A Novel, Effective Approach to Grub Control That is Safe for Pollinators, People, Animals and the Environment with EPA Exemptions in CT

beetle GONE!® tlc

grub GONE!® G

Target the Pest, Not the Rest!™

Joe Magazzi, MS
President

The SCIENCE of Organic Plant, Tree & Turf Care

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Fertilizers • Worm Castings • Soil Probiotics • Disease Control • Tick & Mosquito Control
Pest Insect Control • Grub Control • Herbicides • Animal Repellents • Natural Ice Melts
Know Thy Enemy:
White Grubs / Scarab Beetles
Know Thy Enemy:
White Grubs / Scarab Beetles

• Scarab Beetles (*Scarabaeidae*) are part of the Coleoptera order (General Beetles).
• There are about 30,000 scarab species comprising about 10 percent of all known beetles. The term “**white grub**” is the immature or larval form of the scarab beetle.
• Most consume live plants, fruits and vegetable and are considered agricultural pests with a large negative economic impact.

In Connecticut, the most prevalent and damaging species are: **Japanese beetles, European chafers, Asiatic garden beetles, Oriental beetles, Northern masked chafer**
Know Thy Enemy:
White Grubs / Scarab Beetles Economic Impact

• “White grubs are the most damaging group of turf grass insect pests in our region”…Connecticut IPM Annual Report from UCONN in 2013.

• According to a USDA/APHIS report in 2000, about $156 million is spent in the US annually renovating or replacing damaged turf or ornamental plants.

• That same report from 2000 estimated that $460 million is spent each year to control the grubs and adults.

• Today, the economic impact is likely higher than it was 16 years ago.

• These numbers are *only* for the Japanese beetle – total white grub & adult beetle damage is likely in the billions.
Know Thy Enemy:
Beetle Life Cycles

From Cornell University Integrated Pest Management Program (www.nysipm.cornell.edu/publications/grubs/life.asp)

Exact life cycle and timing will vary depending on species of beetle.
beetleGONE! & grubGONE!
(Bacillus thuringiensis)
& The Cry Proteins:
An Introduction & Mode of Action Against Grubs & Beetles
Biological Control Strategies in General Can Be Summed Up With One Sentence:

“The Enemy of My Enemy is My Friend”
Bacillus thuringiensis (Bt)

• Bacteria first isolated in 1901 by Ishiwatari from diseased silkworms and again by Berliner from diseased flour moth larvae in 1911.
• Bt belongs to the family of bacteria called Bacillus cerus.
• There are currently 82 distinct Bt strains currently described.
• Bt can be found in soils almost everywhere in the world in all types of terrains. As such, we have all been exposed to Bt and it is a very safe and natural soil microbe.
• Bt has been and continues to grow as a commercially important microbe…

From http://bacillusthuringiensis.
Bacillus thuringiensis (Bt) and Cry Toxins

- Bt produces a crystal protein composed of the insect δ-endotoxin called Cry (Crystal) protein.
- Different Bt strains produce over 200 distinct Cry proteins crystals during the stationary (spore) phase of their growth cycle.
- These crystals are specifically toxic to certain orders and species of insects, like Lepidoptera, Diptera, and Coleoptera.
- Some Bt species even produce compounds that have antifungal activity.
- Because an insect’s gut structure and physiology is vastly different from that of humans, Bt does not have the same effect on the human gut.
Bacillus thuringiensis (Bt) and Cry Toxins

**Bacillus thuringiensis (Bt) and Cry Toxins**  
**Commercially important species**

*Bt israelensis*: Flies such as fungus gnats, blackflies, and mosquitoes  
*Bt tenebrionis (san diego)*: Some beetle larvae  
*Bt kustaki*: Caterpillars (cabbageworm, tent caterpillars, gypsy moth)  
*Bt aizawai*: Caterpillars (armyworms, diamondback moth)

