# Optimizing Regenerative Agricultural Cotton Production Systems in Semi-Arid Texas

**Christopher Cobos**
Nicholas Boogades
Joseph Burke, Ph.D.
Paul DeLaune, Ph.D.
Gurjinder Baath, Ph.D.
Sumantra Chatterjee, Ph.D
Wayne Keeling, Ph.D.
Katie Lewis, Ph.D.

2025 Southwest Cotton Physiology Conference
Lubbock, TX
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TEXAS A&M UNIVERSITY
Soil & Crop Sciences

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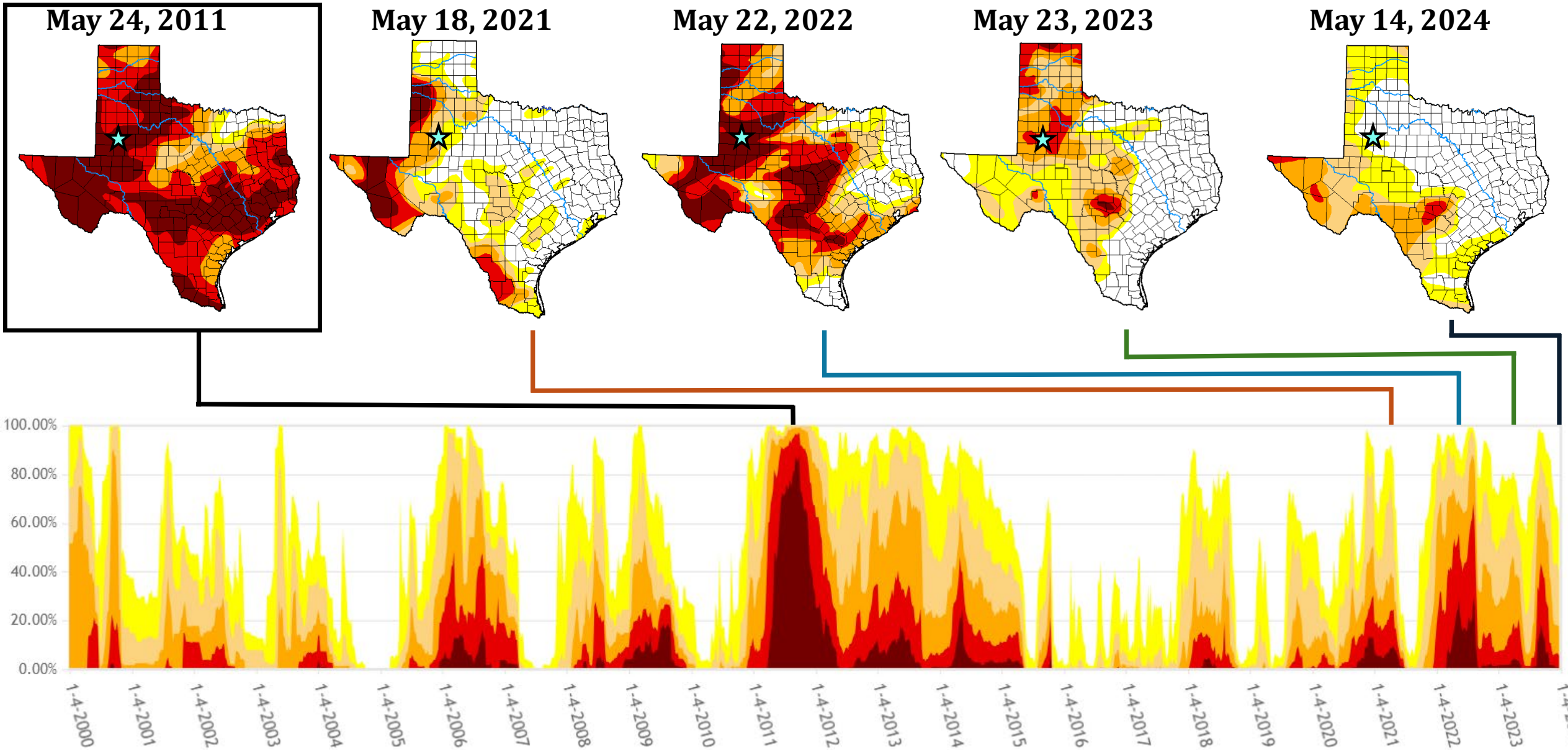
# Regenerative Agriculture

*The continued capacity of agricultural systems to function in a changing climate that supports soil health, communities, economic output, environmental sustainability, and resiliency to the outside threats of those outcomes.*

-Cobos, Burke, & Lewis. 2023

"Each new generation tends to forget – until it confronts the sobering reality – *that dryness has always been the normal condition in the western half of the state. Wet years have been the exceptions*…Traditionally it has taken a strong-willed individualistic breed to live west of [the 98th meridian], especially when that living is tied closely to the soil, as is the case with the rancher and the farmer."

-Elmer Kelton


May 24, 2011
May 18, 2021
May 22, 2022
May 23, 2023
May 14, 2024
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
1-4-2000
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1-4-2002
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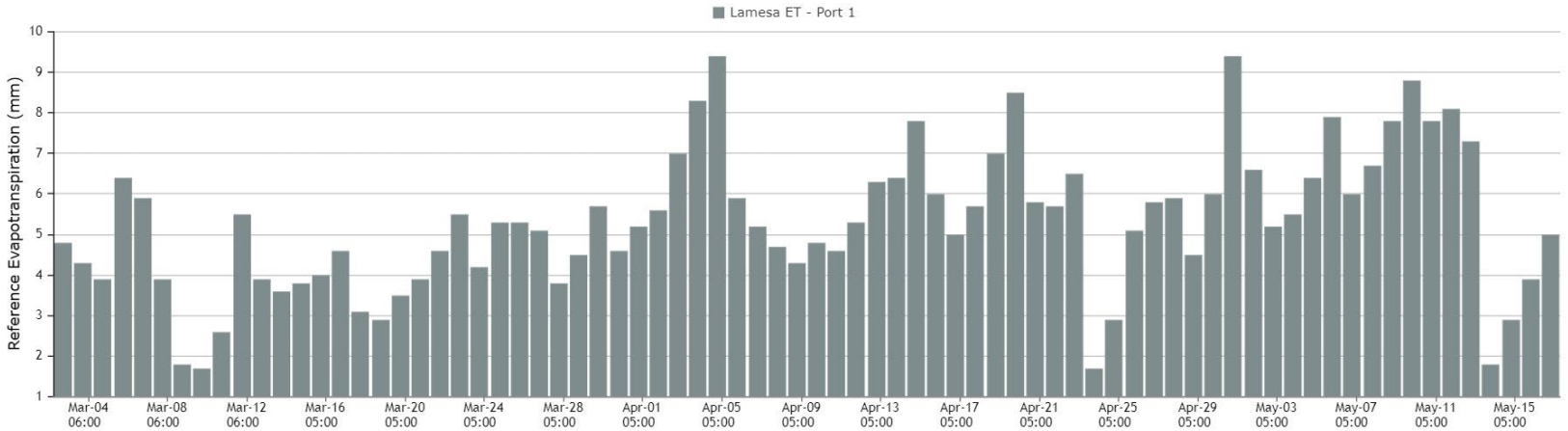
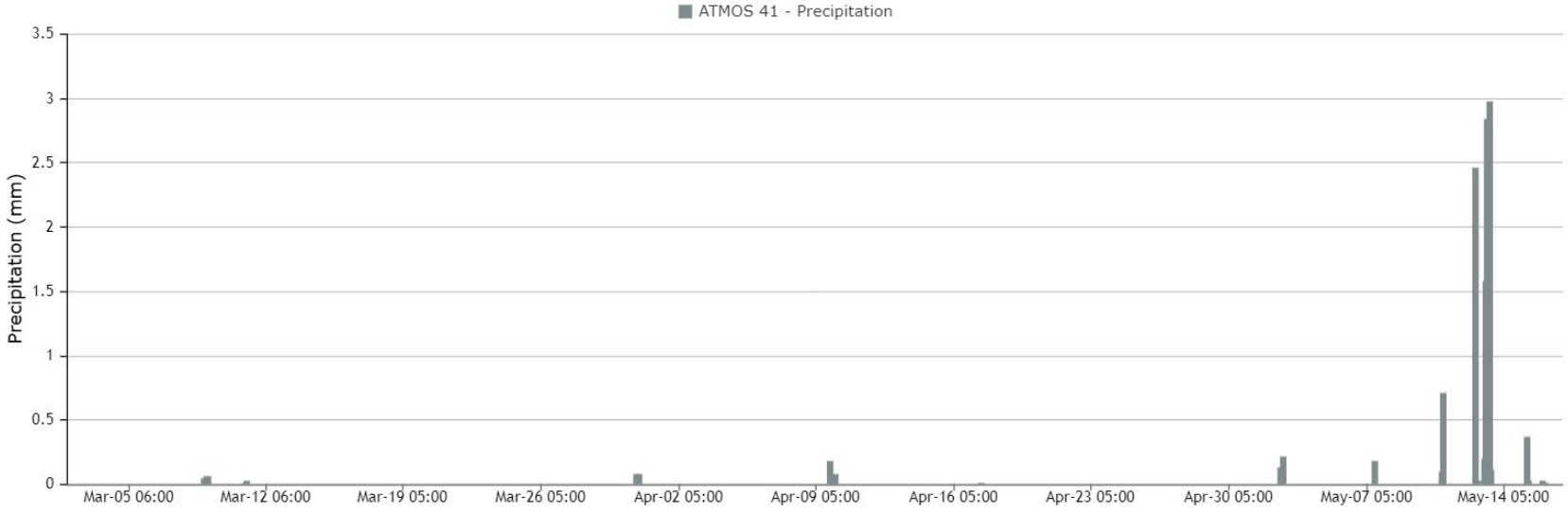
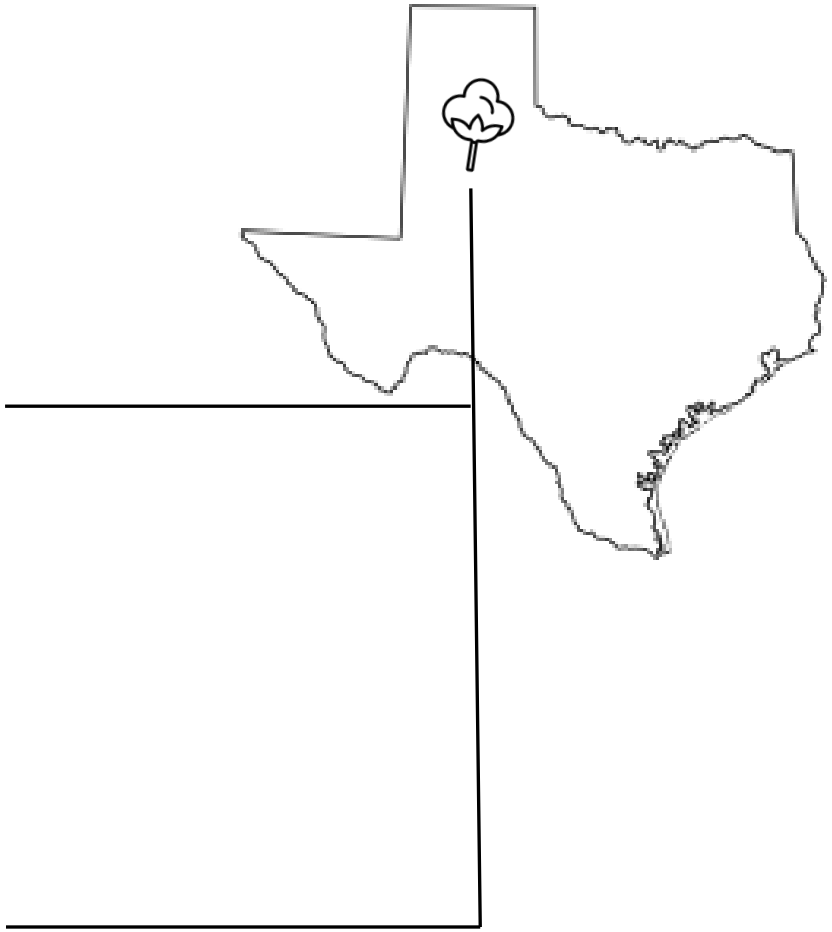
1-4-2024

