

# **Bio-Rational Materials for Pest Management**



**Dr. Charles H. Peacock**

**NC State University**



### NC STATE NTEP FIELD DAY

The field day for the National Turfgrass Evaluation Program

## ACADEMICS

We offer undergraduate and graduate degree programs that answer the need for highly trained individuals at all levels of our occupation. For students wishing to gain technical expertise, the turfgrass management curriculum leading to an Associate's degree is available in the Agricultural Institute. Students wanting a Bachelor of Science degree also have curricula in turfgrass management from which to choose.

## EVENTS



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January 22, 2016  
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# **BEST MANAGEMENT PRACTICES**



## **Goals of Best Management Practices**

The ultimate objective of Best Management Practices is to **protect natural resources both on and off the turf site.** This would include soils, air and water which are an integral part of the abiotic part of the site, but which are interrelated with the biotic components

# Goals of Best Management Practices



- ⌘ **Goal 1** - *To reduce or eliminate the offsite transport of sediment, nutrients and pesticides.*
- ⌘ **Goal 2** - *To reduce the total chemical use through an IPM approach to turf management.*

Examples of how this can be accomplished include setting economic thresholds, using alternate pest control strategies and soil and plant tissue testing in fertilization programs.

# Goals of Best Management Practices

⌘ **Goal 3** - *To control the rate, method and types of chemicals being applied.*

This is supplemental to the IPM strategies in that it proposes using a risk assessment basis for making decisions on pesticide selection.

⌘ **Goal 4** - *Use both biological and mechanical soil and water conservation practices.*

This encompasses design, construction and management principles.

# Goals of Best Management Practices



⌘ **Goal 5** - *To educate the public on the relationship of environmental issues and systems management.*

Participating in programs which promote sound land use management and which extend this in an outreach function to the public can play a critical role in making people aware of the objective of using Best Management Practices.

# What is the “Organic” Approach?

The screenshot shows a web browser window with the address bar displaying various search engines and local news links. The main content area features a large banner for the National Sustainable Agriculture Information Service (ATTRA), which is a project of the National Center for Appropriate Technology (NCAT). The banner includes an illustration of a sustainable farm with wind turbines, sheep, and various crops like sunflowers and tomatoes.

Below the banner is a navigation menu with links for Home, Contact, Calendar, Multimedia, Databases, Español, About, Text Only, and Donate. A search bar is also present with the text "Search ATTRA" and a "search" button.

The main content area is titled "Publications & Resources" and lists several categories: "What Is Sustainable Agriculture?", "Master Publication List", "Education", "Energy Alternatives", "Beginning Farmer", "Field Crops", "Horticultural Crops", "Livestock & Pasture", "Local Food Systems", and "Marketing, Business &".

The featured article is "Sustainable Turf Care Horticulture Systems Guide" by Barbara Bellows, NCAT Agriculture Specialist, published in 2003. The article is available as a printable PDF version, which is 40 pages long and 708K in size. The PDF is available at the URL <http://attra.ncat.org/attra-pub/PDF/turfcare.pdf>. A link to "Download Acrobat Reader" is also provided.

The abstract of the article states: "This publication is written for lawn care professionals, golf course superintendents, or anyone with a lawn. Its emphasis is on soil management and cultural practices that enhance turf growth and reduce pests and diseases by reducing turf stress. It also looks at mixed species and wildflower lawns as low maintenance alternatives to pure grass lawns."

The "Table of Contents" for the guide includes:

- Introduction
- Organic and Least-toxic Turfcare Practices

A small photograph of a garden bed with various plants is visible in the bottom right corner of the page.

# What is the “Organic” Approach?

orthern VA NBC 17 TurfFiles - ...rth Carolina WRAL.com - ... NC Lottery Apple Yahoo! Google Maps YouTube Wikipedia News (480) Popular

## CIVIL FEEDS

**RSS 2.0: Events, Breaking News, Funding Opportunities**  
**Atom: Events, Breaking News, Funding Opportunities**  
What is RSS?


**ATTRA - National Sustainable Agriculture Information Service**

P.O. Box 3838  
Butte, MT 59702  
800-346-9140 (English)  
800-411-3222 (Español)

## Organic and Least-toxic Turfcare Practices

Organic or least-toxic turf management reduces stress on the turf. Turf experiences stress from heat, drought, wetness, compaction, nutrient deficiencies or imbalances, and disease and pest infestations. To minimize stress on turf, you need to pay attention to the following principles:

- Establish and maintain a healthy soil environment.
- Include a diversity of species in the lawn environment.
- Use cultural practices that reduce stress on turf growth.
- Understand and work with your local soil and climate conditions.
- Use biological pest control methods.

 [Back to top](#)

## A Healthy Soil Environment for Turf

Good quality soil with an active population of earthworms, fungi, bacteria, and beneficial nematodes is critical for creating and maintaining healthy lawns. According to Dr. Eric Nelson (2), turfgrass specialist at Cornell University, "The challenge of the turfgrass manager is to become an expert not only in the management of what everyone can see above the ground, but in the management of beneficial soil microorganisms to maximize turfgrass health."

Fungi, bacteria, beneficial nematodes, and earthworms in the soil are important for the decomposition of thatch, enhancing soil aeration through the formation of soil aggregates, and reducing populations of soil-borne plant pathogens. To support a healthy and diverse population of soil organisms, soils need to have on-going additions of organic matter, a near neutral pH, and a balanced supply of



# Integrated Pest Management IPM



⌘ IPM is a program that uses information about turfgrass pest problems and environmental conditions which may precipitate these problems, and integrates these with turfgrass cultural practices and pest control measures to prevent or control unacceptable levels of pest damage.

