

Onions

Recommended Bulbing Onion Varieties

Type	Variety ¹	Hybrid	Days ²	Description ³	Color	Storage	Method ⁴	Size ⁵
Long Day (direct-seeded or transplanted in early spring)	Blush	Yes	107	Sweet Spanish	Pink	Medium	TP	L
	Bradley	Yes	118	Storage LD Sp	Yellow	Long	DS, TP	L
	Ebenezer	No	120	Storage LD	Yellow	Long	Sets	M-L
	Redwing	Yes	110	Storage LD Sp	Red	Long	DS, TP	M-L
	Safrane	Yes	106	Storage LD N	Yellow	Long	DS, TP	M
	Sedona	Yes	120	Storage LD Sp	Yellow	Long	DS, TP	L
	Talon	Yes	110	Storage LD Sp	Yellow	Long	DS, TP	L
Intermediate Day (normally early spring transplanted)	Candy	Yes	95	Sweet Spanish	Yellow	Very Short	TP	VL
	Expression	Yes	98	Sweet Spanish	Yellow	Short	TP	L
	Highlander	Yes	90	Sweet Spanish	Yellow	Short/Medium	TP	L
	Great Western	Yes	110	Sweet Spanish	Yellow	Medium	TP	L
	Great White	Yes	103	Sweet Spanish	White	Medium	TP	L
	Sierra Blanca	Yes	100	Sweet Spanish	White	Short	TP	L
	Spanish Medallion	Yes	110	Sweet Spanish	Yellow	Medium	TP	VL
Overwinter (direct-seeded in later summer)	Bridger	Yes	n/a	Storage	Yellow	Medium	DS, TP	M-L
	T-448	Yes	n/a	Storage	Yellow	Medium	DS, TP	L

¹Listed alphabetically within type. ²Days to maturity; n/a=not available.

³Storage=long keeping types; LD=Long Day; Sp=Spanish type; N=Northern type; Sweet Spanish=short keeping softer scale sweet types.

⁴DS=Direct-Seeded, TP=Transplanted. ⁵M=Medium, L=Large, VL=Very Large.

Recommended Green or Bunching Onions (Scallions) Varieties

Variety (listed alphabetically)	Production Method
Evergreen Long White Bunching	Overwinter
Feast	Summer
Green Banner	Fall, Overwinter, Spring, Summer
Ishikura Improved	Summer
Nabechan	Summer
Parade	Summer
Southport White Globe	Overwinter
Tokyo Long White Bunching	Summer
White Sweet Spanish	Spring-Summer

Recommended Nutrients Based on Soil Tests

In addition to using the table below, check the suggestions on rate, timing, and placement of nutrients in your soil test report and Chapter B Soil and Nutrient Management. Your state's soil test report recommendations and/or your farm's nutrient management plan supersede the recommendations found below.

Onions ^{1,2}	N (lb/A)	Soil Phosphorus Level				Soil Potassium Level				Nutrient Timing and Method
		Low	Med	High (Opt)	Very High	Low	Med	High (Opt)	Very High	
		P ₂ O ₅ (lb/A)				K ₂ O (lb/A)				
Bulb Onions	75-100	200	100	50	0 ³	200	100	50	0 ³	Total nutrient recommended
	50-75	200	100	50	0 ³	200	100	50	0 ³	Broadcast and disk-in
	25-50	0	0	0	0	0	0	0	0	Sidedress 4-5 weeks after planting
Green Onions	150-200	200	100	50	0 ³	200	100	50	0 ³	Total nutrient recommended
	50-75	200	100	50	0 ³	200	100	50	0 ³	Broadcast and disk-in
	50	0	0	0	0	0	0	0	0	Sidedress 4-5 weeks after planting
	50	0	0	0	0	0	0	0	0	Sidedress 3-4 weeks before harvest

¹Apply 1-2 lb/A of boron (B) with broadcast fertilizer; see also Table B-7. in Chapter B Soil and Nutrient Management.

²For sweet onions avoid sulfur applications. For other onions apply 20-30 lb/A of sulfur (S) for most soils.

³In VA, crop replacement values of 25 lb/A of P₂O₅ and 25 lb/A of K₂O are recommended on soils testing Very High.

Seed Treatment

Buy commercial fungicide treated seed, if available. See Disease Control below.

Planting and Seeding Dates

For dry bulb onions, sets or seeds can be planted as soon as soil conditions are favorable in the spring; transplants can be planted March 20 to April 1. For bunching onions, seeds can be planted as soon as soil conditions are favorable in the spring; successive plantings can be made through the summer. For PA growers, the Simply Sweet Onion™ branding program is an option. Visit <https://www.pvga.org/services/pennsylvanias-simply-sweet-onion/> and/or contact the PA Vegetable Growers Association for more information (717-973-5915 or pvga@pvga.org).

Transplant Production

Produce onion transplants in cell trays. For sweet Spanish transplants, the recommended maximum cell size is 338 cells per tray. Grow transplants 10-12 weeks and maintain a plant height of 4 inches by trimming the plants with a sharp clean blade.

