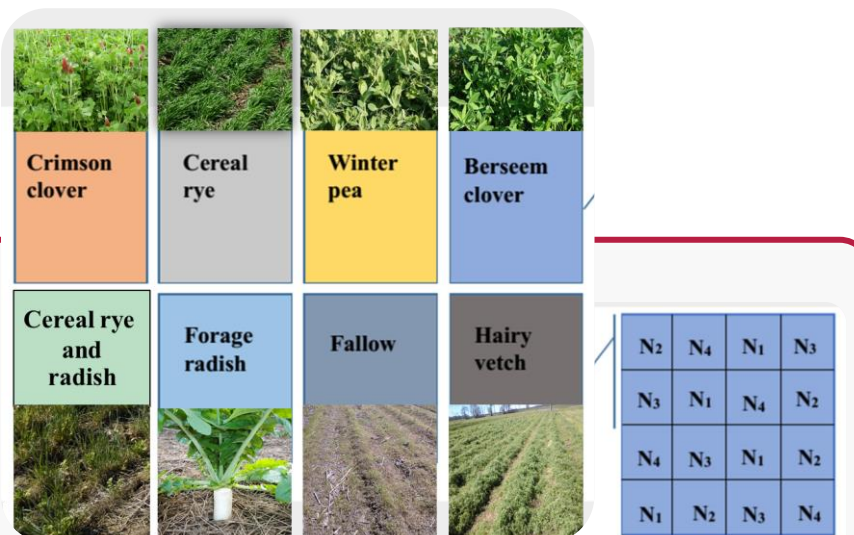


COVER CROP STUDIES

Study 1

Cover crops and nitrogen rates impacts on soil chemical and biological properties in Louisiana no-till corn production



Study 2

The decomposition and nutrient release dynamics of mixed cover crops on corn/cotton/soybean rotation under a no-till system



Study 3

The effect of fallow season cover crops on soil health on-farm demonstration in the mid-south



STUDY 1

Winter Cover Crops and Nitrogen Application Effects on Nutrient Cycling and Soil Biological Properties on Corn Production in Louisiana

Objective: to examine the interaction of **cover crops** and **nitrogen rates** on soil nutrient cycling, enzyme activities, and microbial composition

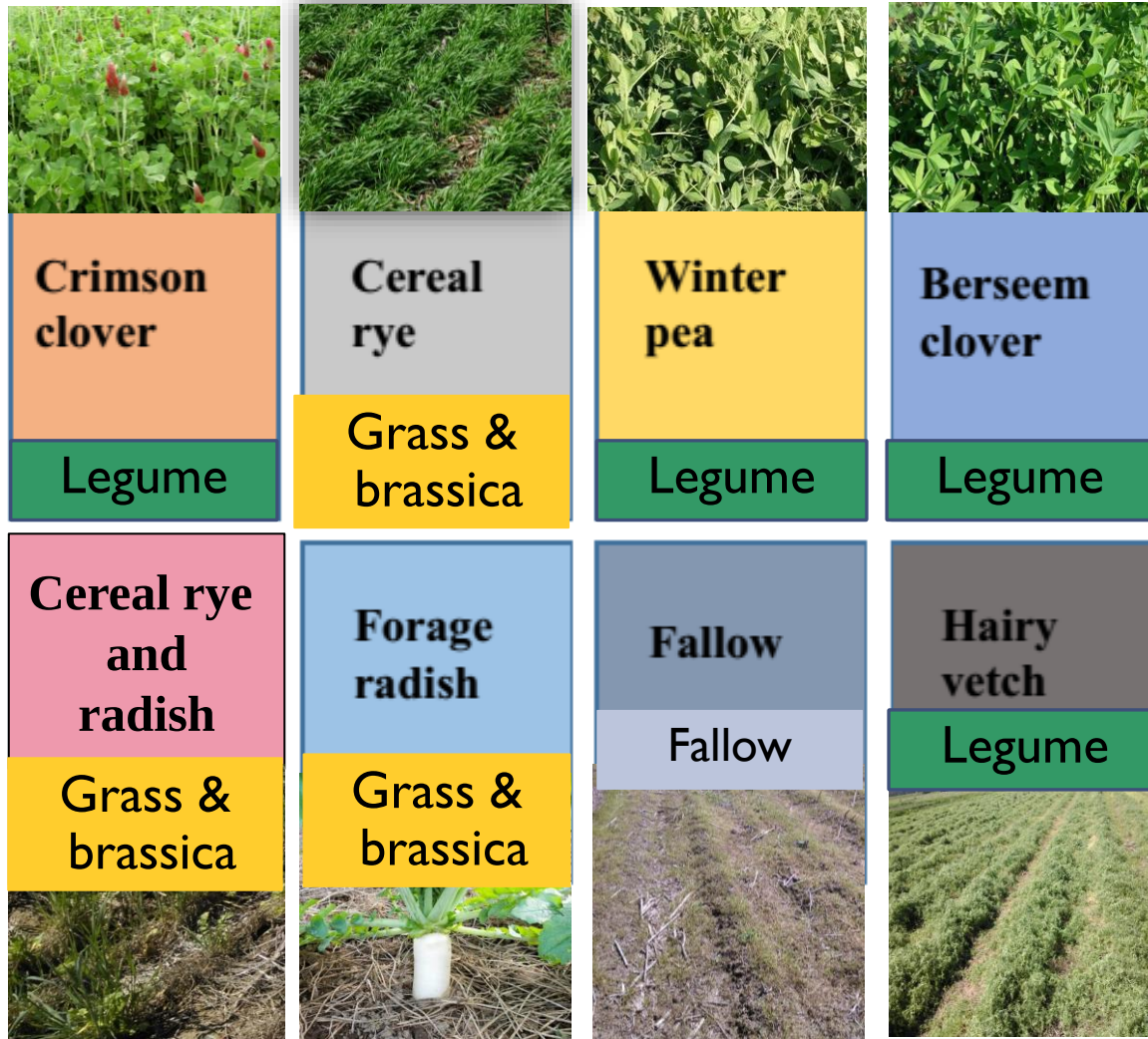


Site description

- Site: LSU AgCenter Macon Ridge Research Station, Winnsboro, LA
- 2017-2018
- Soil type: Gigger-Gilbert silt loam

EXPERIMENTAL DESIGN

Split-plot



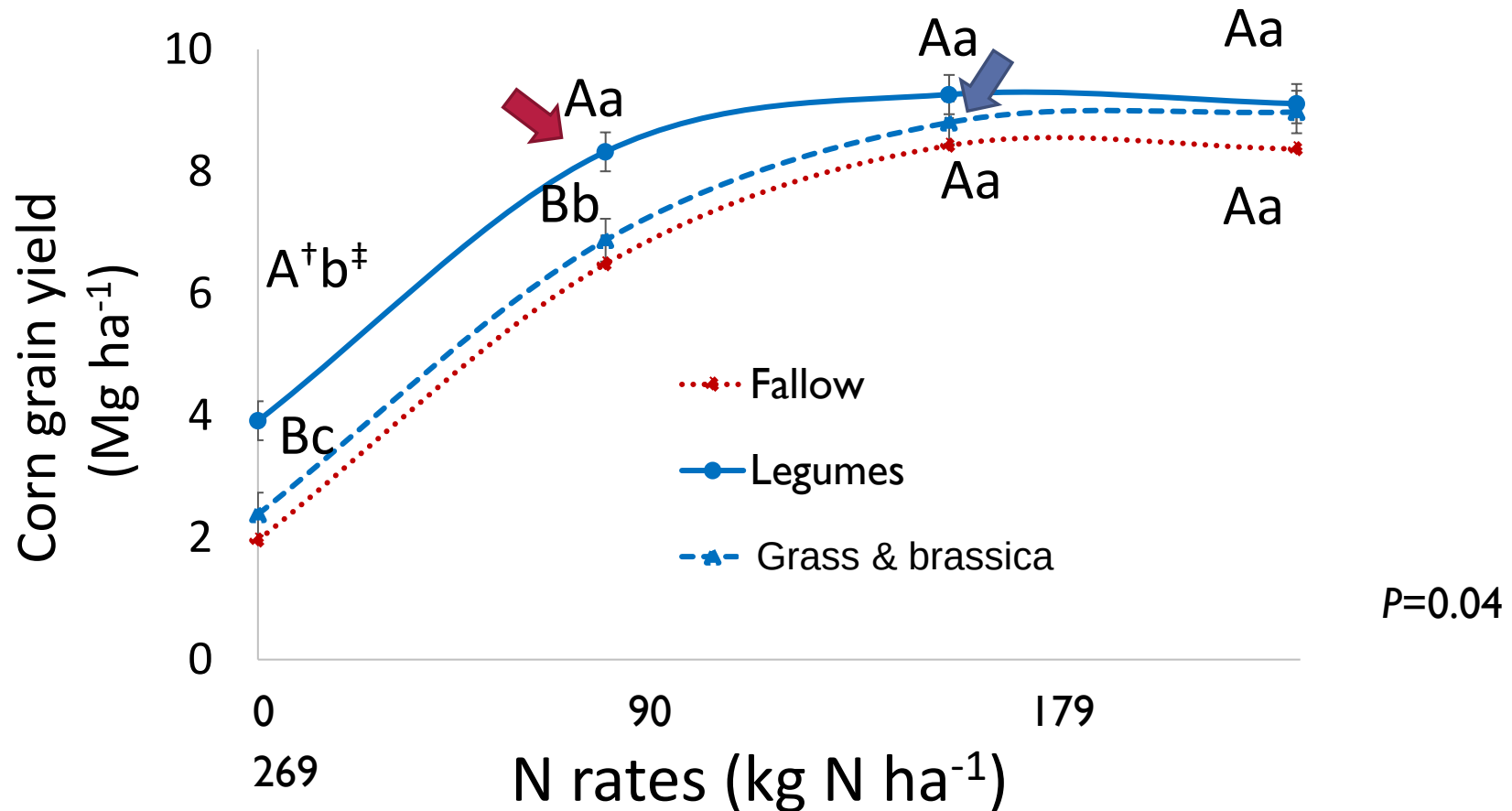
- **Main plot: cover crops**
 - Legumes
 - Non-legumes
 - Fallow
- **Sub plot: nitrogen rates**
 - 0, 90, 179, 269 kg N ha⁻¹

