The Built-up Sand Capped Athletic Field System

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Tifton, GA

High School Athletic Field

- Sports and community events
  - Football
  - Lacrosse
  - Soccer
  - Cheerleading
  - Marching band
  - Rugby
  - Track and field

Native Soil Athletic Fields

- High in silt and clay
  - Advantage
    - Stable when dry
  - Disadvantage
    - Low infiltration rates

During Heavy Rainfall

- Saturated field conditions
  - Decrease soil stability


40
50
40

Solutions

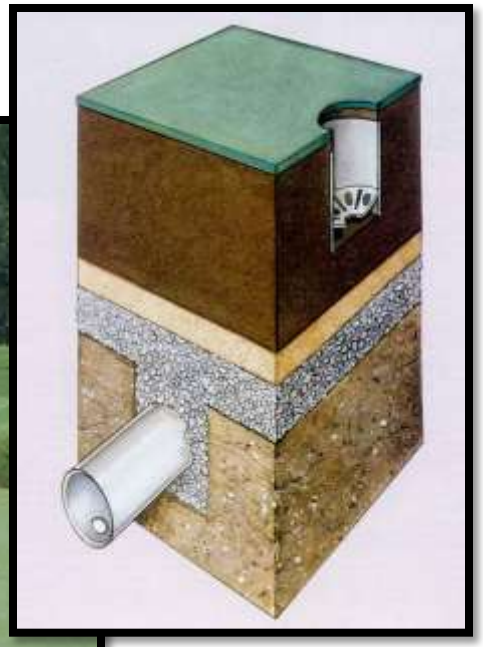
- Complete field renovation
  - Synthetic athletic field
    - $600,000 - 1,000,000

Complete Field Renovation

- Sand-based systems
  - Natural playing surface
  - Rapid infiltration rates
  - Maintain stability during periods of heavy use

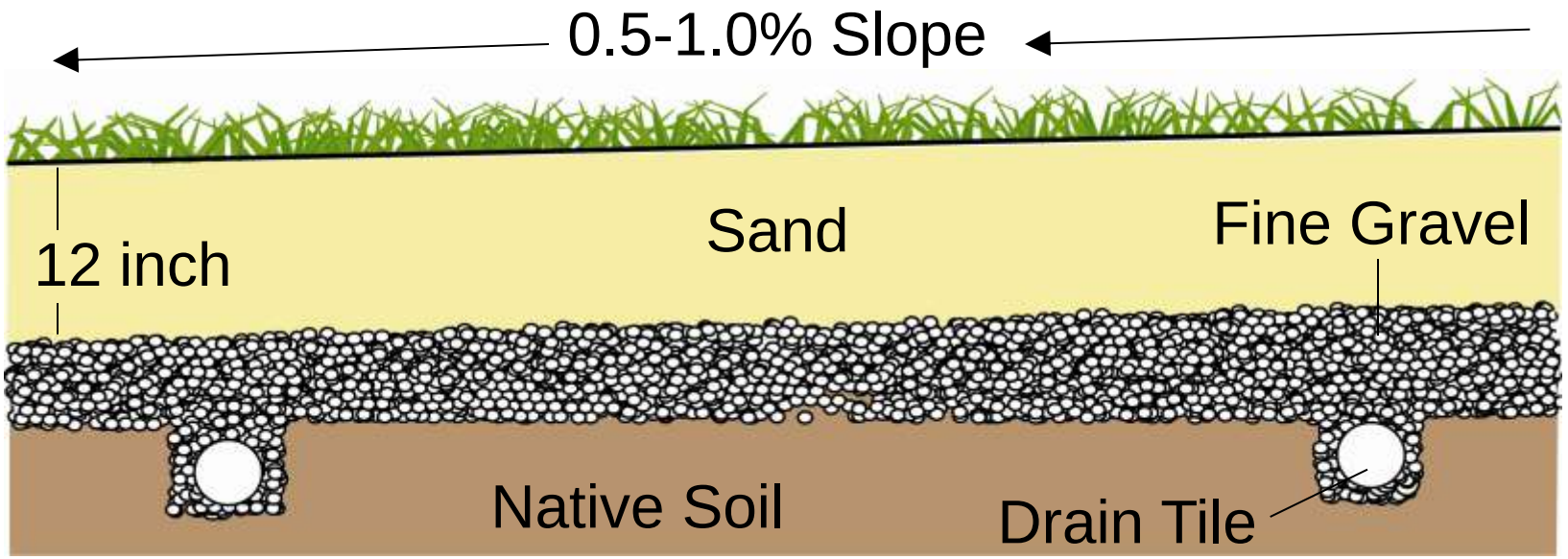
Sand-based Systems

- United States Golf Association (USGA)
  - USGA Green Section Staff, 1960



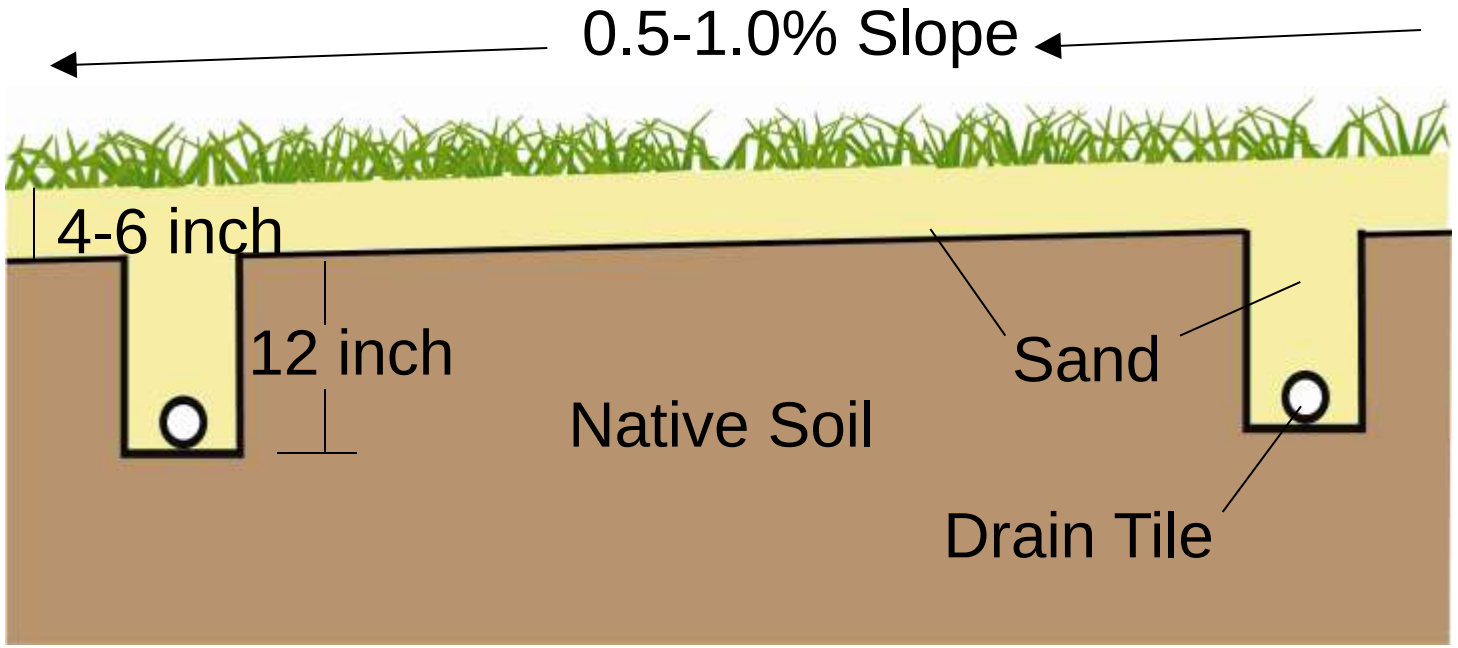
Sand-based Systems

- Conventional sand-based field
  - $400,000 - 600,000



Sand-based Systems

- Sand-capped system
  - $200,000 - 300,000



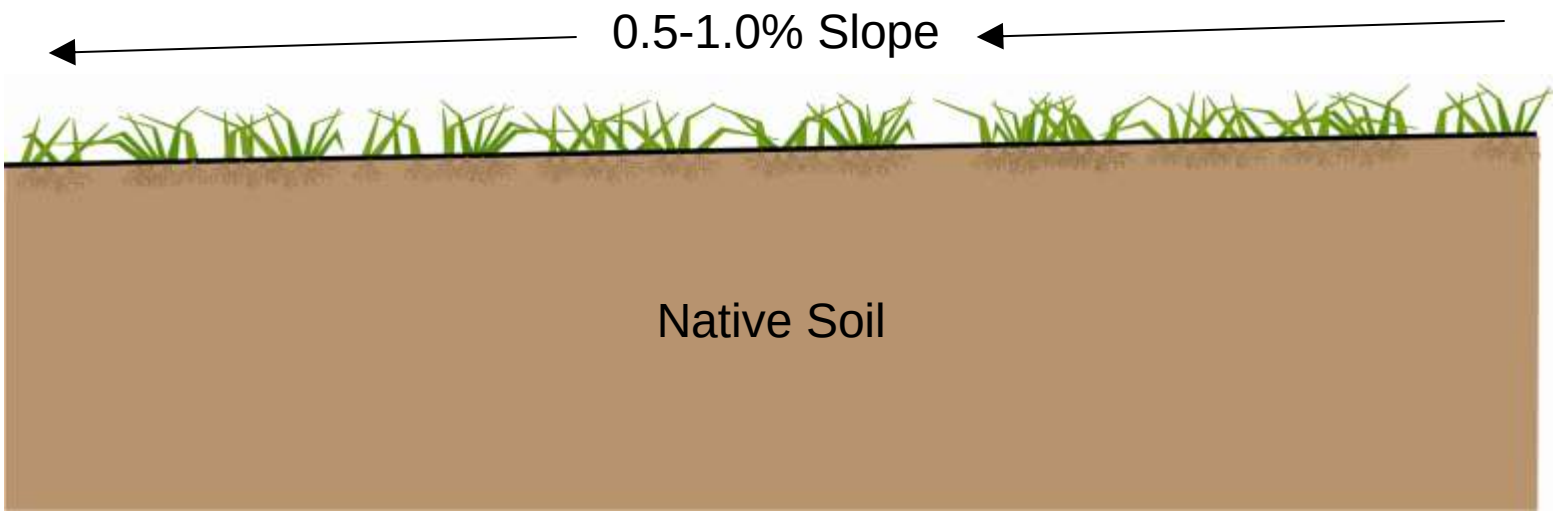
Complete Field Renovations

- Expensive
- Field temporarily useless

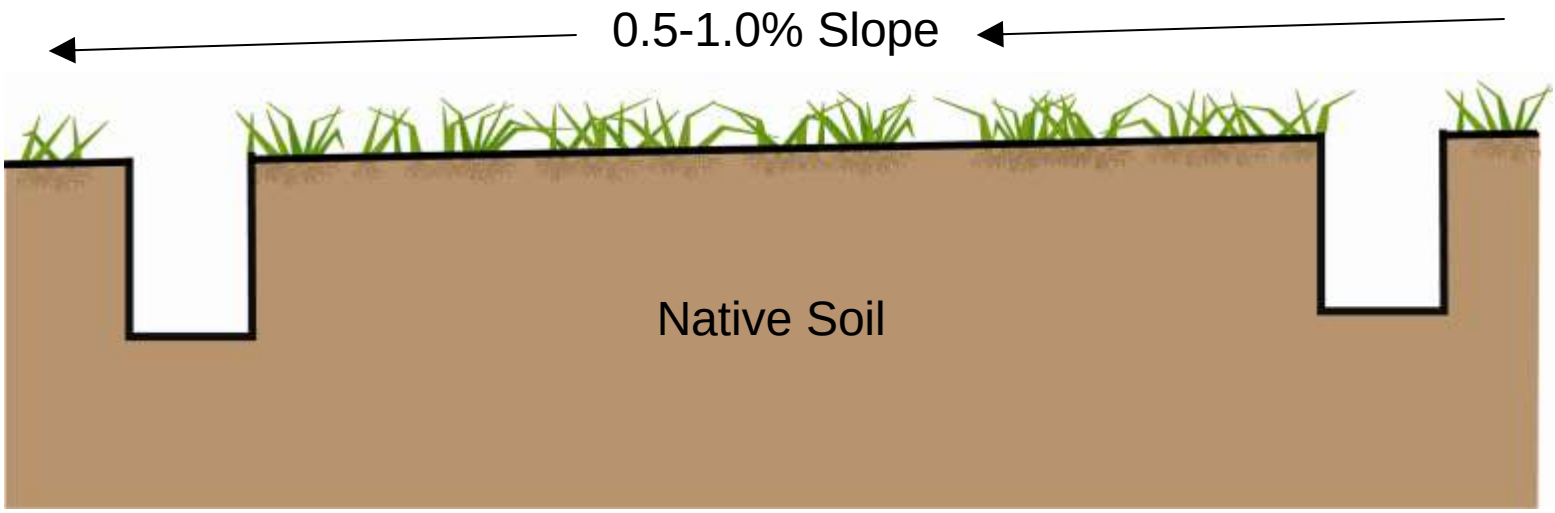
Alternative Renovation Process

- Intercept drain tile installation
- Cumulative topdressing
  - Built-up Sand Capped Athletic Field System