**IPM**

A thick, horizontal yellow brushstroke with a textured, painterly appearance, spanning most of the width of the slide below the 'IPM' text.

**Is a philosophy!!**

# IPM



It is a preventative approach incorporating a number of objectives including the following:

- ⌘ development of a healthy turf that can withstand pest pressure
- ⌘ judicious and efficient use of chemicals
- ⌘ enhancement of populations of natural, beneficial organisms
- ⌘ effective timing of handling pest problems at the most vulnerable stage, often resulting in reduced pesticide usage.

# IPM



⌘ It is an ecologically based system that uses biological and chemical approaches to control. As with BMPs, IPM strategies should be incorporated into every aspect of turf management especially as they relate to environmental impact.

# IPM



programs rely on six basic components for plant and environmental protection

⌘ *Genetic* - selecting improved grasses which perform well in specific areas and show a resistance to environmental stress and pest problems

# IPM



programs rely on six basic components for plant and environmental protection

⌘ *Regulatory* - using certified seed and sod to prevent unwanted weed contamination and guaranteeing true-to-type seed, sod and sprigs of the best adapted turfgrass species and cultivars

# IPM



⌘ *Physical* - mechanical removal of pests (i.e. hand weeding in selected areas) and cleaning equipment to prevent spreading of diseases and weeds from infected areas

# IPM



⌘ *Biological* - for a limited number of pest problems biological control can be used whereby natural enemies are favored or introduced to effectively compete with the pest; biological control can also include developing habitat to favor natural predation such as installing bird and bat houses thus favoring an increase in populations which feed on insects



# IPM



⌘ *Cultural* - following recommendations made for proper cultural practices which will maintain the turf in the most healthy condition and influence its susceptibility and recovery from pest problems. Proper application of practices such as proper mowing techniques, good nutrient management, sound irrigation management, aerification, vertical mowing, and topdressing should produce a high quality turf

# Use only organic fertilizers!!



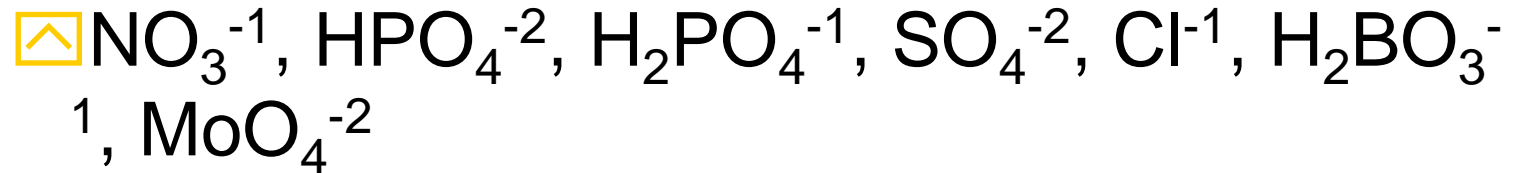
## ⌘ Adds OM

- ☑ One fertilizer application of a 6-2-0 material will add 700 lbs of OM/acre...
- ☑ There is already 20,000 lbs of OM/acre in a soil that has 1% OM by weight!

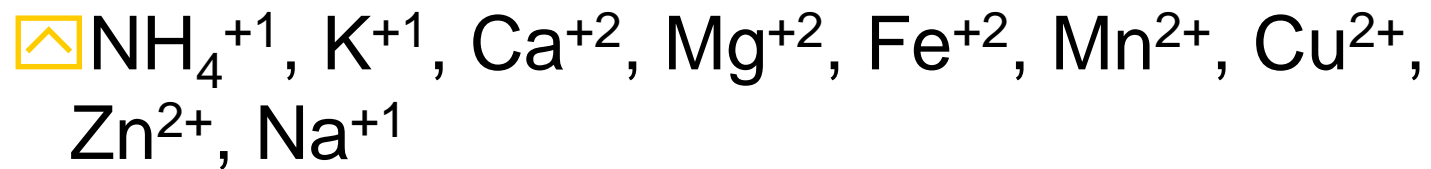
## ⌘ Organic fertilizers don't contain any salts...

