New England
Tomato Crop Profile

Compiled for the PRONewEngland Pest Management Network in 2003 by
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I. Production Overview

New England has fewer than 1% of the total acreage for the U.S. fresh market tomatoes, but is home to 8% of the total farms producing tomatoes in the U.S. In New England, tomatoes are produced by diversified fresh market vegetable producers. For field and greenhouse production combined, most (87%) of growers sold tomatoes as fresh market pre-picked retail, 45% sold fresh market wholesale, 5% sold for processing, and 7% sold for other markets. The estimated breakdown of production by market destination in 2002 for field grown (with greenhouse production in parentheses) was: Fresh pre-picked retail 47% (70%), Fresh wholesale 43% (29%), Processing 3% (<1%), and other sales 7% (<1%). The average producer had 1.4 acres of field tomatoes and 5,400 square feet of greenhouse tomatoes.

Approximately 53% of New England farmers surveyed produce only field grown tomatoes; 10% grow only greenhouse tomatoes; and 37% of farmers surveyed produce both field and greenhouse tomatoes.

Field Grown, Cultural Information

The tomato is a warm-season crop that grows best on well-drained soils high in organic matter. For earliest production, growers use transplants. Many growers use black polyethylene mulch because it conserves water, permits use of less nitrogen fertilizers (because leaching is reduced), and facilitates weed control. Greatest yields are achieved by irrigating with a complete nutrient solution supplemented with trace elements at weekly intervals. Tomatoes should be pruned 4-5 times. Pruning to one or two stems is common, with 2 stems yielding more fruit but requiring more time to prune. Tomatoes are generally topped after the fifth cluster.

Determinate tomatoes (“bush tomatoes”) grown on the ground require no pruning. Seventy percent of the growers surveyed used staking, with the remainder using trellising, basket weave, cages, or no supports. Tomato plants are staked and tied 3-4 times each season. Tomatoes grown using the trellis system supported by twine are tied to a number 9 or 11 wire 5-6 feet above the ground. The trellis system is very time consuming as plants need to be trained (“twisted”) around the string frequently and care must be take to avoid breaking the stem.

Some growers are using a stake and weave system. Wooden stakes 4-5 feet long are driven into the ground and weather resistant twine is wrapped around the stakes and repeated on the opposite row. There are many variations of this method also called the basket weave. Spacing will vary according to cultivar and type of culture used. The growers surveyed use 4-6 square feet per plant.

Liming is done as directed by soil test results to maintain soil pH at 6.5-6.8. Many of the growers surveyed use composted manure as a nutrient. Drip irrigation is used on 75% of acres and overhead on approximately 25%. Only 8% of growers use tissue analysis for determining fertilizer needs and that group does so once a year.

Greenhouse, Cultural Information

Greenhouse tomatoes are grown in glass-covered or plastic-covered houses. Most operations either grow plants in ground beds or in bags or pots of soil-free media. Greenhouse tomato varieties are indeterminate, and plants are pruned and tied to trellis systems. Multiple harvests are by hand, and harvesting typically lasts from April through the fall.

Worker Activities

Worker activities that may occur during the growing season include production of transplants, laying black plastic, setting up trickle irrigation, staking, hand weeding, pruning, thinning, mowing, irrigation, scouting, pesticide application, and harvesting.

General Pesticide Information

In the survey results, some growers reported at least one type of spray but did not provide a value for other types of sprays. We registered a zero for their other types of sprays. The average sprays per year with these assumptions were 5.8 for diseases, 2.8 for insects, 0.8 for weeds, and 0.4 for mites.

Most growers use IPM such practices as insect trapping, degree-day accumulation data, and field sampling. Most of the sampling patterns are informal rather than on scheduled intervals and several reported using the UMASS TomCast program for pest information. Of the growers surveyed,

most classify their farm practices as conventional 38%, but an increasing number consider their practices as IPM (32%) or organic (23%).

Roughly 40% of the growers reported using no pesticides and are considered organic. Generally where no pesticides were used, yields were reduced.

