

Crop Profile for Lettuce in New York

Prepared: May, 1999

General Production Information



New York no longer leads the nation in lettuce production as it once did, but it is still an important fresh market crop. Lettuce is produced for local direct-to-consumer sales as well as for large wholesale markets in the northeastern US. Because of the lack of registered herbicides, weeds are probably the most important pest of lettuce production; the industry has a critical need for more registrations of weed control products. Lettuce is susceptible to a number of diseases, and fungicides remain important disease management tools. Aster leafhoppers and aphids can cause economically significant damage by direct feeding and by vectoring diseases. Because of the differences in soil types used to grow lettuce (muck and mineral); and the different types produced (crisphead and leaf types), a variety of pesticide options are needed by growers.

Registration of new materials by the EPA, even those designated as "low risk", does not guarantee that NY growers will have immediate access to them. The New York State Department of Environmental Conservation conducts its own in-depth reviews before registering new pesticides for use in NY, and may or may not register new materials for portions of or for the entire state.

Basic Commodity Information

State Rank: 6th

% U.S. Production: <1%

Acres Planted: 1384

Acres Harvested: 1384

Cash Value: \$2,940,000

Yearly Production Costs: Not available.

Commodity Destination(s):

- **Fresh Market:** 100%
- **Processing:** 0%

Production Regions: Lettuce production is scattered throughout the vegetable production regions of the state. Counties with larger acreages include Orange, Ulster, Suffolk, Oswego, and Erie.

Cultural Practices

Lettuce is a cool-season crop, and high temperatures in midsummer are very damaging, promoting such disorders as premature bolting, tipburn, and brown rib. Although lettuce can be transplanted, most lettuce in NY is direct seeded. Irrigation after seeding helps promote uniform emergence, and supplemental irrigation is often used through the season. Rows generally are spaced about 15 inches apart, and in-row spacing is determined by variety and desired size of marketed lettuce. While crisphead (iceberg) types are still produced in New York, others such as leaf lettuce, romaine, and bibb lettuce are becoming much more common. Some growers are producing baby lettuces for mesclun salad mixes, but this acreage is still relatively small. Lettuce is grown on both muck (high organic matter) and mineral soils. Some growers use spunbound row covers to extend the growing season in the early spring. Once-over harvest is the norm for commercial plantings, although smaller plantings may be harvested multiple times. Post-harvest cooling (hydro-cooling, icing, and/or refrigeration) is important in maintaining the shelf-life of the product.

Insect Pests

Aster leafhopper (*Macrostelus quadrilineatus*)

Frequency of Occurrence: Annually.

Damage Caused: Feeding injury caused by this insect pest is minimal, but aster leafhoppers vector the phytoplasma that causes aster yellows disease (see "Viruses and Phytoplasmae" section). Infected plants are unmarketable.

% Acres Affected: 100% at risk; typically up to 25% affected.

Pest Life Cycles: This insect feeds on a wide host range. Winter is passed as adults in milder regions of the US, with migration northward each spring. There are 5 nymphal instars and several overlapping generations each year.

Timing of Control: Mid-June through the end of the growing season.

Yield Losses: Can be up to 25% in severely affected fields.

Cultural Control Practices: Rotation is ineffective, and no resistant varieties are available. Mowing headlands around fields may aid in control.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: Destruction of crop debris soon after harvest can help lower inoculum levels.

Insecticides for Lettuce Insect Control:

Pesticide	% Trt.	Target Pest ¹	Typical Rates lbs ai/acre	Type and Timing	# of Appl.	PHI ² days	REI hours
acephate ³ <i>(Orthene)</i>	25-35	ALH, A	0.5-1.0	foliar; as needed through season	1-3	21	24
cypermethrin ³ <i>(Ammo)</i>	25-35	ALH	0.05-0.1	foliar; as needed through season	2	5	12

dimethoate <i>(Dimethoate)</i>	25-35	ALH, A	0.25	foliar; as needed through season	1-5	14	48
disulfoton <i>(Di-Syston)</i>	<1	ALH, A	1.0-2.0	soil applied; at planting	--	40	48
endosulfan <i>(Thiodan)</i>	<1	ALH, A	0.75-1.0	foliar; as needed through season	--	14	24
lambda-cyhalothrin³ <i>(Warrior)</i>	1-5	ALH	0.02-0.03	foliar; as needed through season	1-2	1	24
methomyl <i>(Lannate)</i>	5-10	ALH, A	0.45-0.9	foliar; as needed through season	1	10	48
permethrin <i>(Ambush, Pounce)</i>	25-35	ALH	0.1-0.2	foliar; as needed through season	2-5	1	12
carbaryl <i>(Sevin)</i>	<5	ALH	0.5-1.0	foliar; as needed through season	1-2	14	12
diazinon <i>(Diazinon)</i>	<1	A	0.25-0.5	foliar; as needed through season	--	14	24
imidacloprid <i>(Provado)</i>	15-25	A	0.05	foliar; as needed through season	2	7	12