# NUTRIENT CATEGORIES

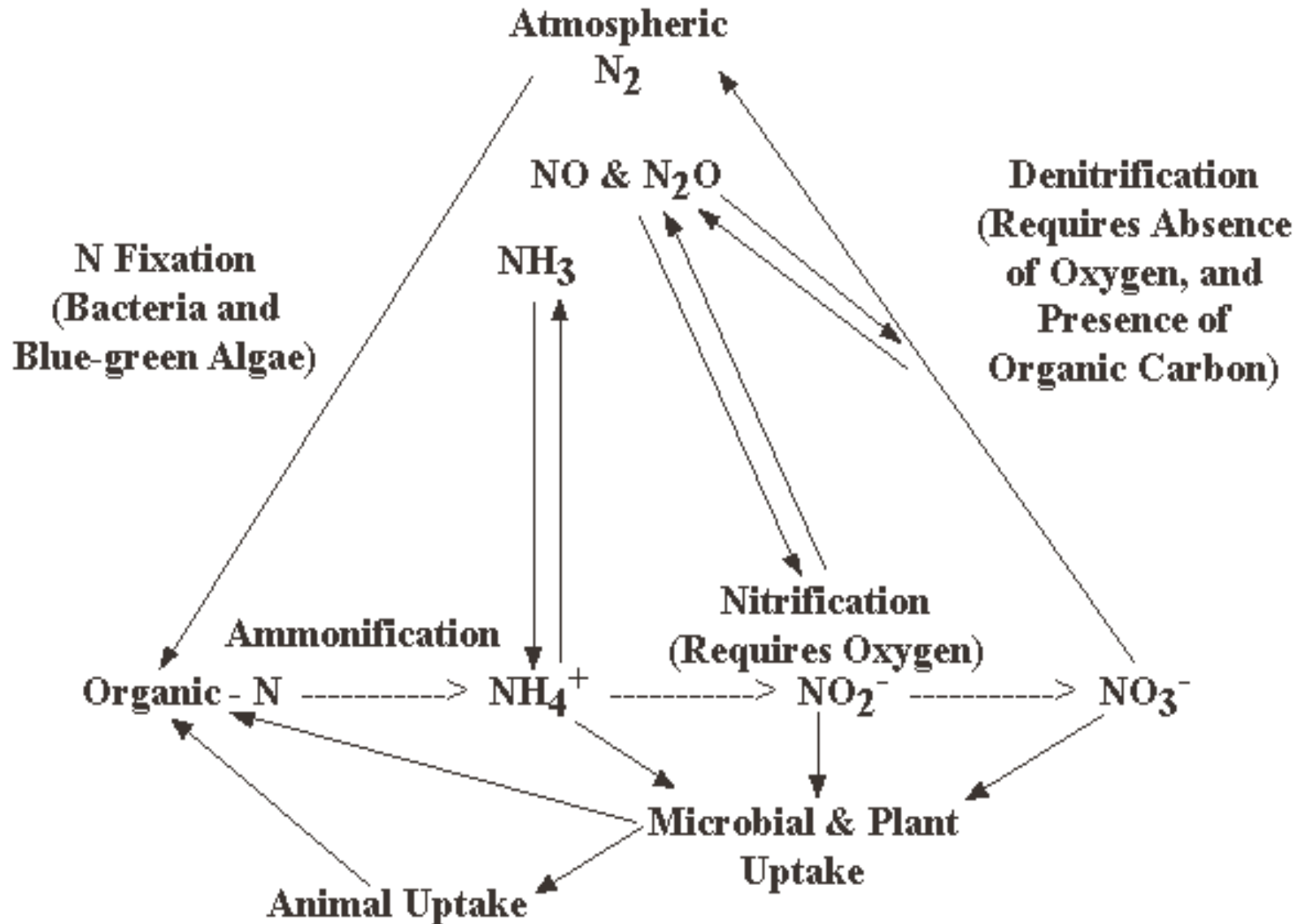
## ⌘ ANIONS (-)



## ⌘ CATIONS (+)



⌘ All are salts!



**Figure 10. The Nitrogen Cycle as represented by the more important biologically mediated conversions of nitrogen into different oxidation states occurring within most aquatic and terrestrial ecosystems.**

# NITROGEN UPTAKE:



- Nitrate ( $\text{NO}_3^-$ )
- Ammonium ( $\text{NH}_4^+$ )

# Mineralization



The decomposition of complex, N-containing organic molecules and the resulting release of  $\text{NH}_4$

# Nitrogen Sources



- ⌘ Inorganic

- ⌘ Organic

  - ⌘ Natural Organics

  - ⌘ Synthetic Organics

    - ⌘ Fast Release

    - ⌘ Slow Release

# Nitrogen Sources



## ⌘ Inorganic

- ☑ Contain no Carbon
- ☑ Can burn
- ☑ Hygroscopic
- ☑ Quick release (fast acting)
- ☑ Examples
  - ☒ Ammonium Sulfate -21%N
  - ☒ Ammonium Nitrate-33%N
  - ☒ MAP, DAP



# Nitrogen Sources



⌘ Organic- contains carbon

☒ Synthetic Organics

☒ Chemically based

☒ Low to moderate burn potential

⌘ Coated products, UF, Methylene ureas, IBDU, SCU, Polymer Coated Urea, etc.

# Nitrogen Sources



⌘ Organic - contains carbon

⌘ Natural Organics

- ⊗ Originate from plant or animal sources
- ⊗ Low burn potential
- ⊗ Slow release by microbes
- ⊗ Low N (3-12%)
- ⊗ Often high in P
- ⊗ Often very low in K

# WHAT ARE ORGANIC FERTILIZERS?



- ⌘ Technically any fertilizer carrier which contains a carbon atom as part of the chemical formula
- ⌘ Would include urea, UF, IBDU, etc.
- ⌘ Does not always mean slow availability

# WHAT ARE NATURAL ORGANIC FERTILIZERS?



- ⌘ Nitrogen is in a complex form
- ⌘ Not readily water soluble
- ⌘ Not readily available to the plant

# HISTORY OF USE



- ⌘ From 1800's until 1950's almost all fertilizers were of natural origins
- ⌘ Cheap energy costs brought on development of higher analysis synthetics

# NATURAL ORGANIC MATERIALS



<u>SOURCE</u>	<u>% N</u>
Blood meal	13
Bone meal	4
Animal tankage	7
Processed manures	3 to 6
Soybean meal	7
Feather meal	16

# NITROGEN RELEASE FROM NATURAL ORGANICS



- ⌘ Depends on the source of the carrier
- ⌘ Depends on the processing of the carrier

# NITROGEN RELEASE FROM NATURAL ORGANICS



- ⌘ Depends on moisture availability
- ⌘ Depends on soil temperature - need soil temperatures consistently above 60 F.



