2005 New England
Sweet Corn Crop Profile

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Note: This profile is a comprehensive list of pests that may be encountered by New England Sweet corn 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, while others only require a single application. Most applications, especially if timed well, will control more than one pest.

*All references in the text to survey results are from the 2004 New England Sweet Corn Pest Management Survey (NE Survey), which represents 215 growers managing 4,474 acres (~25% of total acreage) of sweet corn throughout New England. Percentages were calculated using the number of total respondents as the denominator (Clifton, 2005).

Special thanks to Natalia Clifton for conducting and compiling the New England Sweet Corn Survey. Much of the information and tables presented here are from the survey. Special thanks also to Lee Stivers from New York, author of the New York Sweet Corn Survey. Many pieces of information regarding minor insect pests and diseases have been gleaned from the New York Sweet Corn Profile. Appreciation and thanks also to reviewers of the document: Rich Bonanno, David Handley, Ann Hazelrigg, and Glen Koehler.

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I. Basic Commodity Information

Production Statistics, 2005

Region Rank:.................................8 (6 New England states considered as a single unit)
% U.S. Production:...................... 4.35 %
Acres Planted:.............................. 17,700
Acres Harvested:.......................... 16,000
Cash Value:..................................$42,788,000
Production Regions – Acres planted**:** Connecticut (4700), Massachusetts (6300), New Hampshire (2000), Maine (2300), Rhode Island (1200), Vermont (1200).

The 2002 USDA census counted 1,362 farms growing fresh market sweet corn (16,020 acres harvested) and 4 farms growing sweet corn for processing (42 acres harvested, <1% of total) in New England. All other data are from 2004.

	CT	MA	ME
Rank in National Production:	19	11	23
Percent U.S. Production:	1.18%	1.79%	0.41%
Acres Planted:	4,700	6,300	2,300
Acres Harvested:	4,300	5,800	2,000
Value:	$10.664 million	$16.965 million	$3.96 million
Crop Destination(s):	Fresh Market 100%,	Fresh Market 100%,	Fresh Market 100%,
Production Regions:	Throughout state	Throughout state	Primarily south of line from Dover Foxcroft to Old Town.

	NH	RI	VT
Rank in National Production:	22	24	26
Percent U.S. Production:	0.43%	0.34%	0.19%
Acres Planted:	2,000	1,200	1,200
Acres Harvested:	1,800	1,100	1,000
Value:	$5.292 million	$3.762 million	$2.145 million
Crop Destination(s):	Fresh Market 100%	Fresh Market 100%	Fresh Market 100%
Production Regions:	Scattered throughout; primarily southeastern counties	Throughout state	Scattered around the State.

Values were determined from USDA- NASS data:
http://www.nass.usda.gov:8080/QuickStats/indexbysubject.jsp?Pass_group=Crops+%26+Plants

Cultural Practices:

Sweet corn is a warm-season crop and one of the major vegetables grown in New England. It is an extremely popular crop for roadside stand sales. According to the 2004 New England Sweet Corn Pest Management Survey (NE Survey) results, 54% of the sweet corn crop in New England is sold through fresh market retail sales, 44% is sold as fresh market wholesale, and <1% each is sold for processing, or through community supported agriculture, farmer’s markets or U-Pick operations. Of those answering the survey, 49% identify their crop production practices as conventional, 44% as IPM, 15% as organic, and 4% as other.

Sweet corn is planted on a wide range of soil types in fields throughout New England. The crop is irrigated when necessary, due to dry weather, in those fields that are accessible by irrigation equipment. A wide array of cultivars are available to commercial growers differing in color (yellow, white, or bicolor), days to harvest, sugar content and stability (su, se, sh2, and other genetic variations), ear size, shape, and amount of husk coverage. Effective isolation is required in some of the presently available types of sweet corn on the market and is affected by distance, wind direction, and time of pollen shed and silking. White and yellow cultivars should be separated by 500’. Genetically distinct types of corn that need to be isolated should be separated by at least 250’. Cultivars with the sh2 gene should be planted in a field upwind of others.

Planting

Growers plant a stand every 2-7 days to ensure a steady supply through the season to satisfy market demands. First plantings are made in early April in southern New England and in May in northern New England. Growers plant in early spring to have corn as early as possible in the season, but plantings in cold soils run the risk of erratic germination and poor stands, and the earliest plantings can be frost damaged. Treated seed is used by many growers, and recommended when planting in soils below 60° F.

Most sweet corn is direct seeded into bare ground (94% of growers), with many using clear plastic mulch (22%) and row covers (21%) for the earliest plantings to raise soil temperature. Fertilizer and herbicides are applied, and seed planted, before laying the plastic over seeded rows. Two rows 18” to 24" apart are usually planted under each strip of five-foot wide plastic. Slits or holes are cut in the plastic to allow heat to escape when temperatures under the plastic reach 90° F, and plants to grow through once they are 4” tall. The plastic is removed completely by the time the corn is knee high to facilitate removal and permit cultivating.

Spunbonded row covers offer a potential three-way benefit for early sweet corn production. Maturity is increased by 5 to 10 days, yields are generally increased by 15 to 20%, and the first generation European corn borer can be controlled if the covers are left on until after the peak of the first generation corn borer flight.

Increasingly, growers are transplanting early corn: 7% of sweet corn growers answering the survey transplanted into bare ground, 6% transplanted and used row covers, and 4% transplanted into plastic covered rows.

Sweet corn is direct seeded at approximately 10-15 lbs seed/acre. Early varieties are planted 8-10" within rows and 30-36" between rows, while main season corn is usually 10-12” within rows and 30-36” between rows.

Fertilizer

A typical crop of sweet corn requires 100-160 lbs/A of nitrogen per season. Typically, approximately 50-100 lbs is applied pre-plant with 0-50 lbs applied as a sidedress at the late whorl to pre-tassel stage. Less nitrogen fertilizer is needed if manure or legume sod was plowed down. Most growers use cover crops to supplement the soil, with 67% of growers who responded to the NE survey planting a grass cover crop and 15% using legumes. Thirty percent apply manure, 17% apply compost, and 16% use other soil and/or nutrient management practices. Eighty percent of the growers responding to the NE survey use a soil test to determine fertilizer needs (29% annually, 40% every 2-3 years, 7% every 4-5 years), and 40% of respondents use a pre-sidedress nitrate test in June to determine how much nitrogen to add to the soil.

Worker Activities

Planting

*Seeds treated with fungicides are commonly used to prevent seed decay. Of the survey respondents, 56% used fungicide-treated seed.

*Seeds are purchased pre-treated from the seed supplier.

*Growers who do not wear protective gloves can be exposed to the fungicide on the seeds while doing common tasks during the process of planting, such as filling or cleaning out the hopper, or checking the seed in the soil for spacing and depth.

Scouting

* Scouting sweet corn for insect pests and damage is recommended and done on many farms to determine whether or not insect control is needed and if so, when.

* Scouting in the field begins when the corn is knee high and continues one to two times per week through the silking period. Corn earworm traps are set up in fields before silking and are checked for moths 1-2 times per week.

* The potential for a significant exposure to pesticides is possible if a scout were to enter a field following a pesticide application. Early scouting in whorl, pre-tassel and tassel stage corn involves contact with many leaves. Corn earworm traps are monitored when the corn ears are silking and the corn has grown above head level. It is impossible to reach the trap without exposure to corn foliage.

*87% of survey respondents scout for insect pests on their farms. While 68% of the growers scout themselves, many also use farm employees (16%), private IPM scouts or consultants (11%), and University/ Extension scouts (12%).

*When corn scouts are used, excellent pesticide application records and close communication with the pesticide applicator are necessary to insure that scouting is done after the REI for any sprays that have been applied.

Hand weeding/hoeing
*****Hand weeding (27%) and/or hoeing (20%) are done in young corn to reduce weed competition and help establish the crop.

*Workers who weed in the early corn may be exposed to post-emergence herbicides.

Pesticide applications
*****Most growers achieve marketable sweet corn by spraying for the three main caterpillar pests: corn earworm (*Helicoverpa zea*), European corn borer (*Ostrinia nubilalis*) and fall armyworm (*Spodoptera frugiperda*). NE survey respondents apply an average of 4 pesticide applications per year to their sweet corn aimed at controlling insects, 1.15 sprays for weeds, and 0.135 applications for disease control.

*Sprays for fall armyworm are generally applied when the corn is in the whorl stage, while European corn borer controls are applied at the pre-tassel stage or early tassel stage. Usually one or two sprays will control these pests at these stages. Controls for corn earworm are generally applied during the silking stage, usually every 2-6 days until harvest, as needed, depending upon pest pressure and temperature.

*Pesticide applicators must mix sprays, clean equipment and be on the tractor in the field during the application. Amount of contact with pesticide depends upon the care and personal protective equipment used by the individual worker, and the type of spray equipment used. Applicators using a boom sprayer or an air blast sprayer have limited exposure to pesticide treated corn, but may be more affected by pesticide drift, especially if unprotected. Those using a backpack sprayer or mist blower must walk through the corn, and could potentially be exposed to high levels of pesticides on the treated leaves. Of the New England Growers responding to the survey, 18% apply pesticides at some time using a backpack sprayer.

*92% of NE survey respondents use field IPM and/or read pest alerts to manage insects: 32% use pheromone traps to monitor for corn earworm, 25% to monitor European corn borer, 20% to monitor fall armyworm; 81% field scout for caterpillars or feeding damage; and 60% read state or regional pest alerts.

