Modern Approaches to Turf Management

Municipal Grounds Managers Training
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The "L" Word ....
How water moves pollutants into water bodies

- **Runoff** – movement of water and contaminants over the land/soil surface, usually draining into a surface water body or stormwater system

- **Leaching** – downward movement of water and soluble contaminants through the soil profile to groundwater

- **Erosion** – movement of soil and other particulate matter by water and wind
An ideal soil....
Texture of Rhode Island Soils

- Rhode Island soils have high proportions of sand and silt.
- The best soils in the state are in the southeast; western RI contends with more sand and stone.
- Clay is largely absent (except some areas on Block Island).
- Organic matter is low.
Active Organic Matter

2-5% “The Living”

4-25% “The Dead”

75-95% “The Very Dead” = Humus

Passive Organic Matter
Effects of Rainfall

- RI soils are formed from granite (acidic).
- Soils receiving 30” of rain or more are likely to be acidic (*Westerly, RI averages ~42”*).
- “Acid rain” compounds the problem.
- Acidic soils are typical east of the Mississippi.
- Possible exceptions – Lincoln, and inner-city.

Western soils are *alkaline*
Eastern soils are *acidic*
Adjusting pH

- Lime (CaCO\(_3\)) or dolomite (CaCO\(_3\) + MgCO\(_3\)) raises pH
- Use sulfur to lower pH (some urban lots)
- Avoid excess amounts when crops or plants are present
- A soil test is the best way to determine the amount (if any) to add
What Can We Do?

- **Maintain a healthy lawn**
  - Fertilizer and pH adjustment
  - Proper watering
  - Proper mowing
  - Manage thatch

- **Correct problems**
  - Eliminate weeds
  - Patch bare spots
  - Manage disease and pests
Macronutrients

- **Nitrogen** – required for proteins, chlorophyll
  - Promotes “green” growth
- **Phosphorus** – essential for membrane development; component of DNA; energy
  - Promotes root development and flower development
  - Do we ever let turf grass flower or seed?
- **Potassium** – activates some enzymes in cell, helps regulate ionic balance in cell
  - Helps plant regulate Nitrogen uptake
Macronutrients (continued)

- **Magnesium** – essential for chlorophyll production, seed production
- **Calcium** – essential for creation of pectin (“glue” in cell walls), essential to bud growth, root growth
- **Sulfur** – component of some proteins

*(Almost never deficient, these are often added as a consequence of pH adjustments …)*
What Nutrients Do We Add?

- **Nitrogen**
  - Usually as nitrate ($\text{NO}_3^-$)
  - Sometimes ammonia or urea
  - Often ammonium sulfate

- **Phosphorous**
  - Usually as phosphate ($\text{PO}_4^{3-}$ or $\text{P}_2\text{O}_5$)

- **Potassium**
  - Usually as “potash” ($\text{K}_2\text{O}$)

- (Calcium and Magnesium in limestone)
How Much Do We Add?

- Remember, healthy turf will prevent erosion
  - Question is, “What is healthy turf?”
- Too little fertilizer will not yield healthy turf
- Too much increases the need for mowing, irrigation
- Some evidence that “sufficient” fertilizer causes plant to generate allelopathic compounds
- Need an objective measure of available soil nitrogen....
How Much?

- Deficiency
- Sufficiency
- “Excess”

Response vs. Nutrient Concentration
Turf Color Measurements (by Meter)

Establish a max. baseline, then manage for 90-95% of maximum

Karl Guillard – UCONN

NDVI

N application rate, lb. N / 1000 sq. ft. / month

With K
With no K
How Much?

- Old turf recommendation is ~4# - 5# N / 1000 sq feet
  - Independent of location …
  - Independent of turf species …
  - Growing season may vary from 5 months to 10 months

- Modern research indicates less
  - Kentucky Bluegrass/Perennial Rye – 3# - 4#
  - Fine Fescues – 2#
  - Less in more Northern climates
  - Less if cut with mulching mower
  - Less if turf is “old”
Age of Turf

- Newly-seeded turf needs more fertilizer to get established
- Older turf may have large store in the thatch layer
- Lawn that has been treated with organic fertilizer may have large excess in thatch
Four-Step? (Five-Step?)