N ₂	N ₄	N ₁	N ₃
N ₃	N ₁	N ₄	N ₂
N ₄	N ₃	N ₁	N ₂
N ₁	N ₂	N ₃	N ₄

(Applied urea)

- Soil sampling** (Total 512 samples)
- Spring 2017 (128 samples)
 - Fall 2017 (128 samples)
 - Spring 2018 (128 samples)
 - Fall 2018 (128 samples)

CORN GRAIN YIELD RESPONSE



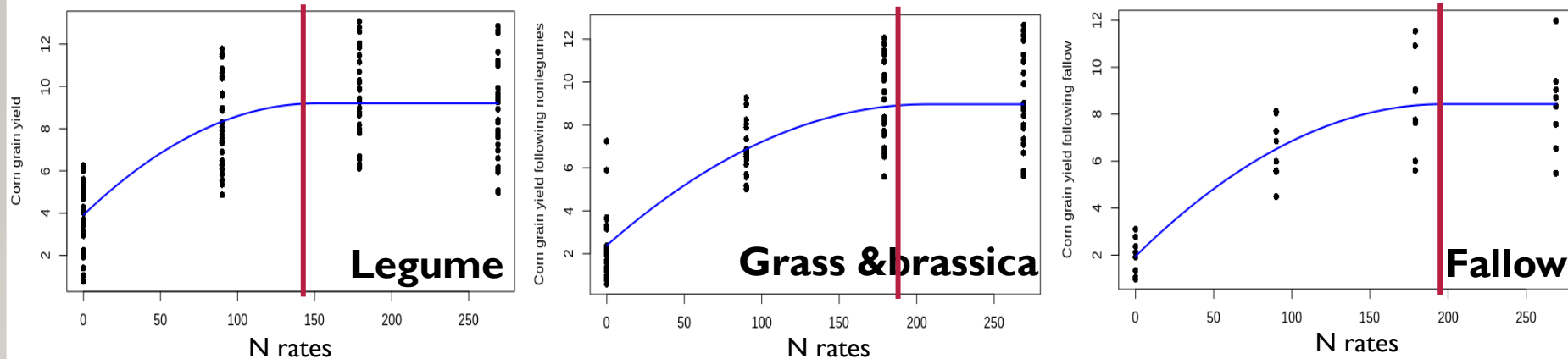
⁺Same uppercase letters are not significant between cover crop treatments.

[‡]Same lower letter are not significant within N rates.

- ❖ Legumes maximized yield at 90 kg N ha⁻¹
- ❖ Grass & brassica maximized corn grain yield at 179 kg N ha⁻¹

ECONOMIC OPTIMUM N FERTILIZER RATE

Corn yield response parameters[†] at economic optimum N fertilizer rate (EONR)



Cover crops	a	b	c	N rate at the plateau	EONR	Yield at plateau
	Mg ha ⁻¹			kg N ha ⁻¹	kg N ha ⁻¹	Mg ha ⁻¹
Legume	3.92	0.06987	-0.00023	151	149	9.23
Grass & brassica	2.39	0.06356	-0.000169	207	184	8.31
Fallow	1.95	0.06569	-0.000167	197	193	8.43

[†] a, b, c, intercept, linear coefficient and quadratic coefficient, respectively

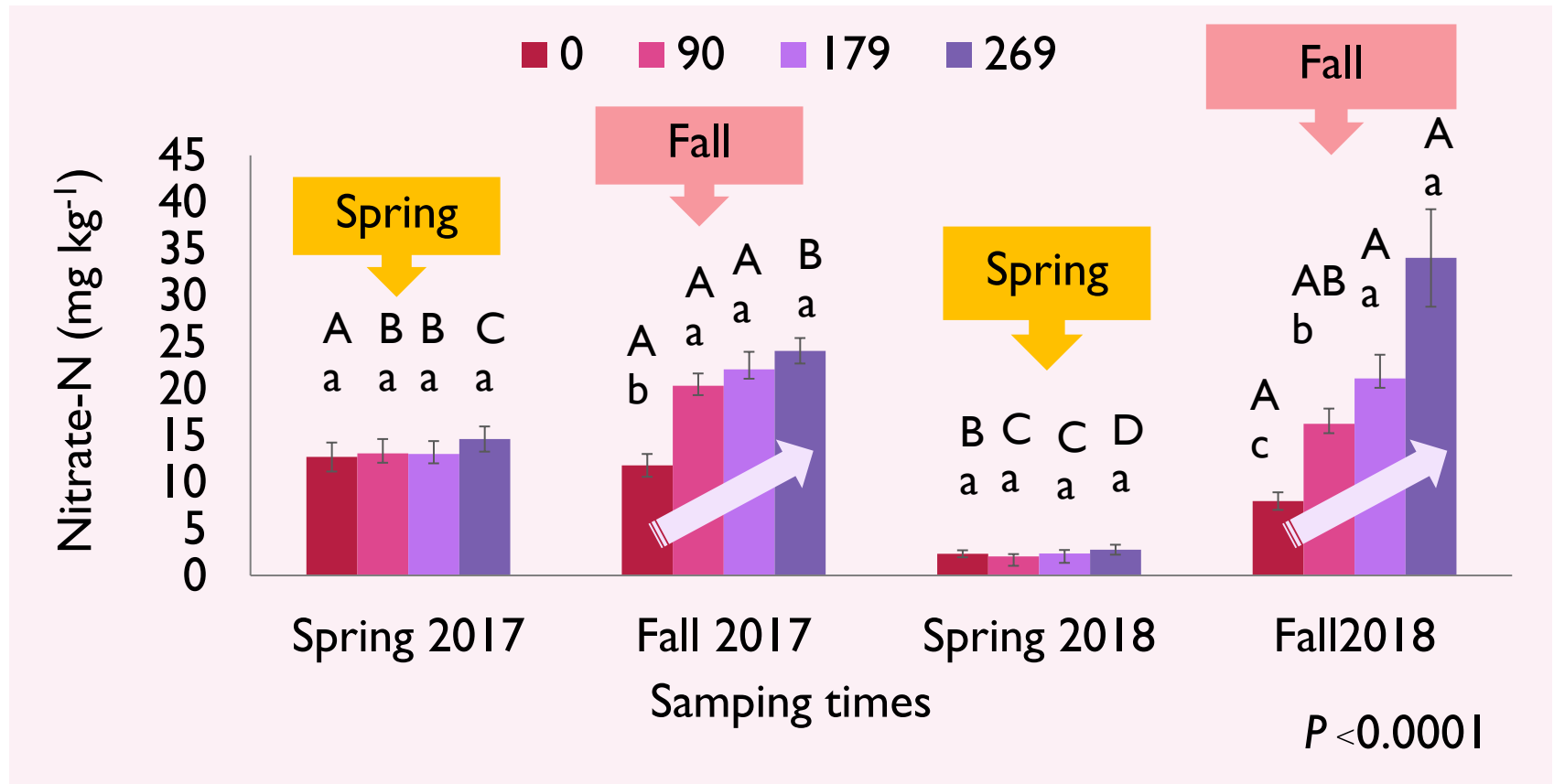
- Growing corn following legumes >> reduce EONR and maintained the yield.
- Grass & brassica treatments >> N immobilization.

