

In-Plant Nitrogen Study

PIVOT BIO'S PIONEERING COMMITMENT TO NITROGEN ADVANCEMENT

Pivot Bio is a market leader in nitrogen innovation, exemplifying unwavering commitment and making significant investments in demonstrating the performance of Pivot Bio PROVEN® 40. Commencing in 2020, the company diligently collected data from growers' farms and has continued to validate the nitrogen advantage delivered by PROVEN® 40.

Figure 1 | Location of Participating Growers

Growers	Fields	States
>1,100	>1,500	32

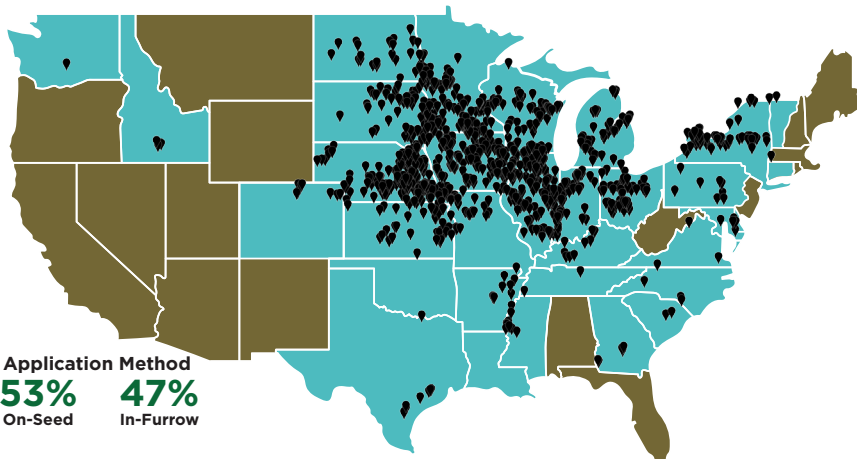
Data available as of August 11, 2023.

Measuring the Pivot Bio PROVEN® 40 Nitrogen Advantage

Throughout the 2023 growing season, Pivot Bio conducted comprehensive field assessments, visiting over 1,500 fields to obtain plant measurements. Agronomists conducted side-by-side on-farm tests comparing PROVEN® 40 In-Furrow and On-Seed applications against the grower's standard practice.

Methodology and Rigorous Testing

The testing protocol aims to assess the relative nitrogen status of plants in two designated field sections: one where PROVEN® 40 was applied and the other one untreated. Sampling took place between the V5 and R4 growth stages. Corn stalks were cut flush with the soil surface to collect plant samples from each section. Uniformity was ensured as both sections consisted of the same hybrid with the same planting dates on similar soil types and elevations. Above-ground plant biomass was measured using a standardized and calibrated scale. Chlorophyll concentration was measured in



the uppermost collared leaf for plants that had not tasseled. For those with a tassel, chlorophyll was measured in the leaf below and opposite the primary ear, as traditionally done with leaf tissue testing for percentage of nitrogen. Plant tissue nitrogen levels were measured using a test based on the industry-standard corn silage nitrate test, akin to the approach used when sending tissue samples to a lab for nitrogen analysis.

Challenging 2023 Growing Conditions

During the 2023 growing season, the United States Corn Belt encountered challenging weather patterns. Despite relatively mild temperatures until mid-June, the region grappled with arid conditions, marked by subpar precipitation levels across all nine Midwestern states. The relentless absence of rainfall, coupled with low humidity and abundant sunlight,

triggered the expansion and intensification of drought, affecting around 65% of the region and rendering 26% of the area abnormally dry by the close of June, as the U.S. Drought Monitor reported. Amidst these dry conditions, PROVEN® 40 nitrogen exists in the ammonium form on the root, readily available for uptake. In cases of insufficient rainfall, synthetic nitrogen becomes immobile within the soil profile, placing an added energy demand on the roots for growth and nitrogen absorption.

These conditions significantly diverged from the 2022 season, during which most areas received near- to above-normal precipitation. Even amidst these distinct growing conditions, Pivot Bio PROVEN® 40 consistently delivered a nitrogen advantage, demonstrating the predictability of the microbes compared to synthetic nitrogen.

Sustained Nitrogen Advantage Attained

In 2023, corn plants treated with Pivot Bio PROVEN® 40 had approximately 8% more in-plant nitrogen compared to plants managed under grower standard nitrogen practices, marking the second consecutive year of a nitrogen advantage. When averaged across 2022 and 2023, PROVEN® 40 consistently delivered an 11% advantage over the grower standard practices.

