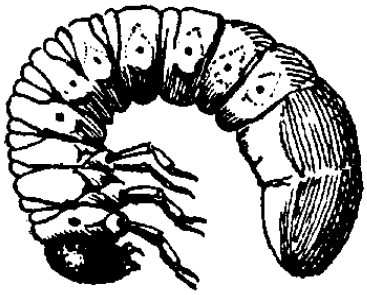
RUTGERS COOPERATIVE RESEARCH & EXTENSION AT THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION

PLANT & PEST ADVISORY

LANDSCAPE, NURSERY & TURF EDITION $1.50 AUGUST 10, 2006



INSIDE

Nematodes for Biological Control of White Grubs

Albrecht M. Koppenhöfer, Ph.D., Specialist in Turfgrass Entomology

Insect-pathogenic (entomopathogenic) nematodes (EPN) in the genera ***Heterorhabditis*** or ***Steinernema*** are obligate lethal parasites of insects that kill their hosts with the help of symbiotic bacteria. EPN are completely safe for plants, pets, and people. The host range of different EPN species varies from being able to infect hundreds of insect species to just a few insect species under laboratory conditions. However, in field applications and particularly in natural populations host ranges are generally much more limited due to EPN and host behavior and ecology. Under the right conditions EPN not only infect and kill hosts after an application but will also recycle in these hosts to produce new generations that can kill additional hosts. Additional information on EPN can be obtained at 'http:www2.oardc.ohio-state.edu/nematodes'.

The only EPN stage that can survive outside of an insect is the 'infective juvenile' (IJ) stage. The free-living, non-feeding IJs seek out a host, penetrate through natural opening (mouth, anus, breathing openings) or thin parts of the insect's cuticle into the host's body cavity. Then the IJs release the symbiotic bacteria from their intestine, and bacteria and nematodes cooperate to overcome the host's immune response and kill it typically in 1-4 days. The bacteria propagate and protect the host cadaver from colonization by other microorganisms. The host cadaver assumes a more or less characteristic coloration. The nematodes develop through 1-3 generations, feeding on the bacteria and host tissues metabolized by the bacteria. When food resources in the host cadaver are depleted 100s to 100,000s of new IJs emerge from the host cadaver in search of a new host.

IJs of different EPN species use different strategies to locate potential hosts, ranging from typical ambushers over intermediate types to extreme cruisers. **Ambushers** show little active dispersal, tend to accumulate near the soil surface, nictate, and, due to these characteristics, are best adapted to infecting mobile insects occurring on or near the soil surface. Nictation is a behavior in nematodes in which they stand on a small bend of their tail. This increases their chances of being accidentally picked up by a host because they stick further out of the ground. Typical ambusher species include *Steinernema carpocapsae* (very effective vs. cutworms, sod webworms, and larvae of billbugs and annual bluegrass

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weevil) and *Steinernema scapterisci* (a mole cricket specialist). Typical **cruisers** actively disperse throughout the soil profile, do not nictate, and are best adapted to infecting relative sedentary hosts in the soil such as white grubs. Typical cruisers include *Steinernema glaseri* and *Heterorhabditis* species. Intermediate species that fall in between the ambusher and cruiser extremes include *Steinernema feltiae* and *Steinernema riobrave*.

For successful use of EPN in insect management it is important to understand the general requirements for good EPN activity and to choose the right nematode for the job. Based on insect species and habitat nematodes should be chosen with the right foraging strategy, good adaptation to prevailing environmental conditions, and a high pathogenicity to the target.

Among the most important environmental factors affecting EPN activity is **soil moisture** because the IJs move inside the water film that surrounds soil particles. If the film gets too thin (dry soil) movement become restricted, if the pores fill up (saturated soil) the IJ start floating around. EPN activity generally is highest at moderate soil moistures. If the soil is dry and hot before application irrigation with around 0.1″ is recommended. If nematodes are applied in a spray, the spray volume should be 2 – 5 gal per 1,000 ft^2. After application additional irrigation water should be applied. For application against surface feeding insect about 0.1″ should suffice to wash any nematodes off the foliage into the soil. For applications against soil insects such as white grubs, 0.25 – 1″ irrigation should be added to wash the nematodes into the root-zone. The drier and heavier the soil the more post-application irrigation water should be applied. After application the soil should be kept at moderate moisture levels for at least 1 week; better 2 – 3 weeks, to allow the nematodes continued optimal activity including host infection, reproduction, and secondary infections.