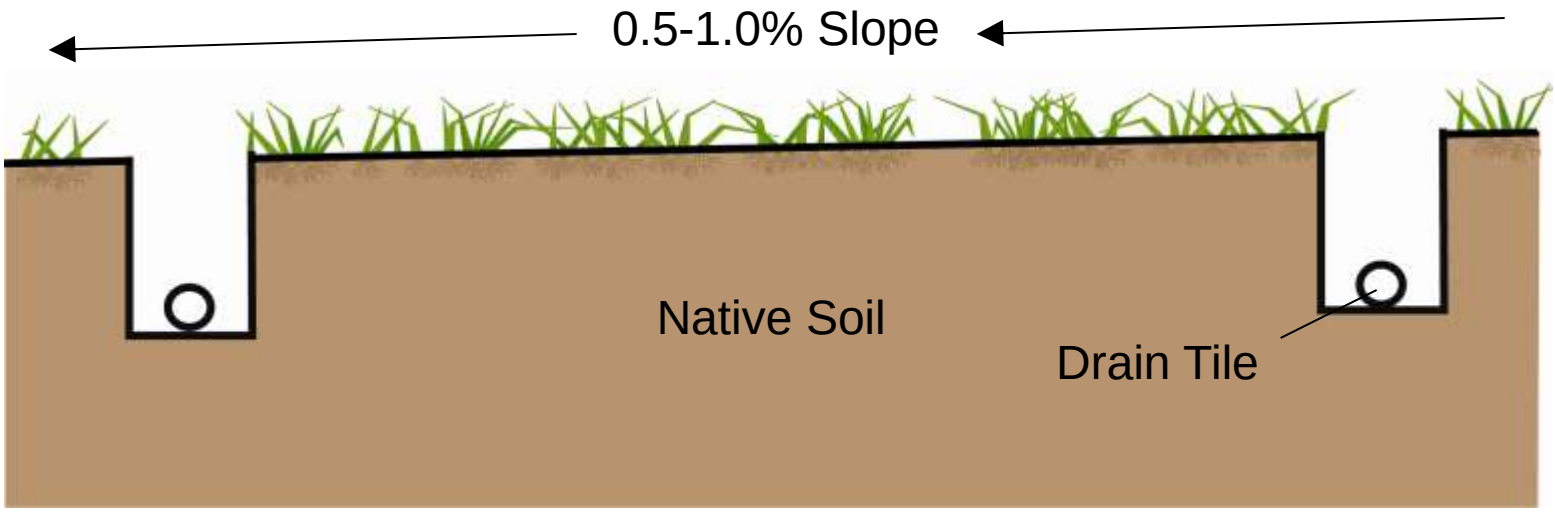
Native Soil Athletic Fields



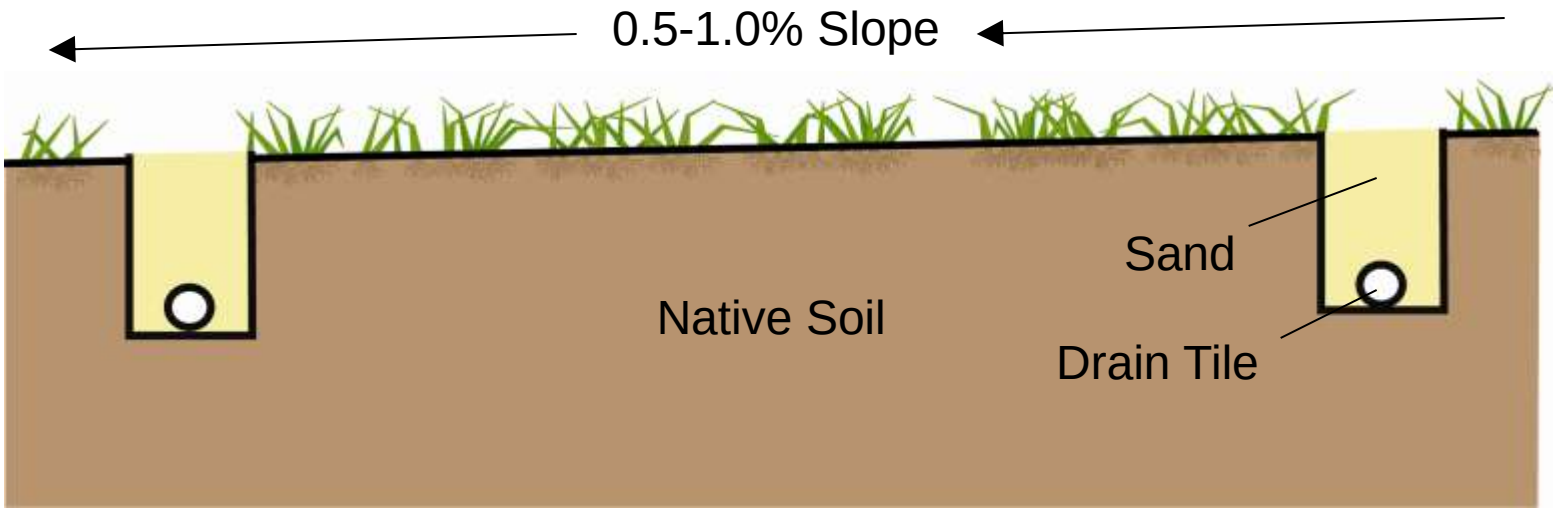
Cut Drain Lines



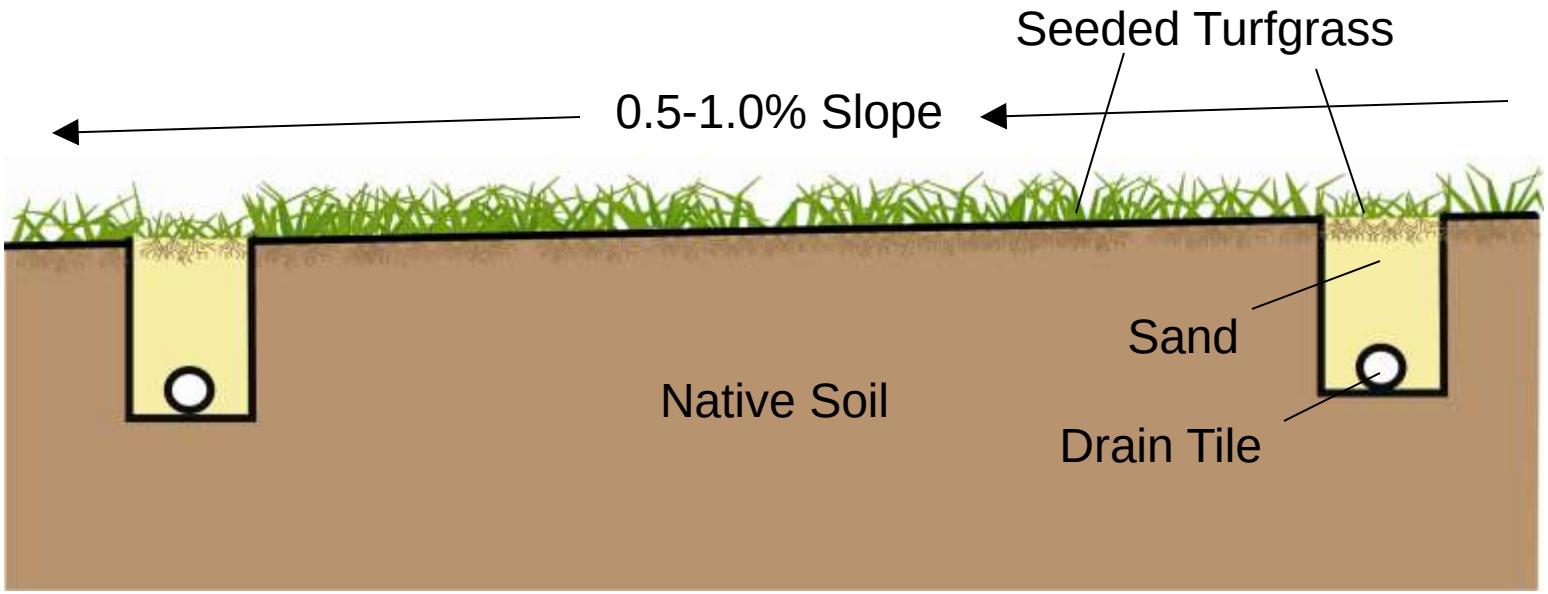
Install Drain Tiles



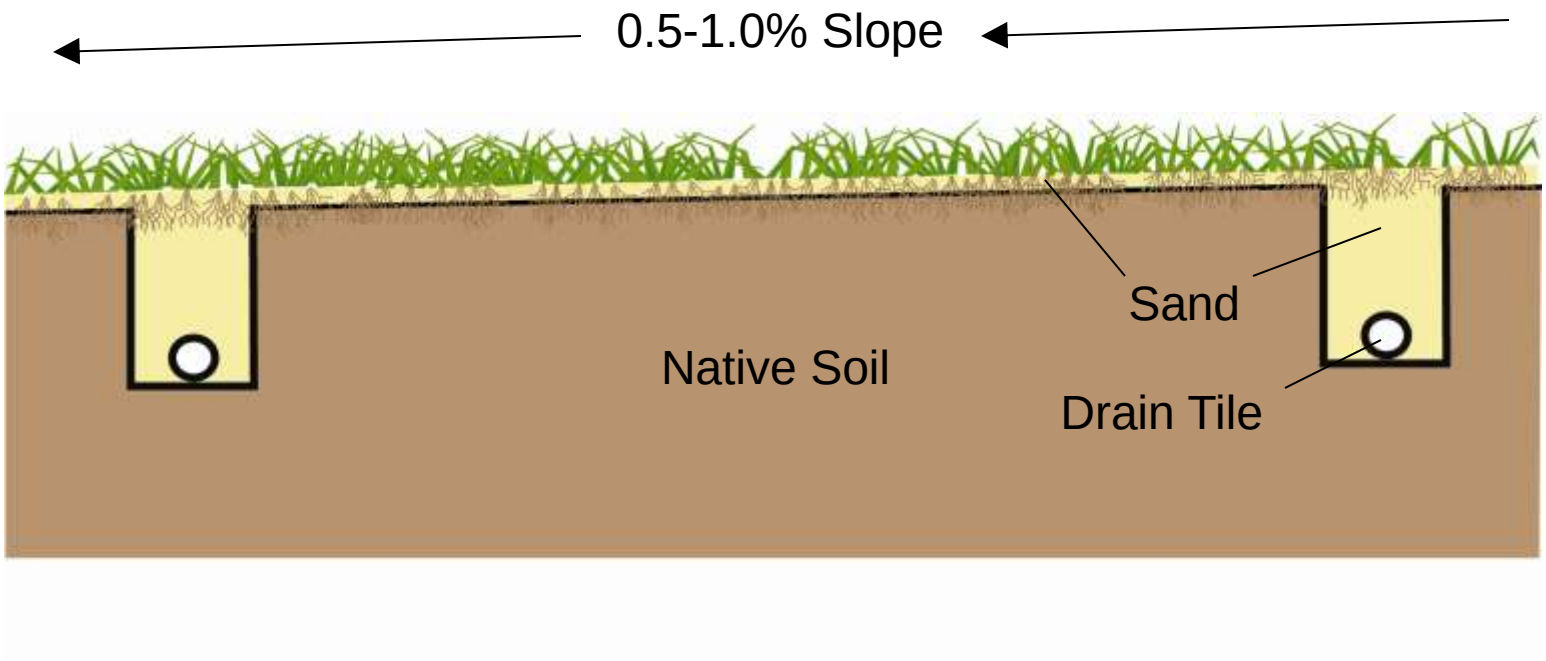
Fill Drain Lines with Sand



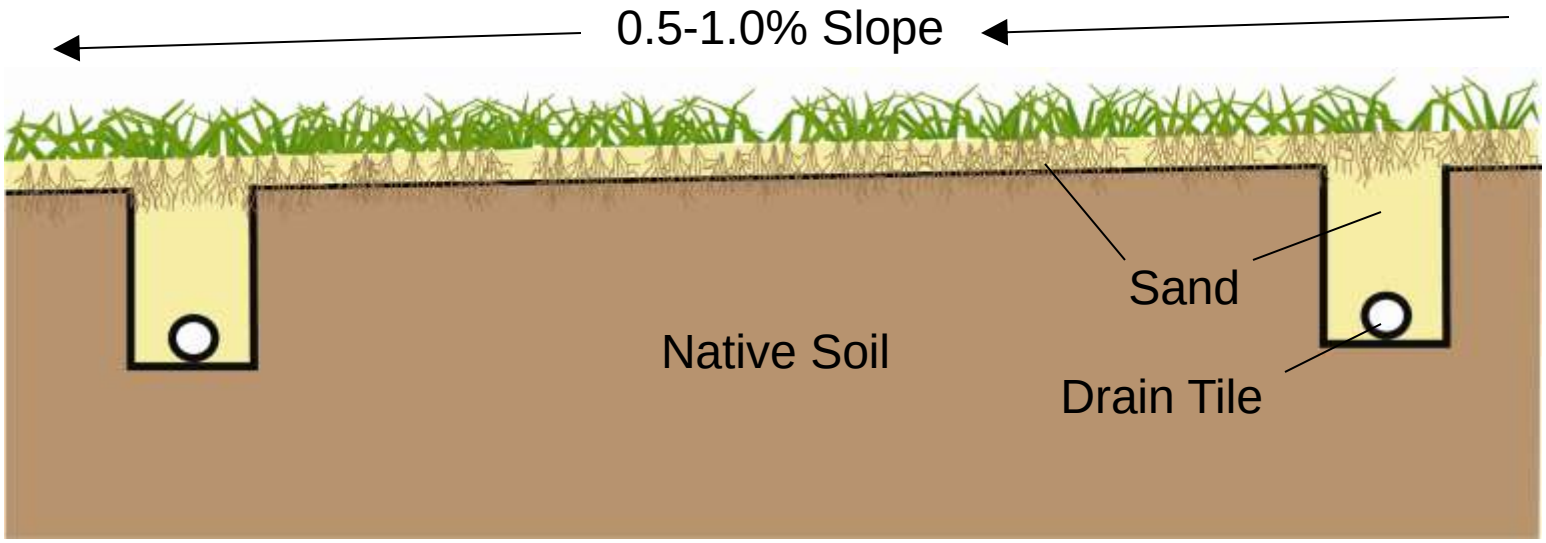
Inter-seed



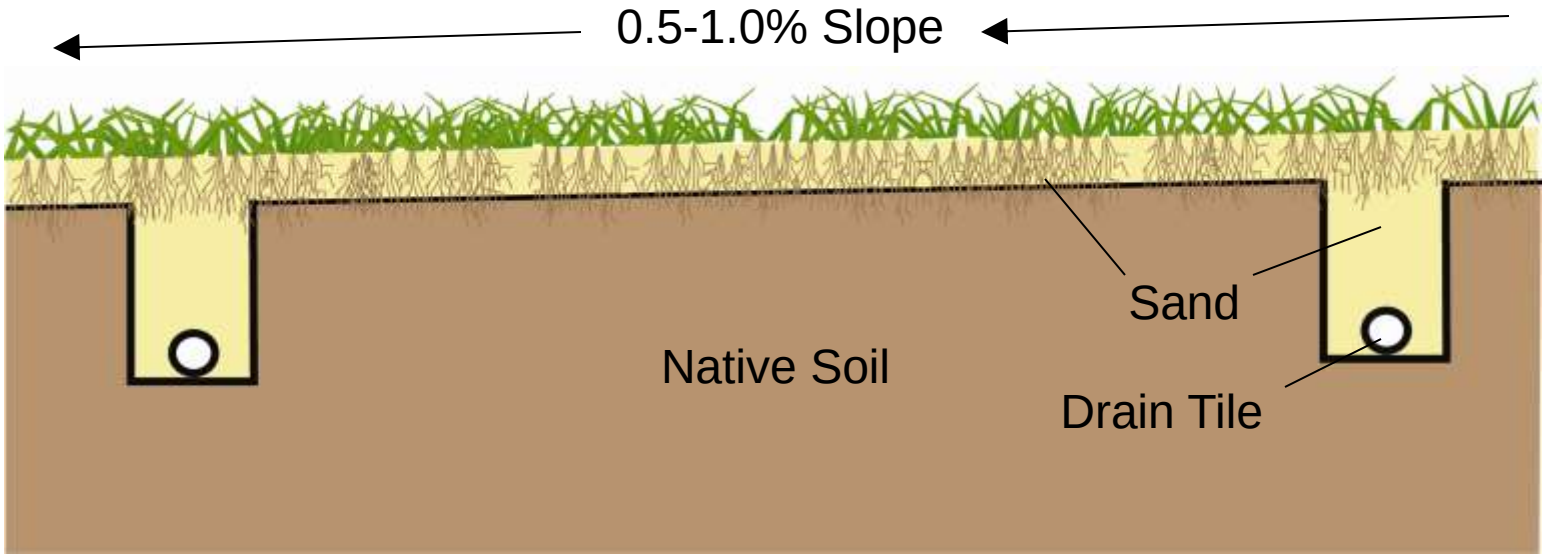
Sand Topdressing #1



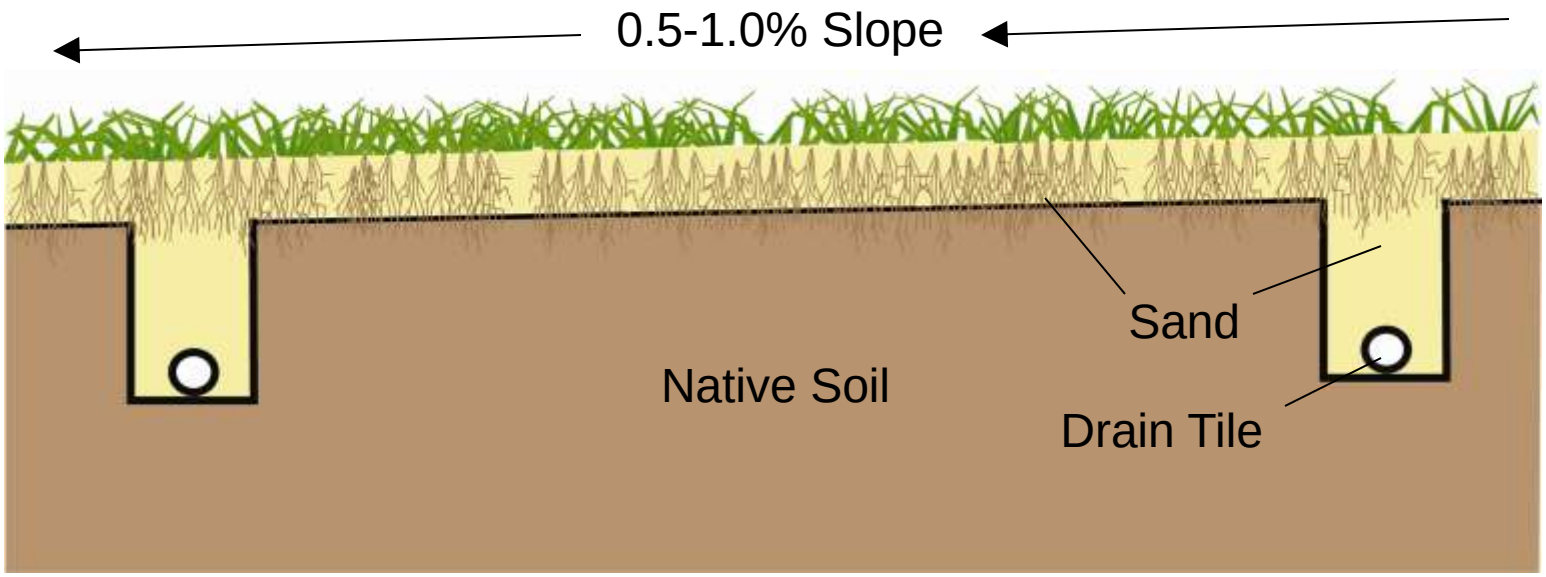
Sand Topdressing #2



Sand Topdressing #3



Sand Topdressing #4



Built-up Sand Capped System

- Benefits
  - Field is never totally out of play
  - Reduced installation cost

Built-up Sand Capped System

- Synthetic field
  - $600,000 - 1,000,000
- Conventional sand-based system
  - $400,000 - 600,000
- Sand-capped system
  - $200,000 - 300,000