*****In the NE survey growers were asked to rate how often they use the following personal protective equipment and protective clothing when mixing and/or applying pesticides (Number of respondents=198, % Growers calculated as percentage of total growers answering survey, not the number answering the question):

Personal Protective Equipment	#Growers	%Growers	Always #	Occasionally #	Never #	Not Applicable #
Long pants	189	88	175	10	1	3
Long-sleeved shirt	189	88	134	50	2	3
Gloves	189	88	122	58	6	3
Respirator	177	82	82	62	29	4
Nitrile gloves	160	74	68	43	41	8
Goggles	175	81	56	72	42	4
Boots (chemical resistant)	178	83	54	63	57	4
Latex gloves	161	75	36	44	71	10
Chemical resistant suit	169	78	34	61	68	6
Face shield	164	76	30	49	80	5
Cotton gloves	151	70	5	16	121	9

*Responses of 199 New England growers indicate the type of application they used for chemical treatment of sweet corn. Growers may have indicated the use of more than one type of equipment:

%Growers	Pesticide application equipment
49	Boom sprayer without drop nozzles
38	Air blast sprayer
24	Boom spray with drop nozzles
18	Backpack sprayer
5	Zea-later (or other oil applicator)
1	Shielded sprayer
1	Air assisted sprayer
6	Other

Pesticide Use

The New England Sweet Corn Survey respondents ranked the importance of various factors to pesticide use decisions. The effectiveness of the pesticide against the targeted pest and the toxicity of the material to humans are the two most important factors growers consider when deciding which pesticides to use (Number of responses: 203):

		Importance		
Rank	**Factors**	**Very**	**Somewhat**	**Not**
1	Effectiveness against pest compared to alternative products	159	17	2
2	Applicator hazard (toxicity to humans)	141	41	4
3	Customer relations (food safety concerns)	113	57	8
4	Label restrictions (reentry and PH intervals, protective equipment)	102	57	11
5	Impact on beneficials	92	74	7
6	Other potential nontarget and environmental impacts	90	66	9
7	Cost per treatment	77	87	10
8	Formulations (liquid vs. dry, etc)	50	83	28
9	Storage requirements	42	84	32
10	Size or type of packaging	43	81	38

Results from the NE survey also showed that the New England Vegetable Management Guide and other Extension activities rank the highest in importance as sources of information that growers rely on in making their pest management decisions (203 responses):

		Importance		
Information source	**Rank**	**Very**	**Somewhat**	**Not**
NEVM Guide	1	141	37	7
Extension newsletters/pest alerts	2	137	44	6
Off-season educational meetings	3	100	70	6
University/Extension Staff	4	103	57	9
Other growers	5	81	76	16
Suppliers/dealers	6	73	75	19
Twilight meetings	7	48	72	36
Trade Publications	8	32	102	27
Web Sites	9	25	75	57
Other: crop consultants	10	6	0	0

Group A – Insect and mite pests identified by New England Growers as most important

Because of the overlapping occurrence of corn earworm, European corn borer, and fall armyworm, a single insecticide application may target two or more of these pests.

1. Corn earworm, *Helicoverpa zea*

Type of Pest: Insect

Frequency of Occurrence: Annually

Damage Caused: Larvae feed on the kernels at the tip of the ear causing unsightly damage and leaving a large amount of frass. Damage is often limited to the first inch of the tip of the ear. When husks are opened the tip of the ear has been eaten away and masses of frass are evident; the caterpillar is often visible at tip.

% Acres Affected: While 100% of crop is at risk, survey responses showed that 85% of the growers treated 81% of sweet corn acreage for this pest in 2004.

Timing of Control: Early July through September

Yield Losses: Losses can be as high as 100% in fresh market sweet corn along coastal New England, and will vary inland depending upon pressure. Typically, corn that is treated for corn earworm can have losses as high as 10%, although the fresh market demands 95-98% clean ears.

Regional Differences: Corn earworms do not over-winter in New England. Adults migrate into New England in mid to late summer with storm fronts. Thus, the timing of corn earworm infestations depend upon the weather. Farms along the coast of New England are subject to high corn earworm pressure every year, while more northern and inland farms may or may not get significant corn earworm pressure in a given year.

Cultural Control Practices: Planting cultivars with complete and tight husk cover at the tip may help control the pest by limiting larval access to the kernels. Because CEW immigrate, early-maturing varieties and early plantings may be less subject to infestation. Cultural controls alone often will not provide adequate levels of control to meet fresh market standards.

Biological Control Practices: There is currently no practical, effective biological control of corn earworm either through native or massed-reared and released beneficial arthropods. Native predators may use eggs as a food source, but are not sufficient to reduce infestations. Mass-reared beneficials that are available for suppression of corn earworm (such as *Trichogramma pretiosum*) have not proven effective for economic levels of control.

Postharvest Control Practices: Some markets will accept corn ears that have had the tips chopped off. This effectively removes the part of the ear damaged by the corn earworm caterpillar. This is not a viable option for most corn growers, however, as the markets differ and the process is time consuming.

Pest life cycle: Throughout most of the Northeast, corn earworm is an annually invasive pest, invading the region from the south. In the mid-Atlantic, pupae over-winter in the soil, but only survive in areas where the frost line is less than an inch below the soil surface. The severity of winter temperatures and the amount of snowfall greatly influence the over-wintering range of corn earworm from year to year. Surviving moths emerge and mate, and females deposit eggs on sweet corn foliage. The early-season larvae that hatch from these eggs may feed on the whorls or undeveloped tassels, but this feeding rarely affects corn production or quality. Late-season populations arise from moths migrating from southern states. Female moths are highly attracted to fresh-silking sweet corn for oviposition. Eggs are typically laid one at a time and hatch in 2-10 days, depending on temperatures. Hatching larvae feed on silks and work their way to the kernels at the ear tip. They reach 1.5 inches in length, going through six instars. They then drop to the ground, burrow into the soil, and pupate. Moths emerge from the pupa in 10 to 25 days.

Other Issues: To kill eggs or newly hatched larvae, insecticide residues must be present at all times on the silk while CEW moths are laying eggs and eggs are hatching.

Pheromone and black light trap counts correlate with the number of eggs laid and subsequent infestations of the ear. Thus, IPM monitoring for corn earworm moth flight through the use of traps is a critical step in the management of this pest in that they determine the need for, and timing of, insecticide applications. It has been shown that the number of sprays can be reduced through their use. Growers manage traps themselves, hire crop consultants on their own farm, or rely upon regional networks, which are generally managed by the state Extension program. Indications from those present at the Northeast regional Sweet Corn PMSP workshop are that an increase in the amount of professional scouts and/or Extension staff would help growers make decisions to reduce pesticide use. Pheromone traps are not a control measure in themselves, but lead to better control with reduced pesticide inputs. In the absence of trap data, growers rely on crop stage, time of year, and past experience to determine when to start and how often to spray, regardless of need.

Microbial insecticides such as *Bacillus thuringiensis* (*Bt)* and spinosad are labeled for this pest. *Bt* may cause suppression, but is inadequate for economic control because it must be ingested to be toxic to the insect and larvae feed very little before entering the ear. Spinosad has demonstrated effectiveness at moderate pest levels but is 3-4 times more expensive than currently used materials and has a high probability of resistance development.

Corn or soybean oil, combined with Bt or another organically approved pesticide product, and applied to the silk of each ear is an alternative to chemical controls. A small quantity of oil is applied directly to each silk using a hand held applicator (Zea-later). This method is most appropriate to smaller scale operations (<25 acres). Regional data indicates that the effectiveness of this technique when used alone decreases under extremely high pest pressure.

* All applications are ground applications unless otherwise noted.

Chemical Controls for Corn earworm:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating[1]) Application Notes	Typical Dose	Num. of Appli-cations[2]	PHI days	REI hours	Resistance Group	Comments
Bacillus thuringiensis sp *aizawi* (Xentari)	no reported use for this pest	½-2lb/A	1-4	0 may vary	4	11	Does not work well as foliar spray
Bacillus thuringiensis sp kurstaki (Dipel, Thuricide)	5% growers use on 1% Acres Excellent/Good/Poor rating score 4 / 4 / 2 Direct to silk or Ground	½-2lb/A	1-4 Depends upon method	0 may vary	4	11	Does not work well as foliar spray
bifenthrin (Capture 2EC)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 1 / 0	2.1-6.4 oz/A		1	12	3A	Use prohibited in all coastal communities
carbaryl (Sevin XLR Plus)	5% Use on 2% Acres Excellent/Good/Poor rating score 2 / 6 / 2	1.5-2 oz/A		2 ears 14 forage	12		
cyfluthrin (Baythroid 2)	4% Use on 7% Acres Excellent/Good/Poor rating score 3 / 5 / 0	1.6-2.8 oz/A		0	12	3A	
deltamethrin (Decis 1.5EC)	NA	1.5-2.4 oz/A		1	12	3A	
esfenvalerate (Asana XL)	9% Use on 14% Acres Excellent/Good/Poor rating score 9 / 10 / 0	5.8-9.6 oz/A		1	12	3A	
gamm-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A		1	24	3A	
lambda-cyhalothrin (Warrior)	48% growers use on 60% Acres Excellent/Good/Poor rating score 75/25 /1	2.5-3.8 oz/A	1-4	1	24	3A	Ranked #1 in use
methomyl (Lannate SP)	39% growers use on 48% Acres Excellent/Good/Poor rating score 49/30 /2	¼-1/2 lb/A	1-4	0 ears 3 forage	48	A	Ranked #2 in use
permethrin (Ambush, Permethrin, Pounce)	15% growers use on 12% Acres Excellent/Good/Poor rating score 11 /17 /3	6.4-12.8 oz/A	1-4	1	12	3A	

vegetable oil	3% growers use on <1% Acres Excellent/Good/Poor rating score 3 /1 / 1 Direct to silk	0.5 ml/ear	1	0	0	25	Used in conjunction with Dipel (see Bt)
spinosad (SpinTor 2SC, Entrust)	7% growers use on 5% Acres Excellent/Good/Poor rating score 8 / 4 / 2	3-6 oz/A (spintor) 1-2 dry oz/A (Entrust)		1	4	5	recommended for low CEW pressure only
thiodicarb (Larvin 3.2)	17% growers use on 16% Acres Excellent/Good/Poor rating score 20 /12 /4	20-30 oz/A		0	48	1A	Ranked #3 in use
zeta-cypermethrin (Mustang)	no reported use for CEW	3-4.3 oz/A		3	12	3A	
(Pyronyl)	1 person, good control						

1 – number of growers who rated the product as excellent, good or poor.
2 – can vary; one single application may be used to control multiple pests.

2. European corn borer, *Ostrinia nubilalis*

Type of Pest: Insect

Frequency of Occurrence: Annually

Damage Caused: Larvae feed on all above ground parts of the plant. During the whorl stage, the emerging larvae feed on leaves within the inner whorl of the plant; at pretassel stage, they feed on the florets, then move into the ptih of the tassel stalk, causing the tassels to bend over at the top; and after tassels emerge and dry out, during the silk stage, they bore into the stalk or the corn ears causing feeding holes through the husk into the ear. Caterpillars can be found in visible tunnels through the kernels or deep tunnels within the ear. Early planted corn may be infested by larvae that move directly into the ears through the silk channel when they lay eggs on flag leaves of silking corn.

