VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

Chris Gunter, Editor
(812) 886-0198
gunter@hort.purdue.edu

No. 462
April 27, 2006

<http://www.entm.purdue.edu/entomology/ext/targets/newslett.htm>

IN THIS ISSUE

SEED GERMINATION FOR SEEDLESS WATERMELONS - *(Dan Egel)* - Most watermelon growers produce seedless (triploid) watermelon. Conditions required for germination of seedless are different from standard seeded (diploid) watermelon. This article is a review of those conditions and is an adaptation of BP-62 <www.btny.purdue.edu/pubs>.

The soil mix: The soil mix should be well drained and free of disease-causing organisms (pathogens). Most commercial potting soil mixes fit this description and perform well. These mixes are often referred to as "soilless mixes" since they are composed primarily of peat, perlite or vermiculite and sometimes bark or ash. These mixes usually come in bales or bags and have been pasteurized (sufficiently heated, to kill soil microorganisms capable of causing disease problems). Disease problems may result from contaminating the soilless mix with dirty tools, floors, or benches that might come into contact with the mix (See bulletin BP-61).

Soil temperature: It is critical that triploid watermelon seed be germinated in soil mix warmed to 85° to 95°F (30° to 35°C). A soil thermometer is essential to germinating triploid watermelon seed. Best germination can be achieved if the soil mix is heated to the proper temperature prior to seeding. This may be achieved by adding soil mix to transplant trays and warming the trays 24 hours before seeding or adding warm water to the soil mix at seeding. To minimize soil cooling overnight, it may be desirable to cover the trays with a plastic covering (e.g., Visqueen). The plastic must be removed before the sun shines on the trays to avoid excessive heat.

Two common methods of heating soil mixed are germination chambers and propagation mats. Germination chambers range from modified chick hatcheries to rooms built specifically for the purpose. Chambers should be well insulated and, as much as possible, distribute heat evenly between trays. Thermostatically controlled propagation mats are available from several companies. Alternatively, some systems provide for hot water to be piped in tubing under the greenhouse floor or bench. Care should be taken so that the applied heat does not dry out the soil mix too much.

Soil moisture: Triploid watermelon seed will germinate poorly (if at all) under soil moisture condition used for standard diploid (seeded) watermelon seed. The most common condition leading to poor triploid seed germination is too much water. The first 48 hours are the most critical. A good rule of thumb to follow regarding soil moisture for triploid watermelon seed germination is as follows: grasp a handful of the soil mix and squeeze. If one can squeeze water out of the soil as one would squeeze water out of a sponge, the mix is too wet. The soil mix should maintain its shape after being squeezed. If it falls apart after being squeezed, it is too dry. By far the more common mistake is to use mix that is too wet. Most growers are very surprised to see how dry the soil can be and still support triploid watermelon seed germination. Maintain the proper soil moisture by misting the soil surface as it dries out. Overhead irrigation with a standard nozzle will result in soil too wet for triploid watermelon seed germination.

The critical period: The conditions of temperature and moisture outlined above should be maintained for approximately 48 hours. Seeds germinated at 85°F usually require a longer germination period that those incubated at 95°F. There appears to be some interaction between soil and moisture: warmer temperatures may make up for too much soil moisture. When approximately one third of the seedlings have emerged, the seedlings should be introduced to moisture and temperature conditions more typical of standard diploid watermelon seeds (70 to 80°F). If seedlings are kept at high temperatures too long, they may become tall and spindly.

Corn Earworm/Tomato Fruitworm - *(Rick Foster)* - For many years, sweet corn, tomato, and green bean growers have received excellent control of corn earworms/tomato fruitworms (same insect, just different names on different crops) with pyrethroid insecticides. Pyrethroids include Ambush, Pounce, Asana, Baythroid, Capture, Mustang, Warrior, and Danitol. All of these insecticides kill insects with the same mode of action, by affecting the sodium channel in the nervous system. In recent years, entomologists in the Midwest have noticed that in our small plot insecticide trials, the levels of control we are getting with all the pyrethroid insecticides are getting lower. Products that used to give us 90-99% control are now giving control more in the 20-50% range. There have been some, but not very many, reports of in-field control failures. Along with several of my colleagues at other universities and in the vegetable processing industry, I have begun to take a close look at the possibility that resistance is developing to these insecticides.