- Built-up Sand Capped System
  - $144,800 – 156,000

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Built-up Sand Capped System

- Irrigation system
  - $15,000
- 6.5 ft drain tile spacing
  - $44,800-56,000
- 6 inch sand topdressing
  - $85,000

- Professional communication
  - Country Club Turf
  - Water Management Co.
  - J.W. Surge Inc.

Questions

Questions

- How many annual topdressing applications can be made?


Walnut Hills Country Club
rivate
3 inch in 30 yrs


3 inch in 3 yrs

Questions

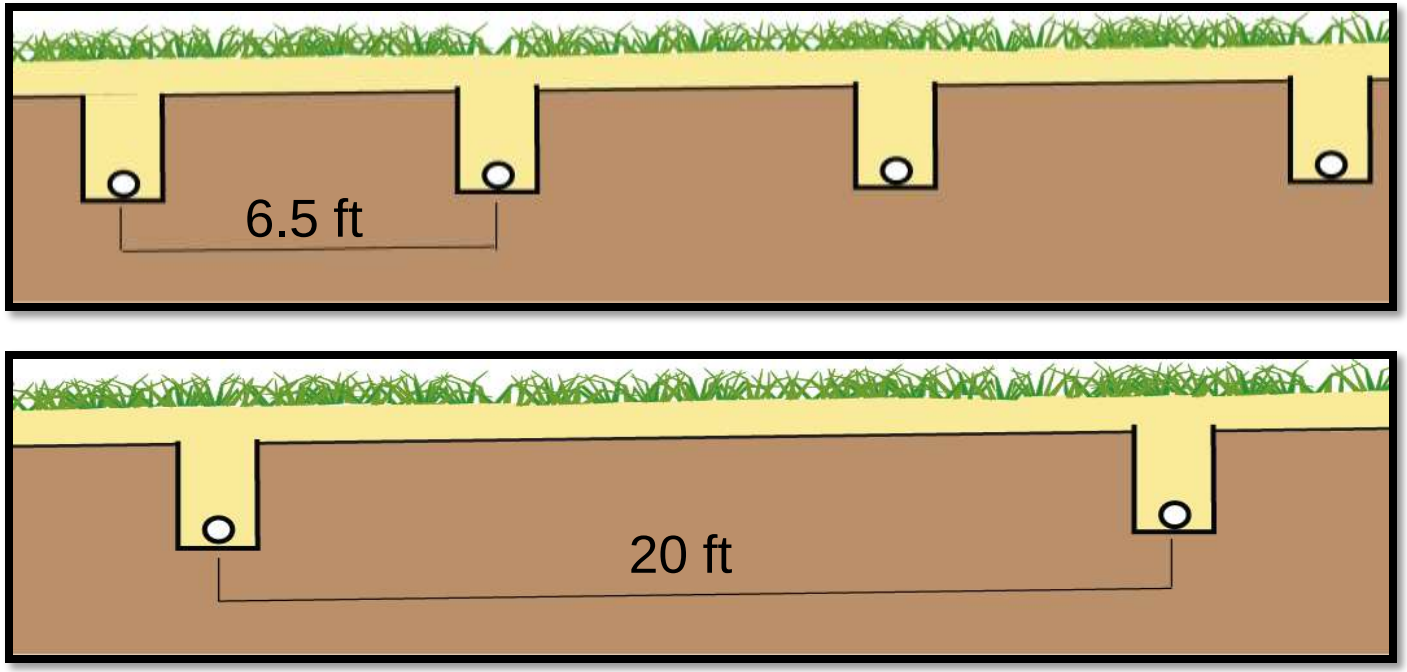
- How many annual topdressing applications can be made?

Questions

- How many annual topdressing applications can be made?
- When sand topdressing is included, what drain tile spacing is necessary to provide a dry and stable playing surface?

