Does Maintenance Impact Synthetic Fields?

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Where did it come from

- Developed by Monsanto in the 1960's
- Goal to provide urban youth a way to exercise
- Currently on the 3rd generation of synthetic turf

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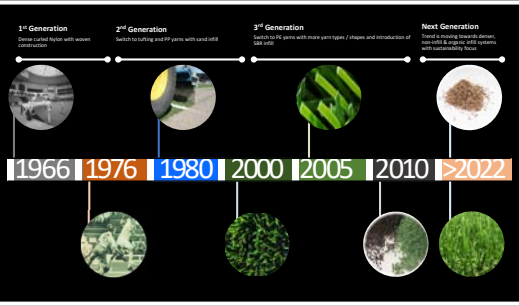
Turf System Evolution



Slide Courtesy of Colin Young, Ph.D. TenCate Grass

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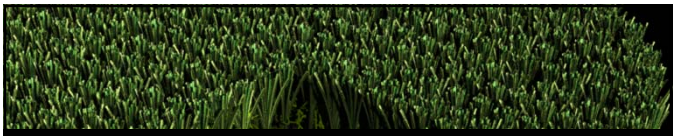

What are the component of today's synthetic turf

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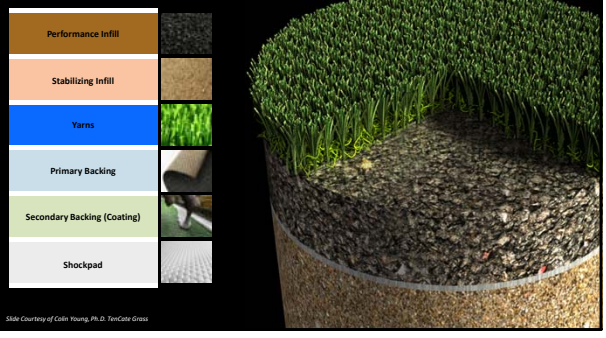
Turf System Components



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Different Types of Infills

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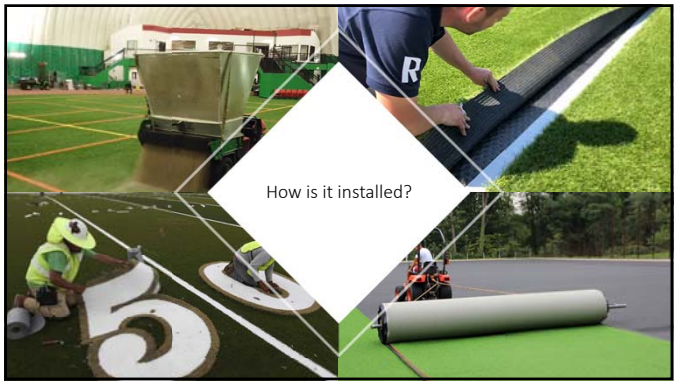
How is it installed?

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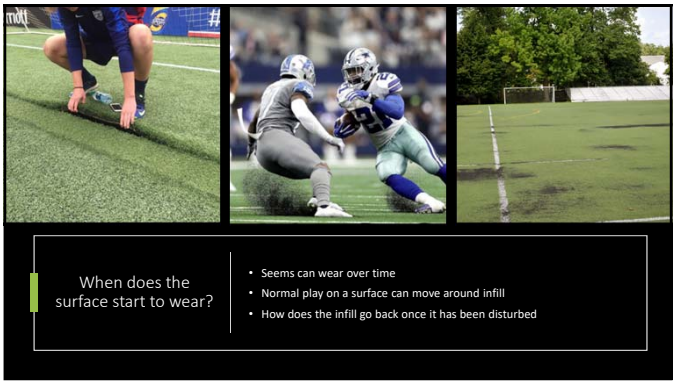
When does the surface start to wear?
Seems can wear over time
Normal play on a surface can move around infill
How does the infill go back once it has been disturbed

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Why would they need maintenance?
Wear from
Sports teams
P.E. classes
Band activities
Graduations
Extra events
CELEBRATING GRADUATES
KNOX COUNTY

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One Tool Every Synthetic Field Manager Needs