EFFECT ON SOIL CHEMICAL PROPERTIES

	SOM	NH ₄ ⁺ -N	NO ₃ ⁻ -N	P	K
	-----mg kg ⁻¹ -----				
Legume	28.48	6.45	15.01 A	33.85 A	183.89 B
Grass& brassica	28.65	6.80	12.57 B	28.02 B	208.36 A
Fallow	27.33	5.86	12.17	29.44	196.14
P value	0.5230	0.3532	0.0099	0.0002	<0.0001
N0	26.92 B	6.17	8.70 C	38.99 A	207.35 A
N90	29.10 A	6.36	12.93 B	26.99 B	191.12 B
N179	29.25 A	6.96	14.65 B	28.80 B	196.17 B
N269	29.01 A	7.01	18.87 A	28.96 B	189.85 B
P value	<0.0001	0.2841	<0.0001	<0.0001	0.0014
Spring-17	26.92 C	9.04 A	13.36 B	34.00	195.67 B
Fall-17	28.83 B	5.59 BC	19.56 A	29.22	213.57 A
Spring-18	28.34 B	5.37 C	2.38 C	29.76	185.44 C
Fall-2018	30.16 A	6.50 B	19.84 A	30.75	189.81 BC
P value	<0.0001	<0.001	<0.0001	0.1317	<0.0001

EFFECT ON SOIL CHEMICAL PROPERTIES

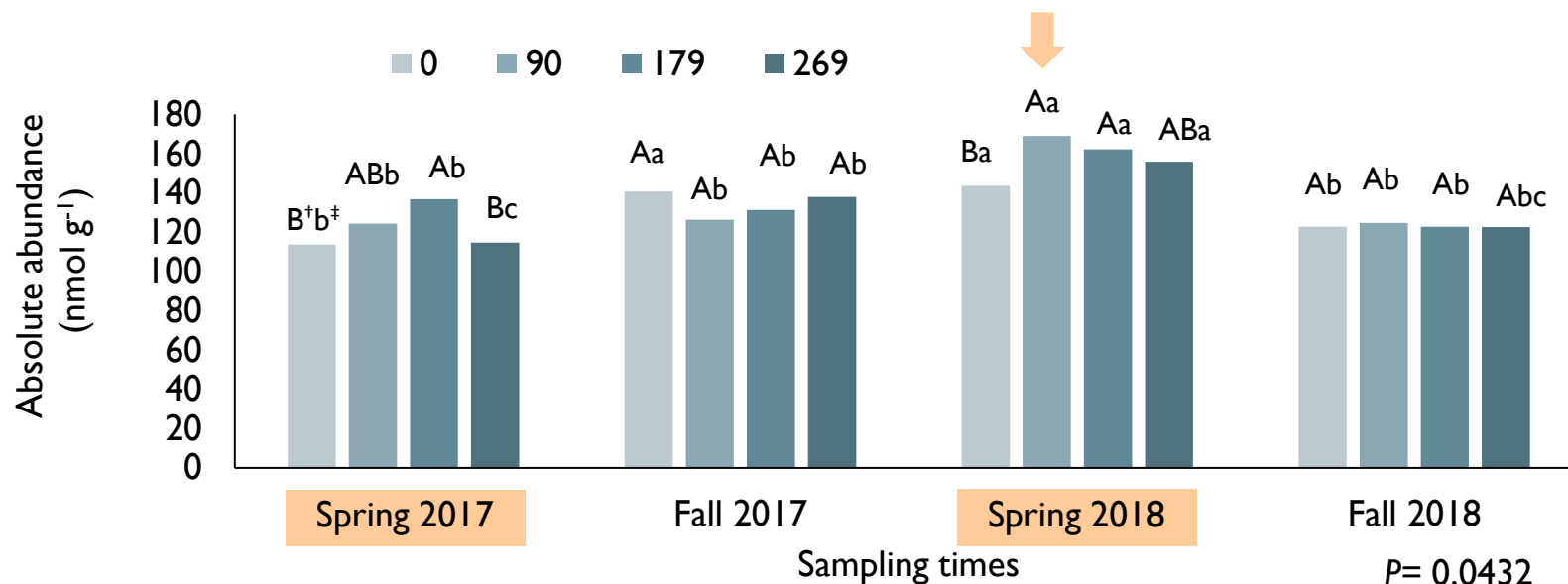
Soil Nitrate-N



Same uppercase letters are not significant ($\alpha = 0.05$) within an N rate across sampling times. Same lowercase letters are not significant ($\alpha = 0.05$) between N rates within a sampling time

SOIL MICROBIAL COMMUNITY

N rate x sampling time effect on microbial biomass



[†]Same uppercase letters are not significant ($\alpha = 0.05$) within a sampling time and . ^{*}Same lowercase letters are not significant ($\alpha = 0.05$) within N rates across sampling times.

- ❖ For total microbial abundance, after grown cover crops in second year at N 90 maximized the total microbial abundance

STUDY 2

The decomposition and nutrient release dynamics of mixed cover crops on corn/cotton/soybean rotation under a no-till system

Objective: to examine cover crop biomass degradation and the release of nitrogen and other nutrients from cover crop biomass and identify the optimum time of inorganic N availability for the subsequent cash crop



Locations

Site: Macon Ridge Research Station,
Winnsboro, LA

(Gigger-Gilbert silt loam)



Site: Dean Lee Research Station,
Alexandria, LA

(Coushatta silt loam)



EXPERIMENTAL DESIGN

Split plot in RCBD

Main-plot ; cover crop treatments

Sub plot ; N Rates (kg N ha⁻¹) 0 and 179

Site: Macon Ridge

801 179	802 269	803 90	804 179	805 90	806 0	807 90	808 269	809 90	810 90	811 90	812 0	813 90	814 0	815 179	816 269
701 0	702 90	703 179	704 0	705 0	706 269	707 269	708 179	709 0	710 269	711 179	712 90	713 269	714 269	715 90	716 0
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101 0	102 0	103 0	104 0	105 0	106 0	107 0	108 0	109 0	110 0	111 90	112 90	113 0	114 90	115 179	116 90

Site: Dean Lee

801 90	802 0	803 90	804 90	805 0	806 90	807 179	808 179
701 179	702 179	703 179	704 269	705 269	706 269	707 0	708 90
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201 90	202 90	203 90	204 90	205 179	206 90	207 179	208 90
101 0	102 0	103 0	104 0	105 90	106 0	107 0	108 179

Mixed cover crop treatments

Cereal rye + Hairy vetch
Cereal rye + Black oats
Fallow
Black oats + Wheat + Hairy vetch + Radish
Black oats + Crimson clover + Radish
Wheat + Crimson clover
Wheat
Crimson clover + Hairy vetch + Radish

- 384 soil and biomass samples

Mixed cover crop treatments

Trt 1 – Fallow control
Trt 2 – Black oats + Austrian winter pea
Trt 3 – Winter wheat + Berseem clover
Trt 4 – Cereal rye + Crimson clover + Radish

- 192 soil and biomass samples

DATA COLLECTION

(2019-2020)



Biomass and soil collection

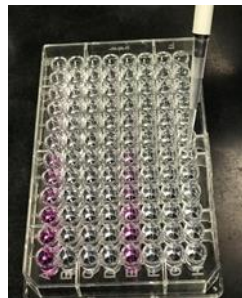
- Week 1,2,3,4, 6, and 8

Cover crop biomass

- Cover crop yield
- Biomass nutrient produced
- % biomass remaining
- % nutrient remaining (TC, TN, P, K and S)

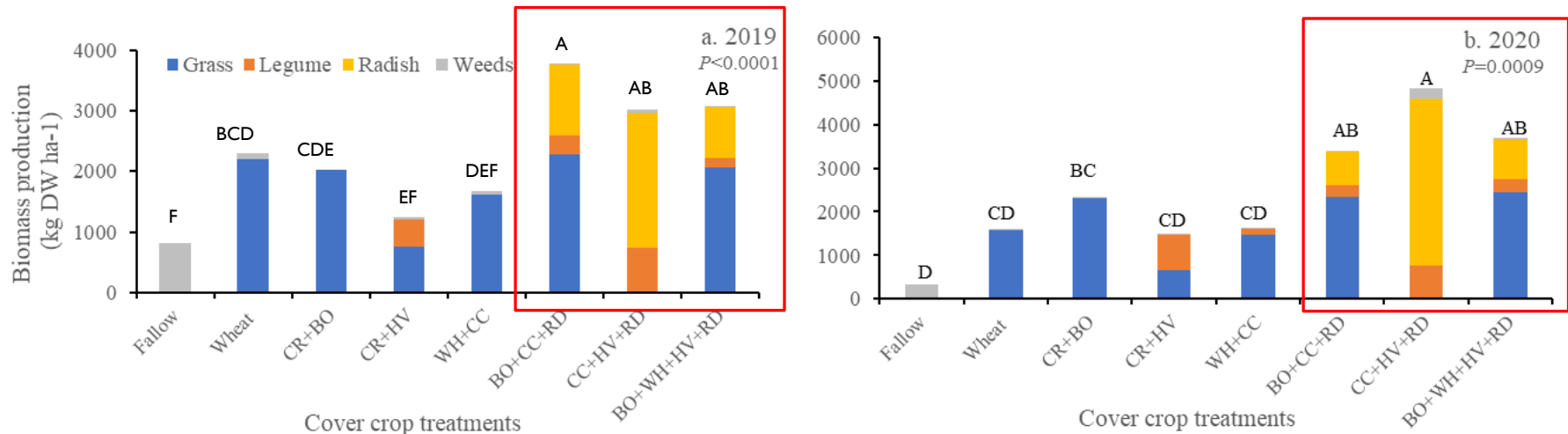
Soil samples (at 10 cm)