Last year in my sweet corn insecticide trial, I purposely used the lowest labeled rates of a number of pyrethroid insecticides, and all of them provided very poor control. We collected larvae from that trial and sent them to a lab in Louisiana, where another colleague has been monitoring for resistance for a number of years. When he subjected them to an adult vial test, only 33% died. A susceptible population would have had close to 100% mortality. So it appears that there is some resistance developing. Because all the pyrethroids kill with the same mode of action, it is reasonable to assume that if an insect is resistant to one of them, it is resistant to them all. We will continue to monitor this closely this summer.

The possibility of resistance to the pyrethroids is particularly serious because of the lack of effective alternatives. Let me address the alternatives by crop.

Sweet corn - The only viable options are Larvin, Sevin, and SpinTor. We don't have a lot of data on Larvin for corn earworm control, but I know that it provides excellent control of fall armyworm from my days in Florida, so I have high hopes for this one. Sevin XLR has always provided mediocre control compared to the pyrethroids, but if they are no longer working, it may deserve another look. SpinTor provided pretty good control, but price may be an issue. However, particularly for fresh market growers, think in terms of how many dozen ears per acre you would have to sell to pay for the cost of the application, compared to what might happen if you have a severe worm problem. Also, SpinTor will not control rootworm beetles, so you may need to add another insecticide to control them when silks are present. With all that said, remember that for most of the year, European corn borer is our most important pest of sweet corn. Pyrethroids will still provide excellent control of ECB. Only the late-planted sweet corn, harvested in late August or September, is likely to have a significant problem with earworms. My recommendation is that you continue to use pyrethroids until you see a problem, or until I notify you through the Vegetable Crops Hotline that problems are developing elsewhere.

Tomato - The options here are the Bt insecticides, endosulfan (used to be called Thiodan), Intrepid, Sevin, and SpinTor. The Bt insecticides will work better on tomatoes than on sweet corn because the fruitworm larvae feed on the leaves before entering the fruit. Most of you know that endosulfan is mediocre for fruitworms, but provides excellent stinkbug control. Don't expect any stinkbug control from Bt, Intrepid, or SpinTor. Intrepid is an insect growth regulator that is only effective against caterpillars, and is fairly expensive.

Green beans - Here the alternatives are Orthene, Sevin, and SpinTor. Orthene has a 14-day PHI, so another product would have to be used closer to harvest. Again, remember that corn borer is the most important pest, so focus your control efforts on that pest with pyrethroids.

The bottom line is that these excellent control materials may not be effective much longer for corm earworm. However, all the pyrethroids continue to be very effective against a wide variety of other pests. During most of the growing season, corn earworm/tomato fruitworm are not present. Most of them must fly up from the South. I again encourage sweet corn, tomato, and green bean growers to monitor moth flights with pheromone traps. If moths are not being caught in the trap, there is no need for concern. When you start catching moths, I would still recommend using the pyrethroids unless you see lack of control or you hear from me. Also, this is no time to skimp on rates. I would only use the pyrethroids, when earworms are present, at the upper end of the rate range. Finally, I would ask that any of you who think that you have a field control failure of corn earworms/tomato fruitworms this year please give me a call (765-494-9572) or email me at rfoster@purdue.edu. Be sure to watch for updates in the Vegetable Crops Hotline.

Pheromones and Pheromone Traps: One way insects communicate with individuals of the same species is with pheromones. Pheromones are volatile chemicals released by an insect that usually can be detected only by individuals of the same species. There are a number of different types of pheromones, but the most common type is the sex pheromone. Usually the females will emit a tiny amount of a chemical that attracts the male to her and increases the likelihood of mating. Because the chemical is volatile, air currents carry it. The male detects the pheromone in the air with receptors on his antennae. He then flies upwind to find the source of the pheromone, a prospective mate. The chemical compositions of pheromones for a number of pest species have been identified and synthetic copies can be produced in the laboratory. Synthetic pheromones can be used in conjunction with traps to catch male insects.

