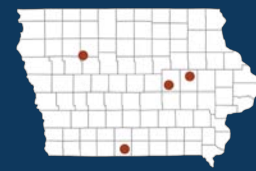
PRACTICAL FARMERS OF IOWA
COOPERATORS' PROGRAM Farmer-Led Research

Seeding Rate for Frost-Seeded and Interseeded Red Clover Cover Crops

EXPERIMENT



2025

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Cooperators

Braxton Clubb – Vinton, IA
Daniel Sheetz – Toledo, IA
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In a Nutshell:

- Many small grains farmers interseed or frost-seed red clover with their small grains. This cover crop grows rapidly after small grain harvest, boosting soil N for the following year's corn and providing a high-protein forage.
- Some farmers also interseed or frost-seed perennial clovers into existing pasture to boost forage quality.
- Clover seed is expensive, and some farmers struggle to identify a seeding rate that results in dense clover stands without wasting a lot of seed.
- A group of cooperators decided to test how clover seeding rate when interseeding or frost-seeding into small grains affects clover stand establishment and biomass over the life of the cover crop. Farmers each planted two rates that made sense for their farms, ranging from 8 to 20 lb/ac.

Key Findings:

- The effects of clover seeding rate were different on farms that interseeded compared with farms that frost-seeded.
- Neil Peterson and Braxton Clubb both interseeded their clover with a drill. They found that doubling their clover seeding rates from 10 to 20 lb/ac (Peterson) and 4 to 8 lb/ac (Clubb), respectively, nearly doubled their clover biomass production.
- Lyndon Miller and Daniel Sheetz, meanwhile, frost-seeded clover into winter wheat that had been planted the previous fall. They each found that higher seeding rates did not correspond with differences in plant counts or biomass.

Neil Peterson's cattle happily munch on a legume mix that was interseeded into oats. Neil's cows grazed the field from Sept. 9-Oct. 10, 2024.

BACKGROUND

Spring interseeding or frost-seeding perennial clovers is a fairly common practice in two different settings: when farmers are looking to establish legumes in existing pasture and when farmers are looking to interseed a perennial legume cover into fall- or spring-planted small grains. In both cases, the clover germinates but grows very little while the pasture grasses or small grains are in their growing season. Following mid-summer grazing, haying or harvest, however, the clover grows rapidly. In most years, it provides a high-quality fall forage or haying crop, groundcover over the winter and a nitrogen credit to the following year's corn.

Clover seed is expensive, and many farmers worry that they are either wasting money by seeding too densely or seeding too lightly to achieve optimal forage biomass or N credit to corn. The general recommended rate for frost-seeding red clover is 15 to 20 lb/ac. This rate maximizes return on investment for fall forage, and PFI farmers and academics report successfully crediting at least 30 lb/ac of nitrogen to their corn following a 15 lb/ac interseeded clover cover crop [1, 2]. However, farmers often wonder if higher or lower rates could also allow them to reach their goals.

In 2024, Braxton Clubb, Daniel Sheetz, Lyndon Miller and Neil Peterson decided to test different seeding rates when frost seeding or interseeding clover to evaluate how seeding rate affects stand density and clover biomass over the life of their clover cover crop. Some have previously used interseeding and frost-seeding, while others were new to the practice entirely.

METHODS

Design

Most participating farmers established four replications of each of their chosen seeding rates, though Lyndon Miller did not replicate his trial. Treatments were randomly assigned within four blocks to account for spatial variability in the field (**Figure A1**). Replication and treatment randomization allow for statistical analysis and conclusions about the effect of the treatments on yield and cover crop biomass. Management details unique to each farm can be seen in **Table 1**.

Daniel Sheetz frost-seeds Welter Plot Down Clover Blend into his standing winter wheat by keeping the row units of his drill above the soil surface on April 6, 2024.

TABLE 1: Trial management details at the four participating farms in 2023-2025.

