TIRE STORE & SERVICE

CTIS Research Studies Data

JULY 2023

Table of Contents

Introduction

ROI is an important consideration for every farmer when deciding to invest in a particular product or technology. This document highlights data from all of the research studies that have examined the effectiveness of central tire inflation systems for increasing a farm's yields and productivity.

We've included the charts/tables and data from the various studies performed in the United States so you are able to see exactly what the researchers saw.

NOTE

FarmX is providing this information to help farmers make informed decisions about purchasing central tire inflation systems. While the research studies featured here were conducted under real world conditions as much as possible, there will always be a number of factors that influence the actual results on a farm. We always advise our dealers to use conservative ROI numbers when helping farmers evaluate CTIS for use on their farms.

If you choose to feature any of the following studies in your marketing materials, please give proper credit when including them. Citations for the studies are included on each page.

2021–2022 | AgRevival Tire Pressure Yield Study

Purpose

This 3-year study, sponsored by NTS Tire Supply and conducted by AgRevival, is testing whether you would see a difference in yield during harvest depending on the tire pressures on your equipment during planting. The study is currently in its final year.

Study Design

TEST EQUIPMENT: John Deere 7280R Tractor (34,000 lbs.) & 8-row 1760NT Planter (6,000 lbs.)

The planter was weighed down with full seed boxes and two full liquid tanks for each test run to get as much weight as possible on the ground. This planting setup was used for both corn and soybeans.

300-FOOT-LONG TEST PLOTS, REPLICATED 6 TIMES

Test plots measured 8 rows by just over 300 feet long. Each tire pressure test plot was replicated 6 times. So in total, there were 30 test plots (5 tire pressures replicated 6 times) for corn and 30 test plots for soybeans across 7 acres of new ground.

3-YEAR STUDY OVER SAME GPS LINES

The study is designed to run 3 years over the same GPS lines. The study is currently in its 3rd year.

CENTER 6 ROWS HARVESTED FROM EACH PLOT

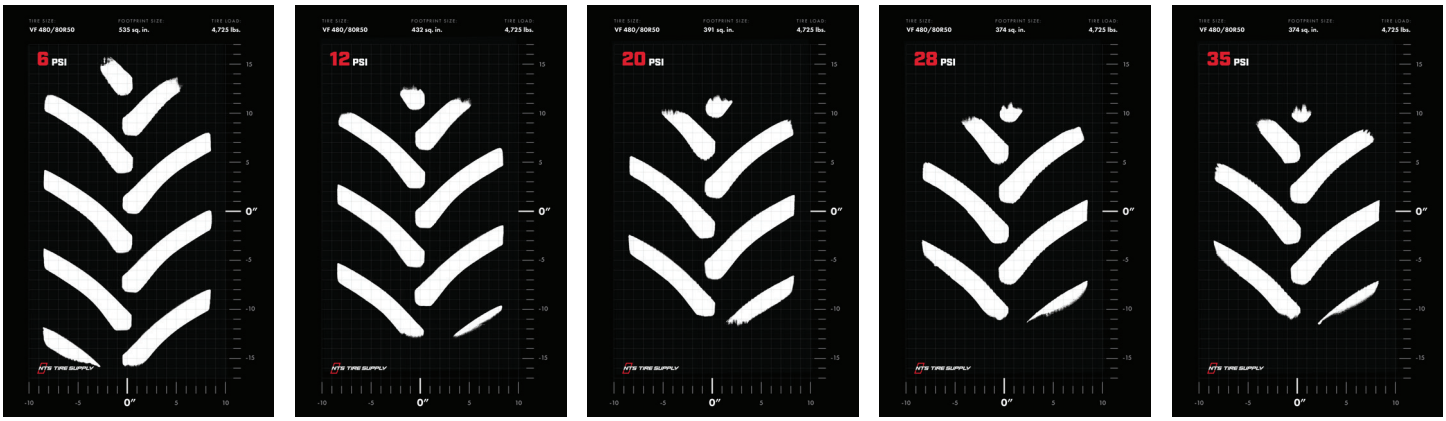
During harvest, only the center 6 rows from each plot were harvested. (Only rows affected by tire traffic—the rows between or next to a tire.)