# NITROGEN SOURCES



## Nitrogen Carrier

Ammonium nitrate

Ammonium sulfate

Urea

IBDU

Ureaform

Natural organics

## Acidifying effect:

Medium

High

Medium

Low

Medium

Low

# IPM



⌘ *Chemical* - pesticides are a necessary and beneficial approach to turf pest problems, but use can be restricted in many cases to curative rather than preventive applications, thus reducing environmental exposure.

# Ban Pesticides!

The screenshot shows a web browser window with several tabs open: 'WRAL.com - Raleigh News, Weath...', 'Canadian Cancer Society approac...', and others. The main content area features a large banner for 'Landscape Management' and 'Celsius' with the tagline 'Weeds vanish without a trace.' Below the banner is a navigation menu with options like 'Home', 'Lawn Care', 'Maintenance', 'Design/Build', 'Livescapes', 'Irrigation', 'Athletic Turf', 'Business', and 'Community'. A 'Log in' button and a search bar are also visible. The main article is titled 'Canadian Cancer Society approaches spring with renewed effort to ban lawn care pesticides' and is dated '1 Mar, 2011' by 'Ron Hall' from 'LM Direct'. The article text discusses the anti-pesticide movement in Canada, mentioning the Canadian Cancer Society's efforts to educate property owners and gain support from activists and lawmakers to outlaw lawn care chemicals. A sidebar on the left contains a 'News & Issues' section with links to 'LM Digital', 'Print', 'Special Reports', 'Resources', 'Guides', 'Subscribe', 'Advertise', 'Online Classifieds', 'Archives', and 'Contact Us'. At the bottom left, there is a logo for 'QUESTEX MEDIA' and a box for 'The official publication of: The American Society of Irrigation Consultants ASIC'. On the right side, there is a vertical advertisement for irrigation systems with the text 'Build exactly the irrigation systems you want.'

WRAL.com - Raleigh News, Weath... Canadian Cancer Society approac... +

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**Celsius**  
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## News & Issues

### Canadian Cancer Society approaches spring with renewed effort to ban lawn care pesticides

1 Mar, 2011  
By: Ron Hall  
LM Direct

As surely as swallows return to San Juan Capistrano and buzzards to Hinckley, OH, spring signals a fresh wave of anti-lawn care activity in Canada. The message is a predictable as April showers, and it's always the same: Ban the use of lawn care chemicals.

The anti-pesticide drumbeat begins in mid-winter and intensifies as the snow and ice retreat. Typically, groups (the Canadian Cancer Society is always in the forefront) begin a publicity campaign to "educate" property owners to the alleged health risks of using or allowing lawn care chemicals to be used on their properties. Then, gaining the support of local (and vocal) activists, they build pressure on provincial or local lawmakers to outlaw law care chemicals, which they maintain have no purpose other than to make lawns more attractive.

This season anti-pesticide activity has been greatest in Alberta and British Columbia (BC) provinces in western Canada and, predictably, is being spearheaded by the Canadian Cancer Society, a national, community-based charitable organization of volunteers. It is Canada's largest national cancer charity. To

Build exactly the irrigation systems you want.

# Ban Pesticides



Sign-up for Digital Edition

SPECIAL SAVINGS ON SELECT EXAMS!

Now is a great time to get certified and save!

Register Today!

lawns more attractive.

This season anti-pesticide activity has been greatest in Alberta and British Columbia (BC) provinces in western Canada and, predictably, is being spearheaded by the Canadian Cancer Society, a national, community-based charitable organization of volunteers. It is Canada's largest national cancer charity. To date, a handful of communities in BC but no municipalities in Alberta have banned the use of lawn care chemicals.

Elsewhere in Canada, these campaigns have been surprisingly effective, especially in its most populous province, Ontario and neighboring Quebec Province, where the anti-lawn care movement began more than 10 years ago.

Most recently activists have turned their attention to the City of Edmonton, the capital of Alberta Province. As I write this, it is not clear whether this city of 730,000 people will ban pesticide use or not. Earlier this year a report from a city committee opined that pesticides bans are **unfunded to enforce**, can add millions to the cost of park maintenance, allow green natural spaces to deteriorate and doesn't seem to lead to ill health affects.

Not unexpectedly, the report was heavily criticized by pesticide critics, but gave some hope to individuals and businesses that routinely use these products, many of which have been on the market for decades.

"What's wrong with having a beautiful, lush, green lawn? When did that become a criminal offence, to enjoy having pride in your property?" lawn care spokesman David Montgomery asked council's transportation and public works committee, reported the *Edmonton Journal* newspaper on Feb. 24.

Regardless, the Canadian Cancer Society claims it has overwhelming support from the public to ban "the use and sale of cosmetic pesticides" on home lawns. It continues to claim that research links pesticide exposure with an increased risk of both childhood and adult cancers. These include childhood and adult leukemia, non-Hodgkin lymphoma, prostate, brain and lung cancers. It also maintains that studies show that children may be at a higher risk due to their rapidly developing bodies.