% Acres Affected: While 100% of crop is at risk, Survey responses show that 85% of growers treated for this pest on 77% of sweet corn acreage in 2004.

Timing of Control: June through September
European corn borer is most serious as a pest problem during ear formation when the larvae are the most difficult to control. As a result control methods are targeted at the pretassel stage and silk stage.

Yield Losses: Damage in untreated blocks ranges from 0-100% depending upon time of year and pest populations. Yield losses can be as high as 100% in fresh market sweet corn, even when damage is only 10-15% unmarketable ears. Wholesale buyers may reject entire loads even if worm infestations are relatively light. Pest pressure can vary considerably from field to field.

Regional Differences: Corn borer pressure varies from field to field throughout region, and is worse in fields where peppers, potatoes, beans or sweet corn have been grown for many years. Except in northern New England, a second generation of the pest occurs and causes more serious damage because populations may be higher and more sweet corn fields are producing ears at this time.

Cultural Control Practices: Fall tillage reduces overwintering survival because larvae overwinter in stalks. Field rotations are important to avoid population build-up. Floating row cover is used by some growers to accelerate growth and to provide a barrier to oviposition by corn borer moths. Covers are generally removed before tasseling, but growers save one or more sprays because egg laying is delayed until after cover is removed.

Effective weed control contributes to reduced ECB infestations: poor weed control is associated with increased oviposition.

Biological Control Practices: Release of parasitic *Trichogramma* wasps, particularly *Trichogramma ostriniae,* into sweet corn has been documented to have significant impact on infestations given proper timing and release rates. Optimal timing for placement of cards with wasp pupae attached is in the mid-whorl stage (12-18 inches tall) when ECB flight is rising or at peak, but before ECB eggs hatch. Two or three releases may be needed to achieve control, at release rates ranging from 30,000 to 60,000 per acre. After wasps emerge, they parasitize European corn borer eggs. Wasps multiply during the season and travel at least ¼ mile into adjacent blocks, but have not been found to over-winter in New England. Research reports show parasitism rates ranging from 60 to 97% by using *Trichogramma ostriniae*, an Asian *Trichogramma* species which was introduced into the US in 1990. A major barrier to more widespread use has been the lack of a commercial domestic source of mass-reared wasps. Other species of Trichogramma *(T. pretiosum, T. brassicae)* are commercially available but have lower efficacy against ECB in corn. Since neither wasp over-winters in New England, they must be purchased and released yearly. Native predators that attack eggs or larvae include the twelve-spotted ladybeetle, *Coleomegilla maculata.* Conservation of this and other beneficials by use of reduced risk insecticides can help suppress ECB.

Postharvest Control Practices: Destruction of corn residue through disking after harvest and plowing can destroy a large percentage of overwintering larvae. Cover crops are widely used to prevent erosion and capture soluble nitrogen.

Pest Life Cycle: European corn borer (ECB) is an introduced pest which is established throughout the Northeast. It has two generations in New England, overwintering as a fully grown larva in the stems and ears of corn plants, usually just above the ground surface, and completes its development in the spring. Adults emerge according to temperature: phenology models based on temperature can be used to predict emergence and first egg laying. Female moths lay their eggs in masses of five to fifty on the underside of corn leaves within four days of emergence, which is sometime from mid-May to late June, depending on location, for the first generation. Females lay an average of 500 to 600 eggs. The eggs hatch in 3 to 7 days, depending upon temperature. The second generation emerges from late July to late August. Larvae feed on all above ground corn plant tissue; during ear development they bore through the husk and kernels into the corn cob causing damage to the ear and reducing marketable yields.

Chemical Controls for European corn borer:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) Application Notes	Typical Dose	Timing	Typical Dose (lbs ai /acre)	Num. of Appli-cations	PHI days	REI hours	Group	Comments
Bacillus thuringiensis sp *aizawi* (Xentari)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 / 0	½-2lb/A	Late whorl to harvest	0.54	1-4	0 may vary	4	11	
Bacillus thuringiensis sp kurstaki (Dipel, Thuricide)	8% growers use on 3% Acres Excellent/Good/Poor rating score 5 / 8 / 1	½-2lb/A	Late whorl to harvest	0.54	1-4	0 may vary	4	11	
bifenthrin (Capture 2EC)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 1 / 0	2.1-6.4 oz/A	Late whorl to harvest	0.073	2	1	12	3A	Use prohibited in all coastal communities
carbaryl (Sevin)	5% growers use on 3% Acres Excellent/Good/Poor rating score 3 / 5 / 2	1.5-2 oz/A	Late whorl to harvest	1.75	1	2	12	1A	
chlorpyrifos (Lorsban)	<1% growers use on 1% Acres Excellent/Good/Poor rating score 1 / 0 / 0	5-6.5 lb/A	whorl	6.5	1	30	12	1B	
cyfluthrin (Baythroid 2)	5% growers use on 9% Acres Excellent/Good/Poor rating score 5 / 5 / 1	1.6-2.8 oz/A	Late whorl to harvest	0.03	1	0	12	3A	
deltamethrin (Decis 1.5 EC)	NA	1.5-2.4 oz/A				1	12	3A	
esfenvalerate (Asana XL)	9% growers use on 13% Acres Excellent/Good/Poor rating score 9 / 9 / 1	5.8-9.6 oz/A	Late whorl to harvest	0.04	2-3 F (NY)	1	12	3A	
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A				1	24	3A	
indoxacarb (Avaunt)	no reported use	2.5-3.5 oz/A	whorl-tassel			3	12	26	
lambda-cyhalothrin (Warrior)	44% growers use on 51% Acres Excellent/Good/Poor rating score 71/23 /1	2.5-3.8 oz/A	Late whorl to harvest	0.02	1-4?	1	24	3A	Ranked #1 in use

methomyl (Lannate SP)	41% growers use on 49% Acres Excellent/Good/Poor rating score 53/33 /2	¼-1/2 lb/A	Late whorl to harvest	0.4	1-2	0 ears3 silage	48	1A	Ranked #2 in use May cause phytotoxicity
methoxyfenozide (Intrepid 2F)	1% growers use on 1% Acres Excellent/Good/Poor rating score 1 / 0 / 1	4-8 oz/A	Late whorl to harvest	0.09		3	4	18	Insect growth regulator
permethrin (Ambush, Pounce)	20% growers use on 17% Acres Excellent/Good/Poor rating score 18 /21 / 3	6.4-12.8 oz/A	Late whorl to harvest	0.15	1-4	1	12	3A	Ranked #3 in use
Spinosad (SpinTor 2SC, Entrust)	11% growers use on 11% Acres Excellent/Good/Poor rating score 16 / 7 / 7	3-6 oz/A (SpinTor) 1-2 dry oz/A (Entrust)	Late whorl to harvest	0.062		1	4	5	Entrust meets USDA National Organic Standards
thiodicarb (Larvin)	18% growers use on 19% Acres Excellent/Good/Poor rating score 21 /15 / 3	20-30 oz/A	Late whorl to harvest	0.75	1-3	0	48	1A	
zeta-cypermethrin (Mustang)	<1% growers use on 3% Acres Excellent/Good/Poor rating score 0 /0 / 0	3-4.3 oz/A	Late whorl to harvest	0.0425		3	12	3A	

3. Fall Armyworm, *Spodoptera frugiperda*

Type of Pest: Insect

Frequency of Occurrence: Sporadic, but damage can be significant

Damage Caused: Larvae feed on the whorl in young corn plants, resulting in large, irregular holes visible in the new leaves as they unfold, and on the ears in older corn, causing extensive, unsightly, damage. Infested plants look ragged and torn, and copious amounts of frass are found where feeding has occurred.

% Acres Affected: While 100% of crop is at risk, 60% of the Survey respondents treated their sweet corn in 2004, representing 37% of sweet corn acreage.

Timing of Control: July through September

Yield Losses: Can be as high as 100% in fresh market sweet corn along coastal New England. Pest pressure can vary considerably from year to year and by location.

Regional Differences: Fall armyworm moths migrate into New England from the south, so the timing and location of infestation depend upon the weather but generally occur in late July. When fall armyworm is present they often have a patchy distribution within the field. Numbers are usually highest along coastal areas, and later in the season. In inland and northern areas significant infestations are not as common.

Cultural Control Practices: Early cultivars are less likely to have problems with fall armyworm; however, sweet corn markets demand full season availability.

Biological Control Practices: No established programs.

Postharvest Control Practices: None

Pest life cycle: The fall armyworm does not generally overwinter in the Northeast. Infestations result from fertile moths migrating northward on storm fronts from southern states. Adult female moths lay egg masses of 50 or more on the underside of leaves, preferring whorl stage corn. Eggs hatch in 10 days depending on temperature. Larvae feed gregariously in the whorl when they are young and disperse as they grow. As corn develops, larvae move into green tassels and, if larvae are not fully grown by the silk stage, they may enter ears. At this stage, damage to the ear is severe. Controls are timed to kill larvae prior to the silk stage. Late in the season eggs may be laid on husks or flag leaves, allowing larvae to move directly into ears via the silk channel. These larvae cause extensive injury to the ear, similar to CEW. When fully grown, larvae move into the soil and pupate for 10-14 days. A second generation is not important in northern parts of New England.

Other Issues: Transgenic Bt cultivars are available. Applications of Avaunt control this pest, but for many growers the product is presently too expensive, especially because it is only packaged in large quantities. Lannate and Warrior are the choice of most growers; however, Warrior provides inadequate control under high pest pressure.

Integrated pest management for fall armyworm includes field scouting to determine the percent of plants with egg masses, live larvae or fresh feeding damage, and blacklight traps or pheromone traps, containing the correct type of pheromone, to detect adult flight. Traps are especially useful because of the sporadic and unpredictable nature of FAW arrival and numbers; however, actual field scouting is crucial in decision making and timing of sprays. Corn may be treated for fall armyworm at any stage, but treatment is recommended at 15% infestation. Treatment is also most effective in whorl stage corn.