- Concept developed for lawns by marketing
- Spread the application over the course of the year; add pesticides where needed
  - Spring – pre-emergent herbicide – crabgrass
  - Early Summer – broad-leaf herbicide
  - Late Summer – grub control
  - Fall – no additions – over-seed new grass

- “Winterizer”
Typical Four-Step

- **Step 1**
  - .89 # N / 1000 sq. ft.  February - April

- **Step 2**
  - .99 # N / 1000 sq. ft.  April - June

- **Step 3**
  - .75 # N / 1000 sq. ft.  June - August

- **Step 4**
  - .89 # N / 1000 sq. ft.  August - November
Annual Amount?

- 3.44 # N / 1000 sq. ft.
- Last application August – November
- “Winterizer”
  - Recommended rate = .63 # N / 1000 sq. ft.
  - “Heavy Duty” rate = .89 # N / 1000 sq. ft.
  - Apply “…late summer or fall…”
  - 8 weeks after new grass germinates
- Total 4.07 # N to 4.31 # N / 1000 sq. ft.
- Step 4 in August-Nov + Winterizer in Nov
When Do We Fertilize?

1960’s and Earlier - Fertilize Turf Prior to Major Growth Phases:
Current Turf Fertilization Programs

Emphasize fall fertilization for spring greenup....
Benefits of Fall N Fertilization of Cool-Season Turf

- Fall and Winter Color Retention
- Earlier Spring Green-Up
- Increased Turf Density
- Improved Rooting/Rhizome Characteristics
- Income generating activity
Root Mass


Winter Root Activity in Kentucky Bluegrass (*Poa pratensis* L.)

Study conducted in Maryland

Check 3 lbs N Sept.

Figure 2—Crowns and roots harvested in February. Left—unfertilized check; right—fertilized with 3 pounds of nitrogen in September.
Winter Color… (Powell et al., 1967)

Summary:

“Bimonthly N applications during fall and winter in Virginia latitudes will not only improve winter color and quality of hardy turf grasses but will also improve root growth”

Study conducted in Virginia
Spring Greening & Other


Effects of Fall Fertilization on Cold Resistance, Color, and Growth of Kentucky Bluegrass

*Study conducted in RI*

Oct. 1 and 15
Nov. 1 and 15
Dec. 1 and 15

Fig. 2. Mg chlorophyll/liter in a turf plug 10.2 cm in diameter obtained from the check and combination treatments.
Wilkinson and Duff, 1972

Summary:

“If the promotion of color alone is emphasized, fertilization up until Nov. 1 provided good turf color in the fall. Fertilization after Nov. 1 appeared to be too late for any significant production or maintenance of color”

Study done in Rhode Island
For some reason **Thanksgiving** is still cited as the time for fall fertilization in our region....
Evapotranspiration Drives Nutrient Uptake…

Ions absorbed with water by root hairs
Why Do We Care?
We want to make landscaping accepted as part of the solution, rather than part of the problem.
UCONN Research

- Using chlorophyll, color meter, and reflectance measurements to quantitatively assess “greening”
- Asked general public to rate several lawns
  - Individually
  - Comparing one lawn to another
- Spent one year calibrating measurements to perceived quality (“It’s good” etc.)
- Now working on total N budget
The soil monolith lysimeter

Last Application:
- September 15
- October 15
- November 15
- December 15

Off-the-Shelf “Winterizer” fertilizer

The soil monolith lysimeter
Spring Greening vs. Fall Fertilizing

Mangiafico and Guillard, JEQ 2006
Shoot Density vs. Fall Fertilizer

Shoot Density vs. Fall Fertilizer

Mangiafico and Guillard, JEQ 2006
N Leaching vs. Fall Fertilization

Mangiafico and Guillard, JEQ 2006
Nitrate Leaching Losses in Home Lawn Turf

Conclusions

- There is some improvement in color and plant mass from fall fertilization
  - Visual improvement is less significant than scientific measurements
- There is dramatic increase in the amount of nitrogen leaching with later dates of fertilization
- October 15 is optimum time for fall fertilization in Southern New England
Should I Use Organic Fertilizer?

