Organic and Low Maintenance Options for Lawn Care

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What is "organic"?

USDA Definition

- Organic food handlers, processors and retailers ***adhere to standards*** that maintain the integrity of organic agricultural products. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people.

Organic Food Production Standards

- No synthetic chemicals
- Exceptions:
  - Copper and Sulfur-based compounds
  - Bacterial toxins
  - Pheremones
  - Soaps
  - Dormant/plant oils
  - Fish emulsions
  - Vitamins and minerals
  - Federal or state Emerging Pest or Disease Program

What about organic turf care?

Currently, no standards exist!

Obstacles to Organic Lawn Care

- No clear definition
- Unproven products
- Expense
- Customer desire lacking
  - Less than perfect lawn quality
- Workforce education lacking

Steps for Success

- Be Selective Based on Initial Condition of the Lawn
- Fertilizing (type, amount, timing)
- Overseeding
- Pest Control
- General Maintenance: Mowing, Irrigation

Initial Conditions Matter!

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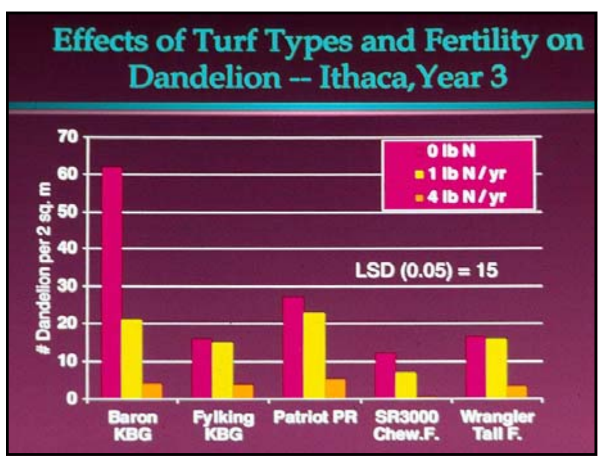


Natural/Organic Fertilizers

- Biosolids (aka: Sewage Sludge)
  - Milorganite
- Poultry and Dairy Manure Derivatives
  - Nature Safe
  - Sustane
  - Chickity Doo Doo

Natural/Organic Fertilizers: Advantages

- Slow-release
- Low Burn Potential
- Usually has all other nutrients
- Disease/Weed suppression possible
- Carbon source – soil physical health

Natural/Organic Fertilizers: Disadvantages

- Inconsistency of response
- N content < 6%
  - Need more bags
- Some have strong smell
- Expensive
  - if not then probably poor quality

Read the Label

- Guaranteed Analysis
  - Three numbers, example: 24-0-12
- Total Nitrogen (1st Number of the three)
  - Water Soluble Nitrogen
  - Water Insoluble Nitrogen
  - Ideal mix is 50/50

Scotts Turf Builder

Guaranteed Analysis

Turf Builder® Lawn Fertilizer With 2% Iron 29-3-4 F643

Total nitrogen (N).................... 29%

6.6% ammoniacal nitrogen

12.3% urea nitrogen

9.3% other water soluble nitrogen*

0.8% water insoluble nitrogen

Available phosphate (P_2O_5)................. 3%

Soluble potash (K_2O)...................... 4%

Sulfur (S)............................... 8%

8.0% combined sulfur (S)

Iron (Fe) (Total)**........................ 2%

Derived from: methyleneurea, ammonium phosphate, potassium sulfate, ammonium sulfate, iron oxide.

*Contains 6.8% slowly available methylenediurea and dimethylenetriurea nitrogen.

74% water soluble
26% water insoluble

Milorganite (6-2-0)

GUARANTEED ANALYSIS	
Total Nitrogen (N)	6.0%
0.75% Water-Soluble Nitrogen	
5.25% Water-Insoluble Nitrogen (Slowly Available)	
Available Phosphate (P_2O_5)	2.0%
Calcium (Ca)	1.2%
Total Iron (Fe)	4.0%
Nutrients Derived from Biosolids	
Net Weight: 50 lbs. (22.7 kilos)	

0.75 / 6.0 = **12.5%** of total N is water soluble, **87.5%** is water insoluble

Chickity Doo Doo Organic Fertilizer (5-3-2.5)