Current Recommendations

- Increase drain tile spacing
- Reduced sand topdressing depth
  - Further reduction in renovation cost



Questions

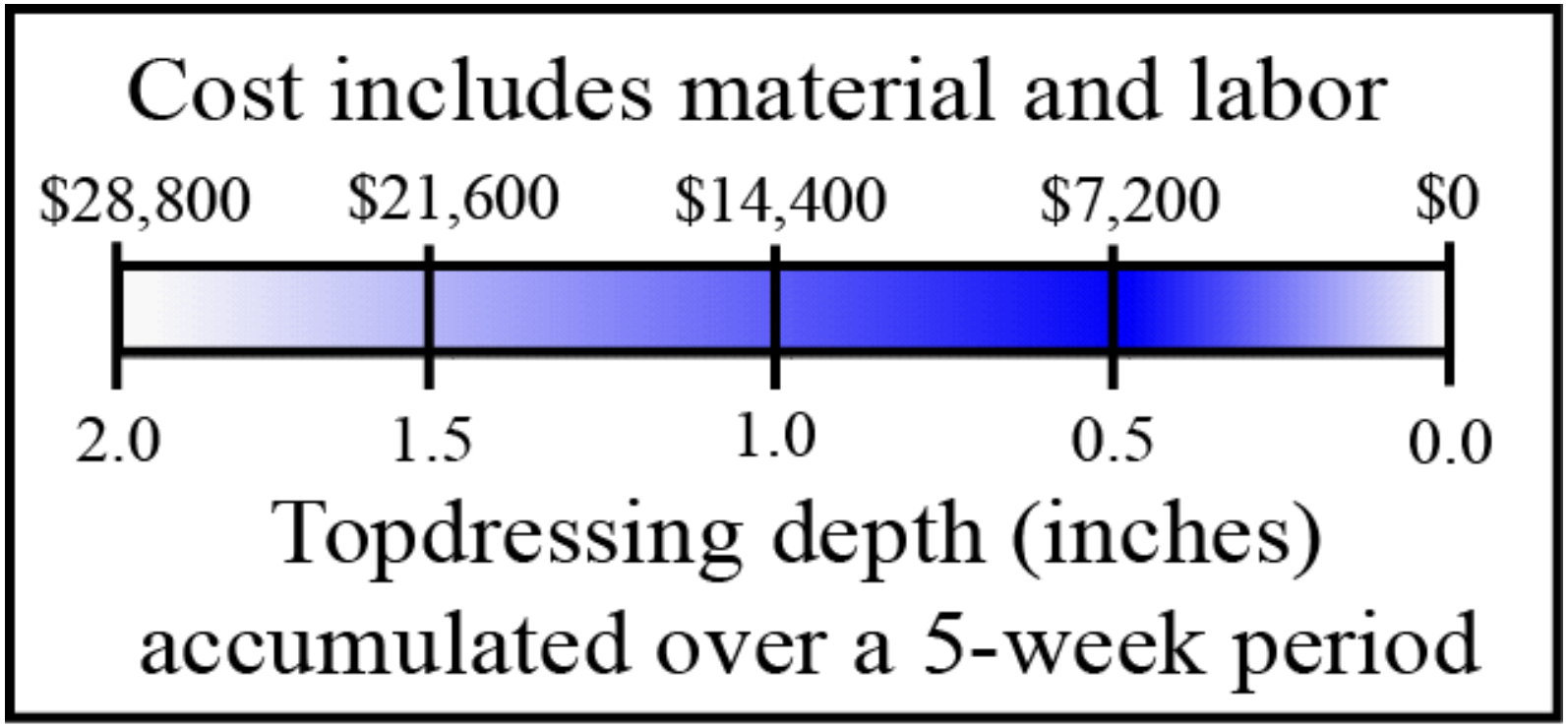
- How many annual topdressing applications can be made?
- When sand topdressing is included, what drain tile spacing is necessary to provide a dry and stable playing surface?

Questions

- Experiment 1
  - How many annual topdressing applications can be made?
- Experiment 2
  - When sand topdressing is included, what drain tile spacing is necessary to provide a dry and stable playing surface?

Results: Experiment 1

- Question
  - How many annual topdressing applications can be made?

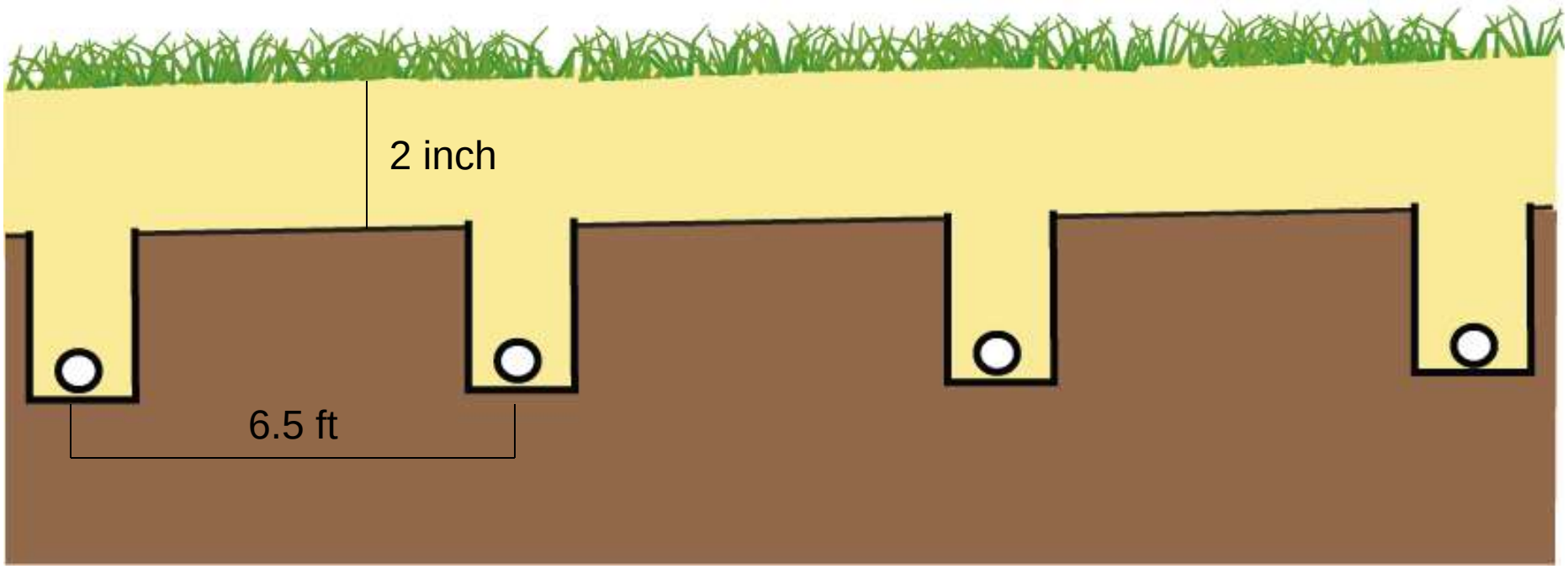


- Optimum turfgrass wear tolerance and surface stability characteristics
- Intermediate
- Minimal turfgrass wear tolerance and surface stability characteristics

Results: Experiment 2

- Question
  - When sand topdressing is included, what drain tile spacing is necessary to provide a dry and stable playing surface?

Results: Experiment 2



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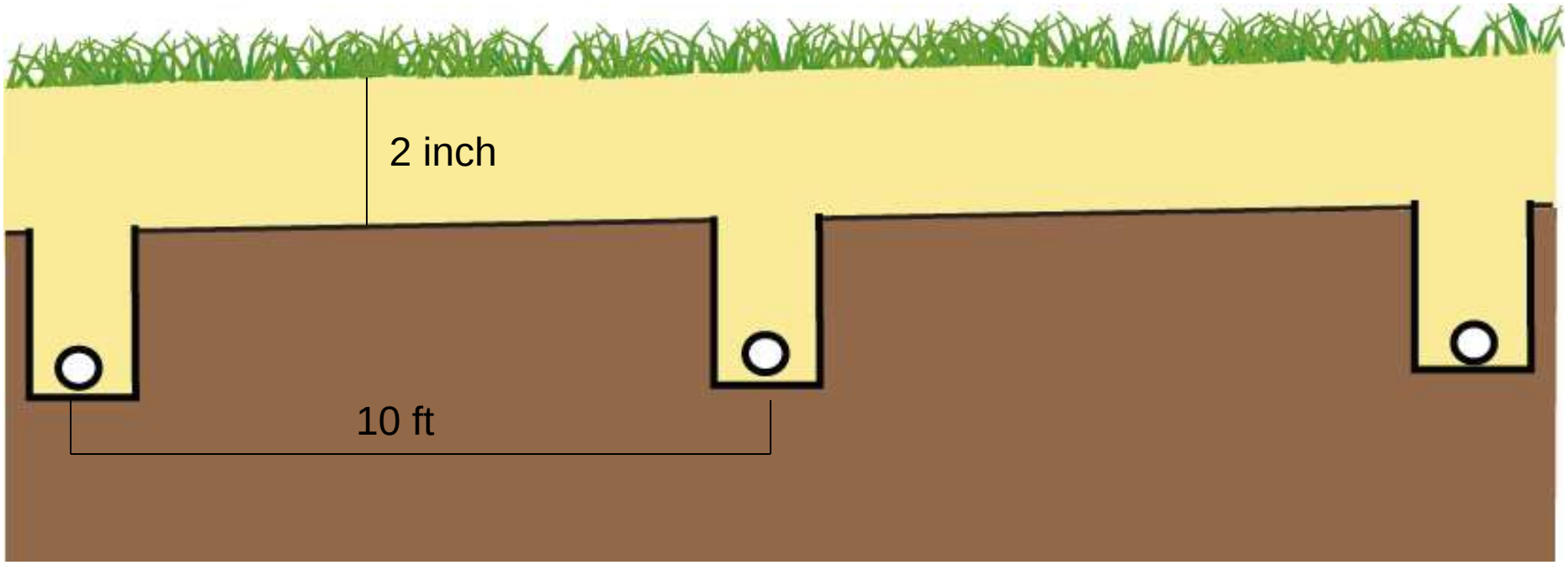

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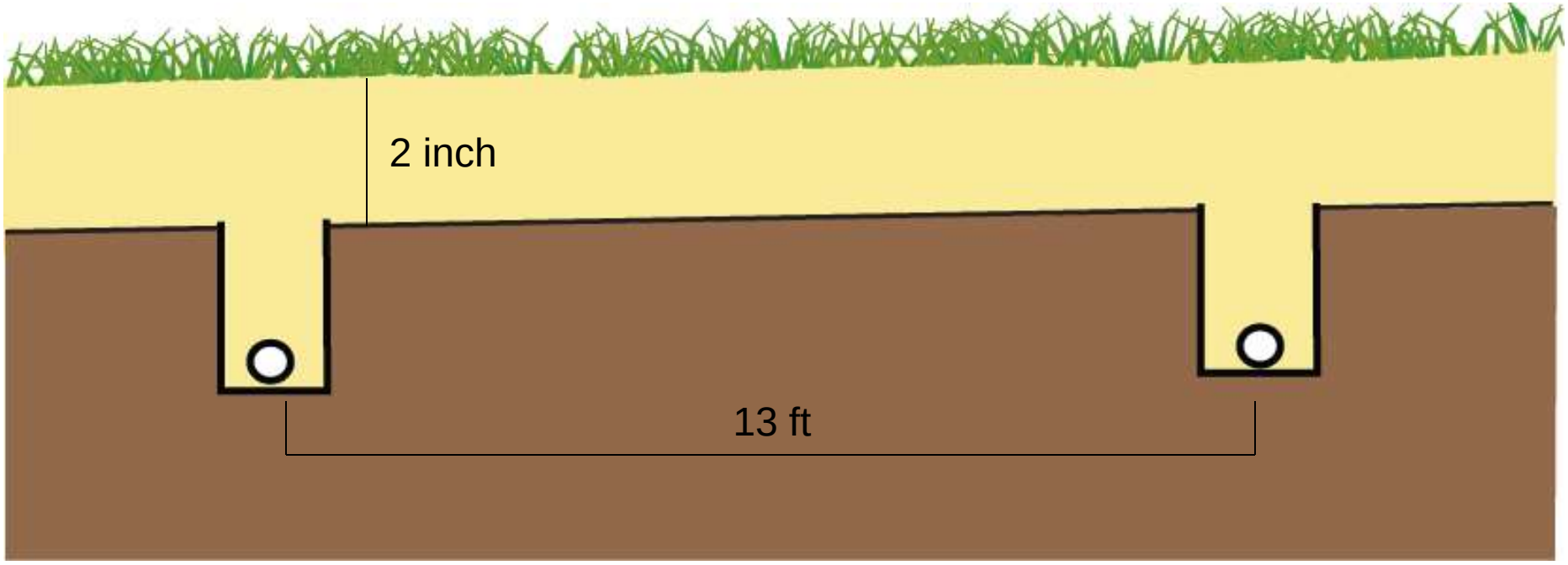