Spacing

For dry bulb onions, space rows 24 inches apart. Space 8-9 sets per ft (24 bushels/A). For large Spanish onions, space sets 4-5 inches apart and seeds ½-2 inches in row (2 lb/A using split shoe). For bunching onions, space rows 12-16 inches apart; space seed ½-1½ inches apart (7-10 lb/A). Plant seed ½-¾ inch deep except on muck soils. On muck soils plant seed ½-1 inch deep. Place sets 1-1½ inches deep.

Plasticulture

For sweet Spanish onion, plasticulture has resulted in consistent high quality, large-sized bulb onions. Raised beds (6-8 inches high) are generally placed on 72-78-inch centers (66-inch centers if equipment is adjustable and soil friable). Transplant on 6 x 6 inch spacing with 4 rows across a 28-30-inch-wide raised bed. Two drip irrigation lines are placed in the bed between each of the outer 2 rows of transplants to maintain adequate soil moisture for sizing onion bulbs and producing a sweet taste.

Broadcast 2/3 of the recommended N prior to making raised beds and laying plastic and 1/3 through the drip irrigation system. Apply P and K as well as any magnesium or calcium based on soil test results prior to making the beds with plastic mulch and drip tape. If top growth appears chlorotic (yellow) or stunted, a tissue test analysis is recommended to make corrective measures before onions initiate bulb enlargement. Avoid using sulfur containing fertilizers. While some sulfate is required for optimum plant growth, soil sulfur levels should be less than 20 ppm since high soil sulfur increases the pungency of onion bulbs by increasing pyruvic acid levels.

Onions are shallow-rooted, and unless moisture supply is constant, they bulb early and produce small bulbs. To minimize leaching of nitrogen from the root zone, light, frequent irrigations should be used when onions are small (3 to 5 applications of 1.5-2 inches of water/week are recommended). Soil type does not affect the total amount of water needed but does dictate the frequency of application. Lighter soils need more frequent applications, but less water applied per application. Irrigation should thoroughly wet the soil to a depth of 18 inches. Stop watering after bulbs have reached full size, and tops have begun to fall.

Cultivation

For bunching onions, hill 1-2 inches to ensure white bases.

Harvest and Post-Harvest Considerations

Bulb Onions:

Start harvesting when at least 50% of tops have fallen. Tops of some Sweet Spanish cultivars may not fall at maturity and bulbs must be checked for desired size before harvesting. Pull bulbs by hand or undercut them without damaging their base. In plasticulture, pull bulbs through existing holes in the plastic. Under dry conditions, lay bulbs on the soil or mulch surface for 3 days. If rain is predicted, cut the tops (leaving 1.5-inch necks; shorter necks increase the risk of disease) and place bulbs in potato burlap bags or bulk bins. Place burlap bags in a greenhouse or high tunnel for 5-7 days; cover burlap with sheets of row cover material to reduce/eliminate sunburn. Place bulk bins in a room with high air flow and controlled heat source (maximum drying temperature 90°F or 32°C). Keep in dryer at moderate heat for at least 48 hours. Check randomly selected onions for dryness of the neck surface paper. For

F. Onions

storage of sweet onion (up to 2 months), maintain cool temperatures (38-45°F, 3-7°C), low relative humidity (75-85%) and active air movement.

For storage-type onions, bulbs are undercut, and after an appropriate time, lifted and windrowed for field curing. Rod-weeder diggers and knife undercutters are commonly used. Tops may be left on to prevent sunscald or removed by hand or machine in the windrowing operation. With good air movement and proper placement, onions store best with tops on. However, this may complicate removal from storage and cause extra handling at packing.

Onions should be adequately cured in the field, in open sheds, or by forced air. In the field or in open sheds, this may require 2-4 weeks, depending on the weather. The best skin color develops between 75-90°F (24-32°C) and 60-75% relative humidity. The most common curing method is forced ventilation in storage. Heated air (75-85°F, 24-29°C) is blown through onions at a rate of 2 cubic feet per minute (CFM). Onions are considered cured when the neck is tight, and the outer scales are dry and brittle. This condition is reached after a 3-5% weight loss. If not adequately cured, stored onions are likely to decay.

Onions that are marketed in late spring are often stored refrigerated. Onions should be placed in cold storage immediately after curing. At 32°F (0°C) and with enough air circulation, onions that were cured well will stay dormant and reasonably free from decay for 6-8 months.

Green Onions and Scallions:

Harvest should begin when the base is ¼-½ inch in diameter. Semi-bulbing types will be slightly enlarged (up to 1 inch) at the base. Hand pull and bunch with 6-9 onions, or ¼ lb, held together with rubber bands. Pulling is usually done without undercutting and bunching is usually done in the field. Field boxes are moved to packing areas within 2-3 hours after harvesting. It is recommended that bunched green onions are run through a washer/cooler machine with wash water temperatures of 33-35°F (1-2°C). Green tops are usually trimmed to 12 inches. Harvested onions may be bunched in the packing shed. Chilled wash water removes field and ambient heat and then the onions are immediately packed in waxed boxes. Hold green onions at 32°F and 95-100% relative humidity. Green onions are normally marketed promptly but can be stored 3-4 weeks at 32°F if moisture loss is prevented. Crushed ice or packaging in perforated polyethylene film aids in preventing moisture loss.

