

Nitrogen fertilization to maintain cotton production following cover crop use in semi-arid West Texas

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Beltwide Cotton Conferences
New Orleans, LA
11 January 2023

TEXAS A&M
AGRILIFE
RESEARCH

The Dust Bowl and beyond


Lubbock County, 2019





Lubbock County, 2021




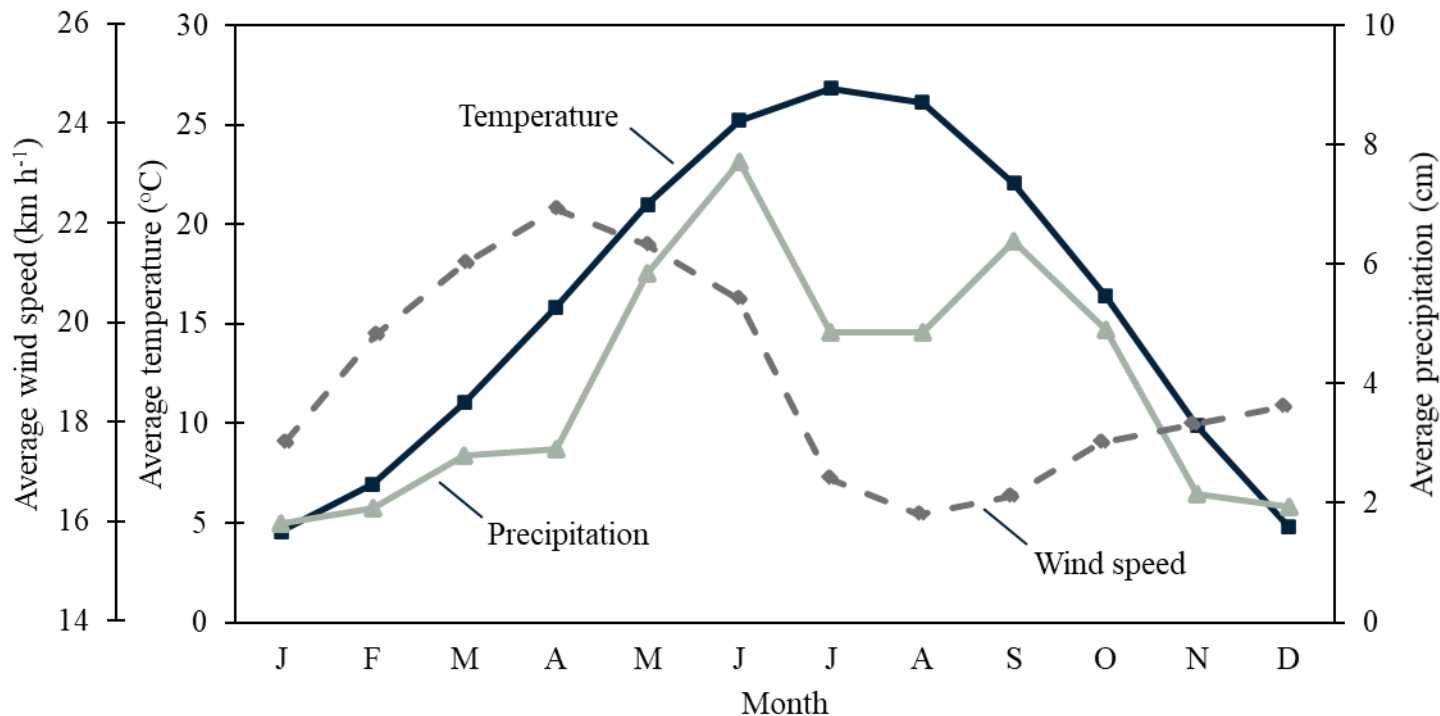
The Southern High Plains climate

 55 – 63°F

 12.3 mph

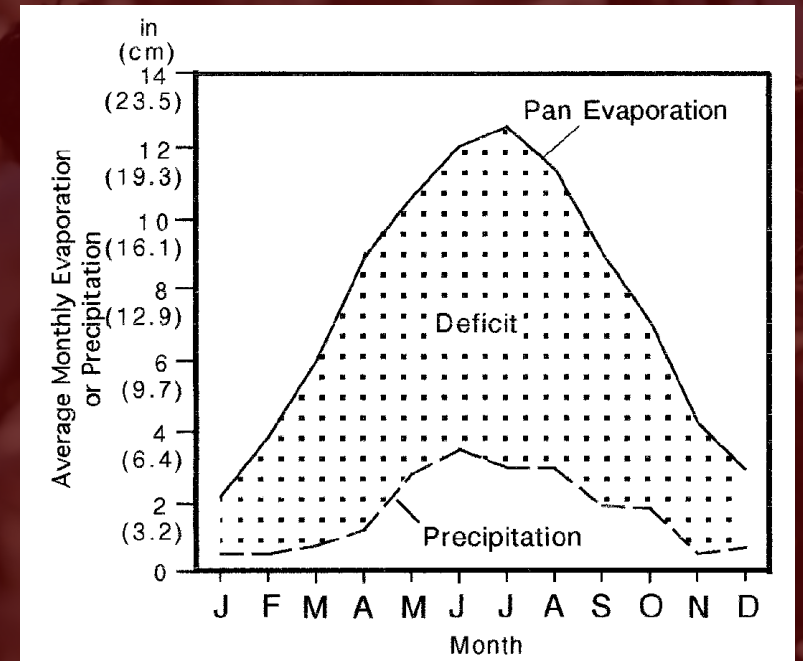
 16 – 22 inches

 195 – 255 days y⁻¹



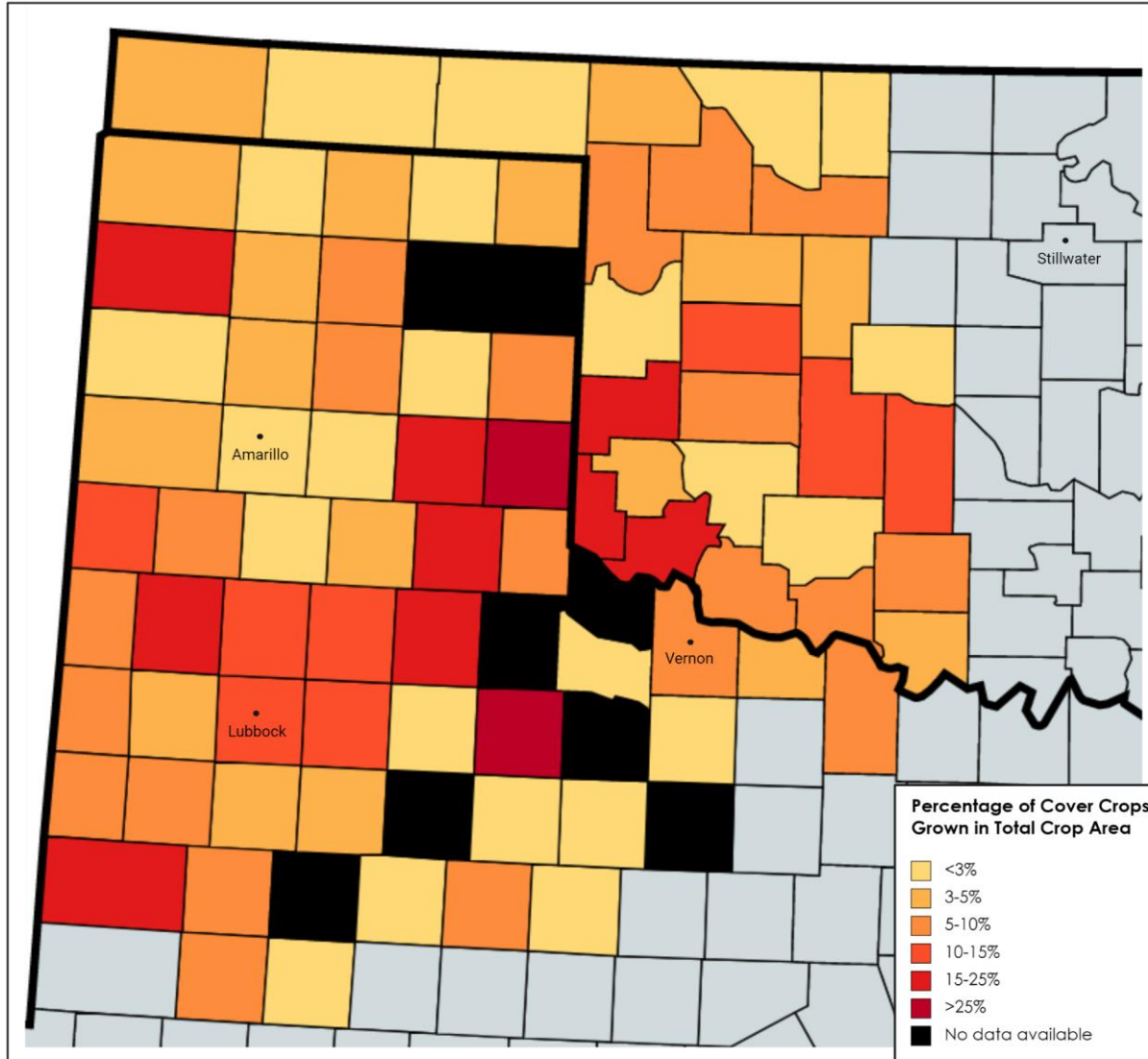
Potential evapotranspiration (PET)