# Soil Water Conservation



# Cover Crops in the High Plains

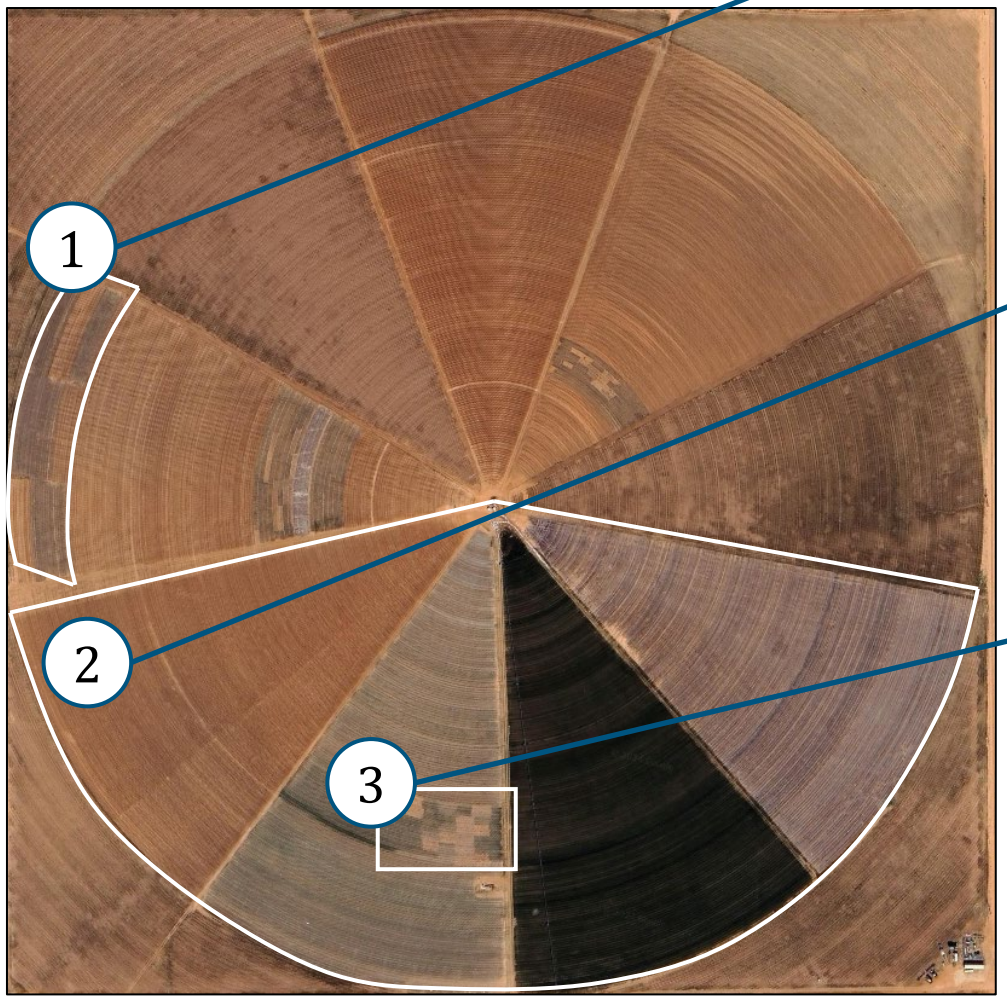
# Crop Rotations in the High Plains

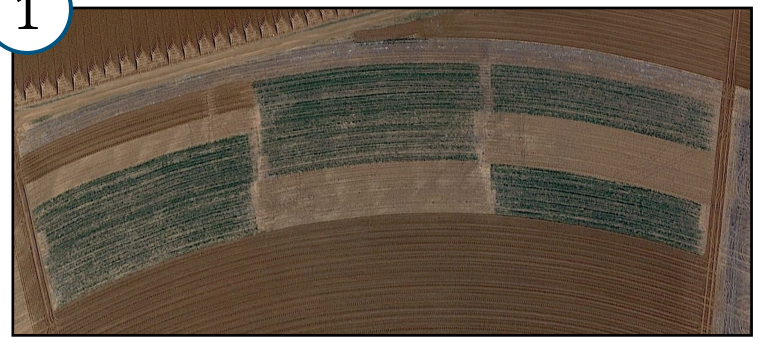
Cotton-
Wheat/Sorghum

Lack of
Infrastructure

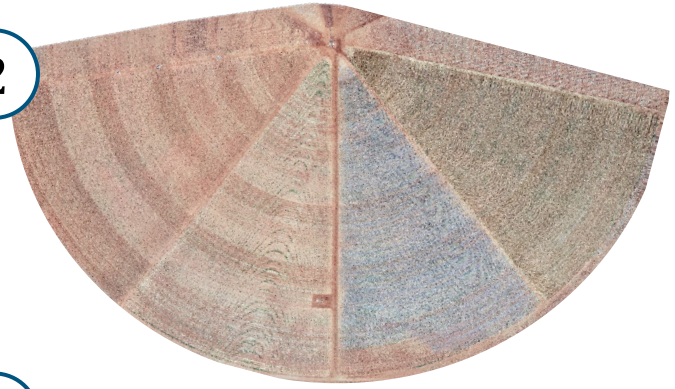
Economic
Restrictions

# Agricultural Complex for Advanced Research & Extension Systems (AG-CARES)- Lamesa, TX

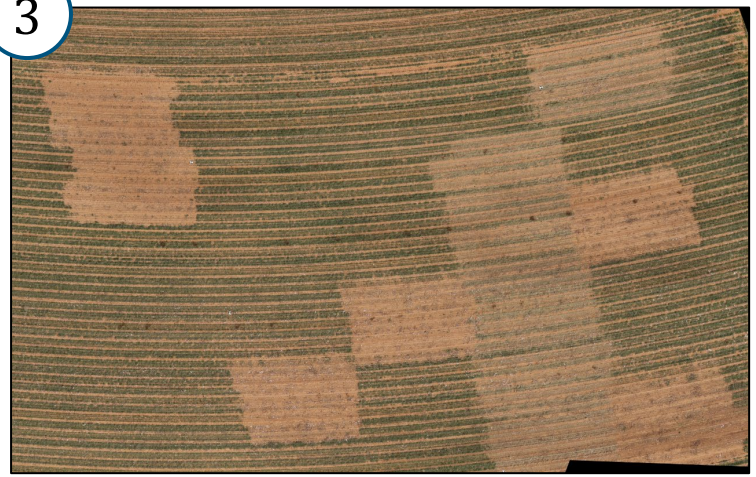