Weed Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F.

Recommended Herbicides

1. Identify the weeds in each field and select recommended herbicides. More information is available in the "Herbicide Effectiveness on Common Weeds in Vegetables" (Table E-3) in Chapter E Pest Management.
2. Minimize herbicide resistance development. Identify the herbicide mode of action group number and follow recommended good management practices; **bolded group numbers in tables below are herbicides at higher risk for selecting resistant weed populations.** Include non-chemical weed control whenever possible.

1.a. Soil-Applied (Preplant Incorporated or Preemergence)						
Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
3	Prowl H2O 3.8CS	2 pt/A	pendimethalin	0.95 lb/A	30	24
<p>-Labeled for green onions. Apply at time of seeding or postemergence. Do not apply preemergence to onions planted on mineral soils with less than 3% organic matter or injury may occur. Onion seed must be fully covered by soil, injury may occur if seed is exposed. Prowl H2O can be applied directly over emerged plants with 2 to 3 true leaves without crop damage. -If sequential applications are made, allow 30 days between applications. -Prowl will not control emerged weeds, only provides residual control, controls most annual grasses and certain broadleaf weeds. -Do not apply more than 2 pt/A per application; and do not apply more than 4 pt/A per season.</p>						
3	Prowl 3.3EC Prowl H2O 3.8CS	4.8 pt/A 4 pt/A	pendimethalin	1.9 lb/A	45	24
<p>-Bulb onions grown on muck soils only. Apply from preemergence through 9 true leaf stage; crop safety is greater if application is delayed to loop stage. If irrigating, do not apply more than 0.5 inches of water until loop stage, do not apply more than 0.5 inches of water until loop stage. -Prowl will not control emerged weeds, only provides residual control. Controls most annual grasses and certain broadleaf weeds. -Do not apply more than 14.4 pt/A per season of Prowl 3.8EC, or more than 12.6 pt/A per season of Prowl H2O.</p>						
8	Prefar 4E	5 to 6 qt/A	bensulide	5 to 6 lb/A	--	12
<p>-Bulb onions only. Labeled for preplant incorporated or preemergence applications; do not incorporate more than 2 inches deep (1 inch is optimum). If applied preemergence, irrigate within 36 h of application with ½ inch of water; if not incorporated with irrigation or rainfall within 36 h, weed control may be reduced. -Provides control/suppression of some annual grass weeds and some broadleaves including pigweeds, purslane, and lambsquarters. -Do not apply more than 6 lb ai/A per season.</p>						

1.b. Post-Transplant Application / Preemergence Control						
Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
3	Prowl 3.3EC Prowl H2O 3.8CS	1.8 to 3.6 pt/A 1.5 to 3.2 pt/A	pendimethalin	0.7 to 1.5 lb/A	45	24
- Bulb onions only. Apply directly over emerged onions with 2 to 9 true leaves. If sequential applications are made, allow 30 days between applications. -Prowl will not control emerged weeds, only provides residual control, controls most annual grasses and certain broadleaf weeds. - Do not apply more than 3.6 pt/A per season of Prowl 3.8EC, or more than 3.2 pt/A per season of Prowl H2O.						
15	Dual Magnum 7.62E	0.67 to 1.33 pt/A	s-metolachlor	0.064 to 1.27 lb/A	21/60	24
- Special Local Needs Label 24(c) for the use of Dual Magnum 7.62E to control weeds in dry bulb onions in NJ and PA and in green onions in NJ (NJ expires 1/28/2027; PA expires 12/31/2027). The use of this product is legal ONLY if a waiver of liability has been completed (see: https://www.syngenta-us.com/labels/indemnified-label-login).						
-Apply at the 2 true leaf stage; a second application if soil organic matter is greater than 5%. The 2 nd application cannot be less than 21 days apart (bulb onions only). Dual Magnum will not control emerged weeds. Emerged weeds should be controlled by cultivation, hoeing, or postemergence herbicides prior to Dual Magnum application.						
-For bulb onions: do not make more than 2 applications per crop and do not apply more than 1.33 pt/A in a single application or more than 2.6 pt/A per crop; for green onions do not apply more than once and do not apply more than 1.33 pt/A.						
- Do not harvest bulb onions within 60 days of application or green onions within 21 days of application.						
15	Outlook 6E	10 to 21 fl oz/A	dimethenamid	0.47 to 0.98 lb/A	30	12
- Bulb onions only. Apply after onions have reached the 2 true-leaf stage. A second application may be needed for longer season seed onions; but will not control emerged weeds. If split applications are made allow at least 14 days between applications.						
-Application rates vary with soil and organic matter content. See the label for specific instructions. Outlook provides control of many grass species and a few small-seeded broadleaf weeds. - Do not apply more than 21 fl oz/A in a single growing season.						