There are a number of vegetable insect pests that can be monitored with pheromone traps. In my opinion, the most important pest to monitor for is corn earworm/tomato fruitworm (see next article).

Listed below are some, but certainly not all, of the suppliers of pheromones and traps.

Gempler's: P. O. Box 270; 100 Countryside Dr.; Belleville, WI 53508; (800) 382-8473; <www.gemplers.com>.

Great Lakes IPM: 10220 Church Rd., NE; Vestaburg, MI 48891; (517) 268-5693; <www.greatlakesipm.com>.

Insects Limited Inc.: 16950 Westfield Park Rd.; Westfield IN 46074-9374; (317) 846-3399; <www.insectslimited.com>.

Pacific Biocontrol Corporation: 620 E. Bird Lane, Litchfield Park, AZ 85340; (623) 935-0512 or (800) 999-8805; <www.pacificbiocontrol.com>.

Scentry Biologicals Inc.: 610 Central Ave.: Billings MT 59102; (800) 735-5323; <www.scentry.com>

Trece Incorporated: P. O. Box 6278, 1031 Industrial St.; Salinas, CA 93901; (408) 758-0205; <www.trece.com>.

You can buy most pheromone traps from these suppliers, but for corn earworm/tomato fruitworm, I recommend that you use the wire mesh trap, which is available from:

Bob Poppe's Service: 25738 N. 3200 Road; Lexington, IL 61753; (309) 723-3201.

The wire traps catch more moths and last longer than the nylon traps.

To get the most from your pheromone traps, they must be used properly:

- Place the traps and the pheromones out before you would normally expect the insect pest to be active. That way you can monitor the adult activity, which will warn you that damage from the larvae may be coming soon.
- Be careful how you store pheromones. Ideally, they should be frozen until ready for use. At the very least, they should be refrigerated. If you keep them on the dashboard of your truck, they won't work well when you place them in the trap.
- When handling pheromone lures, do not touch them with your hands. Use a pair of forceps or wear latex gloves. This is especially important when you are using pheromones for more than one pest. Contamination of a lure with another pheromone will likely reduce the effectiveness.
- Lures usually should be changed every 3-4 weeks, although this will vary for individual lures.
- Check traps regularly, at least weekly. Daily would be better.

Seed and Root Maggots - *(Rick Foster)* - Three species of seed and root maggots attack vegetables in Indiana. The seedcorn maggot feeds on seeds and seedlings of sweet corn, cucurbits, lima and snap beans, peas, and other crops. Cabbage maggots can cause serious damage to transplants of cabbage, broccoli, cauliflower, and Brussels sprouts and make the fleshy roots of radishes, turnips, and rutabagas unmarketable. Onion maggots are pests of seedling onions, developing bulbs and onions intended for storage.

Seedcorn maggot flies emerge in April and May and lay eggs preferentially in areas with decaying organic matter. Fields that are heavily manured or planted to a cover crop are more likely to have seedcorn maggot injury. Maggots burrow into the seed and feed within, often destroying the germ. The seeds fail to germinate and plants do not emerge from the soil, leaving gaps in the stand. When infested seeds germinate, the seedlings are weak and may die. Maggots also will feed within the stems of transplants.

Any condition that delays germination may increase damage from this pest. Damage can be reduced by planting into a well-prepared seedbed, sufficiently late to get rapid germination. The slower the rate of growth, the greater the likelihood of seedcorn maggot injury. Seed treatments with lindane are an inexpensive method of reducing seedcorn maggot damage. For any type of early season transplant, soil temperatures should reach at least 70° F or more for 4-5 days in a row to avoid maggot injury. Anything that raises soil temperature (black or clear plastic mulch) will increase soil warming and decrease the possibility of seedcorn maggot injury. Once damage is observed, the only management strategy available is the decision to replant or not. If you decide to replant, be sure to use treated seed. When resetting transplants be sure to wait 5 days from the first evidence of wilted plants before you reset.

