Topdressing with compost, a more sustainable and affordable alternative

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SUSTAINABILITY

"Meeting the needs of the present generation without compromising the ability of future generations to meet their needs"*

"Using methods, systems, and materials that won't deplete resources or harm natural cycles"

"Sustainability is not a trend as waste management is too expensive"

It's a movement in our society

- Been sustainable
- Go-Green
- Eco-friendly

Crystal Ball Report #29. Green Industry ECOnomics: Innovating Toward a Sustainable and Profitable Future. Planet 2009 . *Brundtland, 1987

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COMPOST

What is COMPOST?

Compost : is the end result of controlled aerobic decomposition of organic matter

Compost QUALITY varies depending on

THE SOURCE

COMPOSTING PROCESS

*Sylvia D. et al, 2005

THE SOURCE

- Municipal solid waste (household refuse)
- Leaves and grass clippings (yard waste)
- sewage sludge (biosolid)
- Animal manure
- Food residuals
- etc





Properties of yard wastes before composting

Characteristics	Grass	Fall Leaves	Spring Leaves	Chipped Brush
Organic matter(%)	86(+-5)	87(+-4)	58 (+- 6)	98(+-1)
pH	8.1(+-0.1)	5.9(+-0.4)	7.9(+-0.3)	6.6(+-0.2)
Carbon (%)	41	42	33.2	46.9
Nitrogen (%)	2.6	0.8	1.2	1
C/N ratio	16	54	28	49

Adapted from Fred Michel presentation at the Ohio Composting Operator Educational Course, Wooster , Ohio, 2010.

N losses during composting are correlated to the initial C/N ratio

COMPOSTING PROCESS

- Biological process

- Organic wastes are stabilized and converted into a product to be used as a soil conditioner and organic fertilizer

COMPOSTING SYSTEM

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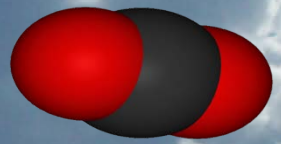
WATER



CARBON
DIOXIDE

HEAT

COMPOST

An example : Sewage sludge composting process

Sludge arrived

Wood chips and straw added to sludge (4:1)

Mixing

Aerate Compost for 25 days

Screen compost to 3/8 in mesh

Ready to sell

Benefits of using compost in sports turf

- Soil physical, chemical, and biological properties improvements
  - Soil structure is improved (micro-macro aggregates)
  - Improved aeration and plant root development
  - Nutrients, N available in slow release form
  - Water holding capacity increased
  - Erosion reduce
  - Prevention and suppression of disease
- Environmental benefit
  - Organic matter recycling
  - Less landfill wastes.
  - Carbon sequestration (capture)
  - Fertilizers, pesticides, and herbicides decrease.
  - Decrease in N leaching (surface water)

Disease supression

Pathogen species	Inoculum	Disease	Main compost feedstocks	Control medium	Rate (%, v/v)	Rate (t d.m./ha)	Control* (%)	References
Laetisaria fuciformis	natural	Red thread	Sewage sludge	sand	20		51	Nelson and Boehm (2002a)
Laetisaria fuciformis	natural	Red thread	Green waste	sand	20		0	Nelson and Boehm (2002a)
Microdochium nivale	mycelium	Fusarium patch	Bark, poultry manure	soil		4.9	64	Boulter et al. (2002b)
Microdochium nivale	mycelium	Fusarium patch	Bark, poultry manure	soil		9.7	84	Boulter et al. (2002b)
Pythium graminicola	natural	Damping-off	Sewage sludge	sand	20		63	Nelson and Boehm (2002a)
Pythium graminicola	mycelium	Damping-off	brewery and sewage sludges	sand	30	0.5	72	Craft and Nelson (1996)
Rhizoctonia solani	natural	Brown patch	sewage sludge	sand	20		42	Nelson and Boehm (2002a)
Rhizoctonia solani	natural	Brown patch	Green waste	sand	20		39	Nelson and Boehm (2002a)
Rhizoctonia solani	mycelium	Large patch	Grass clippings	soil	10		47	Nakasaki et al. (1998)
Sclerotinia homoeocarpa	natural	Dollar spot	sewage sludge	nil	30	5	27	Nelson and Craft (1992)
Sclerotinia homoeocarpa	mycelium	Dollar spot	Bark, poultry manure	nil		7.2	50	Boulter et al. (2002c)
Sclerotinia homoeocarpa	mycelium	Dollar spot	Bark, poultry manure	nil		14.7	66	Boulter et al. (2002c)
Sclerotinia homoeocarpa	natural	Dollar spot	sewage sludge	sand	20		40	Nelson and Boehm (2002a)
Sclerotinia homoeocarpa	natural	Dollar spot	Green waste	sand	20		5	Nelson and Boehm (2002a)
Typhula incarnate	natural	Blight snow mold	sewage sludge	sand	20		70	Nelson and Boehm (2002a)
Typhula ishikariensis	mycelium	Blight snow mold	Bark, poultry manure	soil		4.9	39	Boulter et al. (2002b)
Typhula ishikariensis	mycelium	Blight snow mold	Bark, poultry manure	soil		9.7	82	Boulter et al. (2002b)

Adapted from Noble et at, 2005.*Control is expressed as percentage reduction in disease symptoms compared with unamended turf grass or turf grass treated with sand d.m., dry matter.