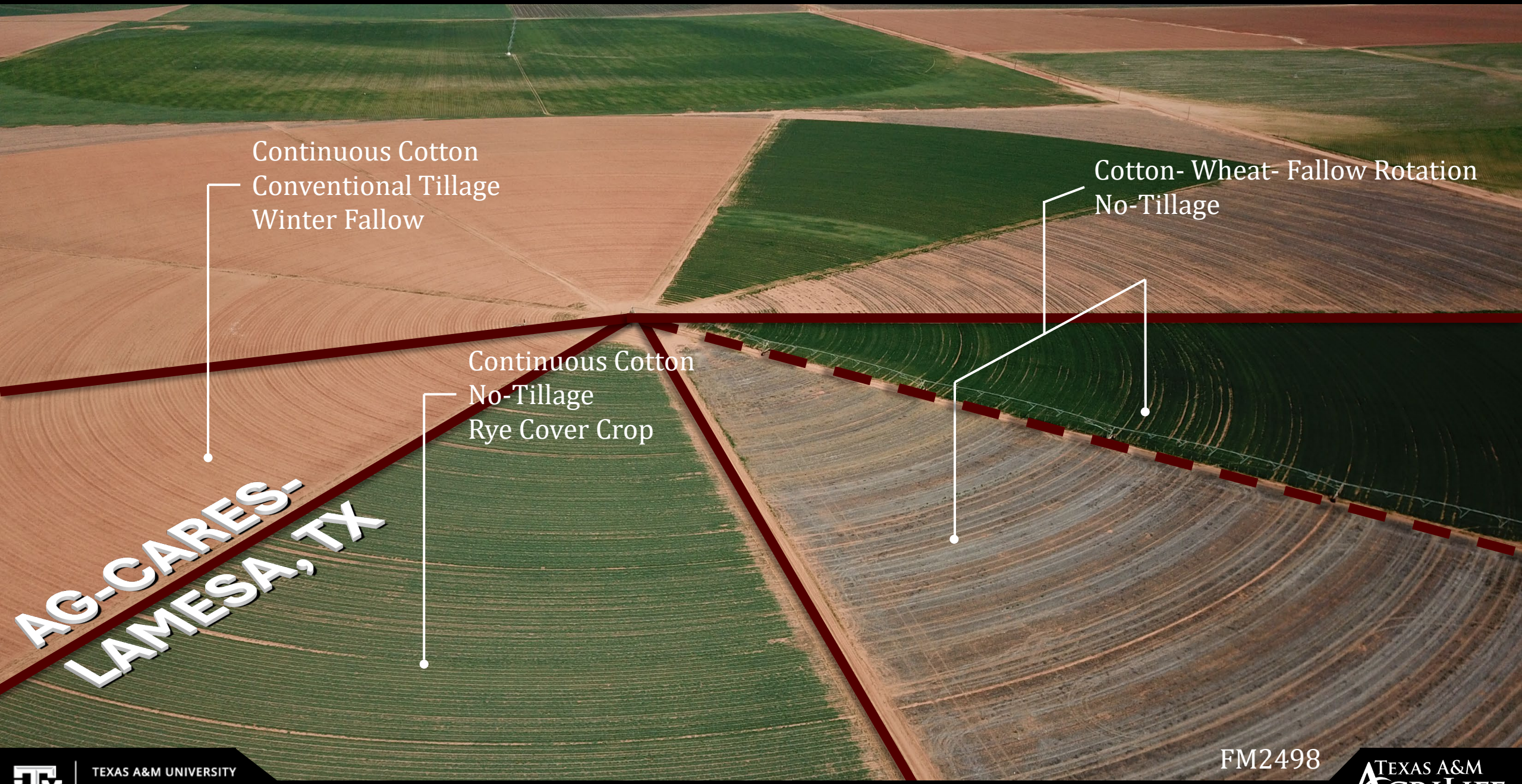

Long-term impacts of cover crop adoption




Soil water dynamics in regenerative cropping systems

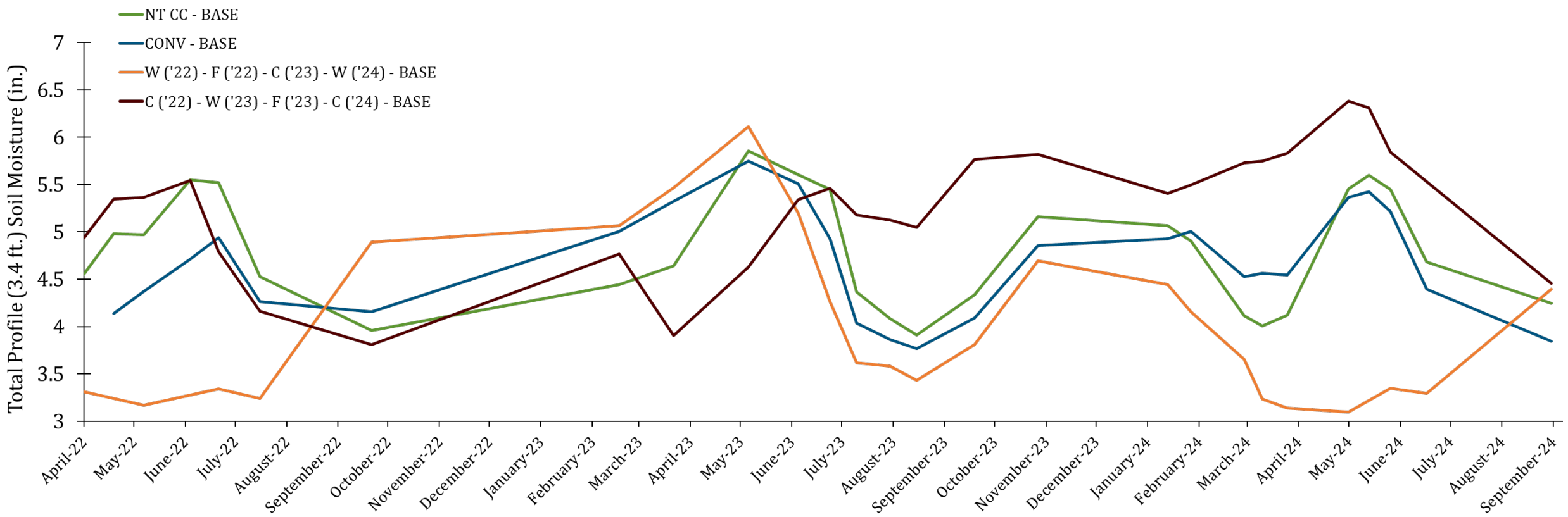



Cover crop termination timing effects on soil moisture and nutrient cycling

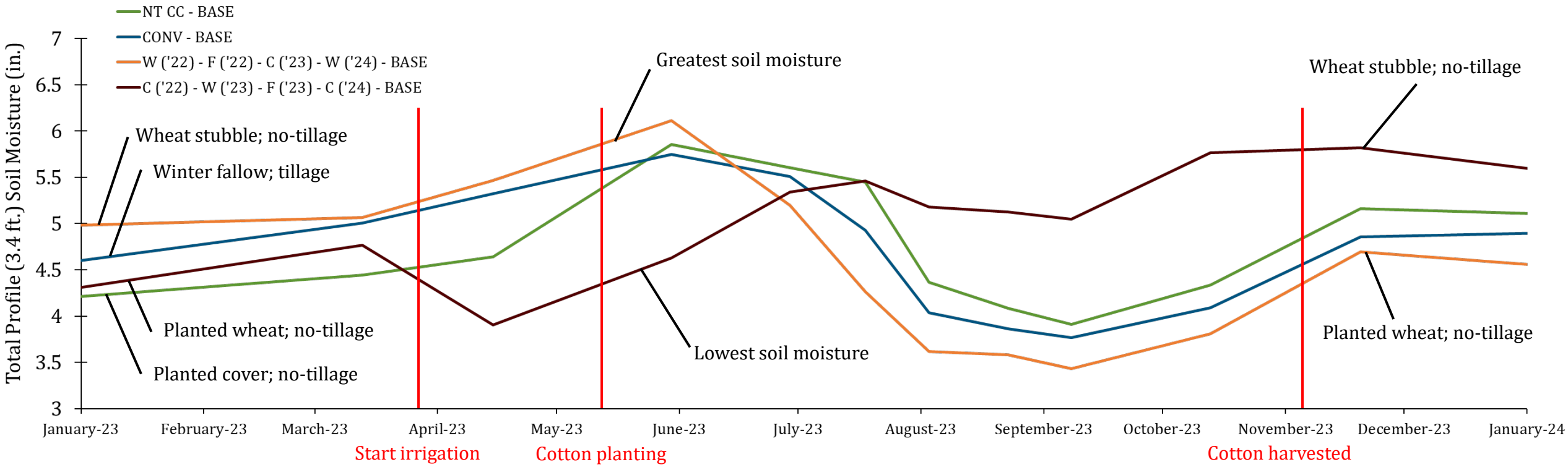

Continuous Cotton
Conventional Tillage
Winter Fallow
Cotton- Wheat- Fallow Rotation
No-Tillage
Continuous Cotton
No-Tillage
Rye Cover Crop
AG-CARES-
LAMESA, TX