Provide the proof, responded Lorne Hepworth, president of CropLife Canada. "As it stands now, the weight of scientific research proves that pesticides can be safely used and Canadians should feel comfortable if they choose to use them," he wrote in a letter to the *Terrace Standard* newspaper.

"If the Canadian Cancer Society has information to back up its pesticide claims it is irresponsibly squandering its efforts on municipal campaigns rather than presenting proof to Health Canada, which regulates the products, or to the industry, which runs hundreds of tests on each and every product seeking federal government registration . . . if the Canadian Cancer Society had even a shred of relevant and compelling information Health Canada would be all over it."



TRAIN ONLINE NOW

SECOND BEST ONLY GETS YOU SO FAR.

# CT Pesticide Ban



## Connecticut's Lawn Care Pesticide Ban Information for Schools and Day Care Centers

### 1. Why no pesticides?

The Connecticut legislature passed a law (P.A. 09-56) banning lawn care pesticide applications on the grounds of day care centers, elementary and middle schools (grade 8 and lower) as a result of residents' concerns about children's health and the environment. This ban went into effect for day care centers on October 1, 2009 and for K-8 schools on July 1, 2010. Some Connecticut municipalities have gone beyond the requirements of the law and have stopped using pesticides to manage turfgrass on all their municipal properties.

# CT Pesticide Ban



## **4. Are there any pesticides that can be used under the new law?**

There are some pest control products that can be applied. EPA has developed criteria for minimum risk pesticides, which are exempt from federal registration and do not bear an EPA registration number. The EPA criteria for these products can be found at [http://www.epa.gov/oppbppd1/biopesticides/regtools/25b\\_list.htm](http://www.epa.gov/oppbppd1/biopesticides/regtools/25b_list.htm). These pesticides are allowed for use on day care centers and K-8 school grounds in Connecticut. Pertinent statutes and regulations must be followed including the requirements that applicators who apply pesticides on school grounds must be licensed and schools under the control of a Board of Education must have a written pest control policy and a system of notification in place.

# IPM



Pesticide selection is based on an ecological risk assessment approach that strives to use only pesticides that are based on effectiveness, are not toxic to non-target species, that act quickly and degrade quickly, are not soluble and not persistent.

# IPM



Few pesticide applications should be made on a regularly scheduled basis. Exceptions may include pre-emergent herbicides and fungicides used to control specific diseases which are predictable based on site history and prevailing environmental conditions.



# IPM



Additionally, materials must be applied strictly in accordance with label instructions, at labeled rates, under appropriate environmental conditions (i.e., no spraying on windy days or when rain is forecast), with a low-volume sprayer to reduce the possibility of drift or using a shrouded sprayer

# IPM



Materials will be rotated for specific uses.

This will deter the development of resistant strains of pests which may require more frequent and/or higher rates of pesticide applications.

# Bio-Rational Materials



⌘ Pest control materials that are relatively non-toxic with few ecological side-effects are sometimes called 'bio-rational' pesticides, although there is no official definition of this term. Some, but not all, biorationals qualify for use on organic farms.

# Organic Materials Review Institute - OMRI

## OMRI Products List, Web Edition

## Crop Products

### Crop Fertilizers and Soil Amendments

#### Activated Charcoal

Black Owl Premium Organic  
Biochar Soil Amendment  
(Biochar Supreme, LLC)  
Garden Valley Naturals All  
Natural & Organic Biochar  
(Rexius Forest By-Products)

#### Alfalfa Meal or Pellets

Down to Earth Alfalfa Meal 2.5-  
0.5-2.5 (Down To Earth  
Distributors, Inc.)

#### Amino Acids – nonsynthetic

Amino Acid 80 12-0-0 (Grower's  
Secret, Inc.)  
Amino Plus Amino Acids Organic  
14-0-0 (JH Biotech, Inc.)  
Bison Soil Nitrogen 12-0-0 (Bison  
Soil Solutions, LLC)  
HYTB BioAmin Regulador de  
crecimiento no sintético  
Concentrado Líquido (Bioderpac  
S.A. de C.V.)

- ψ PHL (Dadelos AgroSolutions,  
SLU)  
Taba (Kan biosys Pvt. Ltd)  
AMINOVA 65 Compuesto de  
Aminoácidos (Zare Agrhos)  
Bio Beast Plant Nitrogen 13-0-0  
(Custom Formulations LLC)  
Biodiversity Organic Nitrogen 12-  
0-0 (BioDiversity Products Inc)  
BioLife S80 Organic Nitrogen  
Fertilizer Based on Hydrolyzed  
Proteins, Amino Acids (Suboneyo  
Chemicals & Pharmaceuticals P.

- ψ Tecamin Bionutriente a Base de  
L-Aminoácidos de Origen Vegetal  
Fertilizante Líquido Para  
Aplicación Radicular y Foliar  
(Agritecno Fertilizantes S.L.)  
ψ Tecomin Fertilizante Orgánico  
Líquido (Iberfol S.L.)  
ψ TRAINER (Italpollina Spa)  
Trebol Fertilizantes Orgafertil  
Jardín Fertilizante Orgánico  
Líquido (Fertilizantes Y Foliare  
de Irapuato)  
Trebol Fertilizantes Orgafol  
Fertilizante Compuesto a Base  
de Productos Orgánicos  
(Fertilizantes Y Foliare de  
Irapuato)  
Wake Up Organo (Natural  
Resources Group)

#### Anaerobic Digestate – from manure feedstock

*Products of anaerobic digestion produced  
with manure feedstocks are subject to the  
same restrictions as raw, uncomposted  
manure. They may only be (i) applied to*



2017  
Pest Control  
for Professional  
Turfgrass Managers

**NC STATE**

EXTENSION

# Bio-Rational Insecticides



- ⌘ Pyrethrum - It is one of the most commonly used allowed non-synthetic insecticides in certified organic agriculture.
- ⌘ Derived from flowers in the Chrysanthemum family.