- Usually agricultural by-products
  - Manure (rotted, not fresh)
  - Bone Meal
  - Fish Emulsion
  - Sea Weed (but remove the salt !)
  - Sewage Sludge
  - Compost

- Slow-release, because the fertilizer must “decompose” (bacterial action) to nitrate, phosphate, etc
- Decomposition rate depends on temperature, moisture
- Less likely to cause “salt burn” (but it can happen !)
- As sources of N, P, and K, they are a bit weak, but they may improve the soil in other ways
Common Sense Dos and Don’ts

- Do not apply fertilizer to frozen ground ....
  - Perhaps only fertilize when you are actively mowing?
- Try to separate fertilization from pest treatment
- Always follow the manufacturer’s directions
- Always calibrate your spreader / sprayer
- Avoid paved surfaces, walks, driveways, etc.
- If material does fall on hard surfaces, sweep it off (“Every curb is a beach front....”)
EdgeGuard™

New product features a baffle to restrict material broadcast on one side...combining the advantages of both broadcast and drop spreaders.
More Common Sense

- Avoid applying fertilizer during a heat wave – wait until the plants are not stressed.
- Avoid applying fertilizer just before a heavy rain
- Be especially careful around water - lakes, ponds, streams, the ocean, your well ….
- Consider pets and/or children playing in the lawn….
- Remember, there are no safe products, only safe practices….
More Common Sense

- Consider applying fertilizer in two passes, made at right angles to each other, maybe spaced 2 weeks apart. Better coverage, less chance for fertilizer burn. (And good exercise !)
Watering

- Lawns need 1” to 2” of water per week
- Better to water all at once (or twice), rather than 5 minutes each day
- Better to water in the morning rather than in the evening
- Noon-time watering may waste water through evaporation
- A lawn needs water when it looks wilted, or when footprints persist …
1” to 2” Per Week ??
Mowing

- Usually mow each week, unless the turf is dormant
  - Controls weeds (removes seeds)
  - Avoids mowing shock
- Never remove more than 1/3 of the leaf blade
- Always use a sharp blade ....
- Mulching is better than bagging, if you mow frequently and with a sharp *mulching* blade
Mowing Height

- Lawn services often mow too short – “Golf Course Syndrome”
- A tall lawn in summer protects roots from heat and minimizes evaporation from soil
- Tall lawn helps control weeds
- My unscientific survey of my neighborhood favors tall (3”+) – it just looks better
- Aim for 2½” – 3” after cut
  - If you cut 1” each time, let it grow to ~3½”
- Mow shorter at end of year (last mowing) to facilitate raking (and to prevent disease)
Thatch

- Often misunderstood
- Naturally-occurring blend of living and dead tissue
- May block water and air penetration in soil if allowed to build up
- Can be controlled by combination of good cultural practices and remedial treatment
Controlling Thatch

- Mulching is not the problem – infrequent mowing, removing too much of the leaf blade in one pass, or a dull mower blade is the problem.
- Thatching tools (rakes, dedicated machines, or spring-ended mower blades) can do the job, but may tear the turf.
- Core aeration is preferred solution today.
- Some turf species / varieties are more prone to thatch than others.
Core Aeration
Core Aeration

Note: Golf shoes do not aerate your lawn. They compress and compact the soil.
Problems ....

