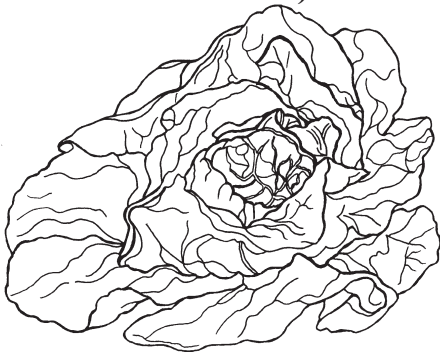


CULTURE AND CULTIVARS

FOR THE GARDENER,
BEDDING PLANT GROWER,
GARDEN CENTER SUPPLIER,
AND DIRECT MARKETER

Growing Leafy Vegetables

(Lettuce, Spinach, Turnip and Mustard Greens, Endive, Escarole, and Radicchio)



PENNSTATE



College of Agricultural Sciences
Agricultural Research and
Cooperative Extension

SPECIAL PRECAUTIONS

Leafy vegetables are of best quality when harvested under moderately cool temperatures (45 to 65°F is ideal). Thus, in Pennsylvania, spring and fall plantings are recommended. Spinach, head lettuce, romaine, radicchio, and most leaf lettuce cultivars may bolt or go to seed during the long, warm days of summer, so it is important to plant at the proper times. A few exceptions are certain cultivars that are especially heat tolerant such as those of spinach and mustard greens.

Loose, fertile, moist, sandy loam soils are best for growing leafy vegetables. Many of these crops have shallow root systems, so cultivate carefully.

CULTURAL PRACTICES

Starting Seedlings

To grow the best quality head lettuce, radicchio, and romaine or cos types in Pennsylvania, use transplants rather than seeds. Sow the seeds 5 to 7 weeks before the desired transplanting date. Seed of certain cultivars require light for germination. Refer to the seed packet to determine if the seed requires light. Once germinated, the seedlings should be transplanted into cells or flats with 1.5 by 1.5 inches or 2 by 2 inches of space between plants. Harden and transplant lettuce and radicchio as soon as the danger of a hard freeze (no lower than 29°F) is over. Harden plants by reducing water and temperatures for about 3 days and placing them outdoors during the day for one week prior to transplanting. This helps plants adjust to outside conditions. Endive and escarole are often seeded in a small row for later transplanting.

Soil pH and Fertility

All leafy vegetables, except lettuce, grow best in soils with a pH of 6.0 to 6.8. Lettuce grows best at about a pH of 6.5 to 7.0. We strongly recommend applying fertilizer and lime based on soil test results. Soil-testing kits can be purchased from Penn State Cooperative Extension offices or garden supply centers. In the absence of a soil test, apply 1 to 2 inches of compost and 3 pounds of 5-10-5

fertilizer per 100 square feet for head lettuce, romaine, turnip and mustard greens, and radicchio; use 4.5 pounds per 100 square feet for spinach, leaf lettuce, endive, and escarole. In both cases, mix into the soil before seeding or transplanting.

Application and Sidedress

Sidedress with small amounts of a high nitrogen fertilizer, or compost one or two times during the growing season.

Seeding Dates (Outdoors)

- Leaf lettuce: April 1 and August 1
- Head lettuce, romaine, and radicchio: August 1
- Spinach: April and the end of August
- Turnip and mustard greens: April 1 and August 1
- Endive and escarole: May to the end of July

Transplanting Dates (Outdoors)

- Head lettuce, romaine, and radicchio: April 20, August 15, or both

Depth of Seeding

- Lettuce, turnip greens, and mustard greens: 0.25 inch deep
- Escarole, endive, spinach, and radicchio: 0.5 inch deep

Spacing Between Rows

- Leaf lettuce, spinach, mustard, and turnip greens: 1.5 feet apart
- Head lettuce, endive, and escarole: 2 feet apart

Spacing Within Rows

- Leaf lettuce: 6 inches
- Head lettuce and radicchio: 12 inches
- Spinach: 4 to 6 inches
- Turnip and mustard greens: 8 inches
- Endive and escarole: 15 inches

HARVEST SUGGESTIONS




















Lettuce

Head lettuce, romaine or cos types, and radicchio are best harvested when the heads are firm but not so hard as to indicate overmaturity. Leaf lettuce may be harvested anytime after the outer leaves are 4 to 6 inches long. First, pull entire plants where they are too thick. When proper stand is established, pick outer leaves as needed.

