



UMASS
EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts



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CROP CONDITIONS

Good crop growth and a hectic harvest schedule characterized this week. The first peppers are nearly mature, tomato harvest is picking up, sweet corn is filling the stands, and nearly every summer crop is being harvested. There are still farms -- those who suffered more flooding and more cold during May and early June -- who just started to pick their corn this week, or who are counting the days for their first harvest. The last corn planting is up, fall brassica crops and greens are going in. Garlic is drying. Given some long leaf wetness periods (last weekend, in the CT Valley, crop leaves were wet from Friday dewfall till Sunday late afternoon; high humidity often means long dew periods every night) growers need to be attentive to fungicide applications, especially in tomato and potato. Cucurbits are starting to see **powdery mildew** in older, early planted pumpkin and butternut fields but it is not widespread yet. Sprays should be started when scouting for this disease on lower leaves finds powdery mildew on one in 50 leaves. What one might call the 'migratory diseases' (those moved on weather fronts) such as downy mildew and late blight have not reached southern or central New England region to date. In the ocean these organisms might be called 'plankton' since they move passively with moving air masses. Migratory moths -- corn earworm, fall armyworm -- are arriving in large numbers this week. See corn report.

As first harvests leave fields free, a few niches appear for some mid-season cover crops. I have seen sorghum-sudangrass and buckwheat filling these gaps, providing weed control and future organic matter. Finding a niche in your day to plant these might be more difficult, but it's worth a try.

It's a hectic time and a tough year, but we are producing an abundance of high quality, fresh and delicious food in this state and in New England. When the reporters call for news about vegetable crops, I always acknowledge our challenges, but I carefully emphasize the positive. Bad news may make a good story, but what brings customers out and keeps our markets buzzing is good news about our great harvests. And we have plenty of good harvests to brag about!

SWEET CORN UPDATE

CEW flight is building quickly this week, **ECB** and **FAW** flights also high. A major influx of corn earworm has moved into the state. Captures rose starting Sunday night and have increased through this week. The nightly rate of capture increased from Sunday through Wednesday night, according to growers who count their moths every morning or every 2-3 days. Note that in the chart below, we report **AVERAGE MOTHS PER NIGHT** rather than per week, because many counts were for less than one week. Traps that were checked on before Tuesday (7/25) may not reflect the upswing in population. Of course, there were exceptions also, even in areas with high counts.

At the same time, the second flight of European corn borer (especially the E-II or New York strain, which tends to fly earlier) surged to high levels. We have not seen egg hatch yet but given the heat we can expect new eggs and new larvae within the next week. Pepper growers whose crops are affected by ECB should start sprays by August 1 (see pepper update). ECB captures over 5 moths per week call for a weekly spray schedule on silk.

Fall armyworm moths are being captured at unusually high numbers as well. Counts of 3 moths per week trigger a silk spray, because in the absence of whorl stage corn (which is preferred for egg laying) moths will lay near the silk and small larvae may tunnel in through the side or the tip of the ear. Not all sites reporting provided FAW data, but in the CT Valley we found 8-82 moths/week. If you want to trap at your farm, use a Mulitpher type bucket trap baited with a four-component lure and with a Vaportape strip to kill the moths, placed in whorl-stage corn. In the absence of CEW or ECB, cap-



Fall Armyworm Feeding on Sweet Corn Tip

tures of over three FAW moths per week warrants a 5 day spray schedule on silk.

All of this adds up to a significant risk to all silking corn at this time.

For **silking corn**, many locations in the state need to be on at least a four day spray schedule, and many should be spraying every three days. Captures in the Connecticut Valley were over 1 moth per night (7 or more per week) at most locations, and a four day spray schedule was recommended. However there were exceptions! Exceptions were Whately, and a second site in Hadley, with 1 moth for the week – in fresh silk. Numbers in Central and Southeastern Mass were also over 1 per night at most locations, even for traps checked on Tuesday. Numbers at Seekonk (South-east; 99 moths on Wed night) and Still River (Central, 18 moths/trap on Wed night) rose dramatically in the past two nights to 13 or more per night, warranting a three- day spray schedule. The Berkshires is not being spared this time, at least in the south part of Berkshire County, where 40 moths were captured in 4 nights (10 per night, 4-day schedule). Farther north, near Pittsfield, a CEW trap in fresh silk remained at 1 or 0 per night through 7/27. Unfortunately we do not have data from Vermont at this time, but growers can usually expect CEW to move northward, often a lower levels, following a migration into the region such as we see this week. New Hampshire numbers were at 4-10 per week through 7/26, for which a 4 or 5 day schedule would be recommended. However, the flight may be increasing there as well.