- Protein-N
- Inorganic N
 - Nitrate-N
 - Ammonium-N
- P, K and S

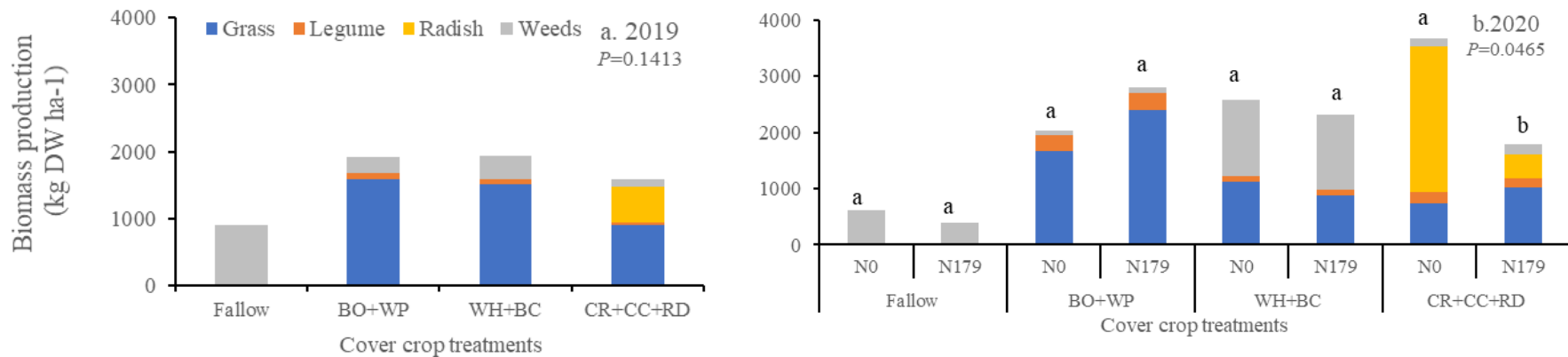


COVER CROP BIOMASS PRODUCED

At Macon Ridge site

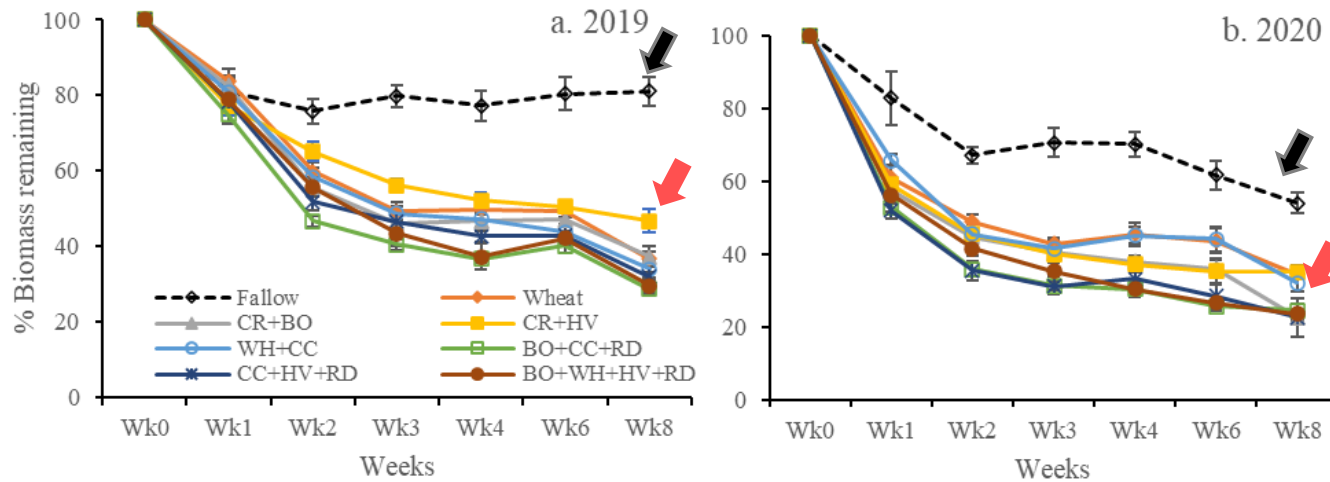


At Dean Lee site

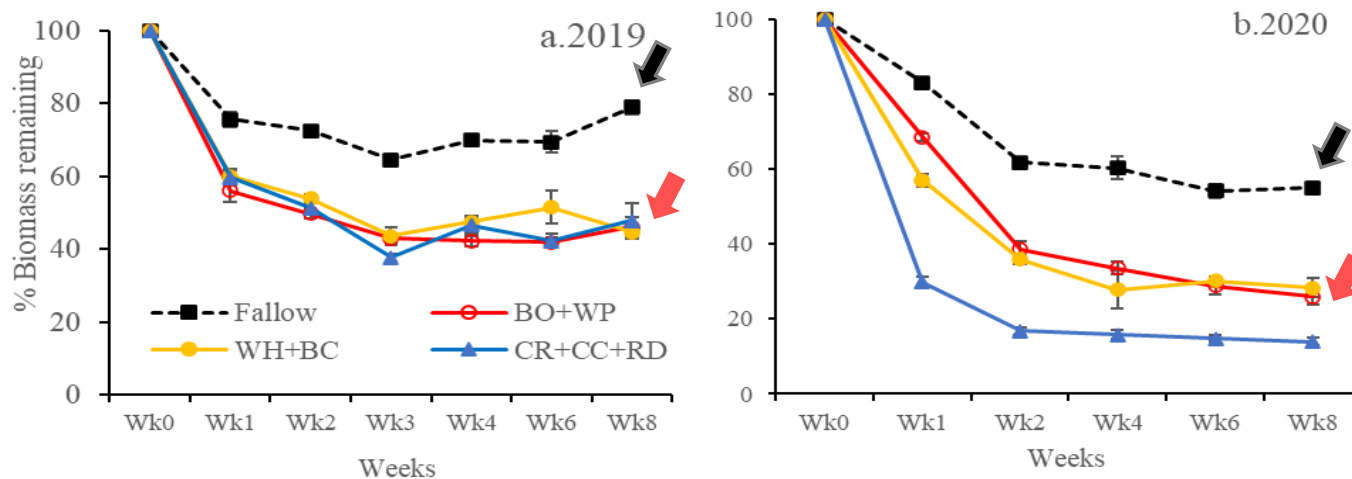


COVER CROP BIOMASS REMAINING OVER TIME

At Macon Ridge site

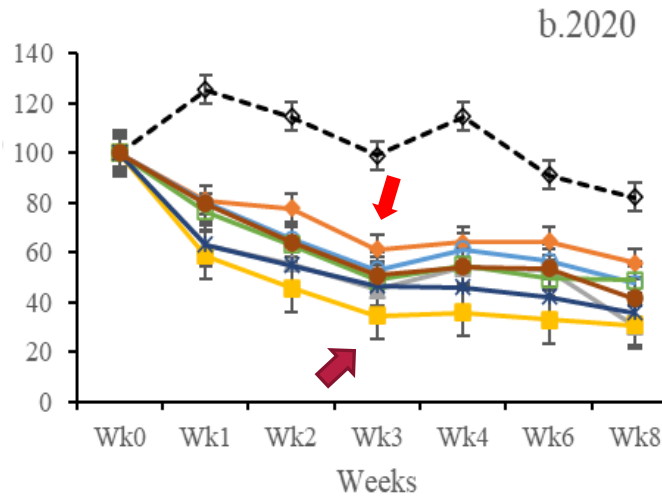
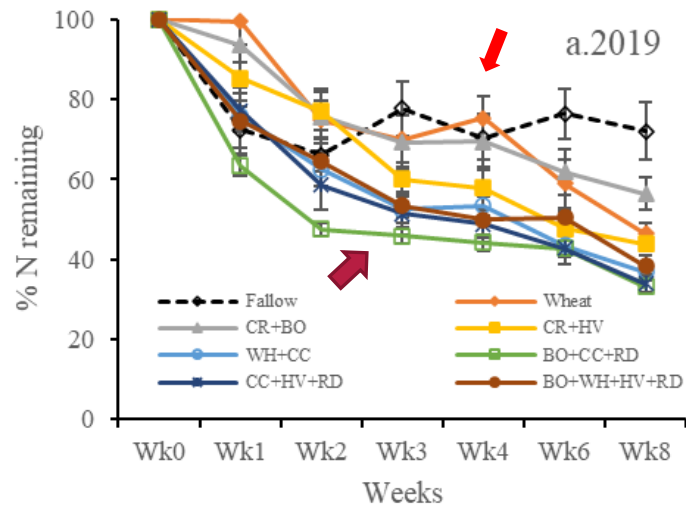


At Dean Lee site



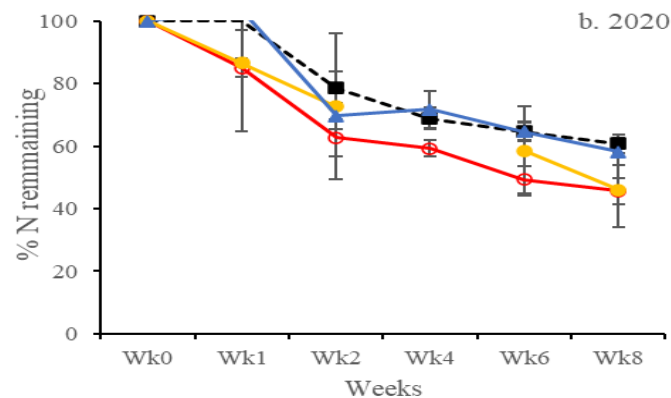
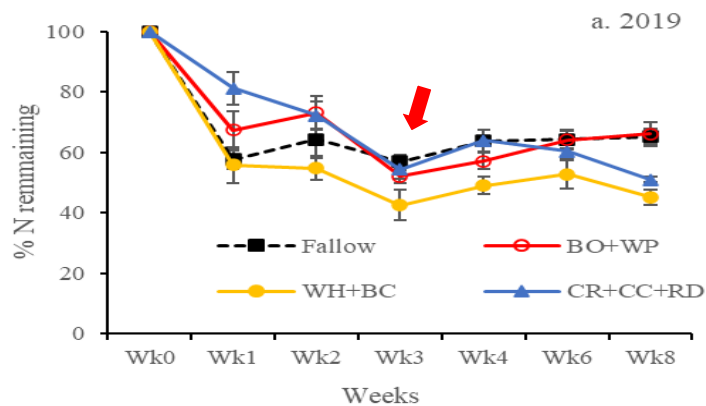
NITROGEN REMAINING IN THE COVER CROP RESIDUES