Advantages depending on the soil profile

IN CLAY SOILS

- Improve structure
- Reduce surface crusting
- Reduce compaction
- Promote drainage
- Provide nutrients

IN SANDY SOILS

- Increase water and nutrient retention
- Supplies nutrients
- Increase microbial activity

General uses and recommendations

As topdressing

- Find the right equipment
- Thin layer (about ¼ - 1/8)
- Work it into the soil
- Aeration with hollow tines
- Heavy drag mat attached
- Better during cool-moist seasons

Incorporate in the soil

- Between 1 - 2 in layer
- Depth 4-6 in
- Mix with the soil
- Rotary tilling equipment, depending on soil
- For seedling growth some compost may need additional P and K
- Check pH and soluble salts

How to select a compost to use in turfgrass?

- You should choose a compost that have been tested by some university, company or a colleague

- You must require the physical and chemical analysis of compost. Or you can send a sample to a laboratory.

- If you don't have any of these options, make a visual analysis

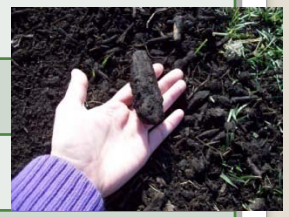
COMPOST ANALYSIS REPORT

LAB NO.: 618570
SAMPLE ID: KURTZ BROS. YARDWASTE COMPOST JUNE 2010
TEST PACKAGE: OHIO EPA COMPOST TESTS (OEPA 3745-27-46)

TEST	RESULTS	UNITS
pH	8.5	SU
Salinity	0.70	mS/cm
Total Nitrogen	1.13	% dw
Total Organic Carbon	9.40	% dw
Total Phosphorus	2,120	mg/kg dw
Total Potassium	7,600	mg/kg dw
Total Boron	50.9	mg/kg dw
Foreign Matter	0.039	% dw

TEST METHOD: Conforms to Ohio EPA Analytical Methods given in Table 4 and Table 5.

Choosing a compost, desirable physical and chemical properties



Color	Brown to black
Odor	Like earth
Particle size for topdressing	¼ to 3/8 inch
Moisture content	30 to 50%
Organic matter	Greater than 30%
Ash content	less than 70%
C/N ratio	Below or equal to 30:1
Nitrogen	0.5 to 3%
Phosphorus	Greater than 0.2%
pH	6.0-7.0
Metals	Determined by state or federal agencies
Soluble salts	Depending on turf species, type of salt, concentration, and application method

PennState agricultural science. Using Compost to improve turf performance. http://turfgrassmanagement.psu.edu/composts.html

Some current examples

Madison Golf and Development Group, Wisconsin, USA

Composting program (they produce certified yard waste compost) for bentgrass fairways and tees, and Kentucky bluegrass roughs
Compost Application

Twice a year in all tees, fairways and roughs at 2 Golf Courses
Spring and fall at 1/8 inch
Equipment: broadcast spreader (1 day =150 acres)

Benefits:

Increase soil stability
Reduced severity and incidence of diseases
Less weeds
Less insects
Decreased thatch
Reduced annual fertilizer by 90%
Reduced other chemical inputs by 50%

=

Cost savings
+
Marketing in a region where environmental issues are a hot topic

Morecambe FC, Lancashire, England (3rd division)

Establishment 50:50 sand/compost mix

Germination of the dwarf ryegrass was very quick

Increased in density and root growth

Decreased irrigation and fertilization

Worthington Schools, Columbus, Ohio, USA

More than 20 years applying an 80/20 sand/compost mix (biosolid compost). Reduced fertilizers by 30%

Why it can be an affordable alternative?

2009 New Soccer Field Maintenance Cost Estimates			114	000 sq.ft.	
Description of Activity	**Man Hours**	**Man Hour Cost**	**Product**	**Product Cost**	**Total Activity Cost**
50 Mowings / Season	113	2,228.36			$ 2,228.36
Growth Regulator, Once Per Month	12	236.64	Primo	1,227.60	$ 1,464.24
Topdressing, 5 Applications Per Year	31.5	621.18	Sand	1,987.50	$ 2,608.68
Water, 1 Acre Inch Per Week/ 26 Weeks	6	118.32	City Water	5,703.62	$ 5,821.94
Fertilizer @ 6.1 #s N / year	12	236.64	Fertilizers	1,548.00	$ 1,784.64
Paint, 6 Applications Per Season / 20-5 Gal. Pails	45	887.40	Paint	378.75	$ 1,266.15
Aeration, 3 Times Per Year	13.5	266.22	Verti-Drain		$ 266.22
Fungicide, Four Applications / Season	8	157.76	Disarm 480 SC	1,575.00	$ 1,732.76
Over-Seeding, Once Per Season	5	98.60	Seed	997.50	$ 1,096.10
Herbicide, One Applications Per Season	2	39.44	Herbicide	22.66	$ 62.10
Fence-line Maintenance, 2 Apps. Per Year	8	157.76	Control Products	125.00	$ 282.76
Miscellaneous	50	986.00	Misc. Products	200.00	$ 1,186.00
Pre-emergent Applications	4	78.88	Drive 75 DF	360.18	$ 439.06
Insecticide Applications		-	Dylox		$ -
					$ -
Sports Lighting		-	Electricity	402.60	$ 402.60
	Labor Cost	$ 6,113.20	Supplies Cost	$ 14,528.41	
* These lighting estimates are based on 10 events @ three hours in length per season.					
76 - 1,500 Watt Lights					
Labor Cost $16.44 x 20% benefits =	$ 19.72	Labor Cost Per Hour			
Mowing Season : 33 Weeks x 1.5 Mowings / w = 50 Mowings / Season x 2.25 hrs. / Mowing = 112.50 hrs.					