oxydemeton- methyl ³ (<i>Metasystox-R</i>)	5-10	A	0.375-0.5	foliar; as needed through season	1	21	48
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1. Key to pests: ALH=Aster leafhopper; A=aphids
2. PHIs in this and all tables represent the shortest actual time between application and harvest, not label PHIs.
3. For use on crisphead (iceberg) types only.

Use in IPM Programs: Cornell IPM Recommendations call for the use of foliar insecticides beginning when lettuce is ½ inch high or when the first leafhoppers are observed.

Use in Resistance Management: None reported.

Efficacy Issues: Dimethoate is only somewhat effective on aster leafhoppers.

Alternatives: A tolerance has recently been established for tebufenozide (Confirm) on lettuce. This may prove to be a useful insecticide for lettuce in New York, but trials need to be performed.

Aphids (primarily *Myzus persicae*)

Frequency of Occurrence: Sporadic.

Damage Caused: Aphids are a contaminant in lettuce, and infested heads are unmarketable. Aphids also vector several viruses (see "Viruses and Phytoplasmae" section). New York State lettuce entering the export market must be kept clean of aphids through the use of aphicides.

% Acres Affected: 100% at risk; typically up to 25% affected.

Pest Life Cycles: Green peach aphids (*Myzus persicae*) are variable in color, and have a wide host range. Aphids overwinter as eggs on crop residue or host plants. Winged forms, less frequently found than wingless forms, enable the insect to move into a field from other areas. Females can reproduce without mating with males. Aphids are generally most abundant from mid-summer through October. Their severity is greatly influenced by weather patterns.

Timing of Control: mid-July through the end of the growing season.

Yield Losses: Can be up to 25% in severely affected fields.

Cultural Control Practices: None.

Regional Differences: None.

Biological Control Practices: Natural enemies help control aphid populations. They can be preserved by using insecticides that are less harmful to them.

Post-Harvest Control Practices: Destroy all lettuce plants in the field immediately after harvest.

Chemical Controls: See "Aster Leafhopper" section, above, for pesticide use information.

Use in IPM Programs: Use of foliar insecticides on an as needed basis is consistent with Cornell IPM recommendations.

Use in Resistance Management: None reported.

Alternatives: Pymetrozine (trade name Fulfill) and thiamethoxam (Adage), two new insecticides under development by Novartis, may be effective aphicides, but trials have yet to be conducted. A tolerance has recently been established for tebufenozide (Confirm) on lettuce. This may prove to be a useful insecticide for lettuce in New York, but trials need to be performed.

Efficacy Issues: Even the best aphicide will not control the spread of mosaic viruses transmitted by aphids from sources outside of the field.

Diseases

Damping-Off (*Pythium spp.*)

Frequency of Occurrence: Sporadic.

Damage Caused: Disease can be expressed as seed decay and pre- and postemergence damping-off of roots and stems

of young plants, leading to plant collapse and death.

% Acres Affected: 100% at risk; typically 1-5% affected.

Pest Life Cycles: These soilborne fungi have a wide host range and can survive in soil for many years as oospores. They are most damaging when excessive moisture occurs, soils are poorly drained, and the temperatures are unfavorable for seed germination and rapid lettuce growth.

Timing of Control: At planting.

Yield Losses: Can be up to 50% in severely affected fields.

Cultural Control Practices: Avoid compacted or poorly drained soils.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: None.

Chemical Controls. Mefenoxam (Ridomil Gold) is labeled for use on lettuce, but is used on less than 1% of the acres. Seed is not typically treated with thiram or other fungicides.

Use in IPM Programs: As-needed use of fungicides is consistent with Cornell IPM recommendations.

Use in Resistance Management: None reported.

Alternatives: None at this time.

Botrytis Gray Mold (*Botrytis cinerea*)

Frequency of Occurrence: Can be found annually within the state.

Damage Caused: The disease causes lesions on leaf margins of outer leaves, causing heads to be unmarketable. It tends to be more of a problem in greenhouses than in the field.

% Acres Affected: 100% at risk; typically <1% affected.