GUARANTEED ANALYSIS
Exclusive Patent Process. U.S. Patent No. 5,730,772

Total Nitrogen 5.0%
| 3% Water Insoluble
| 2% Water Soluble
Available Phosphate (P2O5) 3.0%
Soluble Potash (K2) 2.5%
Calcium (Ca) 9.0%

40% water soluble, 60% water insoluble

Corn Gluten Meal (9-0-0)

ANALYSIS & INGREDIENTS:

Total Nitrogen (N) 9%
9% water-insoluble nitrogen

100% of total N is water-insoluble

Organic Pest Control

Courtesy of Drs. John Stier and Chris Williamson

Organic Pest Control

- Usually small companies
- Products may be:
  - Good
  - Limited efficacy
    - Contact, non-selective herbicides
  - Ineffective
  - Not really organic

Sources of Alternative Products

- Viruses
- Bacteria
  - *Xanthomonas campestris*
- Fungi
- Insects
- Plant products
  - Corn gluten meal
  - Oils

Fungus growing in agar

Challenges for Microbial Products

- Infection requirements
  - Free-water
  - Wounds (bacteria)
  - Stabilize cells in dry-state
  - Sufficient inoculum
    - > 10^7 cells
    - UV light degradation

- USDA Restrictions
  - May harm non-target plants

Post Emergent Herbicides

$27.99 (32 oz) @ Amazon.com

- Burnout Weed & Grass Killer
  - AI: Clove Oil 12%
    Sodium Laurel Sulfate 8%
  - Inert: Vinegar, Lecithin, Water, Citric Acid, Mineral Oil 80%
  - Wilting w/in 20 minutes, dead plants by morning

$14.58 (64 oz) Amazon.com

Scythe Herbicide
(Dow Agrosciences)

- Non-selective, contact
- AI: Pelargonic & other fatty acids
  - Rapid membrane destruction
- Effective
- Signal Word: Warning

Efficacy of Vinegar-based Products

	% Control (crabgrass & broadleaf plantain)		
	24 hrs	2 wks	9 wks
Nature's Glory (25% aa)	96.0	94.7	48.3
Burnout (25% aa)	96.7	97.7	53.3
5% acetic acid*	93.3	74.7	33.3
20% acetic acid	98.3	96.0	76.0
Glyphosate	53.3	97.7	96.7

*Concentration in household vinegar

Source: www.extension.psu.edu/cnregion/hort/newsletter/hort_may02.htm

Sclerotinia minor (fungus)

- Used for broadleaf weed control in Canada
- Efficacy similar to 2,4-
- Considered bioterroris

Corn Gluten Meal for Weed Control

- High use rates (12-20 lb/1000 ft^2)
  - One to two applications/yr
- Expensive
  - $25-$45 per application/1000 ft^2
- Pre-emergent only
- Weed spp. controlled: crabgrass, dandelion, plantain, etc.
- Overseeding limitations
- Fertility effect

Weeds Controlled by Corn Gluten Meal

	% Control		
	----rate (lb/1000 ft^2)----		
Weed spp.	66	142	199
Annual bluegrass	60	81	72
Barnyardgrass	31	35	41
Black medic	49	63	63
Buckhorn plantain	80	95	96
Dandelion	75	90	100
Large crabgrass	51	70	82
Smooth crabgrass	51	85	97
LSD (0.05)		40	

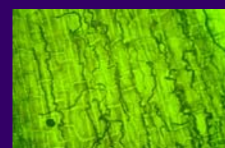
Adapted from: Bingaman, B.R., & N.E. Christians. 1995. Greenhouse screening of corn gluten meal as a natural control product for broadleaf and grass weeds. HortScience 30(6):1256-1259.

Organic Strategies for Insect Control

- Pathogenic microbes
  - Bacteria & fungi
  - Insect-parasitic Nematodes
  - Viruses
- Microbial derivatives
  - Bacillus thuringiensis (Bt)
  - Spinosad
- Choose endophytic grasses

Source: Williamson, 2006

Endophytic grasses are resistant to most foliage & stem feeding pests



Source: Williamson, 2006

Entomopathogenic Nematodes

Source: Williamson, 2006

Liquid culture process technology

Commercial nematode production for biological control of insects

Source: Williamson, 2006

Estimated Cost ($) to treat 0.24 A

$1000

About $50

Source: Williamson, 2006

Infiltration Rates After 3 Years

LOW TRAFFIC SITES

Treatments	Buffalo	Rochester
	------------in/hr------------	
Poultry 1"	17 A	9 A
Dairy 1"	10 AB	6 AB
Poultry 1/2"	14 AB	5 B
Dairy 1/2"	9 AB	4 B
Fertilizer	5 B	4 B
Control	5 B	3 B

