

## Chapter 32.

# Onion, Leek, and Chive Production in Florida

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### BOTANY

#### Nomenclature

**Family** - Alliaceae (Amaryllidaceae)

**Onion** - *Allium cepa*

**Leek** - *Allium ampeloprasum*

**Chive** - *Allium schoenoprasum*

#### Origin

It is believed that all of the edible onions and their relatives are native to Asia.

#### Related Species

Garlic, shallot, and various exotic onions also are members of the Alliaceae family. Many important ornamentals also are included in this family.

### VARIETIES

Onion and leek varieties grown in Florida are listed below (H=hybrid):

#### Onion

Caramelo (H)  
 Dessex (H)  
 Georgia (H)  
 Granex 33 (H)  
 Linda Vista (H)  
 Savannah Sweet (H)  
 Sugar Belle (H)  
 Sweet Success (H)

#### Bunching Onion

Perfecto Blanco  
 Tokyo Long White  
 White Portugal

#### Leeks (Fig. 32-1)

King Richard  
 Tivi  
 Verina

### SEEDING AND PLANTING

Planting dates and seeding information are given in Table 1.

**Table 1.** Seeding and planting information for onion and allies.

Planting dates	Seeded	Transplanted
North Florida	Mid Sept - mid Nov	Nov - Jan
Central Florida	Oct	Dec - Jan
South Florida	Oct	Dec - Jan
<b>Planting information</b>		
Distance between rows (in) <sup>1</sup>	14 - 18	14 - 18
Distance between plants (in)	3 - 4	4 - 6
Seeding depth (in)	0.25 - 0.5	-
Seed per acre (lb)	3 - 4	1.0
Days to maturity	100 - 130	100 - 130 <sup>2</sup>
Plant populations (acre)	149,343	112,123
<sup>1</sup> Traditionally 14 inches between rows, 4 inches between plants.		
<sup>2</sup> From time of field setting.		

## FERTILIZER AND LIME

For unmulched onions with subsurface or sprinkler irrigation, broadcast all P<sub>2</sub>O<sub>5</sub> micronutrients, and 20 to 25% of N and K<sub>2</sub>O before planting (Fig. 32-2). Apply remaining N and K<sub>2</sub>O in split applications through the season up to bulb initiation. Overfertilization with N during bulbing can lead to double bulbs and split bulbs.

For mulched onions, incorporate all fertilizer in bed prior to mulching (Fig. 32-3). For mulched onions with subsurface irrigation, incorporate only 20 to 25% of the N and K<sub>2</sub>O. Place remaining N and K<sub>2</sub>O in bands in grooves 2 to 3 inches deep between rows on bed (see Table 2).

## IRRIGATION

Irrigation requirements of onions can be estimated from crop coefficients given in Tables 4 to 6 in Chapter 8, *Principles and Practices of Irrigation Management for Vegetables*. Irrigation requirements of leek and chives are expected to be similar to those shown for onions. Peak water use during rapid growth and development stages will be about 95% of ETo. Water use will continue at this rate for plants that are harvested green, while water use will drop to about 75% of ETo for onions that are allowed to dry before harvest. See Table 3 in Chapter 8, *Principles and Practices of Irrigation Management for Vegetables* for estimates of ETo in inches per day and gallons per acre per day for Florida climate conditions.

For optimum production, irrigations should be scheduled to maintain adequate soil moisture throughout the growing

season for plants that are harvested green. For onions that are to be harvested dry, irrigation can be discontinued after full growth has been obtained and the plants begin to dry. For drip and sprinkler irrigation, small, frequent applications should be scheduled to avoid water and nutrient losses below the plant root zone. For seepage irrigation, the field water table should be maintained sufficiently high that soil moisture is adequate but not excessively wet in the plant root zone throughout the growing season or until the plants are allowed to begin to dry for harvest.