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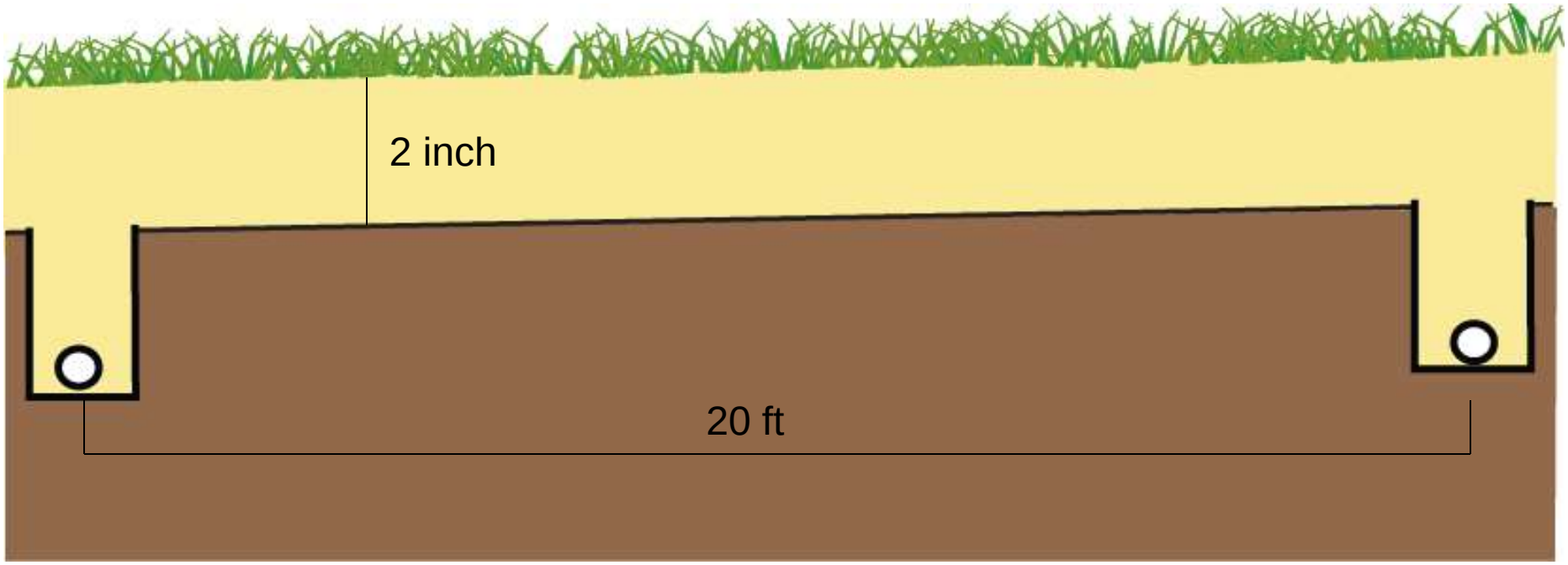
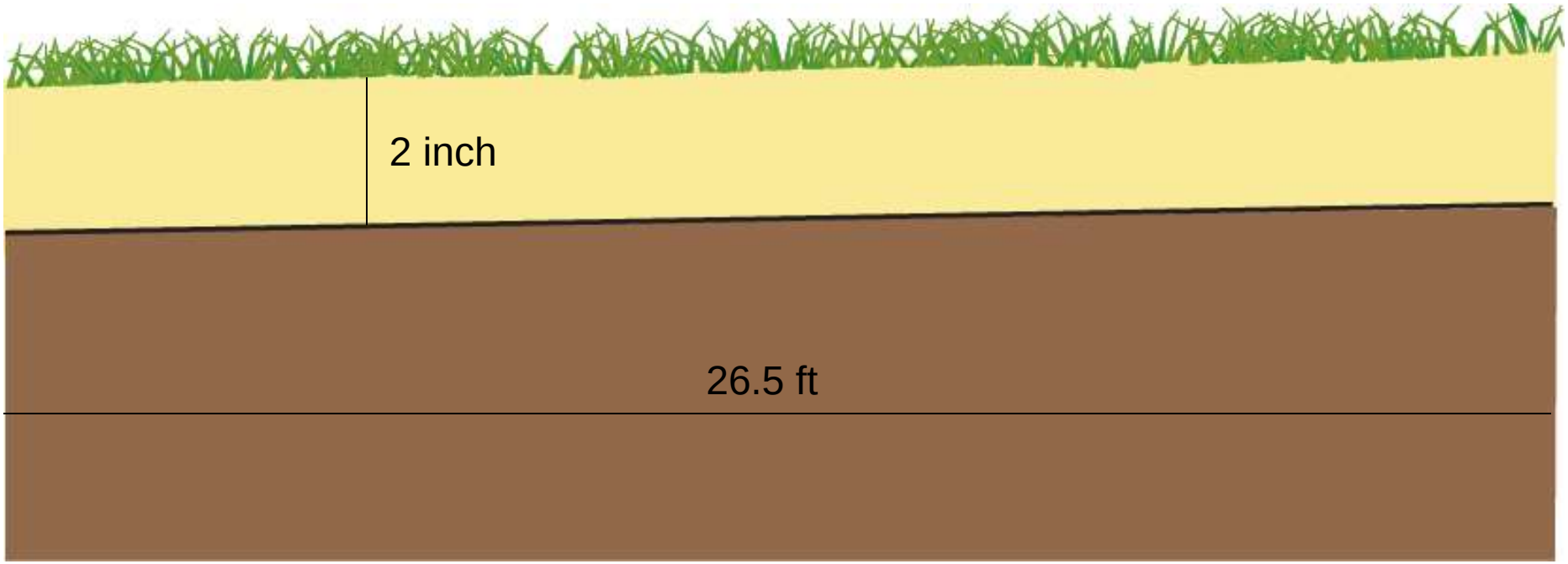
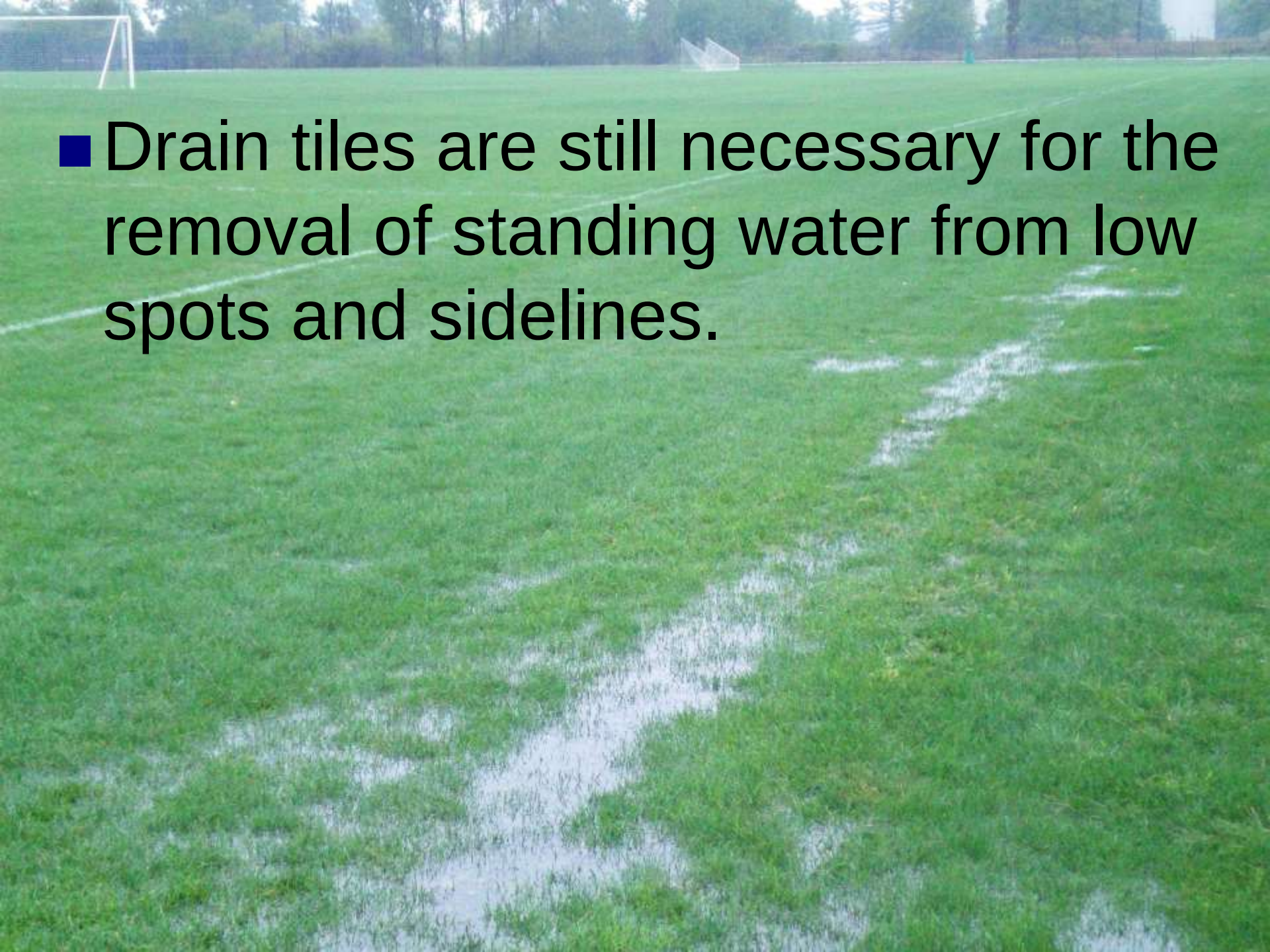


Results: Experiment 2

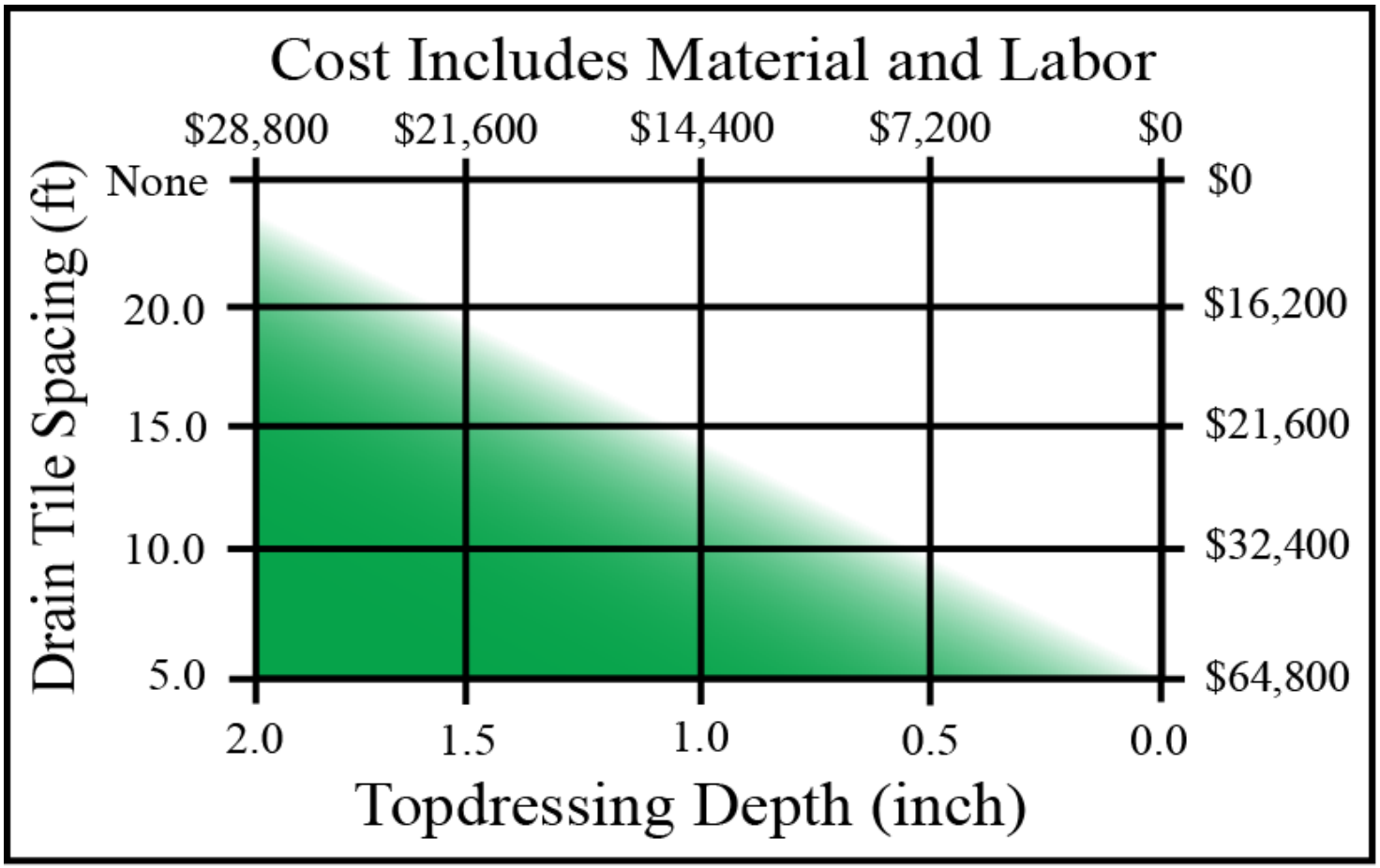


Results: Experiment 2

- Can topdressing alone provide an adequate playing surface without drain tile installation?



- Drain tiles are still necessary for the removal of standing water from low spots and sidelines.



Optimum drainage characteristics and surface stability.

Intermediate drainage characteristics and surface stability.

Minimal drainage characteristics and surface stability.