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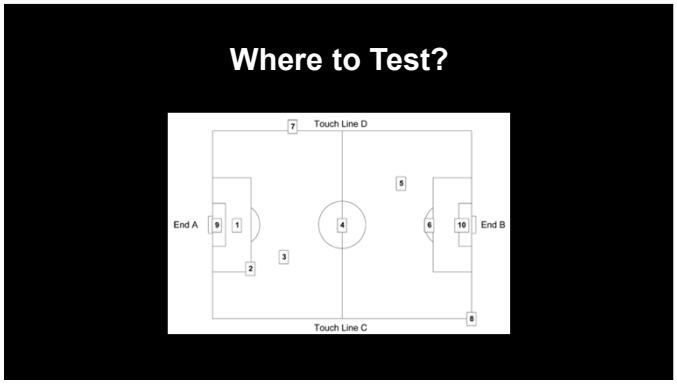
Where to Test?
Touch Line D
Touch Line C
End A
End B

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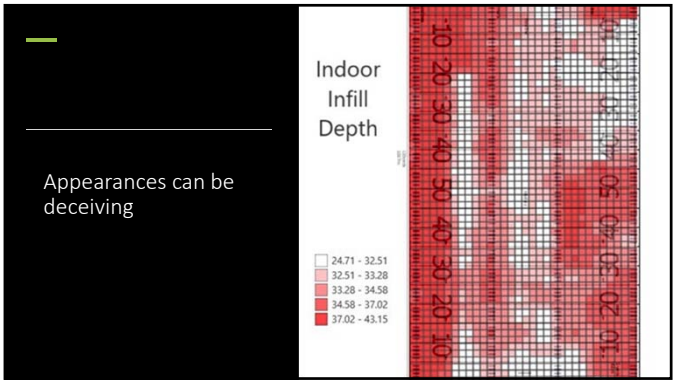
Appearances can be deceiving
Indoor Infill Depth
24.71 - 32.51
32.51 - 33.28
33.28 - 34.58
34.58 - 37.02
37.02 - 43.15

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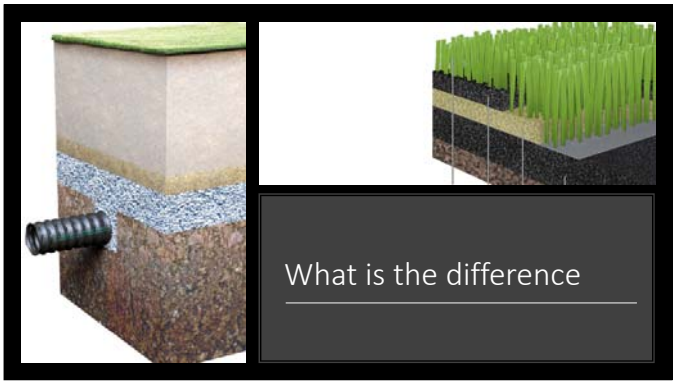

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Maintenance effects on synthetic turf playability and durability

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Synthetic turf systems tested

- **Treatments**
  - Apply traffic at 10 simulated football games per week
  - Brush/groom half of each plot every 20 games
  - Add infill as needed to maintenance
- **Data collection**
  - F355 A missile (3 drops x 3 locations)
  - F355 E missile (3 drops x 3 locations x 2 heights)
  - Infill depth (9 locations)

Synthetic turf	Shock pad	Infill
52 ounce 2 inch pile height	Extruded rubber	Crumb rubber (SBR)
52 ounce 2 inch pile height	Beaded polypropylene	Crumb rubber (SBR)
52 ounce 1.5 inch pile height	Extruded rubber	Coconut/cork
52 ounce 1.5 inch pile height	Extruded rubber	Recycled rubber
80 ounce 1.25 inch pile height	Beaded polypropylene	Coconut/cork

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Data Collection

Collected weekly for 12 weeks

- Surface hardness (A missile)
- Head Injury Criterion (HIC)
- Infill Depth
- Fiber Reveal
- Fiber weight