Although *Bt* has been used as an effective natural insecticide for decades, there was not and effective commercial *Bt* option for white grub & adult control until now…
• Bt galleriae SDS-502 isolated by Asano from diseased Japanese Beetles in 2003.
• Bt galleria SDS-502 was found to produce a protein toxic specifically to Scarab Beetles. Sequencing indicated it was a homologous to cry8 genes. It was designated as cry8Da (AB089299).
• The gene product was formulated for soil application and tested in a peanut field for chafer control.
• Plots treated with SDS-502 had significantly better insect control than the untreated plots based on the amount of undamaged nuts harvested.
**Btg Mode of Action**

- Ingestion of Cry8 crystals by a susceptible Beetle or Grub.
- Crystal Solubilization & Toxin activation
- Receptor Binding
- Pore Formation
- Disruption of Mid-Gut Lining
- Cessation of Feeding
- Septicemia

Intramolecular proteolytic nicking and binding of *Bacillus thuringiensis* Cry8Da toxin in BBMVs of Japanese beetle

Takuya Yamaguchi, Ken Sahara, Hisanori Bando, Shin-ichiro Asano*  
Department of Applied Bioscience, Graduate School of Agriculture, Hokkaido University, N9 W9, Sapporo 060-8581, Japan
beetleGONE! & grubGONE!

Advantages: Broad Spectrum

Effective Against a Wide Range of Beetles and their Grubs
# Pests & Life Cycle Stage Controlled by *Btg*

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Latin Name</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scarabaeidae</td>
<td>Asiatic garden beetle</td>
<td><em>Maladera Castenea</em></td>
<td>adult/larva</td>
</tr>
<tr>
<td></td>
<td>Japanese beetle</td>
<td><em>Popillia japonica</em></td>
<td>adult/larva</td>
</tr>
<tr>
<td></td>
<td>May/June beetle</td>
<td><em>Phyllophaga spp.</em></td>
<td>larva</td>
</tr>
<tr>
<td></td>
<td>Green June beetle</td>
<td><em>Cotinis nitida</em></td>
<td>adult/larva</td>
</tr>
<tr>
<td></td>
<td>Oriental beetle</td>
<td><em>Anomala orientalis</em></td>
<td>adult/larva</td>
</tr>
<tr>
<td></td>
<td>European chafer</td>
<td><em>Rhizotrogus majalis</em></td>
<td>larva</td>
</tr>
<tr>
<td></td>
<td>N. masked chafer</td>
<td><em>Cyclocephala borealis</em></td>
<td>larva</td>
</tr>
<tr>
<td></td>
<td>S. masked chafer</td>
<td><em>Cyclocephala lurida</em></td>
<td>larva</td>
</tr>
<tr>
<td>Curculionidae</td>
<td>Annual bluegrass weevil</td>
<td><em>Listronotus maculicolis</em></td>
<td>larva</td>
</tr>
<tr>
<td></td>
<td>Egyptian alfalfa weevil</td>
<td><em>Hypera brunipennis</em></td>
<td>larva</td>
</tr>
<tr>
<td></td>
<td>Rice water weevil</td>
<td><em>Lissorhoptrus oryzophilus</em></td>
<td>larva</td>
</tr>
<tr>
<td>Chrysomelidae</td>
<td>Rice leaf beetle</td>
<td><em>Oulema oryzae</em></td>
<td>larva</td>
</tr>
<tr>
<td></td>
<td>Alder leaf beetle</td>
<td><em>Agelastica alni</em></td>
<td>adult</td>
</tr>
<tr>
<td>Buprestidae</td>
<td>Emerald ash borer</td>
<td><em>Agrilus planipennis</em></td>
<td>adult</td>
</tr>
<tr>
<td></td>
<td>Gold spotted oak borer</td>
<td><em>Agrilus coxalis</em></td>
<td>adult</td>
</tr>
<tr>
<td>Tenebrionidae</td>
<td>Darkling beetle</td>
<td><em>Alphitobius diaperinus</em></td>
<td>adult/larva</td>
</tr>
</tbody>
</table>

Successful control depends on life cycle and feeding habits - when and where are they feeding? Control not limited to just Scarab Beetles but also some Weevils and Borers.
beetleGONE! & grubGONE!
Advantages: Safety
Safe for Pollinators & Other Beneficials
Safe for People and Animals
Safe for Invertebrates & Fish
beetleGONE! & grubGONE! - Safe for Beneficials: Soil-Borne Beneficials (Nematodes etc...)