Cabbage maggot injury is also favored by cool, wet conditions. The flies, slightly smaller than a housefly, emerge in late April or early May and lay white eggs at the base of newly set plants. Larvae from this first generation tunnel in the roots of small plants, causing the plants to appear sickly, off color or stunted, and may cause them to die. Early cabbage and turnips are particularly vulnerable to damage. Control of first generation maggots can be achieved using soil insecticides such as Lorsban or Diazinon at planting or transplanting. For short season crops such as radishes and turnips, long-residual insecticides cannot be used. Cabbage maggots usually do not affect later planted crucifers.

Onion maggot flies emerge throughout May and lay eggs at the base of onion plants. The maggots attack the underground portions of the onion plants and cause plants to wilt and die. Seeded onions are more susceptible than transplanted onions. Do not overseed to compensate for losses to onion maggots. The flies do not space their eggs evenly, so you may end up with smaller bulbs because the plant spacing is too close. The second-generation flies emerge during July and the third generation emerges during late August and early September. Each generation will damage onions.

Removing cull onions after harvest and planting as far as possible from fields planted to onion the previous year can reduce damage. Soil drenches of Lorsban or Diazinon at planting will effectively control first genera-

tion maggots and provide some control of the second generation. As the onions begin to mature, they become physically resistant to attack from onion maggots, unless they have been injured in some way. Be careful during field operations not to damage the growing plants in any way. A nick in an onion bulb allows the maggots to enter and begin feeding. Also, the flies are attracted to damaged onions to lay eggs. Reducing the amount of physical damage to the onions at harvest as much as possible will also reduce the amount of injury from the third generation. Do not apply foliar sprays to kill flies before they lay eggs.

Outreach Program Information - Purdue University Department of Food Science, (765) 494-8256. Registration and brochures for the follfowing workshops are available at <www.foodsci.purdue.edu/outreach/>.

Aseptic Processing and Packaging Workshop, May 15-18, 2006 - The Aseptic workshop at Purdue incorporates a lecture and "hands on" laboratory format to review the essential scientific and engineering principles relevant to applying the aseptic technology. The topics presented are an overview of aseptic processing and packaging, microbial principles applied to aseptic processing, chemical considerations, principles of thermal processing, equipment features, and packaging considerations. For more information contact Steve Smith at smithrs@purdue.edu.

Wine and Grape Workshops, June 12 and September 2006 - The Purdue Wine Grape Task Force is a cooperation between the Indiana Wine Grape Council and Purdue University to serve the State's existing and prospective vintners and growers and to help propel the local wine/grape industry into world-class competitiveness. On the web at <www.indianawines.org>.

Year-round workshops across Indiana cover topics ranging from vineyard establishment, grape and wine quality assessment and analysis, to commercial winemaking techniques and recent issues in wine sales and marketing. For more information contact Christian Butzke at butzke@purdue.edu.

Development and Implementation of HACCP Programs, October 24-26, 2006 - This course provides instruction for developing Hazard Analysis Critical Control Point (HACCP) programs for meat/poultry/egg and fruit/vegetable industries. This workshop includes an overview of foodborne hazards and prevention strategies, an understanding of HACCP principles, and an awareness of the regulatory requirements for HACCP programs. For more information contact Kiya Smith at kiya@purdue.edu.

An Introduction to Starting a Specialty Food Business in Indiana, October 30, 2006 - Developing and selling specialty foods and ingredients is one alternative for homemakers and farmers to add value to Indiana commodities. This workshop was developed to serve as a comprehensive overview of the issues association with starting a specialty food business. For more information contact De Bush at djbush@purdue.edu.

Introduction to Food Processing Plant Sanitation, November 8, 2006 - This course is recommended for meat, poultry, and egg processing plant personnel involved in sanitation under USDA-FSIS. In this course, participants will learn about sanitation requirements, selection of cleaners and sanitizers, how to train sanitation crews, and how to validate sanitation programs. For more information contact Kevin Keener at kkeener@purdue.edu.