- Average annual PET exceeds precipitation by 2-3 times



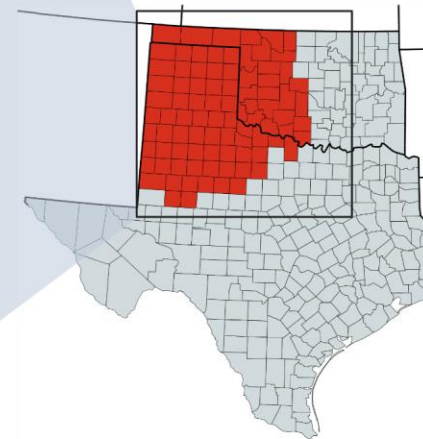
Gustovson and Holliday, 1999.
J. Sediment. Res. 69: 622-634.

Cover crop adoption on the Southern High Plains



Conservation management:

- Cover cropping – 7.5%
- Reduced tillage – 54.4%



Values from 2017 Census of Agriculture

Cotton agronomy timeline

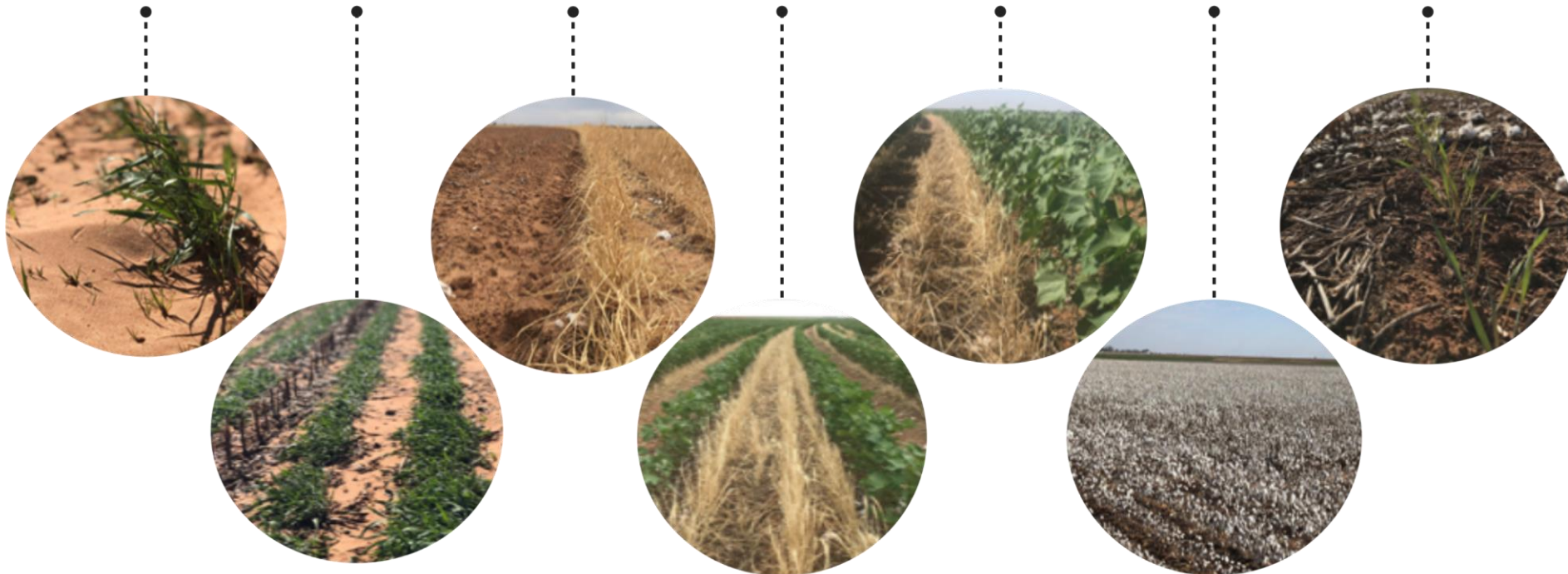