Growers use the *New England Vegetable Management Guide*, off-season educational meetings, newsletters, other growers, and twilight meetings as the most important sources of pest management information.

This profile is a comprehensive list of pests that may be encountered by New England tomato growers, and the approved pesticides that may be used to control them. Only a few pests actually require treatment on an individual farm in a single year. For each pest all of the available effective options are listed. If treatment is needed, only one of those options would be used per application. Some pests require multiple applications for control; others only require a single application.

II. Insect and Mite Pests

Insecticides and Miticides Important for New England Tomatoes

ACTIVE INGREDIENT	TRADE NAME	MANUFACTURER / PHI	RATES	REI
abamectin	Agri-Mek 0.15 EC	Syngenta / 7days	8 to 16 oz/A	12 hrs
azadirachtin	Neemix 4.5	Certis USA, L.L.C./ 0 days	4 to 7 oz/A	12 hrs
Bacillus thuringiensis kurstaki	Foray	Valent Bio /0 days	1 to 3 qt/A	0
Bacillus thuringiensis tenebrionis	Novodor	Valent Bio/ 0 days	1 to 3 qt/A larvae	0
Bacillus thuringiensis israelensis	Gnatrol	Valent Bio/ 0 days	soil drench	4 hrs
Beauveria bassiana	Botanigard 22WP	Emerald BioAg/ 0 days	1/2-1 lb/100 gal water for aphids	4 hrs
			1 to 2 lb/100 gal water for thrips	4 hrs
carbaryl	Sevin XLR PLUS	Bayer/ 3 days	2 qt/A	12 hrs
cyfluthrin	Baythroid 2	Bayer/ 0 days	1.6 to 2.8 oz/A	12 hrs
cryolite	Kryocide	Cerexagri, Inc./	8 to 16 lb/A	12 hrs
diazinon	Diazinon 50W	Mak-Agan/ 1 day	1/2 lb/A	24 hrs
dicofol	Kelthane MF	Dow/ 2 days	12 to 24 oz/A	12 hrs
dimethoate	Dimethoate 4EC	BASF/ 7 days	8 to 16 oz/A	48 hrs
endosulfan	Thiodan 50 WP	Bayer /2days	1 to 2 lb/A	24 hrs
esfenvalerate	Asana XL	DuPont / 1 day	5.8 to 9.6 oz/A for looper/fruitworm	12 hrs
			2.9 to 5.8 oz/A	12 hrs
imidacloprid	Admire 2F	Bayer/ 21 days	1 to 1.5 pt/A	12 hrs
indoxacarb	Avaunt	DuPont/ 3 days	2.5 to 3.5 oz/A	12 hrs

insecticidal soap	M-Pede	Dow/0 days	1.25 - 2.5 oz/gal water	12 hrs
kaolin	Surround WP	Engelhard/ 0 days	6-1/4 to 25 lb/A	4 hrs
lambda-cyhalothrin	Warrior T	Syngenta/ 5 days	2.5 to 3.8 oz/A	24 hrs
methomyl	Lannate LV	DuPont /1 day	1-1/2 to 3 pt/A	48 hrs
permethrin	Ambush	Sygenta/0 days	3.2 to 12.8 oz/A	12 hrs
pymetrozine	Fulfill	Syngenta/ 0 days	2.75 oz/A	12 hrs
pyrethrum	Pyrenone Crop Spray	Bayer /0 days		0
spinosad	SpinTor 2 SC	Dow/ 1 day	6 to 8 oz/A	4 hrs
tebufenozide	Confirm 2F	Dow/ 0 days	8 to 16 oz/A	4 hrs

1. Colorado Potato Beetle: *(Leptinotarsa decemlineata)*

Type of Pest: Insect

Frequency of Occurrence: 29% of growers rated this as a routine pest, 30% as an occasional pest. In terms of damage caused, the Colorado potato beetle (CPB) is the most severe pest on fresh market tomatoes in New England.