At Macon Ridge site



Cover crops	α	
	2019	2020
Fallow	NA	NA
Wheat	0.027	0.044
CR+BO ^s	0.076	NA
CR+HV	0.048	0.082
WH+CC	0.046	0.073
BO+CC+RD	0.081	0.092
CC+HV+RD	0.062	0.036
BO+WH+HV+RD	0.055	0.064

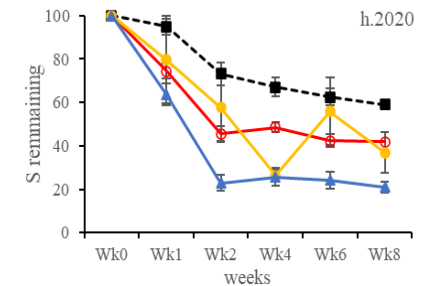
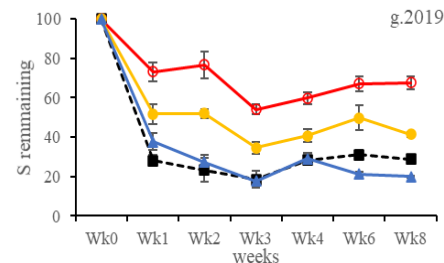
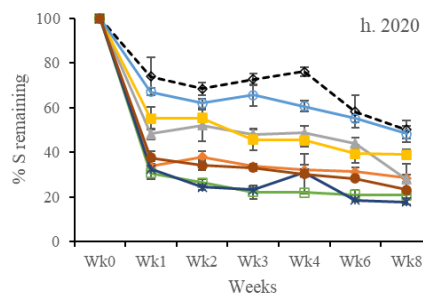
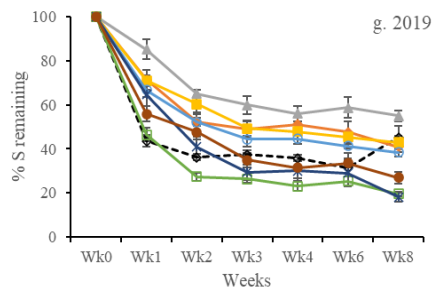
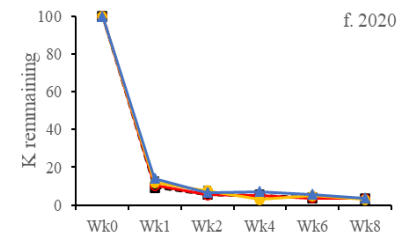
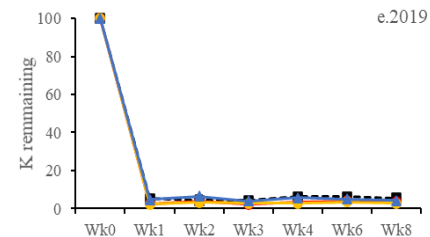
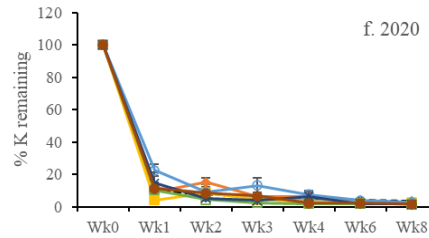
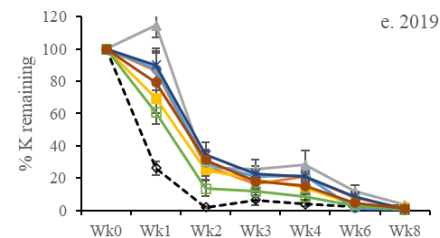
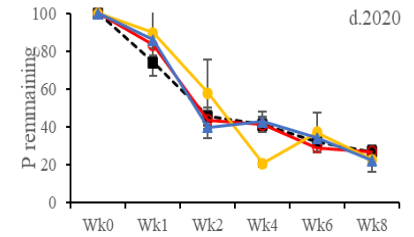
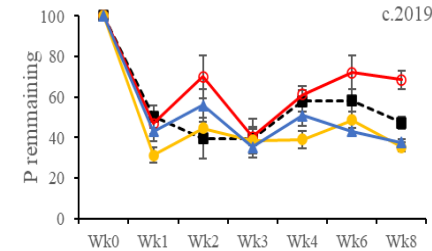
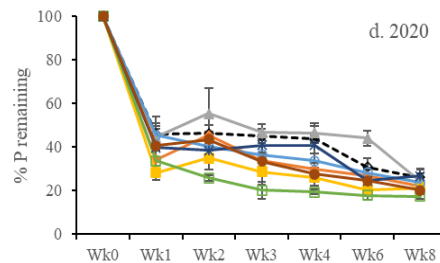
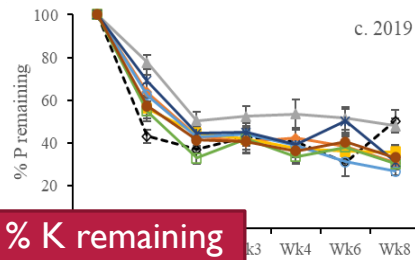
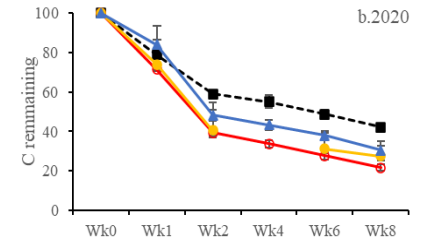
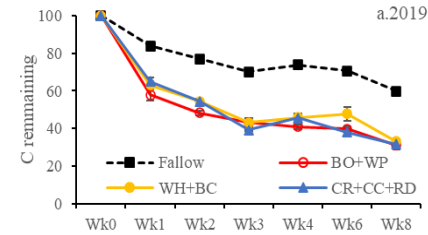
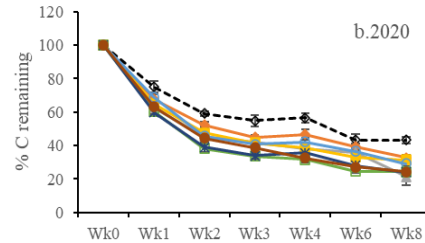
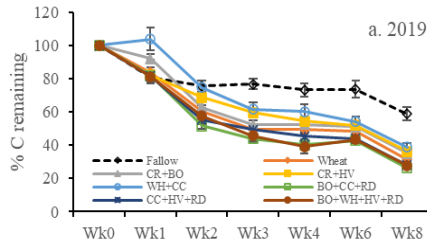
At Dean Lee site



NUTRIENTS REMAINING IN COVER CROP BIOMASS

At Macon Ridge site

At Dean Lee site

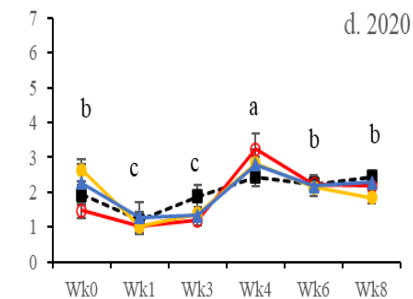
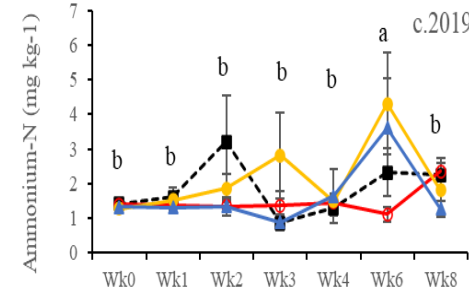
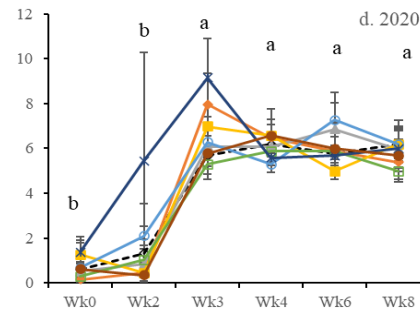
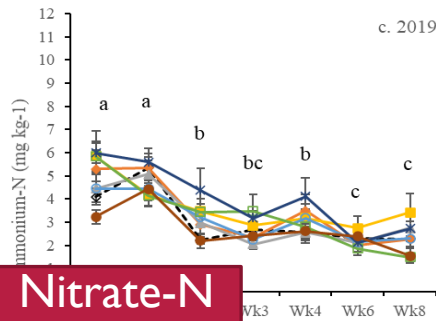
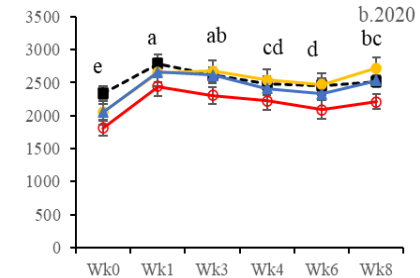
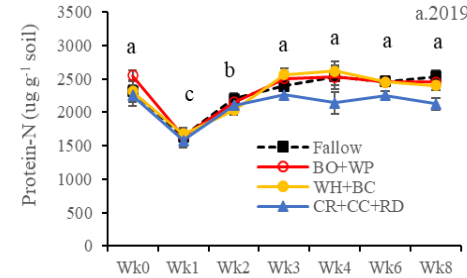
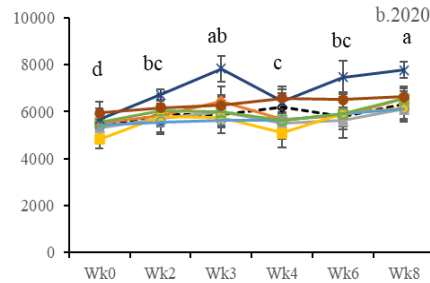
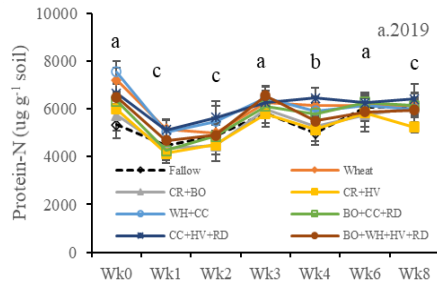