Months of the Year

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

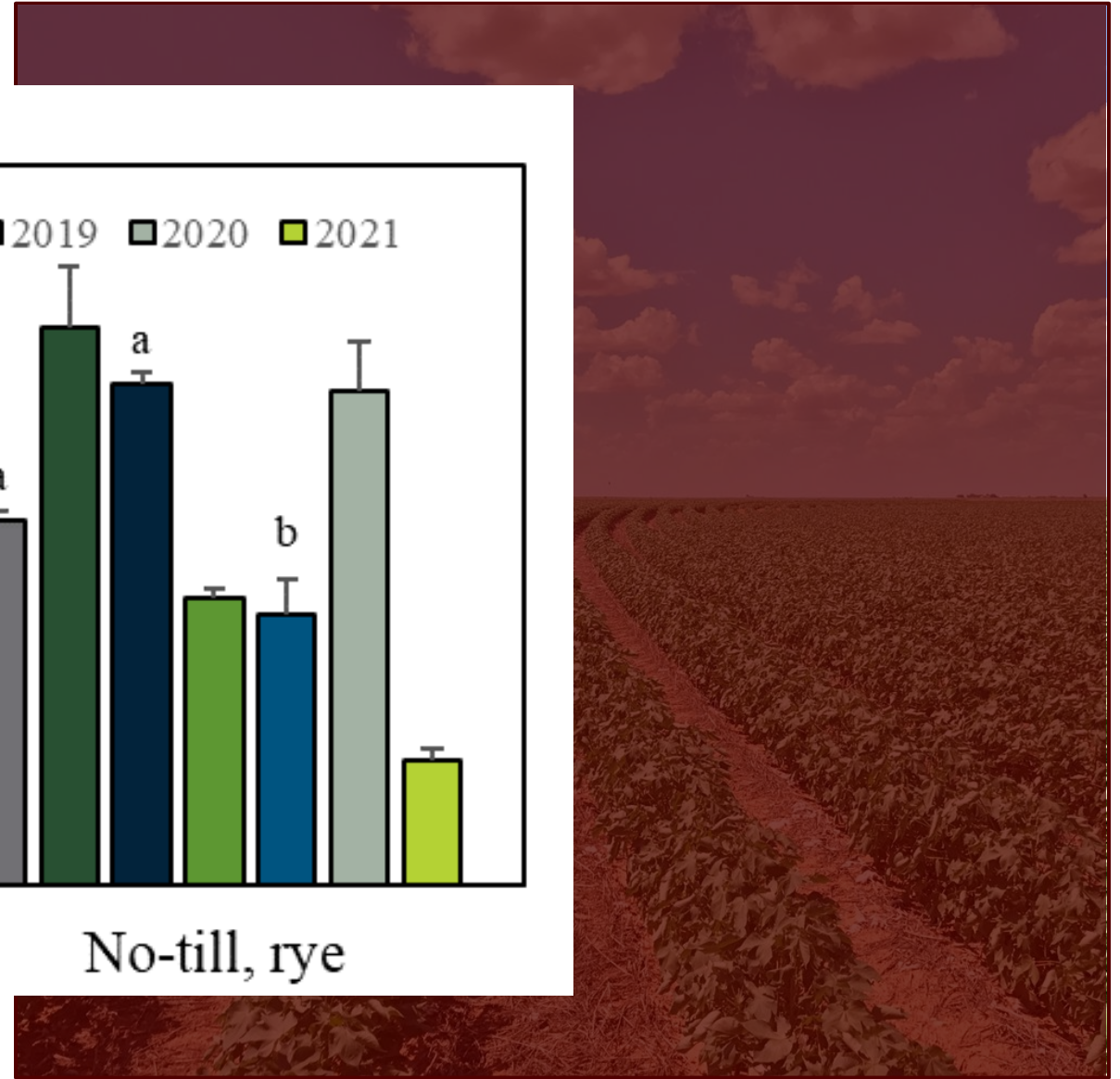
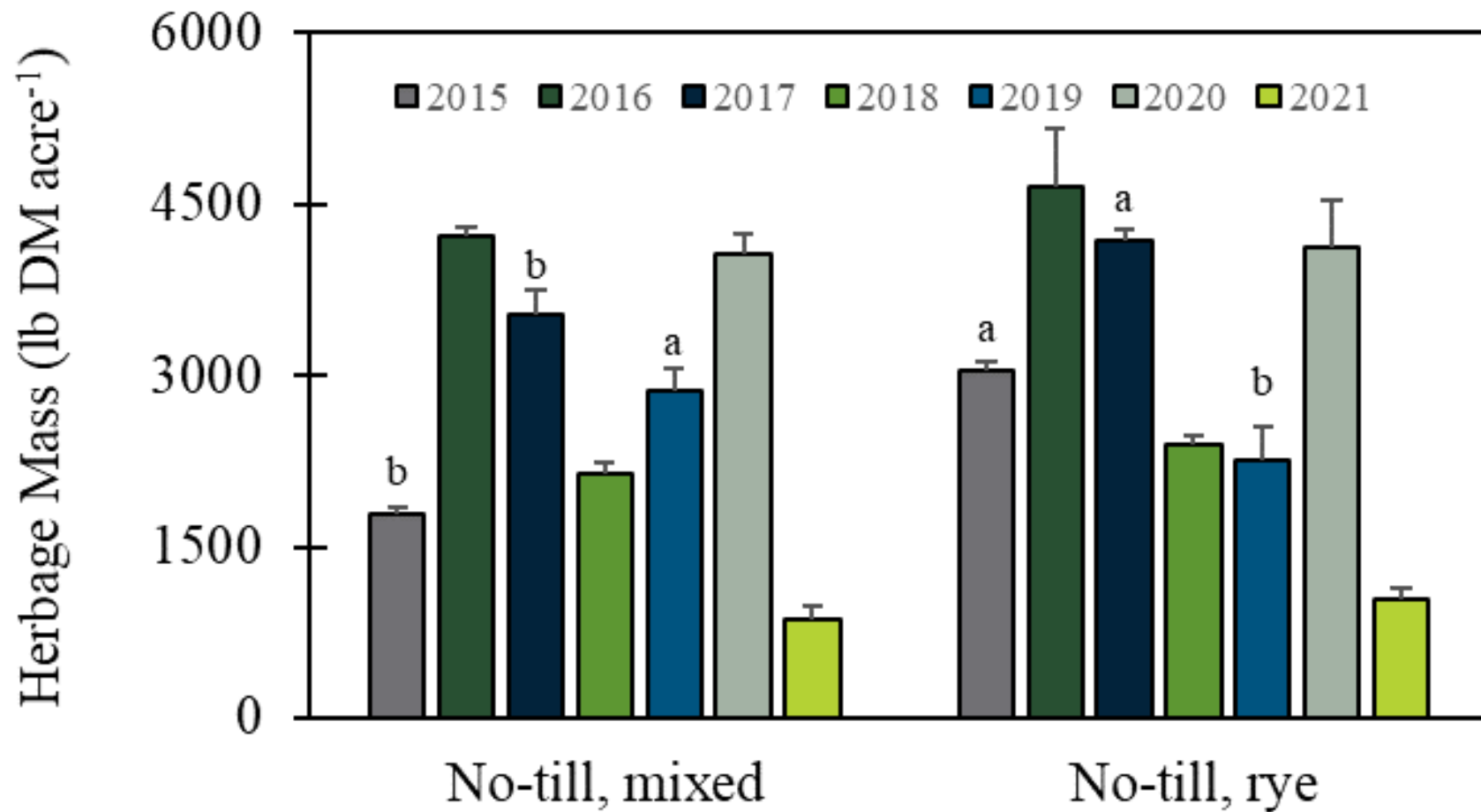
Traditional cotton agronomy timeline:



