available (see "Varieties" table).

Virus complex. Tobacco etch, Potato Virus Y, Tobacco Ring Spot Virus, Alfalfa Mosaic, Tobacco Mosaic, and Cucumber Mosaic are the viruses most common in Kentucky peppers. Grow virus-resistant varieties if they have horticulturally acceptable yields and fruit characteristics. In addition to the varieties listed in the "Varieties" table, 'Gator Belle,' 'Bell Boy,' 'Bell Captain,' and 'Super Sweet 860' are resistant to tobacco mosaic; the long green chile 'Tam Mild Chile-2' has resistance to tobacco mosaic, potato virus Y, and tobacco etch. Eliminate broadleaf weeds and other virus hosts within 150 feet of the field prior to transplanting. Locate fields between plantings of corn or other non-host field crops in which weeds are killed before peppers are transplanted. Do not grow peppers within 150 feet of tobacco. If tobacco and peppers must be planted in close proximity, locate the pepper planting upwind of the tobacco. Use virus-resistant tobacco varieties, and carefully control aphids in the tobacco crop. Control aphids in peppers, especially in transplant production and in later plantings. Reflective mulches may be of value in reducing virus incidence.

INSECT CONTROL: *Peppers*^{1,2,3}

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
SOIL TREATMENT			
Aphids, Flea Beetles, Thrips: Do not use a foliar spray of Actara, Assail, Belay, Provado, or Venom in combination with a soil application of Admire, Belay, Platinum, or Venom in the same season.			
Admire Pro	10 to 14 fl oz	14 fl oz	See label for application alternatives (sidedress, in-furrow, banded, or drip or trickle irrigation).
Belay 2.13 SC	9 to 12 fl oz	12 fl oz	At planting only. See label for application methods.
Platinum 2 SC	5 to 8 fl oz	11 fl oz	See label for application alternatives (sidedress, in-furrow, banded, or drip or trickle irrigation).
Venom 70 SG	5 to 6 oz	12 oz	-
FOLIAR TREATMENT			
Aphids			
Actara 25 WDG	2 to 3 oz	8 oz	Allow 5 days between applications. Not during bloom.
Admire Pro	1.3 to 2.2 fl oz	6.7 fl oz	Allow 5 days between application. Not during bloom.
Assail 30 SG	2 to 4 fl oz	16 oz	Limit 4 applications. Allow 7 days between applications.
Belay 2.13 SC	3 to 4 fl oz	12 fl oz	Allow 7 days between applications. Not during bloom.
Beleaf 50 SG	2 to 2.8 oz	8.4 oz	Allow 7 days between applications.
Closer 2 SC	1.5 to 2 fl oz	17 fl oz	Allow 7 days between applications.
Dimethoate 4	0.5 to 0.67 pt	10.5 fl oz	Allow 7 days between applications.
Exirel 0.83 SE	13.5 to 20.5 fl oz	61.5 fl oz	Allow 7 days between applications. Use an adjuvant.
Fulfill 50 DF	2.75 oz	5.5 oz	Allow 7 days between applications.
Malathion 8	1.5 pt	2 applications	Allow 5 days between applications.
Movento 2 SC	4 to 5 fl oz	10 fl oz	Allow 7 days between applications.
Orthene 75 S	0.67 to 1.33 lb	2.67 lb	For bell types.
	0.67 lb	1.33 lb	For non-bell type peppers.
Venom 70 SG	1 to 4 oz	6 oz	Allow 7 days between applications. Not during bloom.
Beet Armyworm: First detected in Kentucky in 1993, this insect can cause serious pepper losses when present. A Southern insect that doesn't usually occur in Kentucky. Large larvae cannot be controlled effectively with insecticides. Monitor for this insect and treat when larvae are small.			
Avaunt 30 WDG	3.5 oz	14 oz	Allow 5 days between applications.
Belt 4 SC	1.5 fl oz	4.5 fl oz	Allow 3 days between applications.
Confirm 2 F	6 to 16 fl oz	64 fl oz	-
Coragen 1.67 SC	3.5 to 5 fl oz	15.4 fl oz	Foliar and soil applications possible. See label for limitations.
Dimilin 25 W	4 to 8 oz	24 oz	Limit 5 applications.
Exirel 0.83 SE	7 to 13.5 fl oz	61.5 fl oz	Allow 7 days between applications.
Intrepid 2 F	4 to 16 fl oz	64 fl oz	-
Proclaim 5 WDG	2.4 to 4.8 oz	28.87 oz	Allow 7 days between applications.
Radiant SC	5 to 10 fl oz	34 fl oz	Allow 4 days between applications.
Requiem 25 EC	2 to 4 qt	-	-
Rimon 0.83 EC	9 to 12 fl oz	36 fl oz	Allow 7 days between applications.
XenTari	0.5 to 2 lb	-	-
Cutworms: Eliminate weeds from field margins and plow fields at least 2 weeks before planting to destroy cutworm food sources and egg laying sites.			
Battalion 1.5 EC	1.5 to 2.4 fl oz	14.4 fl oz	-
Belt 4 SC	1.5 fl oz	4.5 fl oz	Allow 3 days between applications.
Brigade 2 E	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Mustang Max	2.24 to 4 fl oz	24 fl oz	Allow 7 days between applications.
Proaxis 0.5 EC	1.92 to 3.2 fl oz	46 fl oz	Allow 5 days between applications.
Requiem 25 EC	2 to 4 qt	-	-
Sevin XLR	2 qt	8 qt	Limit 7 applications. Allow 7 days between applications.
Warrior II	0.96 to 1.6 fl oz	23 fl oz	Allow 5 days between applications.
Flea Beetles			
Actara 25 WDG	2 to 3 oz	8 oz	Allow 5 days between applications. Not during bloom.
Asana XL	5.8 to 9.6 fl oz	67.2 fl oz	-
Battalion 1.5 EC	1.5 to 2.4 fl oz	14.4 fl oz	-
Belay 2.13 SC	3 to 4 fl oz	12 fl oz	Allow 7 days between applications. Not during bloom.
Brigade 2 E	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Mustang Max	2.24 to 4 fl oz	24 fl oz	Allow 7 days between applications.
Permethrin 3.2 EC	4 to 8 fl oz	64 fl oz	Bell peppers only.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	46 fl oz	Allow 5 days between applications.
Sevin XLR	0.5 to 1 qt	8 qt	Limit 7 applications. Allow 7 days between applications.
Warrior II	1.28 to 1.92 fl oz	23 fl oz	Allow 5 days between applications.
Thrips			
Battalion 1.5 EC	1.5 to 2.4 fl oz	14.4 fl oz	-
Baythroid XL	2.8 fl oz	16.8 fl oz	Allow 7 days between applications.
Brigade 2 E	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	46 fl oz	Allow 5 days between applications.
Radiant SC	6 to 10 fl oz	34 fl oz	Allow 4 days between applications.
Requiem 25 EC	2 to 4 qt	-	-
Rimon 0.83 EC	12 fl oz	36 fl oz	Allow 7 days between applications. For immatures only.
Scorpion 35 SL	2 to 7 fl oz	10.5 fl oz	Allow 7 days between applications.
Venom 70 SG	1 to 4 oz	6 oz	Allow 7 days between applications.
Warrior II	1.28 to 1.92 fl oz	23 fl oz	Allow 5 days between applications.

(continued on next page)

INSECT CONTROL: Peppers^{1,2,3} (continued)

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
European Corn Borer: Key insect pest of peppers. Use pheromone traps to monitor for adult activity. Begin applications when trap catches exceed 10 moths per week. Advisories are also issued to county Extension offices when the damaging second generation borer larvae are likely to appear in Kentucky.			
Asana XL	5.8 to 9.6 fl oz	67.2 fl oz	-
Battalion 1.5 EC	1.5 to 2.4 fl oz	14.4 fl oz	-
Baythroid XL	1.6 to 2.8 fl oz	16.8 fl oz	Allow 7 days between applications.
Belt 4 SC	1.5 fl oz	4.5 fl oz	Allow 3 days between applications.
Brigade 2 E	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Confirm 2 F	6 to 16 fl oz	64 fl oz	-
Coragen 1.67 SC	3.5 to 5 fl oz	15.4 fl oz	Foliar and soil applications possible. See label for limitations.
Exirel 0.83 SE	13.5 to 20.5 fl oz	61.5 fl oz	Allow 7 days between applications. Use an adjuvant.
Intrepid 2 F	4 to 16 fl oz	64 fl oz	-
Orthene 75 S	1 to 1.33 lb	2.67 lb	Bell peppers only.
Mustang Max	2.24 to 4 fl oz	24 fl oz	Allow 7 days between applications.
Permethrin 3.2 EC	8 fl oz	64 fl oz	Bell peppers only.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	46 fl oz	Allow 5 days between applications.
Radiant SC	5 to 10 fl oz	34 fl oz	Allow 4 days between applications.
Rimon 0.83 EC	9 to 12 fl oz	36 fl oz	Allow 7 days between applications.
Sevin XLR	1 to 2 qt	8 qt	Limit 7 applications. Allow 7 days between applications.
Warrior II	1.28 to 1.92 fl oz	23 fl oz	Allow 5 days between applications.
Stink Bugs			
Actara 25 WDG	3 to 4 oz	8 oz	Allow 5 days between applications. Not during bloom.
Battalion 1.5 EC	1.5 to 2.4 fl oz	14.4 fl oz	-
Baythroid XL	1.6 to 2.8 fl oz	16.8 fl oz	Allow 7 days between applications
Belay 2.13 SC	3 to 4 fl oz	12 fl oz	Allow 7 days between applications. Not during bloom.
Brigade 2 E	2.1 to 6.4 fl oz	12.8 fl oz	Allow 7 days between applications.
Danitol 2.4 EC	10.67 to 16 fl oz	42.67 fl oz	Allow 7 days between applications.
Mustang Max	3.2 to 4 fl oz	24 fl oz	Allow 7 days between applications.
Proaxis 0.5 EC	2.56 to 3.84 fl oz	46 fl oz	Allow 5 days between applications.
Rimon 0.83 EC	12 fl oz	36 fl oz	Allow 7 days between applications. For immatures only.
Scorpion 35 SL	2 to 7 fl oz	10.5 fl oz	Allow 7 days between applications.
Venom 70 SG	1 to 4 oz	6 oz	Allow 7 days between applications.
Warrior II	1.28 to 1.92 fl oz	23 fl oz	Allow 5 days between applications.