## PLANT TISSUE ANALYSIS

Plant tissue analysis information for onion and allies is given in Table 3. The analysis was done prior to bulbing, using the most recently matured leaf.

## WEED MANAGEMENT

Herbicides labeled for weed control in onions and allies are listed in Table 4.

## DISEASE MANAGEMENT

The chemicals approved for disease management in onion and leek are listed in Table 5.

## INSECT MANAGEMENT

Table 6 outlines the insecticides approved for use on insects attacking onion and allies.

**Table 2.** Soil test and fertilizer recommendations for mineral soils for onion and allies.<sup>1</sup>

Target pH	N lb/A <sup>2</sup>	P <sub>2</sub> O <sub>5</sub> <sup>2</sup>					K <sub>2</sub> O				
		VL	L	M	H	VH	VL	L	M	H	VH
(lb/A/crop season)											
<b>Sweet bulb</b>											
6.5	150	150	120	100	0	0	150	120	100	0	0
<b>Bunching onion</b>											
6.5	120	120	100	100	0	0	120	100	100	0	0
<b>Leek</b>											
6.5	120	120	100	100	0	0	120	100	100	0	0

<sup>1</sup> See Chapter 2 section on supplemental fertilizer application and best management practices, pg 11.

<sup>2</sup> Seeds and transplants may benefit from applications of a starter solution at a rate no greater than 10 to 15 lbs/acre for N and P<sub>2</sub>O<sub>5</sub>, and applied through the plant hole or near the seeds.

**Table 3.** Plant tissue analysis just prior to bulbing for onion and allies. Dry wt. basis.

Status	N	P	K	Ca	Mg	S	Fe	Mn	Zn	B	Cu
	Percent						Parts per million				
Deficient	<2.0	0.2	1.5	0.6	0.15	0.2	50	10	15	10	5
Adequate range	2.0-3.0	0.2-0.5	1.5-3.0	0.6-0.8	0.15-0.30	0.2-0.6	50-100	10-20	15-20	10-25	5-10
High	>3.0	0.5	3.0	0.8	0.30	0.6	100	20	20	25	10
Toxic (>)										100	