# Bio-Rational Insecticides



⌘ Pyrethroids = synthetic pyrethrins such as bifenthrin, cyfluthrin, cypermethrin, deltamethrin, lambda-cyhalothrin, permethrin

Not permitted by OMRI

# Bio-Rational Insecticides



⌘ Pyrethroids – labeled for:

Ants, red-imported fire ant, bees, wasps, billbug, chinch bug, cutworm, armyworm, fall armyworm, leafhopper, spittlebug, mole cricket, sod webworm, sowbug




# Bio-Rational Insecticides



⌘ Azadirachtin – insecticide for caterpillars  
key insecticidal ingredient found in the neem tree is azadirachtin, a naturally occurring substance chemically similar to insect hormones called "ecdysones," which control the process of metamorphosis as the insects pass from larva to pupa to adult. Blocks molting, thus disrupts life cycle.

Nontoxic to mammals. Low environmental impact unless introduced into aquatic environment where it is very toxic.

# Bio-Rational Insecticides



⌘ Azadirachtin – insecticide for caterpillars  
(cutworm, armyworm, sod webworm)

## Advantages

naturally occurring material – extract from  
seeds of the Neem tree

nontoxic to mammals

In the UK, pesticides that contain  
Azadirachtin and/or neem oil are banned!

# Bio-Rational Insecticides



⌘ Azadirachtin – insecticide for caterpillars (cutworm, armyworm, sod webworm)

## Disadvantages

must be ingested by insect when in early immature stages.

Cost - \$63/pint or \$5.25/1,000 sq.ft. for material

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**Azatrol EC Insecticide (Azadirachtin)**

OMRI Listed for use in organic production. Azatrol® is an azadirachtin insecticide (1.2%) formulated to provide broad spectrum insect control with very low environmental impact. A popular botanical insecticide/ miticide with multiple modes of action.

Anti-Feedant: Insects will feed less or not at all on treated plant tissue. Foliage is not damaged and insects ultimately starve to death.

Insect Growth Regulator (IGR): Insects will fail to mature and reproduce, eliminating populations over time, or keeping populations at acceptable levels.

Anti-Ovipository & Repellent: The likelihood of insect infestation is greatly decreased in treated plants. This also adds a preventive aspect to your control program.

Azadirachtin does not provide the quick "knock-down" of a contact poison. However, 21 days after treatment, insect control is comparable to the standards. The end result - insect population reduction. As a preventive treatment throughout the season, prior to insect infestation, the goal of protecting plants, ornamental flowers and shrubs and trees will be accomplished. Non-toxic to honeybees and many other beneficials.



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- [Product Label - PDF format](#)
- [Material Safety Data Sheet \(MSDS\) - PDF format](#)
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Quantity:


Item:

Price: \$63.50



TOP ITEMS


# Bio-Rational Insecticides



## ⌘ *Bacillus thuringiensis* toxins

Spores and crystalline insecticidal proteins produced by *B. thuringiensis* are used as specific insecticides under trade names such as Dipel and Thuricide. Because of their specificity, these pesticides are regarded as environmentally friendly, with little or no effect on humans, wildlife, pollinators, and most other beneficial insects.

# Bio-Rational Insecticides



⌘ *Bacillus thuringiensis* toxins

## Advantages

act through a natural process after bacteria are ingested

Cost – several cents per 1,000 sq.ft.

## Disadvantages

must be ingested – no residual


may take up to 5 days for it to act

# Bio-Rational Insecticides



⌘ *Bacillus thuringiensis* - labeled for:  
cutworm, armyworm, sod webworm;  
The subspecies *galleriae* is labeled for white  
grubs under the trade name 'grubGoneG'  
\$10/1,000 sq.ft.

# Bio-Rational Insecticides



⌘ Spinosad – insecticide

Produced by a soil actinomycete

Spinosad is a mixture of the two most active naturally occurring metabolites (spinosyns A and D) produced by *Saccharopolyspora spinosa*

OMRI approved



# Bio-Rational Insecticides



⌘ Spinosad – insecticide for cutworm, armyworm, sod webworm, red imported fire ants)

## Advantages

a high degree of activity on targeted pests and low toxicity to non-target organisms (including many beneficial arthropods)


## Disadvantages

short residual (2 to 9 days)

not systemic

Cost - \$5 to 7.50 per 1,000 sq.ft. just for material

# Bio-Rational Insecticides



- ⌘ Entomogenous nematodes
- ⌘ Beneficial nematodes belong to one of two genera: *Steinernema* and *Heterorhabditis* are commercially available in the U.S.
- ⌘ *Steinernema* is the most widely studied beneficial nematode because it is easy to produce.
- ⌘ *Heterorhabditis* is more difficult to produce but can be more effective against certain insects, such as white grubs, and Japanese beetles.

# Bio-Rational Insecticides




- ⌘ Entomogenous nematodes
- ⌘ Advantage – true biological
- ⌘ Disadvantages - need moisture in the soil for movement (if the soil is too dry or compact, they may not be able to search out hosts). Watering the insect-infested area before and after applying nematodes keeps the soil moist and helps move them deeper into the soil. Care should be taken not to soak the area because nematodes in too much water cannot infect.