¹ See also *Kentucky Pepper Integrated Crop Management Grower Guide (IPM-13)* for more information on scouting and insect pest management.

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

³ Generic products available (Appendix E).

WEED CONTROL: Peppers

Product Amt/A	Lb A.I./A	Comments
0.5-1.6 fl oz Aim 1.9 EW	0.008-0.025 carfentrazone	For contact post-emergence 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 post-emergence as a directed hooded application between crop rows. Use min. 10 gal of water/A and crop oil 1% v/v. Max. rate 6.1 fl oz/A. PHI = 0 days.
0.67-2.67 pt Command 3ME	0.25-1 clomazone	For pre-emergence control of annual grasses and broadleaves. Apply and incorporate 1 to 2 inches before transplanting. Use in combination with other herbicides like Treflan or Devrinol to broaden the weed control spectrum. Can be used on bell, hot, pimento, and sweet peppers but not on banana peppers. Be sure to set transplants with their roots below chemical barrier when transplanting.
2-4 lb Devrinol 50 DF	1-2 napropamide	For control of annual grasses and broadleaves. Apply before transplanting and water-in or incorporate to a depth of 1 to 2 inches. Can be applied on bare ground middles between beds of plastic 24 hours before rain or if watered-in or incorporated. To avoid injury, do not replant with crops not specified on the label until 12 months if using the 4-lb rate.
0.5-1.0 pt Dual Magnum	0.48 - 0.97 s-metolachlor	24(C) Special Local Need Label (transplanted) see label for use and restrictions. Grower assumes all risk of crop injury, yield reductions, and crop loss.
1-2 pt Goal 2XL	0.25-0.5 oxyfluorfen	For pre-emergence and post-emergence 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. 30 days between application and transplanting.
2.0-4.0 pt Gramoxone Inteon	0.69-1.38 paraquat salt	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply pre-plant, pre-emergence, 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.
0.5-2.5 pt Poast 1.5	0.09-0.49 sethoxydim	For control of actively growing grasses only. Use high rate on Johnson grass. PHI = 20 days. Max. rate of 1.5 pt/application and 4.5 pt/season.
5-6 qt Prefar 4 E	5-6 bensulide	For control of grasses and broadleaf weeds. Apply preplant and incorporate to 1 to 2 inch depth. Apply pre-emergence only if it can be watered in within 36 hours. Max. rate of 6 qt/season.
1.5-2 pt Prowl H2O 3.8 E	0.7-1 pendimethalin	For pre-emergence control of broadleaves and grasses. Apply preplant and incorporate prior to transplanting pepper or as a post-directed application to established plants. PHI = 70 days.
16-22 fl oz Roundup WeatherMax 5.5L	0.69-0.94 glyphosate-salt	For non-selective post-emergence 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.
0.5-1 oz Sanda 75 DF	0.023-0.047 halosulfuron	For control of annual broadleaf weeds and yellow nutsedge. Can be applied in row middles of direct-seeded or transplanted peppers. Avoid contact with the crop or with plastic if plastic mulch is used. Max. 2 applications/crop and 2 oz/A per season.
9-16 fl oz Select Max	0.07-0.12 clethodim	For selective post-emergence of actively growing annual grasses and suppression of perennial grasses. Add crop oil 1% v/v. Max. 16 fl oz/application. Min. 14 days between applications. PHI = 20 days.
1.25-2 pt Treflan HFP 4 E	0.62-1 trifluralin	For pre-emergence control of annual grasses and broadleaf weeds. For transplanted pepper use only. Apply as pre-plant soil incorporated before transplanting.

DISEASE CONTROL: Peppers

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Alternaria Fruit Rot, Anthracnose, Leaf Blights					
Aftershock	11	3	2.0 to 5.7 oz	4 apps	Early blight. Apply before disease onset. Alternate with a different FRAC code.
Ariston	M/27	3	2.0 - 2.4 pt	17.5 pt	Anthracnose only. Apply before disease onset, continue every 7 to 14 days.
Cabrio	11	0	8 to 12 oz	4 apps	Apply before disease onset, continue every 7 to 14 days.
Chlorothalonil ⁴					Apply every 7 to 10 days when conditions favor disease.
Bravo Ultrex	M	3	1.4 lb	10.9 lb	
Bravo WeatherStik	M	3	1.5 pt	12 pt	
Endura	7	0	2.5 to 3.5 oz	6 apps	Alternaria only. Apply before disease onset, continue every 7 to 14 days.
Fixed coppers					Apply before disease onset, continue every 7 to 10 days, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.
Badge SC	M	0	1 to 2.5 pt	-	-
Badge X2	M	0	0.75 to 2.25 lb	-	OMRI-listed.
Basic Copper 53	M	0	1.5 lb	-	OMRI-listed.
C-O-C-S WDG	M	0	2 to 4 lb	-	-
Cueva	M	0	0.5 to 2 gal	-	OMRI-listed. Mix in 100 gallons of water, use 50 to 100 gal/A of solution.
Cuprofix Ultra 40 Disperss	M	0	1.25 to 3 lb	-	-
Kentan DF	M	0	2 lb	-	-
Kocide 2000	M	0	1.5 to 2.25 lb	-	-
Kocide 3000	M	0	0.75 to 1.25 lb	-	-
Kocide DF	M	0	2 to 3 lb	-	-
Mastercop	M	0	0.5 to 3 pt	-	-
Nordox 75 WG	M	0	1.25 to 2.5 lb	-	OMRI-listed.
Flint	11	3	2 to 4 oz	4 apps	Apply before disease onset, continue every 7 to 14 days.
Fontelis	7	0	14 to 30 fl oz	72 fl oz	Apply before disease onset, continue every 7 to 14 days.
Inspire Super	3/9	0	16 to 20 fl oz	80 fl oz	Botrytis leaf blight, purple blotch. Apply every 7 to 10 days.
Koverall	M	7	3 lb	19.2 lb	Apply before disease appears and continue every 7 to 10 days as needed.
ManKocide ³	M	7	2 to 3 lb	see footnote	
Manzate Flowable	M	7	2.4 to 4.8 pt	14.4 qt	
Manzate Pro-Stick	M	7	1.6 to 3.2 lb	19.2 lb	Begin treatment prior to symptom development and continue every 7-to 10 days as needed.
Priaxor	7/11	7	4 to 8 fl oz	24 fl oz	Apply prior to development of disease, continue every 7 to 14 days.
Azoxystrobin ⁴					Anthracnose only. Apply before disease onset, continue every 7 to 14 days.
Azoxy 25C	11	0	6 to 15.5 fl oz ⁴	4 apps	
AzoxyStar	11	0	6 to 15.5 fl oz ⁴	4 apps	
Quadris	11	0	6 to 15.5 fl oz ⁴	4 apps	
Satori	11	0	6 to 15.5 fl oz ⁴	4 apps	
Quadris Top	11/3	0	8 to 14 fl oz	55.3 fl oz	Apply before disease onset, continue every 7 to 10 day schedule.
Tanos	11/27	3	8 to 10 oz		Tanos must be tank-mixed with a fungicide from FRAC Group M appropriate for the target disease. Apply before disease onset, continue every 5 to 7 days. Limit 72 oz/A per season.
Bacterial Leaf Spot					
Actigard	21	14	0.33 to 0.75 oz	8 apps	Chile peppers only. Apply 1 week after transplanting or emergence; begin with lowest rate and increase as plants grow; use 30 to 50 gal/A water early, increasing to 100 gal/A by the final application. Apply every 14 days. May be applied through drip irrigation.
Ag Streptomycin, Agri-Mycin 17, Harbour	25	n/a	16 oz/100 gal	n/a	Pre-transplant treatment. Apply when seedlings are in 2-leaf stage and continue every 4 to 5 days until transplanting. Alternate with fixed copper. Not for field use.
Fixed coppers					Apply before disease onset, continue every 5 to 10 days, depending upon product and conditions. Performance will be enhanced by tank-mixing with Manzate or Koverall. See label for mixing instructions and tank-mix precautions.
Badge SC	M	0	1 to 2.5 pt	-	-
Badge X2	M	0	0.75 to 2.25 lb	-	OMRI-listed.
Basic Copper 53	M	0	1.5 lb	-	OMRI-listed.
Champ DP	M	0	1.33 to 2 lb	-	-
Champ Formula 2 FL	M	0	1.33 to 2 pt	-	-
Champ WG	M	0	2 to 3 lb	-	OMRI-listed.
COC DF	M	0	3 to 4 lb	-	-
COC WP	M	0	3 to 4 lb	-	OMRI-listed.
Copper-Count-N	M	0	3 to 6 pt	-	-
Cueva	M	0	0.5 to 2 gal	-	OMRI-listed. Mix in 100 gallons of water, use 50 to 100 gal/A of solution.
Cuprofix Ultra 40 Disperss	M	0	1.25 to 3 lb	-	-
Kentan DF	M	0	2 lb	-	-
Kocide 2000	M	0	1.5 to 2.25 lb	-	-
Kocide 3000	M	0	0.75 to 1.25 lb	-	-
Kocide DF	M	0	2 to 3 lb	-	-
Mastercop	M	0	0.5 to 3 pt	-	-
Nordox 75 WG	M	0	1.25 to 2.5 lb	-	OMRI-listed.
Nu-Cop 50 WP	M	0	2 to 3 lb	-	OMRI-listed.
Nu-Cop 3 L	M	0	1.33 to 4 pt	-	-
Nu-Cop 50 DF	M	0	2 to 3 lb	-	OMRI-listed.
Nu-Cop HB	M	0	1 to 1.5 lb	-	-