SOIL PROTEIN-N, AMMONIUM-N, AND NITRATE-N CONCENTRATIONS DYNAMICS

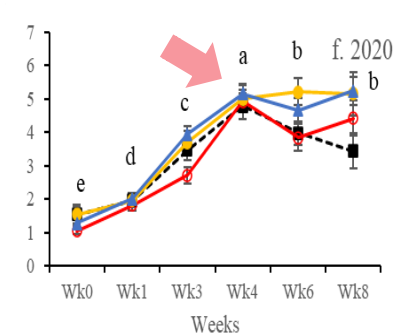
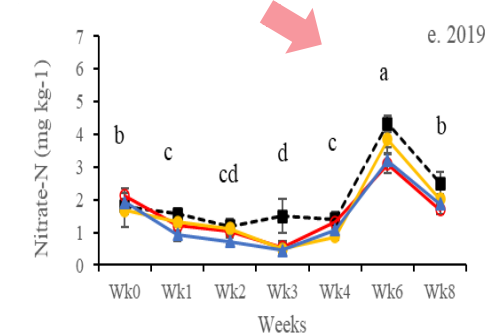
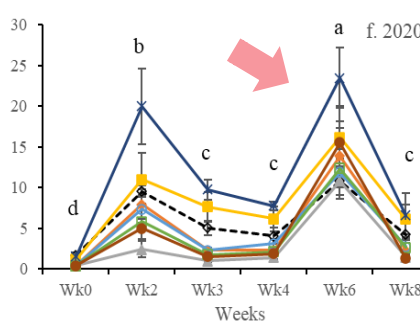
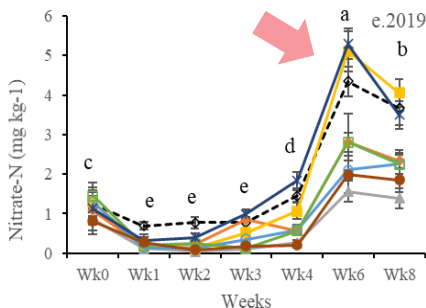
At Macon Ridge site

At Dean Lee site

Protein-N



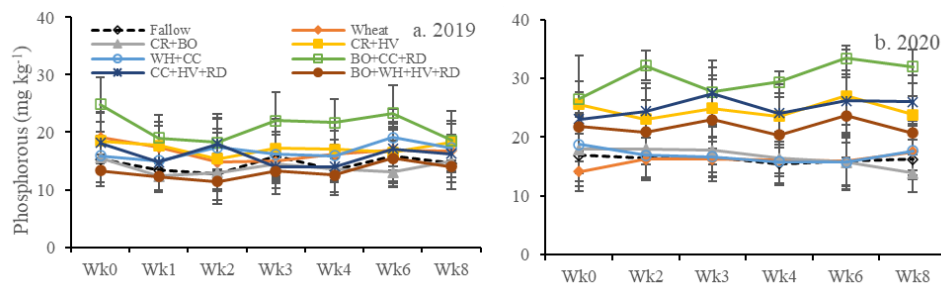
Nitrate-N



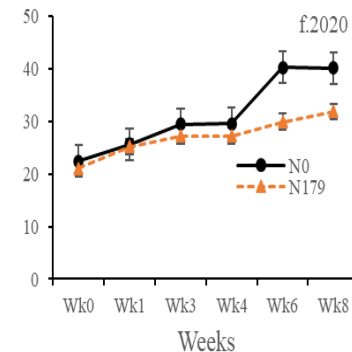
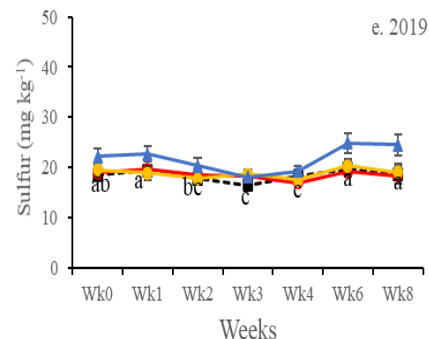
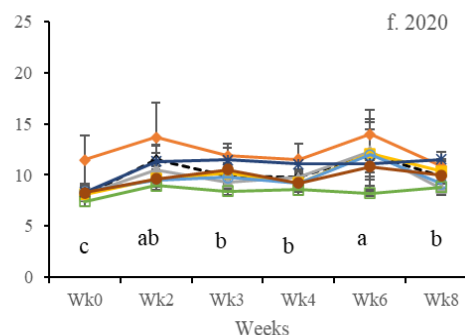
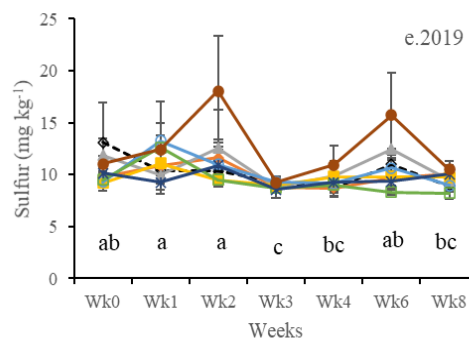
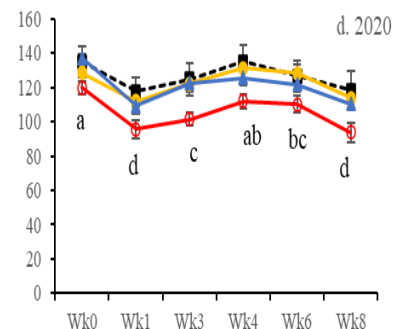
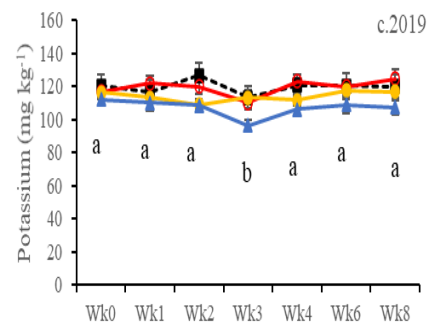
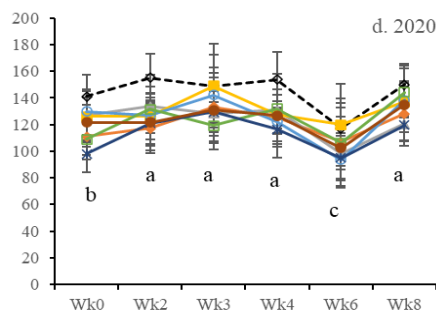
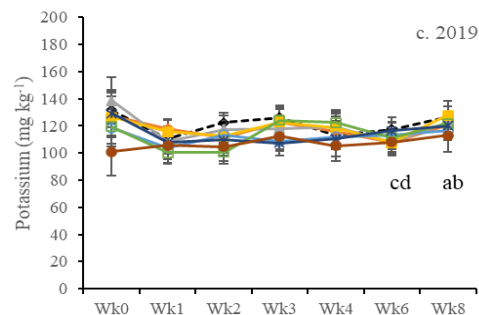
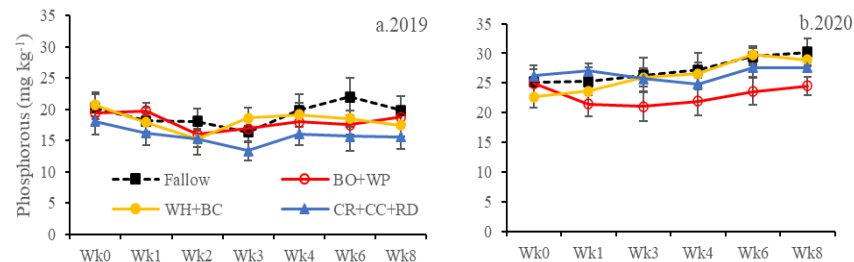
DYNAMIC OF AVAILABLE P, K AND S CONTENTS IN THE SOIL

