Turfgrass Water Conservation

SEARCHING FOR DROUGHT TOLERANT CULTIVERS

WITH FRESH WATER supplies becoming severely limited around the world, the uses of water are being scrutinized more closely than ever before, especially for landscapes, athletic fields, home lawns and other non-agricultural uses. This means the development of turfgrass cultivars with improved tolerance to limited or low quality water remains as one of the most important research objectives facing the turfgrass industry.

The Turfgrass Water Conservation Alliance (TWCA), a non-profit organization, has established a science-based method for qualifying cultivars for drought tolerance and other characteristics related to water conservation of grass seeds at low cost. The approach is to establish turfgrass under optimum conditions, allowing the full expression of above ground and below ground growth and then impose a long-term water deficit stress. Seed during the development of drought stress turf grass plots are monitored for their ability to maintain green cover under protracted drought stress, a process that identifies those cultivars with either low water use or extensive root systems. Those cultivars or selections that maintain green cover for longer periods would delay the need for supplemental irrigation, with the hope that natural rainfall can supply those needs before irrigation is required.

This approach to identifying turfgrass cultivars with superior drought tolerance with as much as 21 day delays in the onset of drought stress symptoms is marketed under the "Aqua Wise" brand, the "Water Star" brand, or the "Water Miser" brand. The criteria are very strict for acceptance into TWCA, and a variety must finish in the top statistical group to even be considered. For more information, including a list of approved turfgrass varieties, visit www.tgwca.org.

COVER STORY CONTINUED...

HEAVY RAINS PROMPT DRAINAGE DISCUSSION

IT IS THIS WATER that sustains the growth of the grass. Installing a drainage system will not remove any of the water held in the micro pores. The removal of excess water from the root zone will normally occur within two or three days.

A properly designed and installed drainage system will greatly assist in reducing the time required for excess water to be removed, often by fifty percent or more, depending on pore space size and distribution in the soil. Additions to the design of the basic drainage system can also increase the removal of surface water during high intensity rains, thus resulting in less water moving through the pore space. Athletic fields that do not have a drainage system can have a basic system installed for approximately $20,000.

Remember that an irrigation system should never be installed without a drainage system.

Variation in costs will be influenced primarily by the availability of a drain outlet and the desire to have surface water removal. With modern installation procedures, the drain lines within the field can be pulled in the same as irrigation pipe and installed with minimum surface disturbance. The system can have a life expectancy of 50-plus years.

In closing, I have no doubt that before this season is over, there will be equal concern about the lack of water and need for irrigation. Remember that an irrigation system should never be installed without a drainage system. Maybe now is the time to take the first step in planning a total water control system – drainage plus irrigation. Note that the drainage system will only remove the excess water applied as irrigation, or irrigation followed by a heavy rain.

~ Murray Cameron quoted from "Wet weather spoils sports in city," Doug Hallett, Guelph Tribune, May 31, 2011.

Beating the Ban (and Turfgrass Pests) With Research Into Environmentally-Friendly Products

Michael Brownbridge, Vineland Research & Innovation Centre and
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April 22, 2009. Overnight, Ontario's Cosmetic Pesticides Ban removed over 250 products that had previously been used to control insects, weeds and diseases in the urban environment, leaving the general public and landscaping community with few proven pest management tools for lawns and home gardens.

OTS HIGHLIGHT
Presented February in Guelph, Ontario.

For lawn care companies, practices have had to change radically. With the ban, all the old quick fixes are gone, and more than ever the emphasis has to be on production of a healthy lawn as the first line of defence, and to shift from curative to preventative approaches. In the past, relatively inexpensive broad-spectrum, persistent insect and weed control products were often applied prophylactically, whether they were needed or not. In order to achieve good insect control today, effective new products are needed, combined with appropriate knowledge on how to use them.

The ban created a real urgency to develop alternative pest management tools, particularly biopesticides (based on naturally-occurring microorganisms, nematodes and plant-derived products) for the major pests that threaten Ontario lawns. Most biopesticides have a low risk profile and while the present focus is on the use of these materials by landscapers and lawn care specialists, it is likely that some may

be successfully transitioned for future use on amenity and sports turf, and in larger operations such as sod farms.