(continued on next page)

DISEASE CONTROL: Peppers (continued)

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Phytophthora Blight					
Badge X2	M	0	0.75 to 1.25 lb	42 lb	OMRI-listed.
Forum SC	40	0	6 fl oz	5 apps	Must be tank-mixed with another <i>Phytophthora</i> fungicide. Apply before disease onset, continue every 5 to 10 days.
Presidio	43	2	3 to 4 fl oz	12 fl oz	Apply every 7 to 14 days. Must be tank-mixed with a fungicide NOT in FRAC Group 43.
Ranman	21	0	2.75 fl oz	16.5 fl oz	Apply every 7 to 10 days when conditions favor disease. Tank-mix with an organosilicone or non-ionic surfactant.
Reason 500 SC	11	14	8.2 fl oz	24.6 fl oz	Foliar and fruit phases of disease only. Apply before disease onset, continue every 5 to 10 days.
Revus	40	1	8 fl oz	32 fl oz	Apply every 7 to 14 days. Use a spreader/penetrant surfactant. Must be tank-mixed with a fungicide NOT in FRAC Group 40.
MetaStar 2EC AG	4	7	4 to 8 pt	12 pt	Ridomil Gold, Ultra Flourish, and MetaStar can be applied preplant, at planting, and post-planting—refer to label for instructions. Best control of disease is achieved with a pre- or at-plant application, with supplemental applications if needed. Will not control foliar or fruit rot phases of disease.
Ridomil Gold SL	4	7	1 pt	3 pt	
Ultra Flourish	4	7	2 pt	6 pt	
Ridomil Gold Copper	4/M	7	2.5	4 apps	Apply 30 days after soil application of Ridomil Gold or similar product and continue every 10 to 14 days. Observe seasonal limits for mefenoxam.
Tanos	11/27	3	8 to 10 oz	72 oz	Foliar and fruit phase only. Tanos must be tank-mixed with a fungicide from FRAC Group M appropriate for the target disease. Apply before disease onset, continue every 5 to 7 days.
Zampro	40/45	4	14 fl oz	3 apps	Apply at planting as a drench or by drip irrigation; make supplemental applications every 5 to 7 days.
Southern Blight					
Aftershock	11	3	2 to 5.7 fl oz	22.8 fl oz	Apply before onset of disease and continue applications every 7 to 10 days as needed.
Blocker Flowable	14	0	4.5 pt/100 gal	1 app	Apply as a drench at planting. Actual rate is dependent on row spacing; see label for application instructions.
Cabrio	11	0	12 to 16 oz	96 oz	Apply as a stem-directed spray; complete coverage of the lower stem and soil surface is required for suppression.
Evito 480 SC	11	3	3.8 to 5.7 fl oz	4 apps	Apply before onset of disease and continue applications every 7 to 10 days as needed.

¹ Products with numerical FRAC codes must be alternated or tank-mixed with products that have a different FRAC code to discourage resistance development. See product label for maximum number of consecutive applications allowed. Refer to the table on page 13 for more information on FRAC codes.

² Pre-harvest interval.

³ Observe seasonal limits for mancozeb.

⁴ Generic products available (Appendix F). Amounts and seasonal limits per acre are product dependent.

Potatoes

Nightshade family (Solanaceae): *Solanum tuberosum*

Potatoes are grown in Kentucky as an early crop primarily for fresh market sales. Opportunity exists for the production of small red “new potatoes,” russets, heirlooms, and other specialty or “gourmet” types for local markets, sales to restaurants, or sales to local/area wholesalers. Sales of very small “baby” or “mini” potatoes are also possible and command premium prices in some markets.

Planting and Culture

Loam soils are most desirable for good potato yields, though potatoes can be grown on a wide range of soil types. Select a well-drained soil. Sod ground should be treated with a soil insecticide prior to planting to control grubs and wireworms.

Optimum planting times are from March 15 to April 10 for early potatoes and from June 15 to July 15 for a late crop (see Appendix J).

Planting should be made in rows 30 to 36 inches apart with a seed piece dropped each 10 to 12 inches in the furrow. Seed planted in mid-March should be planted

VARIETIES: Potatoes

Maturity	Variety	Comments
Early	Dark Red Norland	Red skinned, shallow eyes—very suitable for table and “new” potatoes.
	Red Gold	Light red skin, yellow flesh, good yields of high quality tubers, not suitable for long term storage.
Early-mid-season	Superior	White skinned, resistance to scab, tubers are oval to oblong, suitable for table use and chipping.
	Yukon Gold	Yellow flesh, round, smaller size, nice appearance and flavor, performance variable across state.
	Red Pontiac	Red skinned, readily available, easy to grow.
Midseason	Norchip	White skinned, tubers are round to oblong in shape with shallow eyes—very suitable for chipping. Moderate resistance to scab. Variety has a heavy tuber set and seed should be spaced 12 inches apart in row.
	Kennebec	White skinned, a good general purpose potato, best full season yields in KY.
	Norkota	White russet type, good baking-type potato.
	Red Lasoda	Red skinned, heat tolerant, readily available, not as attractive as some other red types.

FINGERLING TYPES

Early-mid-season	Russian Banana	White skin, light yellow flesh, long, thin shape, unique taste.
	Swedish Peanut	White skin, golden yellow flesh, shorter, teardrop shapes with shallow eyes, unique taste.

2 to 3 inches deep. The late crop should be planted 4 to 5 inches deep. Seed pieces should be 1 ½ to 2 ounces in size. Only certified disease-free seed stock should be purchased. Freshly cut seed should be planted as soon as possible after cutting. Seed may be pre-cut several days in advance of planting if proper storage conditions are provided so the seed pieces can “heal over.” A storage temperature

of 60°F for 10 days to two weeks before planting will help initiate sprout activity and encourage more rapid emergence.

Fifteen to 18 (100-pound) bags of seed potatoes are usually needed to plant an acre. Potatoes should not follow potatoes or other solanaceous crops (tomatoes, tobacco, peppers) on the same ground year after year. Follow a three- or four-year rotation program.

FERTILIZER: Potatoes

Soil Test Results (lb/A)	Fertilizer Needed (lb/A)	
Phosphorus	Phosphate (P₂O₅)	
Low	<31	181-240
Medium	31-60	91-180
High	61-80	61-90
Very High	>80	60
Potassium	Potash (K₂O)	
Low	<201	251-300
Medium	201-300	101-250
High	301-450	51-100
Very High	>450	50
Nitrogen	N	
Total of 150 lb nitrogen/A is recommended. Apply 75 to 100 lb of nitrogen/A at time of planting and apply a sidedressing of 50 to 75 lb N/A when plants are 4 to 8 inches tall or at lay-by.		

When planting, there will be a small ridge of soil developed over each row. Dragging across the ridges just before the sprouts break through helps to eliminate weeds and allows the potato sprouts to more easily break through compacted soil.