Conservation cotton agronomy timeline:

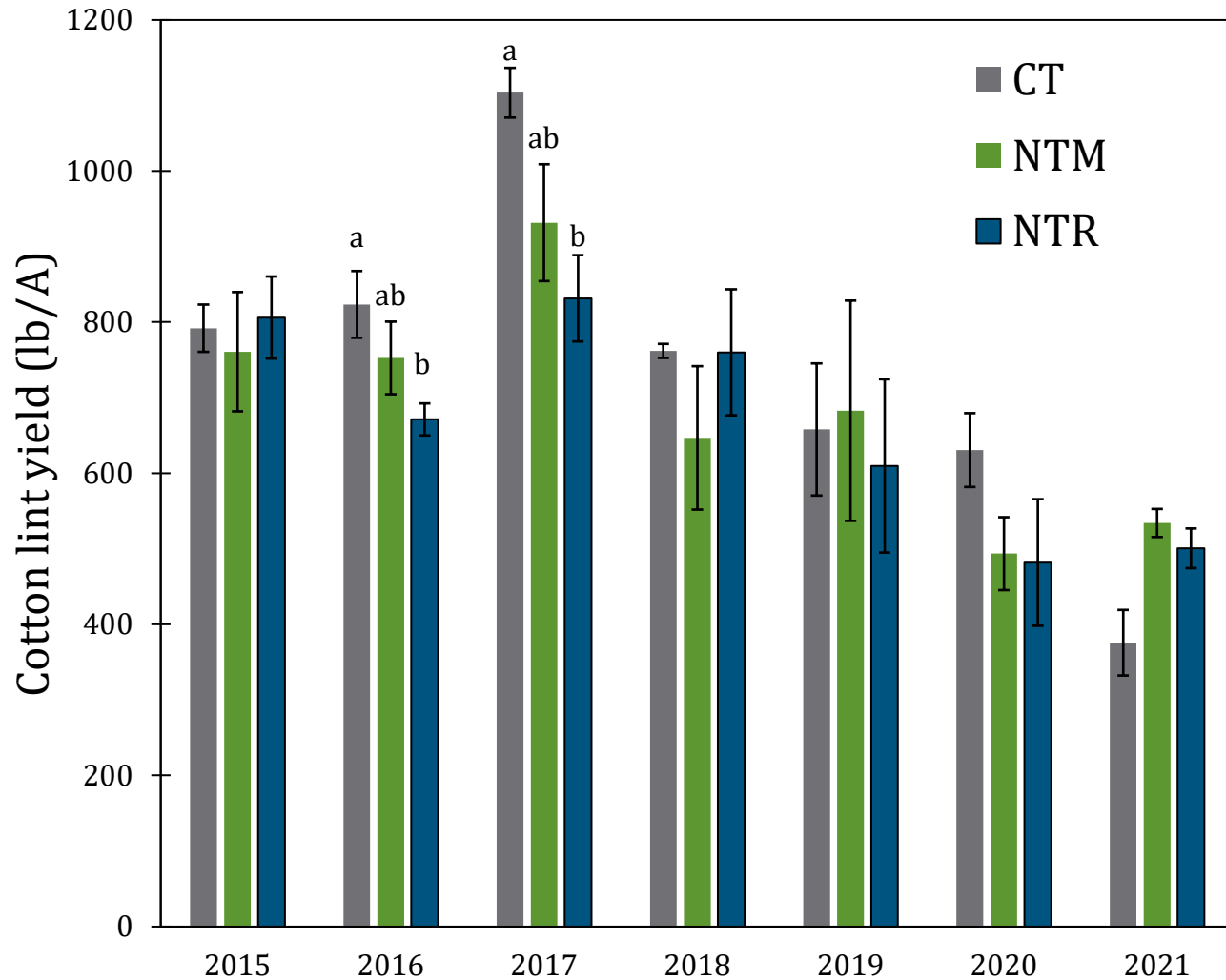


Cover crop biomass



Cotton lint yield

Lewis et al., 2018, *Agron. J.* 110:1616-1623
Burke et al., 2022, *Agronomy*, 12:1306



Conservation management has
a variable effect on yield



Carbon

Nitrogen



CT, conventional tillage, winter fallow; R-NT, no-tillage, rye cover; M-NT, no-tillage, mixed species cover