Target Pests

The main research targets include 'white grubs,' European chafer and Japanese beetle, and hairy chinch bug. European chafer is predominant in most of southern Ontario, while the Japanese beetle is a more recent arrival, now established in the Niagara Peninsula and spreading west, and may even be displacing European chafer as the dominant pest in some areas. Larvae of these insects preferentially feed on organic matter and the fibrous roots of turf grasses and damage usually becomes apparent in late summer/early fall or early spring. The hairy chinch bug feeds at the base of the grass stem rather than the roots. Damage primarily occurs when grasses are water-stressed and temperatures at their highest in late July/August, coinciding with adult feeding activity. Secondary pests such as leatherjackets and sod webworms appear to be increasingly common. These insects were likely kept in check by materials (now banned) previously used to control grubs.

Main. Chinch bug feeding damage on an Ontario lawn. **Adjacent Left.** Late stage European chafer (Rhizotrogus majalis) larva, a very hungry grass root feeder. **Adjacent Right.** A white grub infected and killed by the fungus Metarhizium anisopliae.

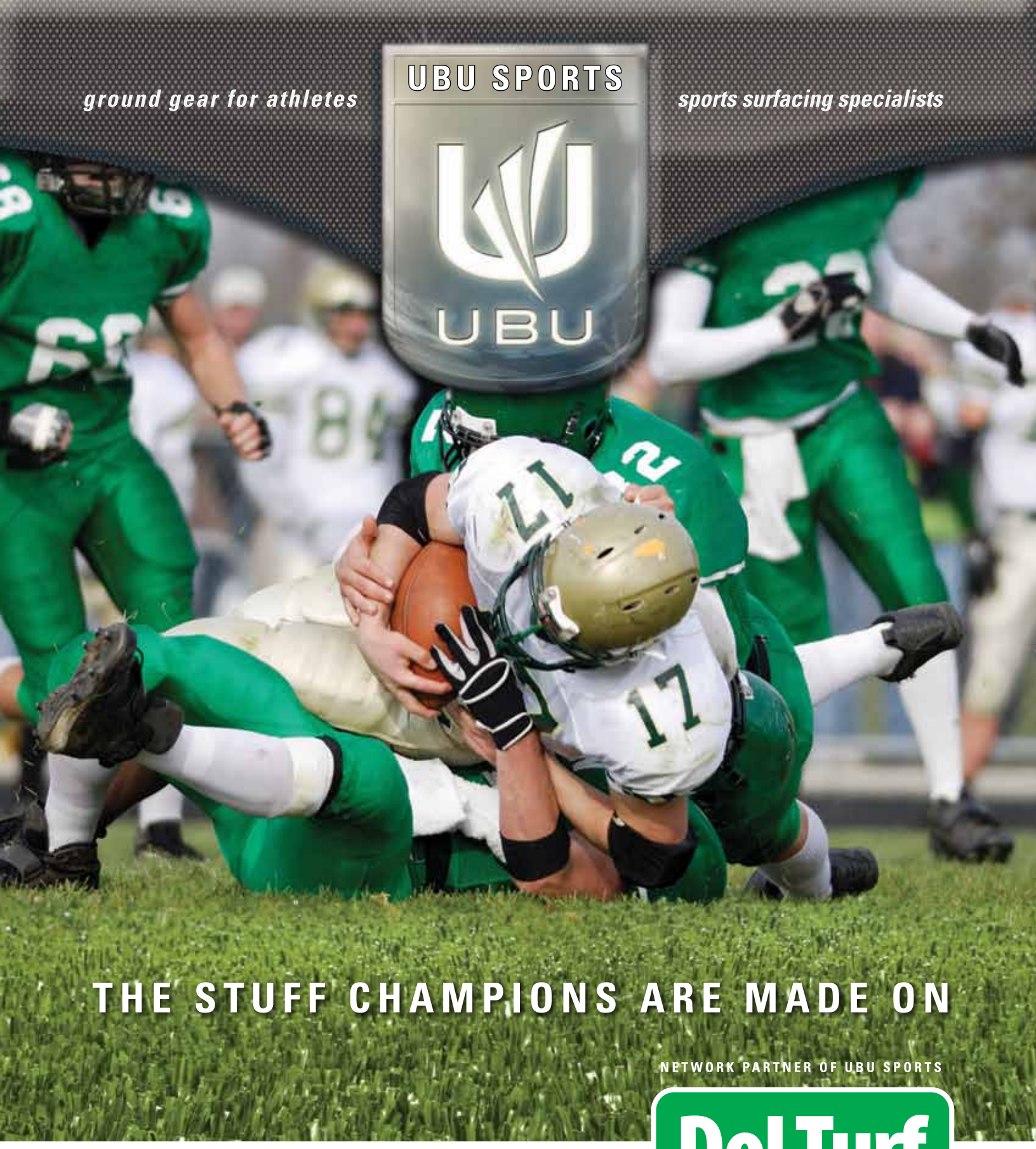
Encouraging results were obtained in summer/fall 2010 field trials where nematodes, fungi and two natural products have been tested against European chafer and chinch bug.