Is this lawn healthy? Or is it over-run with clover? (Hint – the clover was planted here ....)
Weeds

- **Annual weeds (e.g. crabgrass)**
  - Digging may not be practical or effective (seeds)…
  - Prevent them with pre-emergent herbicide (or with allelopathic fescues)
  - Some experiments with “organic” remedies, but inconclusive (an may be unacceptable in terms of fertility)

- **Perennial weeds (e.g. dandelions)**
  - Digging may not be practical
  - Broad-leaf herbicides help (2-4,D, dicamba)
  - General herbicides for non-broadleaf (glyphosate)
  - Spot treatment uses far less active ingredient
Patching Bare Spots

- First, correct the underlying cause
- Eliminate weeds if there are any
- Loosen the soil with a rake, hoe, etc
- Fertilize if needed
- Use Tupersan/Siduron to prevent crabgrass
- Scatter seeds per directions
- Water with fine mist – keep moist for 5-25 days (depends on variety)
- “Patching mix” generally poor investment – cheap seed mixes (often annual ryegrass)
Fix the underlying cause ....

This path has resulted in compacted soil that will not support new growth. Even if it did, would people stop walking here?
The Solution
Insect Pests

- Army Worms
- Chinch Bugs
- Sod Webworms
- Grubs
White Grubs
Grubs
Seasonal life cycle of the Japanese beetle (diagrammatic).
Grub Control

- Minimize your turf area...
- Minimize Kentucky Bluegrass
- Increase shade in your lawn area
- Maintain good cultural practices (water, fertilizer, pH, thatch, etc.)
- Biological Controls
  - “Milky Spore”
  - Nematodes
  - Bt “Bui-bui” (expected 2008)
Lawns Go Dormant

July
Chemical Grub Control

- **“Merit” (Imidacloprid)**
  - Systemic – plant takes it up from roots
  - Long lasting – put down June 1 – Aug 15
  - Recent concerns about over-use

- **Dylox (Trichlorofon)**
  - Fast acting, but short life (10 days)
  - Avoid high pH
  - Also effective against sod webworms

- **“Grub-B-Gon” et al (Halofenozide)**
  - Controls adult beetles – June 21-July 21

- **Acelepryn**
  - New on 2008
  - “Low Risk” by EPA
  - Grubs, caterpillars, billbugs, chinch bugs
Common Lawn Diseases

- Summer Patch
- Dollar Spot
- Red Thread
- Pink Snow
- Necrotic Spot
The Disease Triangle

Pathogen

Host

Environmental Conditions
Summer Patch

- Fungal disease (*fusarium* blight)
- Sometimes results from low moisture or low nitrogen concentration in soil
- Common in summer
- Most common in Kentucky Bluegrass
Dollar Spot

- Fungal disease
- Soil too wet
- Water no more than twice a week, morning only
Red Thread

- Fungal disease
- Red thread develops at cut
- Nitrogen deficiency
Pink Snow

- Tan spot with pink ring
- Early spring
- Excessive N in fall
- Grass left too tall in fall
- Heavy snow cover in winter
Necrotic Ring Spot

- Fungal disease brought on by drought
- May be caused by compaction or thatch build-up
- Leave grass long in summer
Cultural Control of Turf Diseases

- Except on golf courses, few of these require fungicide application
- Some caused by too little N
  - Summer Patch
  - Red Thread
  - Dollar Spot
- Some caused by too much N
  - Pink Snow
Disease Control (2)

- Thatch control
  - Summer Patch (affects water penetration)
  - Necrotic Ring Spot
- Water correctly
  - Summer Patch
  - Necrotic Ring Spot
  - Dollar Spot (too much water)
Take Home Messages

- Get a soil test to manage pH
- Fall fertilization is beneficial for maintaining color, but do so before November
- If you fertilize in Spring, do so after the grass is actively growing
- If you use pesticides, favor spot treatment over broadcast treatment
- Mow high (~3”), with a *sharp* mulching blade, and leave clippings on lawn
- Sweep chemicals and grass clippings off of hard surfaces
- Always use the best seed you can obtain
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Questions ?