Overall Conclusions

- New recommendations
  - Irrigation system
    - $15,000
  - 13 ft drain tile spacing
    - $22,400-28,000
  - 2 inches sand topdressing
    - $28,800
  - Total
    - $66,200-71,800
- Old recommendations
  - $144,800-156,000

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  - Irrigation system
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Built-up Sand Capped Systems

- Grand Blanc football field
  - 2007
- Okemos practice field
  - 2007
- Novi soccer complex
  - 2007
- Okemos soccer field
  - 2008
- Okemos football field
  - 2008
- MSU Intramural
  - 2008
- Marshall soccer field
  - 2009
- Sheppard football field
  - 2009
- East Lansing football field
  - 2010
- Michigan Center football field
  - 2010

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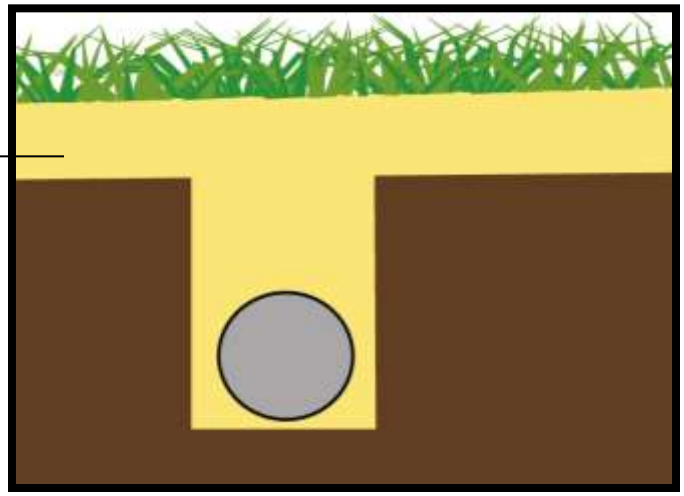
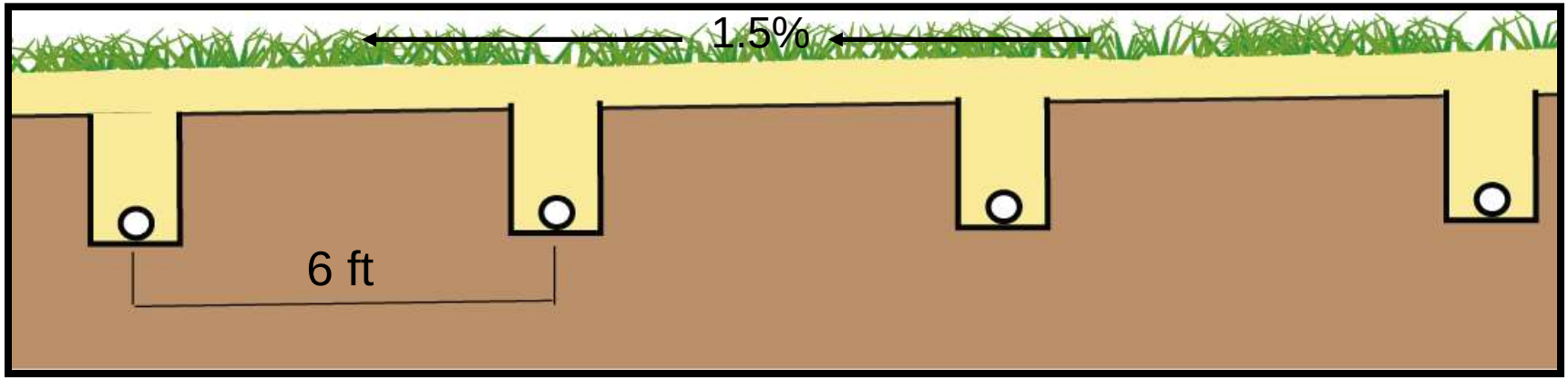
Case Studies

Grand Blanc High School

- May 2007



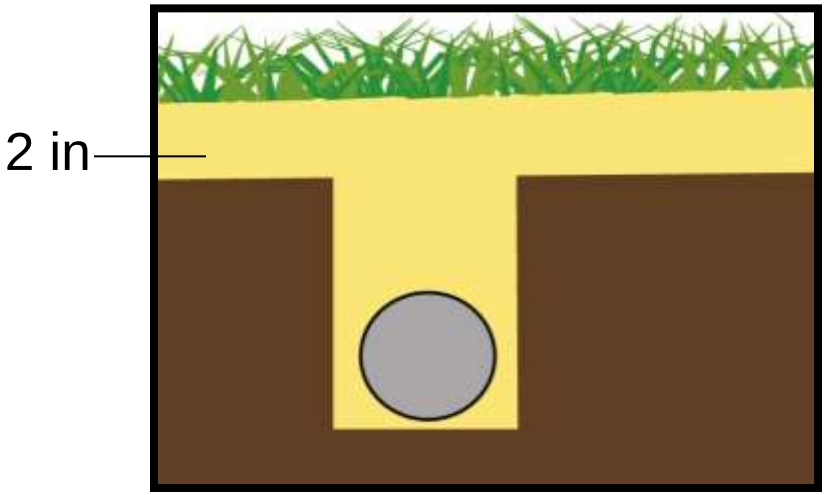


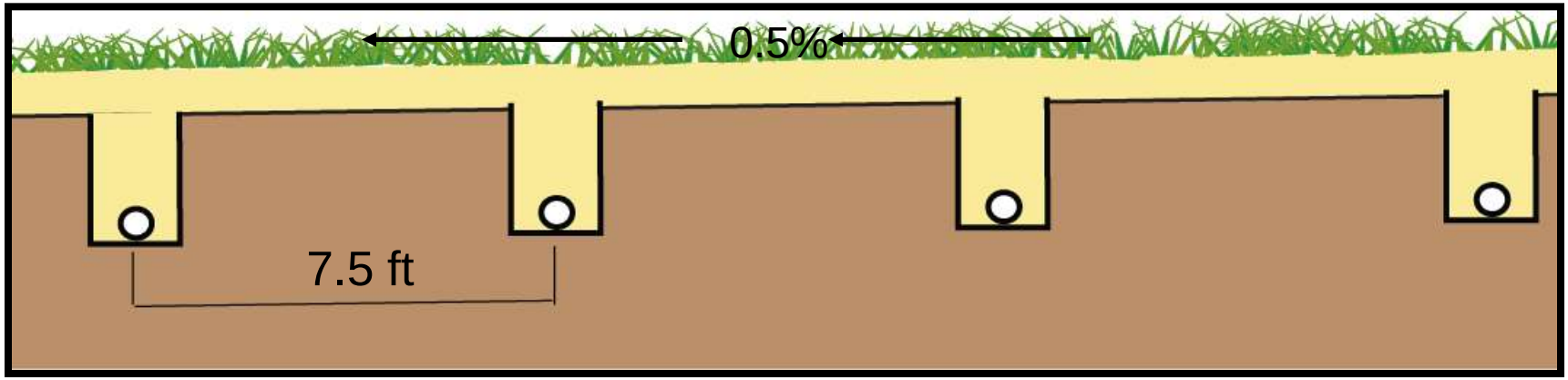
Grand Blanc HS – Dec. 2007

Grand Blanc HS – May 2009

Okemos High School

- Aug. 2007





Okemos Practice Field - Nov. 3, 2008

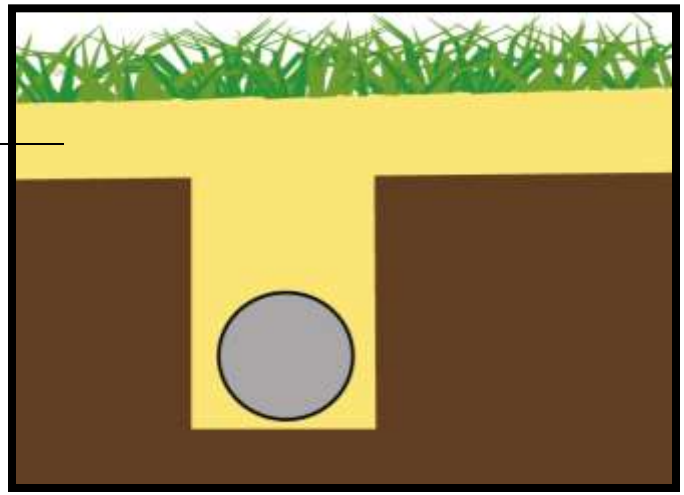
Okemos Practice Field – June 15, 2010

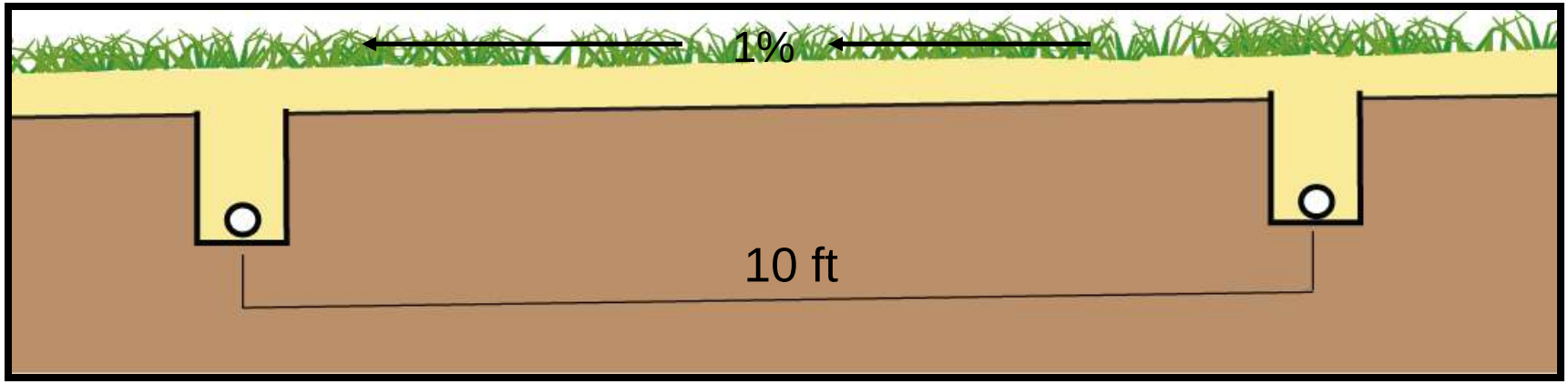
Maintenance

- Moles
  - Talpirid (bromethalin)
    - 20 worms/$35
  - Spring traps

MSU Intramural (IM)

- July 2008





MSU Intramural (IM)

- July 2008

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- July 2008

MSU Intramural (IM)

- July 2008

MSU IM Field – Oct. 27, 2008

- Knotweed
  - Summer annual

MSU IM Field – June 16, 2009

Maintenance

- Cultivation
  - 20% affected surface area
- Topdressing
  - 0.25 inch annually

Maintenance

- Oct. 31, 2009

- Control
- 2 inches in 2 years
  - 0.25 inch maintenance

Maintenance

- Hollow tine core cultivation
  - Remove cores if native soil is excavated
- Solid tine core cultivation
  - No organic matter removal