5 TIRE PRESSURES TESTED(35 PSI–6 PSI)

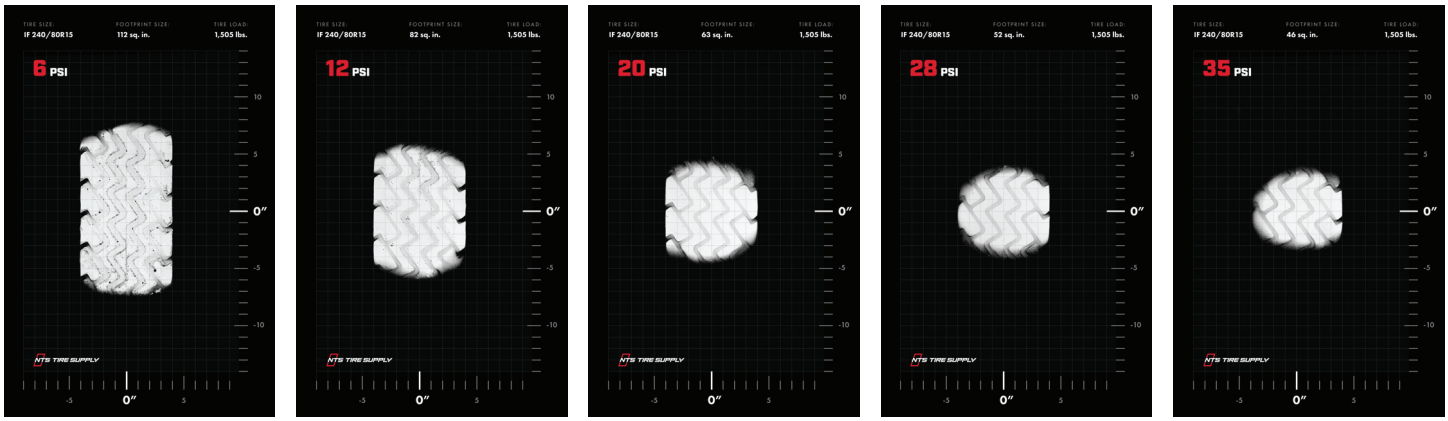
The study tested 6 different tire pressures (35 psi, 28 psi, 20 psi, 12 psi, & 6 psi). All tires were set to the same pressures (tractor fronts and rears, and planter tires). The pressure range was chosen to reflect farmers who run their tractors' tires at roading pressures in the field (35 psi) all the way down to more ideal and super-low pressures.

FRONT TRACTOR TIRES

REAR TRACTOR



PLANTER TRACTOR TIRES



Firle, Nate. "Tire PSI Compaction Study." 2022 AgRevival Research Book (Journal). 2022, pp. 13, 25. URL: https://www.agrevival.com/research/2022-research-studies. Accessed December 2022.

2021–2022 | AgRevival Tire Pressure Yield Study

2022

Corn Data

Tire PSI*	% Moisture	BU./AC.	BU./AC. DIFF.	2-YEAR AVE.
35 PSI	18.3	191.8	N/A	N/A
28 PSI	18.5	197.7	+ 5.9	+ 3
20 PSI	18.6	198.2	+ 6.4	+ 5.5
12 PS	18.6	197.9	+ 6.1	+ 5.8
6 PSI	18.7	202.0	+ 10.2	+ 8.3

Soybean Data

Tire PSI*	% Moisture	BU./AC.	BU./AC. DIFF.	2-YEAR AVE.
35 PSI	11.4	54.7	N/A	N/A
28 PSI	11.4	55.5	+ 0.8	+ 1.2
20 PSI	11.2	55.9	+ 1.2	+ 1.7
12 PS	11.3	56.3	+ 1.6	+ 2.2
6 PSI	11.3	56.6	+ 1.9	+ 3.3

*All tires (tractor front, tractor rear, and planter)

Firle, Nate. "Tire PSI Compaction Study." 2022 AgRevival Research Book (Journal). 2022, pp. 13, 25. URL: https://www.agrevival.com/research/2022-research-studies. Accessed December 2022.