Damage Caused: Colorado potato beetles damage leaves by chewing holes or entirely consuming leaves and stems. The CPB overwinters as an adult several inches beneath the soil surface. Eggs are deposited on the undersides of leaves and larvae feed for two to three weeks before entering the soil to pupate. Generally there are two generations per year.

Timing of Control: CPB adults appear shortly after seedling emergence or transplanting.

Regional Differences: None

Cultural Control Practices: Scouting, handpicking, raised beds, trap crops of eggplant and crop rotation to non-solanaceous crops (crops other than tomato, potatoes, peppers and eggplant) is extremely important in reducing CPB problems

Biological Control Practices: Conservation enhancement is very important.

Chemical Controls: Chemical controls that have provided excellent control include imidaclorprid (Admire) and spinosads. Good control with lambda-cyhalothrin (Warrior), and fair controls with permethrin (Ambush), and endosulfan (Thiodan). Treatments with *Bacillus thuringiensis* var. *tenebrionis* have provided fair control.

Post-Harvest Control Practices: None
Other Issues: This species has developed resistance to every known class of insecticides. Scouting is used and spraying is only done when necessary.

Colorado Potato Beetle Insecticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATES	REI
endosulfan	Thiodan 50WP	2 days	1 to 2 lb/A	24 hrs
bacillus thuringiensis tenebrionis	Novodor	0 days	1 to 3 qt/A larvae	0
lambda-cyhalothrin	Warrior T	5 days	2.5 to 3.8 oz/A	24 hrs
permethrin	Ambush	0 days	3.2 to 12.8 oz/A	12 hrs
imidacloprid	Admire 2F	21 days	1 to 1.5 pt/A	12 hrs
spinosad	SpinTor 2 SC	1 day	6 to 8 oz/A	4 hrs

2. Tomato Hornworm (*Manduca spp.*)

Type of Pest: Insect
Frequency of Occurrence: 31% of growers rated this as a routine pest, 34% as an occasional pest.
Damage Caused: Hornworms feed on leaves and fruit of tomatoes, weakening the plant and causing direct damage to the fruit.
Regional Differences: None
Cultural Control Practices: Scouting and handpicking.
Biological Control Practices: *Bacillus thuringiensis kurstaki* provides excellent control. Parasitic wasps are important in hoop houses.
Chemical Controls: Endosulfan (Thiodan*50WP), esfenvalerate (Asana*XL) and methomyl (Lannate).
Post-Harvest Control Practices: None

Tomato Hornworm Insecticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATES	REI
endosulfan	Thiodan 50WP	2 days	1 to 2 lb/A	24 hrs
Bacillus thuringiensis kurstaki	Foray	0 days		0
esfenvalerate	Asana XL	1 day	5.8 to 9.6 oz/A for looper/fruitworm	12 hrs
methomyl	Lannate LV	1 day	1-1/2 to 3 pt/A	48 hrs
lambda-	Warrior T	5days	2.5 to 3.8 oz/A	24 hrs

cyhalothrin				

3. Twospotted Spider Mite: *(Tetranychus spp.)*

Type of Pest: Mite

Frequency of Occurrence: 11% of growers rated this as a routine pest, 16% as an occasional pest. Most commonly a problem in tomatoes grown in protected culture, i.e., greenhouse and hoop houses.

Damage Caused: Mites live on the underside of lower leaves and deposit eggs. Feeding damage appears as small, chlorotic spots on the upper surfaces of leaves.

Regional Differences: None

Cultural Control Practices: Black plastic.

Biological Control Practices: Predatory mites in greenhouses.

Chemical Controls: Products that provide excellent control are abamectin and petroleum oil.

Post-Harvest Control Practices: None

Twospotted Spider Mite Miticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATES	REI
abamectin	Agri-Mek 0.15 EC	0 days	8 to 16 oz/A	12 hrs
petroleum oil	UltraFine oil	0 days	?	0

4. Aphids

Type of Pest: Insect

Frequency of Occurrence: 17% of growers rated this as a routine pest, 26% as an occasional pest.

Damage Caused: This insect is generally found on the tips and under surfaces of leaves. Treatments are made when aphids exceed 6 per leaf.