Soil type also affects EPN performance. Generally, EPN can move better through coarser (sandy) soils than finer (higher clay content) soils. However, in the field many other factors will affect soil structure including soil compaction, organic matter, roots, tunnels of soil organisms, etc. In addition, finer soils hold soil moisture better. In a summary of dozens of field trials using the nematode *Heterorhabditis bacteriophora* against Japanese beetle grubs, the nematode tended to perform better in the heavier, loamy soils.

While temperature ranges and optima vary somewhat between EPN species, they generally work better at **soil temperatures** of 60 – 93°F with an optimum at 70 – 85°F. For the presently available white grub active species, particularly *Heterorhabditis bacteriophora*, that means that optimum activity against white grubs can be expected from August into late September (depending on local conditions). After September and in spring, these EPN will not be effective.

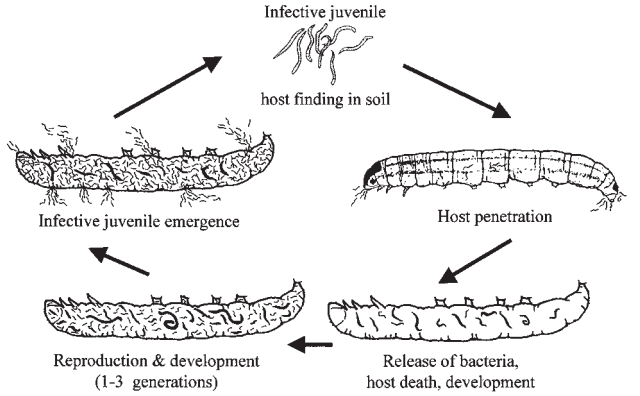
The efficacy of different EPN species varies with **white grub species**. Among the common turfgrass white grub species in the Northeast, the **Japanese beetle** is the most susceptible to most EPN species. Among the presently commercially available EPN species, *Heterorhabditis bacteriophora* (e.g., Heteromask, Grubstake Hb) has generally provided the best control with around 75% control at a rate of 1 billion IJs per acre applied around September. *Heterorhabditis megidis* (e.g., Nemasys H, Grubstake Hm) appears to be somewhat less effective.

Other white grub species such as **oriental beetle**, **European chafer**, or **masked chafers** appear to be less susceptible to *Heterorhabditis* species or *S. glaseri*. *Heterorhabditis zealandica*, a species already commercial in Australia and recently isolated in Florida, could be very effective against masked chafer and somewhat more effective than *H. bacteriophora* against oriental beetle should it become available. Another not presently available species, *Steinernema scarabaei*, isolated from white grubs in turfgrass areas in New Jersey, has shown exceptionally high activity and persistence against most white grub species except masked chafers.

In Japanese beetle and oriental beetle susceptibility to *Heterorhabditis bacteriophora* declines from 2nd stage over young 3rd stage to older 3rd stages larvae. The effect of larval stage, however, seems to vary with nematode species and white grub species. For *S. scarabaei* and *S. glaseri* susceptibility of oriental beetle 2nd vs. 3rd instars was similar.

Based on optimal soil temperatures and white grub larval stage susceptibility, **mid-August into early September is the best time to apply** most EPN species against white grubs. This timing will not only provide better soil temperatures and, at least for *H. bacteriophora* vs. Japanese beetle and oriental beetle, more susceptible targets, but also a longer period of time for the nematodes to be active. Application after mid-September or even October and spring will generally be ineffective. Because nematodes are susceptible to UV radiation and extreme temperatures, it is generally recommended to apply them early or late in the day. Time of day should less critical on cloudy days and with high spray volumes and if treatments are quickly followed by sufficient irrigation.

Fig. 1. Entomopathogenic nematode life cycle.



Diseases of Ornamentals

Ann B. Gould, Ph.D., Specialist in Plant Pathology

Allelopathy hits close to home…

An interesting phenomenon occurred in my garden earlier this year - *Hypericum* (St. John's Wort) planted next to a few Japanese iris were exhibiting signs of **allelopathy**. The shoots closest to the iris were stunted and deformed, and a large circular region devoid of plant life was evident around the iris. So, thus fascinated, I asked the question, what is allelopathy and what causes it?