**Table 4.** Chemical weed controls: onions, leek, garlic & shallot.

Herbicide	Labeled crops	Time of application to crop	Rate (lbs. AI./Acre)	
			Mineral	Muck
Bensulide (Prefar 4E)	onions (dry bulb), garlic, shallots	Preplant Preemergence	5-6	--
<b>Remarks:</b> Preplant incorporate to depth of 1-2 inches in well worked soil. Apply preemergence and irrigate to incorporate. With overhead irrigation, wet soil at least 2-4 inches deep. For furrow irrigation thoroughly wet the entire bed top. Controls many grass species.				
Bromoxynil (Buctril)	Onions Garlic	Preemergence Postemergence	0.25 - 0.375	---
<b>Remarks:</b> Apply to onions before planting until just prior to crop emergence (onions only). Postemergence apply to onions which have 2 to 5 true leaves or to garlic after emergence but before 12 inches in height. Controls several broadleaf weeds such as lambsquarter, smartweed, morningglory, spiny pigweed, ragweed, etc. (see label). When they are small, do not exceed 4 leaf stage, or less than 2 inches in height. Use at least 50 to 70 gallons of water per acre for application. Soil and onion foliage must be dry at time of applications. Waxy coating on onion leaves reduces chances for injury. Onion varieties vary in sensitivity. Use on a trial basis.				
Carfentrazone (Aim)	(All)	Preplant Directed-hooded Row-middles	0.031	0.031
<b>Remarks:</b> Aim may be applied as a preplant burndown treatment and/or as a post-directed hooded application to row middles for the burn-down of emerged broadleaf weeds. May be tank mixed with other registered herbicides. May be applied at up to 2 oz (0.031 lb ai). Use a quality spray adjuvant such as crop oil concentrate (coc) or non-ionic surfactant at recommended rates.				
Clethodim (Select)	Onions (dry bulb) Garlic Shallots (dry bulbs)	Postemergence	0.94-.125	.094-.128
<b>Remarks:</b> Material is a selective postemergence herbicide for control of annual and perennial grasses. Always use a crop oil concentrate at 1% v/v in the finished spray volume should range from 5 to 40 gallons per acre. Rates range from 6 to 8 oz. Product per acre for annual grasses up to 16 oz. Product for perennial grasses. Do not apply within 45 days of harvest.				
DCPA (Dacthal W-75)	Onions, Garlic	Preemergence Posttransplanting or At layby	6.0-10.5	---
<b>Remarks:</b> Controls germinating annuals. Incorporate 0.5 to 1.0 inch with overhead irrigation or shallow cultivation. Apply layby treatment to weed-free field up to 14 weeks after planting at rates not exceeding 10.5 lbs. ai./acre per season. In Hastings area, onions may be injured with single applications exceeding 6.0 lbs. ai./acre. Note precautions of planting non-registered crops within 8 months.				
Fluazifop-p (Fusilade)	Dry bulb onions, garlic	Postemergence	0.188	0.188
<b>Remarks:</b> Controls actively growing grass weeds. A total of 48 oz. product may be applied to the crop per season. Rates for the control of actively growing grass species at specific growth stages are specified on the label. Depending on the species, the growth stage for best control ranges from the 3- to 8-leaf stage. Use oil concentrates or non-ionic surfactants in the spray mixture. A pre-harvest interval of 45 days must be maintained.				
Glyphosate (Roundup, Durango Touchdown, Glyphomax)		Chemical fallow Preplant, pre emergence, Pre transplant	0.3 - 1.0	
<b>Remarks:</b> Roundup, Glyphomax and Touchdown have several formulations. Check the label of each for specific labeling directions.				
Oxyfluorfen (Goal 2XL) (Goaltender)	Dry bulb onions	Early postemergence Posttransplant	0.12 0.5	--- ---
<b>Remarks:</b> Spray when seeded onions have 2 fully developed true leaves. On transplanted onions spray as soon after transplanting as practical. Necrotic lesions, twisting or stunting of onion plants can occur if applications are made during cool, wet weather or prior to the full development of the true leaves on the onion plant. Multiple applications may be made. Do not apply within 60 days of harvest.				
Paraquat (Gramoxone Intron) (Firestorm)	Seeded onions: Green or dry bulb & Garlic	Preplant Preemergence	0.63 - 0.94	0.63 - 0.94
<b>Remarks:</b> Apply as a broadcast treatment prior to, during or after seeding, but before emergence of the crop for control of emerged weeds. Weeds and grasses emerging after treatment will not be controlled. Crop plants emerged at the time of application will be damaged. Use a non-ionic surfactant with application. Do not apply within 60 days of harvest.				
Pendimethalin (Prowl 3.3 EC)	Dry Bulb Onions	Preemergence (muck only) Postemergence or post-transplant	0.5 - 0.75	1.0 - 2.0
<b>Remarks:</b> In mineral soils, apply as broadcast treatment when onions have 2 to 9 true leaves at a rate of 1.2 to 1.8 pts. In muck soils may be applied sequentially as follows: Preemergence through loop stage (2.4 to 4.8 pts/A); Early postemergence (2 to 6 true leaf stage) 3.6 to 4.8 pts/A; Late postemergence (6 to 9 true leaf stage) 3.6 to 4.8 pts/A. Do not apply more than 14.4 pts/A per growing season on muck soils. Do not apply preemergence through loop stage if heavy rains are expected or severe crop injury may result. If irrigating after application, do not irrigate in excess of 0.5 inch. Do not apply within 45 days of harvest.				
Sethoxydim (Poast)	Bulb vegetables: all onions, dry bulb and bunching, garlic, leeks	Postemergence	.187	.187
<b>Remarks:</b> For control of actively growing grass weeds. Always add a crop oil concentrate at a rate of 2 pts./acre. Do not apply within 30 days of harvest. A general use rate of 1 pt. material may be used. Do not apply more than 4.5 pts. per acre in one season.				