2. Postemergence						
Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
1	Shadow 3EC Select 2EC Select Max 0.97EC Fusilade DX 2EC Poast 1.5EC	4 to 10.67 fl oz/A 6 to 8 fl oz/A 9 to 32 fl oz/A 8 to 24 fl oz/A 1 to 1.5 pt/A	clethodim fluazifop sethoxydim	0.07 to 0.24 lb/A 0.125 to 0.19 lb/A 0.2 to 0.3 lb/A	45 45 30	24 12 12
- Select 2EC/Select Max 0.97EC labeled for bulb onions only. Shadow 3EC labeled for dry bulb at 4 to 10.67 fl oz/A and labeled for green onions at 4 to 5.33 fl oz/A.						
- Select 2EC: use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution). Select Max 0.97EC: use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution). Shadow 3EC: use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution) for large or stressed grasses; use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution) when crop safety is a concern. Fusilade DX 2EC: use COC at 1.0% v/v or NIS at 0.25% v/v. Poast 1.5EC: use COC at 1.0% v/v.						
- General comments: -The use of COC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, switch to NIS when grasses are small and soil moisture is adequate. -Use lower labeled rates for annual grass control and higher labeled rates for perennial grass control. For best results, treat annual grasses when they are actively growing and before tillers are present. -Yellow nutsedge, wild onion, wild garlic, and broadleaf weeds will not be controlled with these herbicides. -These herbicides control many annual and certain perennial grasses. Clethodim is best on annual bluegrass; while Poast is preferred for goosegrass control. -Repeated applications may be necessary to control certain perennial grasses. If repeat applications are necessary, allow 14 days between applications. -Rainfastness is 1 h.						
- Do not tank mix with or apply within 2 to 3 days of any other pesticide, unless labeled, as this may increase the risk of crop injury or reduce the control of grasses. Do not apply more than 8 fl oz/A of Select 2EC in a single application and do not exceed 2 applications for the season; do not apply more than 32 fl oz/A of Select Max in a single application and do not exceed 4 pt/A for the season.						
- Shadow 3EC Do not apply more than 5.33 fl oz/A for green onion and do not make more than one application per season; for dry bulb onions do not exceed 10.67 fl oz/A in a single application and do not exceed 21.33 fl oz/A for the season						
- Do not apply more than 24 fl oz/A of Fusilade DX in a single application and do not exceed 3 pt/A per season.						
- Do not apply more than 1.5 pt/A Poast in a single application and do not exceed 4.5 pt/A for the season.						
6	Maestro 2E	1 to 1.5 pt/A	bromoxynil	0.25 to 0.375 lb/A	60, 112*	24
- Bulb onions only. Apply to onions with 2 to 5 true leaves. Apply in a minimum of 50 gals/A. Leaf surface should be dry at time of application. No surfactant or adjuvant is recommended due to risk of crop injury. -Apply to small broadleaf weeds (up to 4-leaf stage, 2 inches in height or 1 inch diameter). -Rainfastness is 1 h. Do not apply more than 1.5 pt/A during the season.						
*Do not harvest for 112 days after application on mineral soils or 60 days on muck soils grown in the northeastern US.						
14	Goal 2XL GoalTender 4F	2 to 4 fl oz/A (NJ) Up to 8 fl oz/A (all other states) 1 to 2 fl oz/A (NJ) up to 4 fl oz/A (all other states)	oxyfluorfen	0.03 to 0.125 lb/A	45	48

2. Postemergence - Goal, GoalTender - continued next page

F. Onions

2. Postemergence - Goal, GoalTender - continued

<p>-Bulb onions only Apply when onions have a minimum of 3 true leaves (do not count the flag leaf)</p> <p>-Multiple treatments of 8 fl oz/A (4 fl oz/A in NJ) can be made up to a maximum of 32 fl oz/A per season.</p> <p>-Goal may cause injury to onion foliage; the injury will appear as necrotic spots on leaves and/or twisted leaves. Heed the following precautions to avoid or minimize injury: Use flat fan nozzles, 20-40 psi and 20-40 gal/A of water. Do not tank mix with any other pesticide. Do not use surfactant, oil concentrates, or any other additive. Do not apply during extended periods of cool, wet, cloudy weather. Control is best if weeks are in the 2 to 4 leaf stage and actively growing. Rainfastness is not specified.</p> <p>-Maximum Goal 2XL application per season 32 fl oz/A. Maximum GoalTender 4F application per season 16 fl oz/A.</p>						
15	Zidua SC 4.17L	2 to 2.75 fl oz/A	pyroxasulfone	0.065 to 0.09 lb/A	60	12
<p>-Apply to onions with 2 to 6 true leaves that have been direct-seeded or transplanted. May result in temporary crop injury.</p> <p>-Zidua controls germinating annual broadleaf and grassy weeds but will not control emerged weeds.</p> <p>-Do not use on coarse soil types. -Do not apply more than 2.75 fl oz/A during the season. -Do not harvest for 60 days after application.</p>						

3. Postharvest

Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient	Active Ingredient Rate	PHI (d)	REI (h)
22	Gramoxone SL 3.0*	1.5 to 2 pt/A	paraquat	0.56 to 0.75 lb/A	--	24
<p>-Supplemental Label in DE for postharvest application to desiccate the crop. -Apply after the last harvest for bareground or plasticulture. Always include an adjuvant. -Spray coverage is essential for optimum effectiveness. See the label for additional information and warnings. -Rainfastness 30 min. A maximum of 2 applications for crop desiccation are allowed.</p> <p>-Paraquat not allowed on much soils.</p> <p>-Restricted-use pesticide. Only certified applicators, who successfully complete the paraquat-specific training, can mix, load, or apply paraquat. Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed. Required training link (https://campus.extension.org/enrol/index.php?id=2201); certified applicators must repeat training every three years.</p>						

4. Other Labeled Herbicides

These products are labeled but limited local data are available; and/or are labeled but not recommended in our region due to potential crop injury concerns.