Total Nitrogen vs. Plant Available Nitrogen

- Total N is the 1st of the three numbers on the bag
- Inorganic fertilizers (think Scotts) total nitrogen is almost all plant available
- Organic fertilizers only 25-50% of total N is plant available

General Organic Schedule: ***Spring***

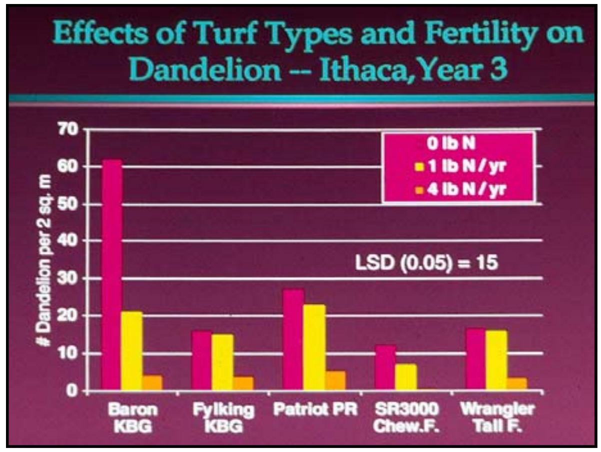
- START WITH A GOOD SITE!
- April: Overseed and fertilize
- May
  - Mow high and follow 1/3 rule
  - Corn gluten meal for pre-emergent (and N)
  - Scythe, others, for post-emergent (or hand pulling)

General Organic Schedule: ***Summer and Fall***

- **Late June/Early July:**
  - Fertilize with organic source (1 lb N/M)
  - Be aware of local P restrictions
  - Irrigate to avoid dormancy
- **Late August:**
  - Overseed
  - Irrigate to avoid dormancy
- **September:**
  - Fertilize with organic source (1 lb N/M)
- **October:**
  - Fertilize with organic source (1 lb N/M)

Establishing a new site

- Select a fast germinating grass
  - **Tall fescue** – watch out for ice damage, probably not the best choice for Wisconsin.
  - **Chewings fine fescue** – Very quick to germinate, may have allelopathic properties. Does well in low traffic situations, full sun to shade, does not like wet, compacted soil.
  - **Traditional grasses** - poorly suited for organic management. Kentucky bluegrass is slow to germinate, perennial ryegrass germinates quickly but will not tolerate harsh winters for long.



Kentucky bluegrass
Fine fescue mix

Tall fescue

Chewings fine fescue

- Adapted to sun and shade
- Likes dry soils, not moist
- Hates traffic and compaction
- Germinates quickly, resists weeds
- Grows slowly, requires less nitrogen and water than most grasses

#1: Sediment is the Primary Source of Phosphorus

Southeast Glacial Plains

USGS comparison of several urban and rural watersheds

Watershed	Sediment Load	Median P Load
	kg/ha	kg/ha
Rural	Median: **113** Range: 15 - 6,000	Median: **0.50** Range: 0.07 – 3.2
Urban	Median: **455** Range: 60 – 1,600	Median: **0.56** Range: 0.23 – 2.1

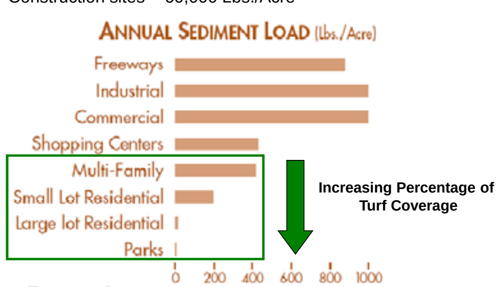
Adapted from Corsi et al., 1997

Sediment Losses From Turfgrass Are Very Low

- During the growing season:
  - Most studies find 3 – 16 kg/ha/yr
  - One study in Texas reported ~100 kg/ha/yr
- Urban watersheds in WI: 400 - 500 kg/ha
  - 50-70% of P from urban areas is from sediment