<table>
<thead>
<tr>
<th>Order</th>
<th>Family</th>
<th>Latin Name</th>
<th>Common Name</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coleoptera</td>
<td>Coccinellidae</td>
<td><em>Coccinella magnifica</em></td>
<td>Ladybird Beetle</td>
<td>No effect</td>
</tr>
<tr>
<td>Hymenoptera</td>
<td>Apidae</td>
<td><em>Apis mellifera</em></td>
<td>Honeybee</td>
<td>No effect</td>
</tr>
<tr>
<td></td>
<td>Eulophidae</td>
<td><em>Tetrastichus plannipennisi</em></td>
<td>Wasp, Parasitoid</td>
<td>No effect</td>
</tr>
<tr>
<td></td>
<td>Braconidae</td>
<td><em>Spathilus agralili</em></td>
<td>Wasp, Parasitoid</td>
<td>No effect</td>
</tr>
<tr>
<td></td>
<td>Braconidae</td>
<td><em>Atanycolus spp.</em></td>
<td>Wasp, Parasitoid</td>
<td>No effect</td>
</tr>
<tr>
<td></td>
<td>Encyrtidae</td>
<td><em>Obius agralili</em></td>
<td>Wasp, Parasitoid</td>
<td>No effect</td>
</tr>
<tr>
<td>Lepidoptera</td>
<td>Bombycidae</td>
<td><em>Bombyx mori</em></td>
<td>Silkworm</td>
<td>No effect</td>
</tr>
<tr>
<td></td>
<td>Noctuidae</td>
<td><em>Spodoptera litura</em></td>
<td>Cutworm</td>
<td>No effect</td>
</tr>
</tbody>
</table>

Tests have confirmed that *Btg* is safe for beneficials such as Bees, Ladybugs (Ladybird Beetle), Parasitic Wasps etc..
Response of four EAB parasitoid species to *Btg* SDS-502 was determined by 7-day exposure to the adult EAB LC$_{50}$ of *Btg* SDS-502 paste suspended in honey (0.4 μg Cry8Da toxin/μL honey)

<table>
<thead>
<tr>
<th>Parasitoid Species</th>
<th>Family</th>
<th>Origin</th>
<th>n</th>
<th>Mortality*</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Tetrastichus planipennisi</em></td>
<td>Eulophidae</td>
<td>China</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td><em>Spathius agrili</em></td>
<td>Braconidae</td>
<td>China</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td><em>Oobius agrili</em></td>
<td>Encyrtidae</td>
<td>China</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td><em>Atanycolus</em> spp.</td>
<td>Braconidae</td>
<td>Michigan</td>
<td>12</td>
<td>0</td>
</tr>
</tbody>
</table>

*Corrected for control mortality using Abbott’s formula

Study performed by Leah Bauer, USDA Forest Service and Michigan State University

Tests have confirmed that *Btg* is safe for Parasitic Wasps
beetleGONE! & grubGONE! - Safe for Beneficials: Bees & Other Pollinators

<table>
<thead>
<tr>
<th>PESTICIDE</th>
<th>NON-TOXIC</th>
<th>LOW TOXICITY</th>
<th>HIGHLY TOXIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insecticides/Repellants/Pest Barriers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacillus thuringiensis (Bt)</td>
<td><strong>Green</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beauveria bassiana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boric Acid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cydia pomonella granulosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diatomaceous Earth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garlic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insecticidal Soap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaolin Clay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limonene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neem</td>
<td></td>
<td><strong>Yellow</strong></td>
<td></td>
</tr>
<tr>
<td>Horticultural Oil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyrethrins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotenone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryania/Ryanodine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sabadilla</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinosad</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*From Xerces Society “Invertebrate Conservation Fact Sheet: Organic-Approved Pesticides, Minimizing Risks to Bees” Copyright © 2012 The Xerces Society for Invertebrate Conservation.*