Group	Product Name (* = Restricted Use)	Active Ingredient
8	Norton	ethofumesate (dry bulb onion)
14	Aim (hooded or directed application only)	carfentrazone
27	Optogen (use on muck soils only, row middles only)	bicyclopyrone

Insect Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F.

Recommended Insecticides

Note: For **premixes**, the group number (representing the mode of action) and active ingredient that contributes the most to control is generally listed first. In some cases, only one ingredient in a premix provides control.

Soil Pests

Onion Maggots

Rotation is extremely important to reduce damage. First-brood adult flies appear in early to mid-May, second brood in July, and third brood in August-September. Flies migrate up to half a mile. Foliar insecticide applications are not likely to control maggot flies as flies spend most of their time outside onion fields. If a spray is applied, apply directly over the row. Soak soil around base of seedlings. Fall maggots are most important because they may end up in stored onions and cause rot. Avoid mechanical injury to bulbs in the field or during harvesting. Crushed onions or culls attract onion maggot flies. Eliminate (bury) culls. Onion seed treated commercially with cyromazine (Trigard ST) is available (pelleted). While only one insecticide is listed other formulations can be used.

Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Pre-planting or in-furrow broadcast just before planting, mix into top 3-4 inches of soil:						
1B	Diazinon AG500*	2.0 to 4.0 qt/A	diazinon	60	72	H
Post-Planting Spray Treatment:						
1B	Malathion 57 AG	2.5 pt/A	malathion	3	12	H
3A	Mustang Maxx*	2.2 to 4.0 fl oz/A	zeta-cypermethrin	7	12	H
3A	Permethrin 3.2EC*	4.0 to 12.0 fl oz/A	permethrin (also has a repellent effect)	1	12	H
3A	Proaxis*	1.92 to 3.20 fl oz/A	gamma-cyhalothrin - bulb only	14	24	H
3A	Warrior II*	0.96 to 1.60 fl oz/A	lambda-cyhalothrin - bulb only	14	24	H

Aboveground Pests

Allium Leafminers

This new pest to the Mid-Atlantic area is a long grey-black fly with a distinctive yellow or orange patch on the top of its head, yellow sides, and “knees” (femur-tibia junction), and white halteres (knobs as second pair of wings). The larvae are typical whitish maggots. Leek (*A. porrum*) or scallions (green onions) tends to be the most damaged Allium species or cultivar. Females repeatedly puncture leaves with their ovipositor, resulting in a line of small white dots. Leaves can be wavy, curled, and distorted. The larvae mine leaves and move into bulbs and leaf sheathes where they pupate. Covering plants in April-May, or September-October, during the adult flight, can exclude the pest. Avoid the adult oviposition period by delaying planting. Systemic and contact insecticides can be effective.

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
3A	Mustang Maxx*	2.24 to 4.0 fl oz/A	zeta-cypermethrin	7	12	H
3A	Proaxis*	1.92 to 3.2 fl oz/A	gamma-cyhalothrin	14	24	H
3A	Warrior II*	0.96 to 1.60 fl oz/A	lambda-cyhalothrin	14	24	H
4A	Scorpion 35SL	8.75 to 10.5 fl oz/A	dinotefuran - soil	21	12	H
4A	Scorpion 35SL	5.25 to 7.0 fl oz/A	dinotefuran - foliar	1	12	H
4A	Venom 70SG	5.0 to 6.0 oz/A	dinotefuran - soil	21	12	H
4A	Venom 70SG	3.0 to 4.0 oz/A	dinotefuran - foliar	1	12	H
5	Entrust SC (OMRI)	3.0 to 6.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	6.0 to 10.0 fl oz/A	spinetoram	1	4	H
17	Trigard 75WSP	2.66 oz/A	cyromazine	7	12	H
28	Exirel	13.5 to 20.5 fl oz/A	cyantraniliprole	1	12	H
28 + 6	Minecto Pro* ¹	7.0 to 10.0 fl oz/A	cyantraniliprole + abamectin	30	12	H
30	Vertento	1.1 to 2.0 fl oz/A	isocycloseram	7	12	H

¹Use of a non-sticker adjuvant is required.

Armyworms (note: uncommon pest of *Allium* crops)

Apply one of the following formulations:						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
3A	Permethrin 3.2EC*	6.0 to 12.0 fl oz/A	permethrin	1	12	H
5	Entrust SC (OMRI)	3.0 to 6.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	5.0 to 10.0 fl oz/A	spinetoram	1	4	H
28	Vantacor	1.2 to 2.5 fl oz/A	chlorantraniliprole	1	4	L

Cutworms

See also section E 3.1. Soil Pests - Detection and Control.