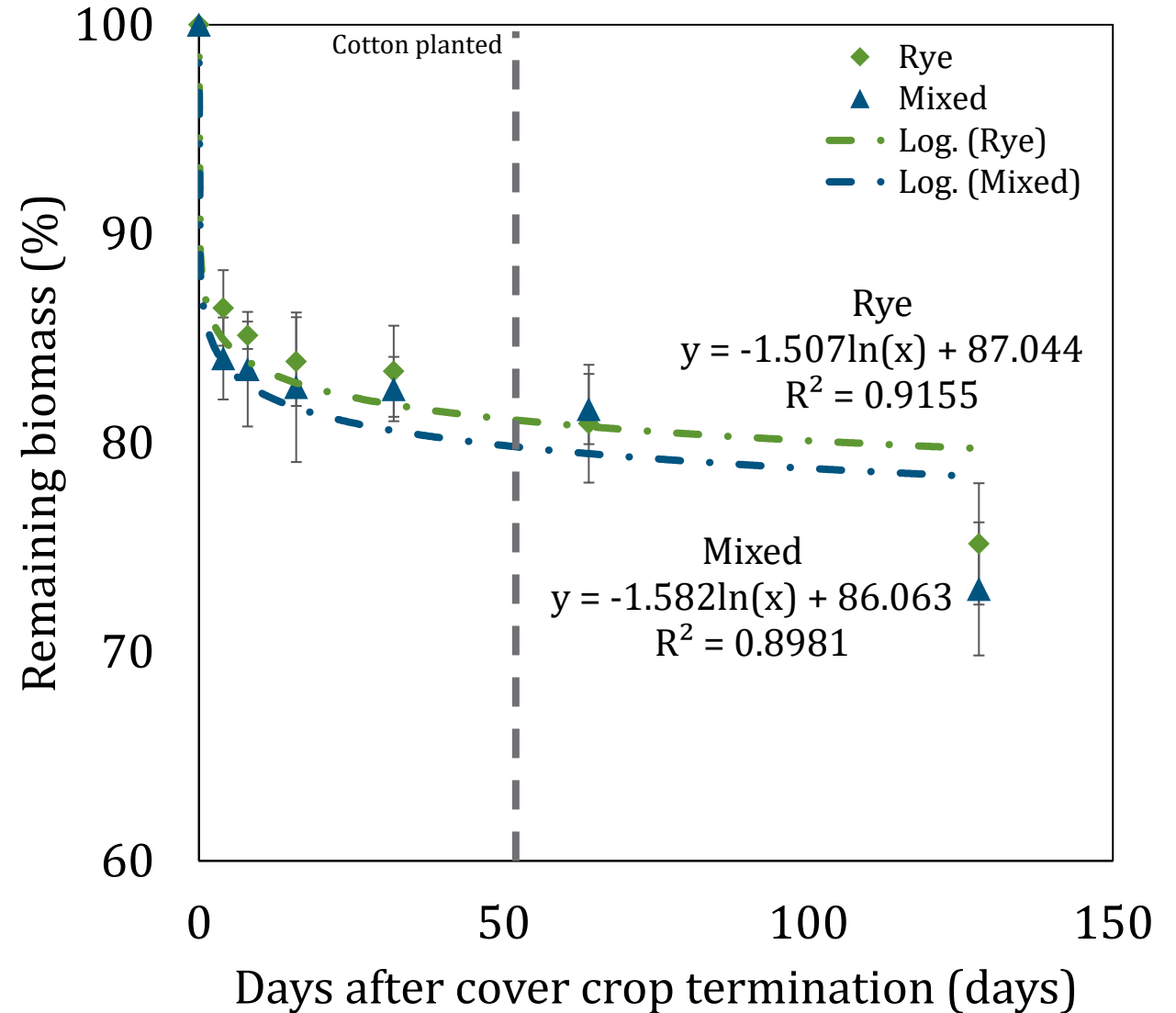
Biomass decomposition - 2020

Cover crop	Biomass (lb ac ⁻¹)	N (%)	Potential N (lb ac ⁻¹)
Rye	4,131	3.1	128.0
Mixed	4,068	3.0	122.1