2021

Corn Data

Tire PSI*	% Moisture	BU./AC.	BU./AC. DIFF.
35 PSI	16.6	184.3	N/A
28 PSI	16.1	184.3	+/-0.0
20 PSI	16.0	188.9	+ 4.6
12 PS	16.3	189.7	+ 5.4
6 PSI	16.3	190.7	+ 6.4

Soybean Data

Tire PSI*	% Moisture	BU./AC.	BU./AC. DIFF.
35 PSI	10.9	53.4	N/A
28 PSI	10.7	54.9	+ 1.5
20 PSI	10.7	55.6	+ 2.2
12 PS	10.6	56.1	+ 2.7
6 PSI	10.5	58.1	+ 4.7

*All tires (tractor front, tractor rear, and planter)

Firle, Nate. "Tire PSI Compaction Study." 2021 AgRevival Research Book (Journal). 2021, pp. 10, 23. URL: https://www.agrevival.com/research/2021-research-studies. Accessed December 2021.

2022 | Beck's Hybrids Tire Pressure Yield Study

Beck's Study Commentary

NATE FIRLE, REGIONAL AGRONOMY MANAGER

The Beck's PFR tire pressure study did not show the same degree of yield improvements as the AgRevival study. However, there was **one critical difference between the two studies:**

The Beck's researchers did not vary the planters' tire pressures. They only varied the tire pressures on the tractors used in the studies.

NATE FIRLE | REGIONAL AGRONOMY MANAGER | BECK'S HYBRIDS

"*It's not the single wheel, it's the whole system. You have three tires in one pass touching that soil.*" Some of Beck's planter tires were running as high as 60 psi, with many over 35 psi. "*That 60 psi donut tire on that planter just erased any benefit that lowering the PSI of the tractor would have done . . . and it shows in their data.*"

In addition, Firle adds that AgRevival's tractor is equipped with VF-rated duals and properly weighted to allow the tires to deflect and create longer, more stable footprints at low pressures. Some of the Beck's tractors were very small or equipped with standard radials or single rear and front tires, which may have caused the inconsistency in yield response across the multiple test sites.

So the Beck's data actually reinforces the importance of having the pressure of every tire in a setup as low as possible in the field. As Firle remarked:

"*The less* [ideal] *pressure is going to be what limits yield. It definitely has to be this combination of inflating or deflating all the tires in a particular pass.*"

Corn Data

Tire PSI (FRONT & REAR TIRES)	Emerged Population	Population Difference	BU./AC.	BU./AC. DIFF.
35 PSI	32,786	N/A	205.4	**N/A**
28 PSI	32,992	+206	206.7	**+1.3**
20 PSI	32,900	+114	207	**+1.6**
12 PS	32,656	-130	207	**+1.6**
10-6 PSI	32,685	-101	207.6	**+2.2**

Soybean Data

Tire PSI (FRONT & REAR TIRES)	Emerged Population	Population Difference	BU./AC.	BU./AC. DIFF.
35 PSI	32,786	N/A	65.1	**N/A**
28 PSI	32,992	+585	66.6	**+1.5**
20 PSI	32,900	-458	66.7	**+1.6**
12 PS	32,656	-1,668	66.6	**+1.5**
10-6 PSI	32,685	+570	66.8	**+1.7**

Beck's Hybrids. "Tire Pressure Study - Planter Tractor." 2022 Practical Farm Research. 2022, pp. 75, 116. URL: https://www.beckshybrids.com/research/practical-farm-research/2022-pfr-book-pdf-download. Accessed December 2022.