Infestations often occur early in the spring and damaging infestations are usually limited to the earliest plantings. Infestations are intermittent and there are no useful methods to predict when and if the pest might occur. Black cutworm moths are attracted to fields containing winter and perennial weeds such as chickweed, purslane, shepherd's purse, and yellow rocket. Moths also are attracted to cereals used as a winter cover crop. The larvae feed just below the soil surface, eventually pulling the aboveground portion into the feeding cell. One possible management option includes reducing winter and perennial weeds that serve as oviposition sites.

Apply one of the following formulations, sprays should be directed at the bases of plants.						
Group	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	3.0 pt/A	methomyl	7	48	H
3A	Mustang Maxx*	2.24 to 4.0 fl oz/A	zeta-cypermethrin	7	12	H
3A	Proaxis*	1.92 to 3.2 fl oz/A	gamma-cyhalothrin	14	24	H
3A	Warrior II*	0.96 to 1.6 fl oz/A	lambda-cyhalothrin	14	24	H
3A	Permethrin 3.2AG*	4.0 to 12.0 fl oz/A	permethrin	1	12	H

Leafminers (*Liriomyza*) Adult leafminer flies are black and yellow. The female punctures the leaf to feed on plant sap and to lay eggs. Eggs hatch within 2-4 days and the yellow larvae tunnel within the leaf tissue, producing the characteristic “mines” in the leaf. Larvae pupate in the soil or in the leaf axils on plants. Many generations occur each year. Damage caused by leafminers can result in dried out, dead foliage and loss of yield or quality.

F. Onions

Leafminers - continued

Apply one of the following formulations:						
Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
4A	Scorpion 35 SL	8.75 to 10.5 fl oz/A	dinotefuran - soil	21	12	H
4A	Scorpion 35 SL	5.25 to 7.0 fl oz/A	dinotefuran - foliar	1	12	H
4A	Venom 70SG	5.0 to 6.0 oz/A	dinotefuran - soil	21	12	H
4A	Venom 70SG	3.0 to 4.0 oz/A	dinotefuran - foliar	1	12	H
5	Entrust SC (OMRI)	3.0 to 6.0 fl oz/A	spinosad	1	4	H
5	Radiant SC	6.0 to 10.0 fl oz/A	spinetoram	1	4	H
17	Trigard WSP	2.66 oz/A	cyromazine	60	12	H
28	Exirel	13.5 to 20.5 fl oz/A	cyantraniliprole - use with adjuvant	1	12	H
28 + 6	Minecto Pro* ¹	7.0 to 10.0 fl oz/A	cyantraniliprole + abamectin	30	12	H
30	Vertento	1.1 to 2.0 fl oz/A	isocycloseram	7	12	H

¹Use of a non-sticker adjuvant is required.

Thrips Onion thrips populations frequently increase following adjacent alfalfa or cereal harvest, as adults overwinter in these fields. Thrips pierce plant tissue and remove plant liquids. Immature thrips usually feed on young tissue between the leaf sheaths and stem, adults feed on more mature tissue. Feeding damage on leaves looks like whitish or chlorotic streaks. If feeding is severe, particularly under dry conditions, the tips of leaves become brown. Prolonged feeding reduces bulb size and increases the incidence of leaf and bulb rots. There are 3-5 overlapping generations per season. Effective management relies primarily on foliar insecticide sprays based on some treatment threshold, usually from 2-4 immatures/leaf. High spray pressures and high gallonages are necessary to ensure good contact between the pest and chemical. Twin flat fan nozzles result in greater coverage than single flat fans. **Note:** Use of spinosad for leafminer control will suppress thrips population. Other thrips species that are less susceptible to pyrethroids or neonicotinoids may be present besides onion thrips.

Apply one of the following formulations:						
Group	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV*	3.0 pt/A	methomyl	7	48	H
3A	Lambda-Cy 1EC*, others	2.56 to 3.84 fl oz/A	lambda-cyhalothrin	14	24	H
3A	Mustang Maxx*	2.88 to 4.0 fl oz/A	zeta-cypermethrin	7	12	H
3A	Permethrin 3.2AG*, others	6.0 to 12.0 fl oz/A	permethrin	1	12	H
3A	Warrior II*	1.28 to 1.92 fl oz/A	lambda-cyhalothrin	14	24	H
4A	Admire Pro	14.0 fl oz/A	imidacloprid - soil	21	12	H
4A	Assail 30SG	5.0 to 8.0 oz/A	acetamiprid	7	12	M
4A	Assail 30SC	4.2 to 6.7 fl oz/A	acetamiprid	7	12	M
4A	Scorpion 35SL	8.75 to 10.5 fl oz/A	dinotefuran - soil	21	12	H
4A	Scorpion 35SL	5.25 to 7.0 fl oz/A	dinotefuran - foliar	1	12	H
4A	Venom 70SG	5.0 to 6.0 oz/A	dinotefuran - soil	21	12	H
4A	Venom 70SG	3.0 to 4.0 oz/A	dinotefuran - foliar	1	12	H
5	Radiant SC	6.0 to 10.0 fl oz/A	spinetoram	1	4	H
6	Agri-Mek SC* ¹	1.75 to 3.5 fl oz/A	abamectin	30	12	H
6 + 28	Minecto Pro* ¹	7.0 to 10.0 fl oz/A	abamectin + cyantraniliprole	30/7 (green)	12	H
21A	Torac	24 fl oz/A	tolfenpyrad	7	12	H
23	Boxadon 360	2.1 to 3.4 fl oz/A	spirotetramat	1	24	L
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat - larvae	3	24	L
30	Vertento	1.1 to 2.0 fl oz/A	isocycloseram	7	12	H