**Table 5.** Disease management for onion.

Chemical (a.i.)	FRAC Group <sup>1</sup>	Maximum Rate/Acre/ Application	Season	Min. Days to Harvest	Pertinent Diseases or Pathogens	Remarks <sup>2</sup>
Ridomil Gold 4 EC (mefenoxam)	4	1 pt./trted acre			Pythium seedling blight	Apply at seeding in a 7-12" band on soil over seed furrow
Manex 4 F (maneb)	M3	2.4 qts	24 qts <sup>1</sup>	7	Botrytis leaf blight Purple blotch	Do not apply to exposed bulbs
Maneb 80 WP (maneb)	M3	3 lbs	30 lbs <sup>2</sup>	7	Botrytis leaf blight Purple blotch	Do not apply to exposed bulbs
Botran 75 W (dichloran)	14	5 1/3 lbs	5 1/3 lbs		Botrytis	Limit is 1 appl./crop
Botran 5 F (dichloran)	14	1 3/5 qts	2 qts	14	Botrytis	Do not plant spinach as a follow up crop
Penncozeb, Dithane M45, or Manzate 80 WPs (Dry bulb only) (mancozeb)	M3	3 lbs	30 lbs	7	Botrytis leaf blight Purple blotch	Do not apply to exposed bulbs
Dithane F-45 or Manex II 4 FLs (Dry bulb only) (mancozeb)	M3	2.4 qts	24 qts	7	Botrytis leaf blight Purple blotch	Do not apply to exposed bulbs
Rovral 75 WG (Dry bulb only) (iprodione)	2	1 lb	5 lbs	7	Botrytis leaf blight Purple blotch	Limit 5 appl./season
Maneb 75 DF (maneb)	M3	3 lbs	32 lbs <sup>3</sup>	7	Botrytis leaf blight Purple blotch	Do not apply to exposed bulbs
Equus 720 or Echo 720 6 FLs (chlorothalonil)	M5	2 pts <sup>4</sup>	20 pts	7 <sup>5</sup>	Botrytis leaf blight Purple blotch	Limit is 3 appl./crop for green bunching onions, leeks or shallots
Bravo Ultrex or Echo Ultimate 82.5 WDGs (chlorothalonil)	M5	1.8 lbs <sup>6</sup>	18.2 lbs (8.2 lbs for green onions, shallots & leeks)	7	Botrytis leaf blight Purple blotch	Limit is 3 appl./crop for green bunching onions, leeks or shallots
Penncozeb, Dithane, or Manzate 75 DFs (mancozeb)	M3	3 lbs	32 lbs	7	Botrytis leaf blight Purple blotch	Do not apply to exposed bulbs
Bravo Weather Stik 6 F (chlorothalonil)	M5	2 pts <sup>4</sup>	9 pts	7	Botrytis leaf blight Purple blotch	Limit is 3 appl./crop for green bunching onions, leeks or shallots
Pristine 38 WG (pyraclostrobin/boscalid)	11 + 7	18.5 ozs	111 ozs	7	Botrytis leaf blight Purple blotch Stemphyllium leaf blight	Limit is 6 appl./crop & alternate chemistry
Quadris Opti 0.5 & 5 FL (azoxystrobin)	11	3.2 pts	11.1 pts	14	Purple blotch Botrytis	Limit is 3 appl./crop & alternate chemistry. For green bunching, leeks & shallots
Endura 70 WP (boscalid)	7	6.8 ozs	41 ozs	7	Purple blotch Botrytis	Limit is 6 appl./crop & alternate chemistry
Acrobat 50WP (dimethomorph)	40	6.4 oz	32 oz	0	Downy mildew	Must be applied in a tank mix with another fungicide active against downy mildew. Do not make more than 2 sequential appl.
Phostrol 54% Salt (salts of phosphorus acid)	33	3.75 pt	26.25pt	0	Powdery mildew	
Aliette WDG (fosetyl-Al)	33	3.0 lb	21lb	7	Downy mildew Purple blotch	

Table 5. Continued.