SUGGESTED VARIETIES AND DESIRABLE CHARACTERISTICS




<i>Cultivars</i>	<i>Days to Maturity</i>	<i>Disease Resistance</i>	<i>Suggested Uses</i>	<i>Comments</i>
<i>Lettuce (Crisphead or Iceberg)</i>				
	58		G	White interior; juicy; mild
☉ Summertime	73	BR, TBR	G	Slower to bolt than 'Ithaca'; sweeter
Ithaca	75	BR, TBR	G	Dependable, firm heads
<i>Lettuce (Batavia or Summer Crisp), Green</i>				
☉ Nevada	48	TBR	G	Green 'Sierra' type; mild; resistant to tipburn and bolting; 8–9 inches in diameter; space closer
Anuenue	50		G	Glossy green; crisp; nonbitter; heat resistant
<i>Lettuce (Batavia or Summer Crisp), Red</i>				
☉ Sierra	48	BR, TBR	G	Red-tinged; resistant to tipburn, bottom rot and bolting
☉ Magenta	48	DMT, MR, TBR	G	Improved 'Sierra'; bottom rot resistant
<i>Lettuce (Romaine or Cos), Green</i>				
Green Forest	56	CR, TBR	G	Garden or greenhouse; earlier, taller, and darker than 'Green Towers'
Coastal Star	57	CR	G	Sweet flavor; dark green
Jericho	57		G	Dense; very heat tolerant
☉ Baby Star	62	DMR	G	Highly DMR; dark-green mini romaine
☉ Winter Density	64	APT	G	Romaine with butterhead interior; tolerant of frost; good for spring, summer, and fall
Vivian	70		G	16 by 6 inches across; buttery texture
Ideal Cos	71	TBR	G	Smooth; large framed, and heavy weight
☉ Green Towers	72	APT	G	Superior to 'Parris Island'; will not take heat
<i>Lettuce (Romaine or Cos), Red</i>				
☉ Eruption	50	DMT	G	Red form of 'Winter Density'
Outredgeous	53		G	Darkest red; 14 inches; open romaine
Rosalita	55		G	Earliest true red romaine
☉ Flashy Trout's Back (Forellenschluss)	60	APT	G	Red flecked open romaine; heirloom
☉ Cimmaron (Rouge D'Hiver)	68	APT	G	The reddest cos; harvest small for mesclun salad mixes or 12 inches for full size
<i>Lettuce (Butterhead, Bib, Boston), Green</i>				
☉ Ermosa	54	DMT, MR, TBR	G	Very dark green; bolt tolerant
☉ Nancy	54	BR, DMR, MR	G	Large; green Boston with thick, crisp leaves
☉ Buttercrunch	56		G	Slow bolting; excellent quality; AAS 1963
☉ Esmeralda	61	DMT, TBR	G	Very tipburn resistant; light weight for size
Bennett	61	TBR	G	Firm headed with wavy margins; crisp; very good flavor
Odyssey	62	TBR	G	Bolt tolerant; lime-green color
☉ Optima	65	DMT, MR, TBR	G	Darkest, largest Boston; very heat tolerant
<i>Lettuce (Butterhead, Bib, Boston), Red</i>				
Red Cross	48	DMR	G	Reddest; Improved 'Marvel of Four Seasons'
Pirat	49		G	Reddish tinge; heat resistant, tender hearts
Fireball	51		G	Heat tolerant; bitter free; longer and greener than 'Red Cross'
☉ Sangria	51	DMT, MR, TBR	G	Fancier red 'Pirat'; less heat tolerant; bicolored
<i>Lettuce (Leaf), Green</i>				
New Black Seeded Simpson	45		G	Green heirloom; early; excellent flavor; low heat tolerance
Tiara	46		G	Upright; puckered leaves; earlier and darker than 'Waldmann's Dark Green'
☉ Salad Bowl	46		G	Heat resistant; ideal for home gardens
☉ Green Ice	46	APT	G	Dark and crisp; fringed
☉ Waldmann's Dark Green	48	APT	G	Dark green; medium butterhead; high tunnels/greenhouses; best for late-spring and fall harvests