¹Use of a non-sticker adjuvant is required. [Insecticides with Suppression Only on the label: Entrust SC (OMRI), Exirel]

Disease Control

THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F. Recommended Fungicides

Seed Treatment

Check with your seed company if fungicide treated seed is available. Multiple fungicides are often needed to manage the diversity of soilborne fungi that cause decay.

Damping-off caused by *Pythium* and *Rhizoctonia*

Code	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Pythium Root Rot						
4	Ridomil Gold 4SL ¹	0.5 to 1.0 pt/A	mefenoxam	7	48	N
4	Ultra Flourish 2E ¹	1.0 to 2.0 pt/A	mefenoxam	AP	48	N
Pythium and/or Rhizoctonia Root Rot						
4 + 11	Uniform 3.72SC	0.34 fl oz/1000 ft of row in-furrow (see label), or apply 4.5 fl oz/A to the bed during shaping for transplanted onions	mefenoxam + azoxystrobin	AP	0	N

¹Applied as a broadcast or banded immediately after seeding the field

Bacterial Diseases**Soft rot, Slippery Skin, Sour Skin and Center Rot**

Plant pathogen-free seed and transplants. Rotate to a non-host for 2 or more years and eliminate volunteer onions and weeds. Avoid overhead irrigation, especially with water that may be contaminated with pathogen(s). Minimize injury to maturing or harvested bulbs and consider harvesting early under high disease pressure. Dry mature bulbs as soon as possible after harvest. For sweet onions grown on plastic mulch, consider transplanting them into silver reflective or black biodegradable plastic mulch to reduce the soil temperatures associated with increased losses due to center rot. When conditions are favorable for bacterial diseases, typically warm and wet, initiate a preventative program consisting of fixed copper tank mixed with mancozeb or ManKocide at 2.5 lb/A. There are also several copper-based products that are OMRI listed for use in organic production systems which will help suppress damage caused by bacterial diseases.

Fungal Diseases**Black Mold (*Aspergillus niger*)**

This fungus is common in the soil and crop residue and affects numerous vegetables. Manage by promptly and adequately drying bulbs after harvest. Heated air favors disease development. Storing bulbs at low temperature and humidity will help manage black mold. Fields with a history of black mold may benefit from preventative late season applications of azoxystrobin (7-day PHI).

Botrytis Leaf Blight (*Botrytis squamosa*)

The pathogen overwinters in cull piles, on onion debris in the soil, and as sclerotia where related crops were recently grown. Botrytis leaf blight is promoted by moist, cool to mild conditions. Eliminate inoculum sources and rotate 2 or 3 years between onion-related crops. Fungicides can be delayed until there is an average of 1 lesion on 10 leaves.

Apply and alternate between one of the following. Always alternate between fungicides from different FRAC codes to reduce chances for fungicide resistance development.						
Code	Product Name (* = Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
M05	chlorothalonil 6F	1.0 to 3.0 pt/A	chlorothalonil	7	12	M
3 + 9	Inspire Super 2.82EW	16.0 to 20.0 fl oz/A	difenoconazole + cyprodinil	7	12	--
7	Endura 70WG	6.8 oz/A	boscalid	7	12	--
7	Fontelis 1.67SC	16.0 to 24.0 fl oz/A	penthiopyrad	3	12	L
7 + 3	Aprovia Top 1.62EC	10.5 fl oz/A	benzovindiflupyr + difenoconazole	7	12	--
7 + 11	Merivon Xemium	8.0 to 11.0 fl oz/A	fluxapyroxad + pyraclostrobin	7	12	N
7 + 11	Pristine 38WG	14.5 to 18.5 oz/A	boscalid + pyraclostrobin	7	12	--
9	Scala 5SC	9.0 fl oz/A	pyrimethanil	7	12	--
9 + 12	Switch 62.5WG	11.0 to 14.0 oz/A	cyprodinil + fludioxonil	7	12	L
11	azoxystrobin 2.08F	9.0 to 15.5 fl oz/A	azoxystrobin	0	4	N
11+M05	Quadris Opti 5.5SC	1.6 to 3.2 pt/A	azoxystrobin + chlorothalonil	7	12	M
29	Omega 500F	1.0 pt/A	fluazinam	7	48	N

Botrytis Neck Rot (*Botrytis alli*)