Soil P

At Macon Ridge site



At Dean Lee site



STUDY 3

The Effect of Fallow Season Cover Crops on Soil Health in the Mid-South

Objective: to demonstrate the **impact** of **fallow season cover crops** on **soil health** in Louisiana row-crop production



SITE DESCRIPTION

Site 1



Location: Bastrop, LA
Texture: Silt-loam

Site 2

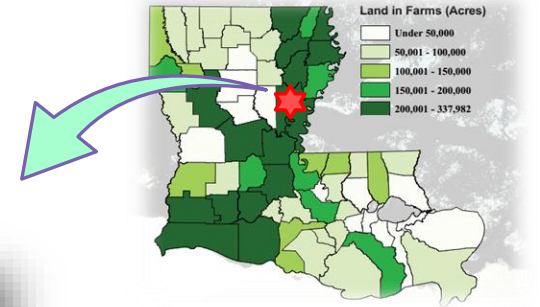


Sicily Island, LA
Silt

Site 3



Oakridge, LA
Silt-loam



Two
treatments
Cover crop mixture
Fallow: no cover crop

Legumes

Hairy vetch

A. Winter pea

Crimson clover

Berseem clover

Grasses

Black oat

Cereal rye

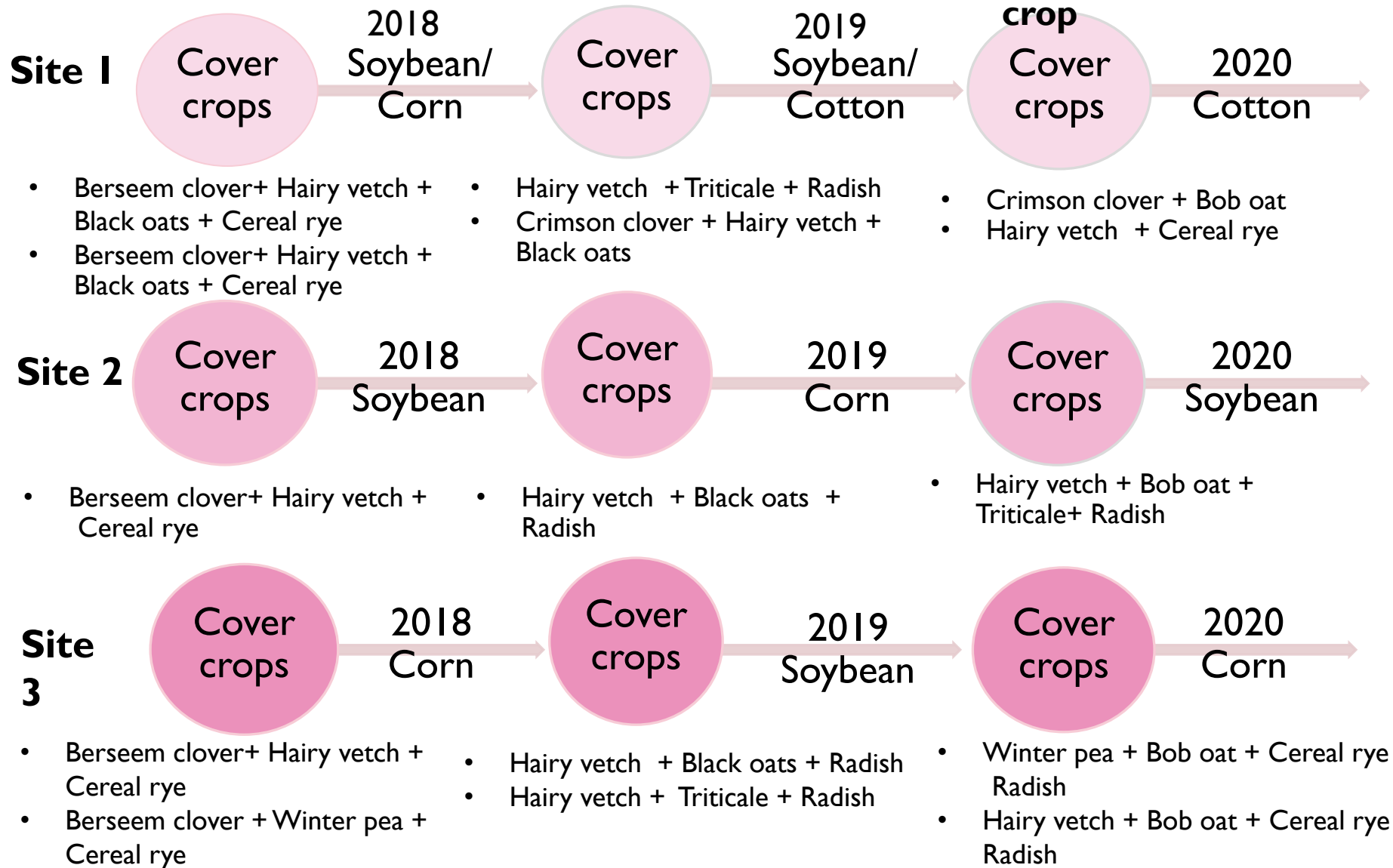
Brassica

Tillage radish

SITE DESCRIPTION

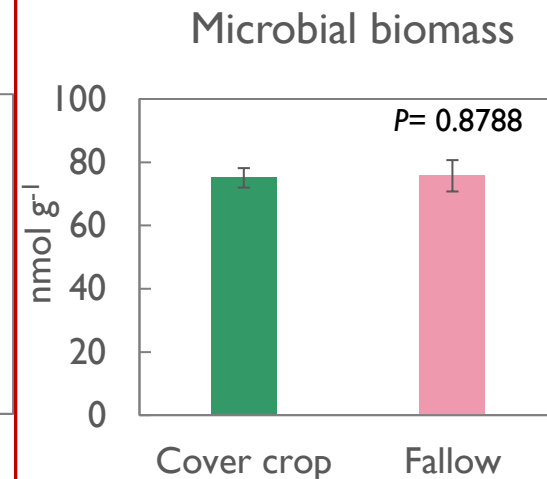
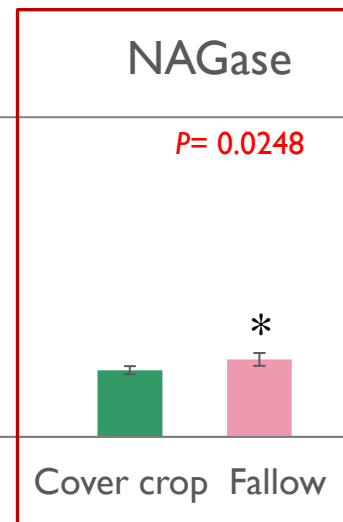
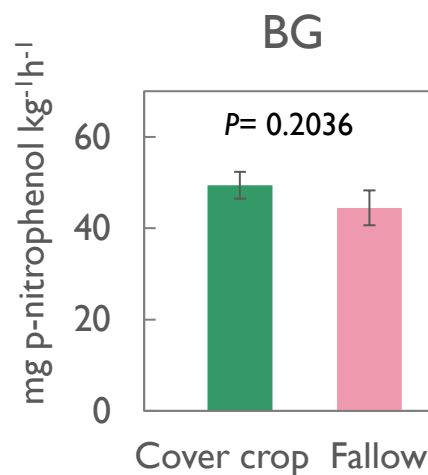
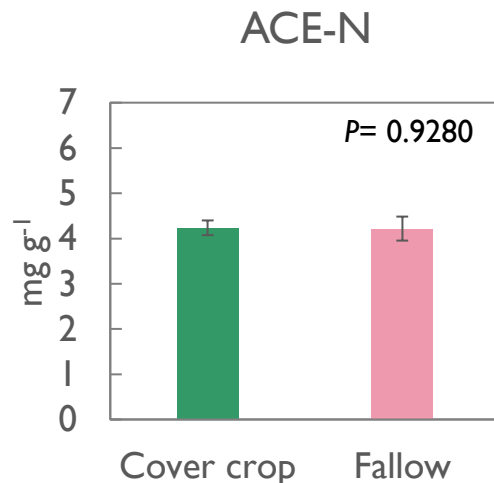
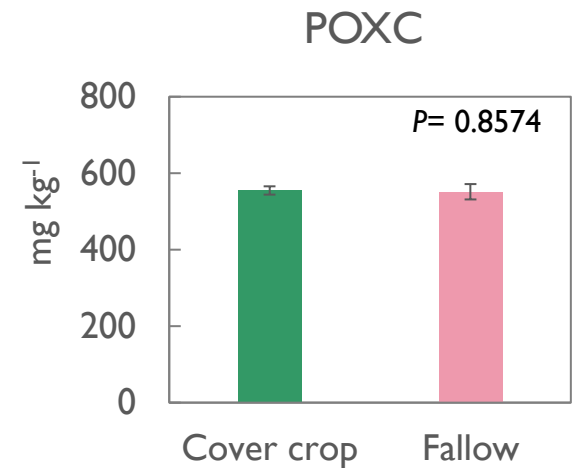
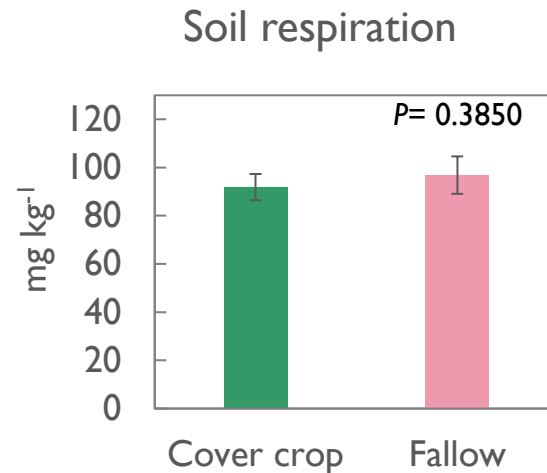
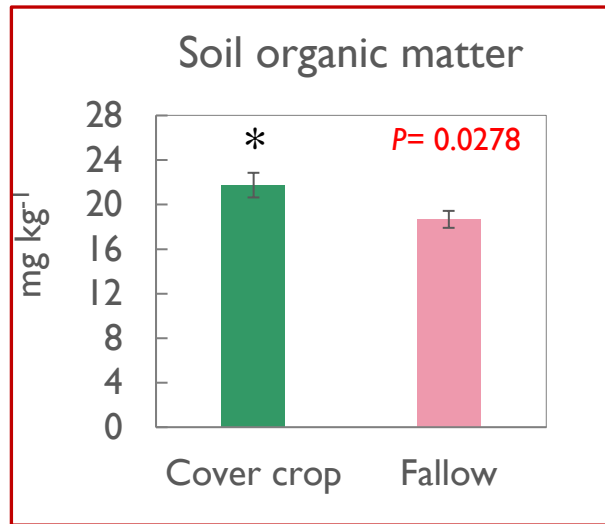
Two treatments