Natural Solutions For Insect Control

Both grubs and chinch bugs are often naturally-infected with fungi and nematodes. How can we use these beneficial organisms to our advantage and develop them into products that can be readily produced and applied? Research is focusing on these biocontrol agents and other natural products and ways of reliably and cost-effectively using them to control turf pests. The work is supported in part by organizations such as the Ontario Turfgrass Research Foundation, Landscape Ontario, Agriculture and Agrifood Canada through its AgriScience Research Cluster Program, the CUPRI Program, companies involved in the production and sale of biopesticides and private lawncare companies.

A number of approaches are being taken, including the search for and testing of novel strains of fungi and nematodes that may be better suited to work in Ontario's cooler soils. So far, several of these microbial biocontrol agents have been recovered from field-collected insects and are being tested in lab/greenhouse studies to allow those best suited to further investigation and development to be identified. Most of our work is presently focusing on existing control agents to provide users with options in the near term. Although some of these have been available for some time, considerable improvements are needed to devise robust use practices to enable their use in a novel environment and to develop 'best use' practices for their application, either alone or in combination with another control agent, in order to maximize control over a range of conditions in the most cost-effective manner. As living control agents, as with any other living organism, they have to be produced, formulated, stored, handled and applied correctly to maintain viability and achieve maximum efficacy.

Nematodes, fungi and two natural products have been tested against European chafer and chinch bug. Research still has some way to go, but encouraging results were obtained in field trials carried out in summer/fall 2010, where various products, formulations and application techniques were tested. The nematode *Heterorhabditis bacteriophora* (Hb) is currently recommended for chafer control in Canada; a second species, *Steinernema glaseri* is a new addition to the bio-arsenal for 2011. For both species, timing of application is critical to their successful use. Soil temperature (ideally around 12 to 15 degrees), insect age and location in the soil all influence efficacy. The fungus *Metarhizium anisopliae* is already registered in Canada for use against black vine weevil in nursery crops. We are assessing its potential utility for both chinch bug and chafer grubs



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and its use together with nematodes. One of the plant-derived products included in our trials is an all-natural organic fertilizer which, in addition to other plant-derived ingredients, also contains neem seed cake. The product functions as a bio-fertilizer and a pre-emergent herbicide; the neem component may also have an impact against some insects, so this product could provide multiple benefits.

Results From Field Trials

Results of the lab and greenhouse trials against chafer grubs showed that they were susceptibile to the microbial biocontrol agents and clearly demonstrated the influence of temperature on performance. In the field trials, treatments were applied in late September when the grubs were older, harder to control and residing lower in the soil profile where they are more difficult to contact. Soil temperatures were also decreasing. All of these factors can result in reduced susceptibility to control agents; however despite the fact that this timing was not ideal, observed downward population trends in plots treated with the Hb nematode, *Metarhizium anisopliae* and biofertilizer were on par with or slightly better than those obtained with the standard insecticide, Merit. It is likely that efficacy can be improved considerably with better formulations, improved application techniques and better timing. Trials planned for 2011 will encompass some of these improvements and will include additional experimental products.