Figure 2 | In-Plant Nitrogen Levels 2023

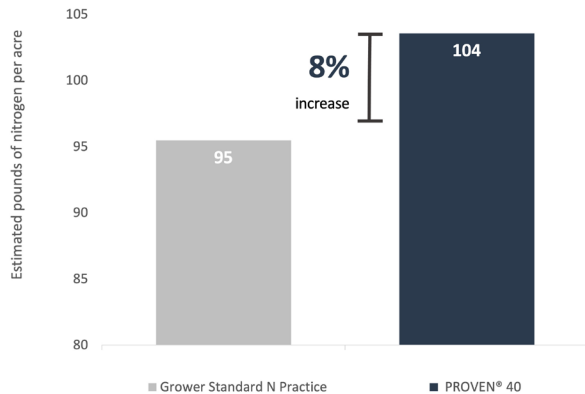


Figure 3 | Combined In-Plant Nitrogen Levels: 2022 & 2023

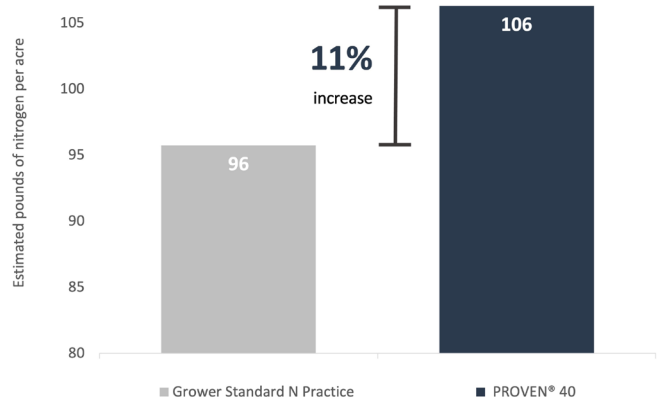


Figure 4 | In-Plant Nitrogen Levels by Application Method

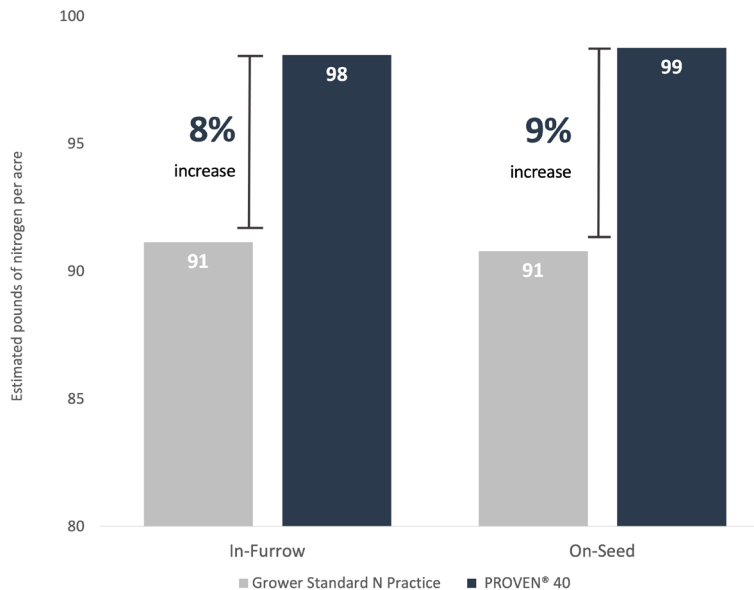
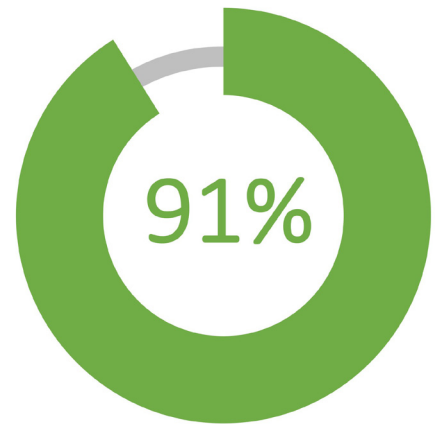


Figure 5 | Win Rate for PROVEN® 40 in 2023



High Win Rate*

In 2023, 91% of field visits showcased elevated plant nitrogen levels with PROVEN® 40, surpassing the grower standard practice and mirroring the 93% win rate of 2022.