We see a noticeable difference between traps placed in blocks of corn with fresh silk and those where silk is dry and corn is close to harvest. **Fresh silk is very attractive to corn earworm – and the place where moths lay the most eggs.** Moving traps into fresh silk still gives the best indication of how high the population is in the corn that is most at risk. If you are trapping, be sure to keep at least one trap in a block of fresh silk This requires moving a trap at least every week.



Corn Earworm Feeding on Sweet Corn

High temperatures mean faster egg hatch for corn earworm eggs. The single, globe-shaped eggs are typically laid on fresh silk. Larvae hatch and move

within an hour or two into the silk channel where they are protected from sprays. **Good control depends on having a residual insecticide on the silk when eggs hatch.** Products which also have ovicidal activity kill eggs directly.

Having a max/min thermometer may be a useful tool to help you know how fast you can expect CEW eggs to be hatching. It should be placed a shaded location, near or in the field. Lab studies in which eggs are held at a constant temperature have determined the following number of days for eggs to hatch:

Average Daily Temp (F)	Days to Hatch
65	6.8
70	4.6
75	3.6
80	2.9
85	2.5
90	2.2

These numbers can be converted into ‘degree days’ or ‘degree hours’ to hatch. A ‘degree day’ is the number of degrees accumulated during the day, above the minimum temperature at which insects develop. Corn earworm eggs do not develop below 54 degrees F, so this is considered the base temperature. The formula for degree days is $\{(Max\ Temp. + Min\ Temp) / 2\} - Base\ Temp = Degree\ Days$. Corn earworm eggs hatch in 76 degree days, equivalent to about 1800 degree hours (degree days X 24 hours/day).

Here are some examples of field temperatures we often have at this time of year, and expected hatch time:

Max Temp	Min Temp	Average Temp	Average DD/Day	Days to Hatch
80.0	60.0	70.0	16.0	4.8
83.0	64.0	73.5	19.5	3.9
89.0	69.0	79.0	25.0	3.0
93.0	71.0	82.0	28.0	2.7

The spray intervals recommended are based on the pressure (moths, or more specifically, eggs laid) and the temperature (assumes that maximum is over 80 degrees F, hence hatch rate is likely 4 days or less).

Pre-tassel and whorl stage corn was very clean at locations scouted in the Connecticut Valley. Infestations ranged from 0 to 6 percent and sprays were not recommended in any of the scouted fields. Since the ECB of the first generation flight have completed their development and are pupating, and the second flight is just beginning, this was not surprising. It takes about 10-14 days from the onset of new flight to hatch of new borers. However, given the unusually high captures of fall armyworm moths, we expected to see more damage from fall armyworm. Apparently, the eggs have not hatched yet (hatch occurs in 2-10 days) . We

anticipate that we will see more in the coming week.

It is very important to scout your late blocks of whorl corn. Walk throughout the field because fall armyworm can be very patchy and can hit one end or one section of the block while the rest is clean. Heavily damaged corn may be delayed or fail to mature. Look for ragged feeding on leaves and in the center of the whorl. Inside the whorl, look for a smooth, tan, green or brown caterpillar with a dark head that has a light marking of an inverted Y. FAW caterpillars reach 1 ¾ inches long, then drop to the soil to pupate. Growers have reported mixed success with standard synthetic pyrethroids on heavy fall armyworm infestations. Those who tested indoxycarb (Avaunt) last year reported very successful control but noted that it was best if the treatment was timed to hit armyworms *before* they were full grown. This year may be a good time to test this product.

The threshold for ECB and armyworms at tassel emergence is 15% infested plants. For corn borers, look down into emerging tassels for tiny larvae or frass (white to brown material about the size of fine sand). For armyworms, look for ragged feeding holes and frass pellets the texture of coarse sawdust. Before any insecticides have been applied, scouting is fast and easy because any sign of feeding is an almost sure sign of live larvae, so it's not necessary to spend time finding the larvae. After the initial insecticide application, feeding damage may be from a larva that has already been killed, so finding the critter is more important for an accurate estimate of the number of infested plants.