Pest Life Cycles: Conidia of the fungal pathogen are spread by blowing winds, running water, on tools, on plant parts, and on animals. Since *Botrytis* can live on weeds as well as on cultivated crops, it survives in fields almost indefinitely. The conidia germinate quickly in water or dew, and germ tubes penetrate plants through wounds. If old plant parts such as tip-burned leaves are present, the fungus grows rapidly in these dying parts until it has become well established, and then it passes into healthy tissue. The mycelium can grow along the soil surface and infect nearby plants. Sclerotia can overwinter and then produce a new crop of conidia.

Timing of Control: Season-long.

Yield Losses: Under severe conditions of infection, up to 20%; typical losses are <1%.

Cultural Control Practices: Rotation is important to minimize crop residues and survival of sclerotia. Strict hygiene is essential in plant bed and greenhouse settings.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: None.

Foliar Fungicides for Lettuce Disease Control:

Pesticide	% Trt.	Target Pest ¹	Typical Rates lbs ai/acre	Type and Timing	# of Appl.	PHI days	REI hours
dicloran² <i>(Botran)</i>	<1	BGM, D	2.0	foliar; as needed through season	--	14	12
vinclozolin <i>(Ronilan)</i>	70-80	BGM, D	0.5-1.0	foliar; as needed through season	1-3	28	12
iprodione <i>(Rovral)</i>	80-90	BGM, BR, D	0.75-1.0	foliar; as needed through season	1-4	14	12

fosetyl-AI <i>(Aliette)</i>	<1	DM	1.6-4.0	foliar; as needed through season	--	3	24
maneb <i>(Maneb)</i>	70-80	DM	1.2-1.6	foliar; as needed through season	1-4	10	24

1. Key to pests: BGM=Botrytis gray mold; BR=Bottom rot; DM=Downy mildew; D=Drop

2. For use on leaf lettuce only.

Use in IPM Programs: As-needed use of fungicides is consistent with Cornell IPM recommendations.

Use in Resistance Management: Because of the risk of resistance development to dicarboximide fungicides, it is recommended not to make repeated applications of either vinclozolin or iprodione, and not to alternate these two fungicides.

Alternatives: Under research conditions, azoxystrobin, propiconazole, and an experimental material, CGA279202, provided good to excellent control of this pathogen in snap beans, and may also in lettuce. Myclobutanil (Nova) may also be effective on gray mold.

Bottom Rot (*Rhizoctonia solani*)

Frequency of Occurrence: Annually.

Damage Caused: Leaf petioles and midribs become rotted, and infection spreads throughout the head, rendering lettuce heads unmarketable.

% Acres Affected: 100% at risk; up to 50% affected per year.

Pest Life Cycles: The fungal pathogen lives indefinitely in soil, and has a wide host range. It can be spread by movement of infested soil, on diseased plant parts. The pathogen can enter plants by penetrating the cuticle, through wounds, or through stomata. The time interval between the appearance of initial lesions and advanced head decay is 5-10 days. After the period of active invasion, the fungus can live long periods in decayed tissues in a vegetative condition. Then sclerotia, overwintering structures, can form in heads and in soil. High temperatures favor disease development.

Timing of Control: from four weeks after seeding through harvest

Yield Losses: Can be up to 50% in severely affected fields.

Cultural Control Practices: No resistant varieties are available. A minimum three year rotation away from lettuce and endive is recommended, but this is not completely effective. Planting on raised beds will allow better air circulation and can reduce disease incidence.

Regional Differences: None

Biological Control Practices: None

Post-Harvest Control Practices: None

Chemical Controls: See "Botrytis Grey Mold" section, above.

Use in IPM Programs: As-needed use of fungicides is consistent with Cornell IPM recommendations.

Use in Resistance Management: None reported.

Alternatives: None at this time.

Downy Mildew (*Bremia lactucae*)

Frequency of Occurrence: Can be found annually within the state, but not always at economically significant levels.

Damage Caused: Light green to yellow areas up to 0.5 inches in diameter develop on the upper surface of older wrapper leaves of infected plants. Affected tissue turns brown, rendering the head unmarketable. In severe cases, plants become dwarfed and yellowish. Affected tissue may rot in the field or during shipping due to secondary pathogens.

% Acres Affected: 100% at risk; up to 50% affected per year.

Pest Life Cycles: Conidiospores from leaf spots can be blown long distances by winds. Spores germinate and infect susceptible tissues within three hours. The fungus overwinters as mycelium and sometimes as oospores in debris from diseased plants. The pathogen has a wide host range.