	CLUBB	**MILLER**	**PETERSON**	**SHEETZ**
Small grain cash crop	Oats and triticale seeded into pasture	Hard red winter wheat	Oats	Hard red winter wheat
Small grain seeding date	March 3, 2024	Oct. 21, 2023	March 12, 2024	Fall 2023
Small grain seeding rate	100 lb/ac	72 lb/ac	3 bu/ac	72 lb/ac
Clover interseeded	Red clover	Red clover	Medium red clover, non-dormant alfalfa and turnip	1/3 Mammoth Red clover, 1/3 Yellow Blossom sweet clover and 1/3 Aslike clover
Clover seeding date	Mar. 3, 2023	Feb. 24, 2024	Mar. 12, 2024	Apr. 6, 2024
Clover seeding rate treatments	4 lb/ac and 8 lb/ac	10 lb/ac, 14 lb/ac and 20 lb/ac	10 lb/ac and 20 lb/ac	10 lb/ac and 20 lb/ac
Clover seeding method	Interseeded with drill	Frost-seeded	Interseeded with drill	Frost-seeded
Fertilization	100 lb/ac N	14 lb/ac N as urea	2 tons/ac cattle manure fall 2023	2 tons/ac chicken litter fall 2023
Stand count date (s)	May 30, 2024 and Aug. 17, 2024	May 9, 2024 and Apr. 1, 2025	Jun. 11, 2024, Aug. 21, 2024 and Apr. 16, 2025	Aug. 20, 2024
Biomass sampling date(s)	Aug. 17, 2024	NA – minimal biomass	Aug. 21, 2024	NA – minimal biomass

Measurements

As conditions allowed, farmers conducted stand counts of clover around May and August 2024 and collected biomass samples in August 2024 and/or Spring 2025 before any grazing or haying activities and termination. Cooperators also tracked and reported all management practices done to the fields during the course of the experiment.

Data Analysis

We used an ANOVA (Analysis of Variance) at a 90% confidence level to determine if there were significant differences in clover biomass between treatments at each farm. The models accounted for whether clover seeding rate and/or replication contributed to clover biomass (2-way ANOVA). The 90% confidence level means any effects we declare statistically significant would be expected to occur at least 9 times out of 10 if the experiments were carried out in identical conditions. We could perform statistical analysis because each farm had replicated and randomized experimental designs (**Figure A1**).

Braxton Clubb dries clover biomass on tables before weighing it to determine total biomass production for each treatment.