Compost prices depend upon Region

“ Biosolid compost price reported by facilities all over the USA range from $6-$30 per cubic yard”. Dec 2010, Biocycle magazine

So for a 114.000 sq ft , 1/4 inch rate (about 0.7 yd3 product) = $478.8 - $2394

- “ORGANIC” DOESN’T MEAN “GOOD”
- PROMOTE A RESPONSIBLE USE AND PRODUCTION
- REGULATIONS

Regulations

Federal Regulations

- Regulates biosolid compost. 503 USEPA regulations (40 CFR code) Special regulations for sewage sludge use and disposal (Salmonella sp and fecal coliform)

State Regulations

- Composting Regulations OhioEPA (OAC 3745-27-01 to OAC 3745-27-40)
- Limits for compost maturity, pH, heavy metals, salts, etc

My current Research

"Evaluation of Compost and Compost Topdressing Programs for Enhancing the Playability and Sustainability of Established Soil-Based Athletic Turf"

TURFGRASS SCIENCE

GOLF

SPORTS TURFGRASS

SANDY SOIL PROFILE

PROFILE SOIL NATIVE

HIGH MAINTENANCE

LOW MAITENANCE

MODERATE MAITENANCE

MAYOR PROBLEMS OF MODERATELY MAINTAINED SPORTS FIELDS

- Excessive use and wear
- Compaction

=

Soil Compaction

Players and Equipment
(Produce shear and compressive stress)

Increase in soil bulk density
(Decrease in total porosity)

Soil compaction inhibits important soil processes such as water infiltration, water drainage and soil aeration. This results in a poor environment for soil microorganisms and plants

First 2-3" upper soil profile

What has been done?

•There are several studies that have shown reduced severity of diseases, improved turf quality during drought, improved turf color, and soil nutrient status when compost was applied as amendments and topdressing in golf and sports turf settings, greenhouse and laboratory studies (Johnson et al, 2009, Loschinkohl and Boehm, 2001, Munoz et al, 2010).

•Topdressing in spring and fall with sewage sludge and yard waste compost showed enhanced color and increased foliar nitrogen concentrations (Garling and Boehm, 2001).

•However, there is little information available about compost topdressing and playability on sports fields.

GAP

- No research relating compost topdressing with playability
- No recommendations for compost application methods-programs
- No research relating compost topdressing to wear-traffic

Objetives

- Evaluate two compost types (sewage sludge bio-solid compost and yard waste compost) and a sand compost blend that are considered to possess good quality compost characteristics and bulking agent.
- Evaluate the potential benefits of compost topdressing to improve soil physical and chemical properties of established athletic field soils.
- Evaluate the effect of compost topdressing on key playability characteristics including wear tolerance surface hardness, turf ground cover, sod strength, and overall turfgrass color and quality.

HYPOTHESIS

Topdressing of composted biosolids, yard waste compost and/or a sand-biosolids blend applied in conjuction with core cultivation will enhance the playability, sustaintability and safety of soil-based athletic turf

Material and Methods

- The research was conducted at the Ohio Turfgrass Foundation Research and Education Facility, OSU, Columbus, Ohio, USA.
- The soil type was a Brookston **silty-clay loam**
- The turf was an established stand of turf-type **tall fescue** (*Festuca arundinacea*), 'Falcon IV'
- The experimental design was a strip-split plot desing (plots 9x5 feet, 1.52 x 2.74 m) with three replication.
- Plots received **moderate maintenance** (mowed twice per week at 63.5 mm (2 ½ in)and irrigated to prevent wilt).

Strip-split plot desing

Rep I

Rep II

Rep III

CORING

COMPOST

Tall fescue (Falcon IV)

- An equivalent of 30 games were imposed between fall and spring 2009-2010 with the Brouwer machine →

- Core cultivation was done prior compost topdressing, using a Ryan GA30 (0.2 g/cm^2 soil removed, 3 in depth)

- Cores were returned and raked in after

- For preliminary results data was analyzed by analysis of variance (ANOVA) and appropriate means separation was computed using Fishers LSD with α=0.05 by SAS

Treatments

I. Topdressing Rate (Turfco Meter-R Matic F15-B)

¼ in (6 mm)

½ in (13 mm)

1 in (25 mm)

II. Compost Type

Sewage Sludge Compost (COMTIL)

Sand/COMTIL mix 70/30 (v/v%) (Kurtz Brothers)

Yard Waste Compost (Kurtz Brothers)

III. Coring Intensity

12-15 cores per square foot

24-30 cores per square foot

(Recycle soil back into surface/compost)