Chemical Controls for fall armyworm:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
Bacillus thuringiensis sp aizawai (XenTari)	no reported use	½-2lb/A	1-4	0 may vary	4	11	for light infestations of first and second instars
Bacillus thuringiensis sp kurstaki (Dipel)	2% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 2 / 1	½-2lb/A	1-4	0 may vary	4	11	for light infestations of first and second instars
bifenthrin (Capture 2EC)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 1 / 0	2.1-6.4 oz/A	2	1	12	3A	Use prohibited in all coastal communities
carbaryl (Sevin)	1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 2 / 0	1-2 oz/A	1	3	12	1A	
cyfluthrin (Baythroid 2)	4% growers use on 4% Acres Excellent/Good/Poor rating score 3 / 4 / 0	2.8 oz/A	1	0	12	3A	for fall armyworm first and second instars only
deltamethrin (Decis 1.5EC)	NA	1.5-2.4 oz/A		1	12	3A	
esfenvalerate (Asana XL)	6% growers use on 4% Acres Excellent/Good/Poor rating score 4 / 8 / 1	5.8-9.6 oz/A	2	1	12	3A	
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A		1	24	3A	for control of first and second instars only
indoxacarb (Avaunt)	no reported use new to market	2.5-3.5 oz/A		3	12	26	Not to be used after silking stage begins
lambda-cyhalothrin (Warrior)	34% growers use on 25% Acres Excellent/Good/Poor rating score 48/22 /3	2.5-3.8 oz/A	1-7	1	24	3A	Use high rate for large larvae

methomyl (Lannate SP)	29% growers use on 20% Acres Excellent/Good/Poor rating score 35/23 /4	¼-1/2 lb/A	1-2	0	48	1A	May cause phyto-toxicity
permethrin (Ambush, Permethrin, Pounce)	10% growers use on 4% Acres Excellent/Good/Poor rating score 10 /11 / 0	6.4-12.8 oz/A	1-4	1	12	3A	
Spinosad (SpinTor 2SC and Entrust)	2% growers use on 1% Acres Excellent/Good/Poor rating score 4 / 1 / 0	3-6 oz/A (SpinTor) 1-2 dry oz/A (Entrust)	1-2	1	4	5	Entrust is OMRI listed Do not feed ears/stalks to animals for 28 days Conserves aphid pred.
thiodicarb (Larvin 3.2)	12% growers use on 5% Acres Excellent/Good/Poor rating score 9 /16 / 1	20-30 oz/A	1-3	0	48	1A	do NOT feed silage to livestock
zeta-cypermethrin (Mustang)	<1% growers use on 2% Acres Excellent/Good/Poor rating score 0 /0 / 0	3-4.3 oz/A	1-2	3	12	3A	

Group B – Insect and mite pests identified by New England Growers to be significant problems in some years

4. Corn leaf aphid, *Rhopalosiphum maidis*

Type of Pest: Insect

Frequency of Occurrence: Annually, though economic impact varies.

Damage Caused: Aphids cause injury to sweet corn by removing plant sap with their needlelike mouthparts. Plant damage occurs only from large colonies and may include interference with pollination, necrosis of upper leaves of the plant, or delay in maturity. The most common problem derives from the excretion of a sugary, sticky substance ("honeydew"). When large colonies of aphids are present the honeydew coats leaves, tassels, and ears and promotes the growth of black sooty mold. Aphids may also burrow between leaves of the husk. These conditions detract from the appearance of the corn and can make fresh market corn unmarketable.

Corn leaf aphid is a potential vector of barley yellow dwarf virus (BYDV), though a poor vector of Maize dwarf mosaic virus (MDMV). Control of corn leaf aphid has little or no impact on the spread of MDMV. (Ferro)

% Acres Affected: While 100% of crop is at risk, 29% of the Survey respondents treated their sweet corn in 2004, representing 29% of sweet corn acreage.

Timing of Control: July through September; Early tassel through harvest. If barley yellow dwarf virus is a threat, applications to whorl-stage corn may be justified.

Regional Differences: None

Cultural Control Practices: Conditions which favor this pest include dry soil conditions and moisture stress in the crop, high temperatures, excessive levels of soil nitrogen, and absence of endemic natural enemies. Keep corn stand healthy with water, and appropriate levels of nitrogen.

Biological Control Practices: Natural enemies help keep aphids from reaching outbreak proportions. Predators include numerous species of ladybird beetles, minute pirate bugs (*Orius* spp), lacewing larvae, and predatory midges; several parasitoids (tiny wasps which lay eggs in the aphid nymphs, where larvae develop inside, killing the host) are also common. Conserving predators and parasites in corn by using selective insecticides or biological organisms to control caterpillars, especially early in the season when European corn borer is the dominant pest, is an important strategy for reducing aphid outbreaks.

Postharvest Control Practices: None

Other Issues:
Field monitoring (e.g., checking 5 plants at each of 5 locations in the field) is done at pre-tassel or tassel stage to determine presence of large or increasing numbers of aphids in the developing tassel. Treatments are based on % of tassels with large numbers of aphids (e.g., 25% of plants), absence of natural enemies, and moisture stress. Treatments at pre-tassel or green tassel stage are most effective. Scouting is most critical under drought conditions. Seed corn producers must pay special attention to protect pollen availability from inbred lines.

Lannate is often the product of choice and is considered the most effective product available. Warrior will suppress aphids, but does not provide significant control. Further, the use of broad-spectrum insecticides, such as synthetic pyrethroids (e.g. Warrior) for caterpillar control, may induce aphid outbreaks by killing natural enemies.

Where spinosad (SpinTor and Entrust) or Bt products are used for caterpillar pests, beneficials that suppress aphids are conserved; however, these products do not directly control aphids. Insecticidal soap is a ‘soft’ alternative for aphids but does not give reliable control.

A combination of moderate nitrogen fertilizer inputs and high presence of beneficial insects decreases outbreaks of this pest.

Chemical Controls for corn leaf aphid:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Group	Comments
bifentrhin (Capture 2EC)	no reported use	2.1-6.4 oz/A		1	12	3A	
delatmethrin (Decis 1.5EC)	NA	1.5-2.4 oz/A		1	12	3A	
endosulfan (Thionex 50W)	1% growers use on <1% Acres Excellent/Good/Poor rating score 2 /0 /0	2 lb/A		1	24	2A	
esfenvalerate (Asana XL)	no reported use	5.8-9.6 oz/A		1	12	3A	
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A		1	24	3A	Suppression only
lambda-cyhalothrin (Warrior)	14% growers use on 13% Acres Excellent/Good/Poor rating score 11 /13 /5	2.5-3.8 oz/A	1-7	1	24	3A	Suppression only
methomyl (Lannate SP)	20% growers use on 20% Acres Excellent/Good/Poor rating score 29 /13 /1	¼- 1/2 lb/A	1-2	0	48	1A	
(M-Pede)	<1% growers use on 4% Acres Excellent/Good/Poor rating score 0 /0 /0						Not labeled for sweet corn

5. Common Armyworm, *Psuedaletia unipuncta*

Type of Pest: Insect

Frequency of Occurrence: Sporadic, but damage can be significant

Damage Caused: Like the fall armyworm, larvae prefer to feed on the whorl in young corn plants, resulting in large, irregular holes visible in the new leaves as they unfold. Infested plants look ragged and torn. Common armyworm does overwinter in New England, so it can affect early planted corn.

% Acres Affected: There is no data on the amount of acreage affected, but growers who answered the New England Sweet Corn Survey ranked common armyworm as the fifth (out of 13) most important pest in sweet corn. Nevertheless, common armyworm is rarely a problem in New England.

Timing of Control: late May through September

Yield Losses: can be significant if

Regional Differences: none

Cultural Control Practices: none

Biological Control Practices: No established programs.

Postharvest Control Practices: none

Other Issues: Common armyworm, unlike the fall armyworm, overwinters in New England. The larvae primarily feed on grass, sometimes moving into sweet corn. Transgenic Bt cultivars of sweet corn are available. Applications of Avaunt control this pest, but for many growers the product is presently too expensive, especially because it is only packaged in large quantities. Lannate and Warrior are the choice of most growers; however, Warrior provides inadequate control under high pest pressure.

Integrated pest management for common armyworm is to scout the field for damage in whorl through tassel stage corn, and to spray only when 15% or more of the field is infested. Common armyworm infestations are sporadic and unpredictable.

Chemical Controls for common armyworm: see fall armyworm (#3, above)

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6. Common stalk borer, *Papaipema nebris*

Type of Pest: Insect

Frequency of Occurrence: Sporadic

Damage Caused: Larvae eat leaves or bore into the corn stalks and consume the whorl, commonly destroying the growing point of the plant. The young corn plants are most susceptible to injury.

% Acres Affected: While 100% of crop is at risk, 15% of the Survey respondents treated their sweet corn in 2004, representing 12% of sweet corn acreage.

Timing of Control: Planting through the six- leaf stage. Late May through July.

Yield Losses: minor

Regional Differences: None

Cultural Control Practices: Stalk borers overwinter as eggs in weeds, entering fields as larvae from the edges in the spring. Reducing weeds around fields is one way to help reduce populations. Stalk borers can become more of a problem in no-till fields where weeds are more difficult to control.

Biological Control Practices: Stalk borers are susceptible to many generalist predators and parasitoids.

Postharvest Control Practices: None

Other Issues: Tends to be more of an issue at field edges, so spot applications to outer rows can be used effectively. Sprays that target European corn borer or fall armyworm may also control this pest.

Chemical Controls for Common stalk borer:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) Application notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
bifenthirn (Capture 2EC)	No reported use	2.1-6.4 oz/A	1	1	12	3A	Use prohibited in all coastal communities
carbaryl (Sevin)	1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 1 / 0	1-2 oz/A	1	3	12	1A	
cyfluthrin (Baythroid 2)	<1% growers use on 2% Acres Excellent/Good/Poor rating score 0 / 0 / 1	1.6-2.8 oz/A	1	0	12	3A	
deltamethrin (Decis 1.5EC)	NA	1.5-2.4 oz/A	1	1	12	3A	
esfenvalerate (Asana XL)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 / 0	5.8-9.6 oz/A	1	1	12	3A	
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A	1	1	24	3A	
lambda-cyhalothrin (Warrior)	10% growers use on 9% Acres Excellent/Good/Poor rating score 13 / 6 /1	2.5-3.8 oz/A	1	1	24	3A	
methomyl (Lannate SP)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 / 0	¼-1/2 oz/A	1	0 ears 3 forage	48	1A	
permethrin (Ambush, Pounce)	4% growers use on 4% Acres Excellent/Good/Poor rating score 4 /4 / 1	4-8 oz/A	1	1	12	3A	
thiodicarb (Larvin)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 / 0	20-30 fl oz/A	1	0	48	1A	Do not exceed 7.5 lb ai/A per season

Group C – Insect and mite pests identified by New England Growers as infrequent pest problems

7. Cutworms- black cutworm (*Agrotis ipsilon*), variegated, dingy, spotted, dark-sided or glassy

Type of Pest: Insect

Frequency of Occurrence: Sporadic, though damage can be significant.