What about chinch bug? A similar suite of microbial and botanical products were included in tests against damaging natural infestations of the pest which were detected in late July/August 2010. Given the high temperatures and dry conditions experienced at that time, results were very encouraging. While results were not conclusive from a statistical standpoint due to uneven distribution of the chinch bug populations, the trials have provided us with some excellent lead candidates for testing in 2011. These include a *Metarhizium anisopliae* spray and the nematode *Steinernema carpocapsae*, particularly when used together with a botanical wetting agent. An essential oil product also provided excellent knock-down of the bugs and may be an ideal partner with a biological, the combination providing rapid knockdown and extended control.

The Final Word

The primary goal of the current project is to provide functional biopesticides to control chinch bugs and European chafer in lawn turf. Field trials have allowed effective candidate organisms to be identified for field validation studies. The project will, in the near term, deliver new pest control tools and techniques to homeowners, lawn care and turf professionals that successfully mitigate turf pests in a cost-effective and environmentally-benign manner. Applications of some of these technologies seem likely to extend into other turf sectors, particularly in high-traffic grassed areas such as recreational and sports fields as legislation and the general public drive change towards the use of sustainable 'green' products.


Researchers chasing chinch.

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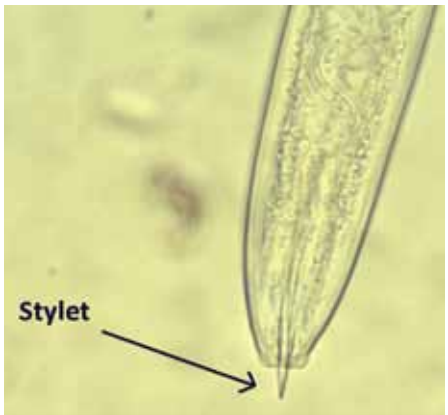
Biology of Entomopathogenic Nematodes (EPN)

Article & Photos By Shahram Sharififar, Entomologist, Natural Insect Control



OTS HIGHLIGHT

Presented February in Guelph, Ontario.

What are nematodes: Nematodes are often referred to as round, eel or threadworms because of their cylindrical and elongated bodies. These non-segmented, invertebrate animals range in size from 0.1 mm to several metres in length. Over 28,000 species have been recognized worldwide and over 16,000 are parasitic. It has been estimated that there are approximately 1,000,000 different nematode species in the world.

Beneficial or Entomopathogenic Nematodes (EPNs): The term entomopathogenic comes from the Greek word entomon referring to insect, and pathogenic, which means producing disease. EPNs of the families called Steinernematidae and Heterorhabditidae are lethal pathogens of insects. All EPNs are symbiotically associated with bacteria located in their intestinal tract.

Host search behaviour & EPN strategies: This can be divided into two broad categories: ambushing and cruising. Ambusher species such as *Steinernema carpocapsae*

Top. EPN application with a backpack sprayer. **Adjacent.** Nematodes parasitic on plants obtain food by sucking juices from them. Feeding is accomplished through a hollow, needlelike mouthpart called a stylet. The nematode pushes the stylet into plant cells and injects a liquid containing enzymes, which digest plant cell contents. The liquefied contents are then sucked back into the nematode's digestive tract through the stylet.

tend to remain stationary; they search by standing on their tail and elevating most of their bodies. This sit-and-wait approach to finding hosts serves as a mechanism for host attachment. Ambushing is clearly an adapted behaviour in the top two inches of non-compacted soil, as it is not possible to do this function effectively deeper in the soil. Cruiser nematodes such as *Heterorhabditis bacteriophora* and *S. glaseri* tend to be highly mobile searching in comparatively large areas for hosts. They are highly responsive to host-released volatiles like CO_2 that they use to orient toward insects. Cruiser species are found distributed throughout the soil profile as would be predicted from their search behaviour. Cruiser nematodes are best adapted to parasitize sedentary, below ground hosts such as white grubs. The cruisers tendency is to move downward about eight to ten inches and horizontally up to 10 feet to seek their host.