Allelopathy is derived from two Greek words: "allelon" ("of each other") + "pathos" ("to suffer")

Allelopathy is the term that describes the positive and negative effects that some plants have on other plants. Certain plants biochemically modify their environment to enhance their chances for survival and reproduction. Such species release allelochemicals (secondary metabolites with phytotoxic effects) that impact the growth and development of neighboring plants. These compounds are found in any plant part (leaves, flowers, fruit, stems, and roots). They may volatilize from above-ground plant parts or may enter the soil as plant root exudates or as leachates from plant litter, mulches, or decaying roots. Allelochemicals can impact the development of neighboring seedlings and affect processes in the plant cell such as photosynthesis, respiration, cell division, growth regulator activity, and uptake of nutrients. They may also impact organisms in the root zone, such as mycorrhizae, that are important for plant development. Such compounds may or may not persist in soil.

Secondary metabolites that may have allelopathic effects include alkaloids, flavonoids, phenols, steroids, terpenoids, amino acids, and carbohydrates. Such compounds may act alone or in concert.

The most commonly known allelopathic plant is black walnut, although other ornamental plants (notably sunflower and tree-of-heaven) and turfgrasses also have negative allelopathic effects. Black walnut exudes a substance called **juglone** (5-hydroxy-1,4-naphthoquinone) from its roots, stems, and leaves. Mulches made from these plant tissues also release juglone into the soil. Juglone inhibits cell respiration in solanaceous plants (eggplant, pepper, and tomato), pine, chrysanthemum, peony, apple, lilac, white birch, and acid-loving plants. Symptoms associated with this allelochemical range from minor yellowing to wilt, reduced growth, or plant death. The concentration of juglone in soil tends to be highest near the drip line of the tree. Soil moisture, microorganisms, the availability of light, and soil texture all affect the activity of juglone as well as other allelopathic compounds. For example, white and red pines are affected negatively by juglone when the soil is wet, but not when the soil is dry. Catalpa, Virginia creeper, and violet are among the species that tend to be tolerant of juglone.

Although this chemical suppression of one plant by another has been studied for over 150 years, most of the literature on allelopathy was published in the 1960s and 1970s. It is now known that allelopathy plays an important role in ecological succession and is implicated as a factor that determines how well certain invasive species establish in non-native areas. In addition, the use of allelopathic plants as bioherbicides has also been explored. Other roles have also been suggested for allelopathic compounds. For example, tree-of-heaven (*Ailanthus altissima*), a tree that is hard to manage in urban areas, produces ailanthone, a potent bioherbicide. Although tree-of-heaven inhibits seedling germination in neighboring plants, compounds produced by this tree may also serve a more primary role to discourage insect feeding.

So, what affected my *Hypericum*? The literature suggests that flavonoids produced by the iris may have played a role. These compounds did not persist in the soil; once the iris was removed, the affected plants returned to a normal growth habit within several weeks. Now, if we could only get that rust under control… ❑

Recycle Your Drip Irrigation Tape Year-Round

If you're looking for a cost effective way to recycle your drip irrigation tape then look no further. The Cumberland County Improvement Authority (CCIA) will continue to collect and recycle drip tape generated by New Jersey farmers in 2006.

This year-round agricultural plastics recycling program, started as a pilot project in 2005 through a grant provided by the New Jersey Departments of Agriculture and Environmental Protection, has been modified for 2006.

Mulch film, silage bags, peat moss bags and other agriculture plastics will *no longer be accepted*. Quality control of the drip tape is the most important variable to a successful recycling program. Here are some guidelines to follow:

- Once the drip tape is removed, be sure to remove as much of the contaminants as possible (dirt, water, plant material, etc.). Excessive contaminants will cause the material to be rejected at the collection site. Minimizing these contaminants will lower your recycling costs.
- Drip tape should be rolled up and tied with *only* drip tape.
- Keep the material as dry as possible because moisture will add to the weight of the material and increase the cost of recycling to the farmer.
- Keep the drip tape as clean as possible - it will save you money on recycling costs.
- *Do not* place any other material in the collection bin except drip tape. If other material is commingled with the drip tape, the entire load will be rejected for recycling.

See Recycling on page 7

Plant Diagnostic Laboratory Highlights

Richard J. Buckley, Laboratory Coordinator

Turf

Extremes in temperature and moisture hammer golf turf! Laboratory submissions have picked up dramatically in the last 7 to-10 days. Each year we have what I call the "great die-off" sometime during the summer. There is always a period of undue stress that causes putting greens to fail at a rapid pace and last week was it. Several days of near 100°F temperatures in the region knocked off stands of *Poa annua* on an unprecedented scale (the bentgrasses held up pretty well). Although everybody suffered to some degree, the most damage occurred on push up or native soil greens rather than the sand-based types. These greens obviously hold more moisture than sand and have remained wet for almost 8 weeks through the heavy rains of June and July. The extra soil moisture contributed strongly to root loss this summer, and those plants without adequate root systems simply boiled in the heat wave. I hope your annual bluegrass weevils like their steak well done…….