Damage Caused: Young larvae feed on the leaves of young plants, and older cutworms bore into or sever the stem at or below ground level. As a result, crop stands can be significantly reduced.

% Acres Affected: While 100% of crop is at risk, 7% of the Survey respondents treated their sweet corn in 2004, representing 11% of sweet corn acreage.

Timing of Control: Seedling stage**.**

Yield Losses: Can be up to 50% in severely affected fields. (from NY sweet corn crop profile)

Regional Differences: None

Cultural Control Practices: Cultural practices such as early clean tillage, avoiding planting corn in recently plowed sod, and delaying planting after initial tillage of cover crops or weeds, are the primary control methods for this pest. Monitoring moth flight with pheromone traps in late winter to determine the need for additional controls such as early tillage can be used to aid in the management of this pest. Avoid fields with a history of cutworm problems. Avoid fields that had heavy weeds the previous year or in the early spring (especially winter annuals such as chickweed), or control weeds well before planting. No resistant varieties are available.

Biological Control Practices: Naturally-occurring predators, parasitoids, and pathogens may help suppress infestations, but information is lacking.

Postharvest Control Practices: None

Other Issues: The percentage of acres infested depends on tillage and the weather conditions each year. Damage is more common in early corn, especially in a cold and wet season. In addition, this pest tends to be more of a problem in fields with a previous cover crop or fields heavily infested with weeds. Populations may be more severe in no-tillage systems or in corn following sod. Tillage of weeds, sod, or cover crops, or killing weeds with herbicide, immediately before planting will encourage cutworms to move to corn seedlings. Generally this pest is not a problem in later corn plantings. Field scouting when seedlings are small is used to determine the need for rescue treatments.

Chemical Controls for cutworms:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Group	Comments
Bacillus thuringiensis kurstaki	no reported use		1	0	4	11	
bifenthrin (Capture 2EC)	no reported use	2.1-6.4 oz/A	1	1	12	3A	Prohibited in coastal communities
carbaryl (Sevin XLR Plus)	1% growers use on <1% Acres Excellent/Good/Poor rating score 2 / 0 / 1 seedling stage	1-2 oz/A	1	2	12	1A	
chlorpyrifos (Lorsban 4E)	3% growers use on 9% Acres Excellent/Good/Poor rating score 3 / 2 /0 seedling stage	1.6-2.8 oz/A	1	35	24	1B	
cyfluthrin (Baythroid 2)	no reported use	1.5-2.4 oz/A	1	0	12	3A	
deltamethrin (Decis 1.5EC)	NA	5.8-9.6 oz/A	1	1	12	3A	
esfenvalerate (Asana XL)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 / 0 seedling stage	2.5-3.8 oz/A	1	1	12	3A	
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A	1	1	24	3A	
lambda-cyhalothrin (Warrior)	2% growers use on 2% Acres Excellent/Good/Poor rating score 2 / 2 / 0 seedling stage	2.5-3.8 oz/A	1	1	24	3A	
permethrin (Ambush)	no reported use	6.4-12.8 oz/A	1	1	12	3A	
thiamethoxam (Cruiser 5FS)	no reported use systemic seed treatment suppression only	1.28-5.1 oz/100 lb seed	1		12	4	
zeta-cypermethrin (Mustang)	no reported use	2.4-4.3 oz/A	1	3	12	3A	

8. Seedcorn maggot, *Delia platura*

Type of Pest: Insect

Frequency of Occurrence: Sporadic, but damage can be extensive.

Damage Caused: The larvae of this fly burrow into corn seed, often destroying the germ, which causes seed death or poor germination. Injury is more prevalent during cool, wet springs. Soils that are high in decaying manure or vegetable matter attract the egg-laying female flies.

% Acres Affected: While 100% of crop is at risk, 23% of the survey respondents treated their sweet corn in 2004, representing 28% of sweet corn acreage. Infestations in New England are generally <10%.

Timing of Control: Pre-plant or at planting**.** May-July

Yield Losses: Stand losses from seed maggots can reach as high as 10%. This pest tends to be a problem in organic corn where chemical seed treatments are not available.

Regional Differences: None

Cultural Control Practices: No resistant varieties are available.
Delayed plantings (at least three to four weeks) after green cover crops are tilled in, or manure or compost is incorporated in spring, will allow time for decomposition of the residue to occur and time for seedcorn maggots to complete their larval development. Reduced or no-tillage systems may exacerbate seedcorn maggot because of the abundance of organic matter.

Planting in warmer soils, shallow planting, or using clear plastic to warm the soil are all non-chemical strategies for maggot control because conditions that delay the germination of the seed and vigorous seedling emergence (e.g., cold, wet soils) favor seedcorn maggot by keeping seed in a vulnerable stage for a longer period of time.

Transplanting has become more widespread among organic and some conventional growers in recent years, but is not likely to have widespread adoption, especially by larger growers, due to its impact on production costs.

Floating row covers may not protect against this pest if adult flies have already laid eggs before row covers are applied.

Biological Control Practices: Naturally occurring predators, parasitoids, and pathogens, including nematodes, may help suppress infestations, but we lack information in this area.

Postharvest Control Practices: NA

Other Issues: Although the above cultural practices are important in the control of seed maggots, seed treatment with an insecticide is still necessary. Corn is somewhat less susceptible to significant damage than beans, but is still very much at risk. There is no rescue treatment for this pest; that is, if damage to seeds is detected, it is too late to apply an insecticide. Therefore, if animal or green manure is applied to fields or damage is expected, a seed or soil treatment is commonly used. Because the damage occurs directly to the seed, treatments must be on or near the seed, but do not have to be long-lived in order to be effective. Neonicotinoids are common seed treatments, while organophosphates and pyrethroids are used as band or furrow treatments at planting.

Chemical Controls for seedcorn maggot:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
bifenthrin (Capture 2EC)	No reported use	1.5-0.3 oz/1,000 row ft	1	30	12	3A	Use prohibited in all coastal communities
chlorethoxyfos (Fortress 5G)	No reported use	3-3.75 dry oz/1,000 row ft			48	1B	
chlorpyrifos (Lorsban 4E)	6% growers use on 14% Acres Excellent/Good/Poor rating score 10 / 3 /0 commercial or grower applied seed treatment	2 qt/A	1	35	24	1B	
diazinon (Diazinon)	2% growers use on <1% Acres Excellent/Good/Poor rating score 3 / 1 /0 at planting	14-28 lb/A	1		24		
gamma-cyhalothrin (Proaxis)	NA	0.66 fl oz/1,000 row ft		21	24	3A	
imidacloprid (Gaucho 480F)	13% growers use on 17% Acres Excellent/Good/Poor rating score 16 / 11 /0 seed treatment	Must purchase treated seed		0	12	4	
lambda-cyhalothrin (Warrior)	No reported use Band or in-furrow	3-3.75 oz/1,000 row ft	1	21	24	3A	Not for use in NH
phorate (Thimet 20-G)	No reported use Band over row	4.5-6 oz/1,000 row ft	1	30	48	1B	
tefluthrin (Force 3G)	<1% growers use on 2% Acres	4-5 oz/1,000 row ft			0	3A	

	Excellent/Good/Poor rating score 1 / 0 /0						
terbufos (Counter CR)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 1 /0	1.28-5.1 fl oz/1,00 lb of seed	1		48	1B	
thiamethoxam (Cruiser 5FS)	3% growers use on 2% Acres Excellent/Good/Poor rating score 3 / 3 /0 seed treatment	1.28 to 5.1 fl oz/100 lb seed	1		12	4	
treated seed	3% growers use on 3% Acres Excellent/Good/Poor rating score 0 / 2 /0						unknown chemical
Diazinon&lindane kernel guard	1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 /0						

9. Corn flea beetle, *Chaetocnema pulicaria*

Type of Pest: Insect

Frequency of Occurrence: Annually, although population pressure varies considerably from year to year. Most troublesome after a mild winter.

Damage Caused: Direct injury is caused by adult feeding on leaves of seedlings, which causes whitened feeding streaks parallel to the leaf veins, but rarely causes significant damage. Damage is most severe when corn is young, <6 inches tall, and when growing conditions (eg cold and wet springs) stress developing seedlings. More important is the transmission of the bacterium *Erwinia stewartii*, which causes Stewart's wilt disease.

% Acres Affected: While 100% of crop is at risk, 11% of the survey respondents treated their sweet corn in 2004, representing 10% of sweet corn acreage.

Timing of Control: Seedling through mid-whorl; at planting if pest pressure is high.

Yield Losses: Losses due to Stewart's wilt (vectored by the corn flea beetle) can be as high as 80%. Yield losses due to corn flea beetle feeding alone are rarely more than 5%. (NY)

Regional Differences: Northern distribution was previously considered to be New York and Massachusetts, but is moving northward as a result of warmer winters.

Cultural Control Practices: Spunbonded row covers can protect plants against this pest. Stewart's wilt resistant varieties are available, but often planting decisions are made base on size, taste and look of the ear, not disease resistance (NY).

Biological Control Practices: Unknown

Postharvest Control Practices: Although not a good soil conservation practice, fall plowing reduces overwintering populations.

Other Issues: The size of flea beetle population late in the season is important in determining the size of the population that enters over-wintering and, subsequently, that may vector Stewarts Wilt the following spring. Infection rates may be as high as 80% late in the season, but the proportion of the over-wintered population that is infected with the bacterium is variable and has been reported at 20-40%. A winter temperature index ("Flea Beetle Index") is used as a predictor of flea beetle survival and thus, Stewart's wilt severity. The index is the sum of the average temperatures of December, January, and February. Susceptible sweet corn cultivars are expected to have low or no Stewart's wilt disease in locations where the index is below 90˚F, light to moderate disease if the index is between 90˚F and 95˚F, moderate to severe if the index is between 95˚F and 100˚F, and severe if the index is above 100˚F.