# Results 2022-2024

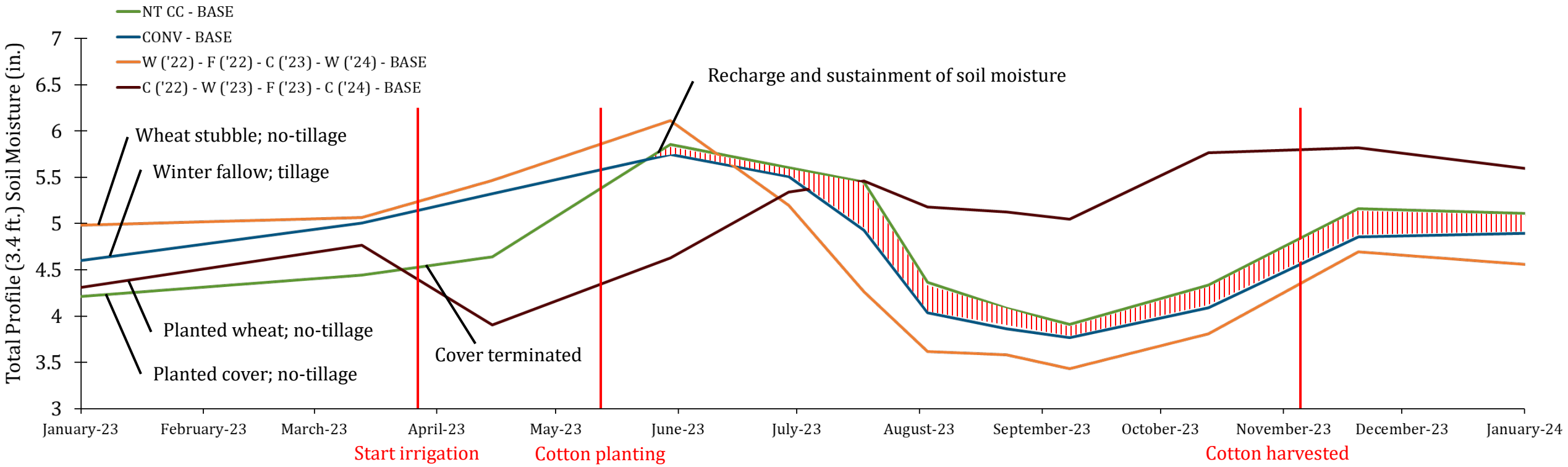
# Profile Soil Water- Long Term



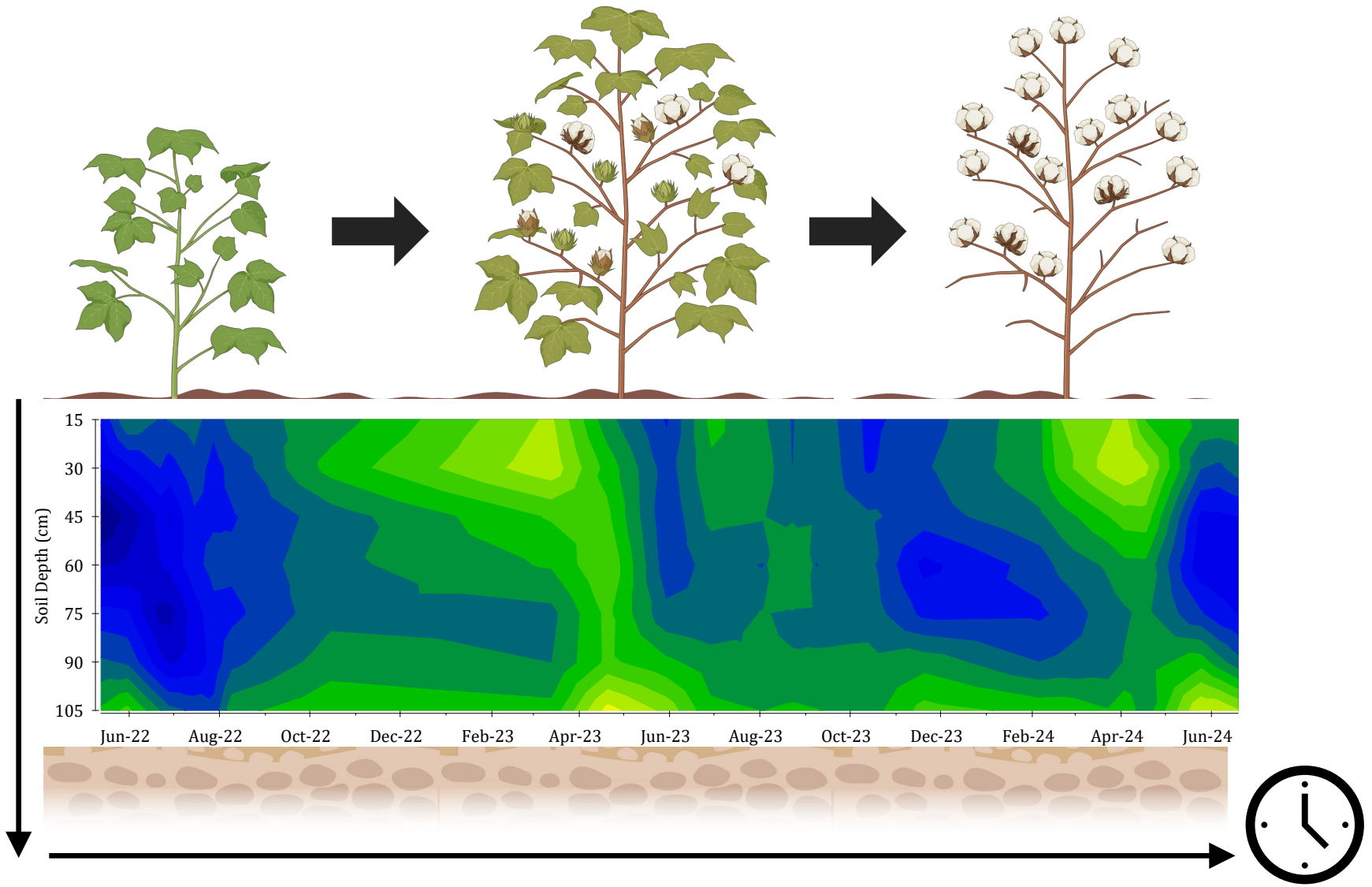
# Profile Soil Water- **2023**



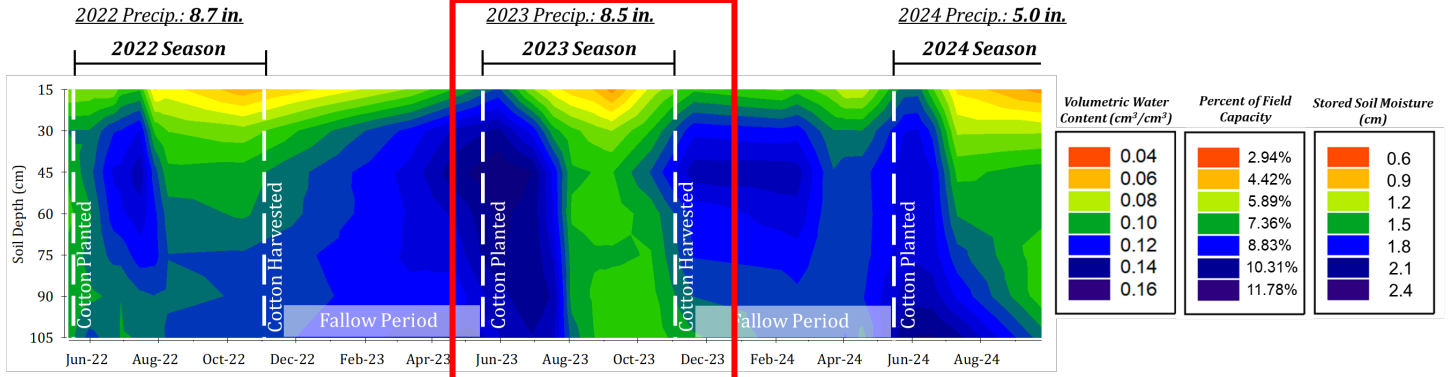
# Profile Soil Water- **2023**



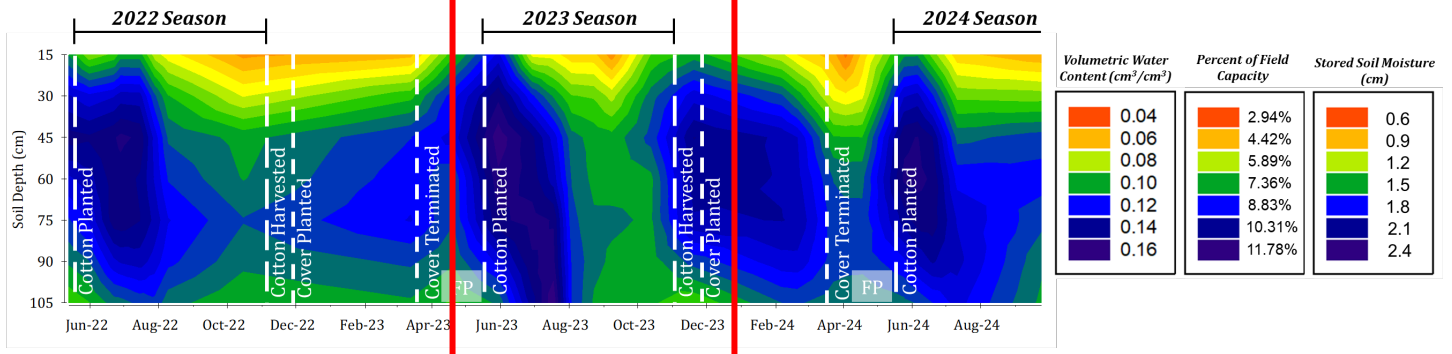
# Soil Water at Depth- Contour Maps



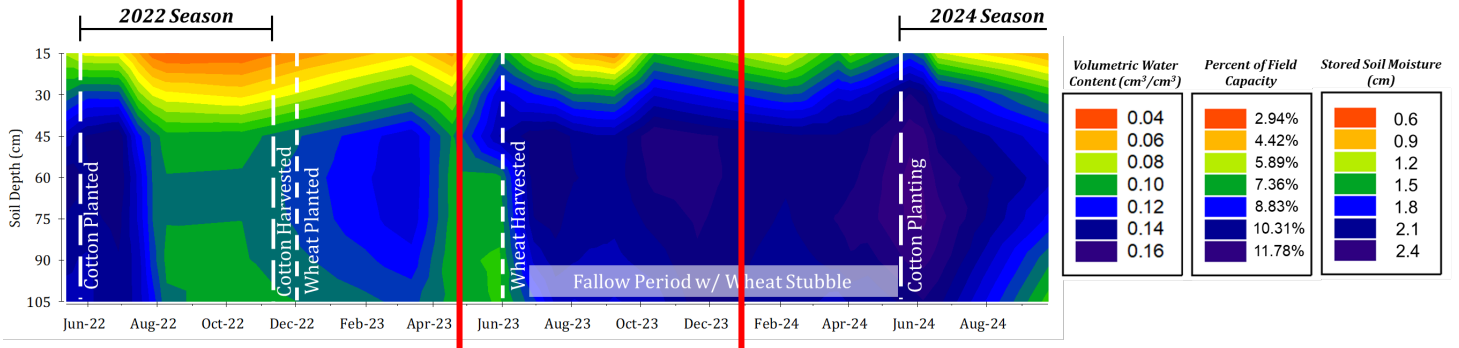
**CONTINUOUS COTTON WITH CONVENTIONAL TILLAGE AND WINTER FALLOW**



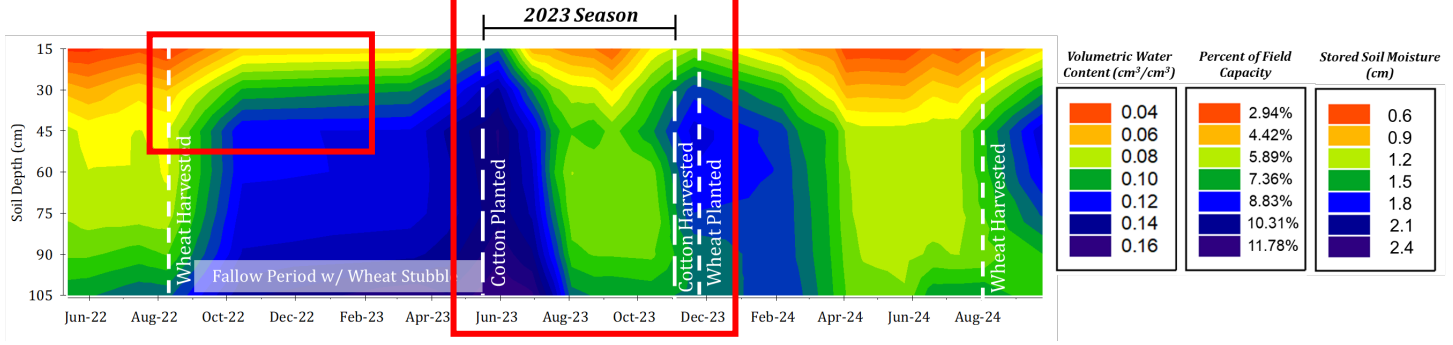

**CONTINUOUS COTTON WITH NO TILLAGE AND RYE COVER CROP**



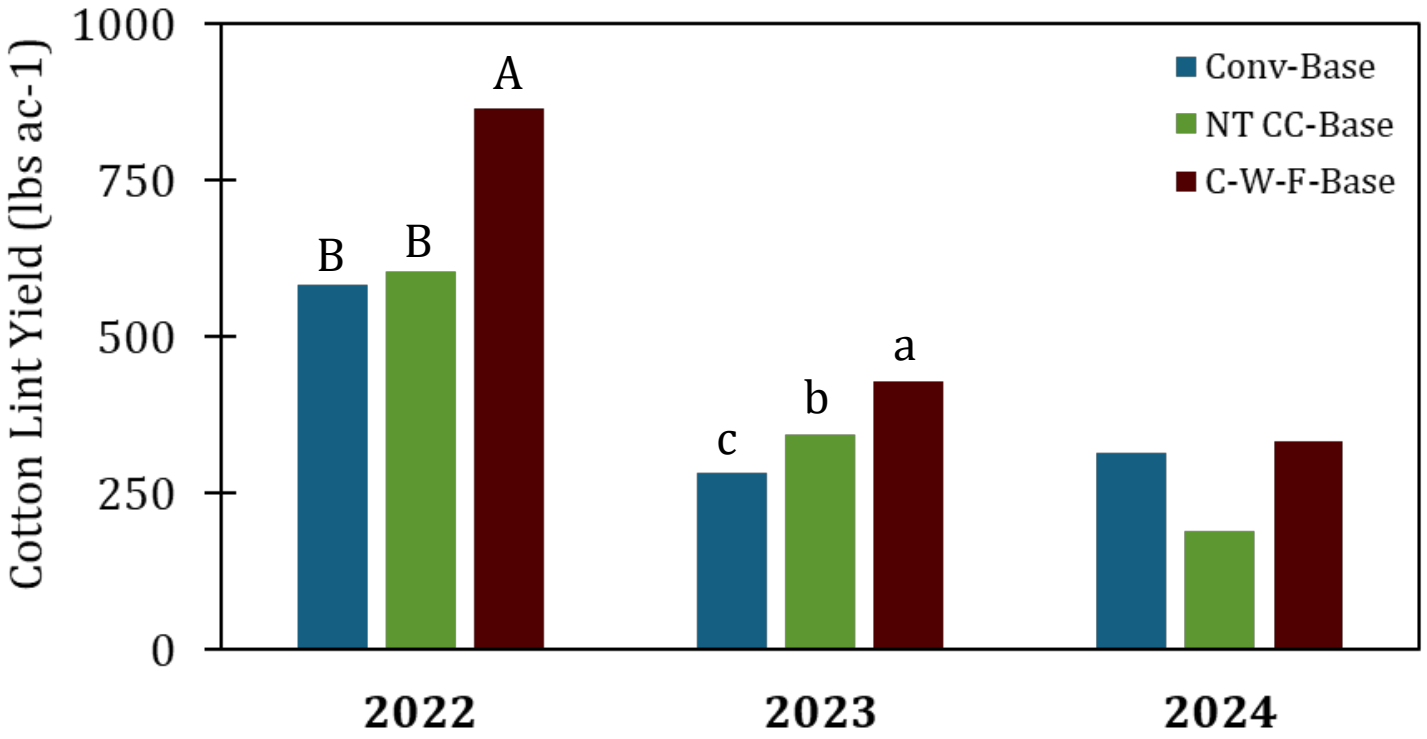

**COTTON ('22)-WHEAT ('23)-COTTON ('24) NO TILLAGE**




**WHEAT ('22)-COTTON ('23)-WHEAT ('24) NO TILLAGE**



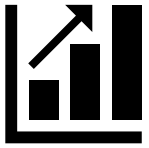
# Cotton Lint Yield- Lamesa, TX




# Summary- Soil Water Dynamics in Regen Ag Systems

"Regenerative agricultural systems" can significantly improve stored soil moisture compared to conventionally tilled cotton agroecosystems

Cotton-wheat-fallow rotation significantly improves cotton lint yield and stored soil moisture compared to continuous cotton systems w/ and w/out cover crops/tillage