RESULTS AND DISCUSSION

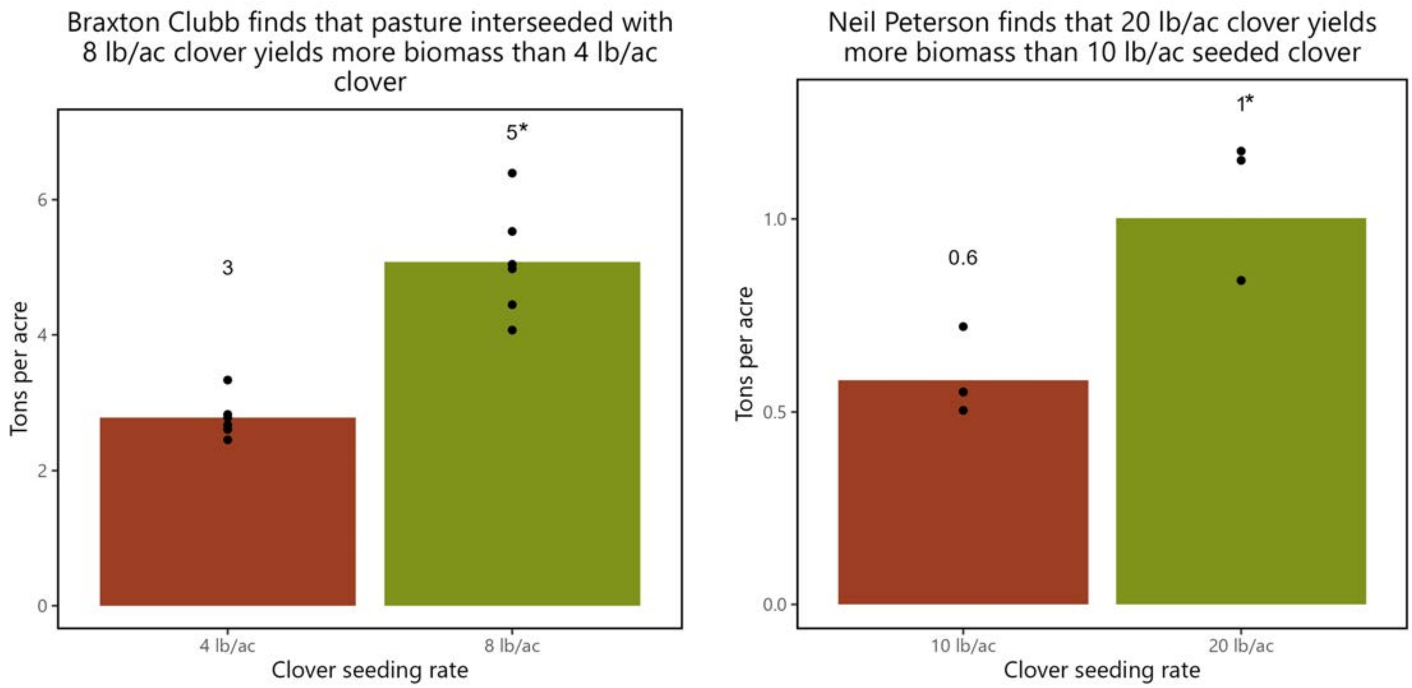


FIGURE 1. Clover biomass at Braxton Clubb's and Neil Peterson's in August 2024. Columns represent the average clover biomass for each treatment. Points represent clover biomass from each individual plot. Asterisk (*) indicates that the higher clover seeding rates at Clubb's and Peterson's resulted in statistically greater biomass at the 90% *confidence level.*

Clover biomass and stand counts

The effects of clover seeding rate were different on farms that interseeded compared with farms that frost-seeded. Peterson and Clubb both interseeded their clover by drilling the clover at the same time as their oats and diverse cover mix in March 2025. They found that doubling their clover seeding rates from 10 to 20 lb/ac (Peterson) and 4 to 8 lb/ac (Clubb) nearly doubled their biomass production for their fall forage and hay cutting and also increased their clover plant counts (**Figures 1 and 2**). Clubb reported that his main takeaway was that drilling the clover at a higher seeding rate in his pasture was well worth the extra cost. "If you are doing all the work to prepare a seed bed, make sure you don't take shortcuts!"

Lyndon Miller and Daniel Sheetz, meanwhile, frost-seeded clover into winter wheat that had been planted the previous fall. Miller broadcast seed in late February at 10, 14 and 20 lb/ac in an unreplicated trial. Sheetz broadcast in April at 10 and 20 lb/ac. Each found that higher seeding rates did not correspond with differences in plant count in 2024 (**Figure 2**). They generally had poor, patchy and delayed red clover germination and concluded that the frost-seeding did not produce sufficient seed-to-soil contact. Miller counted clover plants in the spring of 2025 before planting his corn and found that much of the seed had germinated. He reports that "if I were to do a clover seeding again, I think I would use a drill for a more accurate establishment of plants. Broadcasting clover seed at different rates may affect plant density, but moisture and seed to soil contact may play a greater role in germination."