Chemical Controls for corn flea beetle:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
bifenthrin (Capture 2EC)	no reported use	2.1-6.4 oz/A		1	12	3A	Use prohibited in all coastal communities
carbaryl (Sevin XLR Plus)	1% growers use on <1% Acres Excellent/Good/Poor rating score 2 / 1 / 0	1-2 qt/A	1	2	12	1A	highly toxic to bees
cyfluthrin (Baythroid 2)	no reported use	1.6-2.8 oz/A		0	12	3A	
deltamethrin (Decis 1.5EC)	no reported use	1-1.5 oz/A		1	12	3A	
esfenvalerate (Asana XL)	no reported use	5.8-9.6 oz/A		1	12		
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A		1	24	3A	
imidacloprid (Gaucho 480F)	1% growers use on 1% Acres Excellent/Good/Poor rating score 2 / 1 /0	treated seed must be purchased			12	4	seed treatment
lambda-cyhalothrin (Warrior)	4% growers use on 1% Acres Excellent/Good/Poor rating score 6 / 2 / 0	2.5-3.8 oz/A	1	1	24	3A	
methomyl (Lannate SP)	6% growers use on 8% Acres Excellent/Good/Poor rating score 5 / 7 / 0	¼-1/2 lb/A	1	0 ears 3 forage	48	1A	
permethrin (Ambush)	<1% growers use on 1% Acres Excellent/Good/Poor rating score 0 / 1 / 0	6.4-12.8 oz/A	1	1	12	3A	
phorate (Thimet 20G)	<1% growers use on 1% Acres Excellent/Good/Poor rating score 0 / 1 / 0 at planting	4.5-6 oz/1,000 row ft		30	48	1B	Do not use in furrow
terbufos (Counter CR)	no reported use at planting	4.5-6 oz/1,000 row ft			48	1B	
thiamethoxam (Cruiser 5FS)	1% growers use on 1% Acres Excellent/Good/Poor rating score 1 / 1 /0 pre-plant; early season protection	1.28-2.1 oz/100 lb seed			12	4	systemic seed treatment
zeta-cypermethrin (Mustang)	no reported use	2.4-4.3 oz/A		3	12	3A	

10. Japanese Beetle, *Popillia jopanica*

Type of Pest: Insect

Frequency of Occurrence: Sporadic, but damage can be extensive.

Damage Caused: Adults feed on corn silk, cutting them off from where they emerge from the husk, possibly preventing proper pollination.

% Acres Affected: While 100% of crop is at risk, 7% of the survey respondents treated their sweet corn in 2004, representing 2% of sweet corn acreage.

Timing of Control: During silking period

Yield Losses: minor

Regional Differences: None

Cultural Control Practices: None

Biological Control Practices: None

Postharvest Control Practices: None

Other Issues: Japanese beetles are usually controlled by sprays directed at controlling European corn borer and corn earworm. Sprays are rarely used specifically for this pest, but are needed if silks are clipped to <1/2 inch, fewer than 50% of ears have been pollinated, and beetles are feeding.

Chemical Controls for Japanese beetle:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hrs	Resistance Group	Comments
bifenthrin (Capture 2EC)	no reported use	2.1-6.4 oz/A		1	12	3A	Use prohibited in all coastal communities
carbaryl (Sevin XLR Plus)	2% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 4 / 0	1-2 qt/A	1	2	12	1A	Highly toxic to bees
deltamethrin (Decis 1.5 EC)	NA	1.5-2.4 oz/A		1	12	3A	
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A		1	24	3A	
lambda-cyhalothrin (Warrior)	3% growers use on 2% Acres Excellent/Good/Poor rating score 4 / 3 / 0	2.5-3.8 oz/A	1-7	1	24	3A	
methomyl (Lannate SP)	1% growers use on <1% Acres Excellent/Good/Poor rating score 2 / 0 / 0		1-2	3	48	1A	Not labeled for Japanese beetle
permethrin (Ambush)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 0 / 0		1-4	1	12	3A	Not targeted to Japanese beetle in label
Pyrethrins + piperonyl butoxide (Pyrenone)		1-2 tsp/gal or 12-24 oz/100 gal		0	12	3A	
zeta-cypermethrin (Mustang)	no reported use for this pest	2.4-4.3 oz/A		3	12	3A	

11. Sap beetles, *Glischrochilus quadrisignatus*

Type of Pest: Insect

Frequency of Occurrence: Sporadic.

Damage Caused: Sap (or picnic) beetles are generally secondary pests attracted to damaged plant tissue, thus sap beetle damage is often highest in corn damaged by other pests, such as caterpillars or birds. Adult sap beetles invade injured ears, such as those with corn borer tunnels, and feed on the kernels. They also feed on the pollen as it ripens on the tassels and later as it lodges in the leaf axils, and may lay eggs at the ear tip. Larvae can feed on developing kernels on the upper half of the ear. Their feeding may allow fungal pathogens to get into the plant or ear. Adult feeding in corn often follows damage by European corn borer or corn earworm to tassels, stalks or ears. In corn varieties in which the silk channel is open or short and the tips of the ears are exposed, adult beetles may feed on kernels in the milk stage, or lay eggs.

% Acres Affected: While 100% of crop is at risk, 8% of the survey respondents treated their sweet corn in 2004, representing 8% of sweet corn acreage.

Timing of Control: From silking through harvest**.**

Yield Losses: Up to 30% in severely affected fields.

Regional Differences: Well-established infestations in spotty distribution throughout region.

Cultural Control Practices: Avoid cultivars with short husks or poor tip cover. Clean cultivation is recommended because beetles over-winter in crop residue. It is especially important to destroy or remove infested ears of corn. Removing alternate hosts and overwintering sites may reduce populations on diversified farms. This would include decaying fruits and vegetables where feeding and breeding takes place (e.g., removing discarded tomatoes, summer squash, or fruit from the vicinity) as well as fall tillage or removal of any infested corn ears or removal of dropped apples from orchards near sweet corn fields, which could serve as overwintering sites.

Biological Control Practices: No

Postharvest Control Practices: None

Other Issues: Maintaining good control of caterpillars reduces attractiveness of the plant to sap beetles.

Chemical Controls for Sap beetle:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Timing Type of App.	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
bifenthrin (Capture 2EC)	no reported use	2.1-6.4 oz/A	Silking Foliar Spray		1	12	3A	Use prohibited in all coastal communities
carbaryl (Sevin XLR Plus)	no reported use	1-2 qt/A	Silking Foliar Spray	1	2	12	1A	highly toxic to bees
cyfluthrin (Baythroid 2)	<1% growers use on 3% Acres Excellent/Good/Poor rating score 0 / 0 / 0	1.6-2.8 oz/A	Silking Foliar Spray		0	12	3A	Not labeled for sap beetle
esfenvalerate (Asana XL)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 / 0	5.8-9.6 oz/A	Silking Foliar Spray		1	12	3A	
gamma-cyhalothrin (Proaxis)	NA	2.5-3.8 oz/A	Silking Foliar Spray		1	24	3A	
lambda-cyhalothrin (Warrior)	5% growers use on 3% Acres Excellent/Good/Poor rating score 5 / 6 / 0	2.5-3.8 oz/A	Silking Foliar Spray	1-7	1	24	3A	
malathion (Malathion 57 EC)	No reported use	1 ½ pt/A	Silking Foliar Spray		5	12	1B	
methomyl (Lannate SP)	4% growers use on 4% Acres Excellent/Good/Poor rating score 4 / 3 / 2	¼-1/2 lb/A	Silking Foliar Spray	1-2	0 (ears) 3 (forage)	48	1A	
pyrethrins + pyperonyl butoxide (Pyrenone)	NA	1-2 tsp/gal or 12-24 oz/100gal	Silking Foliar Spray		0	12	3A	
zeta-cypermethrin (Mustang)	no reported use	2.4-4.3 oz/A	Silking Foliar Spray		3	12	3A	

12. Wireworms, *Melanotus spp.*

Type of Pest: Insect

Frequency of Occurrence: Sporadic.

Damage Caused: Wireworms feed on germinating corn seeds and on roots, causing poor seedling emergence and wilting or stunting.

% Acres Affected: While 100% of crop is at risk, 5% of the survey respondents treated their sweet corn in 2004, representing 4% of sweet corn acreage.

Timing of Control: Pre-planting

Yield Losses: minor

Regional Differences: None

Cultural Control Practices: Avoid growing corn in rotation with sod or grass crops. Delay planting on such land for at least two years after sod has been broken. Summer fallow is recommended for at least one season.

Biological Control Practices: None

Postharvest Control Practices: None

Other Issues: Wireworms are most commonly found in corn where the preceding crop was pasture, hay or sod, or fallow. They do more damage in cool wet springs. There are no rescue treatments. Seed treatments for other pests (e.g., seed corn maggot) may also reduce wireworms.

Chemical Controls for Wireworms:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Timing Type of App.	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
bifenthrin (Capture 2EC)	no reported use	0.15-0.3 oz/1,000 row feet	Planting	1	30	12	3A	use prohibited in coastal communities
chlorethoxyfos (Fortress 5G)	no reported use	3-3.75 dry oz/1,000 row feet	Planting In-furrow band	1		48	1B	
diazinon (Diazinon)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 /0	3-4 qt/A	at planting	1	70	24		Broadcast just before planting
chlorpyrifos (Lorsban 4E)	not on Survey but in NEVM guide (2005-6)	2 qt/A	Planting Broadcast	1	35	24	1B	
ethoprop (Mocap 15%G)	no reported use	8 oz/1,000 row feet	Planting Banded			48	1B	
gamma-cyhalothrin (Proaxis)	NA	0.66 oz/1,000 row feet	Planting Band or in-furrow		21	24	3A	Suppression only
imidacloprid (Gaucho 480F)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 1 /0	Treated seed must be purchased	Pre-plant			12	4	
lambda-cyhalothrin (Warrior)	not choice in survey but in NEVM guide	1.75-2 oz/1,000 row feet	Planting Band or in-furrow	1	21	24	3A	Not for use in NH
phorate (Thimet 20-G)	no reported use	4.5-6 oz/1,000 row feet	Planting band and incorporate	1	30	48	1B	
tefluthrin (Force 3G)	no reported use	5 oz/1,000 row feet	Planting in-furrow	1		0	3A	
terbufos (Counter CR)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 /0	4.5-6 oz/1,000 row feet	Planting Banded or in-furrow	1	60	48	1B	
thiamethoxam (Cruiser 5FS)	1% growers use on 2% Acres Excellent/Good/Poor rating score 1 / 2 / 0	1.28-5.1 fl oz/100 lb seed	seed treatment	1		12	4	systemic
Treated seed	2% growers use on 3% Acres Excellent/Good/Poor rating score 0 / 1 / 0		seed treatment	1				unknown chemical
diazinon & lindane (Kernal Guard)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 0 / 0			1				

13. Twospotted spider mite, *Tetranychus urticae*

Type of Pest: Mite

Frequency of Occurrence: Rare, but damage can be extensive.