SUGGESTED VARIETIES AND DESIRABLE CHARACTERISTICS, CONTINUED

<i>Cultivars</i>	<i>Days to Maturity</i>	<i>Disease Resistance</i>	<i>Suggested Uses</i>	<i>Comments</i>
 Royal Oak Leaf Royal Green Tropicana	50 50 52	APT TBR CR, TBR	G G G	Favorite; slow bolting; green, giant leaves Very uniform; widely adapted; frilly leaves Wavy, glossy leaves; high heat tolerance
<i>Lettuce (Leaf), Red</i>				
 Red Sails Concorde New Red Fire  Red Salad Bowl Impulus Red Express	45 46 47 48 49 55 56	DMT APT APT	G G G G G G	Garden spring and fall; winter high tunnel/greenhouse Red with curled leaves; excellent eating quality; AAS 1985 Slow bolting; red-tinged; giant oak leaf Red, wavy, frilled leaves; slow bolting; heat tolerant Red with finely cut leaves Heavily frilled; deep red; use for garnish and mixed salads; slow bolting Deep red both sides of leaf; open frame
<i>Spinach (Spring)</i>				
 Space*  Melody*  Tyee*  Olympia*	30 40 42 42 46	MR MR DMR, MR DMT DMR	C, F, G C, F, G C, F, G C, F, G C, F, G	Early; sweet; vigorous Good heat tolerance Medium-green leaves; slightly wrinkled; susceptible to leaf minor; early fall; AAS bronze 1977 Early; uniform; tender; bolt resistant; wrinkled Smooth leaves; extremely slow to bolt; washes easily
<i>Spinach (Summer)</i>				
 Space*  Tyee*  Olympia*  New Zealand (not a true spinach)	40 42 46 65	MR DMT DMR APT	C, F, G C, F, G C, F, G C, F, G	Good heat tolerance The most bolt-resistant wrinkled type Smooth leaf type is easy to wash; early summer harvest; slow to bolt Heat tolerant; multiple harvest of branched tips
<i>Spinach (Fall)</i>				
 Space*  Melody*	30 40 42	MR MR DMR, MR	C, F, G C, F, G C, F, G	Early; sweet; vigorous Good heat tolerance Medium-green leaves; slightly wrinkled; susceptible to leaf miner; AAS bronze 1977
<i>Spinach (Overwintering)</i>				
 (Longstanding) Dark Green Bloomsdale	48		C, F, G	Large, wrinkled, dark-green leaves; slow bolting
<i>Turnip Greens</i>				
 Just Right*  Shogoin White Lady* Scarlet Queen Red Stems*  Seven Top Topper*	28 28 35 35 43 45 45	APT DMT, MR	F, G F, G F, G F, G F, G F, G	More tender; holds longer in hot weather For fall harvest; glossy and tender leaves; snowy white, tender roots at 60 days; AAS 1935 Aphid tolerant; leaves tall and strap shaped Long, bright-green tops; sweet, tender roots at 45 days Dark-green leaves; red stems Roots woody and inedible; tops very tender Fewer lobed leaves and higher yielding than 'Seven-Top'
<i>Mustard Greens</i>				
 Savanna* Osaka Purple Vitamin Green Green Wave	25 40 45 50	APT	F, G F, G F, G F, G	Very early; tender; productive; heat tolerant; 'Tendergreen' hybrid Tender; green with purple-red veins Flavorful but not mustardy; tolerant of cold and heat Long standing; bright green
<i>Endive</i>				
 Natasha Rhodes Neos	48 60 85	BR, TBR	G G G	Green outer leaves; creamy heart; bolt resistant 9 inches; very finely curled; uniform; compact Chicory endive; for summer production; 12 to 14 inches

(table continued on next page)

SUGGESTED VARIETIES AND DESIRABLE CHARACTERISTICS, CONTINUED

Cultivars	Days to Maturity	Disease Resistance	Suggested Uses	Comments
Tasos	90		G	Very cold tolerant and finely curled
 Salad King	97	APT	G	Tolerates hot and cold weather
Escarole				
 Eros	60	TBR	G	Early; upright leaves
Full Heart Batavian	90		G	Broad leaves; closely bunched
Radichchio				
Chioggia Red Preco No. 1	60		G	Round; early; cold and bolt tolerant; red
 Indigo*	66	BR, TBR	G	4-inch heads; uniform; bolt tolerant; burgundy; summer and/or fall
Fiero*	68		G	Upright; tall; uniform; spring and/or fall; maroon
Carmen	75		G	Improved 'Chioggia type'; crimson with white veins

* = F1 hybrid



 = also recommended for direct market and sustainable agriculture enterprises since they have high yield potential, pest resistance/tolerance, and quality.