Regional Differences: None

Cultural Control Practices: Reflective mulch very important.

Biological Control Practices: Predators include aphid midge and ladybird beetles in greenhouses.

Chemical Controls: Products providing excellent control include Thiodan, Provado, Admire and Lannate. Insecticidal soap provides only fair control.

Post-Harvest Control Practices: None

Aphid Insecticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATES	REI
methomyl	Lannate LV	1 day	1-1/2 to 3 pt/A	48 hrs

endosulfan	Thiodan 50 WP	2 days	1 to 2 lb/A	24 hrs
imidaclorprid	Admire 2F	21 days	1 to 1.5 pt/A	12 hrs
imidaclorprid	Provado	21 days	1 to 1.5 pt/A	12 hrs

5. Stink Bugs:
Type of Pest: Insect
Frequency of Occurrence: 9% of grower reported this as a pest.
Damage Caused:
Both the adult and nymphs feed on the fruit of the tomato by inserting their mouthparts into the tomato to extract juices. The adult stink bug is usually brown and shield shaped, with a large triangle on its back. The nymphs are green and more rounded in shape. The site of feeding on green fruit appears as a dark pin prick which can be surrounded by a white or yellow area. When the tomato skin is peeled back, white spongy cells are found. This damage is caused by the removal of fluid from the fruit and the injection of enzymes by the stink bug. Stink bug damaged fruit is unmarketable in fresh markets but tolerated by processors.
Regional Differences: None
Cultural Control Practices: Research needed.
Biological Control Practices: *Bacillus thuringiensis kurstaki*
Chemical Controls: Excellent control was found with lambda-cyhalothrin (Warrior) and good control with carbaryl (Sevin).
Post-Harvest Control Practices: None

Stink Bug Insecticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATE	REI
lambda-cyhalothrin	Warrior T	5 days	2.5 to 3.8 oz/A	24 hrs
carbaryl	Sevin XLR PLUS	3 days	2 qt/A	12 hrs
Bacillus thuringiensis kurstaki	Foray	0 days		0

6. Cutworms:
Type of Pest: Insect
Frequency of Occurrence: 10% of growers rated this as a routine pest, 32% as an occasional pest.
Damage Caused: The females lay eggs on the lower leaves and stems of tomato plants. The larvae grow to 1-1.5 inches. The larvae are most active at night and return to hiding places in the soil or under plant debris during the day. Damage occurs when the cutworms climb mature plants and feed on green fruit. Their occurrence is sporadic and may not be a major problem.
Regional Differences: None
Cultural Control Practices: Scouting, sanitation and weed management.
Biological Control Practices: None
Chemical Controls: Carbaryl (Sevin XLR+), endosulfan (Thiodan), lambda-cyhalothrin (Warrior) provided excellent control.
Post-Harvest Control Practices: None

Cutworm Insecticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATE	REI
lambda-cyhalothrin	Warrior T	5 days	2.5 to 3.8 oz/A	24 hrs
carbaryl	Sevin XLR PLUS	3 days	2 qt/A	12 hrs
endosulfan	Thiodan 50 WP	2 days	1 to 2 lb/A	24 hrs

7. Flea Beetles:
Type of Pest: Insect
Frequency of Occurrence: 21% of growers rated this as a routine pest, 24% as an occasional pest.
Damage Caused: This insect is generally found on the tips and under surfaces of leaves. Flea beetles can be important pest problems on young seedlings during transplant production or on recently transplanted seedlings.
Regional Differences: None
Cultural Control Practices: Scouting very important.
Biological Control Practices: None
Chemical Controls: Carbaryl (Sevin XLR+) and endosulfan provided excellent control. Imidacloprid and lambda-cyhalothrin/Warrior were good.