*Bt has the safest listing by the Xerces Society for Invertebrate Conservation*
Of the Two Newer White Grub Insecticides, Which is Better? From an ecological and long-term perspective, the 75% white grub control with... (Btg)... reported by my turf entomologist colleagues may be preferable to the 100% control obtained with chlororantraniliprole (each when applied under perfect conditions). My reasoning is that there are important parasites, predators, and diseases of white grubs, which if denied the presence of their hosts for multiple years at a site, will simply disappear.

…Rich Cowles, CT Experimental Ag Station (Disclaimer: Mention of specific products does not constitute an endorsement.)

*Btg’s safety profile not only preserves ecosystems - but also the natural beneficial predators of grubs and beetles. This increases the long-term effectiveness over other non-specific products, even organic (OMRI-listed) products.*
beetleGONE! & grubGONE!

Advantages: EPA Exemption

Btg & Other Biologicals are Exempted from EPA Bans Affecting Schools and Municipal Parks
Pesticide Bans Affect Schools & Municipal Parks

Senate Extends Pesticide Ban To Public Playgrounds

In 2015, CT became the first state to exempt microbial pesticides (Btg and Btg) from EPA laws on school grounds and municipalities!
beetleGONE! & grubGONE! Biologicals are Exempt from EPA Bans on Schools & Parks

CT exempted microbial pesticides (including Btg) from EPA laws on schools and municipalities.
beetleGONE! & grubGONE!
Versus Other Approaches for Beetle & Grub Control:

- Synthetic Chemicals
- Acelypryn / GrubEx
- Beneficial Nematodes
- Milky Spore
beetleGONE! & grubGONE! vs. Alternatives:
Synthetic Chemical Inhibitors - Preventative

Preventative Control
- Halofenozide (Mach 2®) - IGRs or MACs (Molt Accelerating Compounds). Some bans are present around water systems due to off-target toxicity (NY).
- Imidaclorpid (Merit®) - Neonicotinoid
- Clothianidin(Arena®) - Neonicotinoid

These products work well. Timing is crucial - they must be applied prior to eggs hatch. “The disadvantage of preventative insecticide applications is that …an insecticide is being applied whether it is warranted or not”…UCONN

Curative Control
- Organophosphates - Dylox® (Bayer has voluntarily canceled its production of most products containing the chemical), Diazinon® (off residential market) and Dursban®(Under EPA review for food residue tolerances)

Good control. Used when necessary. However, “If the homeowner or turf manager neglects to scout or monitor the site…damage may not be caught in time resulting in severe turfgrass loss. Also, the insecticide used for control often has to be applied at higher rates to control mature grubs.”…UCONN
beetleGONE! & grubGONE! vs. Alternatives: Chlorantraniliprole (Acelepryn® & GrubEx ®)

- Very good grub control.
- Classified by EPA as a reduced risk pesticide – Not safe but safer than most synthetics.
- Chlorantraniliprole has an environmental half-life of <2 to up to 12 months? This degradation is mostly abiotic.
- If released into water, chlorantraniliprole is expected to adsorb to suspended solids and sediment.
- Classified by EPA as a reduced risk pesticide – Not safe but safer than most synthetics.
- The drawback is toxicity to aquatic invertebrates in areas near water.