SAND/COMTIL MIX

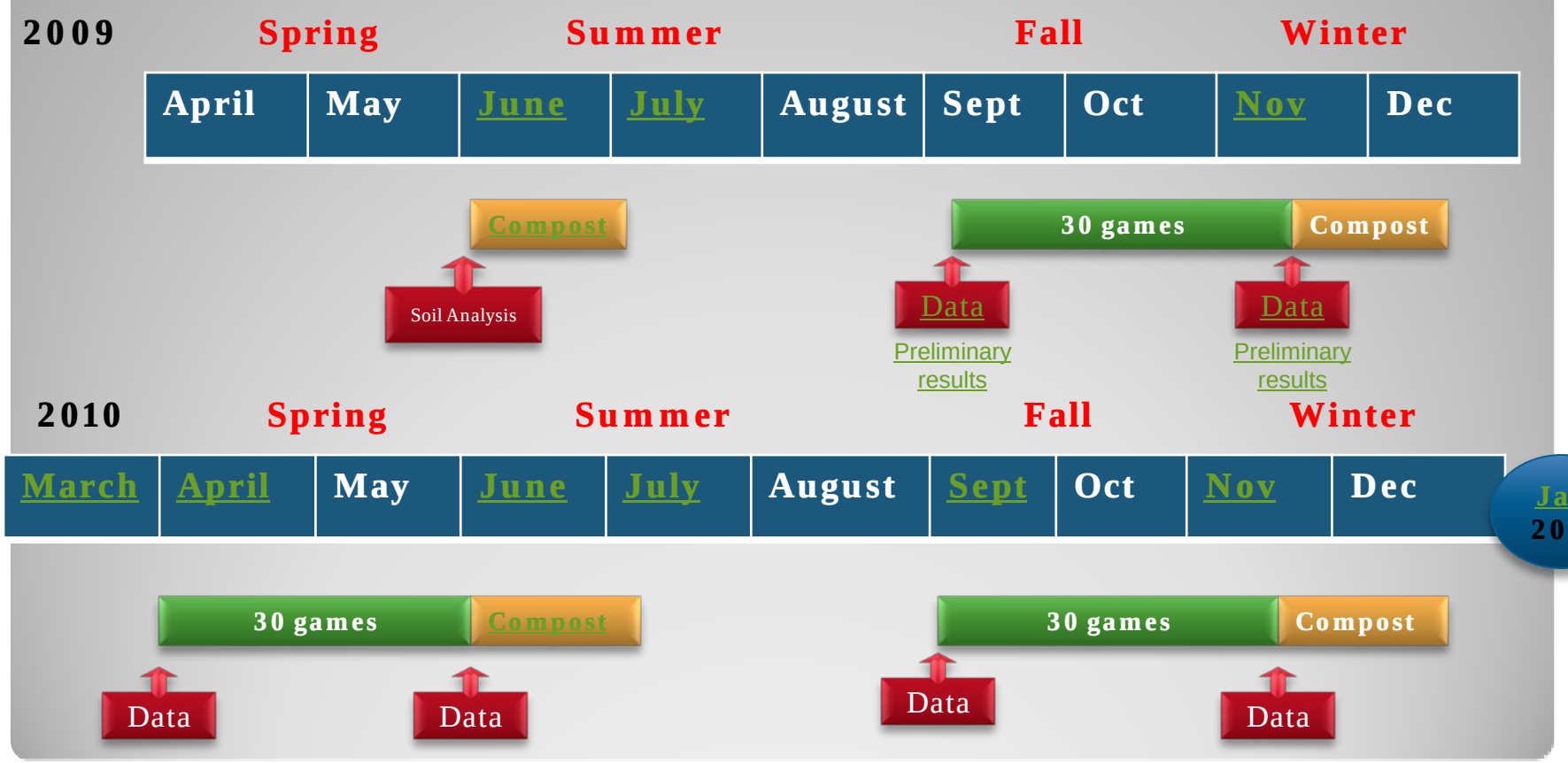

ClubCar


COMTIL


YARD WASTE COMPOST
YARD Waste


ClubCar

Analytical and Field Measurements



2009 Preliminary Conclusions

✓Turfgrass color and soil nutrient status increased with compost treatments indicating a generally positive effect on overall turf quality.

✓Playability parameters after topdressing with compost and wear, were within acceptable ranges/values for sports such as football and rugby indicating that compost can be safely used in athletic turf.

✓These results clearly demonstrated that compost can be use on sports fields and should be considered as an alternative and sustainable method for turfgrass managers.

✓Future data analysis is need to support these results

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ACKNODLEGMENTS

City of Columbus

Kurtz Brothers

Ohio Turfgrass Foundation

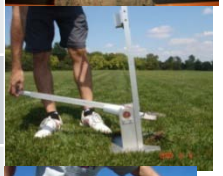
CLC LABS®
Meeting the needs of the Green Industry


THANKS
Any Question???

Measurements

We are measuring	Measurement	Equipment/method
SOIL STRUCTURE AND POROSITY	Soil bulk density (upper 25 mm and lower 50- 75 mm)	One 50.8 mm radius core sampled to a 75 mm depth and cut in two at 25mm ,placed into a laboratory oven and dried at 70°C for 48 hrs
PLAYABILITY	Surface traction - Rotational shear strength	Canaway Turf Shear Tester (weighted at 46.1 kg and dropped from a height of 60 mm using 18 mm long studs, 3 readings per plot)
PLAYABILITY	Surface traction - Lateral shear strength	Turf Shear Tester TST Model CCB1B 50w x 30d, 3 readings per plot
PLAYABILITY	Surface hardness/resiliency	Clegg Impact Soil Tester 2.25 kg hammer dropped from 0.55 m height, 6 readings per plot
PLAYABILITY	Soil compaction	Soil compaction tester (Penetrometer) ¼ in tip at 75 mm depth. 3 readings per plot
TURF QUALITY	Turf color	NTEP Method (1-9 scale, 1=dead, 9= dark green)
TURF QUALITY	Turf Cover	1-100%
COMPOST DEGRADATION	Material Cover	1-100%
SOIL PHYSICAL AND CHEMICAL PROPERTIES	Soil physical and chemical properties (macro and micro nutrients, heavy metals, OM and soluble salts)	CLC Labs (data not reported)
COMPOST PHYSICAL AND CHEMICAL PROPERTIES	Soil physical and chemical properties (macro and micro nutrients, heavy metals, OM and soluble salts)	CLC Labs (data not reported)
WATER VOLUME IN THE SOIL	Volumetric water content	TDR300 (set in clay soil)
PLANT NUTRIENT CONCENTRATION	Plant tissue analysis. Micro-macro nutrient	CLC Labs (data not reported)