Retail Food Safety: Retail Food Manager's Certification Courses - As of January 2005, Indiana requires at least one manager from each retail food establishment be certified in retail food safety and pass a nationally recognized exam. Our program focus is to prepare retail food managers for this requirement and teach sound food handling procedures. The 3 programs are offered in Indiana to address these needs. Each program has been developed as a nationally recognized curriculum and certification program for retail food handlers. Our website provides information about current programs offered. The topics for the courses are:

- Essentials of Food Safety and Sanitation
- SuperSafeMark™
- ServSafe

For more information contact Kiya Smith at kiya@purdue.edu.

Southwest Indiana Beekeepers Spring Clinic - Sunday May 7th, 2006 at Saint Meinrad Archabbey - 11:30 am to 2:30 pm (Central Daylight Savings time). Pot Luck Luncheon - bring a dish!

We will be opening beehives, inspecting hives, looking for queens… Lots of beekeepers will be on hand for questions, answers, and discussions.

For more information contact Amy Steeples at (812) 897-4259. Hope to see you there!

St. Meinrad is located in Spencer Co. on the Perry Co. line. On IN Hwy 62 - pull into the grounds, go to the top of the hill to the houses and honey house.

Winter Temperatures (2005-2006) and Insect Survival in Indiana - (*Frankie Lam and Ken Scheeringa*) - Winter temperature has a strong impact on the survival of over wintering insects. Colonizing insect populations are closely related to the survival of the over wintering stages, which depend greatly on the weather of the past winter. Research has also demonstrated that insect pest numbers on some crops later in the season are largely determined by the size of colonizing populations during spring.

Winter temperatures affect the survival of over wintering insect populations in two ways: how cold the temperature was and how long the insects had to endure that particular cold temperature. Except for a few species we do not have models to predict the percentage of winter survival for most insects. Studies had demonstrated that the winter survival of insects, such as the bean leaf beetle and flea beetle, can be predicted by accumulating the freezing degree-days through winter. These models demonstrated that the greater the duration and intensity of cold in winter, the higher the percentage of insect mortality.

Following the methodology of these studies we can understand how cold the past winter was and how great its impact on the over wintering insect populations. Normally winter is defined as December 1 through February 28; however, freezing degree days occur in November and March may affect the survival of over wintering insects. Thus, the freezing degree-days of winter temperatures in the article is accumulated from November through the end of March. The accumulated freezing degree days of winter 2005-2006 (Table 1) were obtained by subtracting the daily mean air temperature (°F) from 32, rejecting days with negative results, and then accumulating the remaining positive daily values through winter. For example, if the daily mean air temperature is 29°F, three degree-days are calculated for that day. The total number of winter days when freezing degree-days occurred is shown in the subfreezing day column (Table 1).

Table 1. Accumulated freezing degree-days and number of subfreezing days of the nine Indiana agricultural statics districs in winter 2005-2006.

	Winter 2005-2006						
	Accumulated Freezing Degree Days (°F)						Sub-freezing day
District	Nov	Dec	Jan	Feb	Mar	Total	
NW	40	302	9	127	12	490	56
NC	39	288	8	131	14	480	58
NE	44	280	11	139	17	491	64
WC	26	270	2	114	10	422	51
C	23	227	4	113	12	379	51
EC	28	250	5	122	12	417	52
SW	12	105	0	74	0	191	32
SC	15	113	0	73	4	205	36
SE	17	131	0	72	7	227	40

In the article climate normals (Table 2) are used as "standards" to compare with data from the past winter. A climate normal is the arithmetic average of observed daily values over the international standard 30-year period, currently 1971-2000 (three consecutive decades). By comparing the cumulative freezing degree days of the past winter (2005-2006) with the climate normals (1971-2000), although the central and southern districts (with higher accumulated freezing degree days) were slightly colder than a normal year, overall the nine Indiana agricultural districts in the past winter were similar to that of a normal year in Indiana. In addition, if we compare the cumulative freezing degree days and subfreezing days between the past two winters (Tables 1 and 3), the past winter (2005-2006) had lower accumulated freezing degree days and less subfreezing days than the winter 2004-2005. We can conclude that temperatures on average in the past winter were much warmer than that of the winter 2004-2005.