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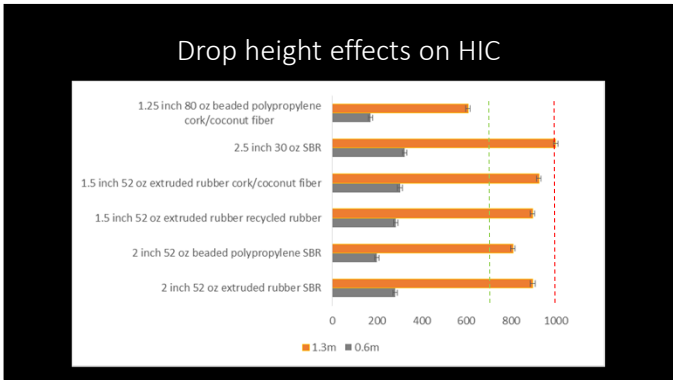

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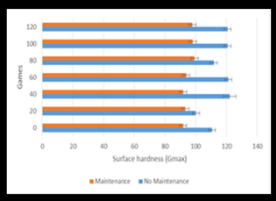
Surface Hardness

- **Plots that did not receive maintenance were 20.2 Gmax harder on average than those that were maintained**
- **No maintenance plots were harder**
- **All Plots required the same amount of maintenance**



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Summary: effects of maintenance on surface hardness

No maintenance equated to 20.2 G harder

Maintenance decreased the variability of the surface

- Maintenance plots deviated 3.2 G
- Non-maintenance plots deviated 8.2 G

All systems tested required maintenance to approximately same degree

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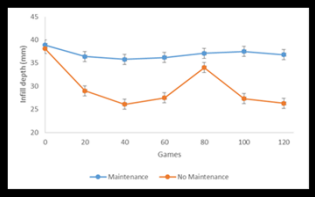
Results

Infill Depth

- Loss of infill overtime was observed in non maintained plots
- Maintenance was more consistent and less variable over time
- A strong negative Pearson's correlation (r = – 0.92) correlation was found between surface hardness and infill depth.



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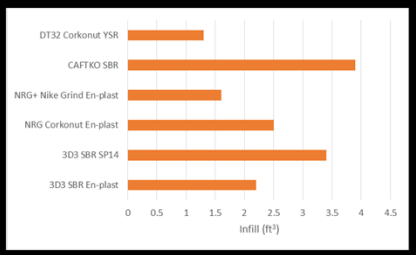
Total infill volume replaced



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Recycled rubber
Added infill every 20 games starting at 60 Games

Coconut fiber / cork
Added infill every 20 games

Crumb rubber (standard)
Added infill every 20 games starting at 40 Games

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Real World Example

- Heavy rain
- 4 in of rain over a 2-hour period
- Corkonut Organic Infill (Cork + Walnut)
- What happened?

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Rain Events

- Lost 1/4 inch depth of infill across the field
- Needed 63 supersacks to restore infill to specified levels
- Cost $91,000 to repair

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Summary: maintenance effects on infill depth

- Applied traffic resulted in significant loss of infill
- Maintenance reduced variability and infill depths consistently measured above minimum requirement
- Additional exposed fiber has been linked (Dr. Richard Kent, STC 2016) to cleat lock

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Conclusions

- Surface hardness and HIC are reduced when brushing is applied, aiding in decompaction of the surface
- Infill depth on 3G synthetic turf had an inverse correlation with surface hardness and HIC
- Replacing lost infill material helps the surface perform to original installation specifications

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Impact on Baseball Angle

Slide Courtesy of Colin Young, Ph.D. TenCate Grass

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Infill Ball Impact Comparison

Slide Courtesy of Colin Young, Ph.D. TenCate Grass

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Traction Comparison

Slide Courtesy of Colin Young, Ph.D. TenCate Grass

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Wear Characteristics of Synthetic Turf Systems

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Synthetic systems tested

Turf	Underlayment	Infill
3D3	En-plast Shockwave	SBR
3D3	Brock SP14	SBR
NRG	En-plast Shockwave	Cork/Coconut
NRG	En-plast Shockwave	Nike Grind
DT32	Brock Powerbase YSR	Guardian DT
CAFTKO	Gravel	SBR
DT32	Brock Powerbase YSR	Nike Nano
DT32	Brock Powerbase YSR	Cork/Coconut