- **Cover crop mixture**
- **Fallow : no cover crop**



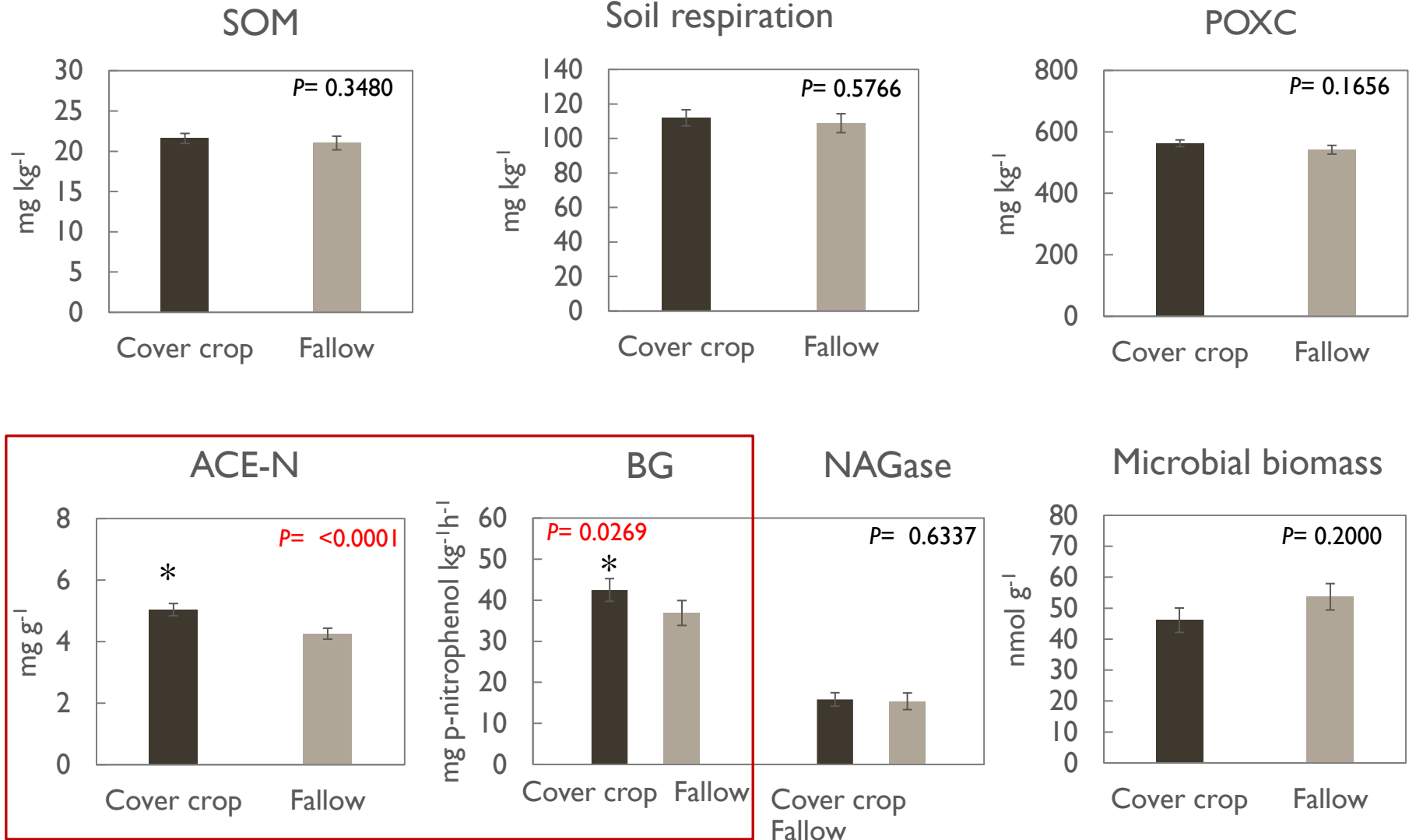
EFFECT OF COVER CROPS ON SOIL BIOLOGICAL ACTIVITY – SITE I

Corn-soybean-cotton

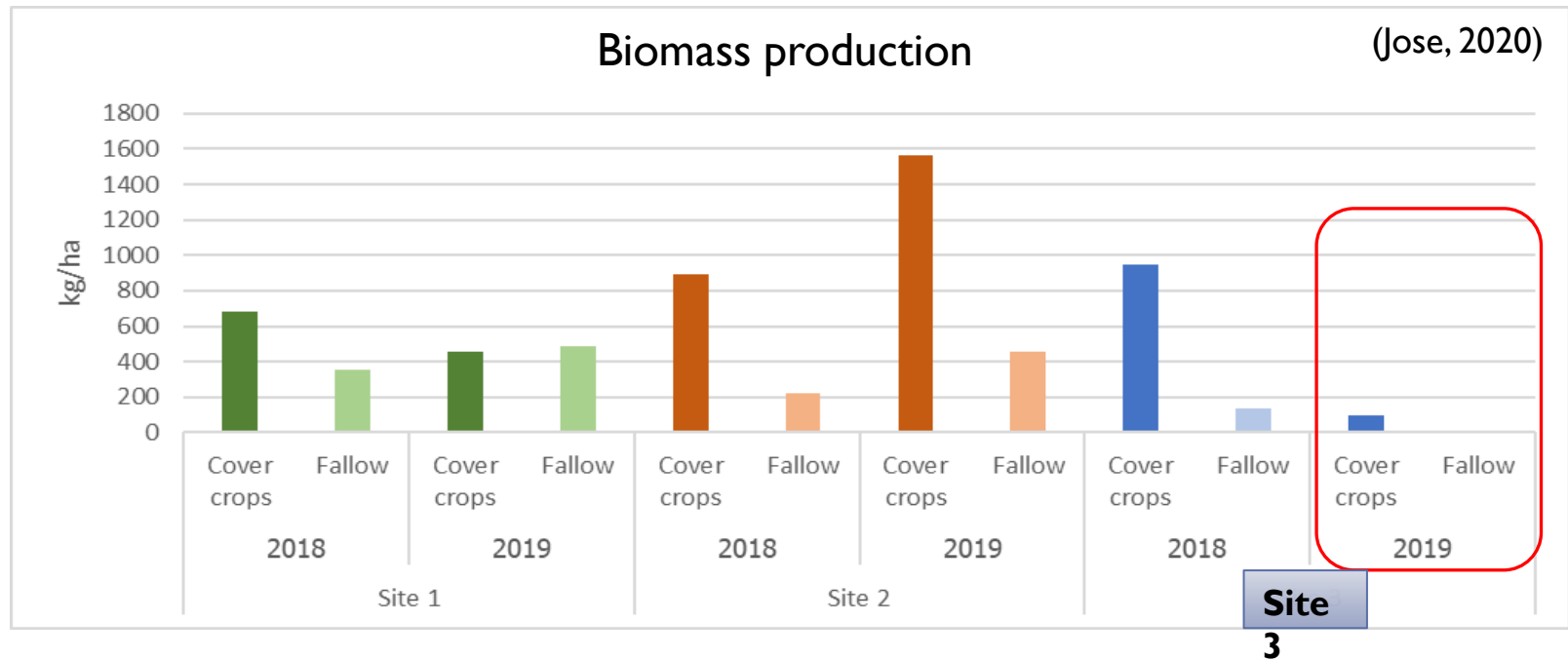


EFFECT OF COVER CROPS ON SOIL BIOLOGICAL ACTIVITY – SITE 2

Soybean-corn-soybean



EFFECT OF COVER CROPS ON SOIL BIOLOGICAL ACTIVITY – SITE 3



3RD SOUTHERN COVER CROP CONFERENCE

- Hosted by the Southern Cover Crop Council
- February 2023 in Baton Rouge, LA
- 2 days of seminars and field demonstrations