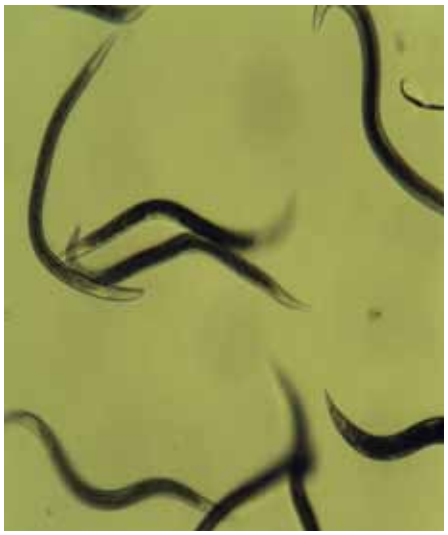
Major turf grass grubs & identification: Some of the most important white grubs in turf grass are: European chafer (*Rhizotrogus majalis*), June beetle (*Phyllophaga spp.*), Japanese beetle (*Popillia japonica*), Asiatic garden beetle (*Maldera castanea*) and black turf grass *Ataenius* (*Ataenius spretulus*). The first three species are the most common pests in Ontario and throughout most of Canada. Correct identification of white grub species is important in determining management strategies and timing of controls.

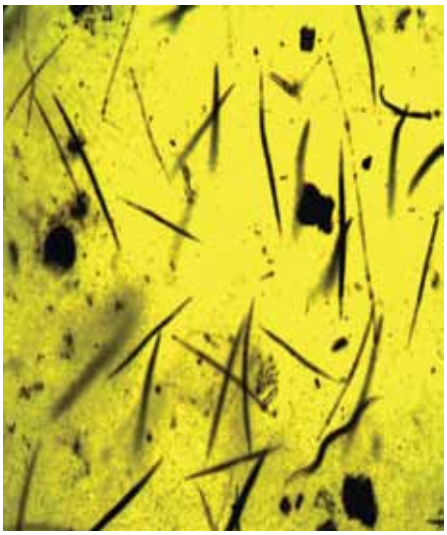
To identify different species we should observe the grub's raster (arrangement of bristles and hairs on the underside tip of the abdomen). A 10x hand lens is needed to see this pattern on most mature white grubs.

Ordering, Receiving & Storage

Ambusher or cruiser, which one to order: According to the type of pests, we can determine which category would be the better choice for application. Generally, to control soil-surface pests, ambushers are more effective. Conversely, to control pests in deeper areas of soil, the cruiser nematode will produce the highest efficacy.

Labeling and necessary information: For assurance of EPN quality and their efficacy, all the nematode packages should have a label with the necessary information including: nematode species, quantity, application rate and the expiration date.





Above. Nematodes under the microscope. On the left they are alive; on the right they are dead.

Viability: There are different methods for checking EPN's viability. First of all, check the attached label and consider the expiry date. If nematodes are on a sponge, make sure it was shipped with icepacks overnight and refrigerated upon receiving. Fresh nematodes will have a slight earthy smell and appear light gray, beige or pinkish (depending on strain). Dying or dead nematodes will have a strong putrid odour. If nematodes are in powder, the same indication as above applies, but be careful that the plastic bag is clean and free of any fungus infection symptoms.

Ambusher or cruiser? Generally, to control soil-surface pests, ambushers are more effective. Conversely, to control pests in deeper areas of soil, the cruiser nematode will be better.

Monitoring for freshness & activity assurance: In case of a sponge carrier, after opening a package, extract a tiny sample of nematode paste by using a small utensil and place it on flat clear surface (solo cup lid) then mix 2 ml of tap water with nematode paste and in case of a powder carrier, mix and dissolve approximately 1 g to 20 ml of tap water. Separate 2 ml on a flat surface. In both cases, look at the suspension by use of magnifier equipment. The fresh nematodes are active and their bodies wiggling under at least a 10x hand lens or a microscope.

Desired Conditions Before Applying EPN

Moisture: Sufficient soil moisture plays a main role in the infective juvenile's (IJ) efficacy and survival. EPNs use the water channels like roads to reach their hosts. Therefore the soil needs to be moist down below the level of the grubs. Keeping the soil wet for 2-3 days after an application can provide an ideal situation for EPN efficacy.

Texture: the capacity of different soil textures in holding oxygen is an important factor in the IJ's survival. For example: a field trial in different soil textures confirmed that the lowest survival for EPNs was recorded in the clay soil (compared to sand, sandy loam and clay loam). This lower survival rate is probably related to the lower oxygen level because of small pores in clay soils. Note: if the soil is saturated from heavy rains or lack of drainage, the nematodes could die from lack of oxygen.