Ecological sustainability is not applicable without economic viability

# Cover Crop Termination Timing in Semi-Arid Cotton Production Systems

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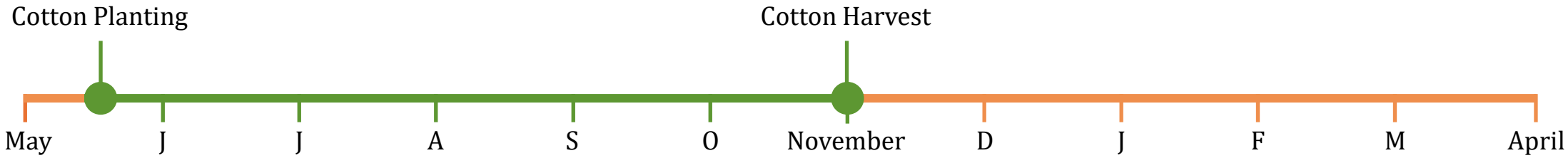
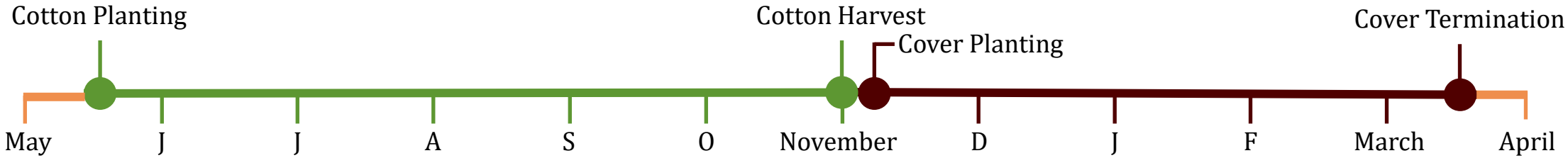
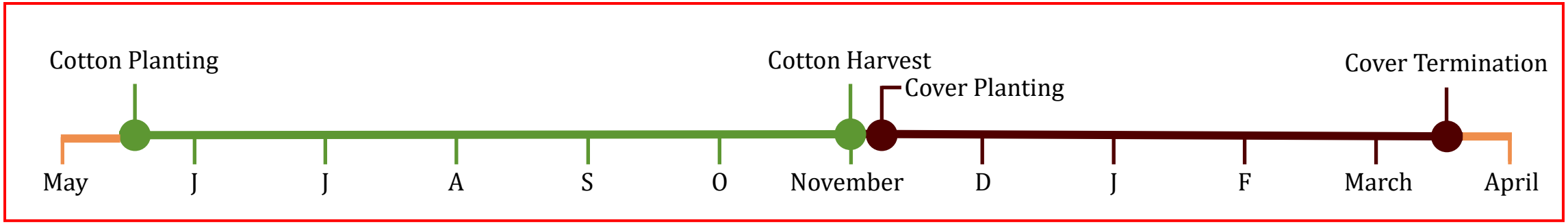
# Continuous Cotton w/ Conventional Tillage and Winter Fallow

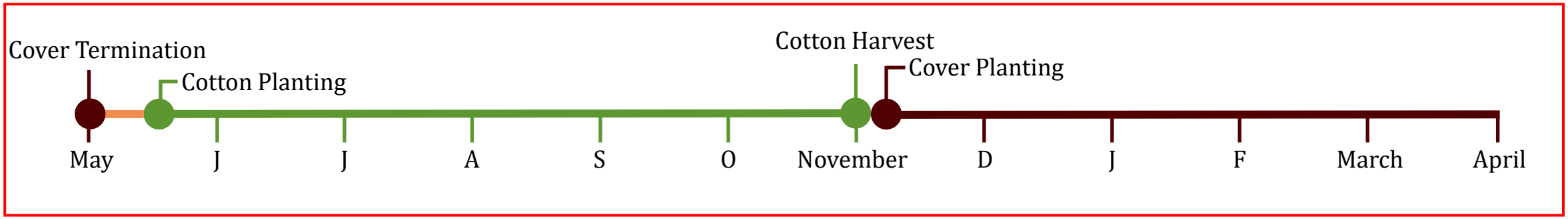


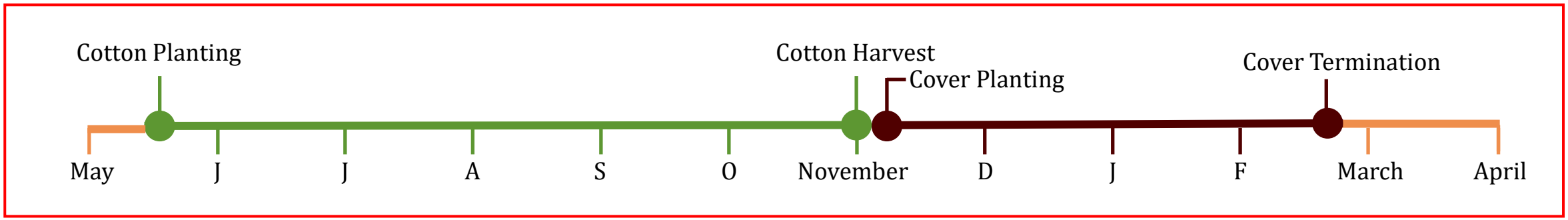




# Continuous Cotton w/ No-Tillage and a Winter Cover Crop

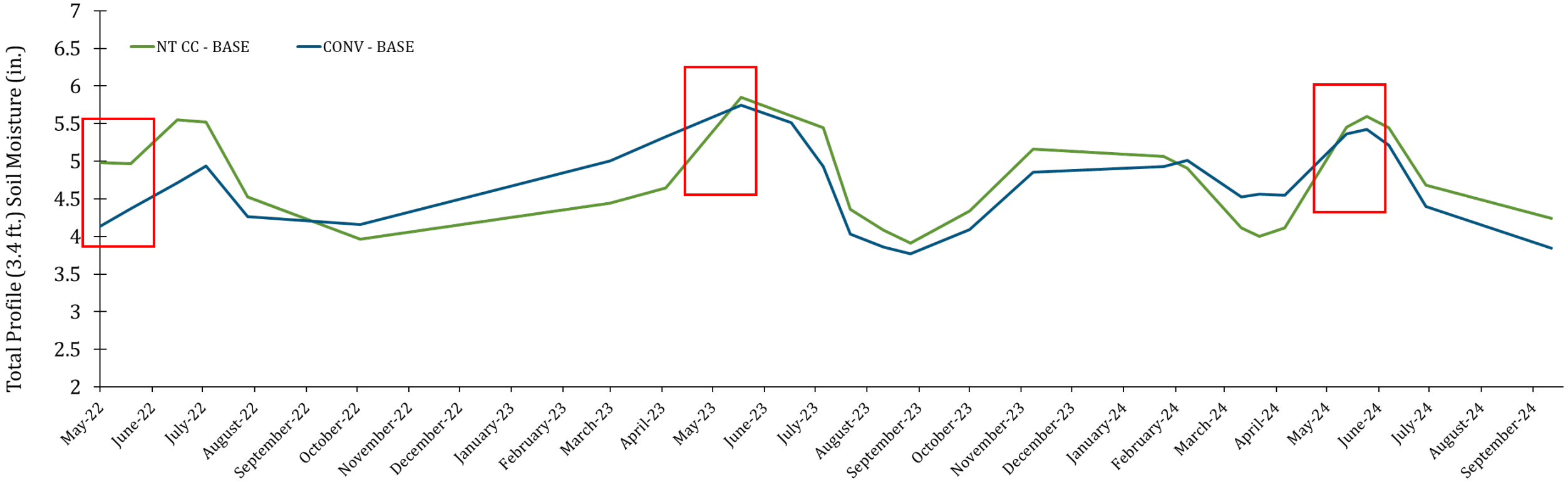
# Continuous Cotton w/ No-Tillage and a Winter Cover Crop