Chemical (a.i.)	FRAC Group <sup>1</sup>	Maximum Rate/Acre/ Application Season	Min. Days to Harvest	Pertinent Diseases or Pathogens	Remarks <sup>2</sup>	
Helena Prophyt 54.5% Salt (potassium phosphite)	33	2 qt	0	Powdery mildew		
Various copper compounds (see ind. Labels), including Basic Copper 53, Champ, COC, Copper Count-N, Cuprofix Disperss, Kocide, Nordox, Nu Cop,	M1			Bacterial blight Downy mildew Purple blotch	See the individual labels	
Iprodione 4L (iprodione)	2	1.5 pt	7.5 pt	7	Botrytis Purple blotch	
Scala SC (pyrimethanil)	9	18 oz	54 oz	7	Botrytis Purple blotch	
Switch 625WG (cyprodinil/fludioxonil)	9 + 12	14 oz	56 oz	7	Botrytis Purple blotch	After 2 appl. of Switch, a/w with another fungicide with a different mode of action for 2 applications
Serenade Max (biofungicide) (QST 713 strain of <i>Bacillus subtilis</i> )		3 lb		0	Botrytis Downy mildew Purple blotch Rust	
Sonata (biofungicide) (QST 2808 strain of <i>Bacillus pumilis</i> )		4 qt		0	Downy mildew Powdery mildew Rust	
Topsin M 70WDG (other formulations available) (thiophanate-methyl)	1	2 lb			White rot	Spray in open furrows at seeding. Not to be used in any irrigation system
Ultra Flourish 2EC (mefenoxam)	4	2 pt/trtd acre			Pythium damping-off	Soil treatment at planting only
<sup>1</sup> 16.8 qts. for green onions <sup>2</sup> 21.0 lbs. for green onions <sup>3</sup> 22.4 lbs. for green onions <sup>4</sup> 3 pts. for green bunching, leeks, shallots & garlic <sup>5</sup> 14 days for green bunching, leeks, shallots & garlic <sup>6</sup> 2.7 lbs. for garlic						