Disease samples were also found among the carnage. **Anthracnose**, **pythium blight** and **pythium root dysfunction**, **brown patch**, **dollar spot**, **fairy ring**, **copper spot**, **nematodes**, and **gray leaf spot** were identified on select plugs. Samples were submitted from golf courses in Connecticut, California, Delaware, Maryland, New Jersey, New York, Ohio, Pennsylvania, Utah, and Virginia, as well as all New Jersey counties. Everybody was invited to the party!

The **brown patch** pressure was very high last week, which makes **brown patch** our disease of the week for home lawns. Almost every sample of turfgrass from a residential site was diagnosed with **brown patch**. The disease was most severe on perennial ryegrass, but was also found on the fescues, and to some extent bluegrasses. We should expect to see conditions for **brown patch** persist as long as the night temperatures and relative humidity remain high.

One last thing, be aware that the possibility for **gray leaf spot** epidemics exists for the next several weeks. If you choose to renovate or seed with perennial ryegrass during this time, be sure to pick varieties with gray leaf spot resistance. A blend of these newer varieties might be your best bet. On high value turf sites, I would also consider fungicide protection for the new seedlings. A strobilurin or thiophanate-methyl fungicide would provide adequate protection.

Ornamentals

Sample submissions of ornamental plants tend to be slow at this time of year. We had a couple of oak samples from central and southern New Jersey with damage from **bacterial leaf scorch**. A Mercer County nursery submitted maple transplants with **flatheaded apple tree borer**. Flatheaded apple tree borers prefer stressed trees and new transplants. I have also noticed shade trees, particularly maple, with leaf tip and edge scorch that is typical of moisture stress. Most of the trees were street trees, which implicates site conditions as contributing factors, but it just goes to show you that all plants – not just the turf – are suffering from the extreme conditions this summer. ❑

Diseases of Turfgrass

Bruce B. Clarke, Ph.D., Specialist in Turfgrass Pathology

Anthracnose

This disease, caused by the fungus *Colletotrichum graminicola,* is causing major problems on annual bluegrass, fine fescue, perennial ryegrass, and Kentucky bluegrass at this time. The fungus typically attacks turf growing under stress. Low fertility, heat stress, low cutting height and traffic can also enhance symptom development. To identify **anthracnose** in the field, look for small black fruiting bodies with protruding black spines. For best results, increase turf vigor with frequent, light applications of nitrogen, maintain adequate irrigation, reduce thatch, and raise the cutting height (whenever possible). On a preventive basis, apply Armada, Banner, chlorothalonil, Compass, ConSyst, Eagle, Endorse, Headway, Heritage, Insignia, Medallion, Rubigan, Spectro, Tartan or thiophanate-methyl per manufacturer's recommendations. Fosetyl Al (e.g., Chipco Signature) can suppress anthracnose development, particularly when it is tank mixed with one of the previously mentioned products. Resistance has been reported at some locations for the QoI (strobilurin) and benzimidazole fungicides; and Prostar may enhance the severity of this disease, therefore, restrict the use of this product to sites that do not have active infections.

Brown Patch

This disease, caused by the fungus *Rhizoctonia solani,* is very common on tees, greens, and home lawns due to the recent hot, humid weather. To reduce the incidence and severity of **brown patch,** avoid nitrogen applications during hot weather, irrigate between midnight and 8 a.m. to reduce the period of leaf wetness, and spray turf with Armada, Banner, Chipco 26GT, chlorothalonil, Compass, ConSyst, Curalan, Eagle, Endorse, Headway, Heritage, Insignia, mancozeb, Medallion, Prostar, Spectro, thiophanate-methyl, Tartan, or Touche per manufacturer's recommendations.

Marasmius

There have been numerous reports recently about the appearance of small mushrooms protruding from brown leaf blades. These structures, belonging to the fungus *Marasmius*, are approximately ½ to ¾ inch in length and consist of a dark brown stem and a small tan to orange colored cap. **Marasmius** often appears in areas that have been thinned by brown patch. Although this fungus may appear to be pathogenic, it is actually invading dead and dying plant tissue and thus is not a threat to the surrounding turf.