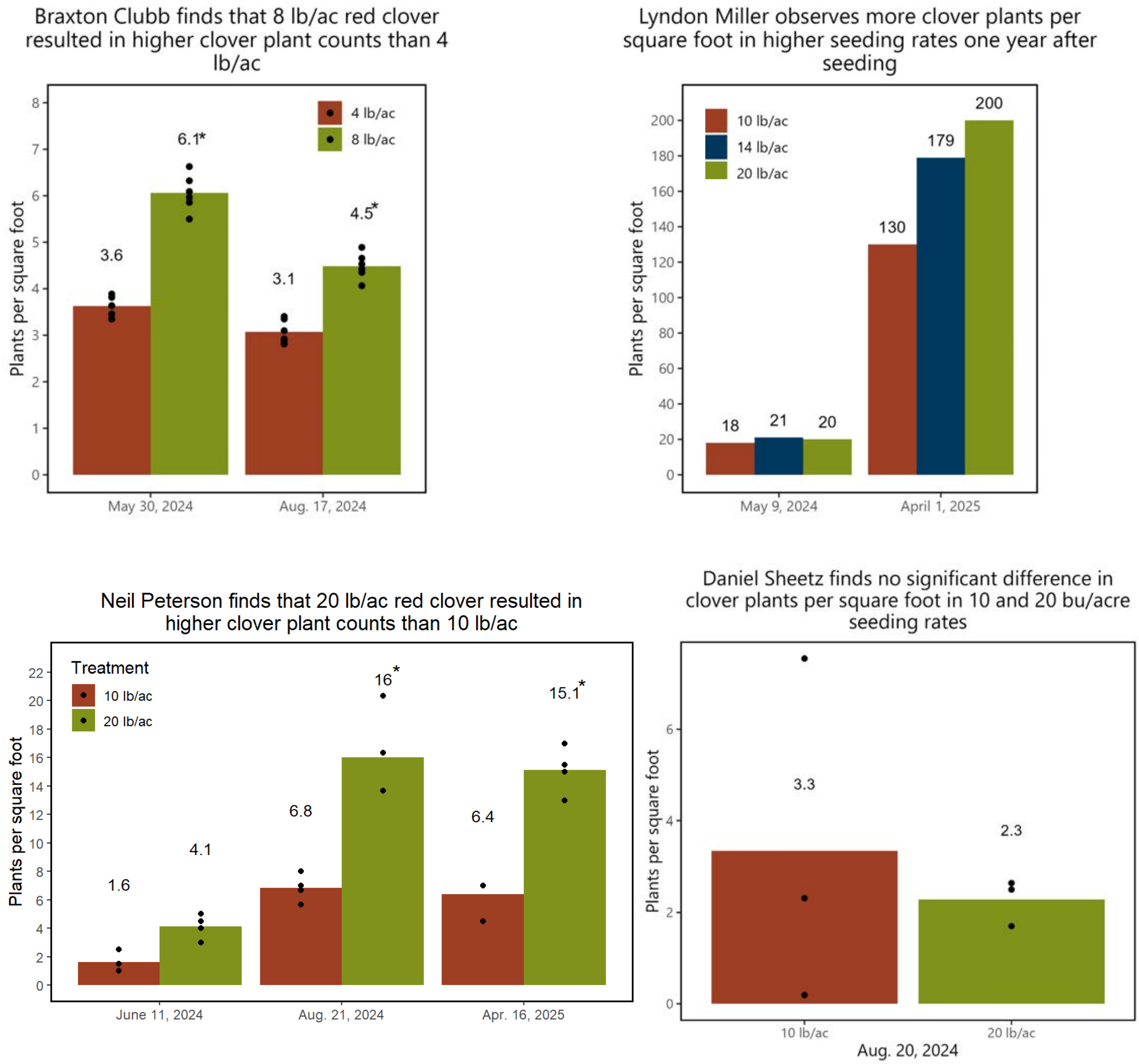


FIGURE 2. Clover biomass stand counts at Braxton Clubb's, Lyndon Miller's, Neil Peterson's and Daniel Sheetz's in May and August 2024 and April 2025. Columns represent the average clover stand count for each treatment. Points represent clover stand count from each individual plot. Asterisk (*) indicates a seeding rate that resulted in statistically greater stand count than another seeding rate on a particular observation date at the 90% confidence level.

Short red clover grows beneath grasses and forbs in early summer in Braxton Clubb's underseeded grazing mix in 2024.

Red clover germinated and growing beneath Lyndon Miller's oats in early summer 2024.

CONCLUSIONS AND NEXT STEPS

Clubb and Peterson were pleased with the performance of their higher clover seeding rate treatments and will plan to use these rates as seed cost considerations allow. In the future, Miller and Sheetz will drill clover into their small grains to ensure better germination. All of the farmers encourage others who grow small grains to consider an interseeded red clover cover crop for forage and N credit to the following year's corn.

Paul and Timothy Peterson help their dad Neil Peterson collect cover crop samples from his clover interseeding rate trial in Fall 2024.

APPENDIX – TRIAL DESIGN AND WEATHER CONDITIONS

	8 lb/ac	13 lb/ac	8 lb/ac	13 lb/ac	13 lb/ac	8 lb/ac	8 lb/ac	13 lb/ac
STRIP	1	2	3	4	5	6	7	8
REP	1		2		3		4	

FIGURE A1. Example of experimental design used by the cooperators which included randomized and replicated treatments. This design allowed for statistical analysis of the results.