Timing of Control: all stages of growth

Yield Losses: Can be up to 100% in severely infected fields; typical losses are <5% in fields treated with fungicides.

Cultural Control Practices: The use of resistant varieties is recommended, although the fungus readily produces new races to overcome plant host resistance.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: None.

Chemical Controls: See "Botrytis Grey Mold" section, above.

Use in IPM Programs: Use of fungicides on a 7-10 day schedule once the disease appears is consistent with Cornell IPM recommendations.

Use in Resistance Management: Because of the high variability of fungus, insensitivity to the systemic fungicide metalaxyl (mefenoxam) is widespread.

Alternatives: Dimethomorph might be a possible alternative. Research would need to be conducted on efficacy and crop tolerance.

Drop (*Sclerotinia sclerotiorum*, *S. minor*)

Frequency of Occurrence: Annually.

Damage Caused: The fungus attacks the outer leaves in contact with the soil, and wilting of these leaves is the initial symptom. Infection progresses inwardly until the entire plant wilts.

% Acres Affected: 100% at risk; up to 50% affected per year.

Pest Life Cycles: The fungus has an extremely wide host range, including many other vegetable crops. *Sclerotinia* lives from season to season as active mycelium in living or dead plants and as sclerotia in or on the soil. In the spring, each sclerotium produces one or more stalks called apothecia, which release ascospores into the air. Resumption of vegetative growth by sclerotia close to lettuce plants is another source of inoculum. The fungus thrives under high moisture conditions.

Timing of Control: from several weeks after transplanting up to harvest

Yield Losses: Can be as high as 50% in severely affected fields; typical losses are <5% in fields treated with fungicides.

Cultural Control Practices: A minimum of a three year rotation with nonhosts such as grains is recommended.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: None.

Chemical Controls: See "Botrytis Grey Mold" section, above.

Use in IPM Programs: As-needed use of fungicides is consistent with Cornell IPM recommendations.

Use in Resistance Management: None reported.

Alternatives: New fungicides such as myclobutanil (Nova) and CGA173506 have shown promising results in control of *Sclerotinia* in snap beans. These may be potential alternatives for lettuce, but trials need to be conducted.

Anthracnose (*Microdochium panattonianum*)

Frequency of Occurrence: Can be found annually within the state, but not always at economically significant levels.

Damage Caused: Water-soaked, circular spots first appear on the undersides of leaves. Later, the lesion centers dry up and may fray or fall out giving a shot hole appearance. Lesions on the midrib begin as water-soaked spots, but become markedly sunken. Young plants can be killed; older plants become disfigured and unmarketable.

% Acres Affected: 100% at risk; up to 20% affected each year.

Pest Life Cycles: The fungus survives in the soil and on crop debris. Spores are carried by splashing rains, in infested soil, on diseased seedlings, and on moving bodies. Wild lettuce (*Lactuca serriola*) is also a host.

Timing of Control: season-long; especially in early spring

Yield Losses: can be up to 50% in severely affected fields; typical losses are <5%

Cultural Control Practices: The following cultural practices are recommended for disease control: use of surface rather than overhead irrigation, minimum one year rotation with a nonsusceptible crop, and use of commercially-produced disease-free seed.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: Avoid packing infected plants with healthy ones as deterioration and spread can occur. Fields should be deep plowed following harvest to encourage decomposition of crop debris.

Chemical Controls: No pesticides are available to manage this disease.

Northern Root-knot nematode (*Meloidogyne hapla*)

Type of Pest: Nematode

Frequency of Occurrence: Annually on affected acres.

Damage Caused: Severely infected lettuce plants show stunting and uneven growth patterns, resulting in the production of small, loose and often unmarketable lettuce heads. Infected plants exhibit distinct galling of the roots.

% Acres Affected: 100% at risk; up to 75% affected.

Pest Life Cycles: Root-knot nematodes spend most of their life cycle in galls on roots. Second stage juveniles invade new sites near root tips and the carrot forms a gall in response to the nematode's feeding. Many vegetable and weed species also serve as hosts for this nematode. The damage threshold is less than one egg per cc of soil, but soil testing is not a practical method for determining occurrence and severity of this nematode.

Timing of Control: Controls must be applied at or before planting.

Yield Losses: Can be up to 100% if untreated; 5-10% if treated.

Cultural Control Practices: Rotation with grain crops is very important for control of this pest.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: None.

Chemical Controls: Metam sodium (Vapam) is the only nematicide available for use in NY, at 25 gal/acre (muck soil rate). It is used rarely by New York growers.

Use in IPM Programs: As-needed use is consistent with Cornell IPM recommendations.