Flea Beetle Insecticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATE	REI
carbaryl	Sevin XLR Plus	3 days	2 qt/A	12 hrs
endosulfan	Thiodan 50 WP	2 days	1 to 2 lb/A	24 hrs
imidacloprid	Admire 2F	0 days	1 to 1.5 pt/A	12 hrs
imidacloprid	Provado	0 days	1 to 1.5 pt/A	12 hrs
lambda-cyhalothrin	Warrior T	5 days	2.5 to 3.8 oz/A	24 hrs

8. Whiteflies:
Type of Pest: Insect
Frequency of Occurrence: 12% of growers rated this as a routine pest, 25% as an occasional pest.
Regional Differences: None
Cultural Control Practices: Scouting and sanitation very important.
Chemical Controls: Lannate provides excellent control. Imidacloprid (Provado 1.6), endosulfan (Thiodan 50WP) and esfenvalerate (Asana *XL) provide good control. Warrior and Fulfill are questionable in control efforts.
Post-Harvest Control Practices: None

Whitefly Insecticides

ACTIVE INGREDIENT	TRADE NAME	PHI	RATES	REI
methomyl	Lannate	1 day	1.5-3.0/A	48 hrs
esfenvalerate	Asana XL	1 day	5.8 to 9.6 oz/A for looper/fruitworm	12 hrs
imidacloprid	Admire	0 days	1 to 1.5 pt/A	12 hrs
endosulfan	Thiodan	2 days	1 to 2 lb/A	24 hrs
pymetrozine	Fulfill	0 days	2.75 oz/A	12 hrs
lambda-cyhalothrin	Warrior T	5 days	2.5 to 3.8 oz/A	24 hrs

While they might be frequently encountered as pests, cabbage looper, leafminers, and tomato fruitworm were not considered significant problems.

III. Diseases and Nematodes

Growers reported an average of 5.8 spray treatments for disease management per growing season. Preventative pesticide treatments are typically applied every 7-14 days, depending on weather conditions. Fungicides are key tools in controlling diseases.

The most common disease concerns were (in order) Early Blight, Late Blight, Septoria Leafspot, Fruit Rot, Anthracnose, Blossom End Rot, Powdery Mildew, and Sclerotinia Blight. The following diseases were less commonly a problem: Blotchy Ripening, Bacterial Cancer, Fusarium and Verticillium Wilt, Seed Decay, Cucumber Virus and Tobacco Mosaic Virus. Whether or not these are diagnosed properly is not known; however, diseases are an important problem for New England tomato growers.

The principle fungicides used by New England growers were chlorothalonil (Bravo Ultrex), maneb / mancozeb (Penncozeb, Manzate, Dithane), azoxystrobin (Quadris), and cupric hydroxide (Kocide).

Fungicides and Bactericides Important for New England Tomatoes

ACTIVE INGREDIENT	PHI	RATE	REI
azoxystrobin (Quadris)	0 days	6 oz/A	4 hours
benomyl (Benlate 50SP)	1 day	8 oz/A	12 hours
chlorothalonil, (Bravo Ultrex 82 WDG)	0 days	2 lbs/A	12 hours
copper sulfate (Basicop 53%)	0 days	1.5-3 lbs/A	24 hours
cupric hydroxide (Kocide 4.5 LF)	0 days	1.5 qt/A	?
mancozeb (Dithane, Fore, Manzate)	5 days	2 lbs/A	12 hours
maneb (Pentathlon)	5 days	2 Pt/ A	12 hours
mefenoxam plus chlorothalonil, (Ridomil/Bravo)	14 days	2 lbs/A	48 hours
mefenoxam plus manzate, (Ridomil Gold MZ)	5 days	2.5 lbs/A	48 hours
mefenoxam, (Ridomil Gold EC)	5 days	1-2 pt/A	48 hours
pyraclostrobin (Cabrio)	0 days	16 oz/ A	12 hours
streptomycin, Agri-Mycin 17, Agri-Step	0 days		12 hours
trifloxystrobin (Flint)	3 days	3-4 oz/ A	12 hours

1. Early Blight (*Alternaria solani*)

Type of Pest: Fungus

Frequency of Occurrence: 69% of growers rated this as a routine pest, 17% as an occasional pest.