Dark green corn leaf aphids were present in some tassels, but we did not see outbreaks in fields checked this week. However, once intensive regimens of corn earworm sprays are underway, it is possible that aphids will be released from all natural enemy suppression and will rebound. Aphids need to be controlled if masses build up on tassels or husks, if husks are infested with the sugary droppings of the aphids' 'honeydew,' the sooty mold that grows on it, or with the aphids themselves.

European Corn Borer Thresholds:

Pre-tassel-Silk: 15% or more of plants scouted are infested .

Silk: 5 or more moths caught in pheromone traps in one week, or 5% of plants are infested.

Corn Earworm Spray Thresholds for Pheromone Traps:

Moths/Night	Moths/Week	Spray interval
0-0.2	0-1.4	no spray
0.3-0.5	1.5-3.5	every 6 days
0.6-1	3.6-7	every 5 days
1.1-13.0	7.1-91	every 4 days
Over 13	Over 91	every 3 days

Thresholds apply only to corn from 5-7 days before harvest. Lengthen spray intervals by one day if maximum daily temperature is **less** than 80 degrees F.

Fall Armyworm Spray Thresholds for Pheromone Traps and Field Scouting:

Whorl Stage: 30% or more of plants infested.

Pre-tassel stage to emerging tassel: 15% or plants are infested (add # plants infested with ECB)

Silk: 3 or more moths captured per trap per week: Spray silk every five to seven days; five days if captures continue to be over 3 moths per week.

•Weekly European Corn Borer and Fall Armyworm and Nightly Corn Earworm Trap Counts

Location	Z I	E II	CEW (per night)	FAW
Sheffield	-	-	10	-
Pittsfield	0	0	0.2	-
S. Deerfield (UMass)	0	10	-	26
Deerfield	1	30	1.7	82
Whately	2	13	0.2	-
Hadley (1)	2	45	2.5	18
Hadley (2)	2	20	0.2	36
N. Hadley			1.8	
Sunderland	6	14	0.9	2
Feeding Hills	12	1	1.3	0
Easthampton	4	7	1.2	12
Still River	0	1	12.25	
Rehobeth	50	30	12.5	-
Seekonk	-	-	24.7	-
Sharon	-	-	14	-
Concord	4	0	1.7	2
Leicester/Spencer	2	11	0.4	1
Northbridge	4	2	2	1
Tyngsboro	27	1	0.4	0
Coventry, RI	1	0	1	-
Mason, NH	1	1	1.4	0
Hollis, NH	1	23	0.8	9
Litchfield, NH	0	5	0.6	3

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UNITED STATES DEPARTMENT OF AGRICULTURE RISK MANAGEMENT AGENCY
2006 COMMODITY INSURANCE FACT SHEET
FRESH MARKET SWEET CORN FOR MASSACHUSETTS

Crop Insured

Acreage planted to sweet corn to be harvested and sold as fresh market sweet corn is insurable, including non-irrigated acreage. To be insurable, the producer must have grown sweet corn for commercial sale or participated in managing a sweet corn farming operation in at least one of the three previous years.

Exclusion: Sweet corn interplanted with another crop or in established grasses or legumes is not covered.

Counties Available

Insurance is available in most Massachusetts counties.

Causes of Loss

- Drought
- Excess Rain
- Excess Wind
- Fire
- Freeze
- Failure of Irrigation Water Supply*
- Hail
- Tornado

* If caused by an insured cause of loss.

Note: This policy does not cover any loss of production due to disease or insect infestation, unless effective control measures do not exist for such infestation; or failure to market the sweet corn, unless such failure is due to actual physical damage caused by an insured cause of loss that occurs during the insurance period.

Note: Revenue losses caused by low market prices or low consumer demand are not covered.

Reporting Requirements

Acreage Report—You must give a report of all your sweet corn acreage in the county by the acreage reporting date (July 15).

Important Dates:

Sales Closing in 2006 was March 15, 2006. Check RMA website for dates for 2007.

Definitions

Allowable Cost—An amount not to exceed \$4.15 per container for harvesting and marketing costs (e.g. picking, hauling, packing, shipping, etc.) will be subtracted from the price received for each container of sweet corn to determine value of sold production.

Container—Fifty (50) ears of fresh sweet corn.

Guarantee—A guaranteed dollar amount of coverage that you select prior to planting.

Minimum Value—A minimum value of \$6.50 per container will be used to determine the value of any appraised production. In addition, the value of any sold production after subtracting the allowable cost may not be less than \$6.50 per container.