Maintenance

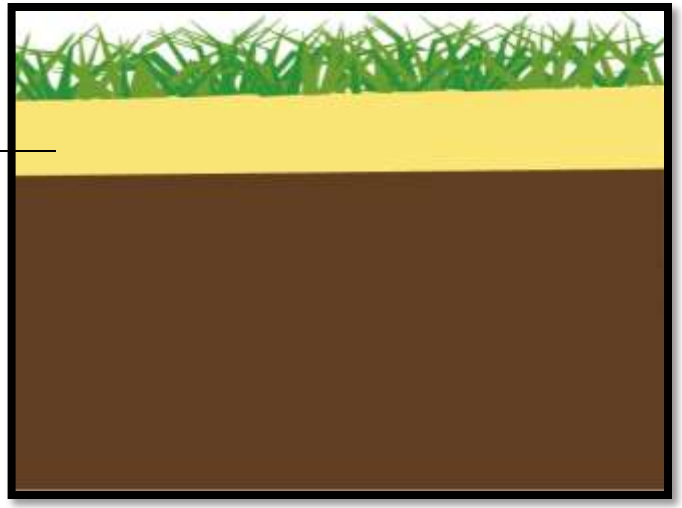
- Vertical mowing

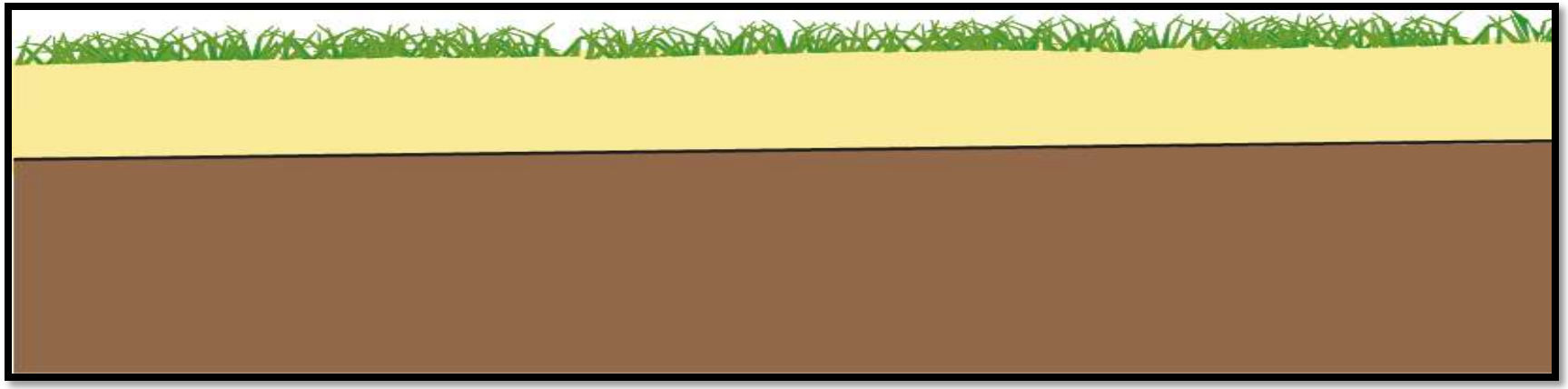
MSU IM Field – Oct. 21, 2009

Munn Field, MSU IM – Oct. 21, 2009

MSU IM Field 2

- July 2009



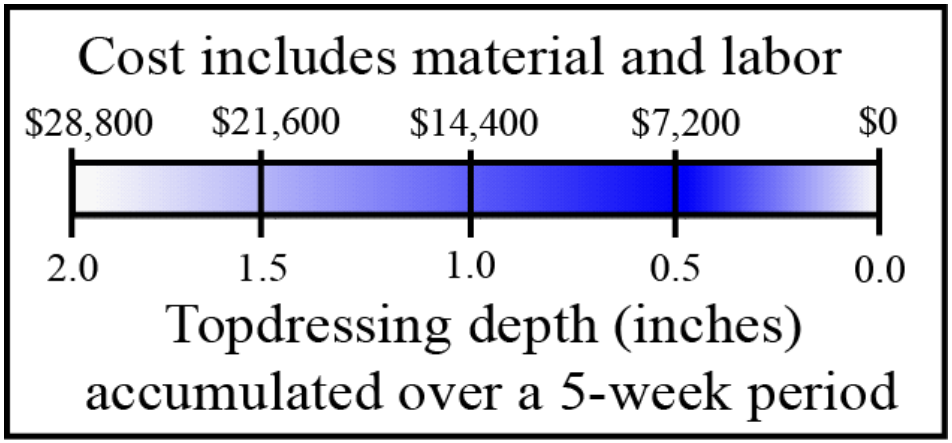


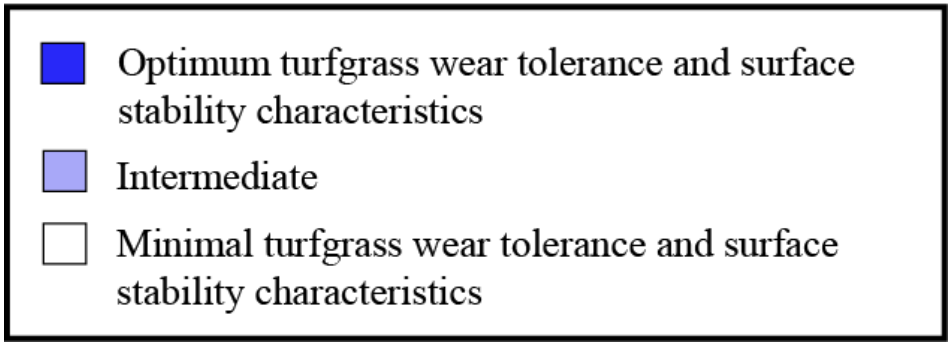
MSU IM Field 2 – Oct. 21, 2009

MSU IM Field 2 – Oct. 21, 2009

2012 Research

- Experiment 1
  - How many annual topdressing applications can be made?
- Recommendations
  - Kentucky bluegrass





2012 Research

- Experiment 1
  - How many annual topdressing applications can be made?

- Recommendations
  - ‘Tifway’ bermudagrass

2012 Research

- Experimental design
  - RCBD, 3 replications
- Topdressing depth (inches/5-weeks)
  - 0.5 inch
  - 1.0 inch
  - 1.5 inch
  - 2.0 inch
- Response variables
  - Quality (1-9 scale)
  - Surface strength (Nm)
  - Sod strength (Nm)

2012 Research

- Hybrid bermudagrass topdressing rates…
  - Built-up Sand Capped Athletic Field System
  - Renovating sand-based systems with sod

Extensive organic matter accumulation over a sand-based system, Lansing Lugnuts

Removing existing turfgrass and organic matter layer, Lansing Lugnuts

Harvesting new sod from HTRC, East Lansing, MI

1 inch topdressing layer accumulated over a 3 month period, Kentucky bluegrass

Harvesting new sod from HTRC, East Lansing, MI

Questions?

- Contact information
  - Alec Kowalewski
    - akowalewski@abac.edu
- Extension bulletin
  - Sand-capped build-up systems
    - http://www.turf.msu.edu/built-up-sand-capped-athletic-field-system
- Publications
  - Soil Science. 2011. 76(3).
  - Hort Technology. 2010. 20(5).
  - Applied Turfgrass Science. doi:10.1094/ATS-2011-1223-01-RS.

More Questions = More Research

- Topdressing material
  - 90% sand – 10% silt+clay
    - $14,400/1.0 inch (72,000 ft^2)
      - 375 tons
    - $14,400/375 tons = $38/ton
  - Alternative topdressing material
    - $10/ton




Objectives

- Evaluate the effects of various topdressing materials on the fall wear tolerance and surface stability of a well established turfgrass stand

Materials and Methods

- Research initiated Apr. 17, 2008
- Hancock Turfgrass Research Center
  - East Lansing, MI
- Kentucky bluegrass seeded in 2005
  - 24.7% ‘Showcase’
  - 24.6% ‘Rugby II’,
  - 24.5% ‘Midnight’
  - 24.5% ‘P 105’
- Native soil
  - Sandy loam

Materials and Methods

- Treatments
  - Topdressing
    - 8 applications @ ¼ inch
      - May 29 - Sep. 14, 08
  - Sand topdressing material
    - Sand #1
    - Sand #2
    - Sand #3
    - Sand #4

2.0 inch sand topdressing layer, accumulated over a 3.5 month period, 2008.

Materials and Methods

	Sand #1	Sand #2	Sand #3	Sand #4
Particel Size (mm)	Sieve fraction sand particle diameter (% retained)			
>2.0	0.1	0.3	0.0	23.7
1.0-2.0	3.7	9.1	0.1	17.2
0.5-1.0	24.0	19.9	2.6	20.4
0.25-0.5	45.8	39.3	69.2	23.7
0.1-0.25	23.1	18.7	27.3	11.6
0.05-0.1	0.9	2.7	0.2	1.0
0.002-0.05	0.4	7.0	0.0	0.5
<0.002	2.0	3.0	0.6	1.9
	dollars/ton			
Cost	$25	$38	$15	$10

Materials and Methods

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0.25-0.5	45.8	39.3	69.2	23.7
0.1-0.25	23.1	18.7	27.3	11.6
0.05-0.1	0.9	2.7	0.2	1.0
0.002-0.05	0.4	7.0	0.0	0.5
<0.002	2.0	3.0	0.6	1.9
	dollars/ton			
Cost	$25	$38	$15	$10

Materials and Methods

- Crumb rubber
  - Particle size
    - 2.0-6.0 mm
  - 4 applications @ ¼ inch
    - May 29 - Sep. 14, 08

1.0 inch crumb rubber layer , accumulated over a 3.5 month period, 2008.

Materials and Methods

- Sand then crumb rubber
  - 4 applications @ ¼ inch
    - Sand #1
      - May 29 – July 10, 2008
  - 4 applications @ ¼ inch
    - Crumb rubber
      - July29 – Sept. 14, 2008

1.0 inch of crumb rubber over 1.0 inch of sand, accumulated over 3.5 months, 2008.

Materials and Methods

- Control
  - No topdressing

Materials and Methods

- Fall traffic (Oct. 15 – Nov. 14, 2008)
  - 2 passes/week
    - 1 pass forward
    - 1 pass backward

Materials and Methods

- Response variables
  - Turfgrass cover (0-100%)
  - Turf shear tester strength (Nm)
- Collected following fall traffic
  - Nov. 14, 2008

2008 Results

- Can topdressing materials alternative to 90% sand – 10% silt/clay be used to improve fall wear tolerance and surface stability?

Mean values for turfgrass cover and turf shear tester strength following fall traffic simulator applications, East Lansing, MI, 14 Nov. 2008.

Topdressing material	Cover (0-100%)	Turf shear tester (Nm)
	2008 Mean values	
crumb rubber	85.0a†	120.8bc
sand #1 then crumb rubber	80.0a	143.2ab
sand #1	63.3b	139.2abc
sand #2	60.0bc	136.6abc
sand #3	60.0bc	109.7bc
sand #4	48.3bc	107.0c
control	46.7c	160.2a

† Means followed by the same letter are not significantly different according to LSD (0.05).

Mean values for turfgrass cover and turf shear tester strength following fall traffic simulator applications, East Lansing, MI, 14 Nov. 2008.

Topdressing material	Cover (0-100%)	Turf shear tester (Nm)
	2008 Mean values	
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sand #1	63.3b	139.2abc
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sand #3	60.0bc	109.7bc
sand #4	48.3bc	107.0c
control	46.7c	160.2a

† Means followed by the same letter are not significantly different according to LSD (0.05).

2008 Results

- Effects of the Cady traffic simulator on a Kentucky bluegrass stand without topdressing (left) and crumb rubber topdressing (right), Nov. 14, 2008.

Conclusions

- Crumb rubber, while being the most expensive topdressing material ($1,000/ton) produced the greatest turfgrass cover.
- The control, no topdressing, while producing TST strength raking in the greatest category, provided the lowest turfgrass cover
- Topdressing sand #1 and 2 produced TST values ranking in greatest category
- Topdressing sand #4, a poorly-graded sand, produced the lowest TST strength

Recommendations

- Crumb rubber
  - Sidelines
  - High traffic areas

Recommendations

- When selecting topdressing material
  - Sand #1 ($25/ton)
    - Well-graded sand
  - Sand #2 ($38/ton)
    - Well-graded sand
  - Sand #3 ($15/ton)
    - Well-graded sand
  - Sand #4 ($10/ton)
    - Poorly-graded sand

  - Maximum 10% silt/clay

More Questions = More Research

- What practices can be used to speed up turfgrass establishment over recently renovated drain lines?

Objective

- Evaluate the effects of seeding mulch on Kentucky bluegrass establishment from seed over a sand-filled intercept drain line.

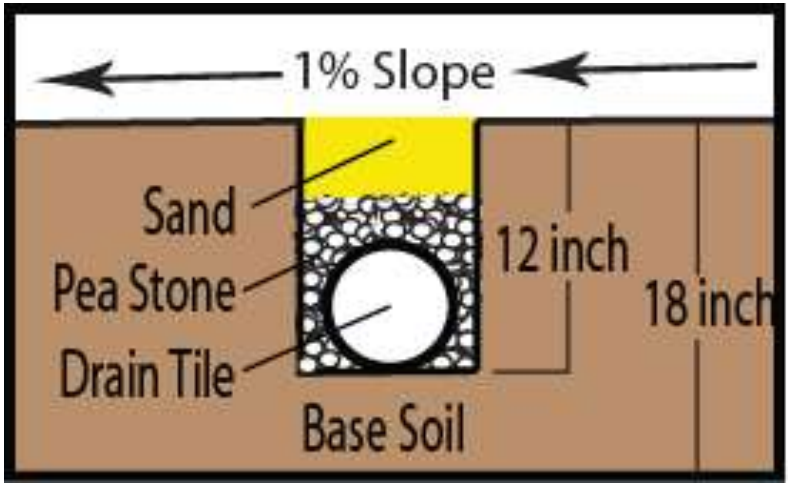
Materials and Methods

- Research initiated May 26, 2010
- Hancock Turfgrass Research Center
  - East Lansing, MI
- Native soil
  - Sandy loam

- Cool-season turfgrass stand seeded in 2007
  - 90% Kentucky bluegrass
  - 10% perennial ryegrass

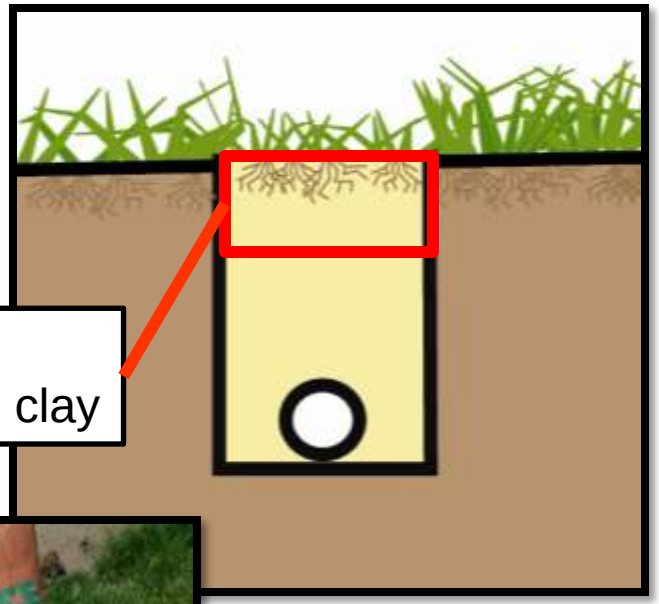
Materials and Methods

- Existing intercept drain lines
  - Excavated
  - Filled with sand



Materials and Methods

- Treatments
  - Turface (calcined clay)
    - 20% v/v ratio
  - Control



Materials and Methods

- Seeded
  - Kentucky bluegrass blend
    - 1.5 lbs/1,000 ft^2
- Treatments
  - Seeding mulch
    - 50 lbs/1,000 ft^2
  - Control

2010 Results

- Effects of seeding mulch on Kentucky bluegrass establishment from seed over a sand-filled intercept drain line, 51 DAS.