Production with Plasticulture

Potatoes can also be grown on raised beds with black plastic and drip irrigation. Growers have obtained higher and earlier yields of better quality potatoes with plasticulture; potatoes grown on plastic mulch are also easier to dig by hand at harvest. If mechanical harvesting or growing large acreages, plastic mulch should be avoided.

All fertilizer can be applied prior to planting or half the nitrogen requirement can be applied before planting with the remainder divided into equal doses fertigated weekly. Planting holes can be made in plastic mulch using a waterwheel setter and seed pieces dropped in the holes and covered with soil by hand. Kentucky growers have used two rows per bed with 18 inches between rows, 9 to 12 inches between plants within the rows, and 5 feet between bed centers. Pennsylvania growers have used double rows 13 inches apart with 8 inches between plants in the rows. Closer spacings promote higher percentages of smaller tubers and should be used to produce potatoes to be sold as "new," "gourmet," "baby," or "mini" (see also "Harvesting and Handling" below). Vine killing can be more problematic for some specialty potato varieties. In addition to chemical dessicants, a plastic mulch lifter can be used to undercut the plants to assist in vine killing prior to digging.

Fertilizing

Fertilize and lime based on soil test results; a soil pH of 6.0 to 6.5 is considered most desirable for maximum availability of nutrients for potatoes. However, potato scab will usually be more serious at high pH levels. There will normally be less scab when the pH is between 5.0 to 5.2. Potatoes

PESTICIDE SAFETY: Potatoes

	Signal ¹	Re-entry (hrs)	Harvest (days) ²
INSECTICIDES			
Acramite 4 SC	C	12	14
Actara 25 WDG	C	12	14
Admire Pro	C	12	AP/7 ⁵
Assail 30 SG	C	12	7
Avaunt 30 WDG	C	12	7
Belay 2.13SC	C	12	14
Beleaf 50 SG	C	12	7
Coragen 1.67 SC	-	4	14
Dimethoate 4 E	W	48	0 ⁴
Fulfill 50 WDG	C	12	14
Imidan 70 WP	W	24	7
Knack 0.83 EC	C	12	3
Malathion 8	C	12	0
Miteus 0.42 EC	W	12	7
Movento 2	C	24	7
Oberon 2 SC	C	12	7
Platinum 2 SC	C	12	AP
Radiant SC	C	4	7
Requiem 25 EC	C	4	0
Rimon 0.83 EC	W	12	14
Scorpion 3.5 SL	C	12	AP/7 ⁵
Sevin XLR	W	12	7
Sivanto 1.67 SL	C	12	7
Transform 50 WG	D	24	7
Venom 70 SG	C	12	7 ⁵
Restricted Use			
AgriMek 0.15 EC	W	12	14
Asana XL	W	12	7
Battalion 1.5 EC	DP	12	3
Baythroid XL	W	12	0
Brigade 2 EC	W	12	21
Hero 1.24 EC	C	12	21
Lannate 90 SP	DP	48	6
Mustang Max	W	12	1
PennCap-M	W	96	5
Permethrin 3.2 EC	C	12	14
Renounce 20 WP	C	12	0
Thimet 20 G	DP	48	90
Vydate L	DP	48	7
Warrior II	W	24	7
FUNGICIDES			
Aftershock	C	12	7
Ag Streptomycin, Agri-Mycin 17, Harbour	C	12	n/a
Ariston	C	12	14
Bloker Flowable/4F	C	12	0
Bravo ZN	W	48	7

grown for chipping should be grown at the higher pH and those for fresh market at the lower pH if scab is a problem.

It is suggested that one-half the fertilizer used at planting be broadcast prior to planting and disked in. Band the remaining fertilizer 2 to 3 inches to the side and slightly below the seed piece. Fertilizer should not come in contact with the seed piece. Sidedress with 50 to 75 pounds of actual nitrogen (N) per acre when plants are 4 to 8 inches tall or at lay-by.

Harvesting and Handling

When to dig potatoes will depend on the price and method of selling. For local market, it may be desirable to dig before

PESTICIDE SAFETY: Potatoes

	Signal ¹	Re-entry (hrs)	Harvest (days) ²
Cabrio Plus	C	24	14
Chlorothalonil ³	D	12	7
Curzate 60 DF	W	12	14
Endura	W	12	30
Evito 480 SC	C	12	7
Fixed coppers ³	D	12/24 ⁴	0
Forum SC	C	12	4
Gavel 75 DF	C	48	14
Gem	C	12	7
Headline	W	12	3
Iprodione 4L AG	C	12	14
Luna Tranquility	C	12	7
Mancozeb ³	C	24	14
Maxim Potato Seed Protectant	C	12	0
Meteor	C	12	14
Moncut 70 DF	C	12	0
Nevado 4F	C	12	14
Omega 500F	W	48	14
Polyram	C	24	14
Presidio	C	12	7
Previcur Flex	C	12	14
Priaxor	C	12	7
Quadris	C	4	14
Quadris Opti	W	12	14
Quadris Top	C	12	14
Quash	C	12	1
Ranman	C	12	7
Reason 500 SC	C	12	14
Revus	C	4	14
Revus Top	C	12	14
Ridomil Gold Bravo SC	W	48	14
Ridomil Gold Copper	D	48	14
Ridomil Gold SL	C	48	0
Ridomil Gold MZ	C	48	14
Rovral 4 Flowable	C	12	14
Scala	C	12	7
Sulfur ³	C	24	0
Tanos	C	12	14
Thiophanate-methyl ³	C	12	21
Ultra Flourish	W	48	0
Vertisan	W	12	7
Zampro	C	12	4
Zing!	C	12	7

¹ W: Warning, C: Caution, D: Danger, P: Poison

² AP: At planting

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

⁴ Safety information varies by product; read the label carefully.

⁵ PHI dependent on application method.

vines die back. Vines of potatoes grown for storage should be dead before digging. Potatoes dug when immature are very susceptible to skinning and bruising. Using chemical desiccants to artificially kill the plant tops will aid in earlier harvest and promote a firmer skin set. Growers often mow plants prior to harvest. Harvesters or diggers should have digger chain speed adjusted to minimize injury to tubers. Protect freshly dug potatoes from hot sun and drying winds. Smaller-sized "new," or "gourmet," potatoes are often dug by hand.

If tablestock potatoes are to be stored and kept for long periods, the storage facil-

ity should be clean and sanitized. Potatoes should be held at 55°F for two weeks at a relative humidity of 90 percent, and then the temperature should be lowered to 40°F with a relative humidity of 85 to 90 percent.

Washing potatoes for fresh market is desirable. Chlorine at the rate of 150 to 200 parts per million should be added to the water to help destroy surface disease organisms. Potato tubers should dry before bagging, especially into plastic, to reduce chances of bacterial soft rot. Do not wash potatoes going into storage.

Sprouting in storage can be reduced by spraying potato plants while still in the field with maleic hydrazide. Apply to the plants when tubers are 1 ½ to 2 inches in diameter. Read the product label for directions and precautions.

Potatoes are marketed in a variety of containers with several grade specifications. Russet potatoes are usually packed in consumer packs, count cartons, or large institutional packs. The most valuable potatoes are generally 8- to 14-ounce tubers packed in 50-pound cardboard boxes, or "count cartons." Each carton has a number that tells how many tubers are in a box. These are sold to retail stores and restaurants and are typically used for baking. Red and white potatoes are sold in a wider range of sizes per container ("non-size" Grade A) including 5-, 8-, 10-, and 50-pound plastic, poly mesh, paper, and burlap bags. Prices for 50-pound cartons of graded U.S. No. 1 potatoes can triple those for 50-pound bags of U.S. No. 1 non-size potatoes.

New potatoes are usually B size (1 ½ to 2 ¼ inches in diameter) tubers, while "gourmet," "baby," or "creamer" potatoes may be even smaller (1 to 1 ½ inches in diameter). Fingerling potatoes are sorted by length and range from 2 to 3 ½ inches long. Specialty potatoes are often sold for premium prices and are packed in small mesh bags, vented poly bags, baskets, cartons, tray packs, or clamshells.

Common Diseases/Management

Black leg, seed-piece rots, and tuber-borne diseases. Planting quality seed pieces prevents losses to certain potato diseases. Do not save seed; local diseases build up quickly. Keep in mind that certified seed may still carry pathogens at low levels.

Seed potatoes should be allowed time to become physiologically active by warming at 65° to 70°F for two to three weeks prior to planting. Buy seed tubers that have been treated prior to storage with thiabendazole (Mertect 340F) to reduce

Fusarium. Plant whole seed tubers, if possible; seed-piece decay can be reduced greatly by this practice. For best results with cut seed-pieces, treat with fungicide immediately, allow time for the fungicide to dry, and plant within six hours after cutting. If cut seed must be held over, let it dry in open slatted crates for two days before bagging. Avoid bruising of seed during handling. Dust seed pieces with mancozeb or Maxim. Soaking seed pieces in a solution of streptomycin sulfate (Agri-Mycin 17) solution at 0.5 pounds per 100 gallons of water for 30 minutes (prior to applying the seed treatment dusts) will assist in controlling black leg.