*A win is defined as a field visit where the nitrogen levels of plants treated with Pivot Bio PROVEN® 40 are within 3% or greater of plants managed with grower standard practice.

Equivalent Performance Across Application Methods

Both PROVEN® 40 On-Seed and In-Furrow treatments delivered an equivalent in-plant nitrogen advantage, confirming the consistent effectiveness of the microbes across application methods.

Enhanced Nitrogen for Sustained Growth

Plants that replaced synthetic nitrogen (20–40 lbs. N/acre) with Pivot Bio PROVEN® 40 had a 7% increase in nitrogen levels. This performance instills growers with confidence, showing that PROVEN® 40 compensates for the synthetic nitrogen replaced and provides an additional average cushion of 7% more nitrogen.

The PROVEN® 40 advantage begins early in the growth stages (V5–V8) as leaf development and stem elongation occur, with plants displaying a notable 16% increase in nitrogen compared to those using grower standard practices. During the corn linear nitrogen uptake phase at V9 and when the plant prepares for tassel development (VT), PROVEN® 40 plants show an 8% nitrogen advantage over the untreated plants. As the reproductive growth stages

Figure 6 | In-Plant Nitrogen Per Acre by Growth Stage

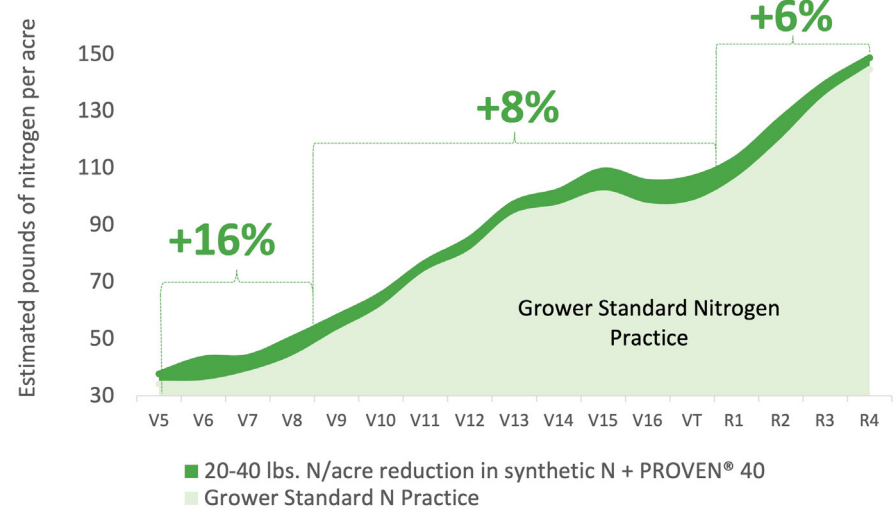


Figure 6 data represents 255 field visits where 20–40 lbs./acre of synthetic nitrogen was replaced with Pivot Bio PROVEN® 40.

(R1–R4) are reached, PROVEN® 40-treated plants demonstrate an estimated 6% increase in pounds of nitrogen per acre, supplementing the 20–40 lbs. of synthetic nitrogen already replaced by the microbes.

In **91%** of field visits in 2023, where synthetic nitrogen was replaced (20–40 lbs./acre) with PROVEN® 40, an increase of in-plant nitrogen levels was reported, similar to the 94.6% observed in 2022.

Consistently Effective Across Corn Growing Regions

Across all corn growing regions, diverse growing conditions pose various challenges. However, Pivot Bio PROVEN® 40 has consistently demonstrated its efficacy, increasing plant nitrogen levels by an average of 9% in 2023, mirroring the results observed in 2022 for all regions where data was collected.