Insurance Period

Coverage begins when the sweet corn is planted and ends the earliest of:

- Total destruction of the crop
- The date harvest should have started on any acreage that will not be harvested
- Abandonment of the crop
- Completion of harvest
- Final adjustment of a claim
- September 30, 2006 (for 2006 policies)

Coverage Levels and Premium Subsidies

Instead of guaranteeing production, the policy guarantees a dollar amount of coverage, depending on the level of coverage selected. Crop insurance premiums are subsidized as shown below. For example if you select the 75-percent coverage level, the premium subsidy is 55 percent and your premium share is 45 percent of the base premium.

Dollar Amounts of Coverage

Coverage Level %	\$ Amount of Coverage	Your Premium Share
CAT*	\$406	0%
50	\$738	33%
55	\$811	36%
60	\$885	36%
65	\$959	41%
70	\$1033	41%
75	\$1106	45%

*Catastrophic (CAT) coverage is equal to 55 percent of the dollar amount of coverage at the 50-percent coverage level. CAT is 100-percent subsidized with no premium cost to you except for an administrative fee of \$100, regardless of the acreage.

Loss Example

A loss occurs when the crop value falls below the guaranteed dollar amount as a result of damage from a covered cause of loss (see the list of Causes of Loss on the front side of this fact sheet).

The example below is based on the 70-percent level of

coverage (\$1033 per acre). Let's assume that as a result of drought, only 50 containers of sweet corn per acre were harvested and sold for \$12 each. Subtracting the allowable cost of \$4.15 per container leaves a net value of \$7.85 per container and a crop value of \$393 per acre (50 containers x \$7.85).

\$1033 Dollar amount of coverage per acre

– 393 Production value per acre

= 640 Loss per acre

– 81 Estimated premium per acre

= \$559 Net indemnity per acre

NOTE: In the example above, if the harvested production had been sold for only \$10 per container, the net value per container would be \$5.85 (\$10 – \$4.15 allowable cost). Since this is below the Minimum Value of \$6.50 per container, the production would be valued at \$325 per acre (50 containers x \$6.50 MV), resulting in a loss per acre of \$708 (\$1033 – \$325).

This fact sheet gives only a general overview of the crop insurance program and is not a complete policy. For further information and an evaluation of your risk management needs, contact a crop insurance agent. This is one in a series of articles on the RMA crop insurance program.

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http://www.rma.usda.gov/aboutrma/fields/nc_rso/



ORGANIC CONTROL FOR CORN EARWORM IN SWEET CORN.

Now that corn earworm has been found throughout the state it is time to take control measures. While sprays of Bt or Entrust will be effective for control of European corn borer in the tassel, additional measures are needed for control of corn earworm. Direct silk application of vegetable oil mixed with Bt reduces corn earworm and corn borer damage to ears by coating the silk channel and carrying the Bt down to the silk and kernels in the tip where CEW (and also some ECB) larvae feed. This method may be used by certified organic growers, though growers must be careful to select approved materials. A handheld oil applicator (the Zealater™) designed to make this hand-application method economical and comfortable, is available from Johnny's Selected Seeds (877-564-6697). The UMass Extension Vegetable program has an eight-page publication, *Organic Insect Management in Sweet Corn: Scouting, Thresholds and Management Methods for Key Caterpillar Pests in Sweet Corn*, describing the pests, monitoring methods,

materials, tools, timing, and how to integrate oil applications with other methods. Contact the Extension Bookstore (413-545-2717) or the Vegetable Program office to obtain a copy (413-545-3696), or download from http://www.umass-vegetable.org/soil_crop_pest_mgt/pdf_files/organic_insect_management_in_sweet_corn.pdf.

Here Is a Brief Summary of Some Key Points:

Timing. Corn should be treated with 0.5ml (not 5.0ml!) of oil, once during early silk stage. Action should be taken when >2 corn earworm moths are found per week in a trap in your area. The best time to apply oil is generally 5-7 days after silk growth starts, or 3-4 days after silk is full grown. At this time, the tips of the silks have just begun to wilt and turn brown and pollination is nearly complete.

Applications made earlier than 5 days after silk do not give better control, but may result in a higher rate of "cone" tips. This occurs when oil interferes with silk pollination resulting in unfilled kernels in the last half-inch of the tip. While partially filled tips are a relatively common occurrence in sweet corn, cone tips caused by oil are more pronounced.