Early blight. Early blight, caused by *Alternaria solani*, is a major cause of early defoliation of potatoes in Kentucky and its control requires a good preventive fungicide spray program. Two year rotations away from potatoes, tomatoes, eggplant, and tobacco are helpful. Minimize stress on plants by avoiding poorly drained sites and irrigating when necessary. Maintain adequate soil fertility, particularly N and K.

Late blight. In general, temperatures in the Commonwealth are too high during the normal growing season to support late blight even when leaf wetness is ideal. To minimize problems with late blight, plant certified seed, destroy all cull piles, and do not plant in fields with volunteer potatoes. Eliminate volunteer potatoes and volunteer tomatoes on the farm. Do not harvest until the vines are completely dead. If late blight appears near harvest, quickly kill vines using a labeled vine-killer. When applied as part of a regular program, many of the fungicides for early blight should provide adequate control of late blight. Under severe conditions in Kentucky, shorten spray intervals and increase gallons per acre to improve coverage; late blight-specific fungicides may be needed. Fixed coppers are more effective on late blight than on early blight and are an excellent option for early in the season.

Nematodes. Avoid problem fields if at all possible until they can be properly rotated to non-host crops. If problem sites must be used, fumigate prior to planting (see "Soil Fumigants for Control of Nematodes and Soilborne Diseases" on page 16). With low populations, adequate control can be obtained with Vydate L at 1 to 2 gallons per 20 gallons of water per acre applied in seeding furrows at 1 to 2 ounces per 100 feet of treated row or with Mocap 15G at 20 pounds per acre applied in a 12-inch band on the side of the row at planting. Rotation for two to three years with grasses is also effective in reducing nematode numbers.

Rhizoctonia stem canker and black scurf. Avoid heavily infested fields, plant uncontaminated seed, and be sure that the previous crop residues are well rotted prior to planting. At-planting applications of azoxystrobin, and PCNB will also reduce losses to black scurf.

Scab. Scab is less problematic in slightly acidic soil; maintain a soil pH of 5.0 to 5.2, especially if the field was planted to potatoes within the last three years. Rotate away from potatoes for three to four years in scab-prone fields. Scab is favored by additions of manure or organic matter immediately prior to planting. This makes scab a significant threat in organic production. Cover crops should be turned well in advance of planting to ensure decomposition. Maintain soil moisture at or near field capacity during tuber formation. Keeping the pH low to discourage scab development is more valuable than seed treatment. In cases where a higher pH is required, some improvement in scab control can be achieved from using seed piece treatments (mancozeb) to suppress seed-borne inoculum.

Verticillium wilt. Use certified seed and seed treatments to minimize introduction of *Verticillium* into clean fields. Rotate to small grains or other grasses to slow population buildup. Control weeds during rotations. The presence of other root pests, such as nematodes, may favor *Verticillium* wilt. Nematodes must be controlled if this wilt pathogen is present. Preplant soil fumigation is also an option for heavily infested fields (see "Soil Fumigants for Control of Nematodes and Soilborne Diseases" on page 16).

Viruses. A high level of control is possible with use of high-quality, certified seed. The potential of potatoes serving as a source of viruses for tobacco is an important thing to consider if both are being planted on the same farm. The nearer the two crops are planted, the greater the risk of potato virus Y and tobacco etch. Keep potatoes 150 to 200 yards away from other solanaceous crops, and control insect vectors (aphids, leafhoppers). The level of common strains of PVY associated with Kentucky tobacco crops has also increased markedly. Therefore, when selecting certified seed, one should also consider the certification standards being used. Speak to local suppliers about this issue before they contract to buy seed potatoes. Consider more than the price of the seed—also consider the benefit to other crops when seed potatoes with lower virus incidence are used.

INSECT CONTROL: Potatoes¹

Insecticide	Product Amt/A	Seasonal Limit/A	Comments and Other Restrictions
PREPLANT INCORPORATED			
Wireworms, Cutworms			
Diazinon 50 W	4 to 8 lb	-	Incorporate immediately.
AT PLANTING			
Wireworms, Flea Beetles, Colorado Potato Beetle, Aphids: Do not use a foliar spray of Actara, Assail, Belay, Provado, or Venom following a soil application of Admire, Belay, Platinum, or Venom.			
Admire Pro	5.7 to 8.7 fl oz	8.7 fl oz	For Colorado potato beetle, aphids, and flea beetles.
Belay 2.13 SC	9 to 12 fl oz	12 fl oz	At planting or cultivation.
Brigade 2 EC	9.6 to 19.2 fl oz	32 fl oz	Limit 2 applications. Allow 7 days between applications.
Platinum 2 SC	5 to 8 fl oz	8 fl oz	For Colorado potato beetles and flea beetles.
Regent 4 SC	3.2 fl oz	3.2 fl oz	In-furrow use only as a 5 to 7 inch band for wireworm. Do not band on surface.
Thimet 20 G	11.3 oz/ 1,000 row-feet	-	-
Scorpion 35 SL	11.5 to 13.25 fl oz	13.25 fl oz	For Colorado potato beetle and flea beetles.
Venom 70 SG	6.5 to 7.5 oz	7.5 oz	For Colorado potato beetle and flea beetles.
FOLIAR TREATMENTS			
Grasshoppers			
Asana XL	5.8 to 9.6 fl oz	67.2 fl oz	-
Dimethoate 4 E	0.5 to 1 pt	2 pt	Allow 7 days between applications.
Mustang Max	3.2 to 4 fl oz	24 fl oz	Allow 4 days between applications.
Warrior II	1.28 to 1.92 fl oz	7.68 fl oz	Allow 7 days between applications.
European Corn Borer			
Asana XL	5.8 to 9.6 fl oz	67.2 fl oz	-
Battalion 1.5 EC	1.5 to 2.4 fl oz	12 fl oz	-
Baythroid XL	1.6 to 2.8 fl oz	16.8 fl oz	Allow 5 days between applications.
Coragen 1.67 SC	3.5 to 5 fl oz	15.4 fl oz	-
Mustang Max	1.76 to 4 fl oz	24 fl oz	Allow 4 days between applications.
Permethrin 3.2 EC	4 to 8 fl oz	64 fl oz	-
Radiant SC	6 to 8 fl oz	32 fl oz	Allow 7 days between applications.
Rimon 0.83 EC	6 to 12 fl oz	24 fl oz	-
Warrior II	1.28 to 1.92 fl oz	7.68 fl oz	Allow 7 days between applications.
Colorado Potato Beetle, Flea Beetle: Colorado Potato Beetle is the key insect pest of potato. 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. [PB] IRAC Codes: Insecticides followed by the same number share the same mode of action.			
Actara 25 WDG (4A)	1.5 oz	3 oz	Allow 7 days between applications.
Admire Pro (4A)	1.3 fl oz	5.6 fl oz	Allow 7 days between treatments.
Agri-Mek 0.15 EC (6)	8 to 16 fl oz	32 fl oz	Make no more than two consecutive applications.
Assail 30 SG (4A)	1.5 to 4 oz	16 oz	Limit 4 applications. Allow 7 days between applications.
Avaunt 30 WDG (22)	3.5 to 6 oz	24 oz	Allow 5 days between applications.
Battalion 1.5 EC (3)	1.5 to 2.4 fl oz	12 fl oz	-
Baythroid XL (3)	1.6 to 2.8 fl oz	16.8 fl oz	Allow 5 days between applications.
Belay 2.13 SC (4A)	2 to 3 fl oz	12 fl oz	Allow 7 days between applications.
Coragen 1.67 SC (28)	3.5 to 5 fl oz	15.4 fl oz	-
Imidan 70 W (1B)	1.33 lb	-	Machine harvested potatoes only.
Radiant SC (5)	6 to 8 fl oz	32 fl oz	Allow 7 days between applications.
Rimon 0.83 EC (15)	9 to 12 fl oz	24 fl oz	-
Scorpion 35 SL	2 to 2.75 fl oz	8 fl oz	Allow 14 days between applications.
Sevin 80 S (1A)	1.25 to 2.5 lb	6 applications	Allow 7 days between applications.
Sivanto 1.67 SL	10.5 to 14 fl oz	28 fl oz	Allow 7 days between applications.
Venom 70 SG (4A)	1 to 1.5 oz	4.5 oz	Allow 14 days between applications.
Leafhoppers			
Actara 25 WDG	1.5 oz	3 oz	Allow 7 days between applications.
Admire Pro	1.3 fl oz	5.6 fl oz	Allow 7 days between treatments.
Asana XL	2.9 to 5.8 fl oz	67.2 fl oz	-
Assail 30 SG	1.5 to 4 oz	16 oz	Limit 4 applications. Allow 7 days between applications.
Battalion 1.5 EC	1.5 to 2.4 fl oz	12 fl oz	-
Baythroid XL	0.8 to 1.6 fl oz	16.8 fl oz	Allow 5 days between applications.
Belay 2.13 SC	2 to 3 fl oz	12 fl oz	Allow 7 days between applications.
Dimethoate 4 E	0.5 to 1 pt	2 pt	Allow 7 days between applications.
Mustang Max	1.76 to 4 fl oz	24 fl oz	Allow 4 days between applications.
Permethrin 3.2 EC	4 to 8 fl oz	96 fl oz	-
Scorpion 35 SL	2 to 2.75 fl oz	8 fl oz	Allow 14 days between applications.
Sevin XLR	0.5 to 1 qt	6 applications	Allow 7 days between applications.
Sivanto 1.67 SL	7 to 10.5 fl oz	28 fl oz	Allow 7 days between applications.
Transform 50 WG	1.5 to 2.25 oz	8.5 oz	Allow 7 days between applications.
Venom 70 SG	1 to 1.5 oz	4.5 oz	Allow 14 days between applications.
Warrior II	0.96 to 1.6 fl oz	7.68 fl oz	Allow 7 days between applications.