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Thermoplastic elastomer

Fine mesh recycled rubber

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Methodology

- Three rates of traffic:
  - 1 game per week; 13 games total
  - 5 games per week; 65 games total
  - 10 games per week; 130 games total
- Data collected:
  - Surface hardness (ASTM F355 A): 3 locations per plot
  - Infill depth: 9 locations per plot
  - Vertical deformation: games 0, 13, 65, 130
  - Force reduction: games 0, 13, 65, 130
  - Energy restitution: games 0, 13, 65, 130
  - Temperature: June 30, July 14, August 11

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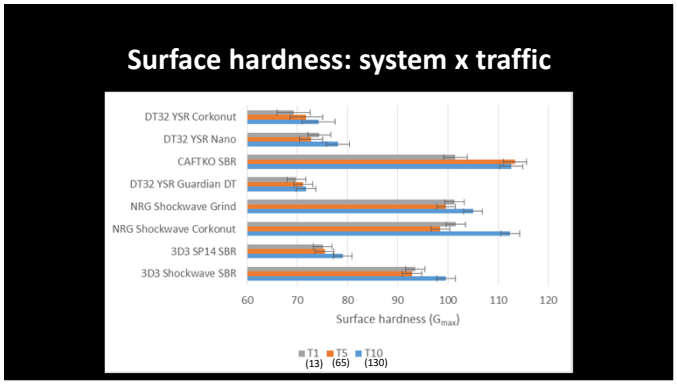

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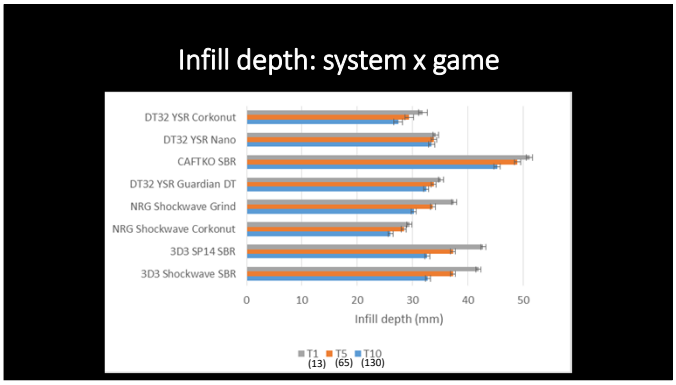

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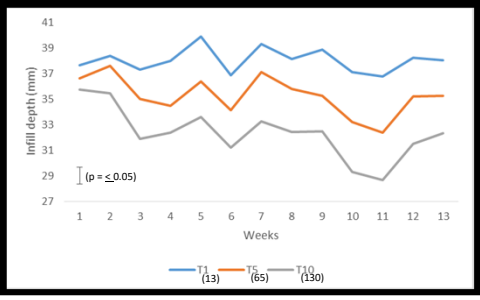
Infill depth: traffic x week



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Advanced Artificial Athlete

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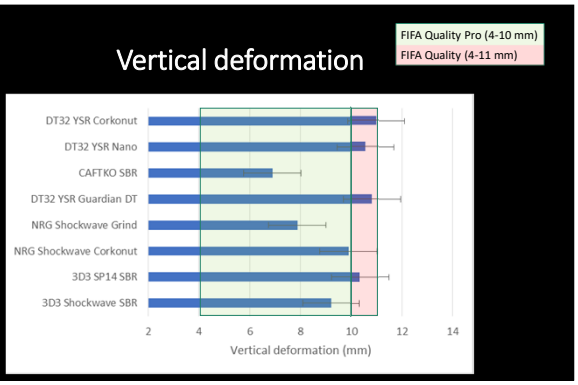
Vertical deformation



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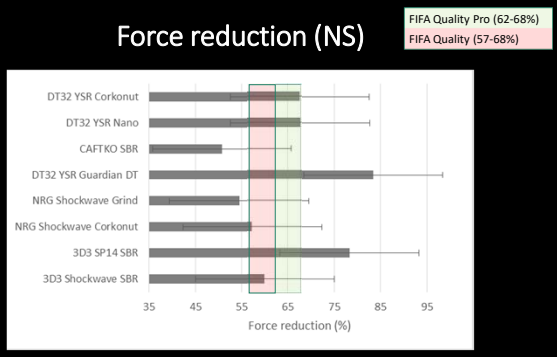
Force reduction (NS)