Damage Caused: This fungal disease is very destructive to tomato. Early blight and Septoria leaf spot may occur together. The fungus overwinters in plant debris and seed. Leaf symptoms begin around flowering and appear as target or bulls-eye lesions on older leaves. These lesions coalesce to form large dead areas in the leaf, which subsequently drops off. Spore production and lesion enlargement are greatest during cool weather; infection is greatest in warm weather. Heavy dews, humid weather, and abundant rainfall are essential for heavy disease pressure.

Regional Differences: None

Cultural Control Practices: Cultural controls are important in control of early blights. Crop rotation, drip irrigation, wider spacing, mulch or plastic, insect management, pruning suckers, staking systems and tolerant varieties are most important. Use of raised beds would be helpful. Plow under plant debris after harvest and rotate away from tomatoes and other solanaceous crops for at least two years. Provide optimum nutrition throughout the season. Integrated pest management practices used to reduce disease incidence include crop rotation, plastic mulch, drip irrigation, keeping plants dry, sanitation, variety selection, air circulation, and staking (2%).

Biological Control Practices: none.

Chemical Controls: If planting in areas where disease is prevalent, fungicide applications should begin before disease is evident, typically around July 1. Quadris, Bravo, Pentathlon, Dithane, and Ridomil/Bravo provide good to excellent control. The new chemistry of Cabrio and Flint has provided good control.

Organic Controls: Cupric hydroxide and copper sulfate provide fair to good control.

2. Late Blight: (*Phytophthora infestans)*

Type of Pest: Fungus

Frequency of Occurrence: 43% of growers rated this as a routine pest, 26% as an occasional pest.

Damage Caused: This disease can cause devastating damage to tomato leaves and fruit. On the leaves, the symptoms first appear as irregular greasy grayish areas. These areas expand quickly, especially during moist conditions, and a white downy mold appears at the margins of the affected areas on the underside of the leaves. On the green fruit, the symptoms of Late Blight appear as grayish green water-soaked spots which enlarge to indefinite size and shape.

Regional Differences: None
Cultural Control Practices: The use of the following cultural practices is very important: crop rotation, drip irrigation, wider spacing, well drained soils, staking systems, sanitation, scouting, and clean transplants. Integrated pest management practices used by the surveyed growers to reduce disease incidence include crop rotation, plastic mulch, drip irrigation, moisture control, sanitation, variety selection, air circulation, and staking.
Chemical Controls: Quadris provides good to excellent control. Bravo and Ridomil MZ have shown good results. The new chemistry product, Armicarb, has been good and Cabrio and Flint have been fair in controlling this disease.

3. Anthracnose (*Colletotrichum coccodes*)

Type of Pest: Fungus
Frequency of Occurrence: 31% of growers rated this as a routine pest, another 31% as an occasional pest. Besides above-ground parts, roots may become infected, resulting in black dot disease.
Damage Caused: This disease causes rotting of ripe fruit, reducing yield and quality. In late spring the lower leaves and fruit may become infected by germinating sclerotia and spores in the soil debris. Infections of the lower leaves are important sources of spores for secondary infections throughout the growing season. Leaves injured by early blight or flea beetles can also become infected and provide sources of secondary spores.
Cultural Control Practices: Cultural practices important for control include: Crop rotation, drip irrigation, wider spacing, mulching, tolerant variety selection, weed management, staking systems, pruning suckers and sanitation. Integrated pest management practices used to reduce disease by growers include crop rotation, plastic mulch, drip irrigation, moisture control, sanitation, variety selection, ventilation, and staking.
Chemical Controls: Good to excellent control with Quadris, Bravo, Cabrio and Flint. Fair control with Kocide, Pentatlon, Dithane, and Copper Sulfate.