Control


Seeding mulch

Analysis of variance results for turfgrass cover (0-100%) from 34 to 103 days after seeding (May 26, 2010), East Lansing, Mich.

	Days After Seeding								
Source of Variation	34	51	61	64	78	85	92	97	103
Calcined Clay (CC)	NS†	NS	NS	NS	NS	NS	NS	NS	NS
Seeding Mulch (SM)	***	**	**	NS	NS	NS	NS	NS	NS
CC X SM	NS	NS	NS	NS	NS	NS	NS	NS	NS

*** Significant at the 0.001 probability level.

** Significant at the 0.01 probability level.

† NS, nonsignificant at the 0.05 probability level.

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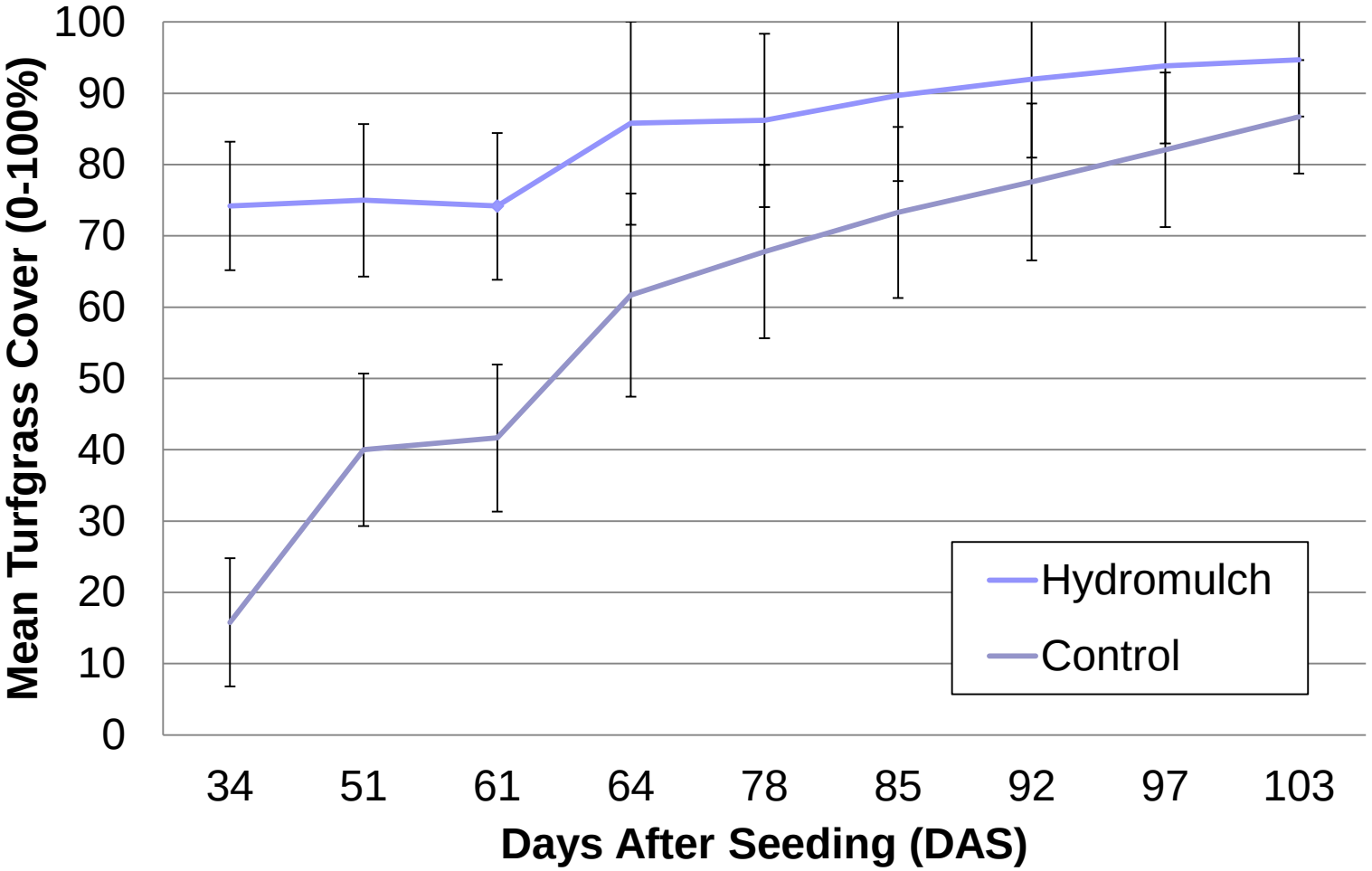
Seeding Mulch (SM)	***	**	**	NS	NS	NS	NS	NS	NS
CC X SM	NS	NS	NS	NS	NS	NS	NS	NS	NS

*** Significant at the 0.001 probability level.

** Significant at the 0.01 probability level.

† NS, nonsignificant at the 0.05 probability level.

Effects of seeding mulch on Kentucky bluegrass establishment fr
seed over sand filled intercept drain lines, renovated May 26, 201(



Means values with overlapping error bars are not significantly different according to LSD (0.05).

2010 Results

- Effects of seeding mulch on Kentucky bluegrass establishment from seed over a sand-filled intercept drain line, 51 DAS.


Control


Seeding mulch

2010 Results

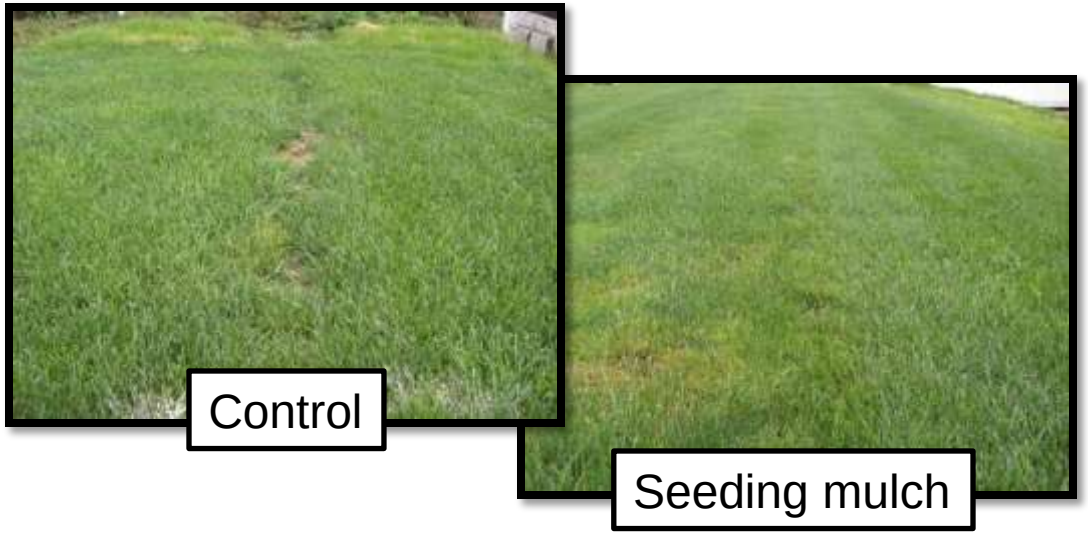
- Effects of seeding mulch on Kentucky bluegrass establishment from seed over a sand-filled intercept drain line, 103 DAS.

Conclusions

- If field use will begin sooner than 64 days following renovation then…
  - Seeding mulch can provide substantially greater turfgrass cover over recently renovated Intercept drain lines
  - Seeding mulch
    - $10/50 lbs
      - 50 lbs/1,000 ft^2
  - Intercept drain tile spacing
    - 13 ft = 3,000 ft^2 affected surface area
      - $30

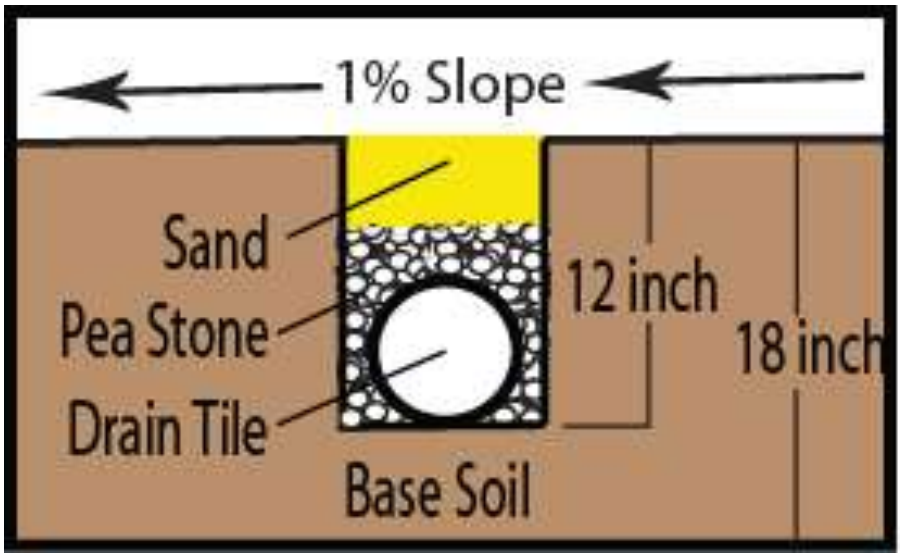
Conclusions

- If field use will begin 64 days after renovation or later…
  - Benefits of seeding mulch are no longer significant



More Questions = More Research

- What materials can be used to cover intercept drain tiles without compromising drainage?

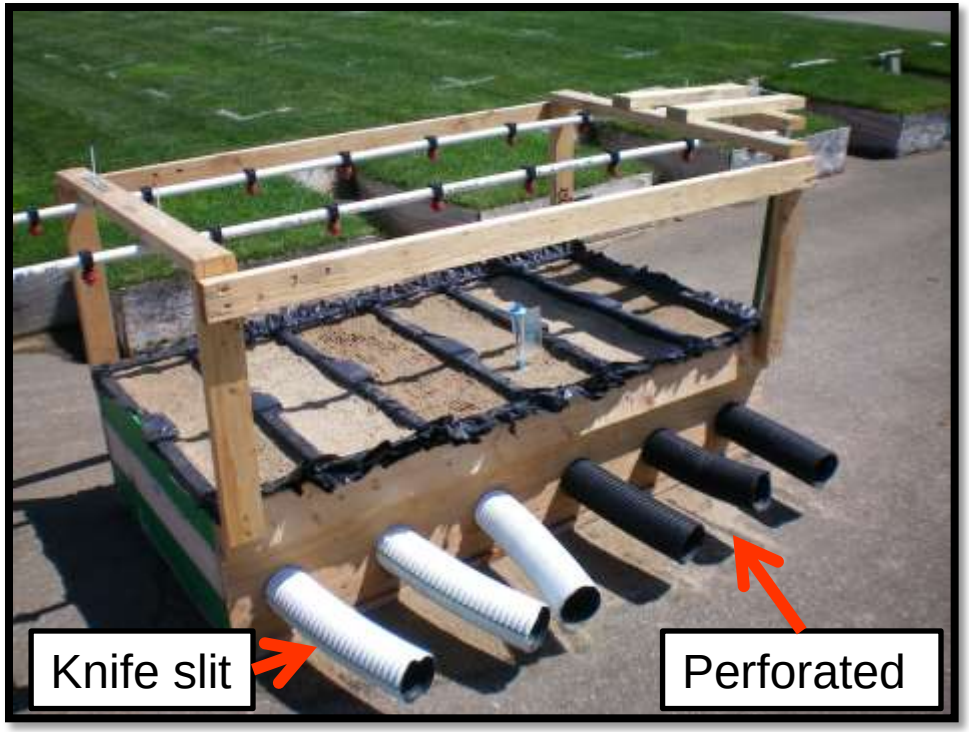


Materials and Methods

- Research initiated June 10, 2019
- Hancock Turfgrass Research Center
  - East Lansing, MI
- Research boxes
  - 6 inch width
  - 12 inch depth

Materials and Methods

- Treatments
  - Corrugated drain tile
    - Knife slit
    - Perforated



Materials and Methods

- Treatments
  - Sand over pea stone
  - Sand
  - 90% sand-10% silt/clay

2010 Results