**Table 6.** Selected insecticides approved for use on insects attaching onions and allies.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code <sup>1</sup>	Notes
<b>Agree WG</b> ( <i>Bacillus thuringiensis</i> subspecies <i>aizawai</i> )	1.0-2.0 lb	4	0	lepidopteran larvae (caterpillar pests)	11B1	Apply when larvae are small for best control. OMRI-listed <sup>2</sup> .
<b>*Ambush 25W</b> (permethrin) (dry only)	6.4-19.2 oz	12	1	armyworms, cutworms, leafminers, onion maggot (adults), onion thrips, stink bugs	3	Dry bulb only and garlic. Maximum of 128 oz/acre per season.
<b>*Ammo 2.5 EC</b> (cypermethrin)	2.0-5.0 fl oz	12	7	aphids, armyworms, cutworms, leafminers, onion maggot adults, stink bugs	3	All <i>Allium</i> spp., green and dry. Maximum of 25 oz product/acre per season.
<b>Aza-Direct</b> (azadirachtin)	1-2 pts, up to 3.5, if needed	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, mites, stink bugs, thrips, weevils, whiteflies	26	Antifeedant, repellent, insect growth regulator. OMRI-listed <sup>2</sup> .
<b>Azatin XL</b> (azadirachtin)	5-21 fl oz	4	0	aphids, beetles, caterpillars, leafhoppers, leafminers, thrips, weevils, whiteflies	26	Antifeedant, repellent, insect growth regulator.
<b>Biobit HP</b> ( <i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i> )	0.5-2.0 lb	4	0	caterpillars (will not control large armyworms)	11B2	Treat when larvae are young. Good coverage is essential. Can be used in the greenhouse. OMRI-listed <sup>2</sup> .
<b>BotaniGard 22 WP, ES</b> ( <i>Beauveria bassiana</i> )	<b>WP:</b> 0.5-2 lb/100 gal <b>ES:</b> 0.5-2 qts/100 gal	4	0	aphids, thrips, whiteflies	--	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Not compatible in tank mix with fungicides.
<b>Crymax WDG</b> ( <i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i> )	0.5-2.0 lb	4	0	caterpillars	11B2	Use high rate for armyworms. Treat when larvae are young.
<b>Deliver</b> ( <i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i> )	0.25-1.5 lb	4	0	caterpillars	11B2	Use higher rates for armyworms. OMRI-listed <sup>2</sup> .
<b>*Diazinon AG500, 4EC, *50W</b> (diazinon)	<b>foliar - AG500, 4EC:</b> 1 pt	24	14	onion thrips	1B	Bulb and green
	<b>50W: 1 lb preplant - AG500, 4EC:</b> 3-4 qts <b>50W:</b> 6-8 lb	24	preplant	wireworms	1B	See label.
<b>DiPel DF</b> ( <i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i> )	0.5-2.0 lb	4	0	caterpillars	11B2	Treat when larvae are young. Good coverage is essential. OMRI-listed <sup>2</sup> .
<b>Entrust</b> (spinosad)	1-2.5 oz	4	1	armyworms, dipteran leafminers, flea beetle, loopers, suppression of thrips	5	No more than 5 applications per year (9 oz product).
<b>Extinguish</b> (S)-methoprene)	1-1.5 lb	4	0	fire ants	7A	Slow-acting IGR (insect growth regulator). Best applied early spring and fall where crop will be grown. Colonies will be reduced after three weeks and eliminated after 8 to 10 weeks. May be applied by ground equipment or aerially.

Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code <sup>1</sup>	Notes
<b>Javelin WG</b> ( <i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i> )	0.12-1.5 lb	4	0	most caterpillars, but not <i>Spodoptera</i> species (armyworms)	11B2	Treat when larvae are young. Thorough coverage is essential. OMRI-listed <sup>2</sup> .
<b>Knack</b> (pyriproxyfen)	8 fl oz	12	3	onion thrips, western flower thrips	7D	Maximum of 2 applications, at least 14 days apart.
<b>*Lannate LV; *SP</b> (methomyl)	<b>LV:</b> 1.5-3.0 pt <b>SP:</b> 0.5-1.0 lb	48	7 = (dry and green)	beet armyworm, black cut- worm, thrips, variegated cutworm	1A	Add a wetting agent to improve coverage.
<b>Lepinox WDG</b> ( <i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i> )	1.0-2.0 lb	12	0	for most caterpillars, including beet armyworm (see label)	11B2	Treat when larvae are small. Thorough coverage is essential.
<b>Lorsban 15 G; 75WG</b> (chlorpyrifos)	See labels for rates	24	at plant- ing	onion maggot	1B	Dry bulb only.
<b>Malathion 8F</b> (malathion)	1-2 pt	12	3	onion maggot, thrips	1B	
<b>M-Pede 49% EC</b> Soap, insecticidal	1-2% V/V	12	0	aphids, leafhoppers, mites, plant bugs, thrips, whiteflies	--	OMRI-listed <sup>2</sup> .
<b>*Mustang Max</b> (zeta-cypermethrin)	2.24-4.0 oz	12	7	aphids, armyworms, cut- worms, leafminers, onion maggot adults, onion thrip, stink bugs	3	
<b>Neemix 4.5 EC</b> (azadirachtin)	4-16 fl oz	12	0	aphids, armyworms, cab- bage looper, cutworms, leafminers, onion maggot, thrips, whiteflies	26	OMRI-listed <sup>2</sup> .
<b>*PennCap-M</b> (methyl parathion)	2 pt	4 days - See label	15	thrips	1B	Do not apply when onions are blooming and bees are foraging.
<b>*Pounce 3.2 EC</b> (permethrin)	4-12 oz	12	1	armyworms, cutworms, leafminers, onion maggot, stink bugs, thrips	3	
<b>Pyrellin EC</b> (pyrethrin + rotenone)	1-2 pt	12	12 hours	aphids, leafhoppers, loop- ers, mites, plant bugs, stink bugs, thrips, white- flies	3, 21	
<b>*Telone C-35</b> (dichlo- ropropene + chloro- picrin)	See label	5 days - See label	preplant	symphylans, wireworms	--	See supplemental label for use restrictions in south and central Florida.
<b>*Telone II</b> (dichloropropene)						
<b>Trigard</b> (cyromazine)	2.66 oz	12	7	leafminers	17	Do not make more than 6 appli- cations.
<b>Trilogy</b> (extract of neem oil)	0.5-2.0% V/V	4	0	aphids, mites, suppression of thrips and whiteflies	26	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed <sup>2</sup> .