Oil applied later than 8 days after silk initiation can result in more feeding damage to the kernels caused by caterpillars that entered the ear prior to the oil. **There is a window between 5 and 8 days after silk initiation that provides the best combination of corn earworm control and ear fill.**

The timing can also be determined by husking a representative ear and examining the kernels. The ideal time to treat is when the silk is still attached to the top 1" or less of the kernels.

Materials. We recommend using corn oil or soy oil with added Bt or spinosad (Entrust). Non-organic corn oil is ok to use on certified organic corn in Massachusetts and many other states. Organically certified growers will need to use a dry formulation of pesticide and add an emulsifier to the oil to keep it suspended in the oil; we have had luck with liquid lecithin. Add 5% volume of liquid lecithin to the oil before adding the Bt mixed in water. Liquid lecithin is the consistency of molasses: we strongly recommend that you add it directly to the oil instead of measuring into a separate container first. Lecithin will mix more readily with oil than water, making cleanup difficult; be careful not to spill the lecithin. Use the labeled rate of Bt or Entrust per acre in corn. Add this to the approximately 2 gallons of oil it takes to treat 1 acre. For the Bt product that we used in our trials (Dipel DF) this translated to approximately 3 tablespoons of Bt per liter of oil for an application rate of 1/2lb Bt per acre.

--If you have any questions please contact Pam Westgate at westgate@umext.umass.edu or 413-545-3696.

PREVENTING BIRD DAMAGE

Bird damage in sweet corn is always a problem; though it is worse in a dry year, it can be damaging in any year. It is better to take action in advance of the problem, because once birds get in the habit of feeding on your corn, it will be harder to stop them! Redwing blackbirds and other flocking birds can cause serious crop losses in some fields. Unfortunately there is no easy answer and no guarantee that a particular tactic will work.

Some General Tips on Repelling Birds:

--Birds invade sweet corn fields about three days before picking. Time any control techniques so they are in place BEFORE harvest, and stay until harvest is complete.

--Use multiple tactics that reach more than one sensory mode. For example, combine scare-eye balloons with auditory repellents like shellcrackers or distress calls. This is likely to be more effective than using one tactic alone.

--Move devices frequently. Birds can learn and become habituated to any device that is used for a long time in one place.

--Good insect control will reduce the corn's attraction to birds. Birds eat insects, which is not a bad thing, but they also like succulent grains of sweet corn and apparently can't tell the difference. And, they cause a lot more damage than most insects do.

--After harvest, scare devices can be removed from one block and concentrated in the next block. Some growers then allow birds to scavenge in the old block. A method that some growers say works is to rotary mow or disc the interior blocks of the previously harvested fields. Birds like to feed on the ground because it is easier than clinging to an ear, but they prefer perching nearby for protection and rest.

Sweet corn topping. A new technique that has been studied and tested in NYS is to 'top' the corn. Topping is the removal of the top of the corn plant from just above the silk or top of the ear, after pollen shed and pollination. Growers who use this method report the advantages to be: 1.) 2 to 3 days early harvesting compared to un-topped; 2) Improved picking ease (and happier pickers); 3) Reduced bird damage and 4) Reduced lodging due to wind. Other benefits may also include better spray coverage. To test this, and evaluate possible negative effects as well, Chuck Bornt and Ted Blomgren of the Capital District Vegetable Program, Cornell Cooperative Extension, have completed several studies. In 2004, they tested it in early and late plantings, with topping at different corn stages (just after pollination, and after dried silk) and different heights (just

above the ear, or with two flag leaves remaining). Topping was completed using a handheld gas powered weed wacker with a blade for different treatments. There were no yield differences except where early corn was topped low, at one site; early corn also showed earlier yields by 2-3 days. At one location where bird damage pressure was high and no other bird controls were used, bird damage was significantly reduced where topping had occurred compared to un-topped plots, which resulted in higher marketable yields. For the complete report, please visit the UMass Vegetable Program website for vertebrate pest control. (http://www.umassvegetable.org/soil_crop_pest_mgt/vertebrate_pests/index.html). This method is also being tested in Maine and Connecticut this season.

Visual Scare Devices:

Eye-spot balloons and reflective mylar ribbons are effective and fairly economical for small fields. Many growers are using these silent deterrents and the general feeling is that they are fairly effective, especially when combined with auditory deterrents. Growers report that the following methods make balloons more effective: use at least 8 balloons per acre, place them in the field several days before harvest, and leave the previous block standing, without balloons, to allow birds to feed in older corn.