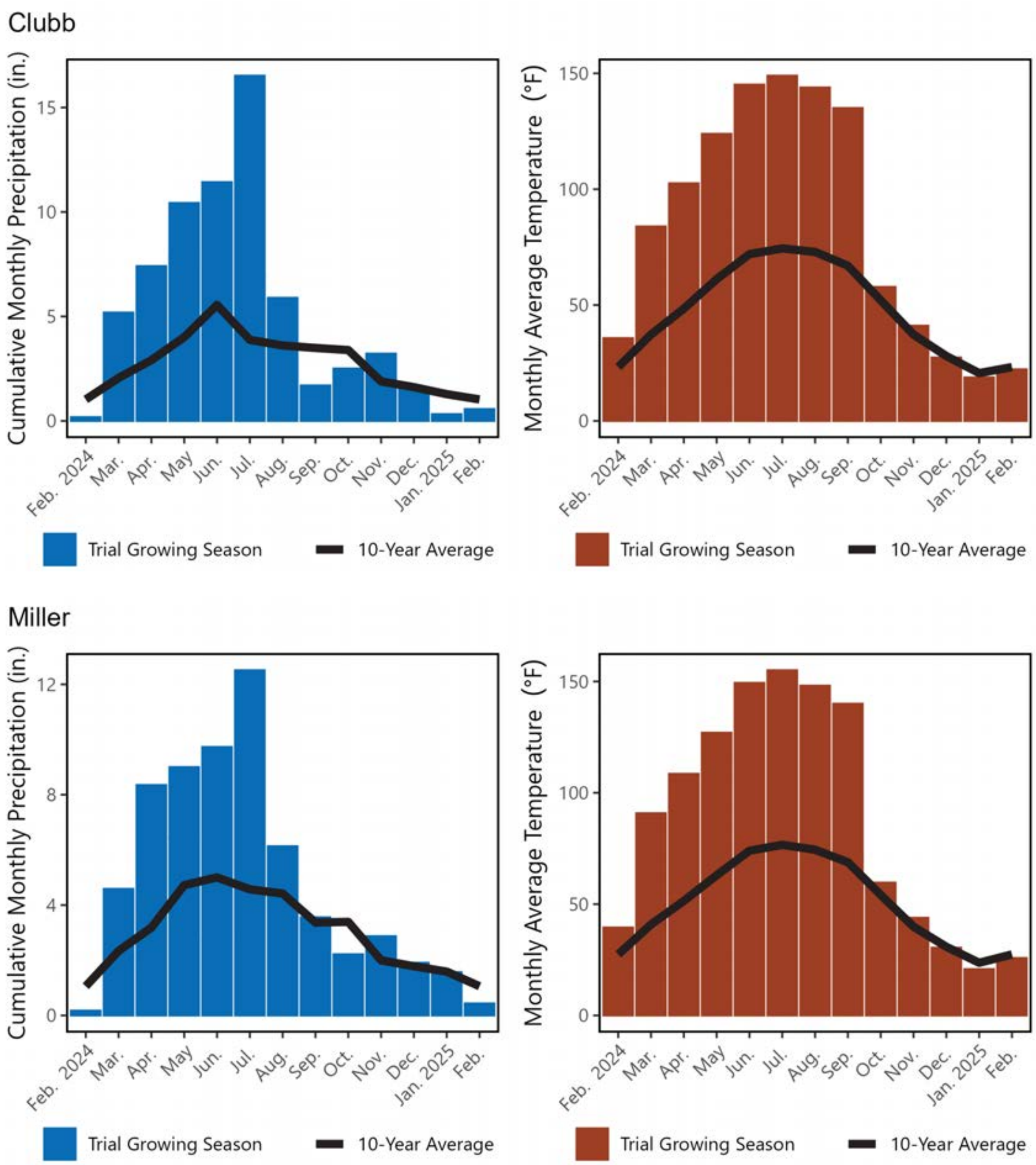
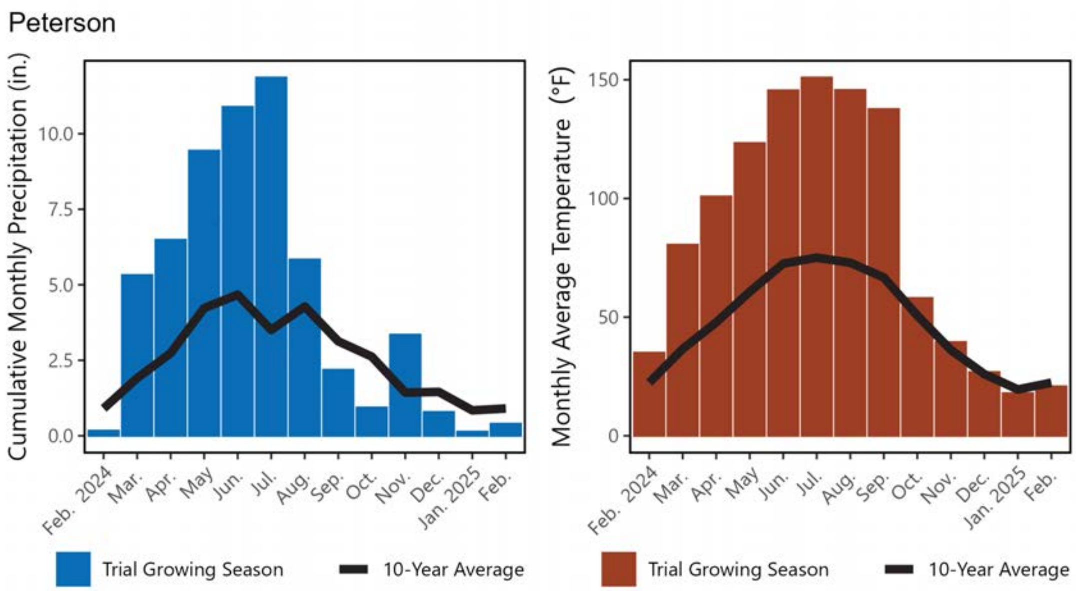