1 in ½ in ¼ Untreated

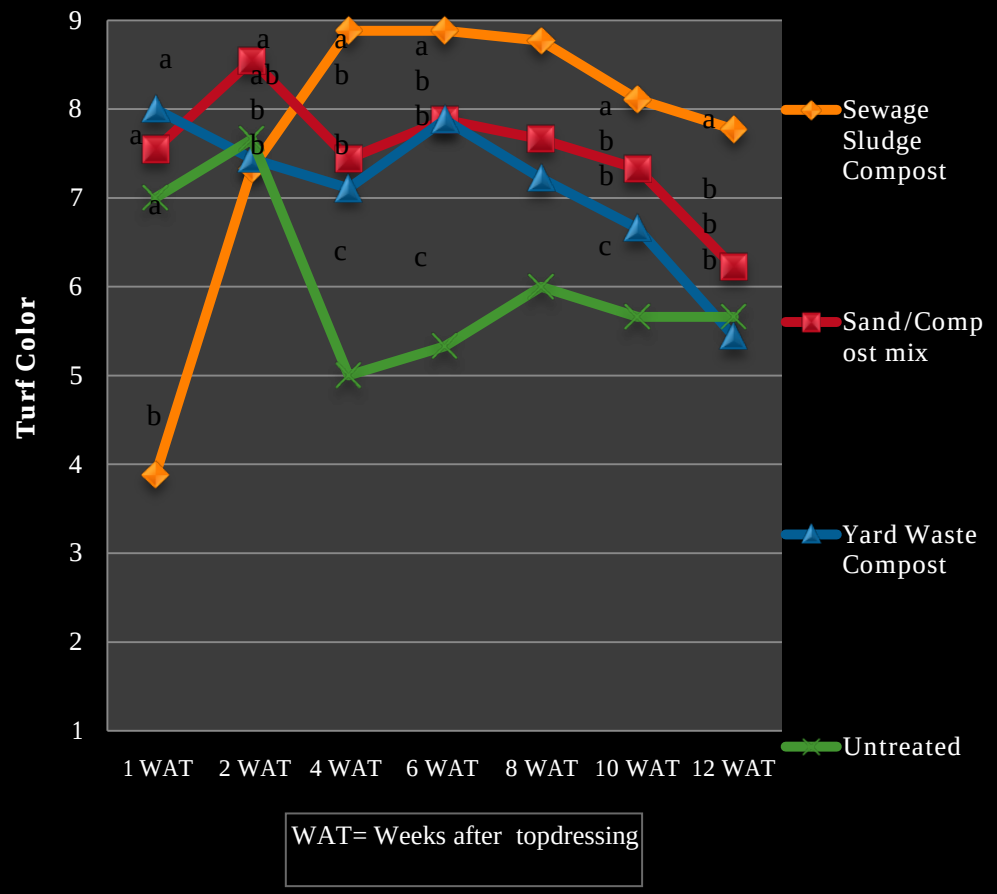
COMTIL

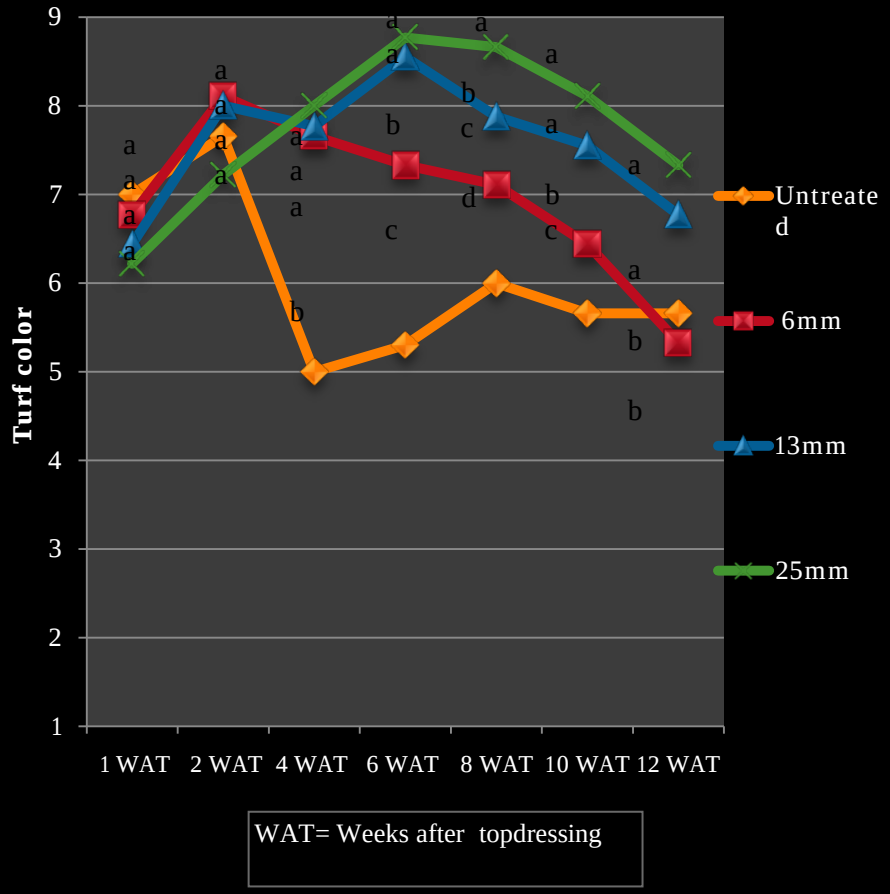
SAND/COMTIL MIX

YARD WASTE

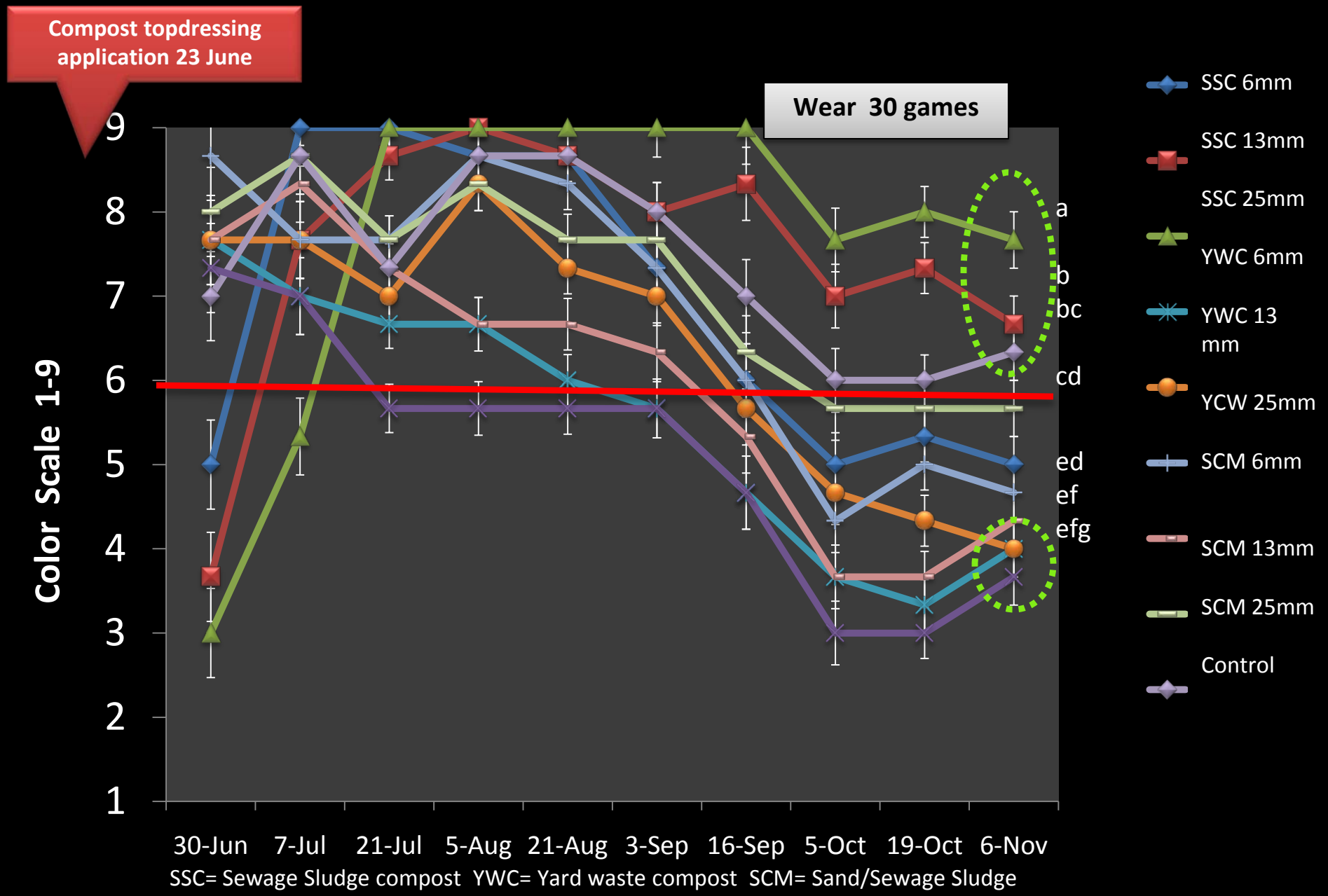
Some preliminary results

Turf color after 12 weeks of first compost topdressing application





Effects of Topdressing with Compost on Turf Color 2009



SSC= Sewage Sludge compost YWC= Yard waste compost SCM= Sand/Sewage Sludge

Table 2. Soil and playability characteristics as affected by compost topdressing, prior and after wear-traffic

Compost type	Compost rate	Bulk density upper 25 mm		Bulk density lower 50-75 mm		Soil compaction		Surface hardness		Rotational shear		Lateral shear	
		Sept 2009	Nov 2009	Sept 2009	Nov 2009	Sept 2009	Nov 2009	Sept 2009	Nov 2009	Sept 2009	Nov 2009	Sept 2009	Nov 2009
	mm	g/cm³		g/cm³		PSI		Gmax		Nm		Nm	
Sewage Sludge Compost	**6**	1.05 bc	1.293	1.286 bc	1.26 ab	110 bc	141.89 c	74.913 abc	82.277 b	96.333 abc	81.777	42.110 b	52.22 ab
	13	0.880 c	1.83	1.003 ef	1.256 ab	114.44 bc	168.89 bc	80.523 ab	83.943 ab	84.11 c	80.777	41 b	50.833 b