Damage Caused: Mites feed on the underside of lower leaves, moving up the plant, causing yellowing and death of leaves. Economic losses can occur if infestations of this pest coincide with ear formation. The presence of webbing and mites on husks will reduce value of corn.

% Acres Affected: <1% of the survey respondents treated their sweet corn in 2004, representing <1% of sweet corn acreage.

Timing of Control: During silking period

Yield Losses: minor

Regional Differences: None

Cultural Control Practices: None

Biological Control Practices: In most years, these mites are controlled by naturally occurring diseases and natural enemies; however, prolonged periods of low humidity can suppress the fungus that naturally controls this pest and cause it to become a problem. The use of broad-spectrum insecticides to kill other pests also can decrease the population of the natural predators of this pest to the point where it may become a significant pest.

Postharvest Control Practices: None

Other Issues: The use of broad-spectrum insecticides to kill other pests also can decrease the population of the natural predators of this pest to the point where it may become a significant problem.

Those present at the Sweet Corn PMSP workshop in 2005 indicated that only Metasystox - R provides reasonable mite control. They felt that this labeled use of Metasystox - R should be retained as a one time use rescue treatment. It is used rarely in the mid Atlantic states; however, it needs to be available in the event an infestation occurs as there are no other effective alternatives.

Chemical Controls for Twospotted spider mite:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
bifenthrin (Capture 2EC)	<1% growers use on <1% Acres Excellent/Good/Poor rating score 0 / 1 / 0	5.1-6.4 oz/A	1	1	12	3A	Use prohibited in all coastal communities
oxydemeton-methyl (Metasystox-R)	no reported use	1.5-2 pt/A	1	7	48	1B	If >1 application per season PHI is 21d

III. Diseases (and nematodes if applicable)

Diseases in sweet corn are most commonly caused by fungi, rusts, and bacteria. Weather, plant residue, and variety selection are the most common factors that affect the incidence of sweet corn diseases. Of the growers that responded to the 2004 NE Sweet Corn Pest Management Survey, 58% manage disease through crop rotations, 56% use fungicide treated seed, 49% use disease tolerant varieties, and only 7% apply fungicides. Although the use of seed treatments and resistant varieties has dramatically reduced the incidence of many sweet corn disease problems, several diseases still present potentially significant economic losses if not properly managed.

Group A – Diseases identified by Survey as most important

None

Group B – Diseases identified as significant problems in some years

None

Group C – Diseases identified as infrequent pest problems

1. Common Smut, *Ustilago maydis*

Type of Pest: Fungus

Frequency of Occurrence: Sporadic, annual

Damage Caused: Common smut is characterized by the presence of large, fleshy, irregular galls on leaves, stems, ears, and tassels. Immature galls are white and spongy; mature galls turn brown and contain dark, powdery spores.

Timing of Control: None

Yield Losses: Although “common smut” is not a common disease, when it does occur it can be of economic significance, mainly because there is no chemical control for this disease.

Regional Differences: None

Cultural Control Practices: There are some varieties that have a slight resistance. Unless a rotation schedule of several years is used, crop rotation and tillage are not effective control measures against common smut because the spores can survive for long periods in the soil.

Biological Control Practices: None

Postharvest Control Practices: None

Other Issues: No registered pesticides. Seed treatments have not been effective.

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2. Corn Rust, *Puccinia spp.*

Type of Pest: Fungus

Frequency of Occurrence: Sporadic

Damage Caused: Can cause significant reductions in ear weight and yield. In addition, the effect of brown spots on the husks that are characteristic of this disease can significantly affect the marketability of fresh market sweet corn.

% Acres Affected: 5% of growers treated for rust on 7% of the sweet corn acreage

Timing of Control: If warranted, fungicide application should be done before tasseling; found in late season corn.

Yield Losses: unknown

Regional Differences: Rust migrates into New England from the south, so the timing and area affected each year are dependent upon the weather.

Cultural Control Practices: Resistant cultivars are available.

Biological Control Practices: None

Postharvest Control Practices: None

Other Issues: When chemical control is used, it is important to alternate chemicals with different modes of action to help minimize potential for resistance development. In whorl stage corn the action threshold is when a moderately susceptible cultivar has 80% infected leaves in the whorl stage.

Chemical Controls for Corn rust:

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
Azoxystrobin & propiconazole (Quilt)	no reported use	10.5-14 fl oz/A	1-3	14	24	11 & 3	
chlorothalonil (Bravo Ultrex 82 WDG)	2% growers use on <1% Acres Excellent/Good/Poor rating score 2 / 1 / 2	0.7-1.8 lb/A		14	12	M5	
maneb/mancozeb (Manzate, Dithane, Maneb, Penncozeb)	3% growers use on 17% Acres Excellent/Good/Poor rating score 0 / 7 / 0	Rates vary		7	24	M3	
propiconazole (Tilt)	no reported use	4 fl oz/A		14	24	3	
Gaucho	1 grower; no rating, <1% acres						Not labeled for rust

3. Seed Rots (including *Pithium*, *Rhizoctaria*, *Fusarium*)

Type of Pest: Fungus

Frequency of Occurrence: Sporadic, but damage can be extensive

Damage Caused: Seeds die before or just after germination, thus failing to produce plants.

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

Timing of Control: Before planting

Yield Losses: Can be as high as 100% if conditions are right and seed is unprotected.

Regional Differences: None

Cultural Control Practices: Avoid fields with poor drainage. Avoid planting into cold, wet soils. No resistant varieties are available, but some types (i.e. sh2 varieties) are more susceptible.

Biological Control Practices: The antagonistic fungi *Trichoderma* (T-22/Rootshield) may provide protection against seedling diseases in fresh market sweet corn, but results are inconsistent. (from NY state sweet corn crop profile)

Postharvest Control Practices: None

4. Stewart’s Wilt

Type of Pest: Bacteria

Frequency of Occurrence: Severity and extent of the disease depends on population levels of the vector, the corn flea beetle (see "Corn Flea Beetle" section).

Damage Caused: This bacterial disease invades and plugs the vascular system of plants. The extent of damage is dependent on the stage of growth when the infection occurs, the strain of the bacterium, and the susceptibility of the host. Early infection can lead to collapse and wilt. Although early infection may not kill the entire seedling, it will kill the main growing point, inducing the plant to tiller but yield no ears. In older plants, chlorotic streaks with wavy margins occur.

% Acres Affected: Primarily early season corn is at risk.

Timing of Control: From seedling emergence through late whorl stage.

Yield Losses: Can be as high as 80% in susceptible varieties of sweet corn, and tolerant varieties may still suffer yield losses up to 5% (from NY sweet corn crop profile).

Regional Differences: Tends to be more of a problem in southern and central New England.

Cultural Control Practices: Resistant varieties should be planted whenever possible, but losses may be seen in these varieties under certain conditions. A forecasting program is available to predict the severity of flea beetle infestations based on winter temperatures and snow cover (see corn flea beetles section). Fields planted midseason generally have lower beetle infestations than early- or late-planted fields.

Biological Control Practices: None

Postharvest Control Practices: Fall plowing reduces overwintering populations, although this is not a good soil conservation practice, unless followed by a winter cover crop.

Other Issues: The only pesticides available for control of Stewart’s wilt are the insecticides used to control corn flea beetles.

IV. Weeds

The 2004 New England Sweet Corn Pest Management Survey results show growers use and rating of the following practices (193 growers answered question, % based on total number answering survey (215)):

% Growers; Practice; Rating (excellent/good/poor):
69%; Mechanical cultivation; (28 / 106 / 6)
27%; Hand pulling; (23 / 26 / 5)
20%; Hoeing; (16 / 23 / 2)
17%; Broadcast or complete field spray; (10 / 21 / 1)
16%; Banded Herbicide (over row); (15 / 17 / 1)
14%; Spot treatment; (13 / 18 / 0)
7%; Shielded Application (between rows); (4 / 10 / 0)
3%; Pre-emergence application; (1 / 6 / 0)
1%; No-till or zone-till; (1 / 1 / 1)

Annual Grass Weeds

Frequency of Occurrence: Annually

Damage Caused: Crop yields are reduced when significant populations are present, particularly in dry years, when competition for moisture early in the season can be critical for sweet corn development.

Percent Acres Affected: 100% susceptible, 80% of growers indicated that annual grass weeds require annual maintenance.

Timing of Control: Preplant, pre-emerge, and postemergence.

Regional Differences: Weed ranges vary throughout region

Cultural Control Practices: Tillage before planting is an important method of annual grass control. Repeated tillage may accelerate reduction in the number of weed seeds from the seed bank in the soil. Row crop cultivation is also effective in reducing the impact of weed competition.

Biological Control: None

Other Issues: Many of these grasses are controlled with preemergence herbicide applications and tillage. Row crop cultivation is effective in reducing the impact of weed competition, but it does not remove enough weeds by itself to result in significantly reduced weed seed numbers in the soil. Other methods of non-chemical control, such as crop rotation and adjusting planting dates tend to change the relative mix of species in fields, but they do not significantly reduce competition from annual weeds overall.

Field sanitation and the use of certified and clean seed reduce the spread of many weed species and are both highly recommended practices.
Weeds present in the field early in the season may attract damaging insects and provide an environment for egg laying.