Table 2. Accumulated freezing degree-days and number of subfreezing days of the nine Indiana agricultural statistics districs during winters 1971-2000 (climate normals).

	Climate Normals (1971-2000)						
	Accumulated Freezing Degree Days (°F)						Sub-freezing day
District	Nov	Dec	Jan	Feb	Mar	Total	
NW	0	112	270	118	0	500	82
NC	0	97	255	114	0	466	80
NE	0	99	259	129	0	487	83
WC	0	57	191	51	0	299	66
C	0	49	177	52	0	278	66
EC	0	62	202	74	0	338	71
SW	0	2	52	0	0	54	33
SC	0	5	57	2	0	64	38
SE	0	3	54	2	0	59	36

Based on these weather data, we might summarize that if the insect pests have a certain stage that overwinter in Indiana, the over wintered populations in early spring would be relatively higher than those of

Table 3. Accumulated freezing degree-days and number of subfreezing day of the nine Indiana agricultural statistics districts in winter 2004-2005.

	Winter 2004-2005						
	Accumulated Freezing Degree Days (°F)						Sub-freezing day
District	Nov	Dec	Jan	Feb	Mar	Total	
NW	2	82	275	68	64	606	65
NC	1	200	292	83	80	656	68
NE	0	205	298	106	88	697	71
WC	0	192	210	42	41	485	57
C	0	193	218	40	50	501	56
EC	0	200	250	62	66	578	63
SW	0	144	97	2	4	247	30
SC	0	145	110	3	10	268	33
SE	0	145	140	5	20	310	41

last spring. We should pay more attention on the emergence of over wintered insect populations once the crops were planted or transplanted in fields. Furthermore, we should scout more frequently for those insects with early populations that are economically important. On the other hand, if the late populations of insect pests are more economically important than the early-season populations in Indiana, it is difficult to predict the relative numbers of their subsequent generations with this hypothesis. This is because the size of subsequent populations will also be greatly affected by the weather in spring and early summer.

Predicting Peaks of Adult Emergence and Egg-Laying Periods for Cabbage and Seedcorn Maggots - (*Frankie Lam*) - Cabbage maggot and seedcorn maggot (Fig. 1) are two species of flies belonging to the same family, which look relatively alike and it's not easy to identify them based on their external features. The maggots feed on the root and tunnel into the crown (Fig. 2). Plants attacked by the maggots may wilt, show stunted growth, and eventually die. The feeding sites of the maggots may cause secondary infection of plant pathogens. Both species have more than one generation per year in the Midwest, but the first-generation is the most damaging population.

Fig. 1. Seedcorn Maggot adult on cucumber. *(Photo by Frankie Lam)*

If growers have heavy maggot infestation in their fields during past years, one of the tactics to prevent heavy infestation during early-season is to avoid planting the crop in the wet, cool spring and within the peak of adult emergence and egg-laying period. Wet and cool weather usually favor the development of both cabbage and seedcorn maggots. The peak of adult fly emergence and egg-laying period can be predicted by using the

Fig. 2. Seedcorn maggots feeding inside the crown of a muskmelon transplant. *(Photo by Frankie Lam)*

Table 1. Calculated degre-days for peak emergence of seedcorn maggot and cabbage maggot at Vincennes in April 2006.

	Temperature (°F)		Accumulated degree-day	
Date	Max	Min	Seedcorn maggot[a]	Cabbage maggot[b]
1	58	44	12.0	8.0
2	73	41	30.0	22.0
3	60	40	41.0	29.0
4	61	36	50.5	34.5
5	67	34	62.0	42.0
6	58	48	76.0	52.0
7	80	50	102.0	74.0
8	53	40	109.5	77.5
9	60	34	117.5	81.5
10	70	38	132.5	92.5
11	79	46	156.0	112.0
12	83	62	189.5	141.5
13	86	48	217.5	165.5
14	88	67		200.0
15	88	63		232.5
16	80	65		262.0
17	68	54		280.0
18	76	48		299.0
19	78	54		322.0