¹ Generic products available (Appendix E).

WEED CONTROL: Potato

Product Amt/A	Lb A.I./A	Comments
1.5-2.9 pt Boundary 6.5 EC	0.98-1.9 s-metolachlor + 0.23-0.43 metribuzin	For control of most annual grasses and certain broadleaf weeds and yellow nutsedge. Apply after planting or after drag-off but before crop emergence. See Dual Magnum label for rotational crops restrictions. Dual Magnum may delay maturity and/or reduce yield of Superior and other early maturing potato varieties if cold, wet soil conditions occur after treatment. PHI = 60 days.
1-2 pt Dual II Magnum 7.6 E	0.95-1.9 s-metolachlor	For control of most annual grasses and certain broadleaf weeds and yellow nutsedge. Apply preplant incorporated, pre-emergence. Dual Magnum may delay maturity and/or reduce yield of Superior and other early maturing potato varieties if cold, wet soil conditions occur after treatment. See label for incorporation directions. 60-day pre-harvest interval.
3.5 pt Eptam 7 E	3 EPTC	For control of annual grasses and broadleaf weeds and suppression of yellow nutsedge. Apply before planting. Incorporate immediately 2 to 3 inches. Superior variety is sensitive to Eptam under stress conditions.
1-2 pt Goal 2XL	0.25-0.5 oxyfluorfen	For pre-emergence and post-emergence 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.
1-2 pt Gramoxone Inteon	0.69-1.38 paraquat salt	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply up to ground cracking to emerged weeds but before crop emergence; may be used instead of drag-off operation for emerged weeds and before using pre-emergence herbicides. Add non-ionic surfactant 0.25% v/v.
1.5-2.5 lb Lorox 50 DF	0.75-1.25 linuron	For control of annual grasses and broadleaf weeds. Apply after planting but before crop emerges. Plant seed at least 2 inches deep. Best results if rainfall or irrigation is applied within 2 weeks of application.
1-1.5 oz Matrix 25 WSG	0.016-0.023 rimsulfuron	For pre-emergence control of broadleaves and grasses. Apply immediately after hilling, drag-off, or reservoir tillage. 1/3 to 1 inch rainfall or irrigation is needed for activation. Do not use on potato grown for seed. Matrix can also be applied chemigation. See label for details.
14-18 fl oz Outlook 6 E	0.6-0.8 dimethenamid-p	For pre-emergence control of broadleaves and grasses. Apply after planting or after drag-off or as chemigation. Leave a 35 foot untreated buffer and avoid applying near endangered plant populations in and around the following counties: Barren, Boone, Hardin, Laurel, Rockcastle, Wolfe. PHI = 40 days.
0.5-2.5 pt Poast	0.09-0.48 sethoxydim	For control of actively growing grasses only. Use high rate on Johnson grass. PHI = 30 days. Max. rate of 2.5 pt/application and 5 pt/season.
1.5-3.0 pt Prowl H2O	0.71-1.43 pendimethalin	For control of annual grasses and broadleaf weeds. Can be applied pre-emergence after planting or after drag-off. Can be applied early post-emergence to plants up to 6 inches tall only if plants are not under stress from cold/wet or hot/dry conditions.
16-22 fl oz Roundup WeatherMax 5.5L	0.69-0.94 glyphosate-salt	For non-selective post-emergence 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.
9-32 fl oz Select Max	0.07-0.24 clethodim	For selective post-emergence 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.
0.3-1.3 lb TriCor 75 DF	0.2-1 metribuzin	For control of annual grasses and broadleaf weeds. Apply pre-emergence broadcast after planting. Do not incorporate. Can be used post-emergence (0.3 to 0.6 lb/A) or as a split-application not to exceed 1.3 lb/A per season on white-skinned varieties (except Atlantic, Chip Belle, Bel Chip, and Shepody) that are not early maturing. Do not use on early maturing or red-skinned varieties. PHI = 60 days.
1.25-2 pt Treflan HFP 4 E	0.62-1 trifluralin	For pre-emergence control of annual grasses and broadleaf weeds. Apply and incorporate after planting but before emergence, following drag-off, or after potato plants have fully emerged.
2.3 fl oz Weedone LV4 3.84 EC	0.07 2,4-D	For selective post-emergence control of broadleaf weeds. This is a low volatility formulation of 2,4-D. Still, caution should be exercised near sensitive crops such as tomato and grape. For use on fresh market red potatoes only. Crop response depends on variety. Apply in 5 to 25 gal water/A to plants in the pre-bud stage (about 7 to 10 inches high) and a second application about 10 to 14 days later.

Pre-Harvest Vine Killing

10 lb Copper Sulfate Crystal	10 copper sulfate	To enhance vine-kill, use in 10 to 100 gal water. Can be mixed with diquat to enhance vine kill.
3.2 qt Defol 750	6 sodium chlorate	To defoliate plants, apply 10 days before harvest in 10 to 20 gal water/A. Do not apply under conditions of extreme heat during the middle of the day.
1-2 pt Reglone	0.25-0.5 diquat	For non-selective contact kill of grasses and broadleaf weeds and top-kill of perennial weeds. Apply to mature potato vines as a pre-harvest desiccation treatment in 20 gal water/A. Make a second application within 5 days if necessary. Include non-ionic surfactant 0.25% v/v. PHI = 7 days.
29 fl oz Rely 200	0.38 glufosinate	For non-selective post-emergence control of annual and perennial grasses and broadleaf weeds. Do not use on potatoes grown for seed. Apply in 20 to 100 gal water/A. Max. 1 application/season. PHI = 9 days.

DISEASE CONTROL: Potatoes

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Black leg, Seed-piece Rots, Tuber-borne Diseases					
Ag Streptomycin, Agri-Mycin 17, Harbour	25	n/a	8 oz/100 gal	1 app	Soak seed pieces in solution for several minutes and treat with fungicide.
Mancozeb4					Products include Dithane, Koverall, Manzate, Penncozeb.
Dry formulations only	M	14	2.5 lb/100 gal	1 app	Soak seed pieces in solution for several minutes and place in clean container following treatment. Plant as soon as possible.
Maxim MZ	12/M	14	0.5 lb/cwt	1 app	Dust seed pieces and plant as soon as possible.
Maxim Potato Seed Protectant	12	0			
Black Scurf, Rhizoctonia Stem Canker					
Azoxystrobin ⁴					Can be applied in-furrow or post-emergence. Post-emergence applications are counted as foliar treatments. See label for specific instructions.
Azoxy 2SC	11	14	0.4 to 0.8 fl oz ⁴	6 foliar apps	
AzoxyStar	11	14	0.4 to 0.8 fl oz ⁴	6 foliar apps	
Quadris	11	14	0.4 to 0.8 fl oz ⁴	6 foliar apps	
Satori	11	14	0.4 to 0.8 fl oz ⁴	6 foliar apps	
Blocker Flowable, Blocker 4F	14	0	5.2 to 10.4 fl oz ⁴	1 app	Use as an In-furrow spray at planting. Actual rate is dependent on row spacing; see label for directions.
Headline	11	3	0.4 to 0.8 fl oz ⁴	6 foliar apps	Apply in-furrow for control of Rhizoctonia diseases. See label for specific instructions.
Headline SC	11	3			
Moncut 70 DF	7	0	0.7 to 1.1 lb	1 app	Apply in-furrow in 3 gal/A of water. Direct spray over seed piece and surrounding soil before covering.