From DuPont™Acelepryn Label H65709
beetleGONE! & grubGONE! vs. Alternatives: Beneficial Nematodes

- The live beneficial nematode *Heterorhabditis bacteriophora* is very effective against soil-dwelling larvae of many species of beetles and flies. It is very safe and a great broad spectrum.
- When there is no new host present, the nematode population will slowly decrease.
- Nematodes are very UV sensitive, and must be not be applied in direct sunlight.
- Shelf life is very short, must be refrigerated. For comparison, *Btg* has a shelf life that is greater than 2 years.
- Beneficial nematodes are very dependent on soil temperatures, the active Cry protein of *Btg* is not.
- Nematodes need grubs to divide and survive. The *Btg* Cry toxin remains active for 3+ months.
beetleGONE! & grubGONE! vs. Alternatives: Milky Spore

<table>
<thead>
<tr>
<th>Active microbial</th>
<th>grubGONE! (Bacillus thuringiensis galleriae)</th>
<th>Milky Spore (Paenibacillus popilliae)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese beetle grub</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Oriental beetle grub</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Asiatic Garden beetle grub</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>May/June beetle grub</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Green June beetle grub</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>European chafer grub</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Northern masked chafer</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Southern masked chafer</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Western masked chafer</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Annual bluegrass weevil</td>
<td>supression</td>
<td>NO</td>
</tr>
<tr>
<td>Overwinters</td>
<td>No</td>
<td>Not in New England</td>
</tr>
<tr>
<td>Controls Adults Also</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Soil Temperature Range</td>
<td>No restrictions if grubs are active</td>
<td>60 and 70 degrees for 3 months</td>
</tr>
<tr>
<td>Effective in Northeast US</td>
<td>Yes, studies prove it (Conn Ag, UMASS)</td>
<td>Questionable at best (UCONN)</td>
</tr>
<tr>
<td>Applications per season</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Works in application season</td>
<td>YES in season of application</td>
<td>NO</td>
</tr>
<tr>
<td>Works preventatively</td>
<td>YES in season of application</td>
<td>YES 3 years later</td>
</tr>
<tr>
<td>Works curatively</td>
<td>YES in season of application</td>
<td>NO</td>
</tr>
<tr>
<td>Shelf life</td>
<td>2+ years</td>
<td>?</td>
</tr>
</tbody>
</table>

Milky Spore is generally only effective against Japanese beetle grubs (not adults). Btg provides a much broader spectrum, effective control for grubs & adult beetles.
beetleGONE! & grubGONE! vs. Alternatives: Milky Spore

“According to tests conducted in New Jersey, there is no evidence that milky disease is effective against other species of grubs...Milky disease is somewhat inconsistent in the Northeast...the milky disease organism may take several months to become effective...Studies conducted in Kentucky indicate that there is no evidence that commercial preparations of P. popilliae increase the incidence of milky disease significantly in field populations.”

Milky Spore is generally ineffective in many areas according to Universities.
beetleGONE! & grubGONE!
Against White Grubs:
University Studies & Field Trials
2009 Control of Oriental Beetle Grubs with Btg

- Untreated
- grubGONE! G 115lb/A Treatment
- Merit .5G 60lb/A

Btg worked as well as Merit® Synthetic in a head-to-head grub trial at UMASS.
**beetleGONE! & grubGONE! University Studies**

*Btg* Golf Course Study – Dr. Daniel Peck
Cornell University, NYSAES

**grubGONE! vs *H. Bacteriophora***
Against 3 grub species (OB, AB, EC)

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*Btg* was comparable to beneficial nematodes but are easier logistically to apply (no refrigeration, no UV sensitivity) and much longer lasting (2+ years).
beetleGONE! & grubGONE! University Studies

Btg Study – Dr. Rick Brandenburg
NC State University, Department of Entomology

Control of Japanese Beetle Grubs with Btg

Btg worked as well as Arena® Synthetic in a Japanese Beetle grub trial at NC State.
2010 Control of So. Masked Chafer 3rd instar Grubs with Btg G

% Control

- Untreated
- grubGONE! G 153lb/A
- Dylox 6.2G 130lb/A

Btg worked better than Dylox® Synthetic against 3rd instar grubs at U of Nebraska.
2009 Control of masked chafer & Japanese beetle grubs with Btg G