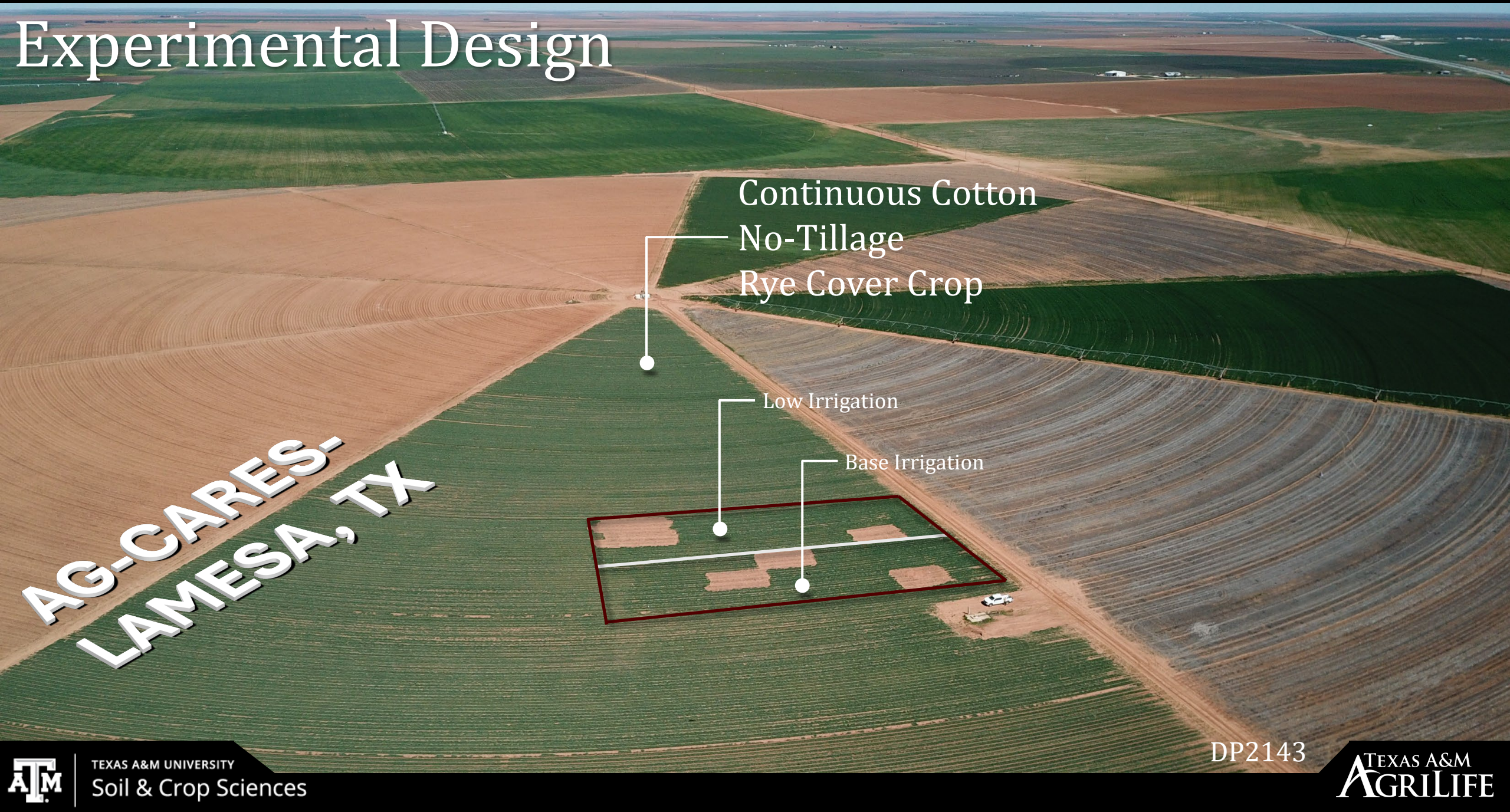



# Soil Water Dynamics

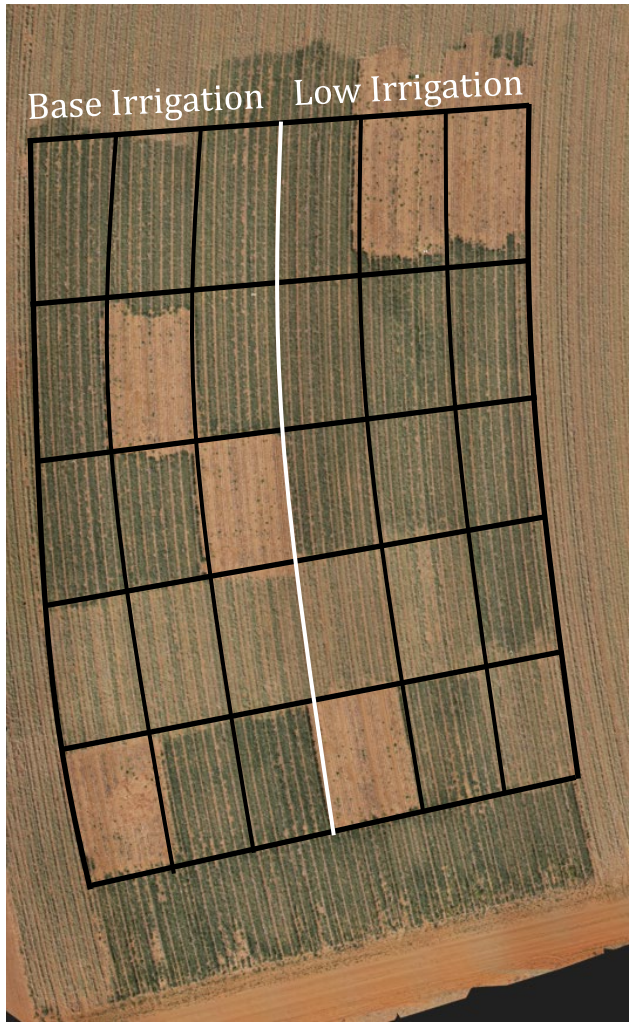


# Experimental Design




DP2143

# Experimental Design



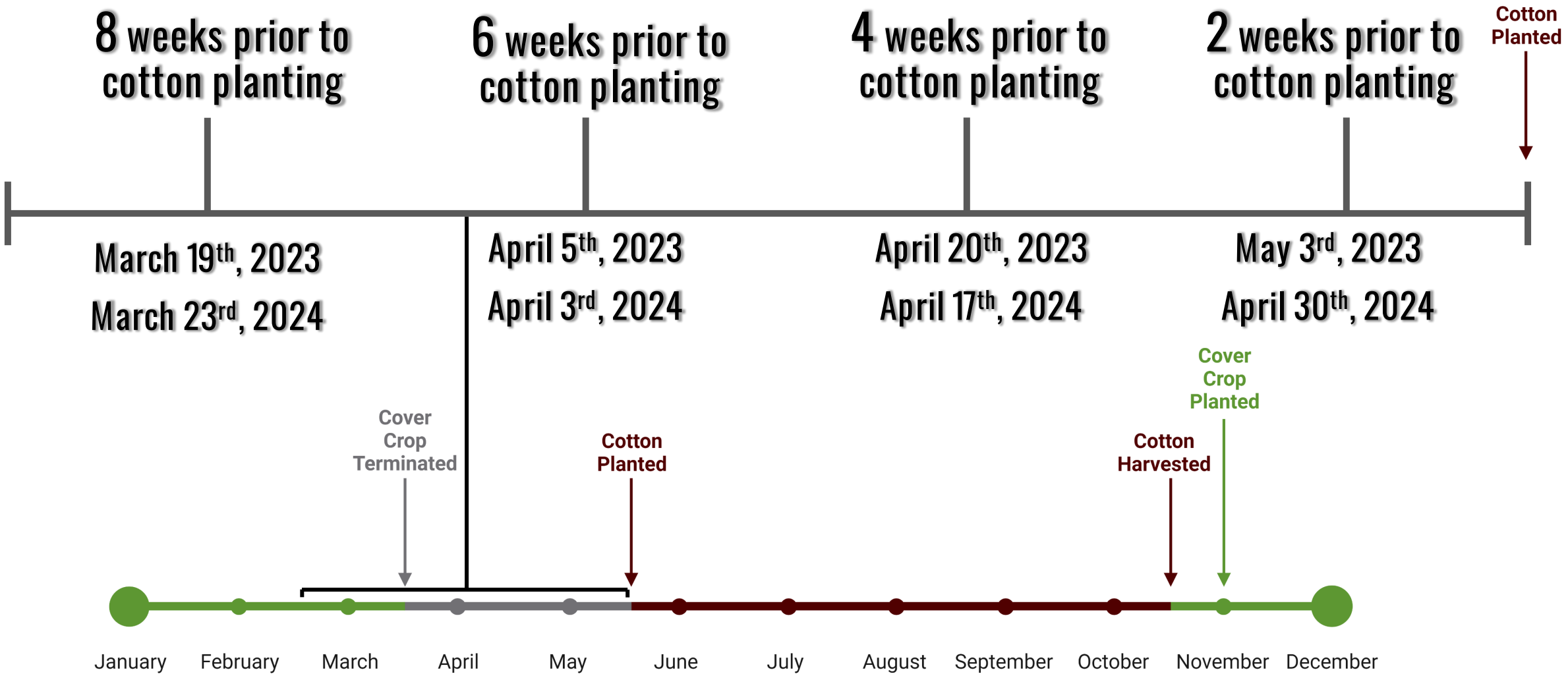

Split-plot RCBD

Base irrigation: 60% ET Replacement
Low irrigation: 30% ET Replacement

No cover control
Cover termination 8 weeks prior to cotton planting
Cover termination 6 weeks prior to cotton planting
Cover termination 4 weeks prior to cotton planting
Cover termination 2 weeks prior to cotton planting