	25	0.886 c	1.323	0.946 f	1.196 b	146.67 ab	191.11 ab	84.933 a	92.890 a	88.777 bc	87.777	44.667 ab	54.780 ab
Yard Waste Compost	**6**	1.15 abc	1.436	1.073 efd	1.29 ab	120 bc	166.67 ab	79.750 abc	87.113 ab	99.89 ab	88.333	52.777 a	68.387 a
	13	1.13 abc	1.366	1.076 efd	1.3 a	113.33 bc	163.33 bc	76.107 abc	88.17 ab	93 abc	88.223	48.890 ab	65.443 ab
	25	0.983 c	1.346	1.173 ecd	1.246 ab	166.67 a	186.67 ab	72.303 abc	90.72 ab	87.89 bc	89.113	39.887 b	58.333 ab
Sand/Sewage Sludge Compost	**6**	1.403 ab	1.337	1.59 a	1.283 ab	120 bc	186.67 ab	81.650 ab	90.72 ab	104 a	88.557	54.333 a	62.553 ab
	13	1.167 abc	1.31	1.206 ecd	1.333 a	106.67 c	186.67 ab	68.6 bc	85.89 ab	89.223 bc	87.443	41 b	55.553 ab
	25	1.210 abc	1.34	1. 4 ab	1.266 ab	140 abc	216.67 a	65.503 c	84.39 ab	84 c	87	45.223 ab	48.78 b
Control	-	1.463 a	1.34	1.256 bcd	1.283 ab	122.78 bc	177.78 bc	75.340 abc	89.057 ab	97 abc	89	52.447 a	65.223 ab
	LSD (p=0.05)	0.364	ns	0.205	0.0997	37.367	36.19	14.566	10.191	14.041	ns	9.897	16.681