Untreated

grubGONE! G 115lb/A Treatment

Merit .5G 60lb/A

Btg worked almost as well as Merit® against grubs at Ohio State University.
Btg worked comparably to GrubEx® & Meridian® against grubs. Btg worked as both a Curative and a Preventive.
beetleGONE! & grubGONE!
Against Beetles:
University Studies & Field Trials
beetleGONE! & grubGONE! University Studies

Btg Study – University of Wisconsin
Dr. R. Chris Williamson

beetleGONE! efficacy on Japanese Beetle Adult in Roses

Btg worked as well as Imidacloprid (neonicotinoid) against beetles.
Mean % rose foliage skeletonized by Japanese beetle adults after treatment with Btg & assessed at intervals

Btg reduced rose damage about 50% from beetles in a study from Wisconsin
beetleGONE! & grubGONE! University Studies

Btg Study – University of Wisconsin
Dr. R. Chris Williamson

Mean % wine grape foliage skeletonized by Japanese beetle adult after treatment with Btg & assessed at intervals

Btg reduced grape leaf damage from beetles as well as Permethrin (2x-5x).
beetleGONE! & grubGONE! University Studies

Btg Study – University of Wisconsin
Dr. R. Chris Williamson

Mean % Little Leaf Linden foliage skeletonized by Japanese beetle adult after treatment with Btg & assessed at intervals

- Untreated
- beetleGONE! (2 oz/gl)
- beetleGONE! (4 oz/gl)
- Permethrin 8 floz/100 gl

Btg reduced linden damage 3x-7x from beetles in a study from Wisconsin
beetleGONE! & grubGONE! University Studies

Btg Study - UC Davis
Dr. Larry Godfrey & Rachael Long, MS

Alfalfa weevil IPM study

Btg performed as well as almost all synthetic insecticides against alfalfa weevil in this study at UC Davis
beetleGONE! & grubGONE!
Against grubs in potted nursery stock for USDA Export Quarantine Program:
University Studies & Program Update
beetleGONE! & grubGONE! University Studies

*Btg Study – Tennessee State University & USDA*
Dr. Jason Oliver (TSU); Dr. C. Ranger & Dr. M. Reding (USDA)

**3rd instar Japanese beetle grub % control after fall nursery plant insecticide dipped 2 minutes with 150 DAT assessment**

*Figures represent % control of 3rd instar Japanese beetle grubs with various treatments.*

- Talstar NF .0125 lb.A.I./100 gl
- Onyx Pro .0125 lb.A.I./100 gl
- Sevin .125 lb.A.I./100 gl
- Amorex 1 ml/gl
- Dylox 420SL .125 lb.A.I./100 gl
- beetleGONE! tlc 1 oz./gl
- beetleGONE! tlc 2 oz./gl

*btg provided 100% control of 3rd instar Japanese beetle grubs as well as synthetics when mixed in with soil. EPA Quarantine Program for state export of nursery stocks submission will be in progress. If approved, will be only organic allowed.*
beetleGONE! & grubGONE! University Studies

Btg Study – Tennessee State University & USDA
Dr. Jason Oliver (TSU); Dr. C. Ranger & Dr. M. Reding (USDA)

Btg added with Japanese beetle grubs
Btg @ 2oz./gal (Upper pots) vs Dylox 420SL @ .7 fl.oz./gal. (lower pots)
applied as topical drench to pine bark soil media +10-10-10 NPK mix then over

Btg-treated pots demonstrated much more turf growth than chemical treated potts. All synthetic grub control products showed same effect as lower pots.
beetleGONE! & grubGONE! University Studies

_Btg_ Golf Course Study – Dan Gilrein
Cornell (L.I. Research Extension Center)

3rd instar Oriental beetle grub potted soil media study of _Btg_ (topical drench) vs. Talstar® (media incorporated).