FIGURE A2. *(Continued on next page)*



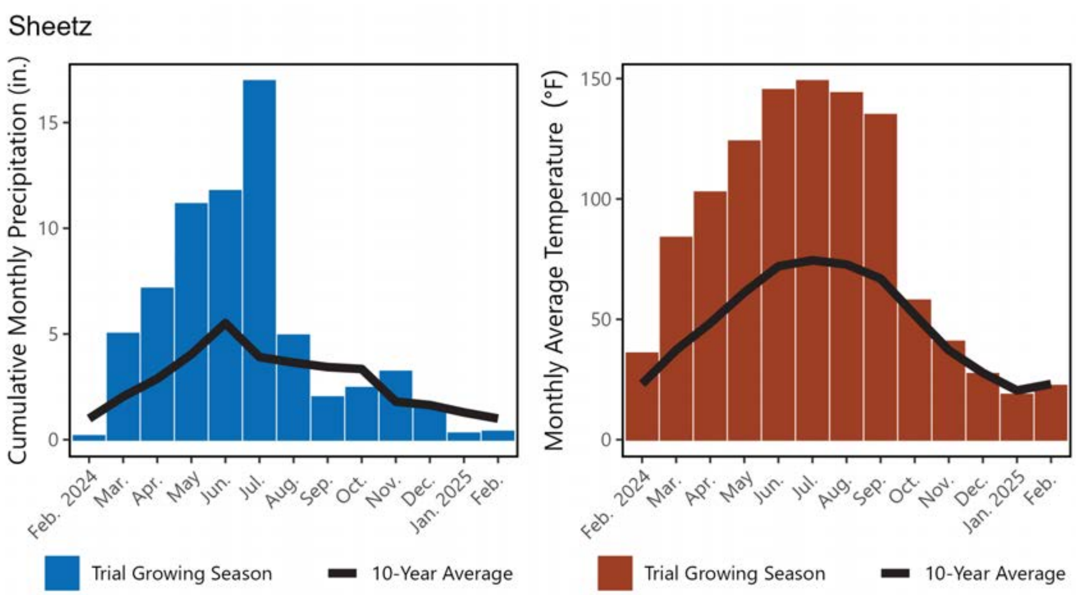


FIGURE A2. Modelled mean monthly temperature and rainfall in Vinton, Toledo, Leon, and Fonda, IA during the study period and the ten-year historic averages. Data is from the NasaPOWER climate dataset [3], [4].

FUNDING ACKNOWLEDGEMENT

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PRACTICAL FARMERS of Iowa

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