Use in Resistance Management: No instances of resistance have been reported.

Alternatives: The use of sudangrass cover crops may suppress nematode populations. Oxamyl (Vydate) is used successfully to manage this pest in carrots, and has recently been granted a SLN 24(c) label for onions in NY for 1999. It might be a potential alternative for lettuce.

Other Issues: A growing-out bioassay for the root-knot nematode is available, but it is costly in time and money. Research is in progress to develop a rapid and accurate molecular diagnostic method for the detection and quantification of this nematode in NY.

Viruses and Phytoplasmae (*several*)

Frequency of Occurrence: Can be found within the state every year.

Damage Caused: While specific symptoms vary with pathogen, these diseases cause stunting, distorted growth, yellowing, or mosaic coloration. Infected plants are unmarketable.

% Acres Affected: 100% at risk; typically <5% affected by viruses, and up to 50% by aster yellows.

Pest Life Cycles: Lettuce mosaic virus (LMV), cucumber mosaic virus (CMV), and broadbean wilt virus (BBWV) are all transmitted by aphids in a non-persistent manner. Lettuce mosaic virus is also seedborne. Aster yellows (AL) is a phytoplasma transmitted by aster leafhoppers.

Timing of Control: Season long.

Yield Losses: Can be up to 50% in severely affected fields.

Cultural Control Practices: Plant resistant varieties when possible, and use lettuce seed designated mosaic tolerance zero

(for LMV only). Control of weed hosts may help control CMV and BBWV. Isolate late plantings from early plantings.

Regional Differences: None.

Biological Control Practices: None.

Post-Harvest Control Practices: None.

Chemical Controls: No pesticides are available to control viruses; controlling the aphid vectors with insecticides is usually ineffective for controlling virus spread. Management of AY depends on reducing the aster leafhopper population which migrates into lettuce fields about mid-June (see "Aster Leafhopper" section, above).

Weeds

Broadleaf and Grass Weeds

Frequency of Occurrence: Annually.

Damage Caused: Weed competition reduces yields and makes harvesting difficult. Weeds also serve as hosts of several lettuce diseases.

% Acres Affected: 100%

Pest Life Cycles: Annual and perennial weeds such as ragweed, lambsquarters, henbit, Galinsoga, yellow nutsedge, annual and perennial grasses, mustards, and others, are a problem throughout the growing season.

Timing of Control: Preplant, preemergence, and postemergence.

Yield Losses: Can be 100% if not treated, 5% if treated.

Regional Differences: None.

Cultural Control Practices: Because of the limited number of herbicides and their relatively narrow spectra of weed control, cultivation is necessary in lettuce production in NY. In addition, producers use handweeding (hoe crews) to control weed escapes, particularly in-row weeds.

Regional Differences: While weed species spectra may vary regionally, weeds are a severe problem in all lettuce growing areas.

Biological Control Practices: None.

Post-Harvest Control Practices: Cultivation. Post-harvest application of herbicides to control perennial weeds.

Chemical Controls:

Pesticide	% Trt.	Type of Appl.	Typical Rates lbs ai/acre	Timing	# of Appl.	PHI	REI
benefin¹ <i>(Balan)</i>	<1	soil incorporated	0.3-0.45	preplant	1	40	12
pronamide¹ <i>(Kerb)</i>	15-25	soil surface	1-1.5	preemerge	1	35	24
glyphosate <i>(Roundup)</i>	5-10	soil surface	1-1.5	before planting	1	--	4
sethoxydim <i>(Poast)</i>	<1	soil surface	0.14-0.3	post emerge	1	15 leaf; 30 crisp	12

1. For use on mineral soils only.

Efficacy Issues: Benefin and pronamide are effective on annual grasses and some broadleaves. Sethoxydim is effective on annual grasses. Glyphosate is broad spectrum, and is used before planting. The industry has a critical need for more weed control options for lettuce production. Many in the industry feel that the loss of herbicides has been an important factor in the continued decline of lettuce acreage in the state.

Alternatives: IR-4 is currently running residue trials on glyphosate, carfentrazone-ethyl and imazamox. Glyphosate could

be useful as a shielded spray between the rows. Carfentrazone-ethyl is probably too phytotoxic for practical use, and efficacy trials on imazamox are being conducted in 1999. The rice herbicide Bolero (common name?) has been used under Section 18 labels in muck soils in Florida, and might be a potential alternative in NY.

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5. Information for and review of this Crop Profile were provided by producers, consultants, researchers and Extension Educators. Pesticide use information was gathered through a survey of five lettuce growers in the state.

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