(continued on next page)

DISEASE CONTROL: Potatoes (continued)

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Vertisan	7	7	0.7 to 1.6 fl oz ⁴	1 app	Apply in-furrow for control of Rhizoctonia diseases. See label for specific instructions.
Early Blight, Late Blight, White Mold (Sclerotinia Blight)					
Aftershock	11	7	2 to 3.8 fl oz	22.8 fl oz	Apply before onset of disease and continue applications every 7 to 10 days as needed.
Ariston	M/27	14	2.0 pt	17.5 pt	Apply before disease onset, continue every 5 to 7 days.
Azoxystrobin ⁴					Early/late blight only. Apply before disease onset, continue every 7 to 14 days.
Azoxy 2SC	11	14	6 to 15.5 fl oz ⁵	6 apps	
AzoxyStar	11	14	6 to 15.5 fl oz ⁵	6 apps	
Quadris	11	14	6 to 15.5 fl oz ⁵	6 apps	
Satori	11	14	6 to 15.5 fl oz ⁵	6 apps	
Cabrio Plus	11/M	14	2 to 2.9 lb	17.4 lb	Apply before onset of disease and continue applications every 7 to 14 days as needed.
Chlorothalonil ⁵					Early/late blight only. Apply before disease onset; continue every 5 to 10 days.
Bravo Ultrex	M	7	0.7 to 1.36 lb	13.6 lb	
Bravo WeatherStik	M	7	0.75 to 1.5 pt	15 pt	
Bravo ZN	M	7	1.25 to 2.25 pt	21.5 pt	
Curzate 60 DF	27	14	3.2 oz	7 apps	Late blight only. Must be tank-mixed with a fungicide from FRAC Group M. Apply before disease onset, continue every 5 to 7 days.
Endura	7	30	2.5 to 10 oz	20.5 oz or 4 apps	Early blight and white mold only. Apply before disease onset, continue every 7 to 14 days.
Evito 480 SC	11	7	3.8 fl oz	6 apps	Early/late blight only. Apply before onset of disease and continue applications every 7 to 10 days as needed.
Fixed coppers					Early/late blight only. Apply when plants are 6 inches tall and continue every 5 to 10 days, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.
Badge SC	M	0	1 to 3 pt	-	
Badge X2	M	0	1 to 4 lb	-	OMRI-listed.
Basic Copper 53	M	0	3 to 4.7 lb	-	OMRI-listed.
C-O-C-S WDG	M	0	1.5 to 4 lb	-	
Champ DP	M	0	0.67 to 2.67 lb	-	
Champ Formula 2 FL	M	0	0.67 to 2.67 pt	-	
Champ WG	M	0	1 to 4 lb	-	OMRI-listed.
COC DF	M	0	3 to 4 lb	-	
COC WP	M	0	3 to 4 lb	-	OMRI-listed.
Copper-Count-N	M	0	3 to 6 pt	-	
Cueva	M	0	0.5 to 2 gal	-	OMRI-listed. Mix in 100 gallons of water, use 50 to 100 gal/A of solution.
Cuprofix Ultra 40 Disperss	M	0	0.75 to 3 lb	-	
Kentan DF	M	0	1 to 4 lb	-	
Kocide 2000	M	0	0.75 to 3 lb	-	
Kocide 3000	M	0	0.5 to 1.75 lb	-	
Kocide DF	M	0	1 to 4 lb	-	
Mastercop	M	0	0.5 to 1.5 pt	-	
Nordox 75 WG	M	0	0.66 to 4 lb	-	OMRI-listed.
Nu-Cop 50 WP	M	0	1 to 4 lb	-	OMRI-listed.
Nu-Cop 3 L	M	0	0.66 to 4 pt	-	
Nu-Cop 50 DF	M	0	1 to 4 lb	-	OMRI-listed.
Nu-Cop HB	M	0	0.5 to 2 lb	-	
Forum SC	40	4	4 to 6 fl oz	30 fl oz	Late blight only. Must be tank-mixed with another <i>Phytophthora</i> fungicide. Apply before disease onset, continue every 5 to 10 days.
Gavel 75 DF2	22/M	14	1.5 to 2 lb	6 apps	Early/late blight only. Apply when conditions favor disease and continue every 5 to 10 days.
Gem	11	7	6 to 8 oz	6 apps	Early/late blight only. Apply before disease onset, continue every 7 to 10 days.
Headline	11	3	6 to 12 fl oz ⁶	6 apps	Apply before disease onset, continue every 7 to 14 days.
Headline SC	11	3			
Luna Tranquility	7/9	7	11.2 fl oz	33.6 fl oz	Early blight, white mold only. Apply every 7 to 14 days.
Mancozeb ⁴					Products include Dithane, Koverall, Manzate, Penncozeb.
Dry formulations	M	14	0.5 to 2 lb	14-15 lb	Early/late blight only. Apply when plants reach 4 to 6 inches and continue every 5 to 10 days as needed. Limit 11.2 lb ai/A per season.
Liquid formulations	M	14	0.4 to 1.6 qt	11.2 qt	
ManKocide ³	M	14	1.5 to 5 lb	see footnote	Early/late blight only. Apply before disease appears and continue every 3 to 10 days as needed.
Omega 500F	29	14	5.5 to 8 fl oz	56 fl oz	Late blight, white mold only. Begin when plants are 8 to 10 inches tall, reapply every 7 to 10 days.
Polyram 80 DF	M	14	1.5 to 2 lb	14 lb	Early/late blight only. Apply before disease appears and continue every 5 to 10 days as needed.
Presidio	43	7	4 fl oz	12 fl oz	Late blight. Apply before disease onset, continue every 7 to 10 days.
Previcur Flex	28	14	0.7 to 1.2 pt	6 pt	Early/late blight only. Apply before disease appears and continue every 7 to 10 days as needed.
Priaxor	7/11	7	4 to 8 fl oz	24 fl oz	Apply prior to development of disease, continue every 7 to 14 days.
Quadris Opti	11/M	14	1.6 pt	6 apps	Early blight/late blight. Apply before disease onset, continue every 5 to 14 days.
Quadris Top	11/3	14	8 to 14 fl oz	55.3 fl oz	Early blight. Apply before disease onset, continue every 7 to 10 day schedule.
Quash	3	1	2.5 to 4 oz	4 apps	Early blight, white mold only. Apply before disease onset, reapply every 7 to 10 days.
Ranman SC	21	7	1.4 to 2.75 fl oz	10 apps	Late blight. Apply before disease onset, continue every 7 to 10 days.

(continued on next page)

DISEASE CONTROL: *Potatoes (continued)*

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Reason	11	14	5.5 to 8.2 fl oz	24.6 fl oz	Early blight/late blight. Apply before disease onset, continue every 5 to 10 days.
Revus	40	14	5.5 to 8 fl oz	32 fl oz	Late blight only. Apply every 7 to 10 days. Use a spreader/penetrant surfactant. Must be tank-mixed with a fungicide NOT in FRAC Group 40.
Revus Top	40/3	14	5.5 to 7 fl oz	28 fl oz	Early/late blight only. Apply every 7 to 10 days. Use a spreader/penetrant surfactant.
Ridomil Gold Bravo SC	4/M	14	2.5 pt	3 apps	Early/late blight only. Apply before disease onset, continue every 14 days. Rotate to another mode of action between applications of RG Bravo. Observe seasonal limits for chlorothalonil.
Ridomil Gold Copper	4/M	14	2 lb		Late blight only. Apply before disease onset, continue every 14 days. Rotate to another mode of action between applications of RG Copper.
Ridomil Gold MZ2	4/M	14	2.5 lb		Early/late blight only. Apply before disease onset, continue every 14 days. Rotate to another mode of action between applications of RG MZ.
Iprodione ⁵					Early blight/white mold only. Apply before disease onset, continue every 7 to 21 days.
Rovral 4 Flowable	2	14	1 to 2 pt	4 apps	
Scala	9	7	7 fl oz	35 fl oz	Early blight only. Apply before disease onset, continue every 7 to 14 days. Tank-mix with another fungicide labeled for early blight.
Tanos	11/27	14	6 to 8 oz	6 apps	Early/late blight only. Tanos must be tank-mixed with a fungicide from FRAC Group M appropriate for the target disease. Apply before disease onset, continue every 5 to 10 days.
Thiophanate-methyl ⁵					White mold only. Apply before row closure and continue every 7 to 14 days.
Topsin 4.5 FL	1	21	20 to 30 fl oz	80 fl oz	
Topsin M 70 WP	1	21	1 to 1.5 lb	4 lb	
Topsin M WSB	1	21			
Vertisan	7	7	10 to 24 fl oz	72 fl oz	Early blight, white mold only. Apply before disease onset, reapply every 7 to 14 days.
Zampro	40/45	4	11 to 14 fl oz	3 apps	Apply before disease onset and repeat every 5 to 7 days.
Zing!	M/22	7	32 to 34 fl oz	8 apps	Apply before disease onset and repeat every 5 to 14 days. Alternate with another FRAC code.

¹ Products with numerical FRAC codes must be alternated or tank-mixed with products that have a different FRAC code to discourage resistance development. See product label for maximum number of consecutive applications allowed. Refer to the table on page 13 for more information on FRAC codes.

² Pre-harvest interval.

³ Observe seasonal limits for mancozeb.

⁴ Per 1,000 row-feet.

⁵ Generic products available (Appendix F). Amounts and seasonal limits per acre are product dependent.

⁶ Use higher rate when pressure is severe.

Rhubarb

Buckwheat family (Polygonaceae): *Rheum rhubarbarum*

Planting and Culture

Rhubarb is a cool-season crop. It thrives on a well-drained soil that is deep and fertile.