Disease resistance: **APT** = apparent pest tolerance to little to no pest damage over several years of observation; **BR** = brown rib or bottom rot (*Rhizoctonia solani*) resistant/tolerant; **CR** = corky root rot tolerant; **DMR** = downy mildew resistant; **DMT** = downey mildew tolerant; **MR** = mosaic blight resistant or tolerant; **TBR** = tip-burn resistant

Suggested use: **C** = canning; **F** = freezing; **G** = fresh from the garden

Comments: **AAS** = All-America Selections winner

Spinach

Spinach is harvested by either removing outer leaves or by cutting off the entire plant at the soil line. It may be harvested anytime after the plant has six to eight leaves. For mustard and New Zealand spinach, pick the tender, new leaves at the tips of branches.

Greens

Mustard and turnip greens are harvested once the outer leaves are 6 to 8 inches long. New leaves throughout the season will provide uninterrupted harvest until warm weather causes strong flavor and tough leaves to develop.

Fall Salad

Endive or escarole is fully developed when it is 10 to 12 inches in diameter. To maximize sweetness, tenderness, and crispness, consider blanching (by covering with a row cover, corn shucks, or oak leaves or loosely tying the outer leaves with string or rubber bands to exclude light) 2 to 3 weeks before harvest.

WEED MANAGEMENT

Dense weeds in the garden not only rob vegetables of moisture, light, and nutrients but can also harbor insects and create an ideal environment for

many disease causing organisms. Eliminate young weed seedlings with shallow hoeing or cultivating. Never allow weeds to set seed. Place mulch such as straw or newspaper around plants and between rows to reduce weeds and conserve moisture. Manage perennial weeds year round near and in plantings as they can harbor disease-causing organisms.

To help keep weeds and weed seeds out of plantings during the fall and winter months, consider sowing a cover crop in late summer or fall (for example, annual ryegrass or spring oats mixed with hairy vetch). Turn the cover crop into the soil about one month before spring planting.

As a general rule, avoid using herbicides for weed management in the home garden for several reasons. First, no one herbicide is available that can be safely used on all kinds of vegetables growing in the garden. Second, herbicides are difficult to apply at proper rates in small areas with hand sprayers. In most cases, some areas will receive too little herbicide for effective weed management and other areas may receive such heavy rates that the crop will be damaged or killed. You also risk damaging or killing your plants from spray drift

when using herbicides. Finally, avoiding herbicides eliminates potential adverse health affects.

DISEASE IDENTIFICATION AND MANAGEMENT

Color photos of disease symptoms may be seen in the publication *Identifying Diseases of Vegetables*, for sale by the Publications Distribution Center, 112 Agricultural Administration Building, University Park, PA 16802, or from county extension offices.

Lettuce White Mold (Drop or Sclerotinia Mold) and Gray Mold (Botrytis Mold)

A wet rot appears at the base of the plant where the outer leaves touch the soil. During wet weather, especially when plants are mature, rots progress into the head. Distinctive mold growth develops on the surface of affected tissue. Sclerotinia mold is white. Botrytis mold is gray and appears powdery. Soft rot bacteria can follow the molds and result in slimy, rotted heads.

Management: Remove and discard diseased tissues (heads, dead leaves, and roots) as soon as symptoms appear. Do not plant lettuce in areas where similar disease has appeared in recent years on lettuce, cabbage,

celery, tomatoes, or cucurbits. Plant in well-drained soil.

Spinach Downy Mildew

A yellow spotting first appears on the top surface of leaves. If downy mildew is the cause, following wet, cool weather, a violet to gray mold will appear on the underside of leaves directly under the yellowish area observed on the top surface. Affected areas on leaves die.

Management: Where disease is a persistent problem, plant resistant cultivars and rotate into other plant families. When necessary, consider applying labeled fungicide sprays that contain a fixed copper.