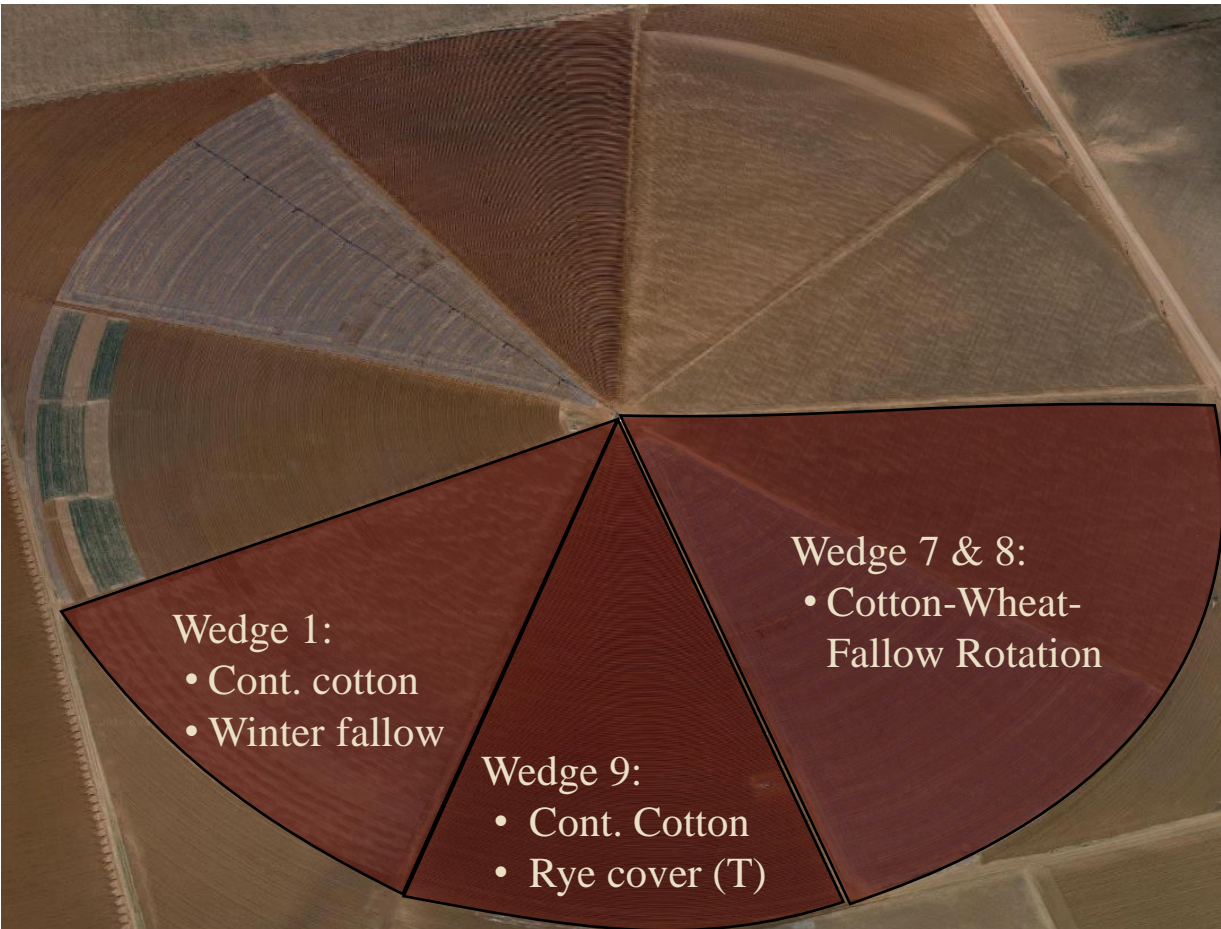
Potentially mineralizable N

% Mineralized	Mineralized N (lb ac ⁻¹)	
	Rye	Mixed
5	6	6
10	13	13
20	26	24
30	38	37
40	51	49
50	64	61

Will N mineralization and availability coincide with cotton demands?



The experimental design



Nitrogen study plot design at Ag-CARES in Lamesa, TX

Treatments

- Cropping systems –
 - Conventional tillage, winter fallow (CC)
 - Continuous cotton with rye cover (CCRC)
 - Cotton-wheat-fallow rotation (CWR)
- Nitrogen applications –
 - Farmer's practice (120 lb N A^{-1} , FP)
 - FP + 30 lb N A^{-1} preplant (PPN)
 - FP + 30 lb N A^{-1} 2-3 weeks post emergence (POS)
 - FP + 30 lb N A^{-1} pinhead square + 2 weeks (PIN)

Plot Size – 4 rows by 40 ft long
RCBD with four replications

- Replication within span

Cotton production

2018-2020 averages

Cropping System	Nitrogen fertilization strategies				AVG
	FP	PPN	PEN	PHSN	
	Lint yield (lint acre ⁻¹)				
CC	723	787 (8.9%)	715 (-1.1%)	683 (-5.5%)	727
CCRC	806	938 (16.4%)	965 (19.6%)	857 (6.2%)	891 (23.3%)
CWR	1,134	1,032 (-9.0%)	1,117 (-1.5%)	1,064 (-6.2%)	1,087 (50.4%)
AVG	888	919 (3.5%)	932 (5.0%)	868 (-2.2%)	



Fertilization strategies:

- FP = farmers practices (120 lb N A⁻¹)
- PPN = FP + 30 lb N A⁻¹ at preplant
- PEN = FP + 30 lb N A⁻¹ at post emerg. + 2 wks
- PHSN = FP + 30 lb N A⁻¹ at pinhead square + 2 wks

Cropping systems:

- CC = Continuous cotton, conventional tillage (>25 yrs)
- CCRC = Continuous cotton-Rye cover (est. 2014)
- CWR = Cotton-Wheat rotation (est. 2014)

Gross Margins

2018-2020 averages

Cropping System	Nitrogen fertilization strategies				AVG
	FP	PPN	PEN	PHSN	
	Gross Margin (\$ acre ⁻¹)				
CC	434	489 (12.7%)	441 (1.6%)	420 (-3.3%)	336
CCRC	489	591 (20.7%)	608 (24.3%)	536 (9.5%)	556 (65.5%)
CWR	609	575 (-5.6%)	610 (0.3%)	587 (-3.6%)	595 (77.1%)
AVG	511	552 (8.0%)	553 (8.2%)	514 (0.6%)	



Fertilization strategies:

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Summary & recommendations



Cotton following a cover crop benefits from additional N fertilization and added N fertilizer earlier in the growing season is most beneficial.



Cotton following wheat did not benefit from additional N fertilization to stimulate mineralization but did yield the greatest lint.



Partial budgets indicate no-tillage with cover crops or crop rotations are economical alternative to continuous cotton production on the High Plains.



Complete economic budgets are needed to understand the system. Current fertilizer prices may change the benefit of these production systems.

THANK YOU

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