Rhubarb plants (pieces of the crown) should be transplanted in rows 4 to 5 feet apart with plants spaced 3 feet apart in the row. The crown pieces should be planted so that there are 2 to 3 inches of soil covering the pieces. Transplant crowns in early March or in late August (see Appendix J).

Harvesting

Rhubarb may be harvested for a short period during the second year and a full harvest period (eight to 10 weeks) during the third growing season and thereafter. Pull the stalks rather than cut them.

VARIETIES: *Rhubarb*

Variety	Comments
Canada Red	Hardy, with cherry-red tender stalks.
Tilden Strain	Thin, very red tender stalks.
MacDonald Strain	Vigorous, very productive, some root rot resistance.

PESTICIDE SAFETY: *Rhubarb*

	Signal ¹	Re-entry (hrs)	Harvest (days)
INSECTICIDES			
Actara 25 WDG	C	12	7
Admire Pro	C	12	45
Assail 30 SG	C	12	7
Avaunt 30 DG	C	12	3
Belay 2.13 SC	C	12	21
Confirm 2 F	C	4	7
Coragen 1.67 SC	-	4	1
Fulfill 50 WDG	C	12	7
Intrepid 2 F	C	4	1
Movento 2	C	24	3
Platinum 2 F	C	12	30
Radiant SC	C	4	1
Requiem 25 EC	C	4	0
Sevin XLR	C	12	14
Trigard 75 WP	C	12	7
Venom 70 SG	C	12	7/21 ³
Restricted Use			
Agri-Mek 0.15 EC	W	12	7
Baythroid XL	W	12	0
Brigade WSB	W	12	7
Mustang Max	W	12	1
Permethrin 3.2 EC	C	12	1
Proclaim 5 WDG	C	48	7

INSECT CONTROL: *Rhubarb*

Stalk Borer and Rhubarb Curculio are controlled by cultivating field margins to keep weed populations low. Remove all curly dock, the normal host of the curculio. For various leaf- and stalk-feeding insects, use Mustang or Permethrin as needed.

PESTICIDE SAFETY: *Rhubarb*

	Signal ¹	Re-entry (hrs)	Harvest (days)
FUNGICIDES			
Aliette WDG ⁴	C	12	3
Cabrio EG	C	12	0
Evito 480 SC	C	12	3
Fixed coppers ²	D	24/48	0
Fontelis	C	12	3
Gem	C	12	7
Meta Star 2EC AG	W	48	0
Presidio	C	12	2
Propiconazole ²	W	12	14
Quadris	C	4	0
Reason	C	12	2
Revus	C	4	1
Ridomil Gold SL/GR	C	48	0
Ultra Flourish	W	48	0
Zampro	C	12	0

¹ W: Warning, C: Caution, D: Danger, P: Poison

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

³ PHI depends on the type of application, see label.

⁴ 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.

FERTILIZER: *Rhubarb*

Soil Test Results (lb/A)	Fertilizer Needed (lb/A)	
Phosphorus	Phosphate (P₂O₅)	
Low	<31	240
Medium	31-60	180
High	61-80	120
Very High	>80	60
Potassium	Potash (K₂O)	
Low	<201	200
Medium	201-300	150
High	>300	100
Nitrogen	N	

If 15 to 20 tons of manure have been applied/A and worked into the soil before transplanting crowns, apply an additional 50 lb of nitrogen.

Common Diseases/Management

Crown rot. Use disease-free transplants and plant into well-drained soils high in organic matter. This disease is stress related, so maintain optimal soil fertility; do not over-harvest. At harvest, pulling stalks rather than cutting them reduces entry sites and the food base for pathogens.

Damping-off. Mefenoxam or metalaxyl can be applied preplant to manage damping-off and root rots caused by *Pythium*. Planting into well-drained soils is an important control measure.

Leaf spots and blights. Rhubarb is generally disease-free; however, fungicides are labeled for a number of foliar diseases. Control weeds in and around the field. Remove yellowed leaves promptly during the season. *Fall maintenance is important*—remove all leaf material in the fall to reduce pathogen populations and use fall fertilization to encourage spring growth.

WEED CONTROL: *Rhubarb*

Product Amt/A	Lb A.I./A	Comments
0.5-1.6 fl oz Aim 1.9 EW	0.008-0.025 carfentrazone	For contact post-emergence 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 post-emergence 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.
6.0 fl oz Callisto	0.19 mesotrione	For post-emergent and pre-emergent control of select species. Apply prior to crop emergence in established rhubarb. If weeds are emerged at time of application use a non-ionic surfactant at 0.25% v/v. Do not apply to rhubarb that is not dormant. Limit 1 application/season. PHI = 21 days.
0.67-1.33 pt Dual Magnum	0.64-1.27 s-metolachlor	Apply as a broadcast or banded to soil prior to crop emergence for pre-emergent control of select weed species. Make only one application per season. PHI = 62 days.
2.5-4.0 pt Gramoxone Inteon	0.86-1.38 paraquat salt	For non-selective contact kill of annual grasses and broadleaf weeds and top-kill of perennial weeds. Apply during dormant season before buds in crown begin to grow 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.
0.5-1.5 pt Poast	0.09-0.27 sethoxydim	For control of actively growing grasses only. Use high rate on Johnson grass. PHI = 30 days. Max. rate of 1.5 pt/application and 3 pt/season.
16-22 fl oz Roundup Weather-Max 5.5L	0.69-0.94 glyphosate-salt	For non-selective post-emergence 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.
9-16 fl oz Select Max	0.07-0.12 clethodim	For selective post-emergence of actively growing annual grasses and suppression of perennial grasses. Add crop oil 1% v/v. Max. 16 fl oz/application. Min. 14 days between applications. PHI = 30 days.

DISEASE CONTROL: *Rhubarb*

Product	FRAC Code ¹	PHI ² (days)	Amt/A	Seasonal Limits/A	Comments
Damping-off (Pythium)					
MetaStar 2E AG	4	0	4 to 8 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 (preplant) or with irrigation (pre- and at-planting) if rainfall is not expected within 24 hours of treatment.
Ridomil Gold SL	4	0	1 to 2 pt		
Ultra Flourish	4	0	2 to 4 pt		
Ridomil Gold GR	4	0	20 to 40 lb	1 app	Apply pre- or at-planting; refer to label.
Downy Mildew					
Aliette WDG ⁴	33	3	2 to 5 lb	7 apps	Apply when conditions favor disease and continue every 7 to 21 days. Do not tank-mix with copper compounds.
Cabrio	11	0	12 to 16 oz	4 apps	Use highest rate for downy mildew. Apply before disease onset, continue every 7 to 14 days.
Presidio	43	2	3 to 4 fl oz	12 fl oz	Apply every 7 to 14 days. Must be tank-mixed with a fungicide NOT in FRAC Group 43.
Reason 500 SC	11	2	5.5 to 8.2 fl oz	24.6 fl oz	Apply before disease onset, continue every 5 to 10 days.
Revus	40	1	8 fl oz	32 fl oz	Apply every 7 to 10 days. Use a spreader/penetrant surfactant.
Zampro	40/45	0	14 fl oz	3 apps	Apply before disease onset and repeat every 7 days.

Leaf Spots (Alternaria, Anthracnose, Cercospora), Powdery Mildew

Azoxystrobin ³					Apply before disease onset, continue every 7 to 14 days.
Azoxystrobin	11	0	6 to 15.5 fl oz ⁴	4 apps	
Azoxystrobin	11	0	6 to 15.5 fl oz ⁴	4 apps	
Quadris	11	0	6 to 15.5 fl oz ⁴	4 apps	
Satori	11	0	6 to 15.5 fl oz ⁴	4 apps	
Cabrio	11	0	12 to 16 oz	4 apps	Apply before disease onset, continue every 7 to 14 days.
Evito 480 SC	11	3	5.7 fl oz	4 apps	Apply before disease onset, continue applications every 7 to 10 days as needed.
Fixed coppers					Apply before disease onset, continue every 5 to 10 days, depending upon product and conditions. See label for mixing instructions and tank-mix precautions.
Badge SC	M	0	1 to 2.25 pt		-
Badge X2	M	0	1 to 2.25 lb		OMRI-listed.
Fontelis	7	3	14 to 24 fl oz	72 fl oz	Apply before disease onset, continue every 7 to 14 days.
Gem 500SC	11	7	1.9 to 2.9 fl oz	4 apps	Apply before disease onset, continue every 14 days.
Propiconazole ³	3	14			Cercospora only. Apply before disease onset, continue every 7 days.
Tilt	3	14	4 fl oz	16 fl oz	

¹ Products with numerical FRAC codes must be alternated or tank-mixed with products that have a different FRAC code to discourage resistance development. See product label for maximum number of consecutive applications allowed. Refer to the table on page 13 for more information on FRAC codes.

² Pre-harvest interval.

³ Generic products available (Appendix F). Amounts and seasonal limits per acre are product dependent.

⁴ Restricted in some Kentucky counties. See fungicide safety table on page 20.