Spinach Mosaic (CMV)

This can be a problem in fall crops. First, young leaves on isolated plants become mottled. Later, older leaves on these plants can turn yellowish, plants become stunted. In severe cases, plants may die. High temperatures promote rapid development of symptoms.

Management: Grow resistant cultivars (use MR code).

Clubroot (*Plasmodiophora brassicae*) of Turnip and Mustard Greens

The first sign that clubroot is present is a wilting of plants, especially where soil has been wettest. Pull a wilted plant to determine whether the wilting is caused by clubroot or insect grubs. Clubroot is characterized by distinct swellings on the tap and branch roots.

Management: Rotate all plants in the cabbage family (e.g., cabbage, cauliflower, broccoli, Brussels sprouts, radish, collards, kale) with unrelated plants. Where clubroot is present and after several years without growing related plants, clubroot may be minimized by applying hydrated lime and thoroughly mixing it into the soil before planting (3 to 4 pounds per 100 square feet) and by providing good soil drainage.

INSECT IDENTIFICATION AND MANAGEMENT

Leafminers

Plants are often disfigured and damaged by the larvae of several species of small flies that live as maggots between the upper and lower surfaces of the leaves. Their feeding causes large, white blotches and winding trails through the interior of the leaf. Infected leaves are unattractive and unfit for human consumption.

The preferred hosts of the spinach leafminer are spinach, beet, and chard. The insect also attacks many species of weeds. Adult flies emerge in April in Pennsylvania and deposit eggs on the underside of the host plant's leaves. The eggs hatch in 4 to 6 days, and the young maggots bore directly into the leaves where they feed for 10 to 14 days. There are three generations each year.

Management: Eliminating weeds will aid in the management of leafminers. During most years, sprays may be needed to prevent injury. Apply insecticides according to label directions.

Aphids

Aphids are small, soft-bodied insects, often called plant lice. They spread several virus diseases, reduce vigor and yield of plants, and contaminate leaves. Often, natural controls, such as beneficial parasites, and many generalist predators, such as ladybeetles, lacewings, and predatory bugs, hold down aphid populations, especially if you have not recently used a broad-spectrum pesticide.

Management: Eliminating weeds will aid in the management of aphids. High populations can be reduced with insecticides labeled for aphid management. Soapy water aids in management.

Cabbage Worms

Two worms attack leafy vegetables—the cabbage looper and the imported cabbage worm. The tiny, light-green worms are called loopers because of their characteristic way of walking. The looping movement results from having only two pairs of legs toward the tail end of the body. Loopers do not overwinter in Pennsylvania, so problems vary from year to year. However, the looper can cause considerable injury during late August and September.

The imported cabbageworm is velvety green with numerous ridges across the body. The worms have four pairs of legs on the center of the body. The cabbageworm is a persistent problem from early spring until frost. The adult insect is the common white butterfly often seen flying around cabbage plants.

Management: Avoid spraying insecticides directly over the tops of plants since most eggs and young loopers feed on the underside of leaves. To manage cabbageworms, use *Bacillus thuringiensis* (Bt) according to label directions. Bts are microbial insecticides and are not harmful to beneficial insects. They must be used on a regular schedule, but Bts are most effective when the worms are very small. Other insecticides are available for management of these pests; be sure to read and follow the directions on the label.

Pest management programs for growing vegetables use both cultural and chemical management measures. The success or failure of a fungicide or insecticide is related to correct identification of the pest problem, choice of the right pesticide, method of application, correct timing of sprays, and weather conditions.

Prepared by P. A. Ferretti, professor emeritus of vegetable crops; E. S. Sánchez, assistant professor of horticultural systems management; T. E. Elkner, Lancaster County senior extension educator; J. D. Peplinski, coordinator plant disease clinic; S. Fleischer, professor of entomology; and G. Pryor, master gardener coordinator

Visit Penn State's College of Agricultural Sciences on the Web: www.cas.psu.edu

Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

This publication is available from the Publications Distribution Center, The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802. For information telephone 814-865-6713.

This publication is available in alternative media on request.

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, gender identity, or veteran status. Discrimination or harassment against faculty, staff, or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901; Tel 814-865-4700/V, 814-863-1150/TTY.

Produced by Information and Communication Technologies in the College of Agricultural Sciences

© The Pennsylvania State University 2007

Code # UJ226

Rev5M5/07mpc3967