4. Septoria Leafspot *(Septoria lycopersici)*

Type of Pest: Fungus
Frequency of Occurrence: 30% of growers rated this as a routine pest, 42% as an occasional pest.
Damage Caused: The disease overwinters on residues from diseased plants. The first symptoms appear later in the season on the older leaves near the ground where small, water-soaked spots can be seen. The spots soon become nearly circular and have gray centers surrounded by darker margins. Later the centers show tiny dark specks in which the spores of the fungus are produced. The spots are smaller and more numerous than those found in early blight. If a leaf develops many spots, it usually dies and

drops from the plant. As the disease spreads, there is a progressive loss of leaves until only a few are left at the top of the plant and the fruit become exposed to sunscald. Wet weather favors fungus growth, spread, and subsequent disease development

Chemical Controls: Products providing good to excellent control are Quadris, Bravo, Cabrio, and Flint. A good control product has been Ridomil/Bravo. Fair control has been achieved with Kocide and Copper Sulfate. There has been poor control with Pentathlon and Mancozeb.

Post-Harvest Control Practices: None

Other Issues: With Pentathlon and Mancozeb the 5 days to harvest interval is a concern**.**

5. Powdery Mildew (*Oidium lycopersicum*)

Type of Pest: Fungus

Frequency of Occurrence: 21% of growers rated this as a routine pest, 31% as an occasional pest.

Damage Caused: Powdery Mildew is a disease that can cause severe leaf blighting. Symptoms include mycelial growth on leaves and stems, followed by desiccation, necrosis, and defoliation.

Regional Differences: None.

Cultural Control Practices: Wider spacing and staking seems to be most important cultural control for powdery mildew. Integrated pest management practices used to reduce disease incidence include crop rotation, plastic mulch, drip irrigation, keeping plants dry, sanitation, variety selection, ventilation and staking.

Biological Control Practices: None

Chemical Controls: Excellent to good control attained with Quadris, Cabrio, Flint, Nova and Armicarb. Fair control attained with Bravo and Ridomil/Bravo alternation.

MINOR DISEASES

6. Damping off/Seed Decay: Seed treatment is important for chemical control of these diseases. For damping off, water management, temperature management, and seedling growth temperatures are all important cultural controls.

7. Wilt *(Fusarium /Verticillium):* Resistant varieties are key for control.

8. Blotchy ripening: Management of water, fertility, and temperature are important cultural controls.

9. Bacterial Canker *Corynbacterium michiganense*: Copper sulfate as a control and streptomycin for greenhouse grown tomatoes may be effective. Cultural Controls: Pruning suckers makes the problem worse. Treated seed, hot water treatment of seed, and three year crop rotation may reduce the incidence of the disease. It is important to sterilize pots and stakes.

10. Bacterial speck *(Pseudomonas):* Kocide with Maneb or copper sulfate with Maneb has provided good control.

11. Virus: *Tomato Spotted Wilt Virus, Tobacco Mosaic Virus, Cucumber Mosaic Virus*: Weed management is an important cultural control. The virus can be spread by contact with contaminated hands and tools.

12. Sclerotinia Blight: Weed management is an important cultural control. It is important to scout regularly and rogue infected plants before sclerotia are formed.

13. Grey Mold (*Botrytis*): Ventilation is an important cultural control in greenhouse-grown tomatoes.

14. Leaf Mold: Bravo provides good control or Maneb/Pentathlon can be used but PHI can be limiting. Water management is important in control, as is variety selection.

IV. Weeds

Ninety-one percent of growers surveyed used one or more non-chemical practice to control weeds. Cultivation (48% of growers), growing tomatoes on black plastic and other mulching (35%), and mowing (16%) were the most frequently reported practices.

Stable seedbed, pre-emergence herbicide, and postemergence herbicide use were reported by 32%, 34%, and 36% of growers, respectively. The average number of herbicide sprays per year was 0.8.

1. Stale Seed Bed

ACTIVE INGREDIENT	TRADE NAMES	PHI	RATE	REI
glyphosate	Roundup	14 days	1 to 5 qt/A	12 hrs
paraquat	Gramoxone Max 3S	0 days	1.5 to 2.7 pts/A	12 hrs
pelargonic acid	Scythe 4.3	24 hours	3 to 10 pal/A	24 hrs

2. Preplant Incorporated Herbicide for Transplants

Metribuzin (Lexone/Sencor 75DF) and Trifluralin (Treflan 4C) were the most frequently reported herbicides used for preemergent weed control.