10 3rd instar grubs/ pot
Means fb the same letter are not significantly different at p=0.05

_Btg_ worked almost as well as Talstar® against 3rd instar Oriental beetle grubs despite the fact that Talstar was in the media and _Btg_ was applied topically.
beetleGONE! & grubGONE!
The Future:
An Exclusive Sneak Peek
Emerald Ash Borer: Economic Impact

- Exotic pest of ash trees native to Asia
- Found in Michigan and Ontario in 2002
- Currently 23 additional US states as well as Quebec have EAB infestations
Emerald Ash Borer: Life Cycle

Peak Adult Flight
1000 degree days

- Adults feed & mate on ash leaves

Females lay eggs on or under bark

Larvae develop (1-4 instars) feed on phloem

Adults emerge from under bark

450-500 degree days
beetleGONE! & grubGONE!: The Future

*Btg* is Effective Against the Emerald Ash Borer

Study performed by Fredric Miller, Morton Arboretum and Joliet Junior College

*Btg* has demonstrated efficacy against the Emerald Ash Borer. Label pending EPA approval in the next year or so.
When & How to Use beetleGONE! & grubGONE!
When & How To Use grubGONE & beetleGONE!

Turf
- Granular Application
- Drench with Wettable Powder

Plants
- Spray with Wettable Powder

Granular & Foliar Application Formulas

grubGONE! and/or beetleGONE! delivery method and timing is based on the target pest life cycle.
When & How To Use grubGONE & beetleGONE!

From Cornell University Integrated Pest Management Program (http://www.nysipm.cornell.edu/publications/grubs/life.asp)
**Turf (Grubs) – Granular Application**

- About 0.5 lb. of *Btg* per 1,000 square feet or 100 lbs. per acre.
- 1x of the 40 lb. bags covers 17,500 square feet (or about 2.5 bags per acre).

**Turf (Grubs) – Liquid Application from Wettable Powder**

- About 0.35 lbs. per 1,000 square feet (in 1 to 2 ounces or 1/2 a cup per gallon of water).
- 1x of the 5 lb. bags covers 14,000 square feet (or about 3 bags per acre).

**Plants (Beetles)**

- Begin applications at first sign of adult beetles.
- 1.0-2.0 ounces of *Btg* Wettable Powder per gallon of spray solution for foliar applications.
- 7-10 days between applications, depending on factors such as rain, adult beetle populations, speed of foliage growth and value of the commodity being treated.
- Terpene (from pine) based sticker/spreaders such as Nufilm® are suggested.

**Potted Nursery Stocky (Grubs)**

- 1.0 ounce of *Btg* Wettable Powder per gallon of water to just wet soil. Rate for pre-mixing of powder with media is being evaluated.
Summary: beetleGONE! & grubGONE!
Summary - grubGONE & beetleGONE!

*Btg* is a “Game Changer”: Safe, Effective and Easy

- *Btg* is as good or better than most alternative grub and beetle controls.
- *Btg* works against adult beetles as well as 1st-3rd Instar Grubs.
- *Btg* is safe for people, children, pets, animals and the environment.
- *Btg* has no effect against beneficials such as bees, butterflies, parasitic wasps, ladybugs or ladybeetles, beneficial nematodes etc…
- *Btg* is exempt from pesticide bans in CT and can be applied on School Grounds and Municipal Parks for which there currently are no alternatives.
- Labeled “For Organic Production” - can be used by those that are certified.
- *Btg* comes in both granular and wettable powder forms and do not require any special equipment to apply.
- *Btg* is shelf stable for more than 2 years.
- No adverse effects on aquatic organisms.
- Backed by extensive University Data and Field Trials; research continues.
- The lowest reentry restrictions allowed by the EPA.
Summary – Market Assessment
Growing Consumer Demand

**Natural or organics are the fastest growing sector of agriculture and turf care.**

- A 2008 survey indicated that about 12 million households were using only natural products on lawns and gardens, up from 5 million in 2004. *That’s a 240% Increase!*
- 20% of consumers have bought an environmentally friendly lawn-and-garden product (2005).
- An estimated yearly 10% annual growth for the organic fertilizer market. That is twice the projected growth for all lawn and garden goods.
- Scott’s organic line of products have doubled sales each year since their inception.
Questions?

Presentation available at:

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