# Bio-Rational Insecticides



- ⌘ Entomogenous nematodes
- ⌘ Disadvantages - Exposure to UV light or very high temperatures can kill nematodes. Apply nematodes in the early evening or late afternoon when soil temps are lower and UV incidence is lower as well (cloudy or rainy days are good too). Nematodes function best with soil temperatures between 48F<sup>o</sup> and 93F<sup>o</sup> day time temperatures.

# Bio-Rational Insecticides




⌘ Entomogenous nematodes – labeled for:

cutworm, armyworm, mole crickets


Cost - \$3/1,000 sq.ft.

# Bio-Rational Insecticides



- ⌘ Avermectin - naturally occurring compound generated as fermentation product by *Streptomyces avermitilis*, a soil actinomycete.
- ⌘ Used in fire ant bait – not really a turf problem.

# Bio-Rational Insecticide?



⌘ chlorantraniliprole (Acelepryn) – reduced risk  
synthetic material

# New England VEGETABLE MANAGEMENT GUIDE

[About the Guide](#)
[Cultural Practices](#)
[Vegetable Transplants](#)
[Pest Management](#)
[Crops](#)
[Risk Management](#)
[Appendices](#)
[Home](#) » [Pest Management](#) » [Biorational and Organic Pesticides](#)

## PEST MANAGEMENT

[Overview: Integrated Pest Management](#)
[Diagnostics for Plant Problems](#)
[Pesticide Safety and Use](#)
[Protecting Groundwater and Surface Waters](#)
[Biorational and Organic Pesticides](#)

### Table 21: Biorational Insecticides and Miticides

[Table 22: Biological Controls for Insect Pests](#)
[Table 23: Biorational Disease Control Materials](#)
[Table 24: Biological Disease Control Products](#)
[Weed Management](#)
[Insect Management](#)

## Table 21: Biorational Insecticides and Miticides

This table includes products that are registered as pesticides as well as some that are exempt from EPA registration. All of the registered pesticides listed are labeled with the EPA signal word "Caution", the least toxic EPA classification (see [Pesticide Safety and Use](#)). Most have low toxicity to bees and beneficial insects. None are federally restricted-use products. Most have dermal and oral LD50 values over 2,000 mg/kg (see Table [28](#) and [29](#) for LD50 values for insecticides and fungicides).

Insecticides	Trade Name	Target Pests	Comments
<b>azadiractin</b>	Amazin Plus 1.2%ME <sup>OG</sup> ; Aza-Direct <sup>OG</sup> ; AzaGuard <sup>OG</sup> , Azatin O <sup>OG</sup> ; XL; Azatrol EC <sup>OG</sup> ; Azera <sup>OG</sup> (M); Ecozin Plus 1.2%ME <sup>OG</sup> ; Molt-X <sup>OG</sup> ; Neemix 4.5 <sup>OG</sup> , Ornazin 3%EC	Aphids, caterpillars, leafhoppers, leafminers, thrips, whiteflies, beetles, and other insects	An insect growth regulator extracted from the seeds of the neem tree. works by contact or ingestion against immature stages, and has antifeedant properties.
<b><i>Bacillus thuringiensis</i> subsp. <i>aizawai</i></b>	Xentari <sup>OG</sup>	Caterpillars, as listed for <i>Bt kurstaki</i> , as well as cross-striped cabbageworm,	Use in rotation with <i>Bt kurstaki</i> products to prevent resistance. May be used in greenhouse or field.
<b>chlorantraniliprole</b>	Coragen	Caterpillars, Colorado potato beetle, leafminers	May be used as soil or transplant water treatment at planting, in drip or as foliar. Avoid run-off in surface waters. Non-toxic to bees.



# Bio-Rational Insecticide?



- ⌘ chlorantraniliprole (Acelepryn) – interrupts the normal muscle contraction of insects resulting in death. The mode of action of chlorantraniliprole is the activation of insect ryanodine receptors.
- ⌘ Chlorantraniliprole acts mainly by ingestion and has little contact activity.
- ⌘ It has been classified as non toxic to birds, mammals, and fish.
- ⌘ Dr. Rick Brandenburg disagrees that this is a bio-rational material!

# Bio-Rational Nematicides



- ⌘ *Bacillus firmus* (Nortica) - The active ingredient in Nortica™ is the bacterium *Bacillus firmus* strain I-1582. This bacterium colonizes the root system of the turf and produces compounds that protect the root system from nematodes.
- ⌘ Can be used anywhere nematodes are a problem as it is a true biological.

# Bio-Rational Nematicides



⌘ Abamectin (Avid) – a mixture of avermectins containing more than 80% avermectin B1a and less than 20% avermectin B1b. These two components, B1a and B1b have very similar biological and toxicological properties. The avermectins are insecticidal and antihelmintic compounds derived from various laboratory broths fermented by the soil bacterium *Streptomyces avermitilis*. Abamectin is a natural fermentation product of this bacterium.

# Bio-Rational Nematicides



- ⌘ Abamectin (Avid) – for use only on putting greens for sting and ring nematodes

# Bio-Rational Nematicides



- ⌘ Furfural (Multiguard Protect) - is an organic compound derived from a variety of agricultural byproducts, including corncobs, oat, wheat bran, and sawdust.
- ⌘ Multiguard Protect is labeled for golf course tees and greens, practice greens, spot treatment of fairways, roughs and turf/sod farms.