Urban Runoff Sources of Sediment

Construction sites = 60,000 Lbs./Acre



Source: UWEX, DNR
Polluted Urban Runoff: A Source of Concern

Urban Runoff Sources

- Construction sites = 60,000 Lbs./Acre

Original Graph

Photo credit: University of Nebraska

#2: Most Phosphorus Runoff from Turfgrass Comes During Winter

- Eight years of studies from University of Wisconsin (Kussow, 2008; Steinke et al., 2007)
  - 80 to 87% of P load came during the winter and spring snow melt
- Three years @ University of Minnesota (Bierman et al., In Press)
  - 80% of P load in winter
  - 66% of water volume in winter
- New York Studies found 62% of runoff in winter (Easton and Petrovic, 2004)

#2: Most Phosphorus Runoff from Turfgrass Comes During Winter

- What can we do about it?

#4 Dense Ground Cover is Good for the Urban Environment

- Reduces runoff
- Reduces sediment losses
- Reduces nutrient losses
- Sequesters Carbon
- Increases Groundwater Recharge

Baltimore Urban Ecosystem Study (Pickett et al., 2008)

"Lawns … have features that can increase N retention. For example, they have permanent cover and low soil disturbance, and they photosynthesize and take up water and nutrients for a much longer portion of the year than do forests or agricultural ecosystems. **Data from the Baltimore Ecosystem Study plots show that nitrate leaching and nitrous oxide flux from the soil to the atmosphere are not markedly higher in lawns than in forest.** Perhaps even more interesting, <u>variation among the lawns was not related to fertilizer input</u>. Nutrient cycling in lawns is complex, and **the effects of lawns on water quality are probably less negative than anticipated**." (all emphasis mine)

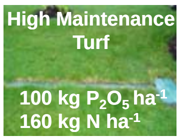
Univ. of Minnesota Study (Bierman et al., 2010)

Found 20% less P runoff losses when zero-P fertilizer was used vs. no fertilizer at all

- Nitrogen fertilization increase turfgrass density which improved infiltration and led to less runoff and lower phosphorus loss

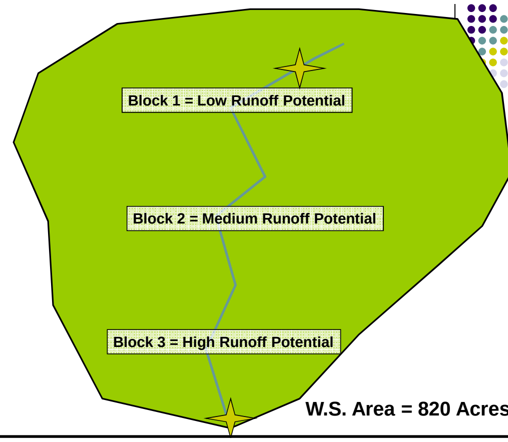
P loss from urban watersheds

- **Nine runoff collection plots installed on three landscapes**

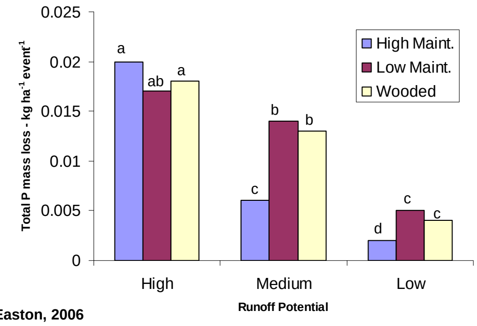


- **Runoff collected from all (77) events >0.1 mm**

Easton, 2006

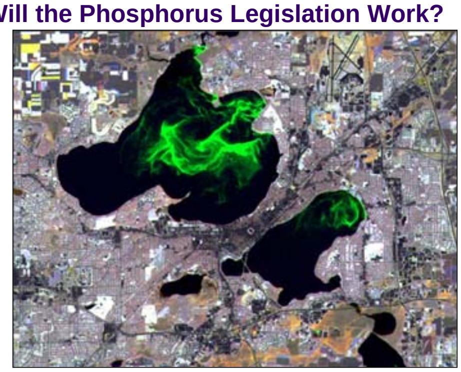


Runoff potential most important factor in predicting P loss



Easton, 2006

Will the Phosphorus Legislation Work?