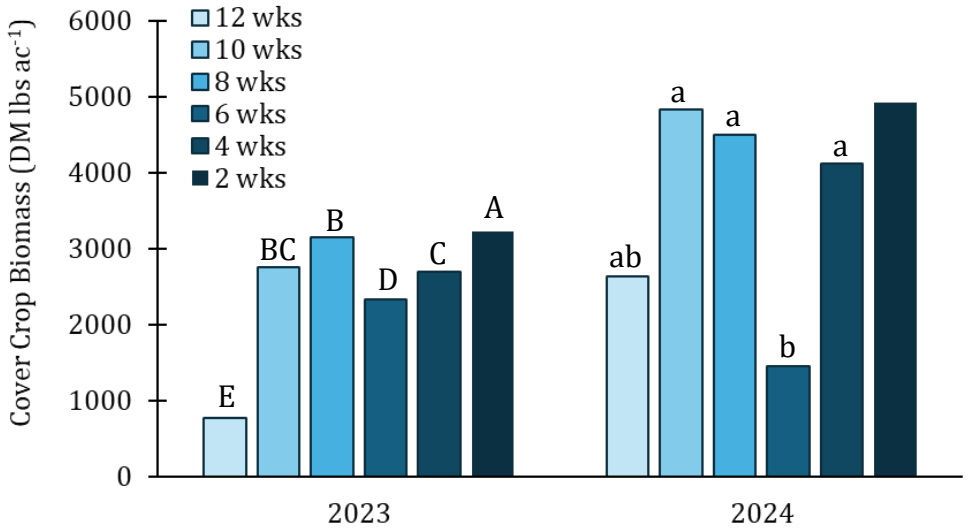
8-row plots; 40 ft row length

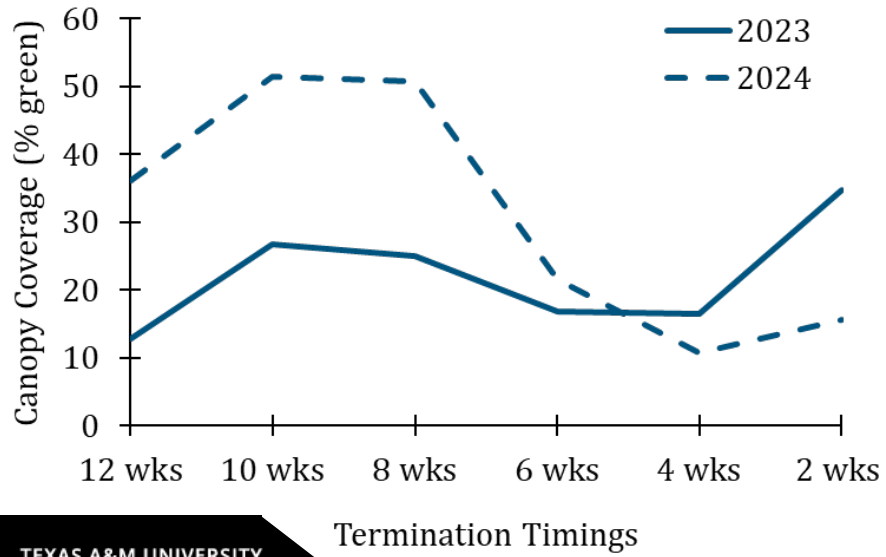
# Cover Crop Termination




Results

# Cover Crop Biomass



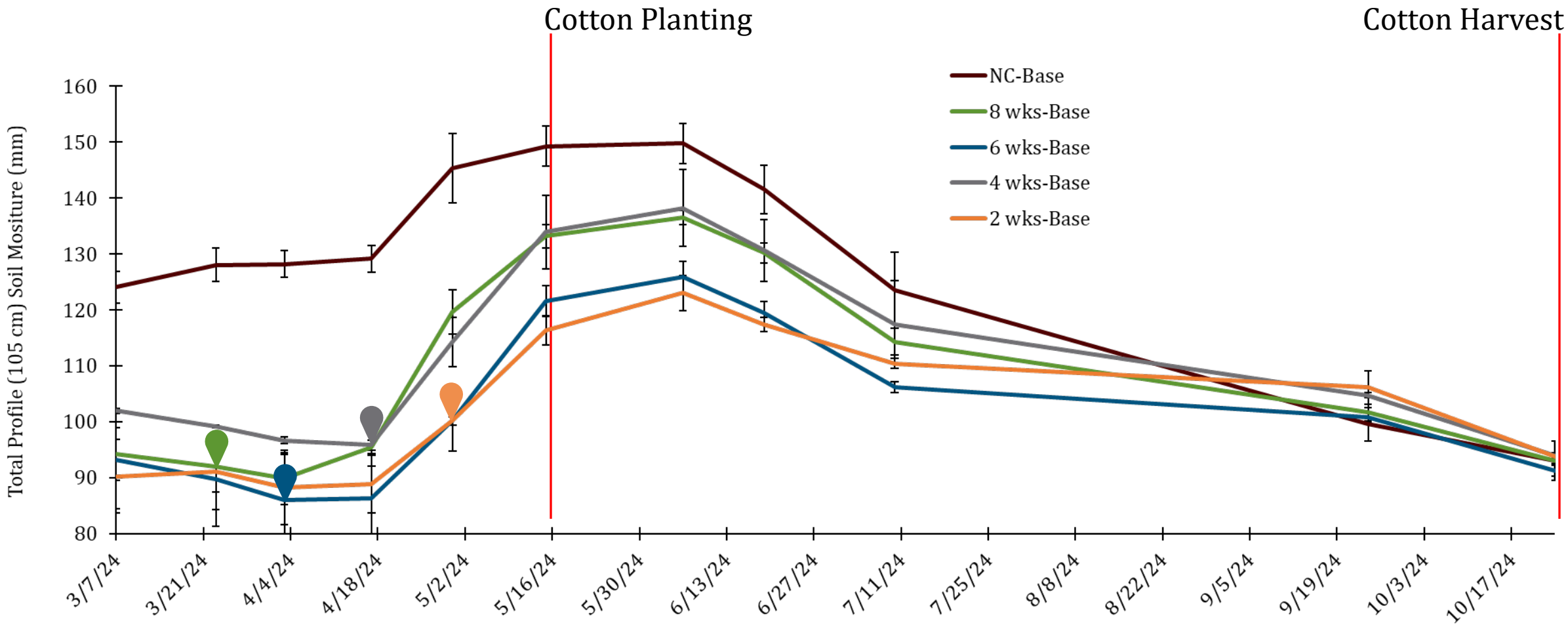




Polynomial curve for cover biomass growth

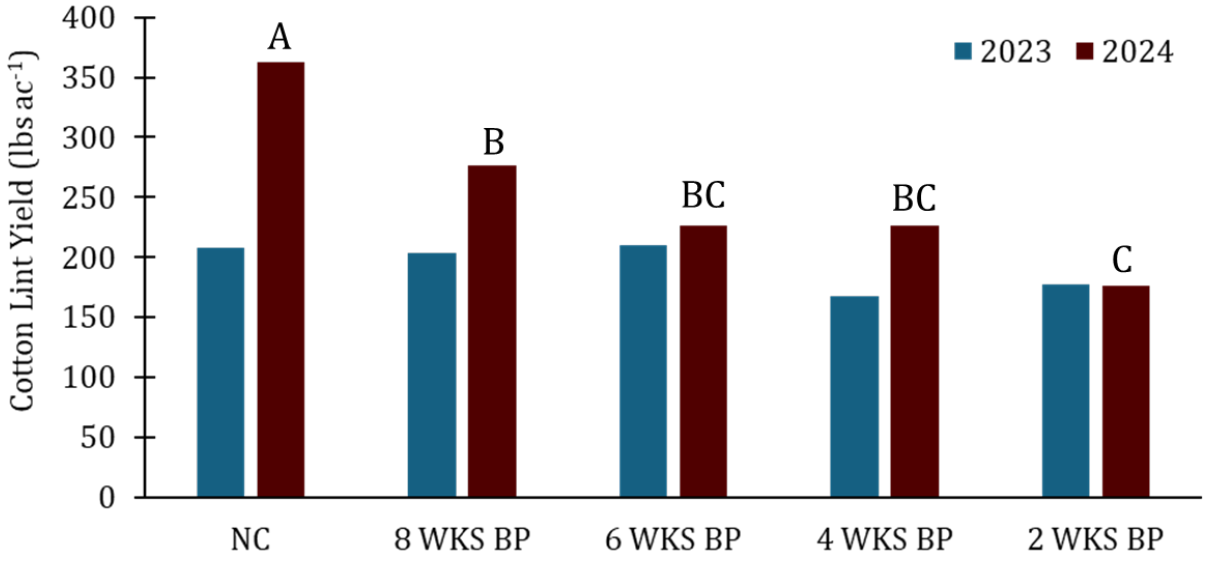
6 weeks from cotton planting shows a decrease in cover biomass and canopy coverage

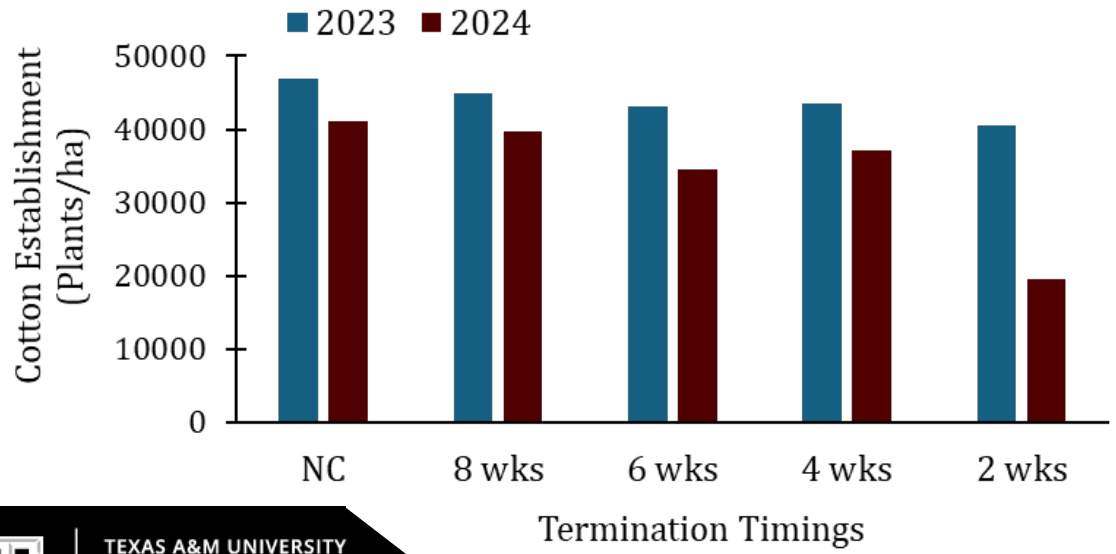
Soil water dynamics, soil nutrient cycling, and plant nitrogen uptake must be considered

# Soil Water Dynamics



# Cotton Lint Yield




Decrease in cotton lint yield the closer the cover is terminated to cotton planting

Decrease in cotton establishment when cover is terminated 2 weeks before planting

# Summary

- **Decreased soil moisture compared to No Cover control and with closer termination timings to cotton planting**
- **Cotton lint yield differences in Year 2**
- **Cover crop biomass dynamics are consistent in Years 1 & 2**
- **Soil and plant nutrient data will elaborate on optimization**

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# QUESTIONS?

Christopher J. Cobos
Ph.D. Student & Sr. Research Associate
Texas A&M AgriLife – Soil Chemistry and Fertility
Christopher.cobos@ag.tamu.edu – txsoillab.com