Infection is favored by cool, wet conditions and poor drying and curing, and often develops on injured bulbs in storage. Minimize nitrogen late in the season to promote drying of the necks at harvest. Windrow plants to ensure dry tops before topping operation. Apply and alternate between the following. Always alternate fungicides from different FRAC codes to reduce chances for fungicide resistance development. (continued next page)

F. Onions

Botrytis Neck Rot (Botrytis alli) - continued

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
7	Endura 70WG	6.8 oz/A	boscalid	7	12	--
7 + 11	Merivon Xemium	8.0 to 11.0 fl oz/A	fluxapyroxad + pyraclostrobin	7	12	N
9	Scala 5SC	9.0 fl oz/A	pyrimethanil	7	12	--
29	Omega 500F	1.0 pt/A	fluazinam	7	48	N

¹Apply at 14-day intervals (for dry bulb onions only).

Downy Mildew (*Peronospora destructor*) The pathogen can survive as oospores in the soil, or on bulbs, sets and seed. Downy mildew development is promoted by cool, moist conditions. Management begins with planting pathogen-free seed or sets and crop rotations of at least 3 years without related crops. Be sure to eliminate culls and volunteers from the field. Apply one of the following fungicides and rotate between different FRAC codes.

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
M03	mancozeb 75DF	3.0 lb/A	mancozeb	7	24	N
M05	chlorothalonil 6F	1.0 to 3.0 pt/A	chlorothalonil	7	12	M
11	Cabrio 20EG	12.0 oz/A	pyraclostrobin	7	12	N
11	Reason 500SC	5.5 fl oz/A	fenamidone	7	12	--
11+M05	Quadris Opti 5.5SC	1.6 to 3.2 pt/A	azoxystrobin + chlorothalonil	7	12	M
29	Omega 500F	1.0 pt/A	fluazinam	7	48	N
40 + 45	Zampro 525SC	14.0 fl oz/A	dimethomorph + acetochradin	0	12	--
49+M05	Orondis Opti ¹	1.75 to 2.5 pt/A	oxathiapiprolin + chlorothalonil	7	12	--

¹Also labeled for Botrytis leaf blight and purple blotch.

Purple Blotch (*Alternaria porri*) and Stemphylium Leaf Blight (*Stemphylium vesicarium*)

The pathogen overwinters in plant residue from onion-related plants. Purple blotch and Stemphylium development are favored by warm, moist conditions. Grow onions in well-drained soil and rotate with non-related crops. Sweet Spanish types are especially susceptible to purple blotch.

Apply and rotate between one of the following every 7 d as long as conditions favor disease development. Rotate fungicides from different FRAC codes to help reduce the development of fungicide resistance.						
Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
M05	chlorothalonil 6F (for purple blotch only)	1.0 to 3.0 pt/A	chlorothalonil	7	12	M
3 + 9	Inspire Super 2.82EW	16.0 to 20.0 fl oz/A	difenoconazole + cyprodonil	7	12	--
3 + 11	Quadris Top 1.67SC	12.0 to 14.0 fl oz/A	difenoconazole + azoxystrobin	7	12	--
7	Endura 70WG	6.8 oz/A	boscalid	7	12	--
7	Fontelis 1.67SC	16.0 to 24.0 fl oz/A	penthiopyrad	3	12	L
7 + 9	Luna Tranquility 4.16SC	16.0 to 27.0 fl oz/A	fluopyram + pyrimethanil	7	12	--
7 + 11	Merivon Xemium	5.5 to 11.0 fl oz/A	fluxapyroxad + pyraclostrobin	7	12	N
7 + 11	Pristine 38WG (apply at 14-d intervals)	10.5 to 18.5 oz/A	boscalid + pyraclostrobin	7	12	--
7 + 12	Miravis Prime	10.3 to 11.4 fl oz /A	pydiflumetofen + fludioxonil	7	12	--
9	Scala 5SC	9.0 fl oz/A	pyrimethanil	7	12	--
9 + 12	Switch 62.5WG ²	11.0 to 14.0 oz/A	cyprodinil + fludioxonil	7	12	L
11	azoxystrobin 2.08F	9.0 to 15.5 fl oz/A	azoxystrobin	0	4	N
29	Omega 500F	1.0 pt/A	fluazinam	7	48	N

¹Apply at high rate and at 14-day intervals (for dry bulb onions only). ² For Stemphylium leaf blight only.

White Rot (*Sclerotium cepivorum*)

White rot is most limiting in cool, moist soils and most severe on overwintered onions. The sclerotia can be long lived (over 20 years) in the soil in the absence of an Allium host. White rot development is very dependent on soil temperatures with optimum temperatures of 60-65°F (16-18°C).

Code	Product Name (*=Restricted Use)	Product Rate	Active Ingredient(s)	PHI (d)	REI (h)	Bee TR
Apply in a 4- to 6-inch band over or into the furrow at planting or may also be applied by chemigation:						
3	tebuconazole 3.6F	20.5 fl oz/A	tebuconazole	7	12	N
Two additional foliar applications may be applied (dry bulb onion only):						
3	tebuconazole 3.6F	4.0 to 6.0 fl oz/A	tebuconazole	7	12	N