Auditory Scare Devices:

Exploders are gas fired cannons placed in the field and fire with automated discharge timings. These can be quite effective. Cannons are available from some agriculture supply sources. Do check with your farm neighbors and the local police to let them know what you are going to do. Cannons are very loud.

Shellcrackers are 12 gauge shotgun shells in which the lead shot has been replaced with a bulldog firecracker. When fired from a shotgun, this firecracker travels 75 to 150 yards and explodes in the air with a loud report. Use a single shot, inexpensive 12 gauge shotgun as the loads are very corrosive. Firing a few rounds early and late in the day will unsettle birds. Federal permits are not required. Again, notify local police and neighbors to let them know what you are doing. Check on local town ordinances. This method can be satisfying on a short term basis. The disadvantage is that it requires a person to take time in the field to discharge the shellcrackers. For a more detailed fact sheet on shellcrackers and other prevention devices, contact USDA Wildlife Services (413-253-2403).

Here are three sources for shellcrackers:

-Reed-Joseph International Co. P.O. Box 894

Greenville, MS 38702 (800) 647-5554

-Margo Supplies Ltd. Site 20, Box 11, RR#6 Calgary,

Alberta, Canada T2M 4I5 (403) 652-1932

-Sutton Ag Ent. 1081 Harkins Rd. Salinas, CA 93901
(866) 482-4240

Distress Calls

Recordings of distress calls or the calls of predatory birds, which repeat at regular or random intervals and operate on battery or solar-power, can be quite effective. Because flocking birds are very responsive to the signals from others in their flock, a distress call from one bird is a sign to all the others that an area is unsafe. These have become quite sophisticated, with programmable or random call intervals that help to overcome birds' ability to get used to regular sound intervals. Make sure you are using a distress call that matches the bird species you need to scare away.

Here are some sources:

- OESCO, www.oescoinc.com/, 800-634-5557 or 413-369-4335. Box 540, Rte 116, Conway, MA 01341
- BirdGuard Bird Control Products, 800-331-2973
 - E-Mail: info@birdguard.com, 100 State Street • Suite 312 • Erie PA 16507
- Birdbusters, 300 Calvert Ave, Alexandria, VA 22301, phone (703) 299 8855
- Bird-X, Inc, 300 Elizatbeth Ave., Chicago, Ill 60607 (800) 860-0473
- Gemplers' 100 Countryside Dr., PO box 270, Belleville, WI 53508 (800) 382-8473

Shooting birds. A federal permit is not required to shoot or otherwise control blackbirds, cowbirds, grackles, crows or magpies when they are found committing or are about to commit damage to or "depredation upon" agricultural crops. In Massachusetts, state permits are not needed for controlling starlings. State regulations allow hunting of crows any time of year except during the nesting season. For more details contact the MA Division of Fish and Wildlife Field Office (508-792-7270). From now through the rest of the corn harvest season, no permit would be required to hunt crows. While hunting can reduce numbers over the long term, it may not be effective against flocks of invading birds. It is not illegal to display dead birds in the field, but it is not clear that this is an effective deterrent. For regulations on geese, consult the US Fish and Wildlife service at 413-253-8200.

--R. Hazzard, with information from Laura Henze, US Fish and Wildlife Service; Chuck Bornt and Ted Blomgren, Cornell Cooperative Extension..

ECB, APHIDS AND PEPPER MAGGOT IN PEPPERS

European Corn Borer

The second generation of European corn borer moths has emerged and captures exceeded the threshold of 7 moths per week at most trapping locations. It is this second flight which causes damage to pepper fruit. Sprays should begin the week of July 30-August 4.

ECB Damage in Pepper. Moths lay flat, white egg masses on the underside of leaves. Eggs hatch in 4-9 days, depending on temperature. ECB caterpillars are whitish or gray with a pattern of dark spots and a black or dark brown head. This dark head capsule distinguishes them from pepper maggots, which are completely white. Young larvae usually enter the fruit by tunneling under the cap. They leave a pile of light brown frass on the surface. Often this is the only indication that a pepper is infested until two or three weeks after the borer enters, when bacterial soft rot causes the fruit to decay.