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http://www.sciencedaily.com/releases/2009/08/090817190741.htm

Water Quality Improves After Lawn Fertilizer Ban, Study Shows

ScienceDaily (Aug. 27, 2009) — In an effort to keep lakes and streams clean, municipalities around the country are banning or restricting the use of phosphorus-containing lawn fertilizers, which can kill fish and cause smelly algae blooms and other problems when the phosphorus washes out of the soil and into waterways.

But do the ordinances really help reduce phosphorus pollution? That's been an open question until now, says John Lehman, professor of ecology and evolutionary biology at the University of Michigan.

"It's one of those things where political organizations take the action because they believe it's the environmentally conscious thing to do, but there's been no evidence offered in peer-reviewed literature that these ordinances actually have a salutary effect," Lehman said.

The Huron River. In an effort to keep lakes and streams clean, municipalities around the country are banning or restricting the use of phosphorus-containing lawn fertilizers, which

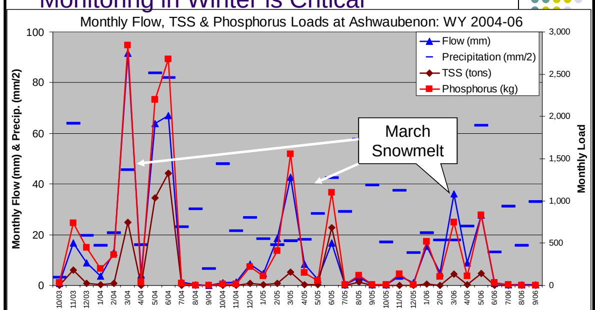
University of Michigan Study (Lehman et al., 2009)

- 36 mi^2 watershed in Ann Arbor, MI
- 5 kg/day P reduction (28%) **May – Sept** (other months not monitored)
- New P ordinance could have accounted for this reduction, but was a piece of a larger effort to reduce P runoff

"The magnitudes of the TP reductions are generally greater than DP reductions, even though DP accounted for 56% (SE= 3%) of TP at all sites during the reference period and 60% (SE=3%) of TP in 2008. ***This suggests that the main effect has been reduction in the particulate P load of the river.***"

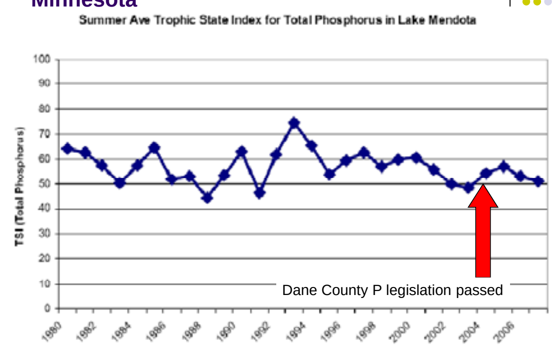
Lehman et al., 2009

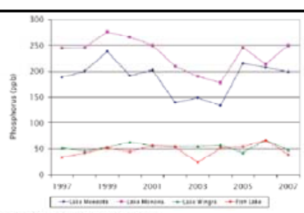
Monitoring in Winter is Critical



Data from Fermanich, et al., 2007
Lower Fox River Tributaries (Green Bay, WI) - 2004-2006

Have not seen the same results in Madison or Minnesota





As shown in the figure above, phosphorus levels in the larger lakes forming the isthmus, Lakes Mendota and Monona, have increased since 2004 while the smaller lakes have remained relatively consistent during the reporting period. Phosphorus levels displayed in the figure above were sampled from the center of the lake. Conditions near the lake shoreline, where the majority of exposure to algae blooms would tend to occur, might be very different and may vary widely from day to day.

GRADE: NEEDS IMPROVEMENT

Consistent increases in phosphorus levels in Lakes Monona and Mendota while smaller lakes remain consistent.

From: 2008 Dane County Environmental Report Card

Prediction: **Water quality from suburban watersheds will improve**

New Housing Starts: Midwest

- Average 2003-2005: 350,000
- Average 2008: 135,000

Conclusions

1. Sediment control should remain a high priority in urban areas
2. Phosphorus losses are greatest in winter from turfgrass areas
3. Improving soil conservation during construction will substantially improve environmental quality
4. Proper nitrogen fertilization should be emphasized to maintain dense ground cover
5. Don’t apply phosphorus unless need is shown in a soil test. Avoid late fall applications of phosphorus from sites that require phosphorus.

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