Pythium Blight

Pythium blight continues to be reported on golf and landscape turf. Since pythium thrives in low or poorly drained areas, especially when the night temperatures are above 68^0F, we should see more of this disease if the "hot, muggy" weather continues this summer. For best results, improve drainage, water in the morning hours, avoid over fertilization, and apply Alude, Banol, Chipco Signature, Headway, Heritage, Insignia, Koban, Magellan, mancozeb, Prodigy, Quell, Subdue MAXX, or Terrazole, according to the manufacturer's recommendations.

Summer Patch

This has been one of the worst years for summer patch since the late 1980's due to the extremely hot, humid weather. Summer patch can be troublesome on Kentucky bluegrass, annual bluegrass, and fine fescue turf. To control existing infections, apply Armada, Banner, Bayleton, Compass, Eagle, Headway, Heritage, Insignia, Rubigan, Tartan, or thiophanate-methyl in 4 to 5 gal of water/1000 ft^2. Repeat every three to four weeks (every two weeks if using thiophanate-methyl). If fungicides cannot be applied with this much water, irrigate them into the thatch immediately with 1/16 to 1/8 inch of water. Aerification (when symptoms are not present) and improved drainage will also aid in disease suppression. Soil pH should be maintained at or slightly below 6.0 for optimum disease control.

Yellow Ring

This disease, caused by the fungus *Trechispora alnicola*, is evident on Kentucky bluegrass lawns and sod fields at this time. Patches are 1 to 2 feet in diameter and consist of green grass surrounded by 2 to 3 inch diameter yellow rings. Upon close inspection of the thatch, a dense mat of white mycelium is often apparent. Infected turf rarely dies and rings do not always reappear the following year. Symptoms are most apparent during cloudy weather between May and October. The fungus is primarily a saprophyte which colonizes organic matter in the thatch. Since the damage caused by this fungus is cosmetic and the turf recovers during cool weather in the fall and spring, control is rarely warranted. In areas where symptom expression cannot be tolerated, turf managers should dethatch affected turf. No chemicals are currently labeled for the control of yellow ring. ❑

Cream Ridge Nursery Research & Extension Meeting

Thursday, August 17, 2006
1:30 p.m. to 6:30 p.m.
Rutgers Fruit Research & Extension Center
283 Route 539, Cream Ridge, NJ

This program is sponsored by Rutgers Cooperative Research & Extension of Monmouth County in cooperation with the New Jersey Nursery and Landscape Association.

Agenda

1:00 Registration

1:30 "Does it Matter what Type of Fertilizer and Substrate Medium you use for Growing Nursery Crops?", Dr. Gladis Zinati, Specialist, Nursery Mgmt, Rutgers Univ.

"Nursery Stock Availability, What's Hot What's Not", Rick Henkel, Princeton Horticultural Services

"Weed Management for Growing Herbaceous Ornamentals", Dr. Andrew Senesac, Weed Science Specialist, Cornell University

"What IR-4 can do for you", Dr. Cristi Palmer, Ornamental Horticulture Manager, IR-4, Rutgers University

"Integrated Pest Management Scouting - The Fundamentals", Steve Rettke, IPM Program Associate, Rutgers University

"Pesticide Safety and Regulations", Dr. George Hamilton & Ray Samulis, Rutgers University

4:00 Hay Wagon Tour - where you will see:
- ◆ Nursery Crop Research and Demonstration
- ◆ Plant Variety Trials
- ◆ Weeds "au natural"
- ◆ Field Pest Diagnostics and more

5:30 Pesticide Credits, Evaluation, SOCIAL TIME AND FOOD (sandwiches, salads & beverages)

Cost: Free!

Pesticide License Recertification Credits: (anticipated) CORE-1, PP2-4, 3A-4

Pre-registration is required, *deadline is August 15, 2006.* To register, call Monmouth County Extension Office 732-431-7260 or 7261.