[a] $\sum_{\text{April 1}}$ [(Maximum temperature + Minimum temperature)/2] - 39
[b] $\sum_{\text{April 1}}$ [(Maximum temperature + Minimum temperature)/2] - 43

equation, [(Maximum Temperature + Minimum Temperature)/2] - Developmental Threshold, and accumulating to the required total degree-days. The developmental threshold for seedcorn maggot is 39°F, whereas for cabbage maggot is 43°F. The total degree-day for the first-generation seedcorn maggot adult emergence is

200, while for cabbage maggot is 300. To avoid heavy infestation, the crop should be transplanted at least 1 week before or after the predicted peak emergence.

Examples for calculating the degree-days of the maggots at Vincennes in this April are presented in Table 1. The weather data of Vincennes in April were obtained from weather.com <www.weather.com/outlook/travel/businesstraveler/monthly/47591?from=36hr_topnav_business>. The degree-day for seedcorn maggot was calculated by [(Maximum Temperature + Minimum Temperature)/2] - 39; whereas the degree-day for cabbage maggot was calculated by [(Maximum Temperature + Minimum Temperature)/2] - 43. By accumulating the degree-days from April 1, the peak of emergence can be predicted. The predicted day of the peak of adult emergence for seedcorn maggot and cabbage maggot is April 13 (> 200) and April 19 (> 300), respectively. Thus, these results indicated that the planting dates, which should be avoided for the peak of seedcorn maggot adult emergence, was from April 7 to 19; while for the cabbage maggot adult was April 13 to 25. Growers having a weather logger in their fields or obtaining data from a nearby weather station can calculate the peaks of emergence for their areas. If growers need help for calculating the peak, please call me at (812) 886-0198.

As a whole, the preventive tactics to avoid heavy infestation of maggots during early-season are:

- Plowing down cover crops at least 3 to 4 weeks before planting.
- Avoid planting in the cool and wet spring.
- Plant the crop when soil temperatures at 4-inch depth exceed 70°F.
- Check with the weather forecast and predict the peak of adult fly emergence. Transplant the crop at least 1 week before or after the predicted peak of adult emergence.

The Distant Sound of Drumming - *(Shari L. Plimpton)* - Growers, packers, processors and shippers of fresh and fresh-cut produce should be hearing the distant sound of drumming from the mighty jungle that is our nation's capital. Those aren't celebratory drums you are hearing either, particularly if your business includes lettuce, spinach and/or tomatoes. The Food and Drug Administration (FDA) has issued two letters of concern addressed to the fresh produce industry (February 2004 and November 2005), an "Action Plan to Minimize Foodborne Illness in Fresh Produce…" (2004) and most recently, a draft guide for Industry to minimize microbial food safety hazards for fresh-cut fruits and vegetables (March, 2006). All of this activity and attention from the FDA can mean only one thing: if you haven't already done so it is time to work on evaluating your practices for potential food safety hazards, modify your operation to minimize those hazards, and fast.

The first letter of concern from the FDA was addressed to growers, packers and shippers of fresh lettuce and fresh tomatoes and focused on 14 outbreaks of foodborne illness caused by Salmonella, E. coli O157:H7, Cyclospora and Hepatitis A virus. The FDA then proceeds to let you know what information is available to address the problem, their expectation that some action is required on the part of industry and they finish with a warning regarding their legal jurisdiction in these matters.

Based on their concerns, the February 2004 letter directs growers to refer to the 1998 "Guide to Minimize Microbial Food Safety Hazards for Fruits and Vegetables" for an overview of Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs) recommended by the FDA. The letter also directs your attention to a 2001 report "Analysis and Evaluation of Preventive Control Measures for the Control and Reduction/Elimination of Microbial Hazards on Fresh and Fresh-Cut Produce," available at <www.cfsan.fda.gov/~comm/ift3-toc.html>. This collaborative report between the FDA and the Institute of Food Technologists (IFT) summarizes then "current scientific research relating to the various methods of eliminating or reducing pathogens, while maintaining fresh attributes, on whole and fresh-cut produce." However, understanding GAPs and GMPs by using the FDA Guide and related USDA materials is a bit easier than trying to read through the FDA/IFT 2001 report.