Means within a column not followed the same letter are significantly different at p=0.05. ns = not significant

•Soil compaction prior to wear was significantly higher with YWC at 25 mm, however after wear compaction was higher for SCM at 25mm

•Soil bulk density in the upper 25 mm prior to wear was significantly lower than control in plots topdressed with SSC at 13, 25 mm and YWC at 25mm

•Soil bulk density in the upper 25 mm increased after wear, however, no significant differences between treatments and control occurred

•**Soil bulk density increased after wear** with no significant differences between treatments the and control.

•Prior to and after wear, **surface hardness** resulted in **acceptable ranges** for football and rugby (10-100 Gmax, Baker, 1991) .

•**Rotational and lateral shear strengths were within the preferred (› 35Nm) and acceptable** (›25Nm) values for football and rugby (McClements and Baker, 1994).


June 2009


July 2009- 1 month after first topdressing application


RYAN

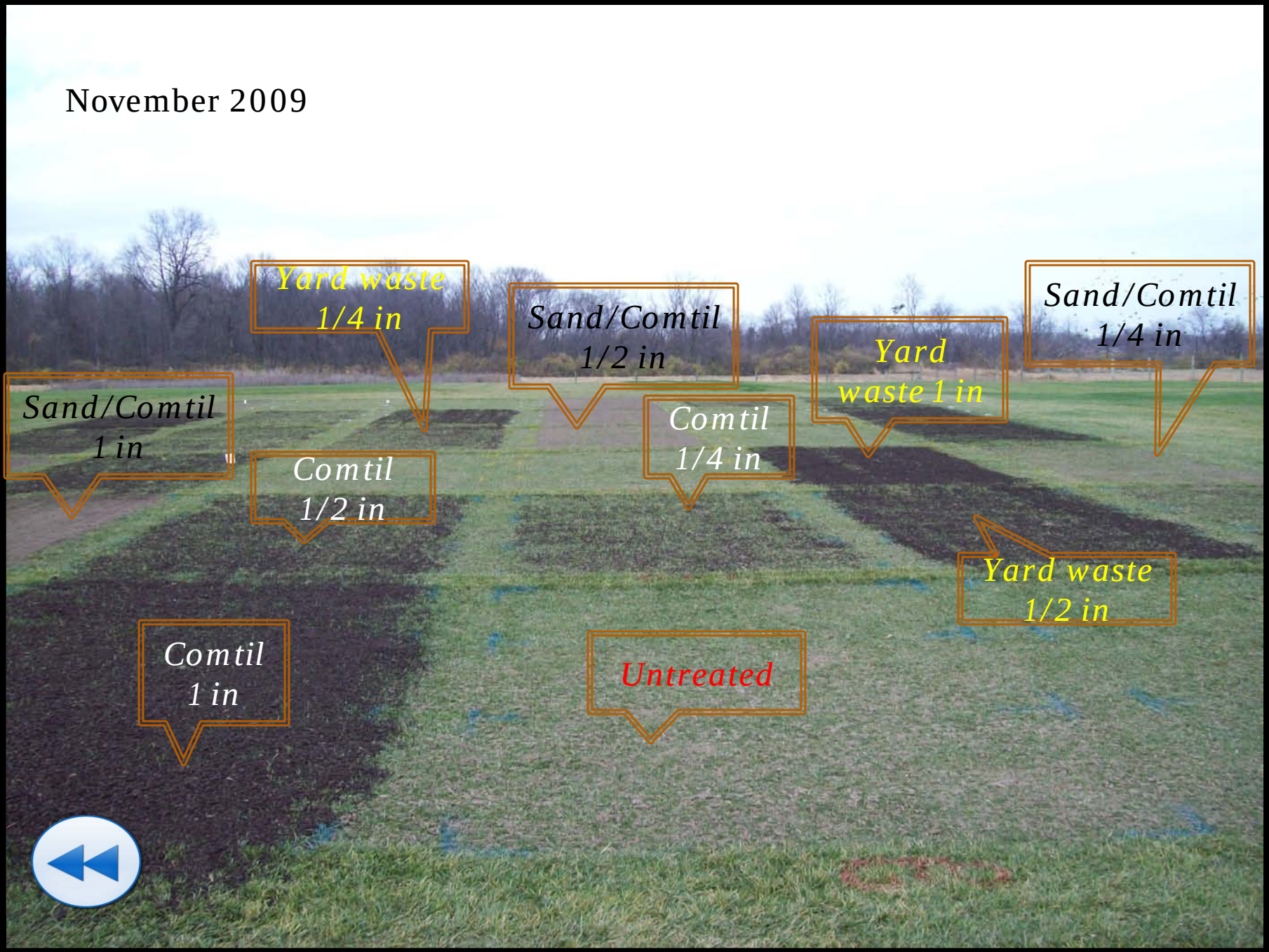

Bobcat


Bobcat
CHEVROLET


FAT


TURFCO

November 2009

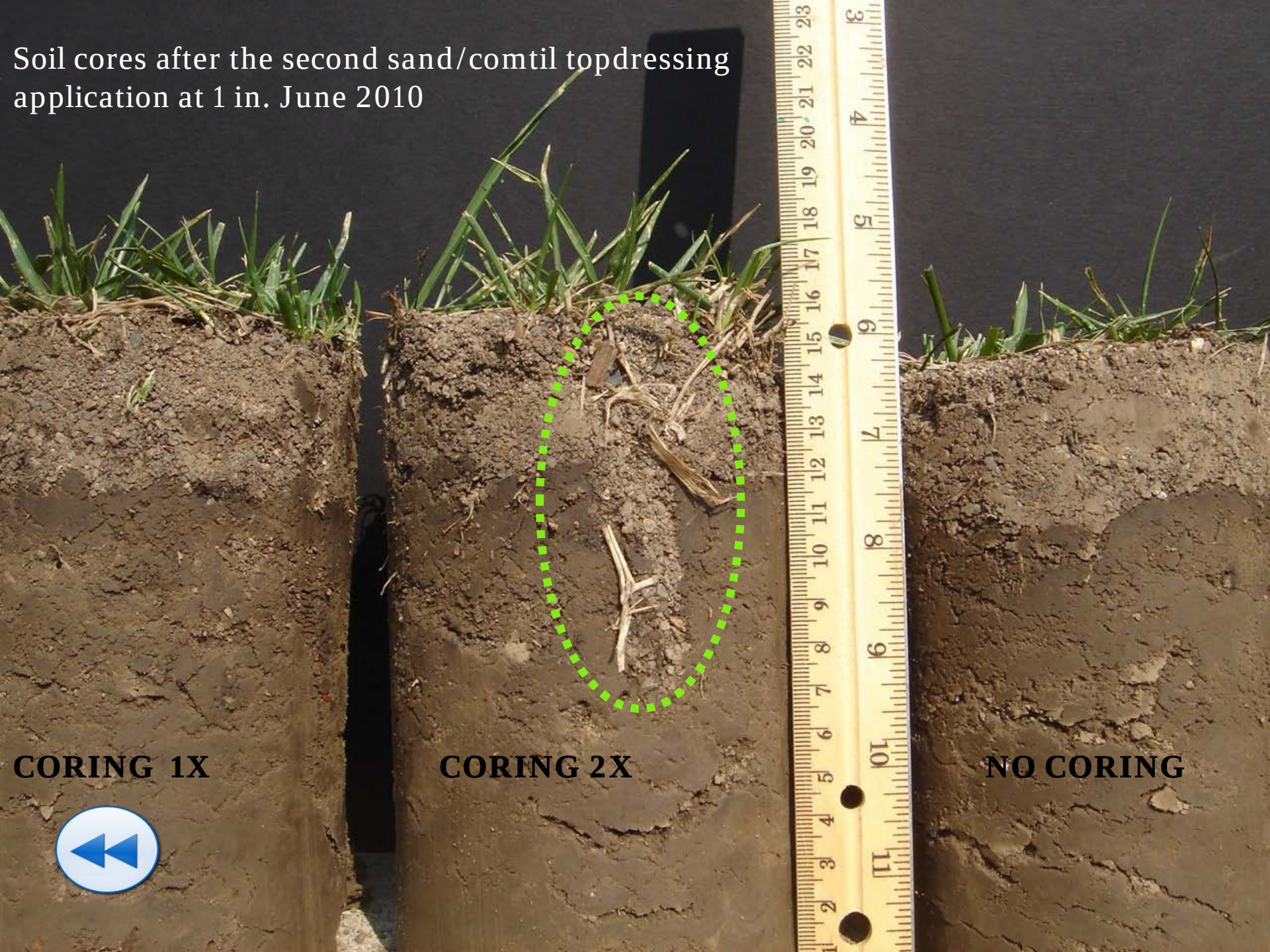



March 2010


01 April 2010


End of April 2010. First spring cut


June 2010