Table 6. Continued.

Trade Name (Common Name)	Rate (product/acre)	REI (hours)	Days to Harvest	Insects	MOA Code <sup>1</sup>	Notes
<b>*Warrior</b> (lambda-cyhalothrin)	1.92-3.84 fl oz	24	14	aphids, armyworms, cutworms, onion maggot adults, plant bugs, stink bugs, thrips	3	For bulb crops only, not green onions. Do not apply more than 0.24 lb ai/acre per season.
<b>Xentari DF</b> ( <i>Bacillus thuringiensis</i> subspecies <i>aizawai</i> )	0.5-2.0 lb	4	0	caterpillars	11B1	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic produc- tion.

The pesticide information presented in this table was current with federal and state regulations at the time of revision. The user is responsible for determining the intended use is consistent with the label of the product being used. Use pesticides safely. Read and follow label instructions.

<sup>1</sup> Mode of Action codes for vegetable pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v.3.3 October 2003. 1A. Acetylcholine esterase inhibitors, Carbamates 1B. Acetylcholine esterase inhibitors, Organophosphates

2A. GABA-gated chloride channel antagonists

3. Sodium channel modulators

4A. Nicotinic Acetylcholine receptor agonists/antagonists, Neonicotinoids

5. Nicotinic Acetylcholine receptor agonists (not group 4)

6. Chloride channel activators

7A. Juvenile hormone mimics, Juvenile hormone analogues

7D. Juvenile hormone mimics, Pyriproxifen

9A. Compounds of unknown or non-specific mode of action (selective feeding blockers), Cryolite

9B. Compounds of unknown or non-specific mode of action (selective feeding blockers), Pymetrozine

11B1. Microbial disruptors of insect midgut membranes, *B.t. var aizawai*

11B2. Microbial disruptors of insect midgut membranes, *B.t. var kurstaki*

12B. Inhibitors of oxidative phosphorylation, disruptors of ATP formation, Organotin miticide

15. Inhibitors of chitin biosynthesis, type 0, Lepidopteran

16. Inhibitors of chitin biosynthesis, type 1, Homopteran

17. Inhibitors of chitin biosynthesis, type 2, Dipteran

18. Ecdysone agonist/disruptor

20. Site II electron transport inhibitors

21. Site I electron transport inhibitors

22. Voltage-dependent sodium channel blocker

23. Inhibitors of lipid biosynthesis

25. Neuroactive (unknown mode of action)

26. Unknown mode of action, Azadirachtin

<sup>2</sup> OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

\* Restricted Use Only.