ECB monitoring: Flight is detected by placing two white nylon mesh Heliothis Scentry™ traps in weedy areas near pepper fields. Traps should be placed 50-100 feet apart with the base at the top of the weed canopy. Bait one trap with a lure for the Iowa strain (Z I) and the other with a lure for the New York strain (E II), as both of these strains occur throughout New England. Check traps once or twice a week from the third week of July.

ECB threshold: Insecticide applications should begin one week after trap counts reach 7 per week (or one per night). This week delay provides an ample time margin while mating, egg-laying and egg hatch occur before the larvae enter the fruit. During the period when ECB moths are active, a regular schedule of insecticide applications should be maintained. This flight period usually lasts through August. At the end of the flight, when trap captures drop below 20 per week, insecticides should no longer be needed.

The intervals recommended for insecticide applications depend on the active ingredient used. Acephate products (7dh) can be used at 10-day intervals; synthetic pyrethroids (products range from 1 to 7 dh) and spinosad (1dh) at 7-day intervals; and *Bacillus thuringiensis* products twice weekly. Days to harvest restrictions for these insecticides often dictate the choice of material, especially in bell peppers. Use of selective products will conserve the natural enemies that keep aphids under control. This includes spinosad and Bt, as well as Intrepid, an insect growth regulator, (1dh). Do not rely entirely on one product or chemical family, to prevent resistance. If you are concerned about pepper maggot, use of Acephate product for the first ECB spray will also

control the end of pepper maggot flight. For more details check the *2006-2007 New England Vegetable Management Guide*.

Aphids

Aphids fly into pepper fields in June and July. The most common species is green peach aphid (*Aphis gossypii*), which is light green, yellow green, or pink, with no distinctive markings. Aphids can easily be seen with the naked eye, but a 10X hand lens allows you to observe them more clearly. Wingless females use their piercing-sucking mouthparts to feed on the underside of leaves. Females produce smaller, light-green nymphs, which feed in clusters nearby.

Most of the time, beneficial insects such as ladybeetles and lacewings keep aphid numbers under control in peppers. By avoiding unnecessary insecticide applications, these natural enemies can be conserved. Use of broad-spectrum insecticides, particularly synthetic pyrethroids, to control other pests may cause aphid outbreaks. High numbers cause a buildup of sticky honeydew secretions on leaves and fruit.

Green peach aphids can vector viruses such as **cucumber mosaic virus (CMV)**. Insecticides are not effective in controlling these viruses because the transmission occurs rapidly at low population numbers.

Aphid monitoring: From mid June to September, examine the underside of four leaves per plant on 25 plants chosen at random. Count aphids found. Calculate the average aphids per leaf (divide total by 100).

Aphid threshold: 10 per leaf. If five per leaf are found, check again within a week to determine if numbers are rising or falling. Often, they fall.

Pepper maggot fly (*Zonosemata electa*), which is closely related to the apple maggot fly, has one generation per year. It is typically a problem in southern New England, including southeastern Massachusetts. Pepper maggot fly activity can be very localized, and varies by farm, by region, and by year. Many farms never have a problem with this pest. Some may have it and not realize it, because it is possible to confuse maggot damage with damage caused by European corn borer. Check infested fruit carefully for proper identification. If a given farm has a history of pepper maggot activity, and pepper maggot fly has been captured nearby, then it is recommended that an insecticide be applied on that farm. Farms that have never had a problem with this pest generally do not need to be concerned.

Adults emerge in mid to late July and are active for several weeks. Flies are smaller than a house fly, bright yellow with three yellow stripes on the thorax, green eyes, and clear wings with a distinct banding pattern. Females insert their eggs directly into the pepper fruit. The legless

white maggots feed and tunnel inside the fruit, especially in the placenta. Maggots reach about ½ inch in length over a period of about two weeks, and have no distinct head capsule. When they are ready to pupate, they exit at the blossom end, leaving tiny round exit holes. These holes allow for the entry of pathogens into the fruit. Sometimes the oval brown pupae can be found inside the fruit. Often damage is detected only because of premature ripening or decay of the fruit.

Pepper maggot monitoring: Hot cherry peppers placed in the border rows can also be used as indicator plants. The egg-laying stings appear as depressions or scars and are easy to find on these small, round fruit. These stings may also be found on bell peppers. By timing insecticide applications with the first occurrence of the stings on the indicator plants fruit, damage to the main crop can be avoided. Pepper maggot threshold: If stings are observed on fruit, make two insecticide applications, 10-14 days apart, with a material labeled for pepper maggot.

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