Soil cores after the second sand/comtil topdressing application at 1 in. June 2010
CORING 1X
CORING 2X
NO CORING


July 2010


September 2010


November 2010 after 30 games

November 2010

COMTIL




¼ in | ½ in | 1 in | CONTROL

YARD WASTE COMPOST

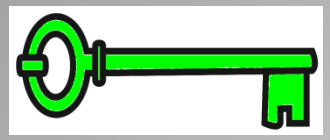



¼ in | ½ in | 1 in | CONTROL

SAND/COMTIL MIX




JANUARY 2011 (one week ago)



Bulking Agent

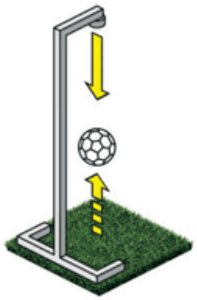
- Dry organic materials added to the compost mix to adjust aeration properties, provide structural suport and absorbs moisture
- Unique for each type of compost
- Types: wood chips, ground yardwaste, bark, sawdust, tires, etc
- EPA authorized : wood chips, straw & strover, shredded newspaper/cardboard, sawdust, shredded brush, biodegradable containers
- Bulking agent size ≤ ½ inch

Playability

How the surface interacts with the players and the ball

PLAYING QUALITY

- **Surface hardiness**
  - Ball rebound, ball roll and speed
  - Safe play
- **Surface traction**
  - Player movement (injuries or slipper)
- There are testing methods and acceptable ranges



Spreader with large hoopper

Modified manure spreaders with conveyor belts and brushes mounted on the back

Conventional tractor mounted fertilizer

Spreading the pile with a thin york rake or grading blade