Napropamide (Devrinol 50DF) was used prior to transplanting. It primarily controls annual grasses and certain broadleaf weeds. Used in combination with Metribuzin to improve the spectrum of broadleaf weeds controlled.

ACTIVE INGREDIENT	TRADE NAMES	PHI	RATE	REI
Metribuzin	Sencor 75 DF	7 days	1/3 to 2/3 lb/A	12 hrs
Napropamide	Devrinol 50 DF	0 days	2 to 4 lb/A	12 hrs
Trifluralin	Treflan	0 days	1 to 2 pt/A	12 hrs

3. Post Emergence Herbicide for Transplants

Metribuzin (Lexone/Sencor 75DF) and paraquat (Gramoxone Extra) were the most frequently reported herbicides used for postemergent weed control.

ACTIVE INGREDIENT	TRADE NAMES	PHI	RATE	REI
metribuzin	Sencor DF	7 days	1/3 to 2/3 lb/A	12 hrs
clethodim	Select 2EC	20 days	6 to 8 oz/A	24 hrs
paraquat	Gramoxone Max 3S	0 days	1.25 pt/A	12 hrs
sethoxydim	Poast 1.53EC	20 days	1 to 1.5 pt/A	12 hrs
glyphosate	Roundup	14 days	1.5 qt/Acre	12 hrs.
halosulfuron	Sandea	30 days	1.5	12 hrs.

V. Vertebrate Pests

1. Birds

Frequency of Occurrence: Constant pressure. 35% of growers report birds cause significant damage to tomatoes.
Damage Caused: Severe damage to crops.
% Acres Affected: 100%
Timing of Control: When damage is noticed**.**
Yield Losses: can be significant.
Regional Differences: Each farm differs.
Cultural Control Practices: Scare eye balloons, sound devices such as bird calls and gun shots, exclusion by netting, row cover, chicken wire.
Chemical Controls: Bird toxicants

2. Deer

Damage Caused: 32% of growers reported deer damage was common on farms and those farmers report significant damage.
% Acres Affected: 100%
Yield Losses: 25-50% potential.
Regional Differences: Each farm differs in pressure from deer.
Cultural Control Practices: Control tactics include the use of electric and non-electric (8 foot) fencing, hunting, and repellants (hair, blood meal, spray, soap, urine), and harassment (dog, 4-wheeler, noise makers, walking).

Electric fencing works well, but is expensive.

3. Mice/Voles

Frequency of Occurrence: Constant pressure. 25% of growers reported mice/voles as important pests.
% Acres Affected: 100%
Regional Differences: Each area differs in pressure from mice/voles.
Cultural Control Practices: Snap traps, unique delivery methods, PVC piping for baiting.
Chemical Controls: Poison Baits

4. Minor Vertebrate Pests:

Chipmunks, Pheasants, Raccoons, Humans, Woodchucks, Dogs. 16% of growers reported woodchucks or raccoons as important pests.

VI. Acknowledgements:

References:

1. New England Vegetable Management Guide: 2002-2003. Cooperative project from University of Connecticut, University of New Hampshire, University of Maine, University of Rhode Island, University of Massachusetts and University of Vermont.

2. Tomato Pest Management Survey, (Field and Greenhouse), Margaret Siligato, University of Rhode Island. PRONewEngland Pest Management Network. 2002.

3. New England Tomato Pest Management Strategic Planning Meeting, November 2003. Concord, New Hampshire.

5. Census of Agriculture, 1997. USDA National Agricultural Statistics Service

6. Maynard, Donald and George Hochmuth. 1997. Knots Handbook for Vegetable Growers. 4th Edition. John Wiley Publishers.

7. Farm Chemicals Handbook, 2003. R. T. Meister, G. L. Berg, C. Sine, S. Meister, and J. Poplyk, eds. Meister Publishing Co., Willoughby, OH.

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