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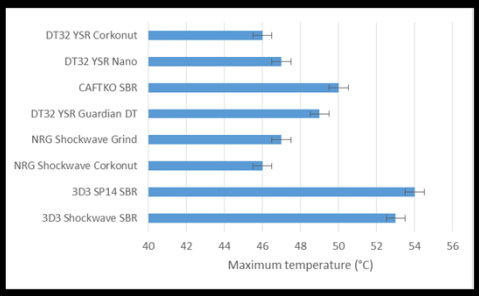
Temperature: system



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Conclusions

- In these three 3G non-traditional rubber infills surface hardness and infill depth have a negative relationship
- Particle size and distribution of the infill play a key role in reduction of infill loss when trafficked
- Infill type can significantly impact athletic field performance in 3G synthetic turf systems

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Ongoing Research

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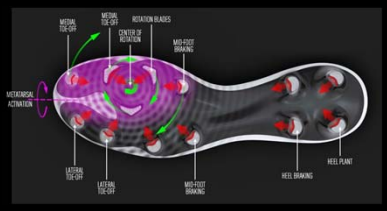
What is Friction/Traction

- **Friction** is the force resisting the relative motion of solid surfaces, fluid layers, and material elements sliding against each other
- **Friction force** is directly proportional to the applied load



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Main Focus of Lower Extremity Testing

1. **Injury**
2. **Performance**

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Acceleration Condition

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Deceleration Condition

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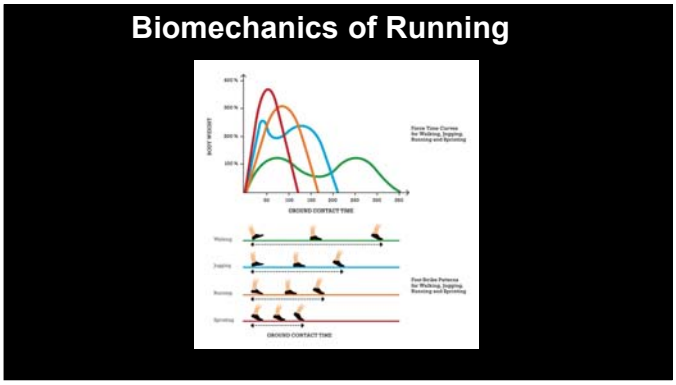

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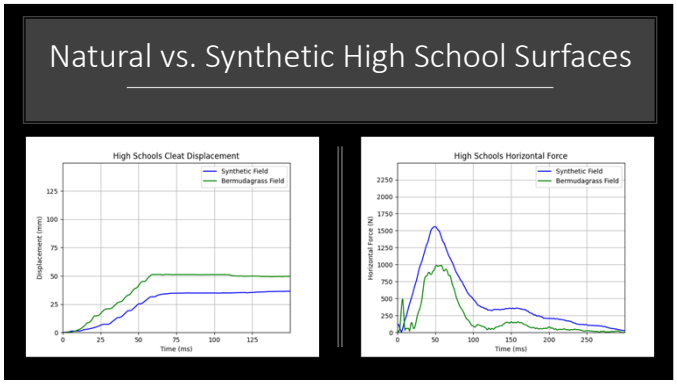

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What about when cleats wear out?

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ASTM F1292 1.3 m drop on synthetic turf

Clegg: ~71 avg.
F355A: ~119 avg.
HIC: ~1,225 avg. (1.3 m)

Clegg: ~88 avg.
F355A: ~111 avg.
HIC: ~370 avg. (1.3 m)

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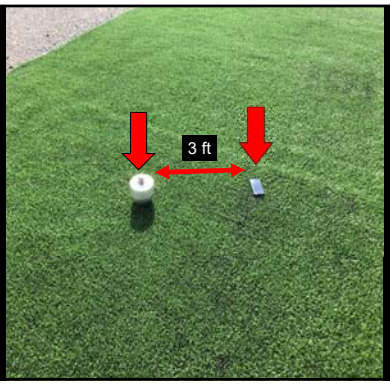

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Thank You
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