Weather Summary for the Week Ending 8 am Monday 8/ 7/ 6

	RAINFALL			TEMPERATURE				GDD BASE50		MON
WEATHER STATIONS	WEEK	TOTAL	DEP	MX	MN	AVG	DEP	TOT	DEP	%FC
CANOE BROOK	.18	20.18	-1.58	99	62	82.	9	2249	536	62
CHARLOTTEBURG	.18	20.74	-1.20	94	61	79.	8	1902	561	65
FLEMINGTON	.06	25.97	4.92	97	62	81.	8	2145	386	64
NEWTON	.48	21.22	1.05	95	60	78.	6	1671	111	71
FREEHOLD	.35	19.23	-1.21	98	61	82.	8	2187	305	63
LONG BRANCH	.23	19.30	-1.11	99	66	83.	9	2106	303	34
NEW BRUNSWICK	.20	20.14	-.33	98	63	82.	8	2281	314	69
TOMS RIVER	.00	16.41	-4.61	100	63	83.	10	2200	397	29
TRENTON	.00	20.91	1.36	97	66	82.	6	2322	269	36
CAPE MAY COURT HOUSE	.00	12.69	-5.43	96	65	83.	7	2218	292	26
DOWNSTOWN	.00	16.88	-2.27	96	62	82.	7	2083	18	36
GLASSBORO	.00	17.56	-2.56	97	68	83.	8	2474	436	36
HAMMONTON	.00	16.11	-4.07	99	64	84.	8	2398	360	36
POMONA	.00	17.70	-.60	98	64	83.	9	2275	373	27
SEABROOK	missing									
SOUTH HARRISON	.00	21.68	2.79	96	66	83	NA	2440	NA	NA

WES KLINE — GDD BASE 40 PINEY HOLLOW LAST WEEK 272 (Ending 7/31/06) THIS WEEK 296 (Ending 8/7/06)
* SOME CUMLATIVE VALUES ESTIMATED DUE TO EARLIER MISSING DATA

2006 Introductory Greenhouse Short Course:

Design and Operation of Greenhouse, High Tunnel and Nursery Systems

Rutgers Agricultural Research and Extension Center (RAREC)
121 Northville Road, Upper Deerfield, NJ
Thursday, September 28, 2006

8:30 am	Registration
9:00 am	Greenhouse Heating - A.J. Both, Specialist in Controlled-Environment Engineering
9:45 am	Container Media and Nutrition Management - Gladis Zinati, Specialist in Nursery Management
10:30 am	Break
10:45 am	Greenhouse Ventilation and Cooling – A.J. Both
11:30 am	Irrigation Management for Container Grown Nursery Crops - Gladis Zinati
12:15 pm	Lunch
1:15 pm	Overwinter-Hardening and Dehardening Management Practices - Gladis Zinati
2:30 pm	Edible Greenhouse Crops and Their Production Systems - Wes Kline – Cumberland County Agricultural Agent
3:15 pm	Break
3:30 pm	High Tunnel Production Systems – A.J. Both and Wes Kline
4:15 pm	Disease Management in High Tunnels – C. Andrew Wyenandt – Specialist in Vegetable Pathology
5:00 pm	Adjourn

Pre-registration is required. Cost for the course is $100 per person. The registration deadline is Friday, September 22, 2006 and no refunds will be issued after that date. Contact Donna Dugan, RAREC, at 856-455-3100 X4102 for additional information or directions to the short course.

Additional one-day greenhouse short courses may be scheduled in October and/or November if sufficient registration is obtained for this session.

RECYCLING FROM PAGE 4

Collection Site Information:

Date: Collection runs year-round
Cost: $30 per ton
Location: Cumberland County Solid Waste Complex
169 Jesse Bridge Road, Deerfield, NJ
Located off Route 55, Exit 29 (Sherman Ave., Route 552)
Time: Monday-Friday 7:30 a.m.-3:30 p.m. (Saturday by appointment only)
Contact: Dennis DeMatte, Jr., Recycling Coordinator, CCIA
Phone: 856-825-3700

- When entering the Solid Waste Complex, identify the material as drip tape. This is necessary since the CCIA also has a nursery and greenhouse film collection program and the drip tape must be stored in a separate area.
- Vehicles used to transport the drip tape are not required to be licensed by the NJDEP so long as the drip tape is transported directly to the collection site.
- Prior to delivery of the drip tape, all growers *must* establish an account with the CCIA or utilize a licensed solid waste hauler.

Additional questions regarding the recycling of plastics generated in agriculture contact Karen Kritz, NJ Department of Agriculture, 609-984-2506 or e-mail Karen.Kritz@ag.state.nj.us. ❑

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Pesticide User Responsibility: Use pesticides safely and follow instructions on labels. The pesticide user is reponsible for proper use, storage and disposal, residues on crops, and damage caused by drift. For specific labels, special local-needs label 24(c) registration, or section 18 exemption, contact RCRE in your County.
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