Finally, that first letter finishes with the following warning, "As you are aware, food produced under unsanitary conditions whereby it may be rendered injurious to health is adulterated under § 402(a)(4) of the Federal Food, Drug, and Cosmetic Act ((21 U.S.C. 342(a)(4)). FDA will consider enforcement actions against firms and farms that grow or pack fresh produce under such unsanitary conditions." Take note of this warning, regardless of whether you grow, pack, ship or distribute tomatoes or lettuce. This letter, signed by Terry C. Troxell, Ph.D. Director, Office of Plant and Dairy Foods, Center for Food Safety and Applied Nutrition, FDA, clearly sends the message to the entire fresh produce industry that the FDA has taken notice and is going to expect action from the industry to minimize this problem.

A second letter of "serious concern" followed the first this past November of 2005. The second letter was addressed to California lettuce and spinach growers, packers, processors and shippers of fresh and fresh-cut lettuce and spinach and signed by the Director for the Center for Food Safety and Applied Nutrition of the FDA, Robert E. Brackett, Ph.D. Citing the previous letter and the resources it referenced, the second letter focused on reiterating the FDA's concerns and to "strongly encourage" the industry to focus on reviewing the practices in their operations that could lead to microbial contamination and to implement modifications from the farm through distribution.

The November 2005 letter also focuses on the issue of produce being contaminated by floodwaters without

equivocation. Dr. Brackett writes, "Although it is unlikely that contamination in all 19 outbreaks was caused by flooding from agricultural water sources, we would like to take this opportunity to clarify that FDA considers ready to eat crops (such as lettuce) that have been in contact with flood waters to be adulterated due to potential exposure to sewage, animal waste, heavy metals, pathogenic microorganisms, or other contaminants." And he notes that adulterated food is subject to seizure by the FDA.

And it doesn't stop there. The FDA is apparently beginning to lose its patience with efforts to work with industry on this problem. They quite poignantly state that they have been attempting to work with everyone on this issue since 1998 and that the stance taken by some in the industry that the exact nature of the problem must be known before anyone should take action is not acceptable to them. Therefore, specifically in California, yet, intended for the entire industry, the FDA is asking for industry cooperation in the following areas: communication, guidance, outreach and research. It would be unwise at this point to simply hope that this will go away.

My recommendations for those who aren't in California is to learn as much as you can about GAPs, review your own operation for potential contamination, modify your operation based on what you determine, and document your food safety policies and procedures in a food safety plan. Another potential resource for this is the FDA's 2004 Action Plan at <www.cfsan.fda.gov/~dms/prodpla2.html>. This document reviews many of the same recommendations given in all GAPs programs and it gives an update on the FDA's most recent views on safe practices and their implementation.

Also, take the time to look at the March, 2006 draft Guide to Minimize Microbial Food Safety Hazards of Fresh-cut Fruits and Vegetables <www.cfsan.fda.gov/guidance.html> and send comments while the door is open (through April, 2006). You may not do any cutting; however, the FDA is asking fresh produce growers to look at this document, too. Anything that gets by without comment is assumed to be accepted by all. Your comments on this draft guide are part of what the FDA means when it says it is looking for communication.

And for Indiana and Ohio fruit and vegetable producers who could use a little help with all of this, feel free to contact us at the Ohio and Indiana Specialty Crop Food Safety Initiative by calling Mid American Ag and Hort Services at (614) 246-8286 or emailing us at maahs@ofbf.org. We are funded by the United States Department of Agriculture's Risk Management Agency to provide free materials regarding GAPs, as well as free on-farm consultations through September 2006. Visit us at the MAAHS website at <www.midamservices.org> and select "Projects" from the list on the left side of the page.

Vegetable Crops Hotline
c/o Chris Gunter
Southwest Purdue Agricultural Program
4369 N Purdue Rd
Vincennes, IN 47591