Chemical Controls for Annual Grass weeds

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
alachlor (Lasso 4EC)	11% growers use on 25% Acres Excellent/Good/Poor rating score 7 / 16 / 0 Applied immediately after seeding Can be applied post-emergence as part of reduced rate program	2-3 qt/A	1		12	15	Weak on lambsquarter and ragweed
butylate (Sutan+ 6.7E)	4% growers use on 8% Acres Excellent/Good/Poor rating score 2 / 4 / 1 Broadcast and incorporated over soil before planting	3 ¾ pt/A	1		12	8	weak on many broad-leaf weeds
dimethenamid (Frontier 6.0)	1% growers use on 2% Acres Excellent/Good/Poor rating score 1 / 2 / 0	16-32 oz/A	1	50	12	15	controls certain smaller-seeded broadleaf weeds as well
EPTC + safener (Eradicane 6E)	3% growers use on 8% Acres Excellent/Good/Poor rating score 3 / 4 / 0	2 7/10 –4 qt/A	1		12	8	Broadcast and incorporated over soil before planting; must be incorporated immediately
metachlor (Dual Magnum)	37% growers use on 49% Acres Excellent/Good/Poor rating score 38 / 37 / 4	½-2 pt/A	1		12	15	Poor control of lambsquarter some control of yellow nutsedge Applied immediately after seeding Can be applied post-emergence as part of reduced rate program
pelargonic acid (Scythe 4.2)	no reported use post-emergence application	3%-10%	1		24	27	
Pendimethalin (Prowl H20)	23% growers use on 27% Acres Excellent/Good/Poor rating score 16 / 29 / 2	2-4 qt/A	1		24	3	controls certain smaller-seeded broadleaf weeds as well

Annual Broadleaf weeds

Frequency of Occurrence: Annually

Damage Caused: Crop yields are reduced when significant populations are present, and loss due to interference with harvesting equipment.

Percent Acres Affected: 100%

Timing of Control: Preplant, pre-emerge, and postemergence.

Regional Differences: Weed ranges vary throughout region.

Cultural Control Practices: Tillage before planting is an important method of annual broadleaf control. Repeated tillage may accelerate reduction in the number of weed seeds from the seed bank in the soil. Row crop cultivation is effective in reducing the impact of weed competition, but it does not remove enough weeds by itself to result in significantly reduced weed seed numbers in the soil. Planting into stale seed beds and flaming weed seedlings can also alleviate weed pressure. Field sanitation and the use of certified and clean seed reduce the spread of many weed species and are highly recommended practices.

Biological Control: None

Other Issues: Annual broadleaf weeds produce a significant number of seeds that may lie dormant for very brief (2 weeks) or very long (30-50 years) periods before germination. Use of manure may introduce weed seeds.

Chemical Controls for Annual Broadleaf weeds

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating)	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
ametryn (Evik 80W)	no reported use	2-2.5 lb/A	1		12	5	Use as rescue treatment when 2,4 D use not desirable
Atrazine (Aatrex 4L)	35% growers use on 56% Acres Excellent/Good/Poor rating score 31 / 45 / 3	1 qt/A	1		12	5	pre or post-emergence
atrazine + bentazon (Laddock)	4% growers use on 4% Acres Excellent/Good/Poor rating score 2 / 3 / 0		1			5 6	
atrazine + metachlor (Bicep)	37% growers use on 39% Acres Excellent/Good/Poor rating score 29 / 47 / 3		1			5 15	
Bentazon (Basagran 4E)	24% growers use on 23% Acres Excellent/Good/Poor rating score 20 / 29 / 2	1.5 pt/A	1		48	6	No control of redroot pigweed; partial control of giant ragweed, lambsquarters, and morning glory Post emergence
carfentrazone (Aim 40 WG)	no reported use post-emergence crop injury varies depending upon cultivar and weather	0.33-0.67 oz/A	1		12	14	
halosulfuron (Permit 75 WSG)	13% growers use on 11% Acres Excellent/Good/Poor rating score 11 / 18 / 0 post-emergence not for use on drought-stressed weeds	2/3 – 1 1/3 oz/A	1		12	2	Use on small scale to control problem weeds such as yellow nutsedge, ragweed, velvet leaf and triazine-resistant lambsquarters
Linuron (Lorox 50 DF)	1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 1 / 0	1.25-3 lb/A	1		24	7	post-emergence only, on corn >15" high
Mesotrione (Callisto 4EC)	no reported use- new to market pre or post emergence	6-7.7 oz/A (pre) 3 oz/A (post)	1	45	12	28	Excellent control of problem broadleaf species such as velvetleaf and triazine-resistant lambsquarters
pelargonic acid (Scythe 4.2)	no reported use post emergence	3%-10%	1		24	27	will cause crop injury use shielded spray
Simazine (Princep 80WP)	8% growers use on 6% Acres Excellent/Good/Poor rating score 4 / 14 / 0 pre-plant	2.5-3.75 lb/A	1		12	5	
2,4-D amine (Amine 4)	5% growers use on 4% Acres Excellent/Good/Poor rating score 5 / 5 / 0 post-emergence	0.5-1 pt/A	1		48	4	Use only amine formulation (not ester or low-volatile ester formulations)

Perennial Grass weeds

Frequency of Occurrence: Annually

Damage Caused: Crop yields are reduced when significant populations are present, and loss due to interference with harvesting equipment.

Percent Acres Affected: 100%

Timing of Control: Preplant, pre-emerge, and postemergence.

Regional Differences: Weed species ranges vary throughout region

Cultural Control Practices: Tillage can be an effective mechanism of controlling perennial grasses, but when done improperly it may further distribute the weed throughout the field and exacerbate the problem. Repeated tillage is sometimes the only effective method of perennial weed control. Row crop cultivation also may impact perennial weeds and reduce weed competition. Field sanitation reduces the introduction of some perennial weed species and is a recommended practice. Fallowing works but is not widely practiced.

Biological control: None

Postharvest Control Practices: Application of herbicides and/or cultivation after harvest can be useful in controlling perennial weeds.

Other Issues: Perennial grasses tend to grow more actively during the late spring and summer. No alternative herbicides provide the breadth of control of atrazine without significant increases in cost to the producer.

Chemical Controls for Perennial weeds

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
glyphospate (Roundup 4S)	35% growers use on 14% Acres Excellent/Good/Poor rating score 51 / 19 / 3	1-5 qt/A	1		12	9	pre-plant
Paraquat (Gramoxone)	1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 1 / 0	0.75-2.7 pt/A	1		12	22	pre-plant or spot or with shielded sprayer

Perennial Broadleaf herbaceous weeds

Frequency of Occurrence: Annually

Damage Caused: Reduced yields, serve as refuge and hosts for insect pests

Percent Acres Affected: 100%

Timing of Control: Preplant, pre or post emergence

Regional Differences: Weed species' ranges vary throughout region.

Cultural Control Practices: Tillage can be effective for controlling many perennial weeds, but it also may distribute viable rhizomes, roots, and tubers throughout the field if done improperly. Because most perennial broadleaf weeds do not tolerate tillage, they are more of a problem in reduced tillage and no-tillage fields.

Biological Control: None

Chemical Controls for Perennial Broadleaf herbaceous weeds

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Resistance Group	Comments
glyphospate (Roundup 4S)	35% growers use on 14% Acres Excellent/Good/Poor rating score 51 / 19 / 3	1-5 qt/A	1		12	9	pre-plant
Paraquat (Gramoxone)	1% growers use on <1% Acres Excellent/Good/Poor rating score 1 / 1 / 0	0.75-2.7 pt/A	1		12	22	pre-plant or spot or with shielded sprayer

V. Vertebrate Pests

Birds

Frequency of Occurrence: Birds require annual management for 47% of growers

Damage Caused: Birds eat newly planted seeds or pull up young seedlings. They also open the husks and eat the ripened ears. Birds invade sweet corn fields about three days before picking and feed on insects and the succulent grains of sweet corn. The corn caterpillar complex and sap beetles tend to open the tips, making it easier for birds to feed.

Percent Acres Affected: 100% at risk,

Timing of Control: Planting and after ear formation

Yield Losses: Can be severe. If seeds or seedlings eaten grower may have the opportunity to re-plant field.

Regional Differences: No

Cultural Control Practices: 31% of growers use scare-eye balloons (effectiveness: 5 excellent/ 40 good/19 poor);

Postharvest Control Practices: Many growers (18%) chop and leave debris after harvest (2/25/11). If they rotary mow or disc the interior blocks of the previously harvested fields the birds will feed on the ground in the harvested field and perch on the edges for protection and rest, providing a preferred feeding site for the birds. If the only perching spots are in the unharvested fields, the birds will drop down and feed on the newer crop instead**.**

Other Issues: 13% use recorded distress call devices (4/12/12); 12% use cannons (2/15/7); 9% use shell crackers (2/10/8). Other methods mentioned include hanging bird carcasses, and the use of dogs, fake owls, scarecrows and netting, all rated as giving excellent or good success.

Chemical Controls for Birds

Pesticide	Survey Data (% growers reporting use, % acreage, efficacy rating) and Application Notes	Typical Dose	Num. of Appli-cations	PHI days	REI hours	Comments
4-Aminopyridene (Avitrol bait)	5% growers use Excellent/Good/Poor rating score 2 / 4 / 5	NA	NA	NA	NA	Material not to be applied to crop
Treated seed	1 grower, excellent rating					unknown chemical

Raccoons and **Deer** are the other vertebrate pests of importance in sweet corn, needing annual management on 40% (raccoons) and 25% (deer) of the farms.

Frequency of Occurrence: variable; some fields always at risk yearly

Damage Caused: Ears at maturity are eaten

Percent Acres Affected: 100% at risk

Timing of Control: Ear formation

Yield Losses: Can be severe, especially in smaller sweet corn plantings

Regional Differences: No

Cultural Control Practices: None

Biological Control: None

Postharvest Control Practices: None

Other Issues: From New England sweet corn survey**,** % growers reporting use, efficacy rating (excellent/good/poor)
Raccoon control:
42% trap (23/50/16)
17% use dogs (14/18/4)
17% use electric fence (10/13/11)
3% shoot (2/2/1)
1% plant trap crop at edge (0/1/1)

Deer control:
27% hunt (12/25/19)
13% use electric fence (13/12/1)
7% use dogs (6/5/5)
4% use deer away (0/2/6)
3% Hinder (0/4/2)
2% use non electric fence (2/1/2)

VI. Acknowledgements and Contacts

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University of Massachusetts Extension Vegetable Program website; sweet corn. http://www.umassvegetable.org/soil_crop_pest_mgt/ sweet_corn/index.html

Meetings and Newsletters

New England Vegetable and Fruit Conference. Biennial, December 2007, 2009, etc. Manchester, New Hampshire.

Twilight and Winter Meetings. UMass Amherst Extension Vegetable Program http://www.umassvegetable.org/

Veg Notes Newsletter. University of Massachusetts Amherst Extension Vegetable Program, http://www.umassvegetable.org/newsletters/current_news.html

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