# Bio-Rational Fungicides



- ⌘ Phosphorous acid (Allude, Jetphiter, Magellan, Resyst, Vital) – brown patch, Pythium blight and root rot;
- ⌘ Mineral oil (Civitas) + proprietary pigment (Civitas Harmonizer) – dollar spot, gray leaf spot, Helminthosporium leaf spot
- ⌘ Potassium phosphite (Appear) – Pythium blight and root rot

# Bio-Rational Materials - Herbicide

## ✂ Corn gluten meal

Corn Gluten Meal Research Page : Department of Horticulture - Windows Internet Explorer

http://www.hort.iastate.edu/gluten/? corn gluten meal

Road Runner Corn Gluten Meal Resear... Biorational Pesticides

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News  
Student Life/Clubs  
Current Students  
Prospective Students  
Graduate Program  
Courses  
**Research**  
Areas  
Departmental Research  
Turfgrass Central  
**Corn Gluten Meal Research**  
Extension/Outreach  
Facilities  
Home

### Corn Gluten Meal Research Page

[Dr. Nick Christians](#)

Welcome to the corn gluten meal research page. Here you will find information regarding the use of corn gluten meal as a natural herbicide for use on turf and organic crop production.

**Background:** It was found that a byproduct of the corn (*Zea mays* L.) wet-milling process, corn gluten meal, has potential as a natural preemergence herbicide. U.S. Patent 5,030,268 on the use of corn gluten meal as a natural



herbicide was issued in 1991. The patent was reissued in 1993 with broader claims that cover the use of corn gluten meal on field crops and home gardens. Two additional patents were also issued in 1993 on the technology. The first is on the use of hydrolyzed proteins from corn and other grains that were shown to have higher levels of herbicidal activity than the corn gluten meal. These materials are water soluble and can be sprayed on the soils surface. The second patent was on 5 dipeptides extracted from the hydrolyzed

# Bio-Rational Materials

## ✂ Corn gluten meal

EarthEasyShop: Product Detail - Windows Internet Explorer  
http://eartheasy.com/store/proddetail.php?prod=64300  
corn gluten meal

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product detail

Energy Efficiency  
Water Conservation  
Composting  
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Raised Beds  
Planters  
Potting tables, etc  
Garden Kits  
Greenhouses  
Food Security  
Natural Lawn Care  
Natural Pest Control  
CFL & LED Lighting  
CFL Lighting  
LED Lighting  
LED Holiday Lights  
Solar Ovens  
Toys & Games  
Natural Wooden Toys  
Cooperative Games  
Art & Music  
Kites  
Tire Swings  
Gifts  
Hemp Gift Wrap  
Grow-a-note Cards  
Candles  
Gifts that Grow  
Assorted

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Bradfield Organics Corn Gluten  
List Price: \$39.95  
Price: \$29.95

This is a 20lb Bag - treats 1,000 - 2,000 sq.ft. (shipping only \$8.95)

A great ORGANIC lawn fertilizer and weed control - can be applied year-round to fertilize lawns and shrubs while preventing weeds from emerging. Your lawn will also develop deeper roots and require less watering.

Developed by Iowa State University, Corn Gluten contains 100% corn gluten, a naturally occurring substance, which inhibits the growth of a seed's tiny feeder roots. This causes the seedlings to die before they germinate. Since most weeds germinate through seeds, Corn Gluten will kill the seeds before they sprout. The granulated form makes it easy to spread by hand or by spreader. Our corn gluten is NON-gmo.

Corn Gluten as Fertilizer

As a plant food, corn gluten has a N-P-K ratio of 9-0-0, or 9% nitrogen by weight. It will fertilize your lawn, and prevent the growth of new weeds. Because it prevents seeds from sprouting, make sure you wait 60 days after application before spreading grass seed. Corn Gluten can also be used to fertilize shrubs and transplants. As a fertilizer, corn gluten

Quantity: 1  
add to cart

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McAfee SECURE  
TESTED 10-MAR

You may also like

Brill Razorcut 33  
List Price: \$235.00  
Price: \$189.00

Milky Spore Powder (10oz)  
Price: \$32.95



# Bio-Rational Materials



⌘ Corn gluten meal

How to use:

Apply 10 to 20 lbs/1000 sq.ft.

If no rain for 5 days, apply 0.25 in of water

Lasts for 5 to 6 weeks

# Bio-Rational Materials



⌘ Corn gluten meal (9-1-0)

## Advantages

natural material and is nontoxic  
provides 1 to 2 lbs N/1000 sq.ft.

## Disadvantages

provides 1 to 2 lbs N/1000 sq.ft.  
cost – \$19.45 to \$38.90/1000 sq.ft. just for the  
material.

# IPM approach



- ⌘ **monitoring** of potential pest populations and their environment;
- ⌘ **determining** pest injury levels and establishing treatment thresholds;
- ⌘ **decision making**, developing and integrating all biological, cultural, and chemical control strategies;

# IPM approach



- ⌘ **educating** personnel on all biological and chemical control strategies;
- ⌘ **timing and spot treatment** utilizing either the chemical, biological or cultural methods;
- ⌘ **evaluating** the results of treatment.



**[www.TurfFiles.ncsu.edu](http://www.TurfFiles.ncsu.edu)**

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