Figure 7 | In-Plant Nitrogen Advantage by Pivot Bio Regions

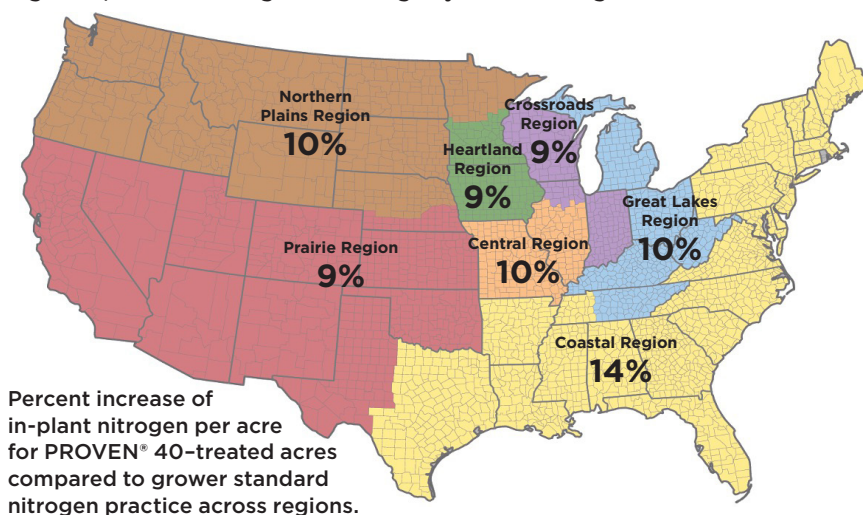


Table 1 | In-Plant Nitrogen Advantage of PROVEN® 40 by State

AR	15%	MO	11%
CO	12%	NE	9%
GA	7%	NY	15%
ID	14%	NC	9%
IL	10%	ND	6%
IN	8%	OH	9%
IA	11%	PA	11%
KS	11%	SC	35%
KY	18%	SD	10%
LA	10%	TN	7%
MD	21%	TX	21%
MI	12%	VA	13%
MN	7%	WI	7%
MS	7%		

Table 1 encompasses states with a minimum of two collected data points.

Why We Measure Biomass

The essential role of nitrogen in promoting healthy and productive crops is well-established and widely understood. Nitrogen application has been consistently linked to increased biomass, grain yield, and kernel protein content in corn (Zhang et al., 1993; McCullough et al., 1994; Ma & Dwyer, 2001). Biomass is a reliable indicator of plant health, reflecting the plant’s capacity to efficiently harness sunlight, water, and minerals to produce plant mass. In-season measurement of plant biomass empowers growers by assuring them of sufficient nitrogen availability for plant growth well before harvest.

Results from the 2023 season have shown that Pivot Bio PROVEN® 40-treated plants outperform those managed with grower standard practices in biomass by 9%. This finding highlights the efficacy of microbes in supplying nitrogen to the crop, leading to healthier and greener plants that accumulate vital carbohydrates. PROVEN® 40 consistently elevates the average plant biomass compared to untreated acres, amplifying the plant’s potential for enhanced grain production.

Why We Measure Chlorophyll

Nitrogen is vital in producing leaf chlorophyll, making the chlorophyll concentration in leaves a significant indicator of the nitrogen status of the corn plant. As the pigment responsible for the green color in plants, the primary function of chlorophyll is to absorb radiation, providing essential energy for photosynthesis. Most leaf nitrogen is contained within chlorophyll molecules; therefore, a strong correlation exists between leaf chlorophyll and leaf nitrogen content (Yoder & Pettigrew-Crosby, 1995).

Chlorophyll concentration in plant leaves is commonly expressed in micromoles per square meter (umol m²), representing the quantity per area of the leaf surface. This study reveals that Pivot Bio PROVEN® 40-treated plants exhibited a 6% increase in chlorophyll levels compared to grower standard practices. This enhanced chlorophyll concentration empowers the plants to efficiently conduct photosynthesis, producing oxygen and simple sugars vital for supporting the plant during critical stages of development.

Figure 8 | Biomass Levels in 2023

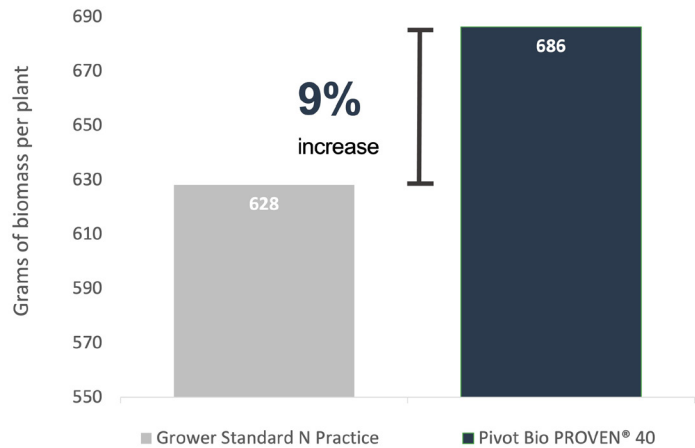


Figure 9 | Leaf Chlorophyll Levels in 2023