2022 | Hefty Brothers Tire Pressure Yield Study (Corn)

Background

In 2022, FarmX dealer NTS Tire Supply outfitted the Hefty Brothers' 8R 370 and DB60 planting setup with CTIS. The Hefty Brothers then studied what would happen once they dropped the machines' tire pressures down to their lowest safe field pressures (versus running them at the higher pressures required to handle roading).

Study Setup

The team made passes in the field with the planting setup's tires at both road and field pressures.

TRACTOR TIRES ROAD PRESSURE:	26 psi
PLANTER TIRES ROAD PRESSURE:	70 psi
TRACTOR TIRES FIELD PRESSURE:	9 psi
PLANTER TIRES FIELD PRESSURE:	25 psi

Results

A **3.4% yield increase** when using the optimized pressures made possible by CTIS.

NTS Tire Supply. "Keep Farm Tire Pressures Low for Higher Profits." Practical Traction Knowledge Blog. June 2023. URL: https://www.ntstiresupply.com/ptk-shared/keep-farm-tire-pressures-low-for-higher-profits. Accessed June 2023.

2021 | Michelin Tire Pressure Yield Study (Corn)

Background

In 2021, Michelin conducted a test near Windom, Minnesota, similar to the 2022 Hefty Brothers study. The rear axle of the John Deere 8295R and John Deere 1770NT planter were equipped with CTIS. The study's goal was to measure the yield difference in the field's pinch rows between the passes made at road pressure versus the optimized field pressures made possible by CTIS.

Study Setup

REAR TRACTOR TIRES ROAD PRESSURE:	30 psi	REAR TRACTOR TIRES FIELD PRESSURE:	14 psi
PLANTER TIRES ROAD PRESSURE:	61 psi	PLANTER TIRES FIELD PRESSURE:	23 psi

Results

A **6.4% yield increase** on pinch rows when using the optimized pressures made possible by CTIS.

(7.8% yield loss without CTIS enabled pressures vs. 1.4% yield loss with CTIS enabled pressures.)

24-ROW
25% of your crop is pinch rows

After a rainfall you can see that the water infiltration is much better on the **lower tire pressure strip** (right) vs. the high tire pressure strip (left) as the water stayed in the tracks and didn't go into the soil.

HIGH PRESSURE

LOW PRESSURE

Higgins, Sean. "Michelin CTIS Overview; NT Planter." Presentation. January 2022. Slide 11.

2021 | Michelin Sprayer Fuel Economy Study

Background

A 2021 Michelin study tested the fuel economy of a John Deere R4045 sprayer equipped with Michelin Spraybib VF420/95R50s on the road and in the field. The object was to compare the machine's fuel economy with the tires set to CTIS-enabled optimum pressures to the machine's fuel economy with the tires set to typical "compromise" air pressures.

Study Setup & Results

The road course was 8 miles; the field course was 2,250 feet (with multiple passes on each).

COMPROMISE ROAD TIRE PRESSURE:	38–40 psi
OPTIMIZED ROAD TIRE PRESSURE:	**52 psi 6% higher fuel economy**
COMPROMISE FIELD TIRE PRESSURE:	32/45 psi
OPTIMIZED FIELD TIRE PRESSURE:	**26/25 psi 11% higher fuel economy**

Results

6%/11% higher fuel economy when using the optimized pressures made possible by CTIS.

Higgins, Sean. "Michelin CTIS Project on Sprayers." Presentation. January 2022.

2013 | Tires vs. Tracks: Which Causes More Compaction?

Summary

Tire pressure is the critical factor that determines whether a tire setup will provide a compaction advantage over a track setup on the same machine.

Background

Yes, tracks have a huge footprint. But the weight of the machine isn't evenly distributed over that footprint. Instead, the machine's weight is concentrated on a few small pressure points—the area of the track beneath its midrollers.

GROUND PRESSURE COMPARISON

The Role of Tire Pressure

A study by Firestone found that radial tires can beat the compaction performance of tracks when properly inflated.

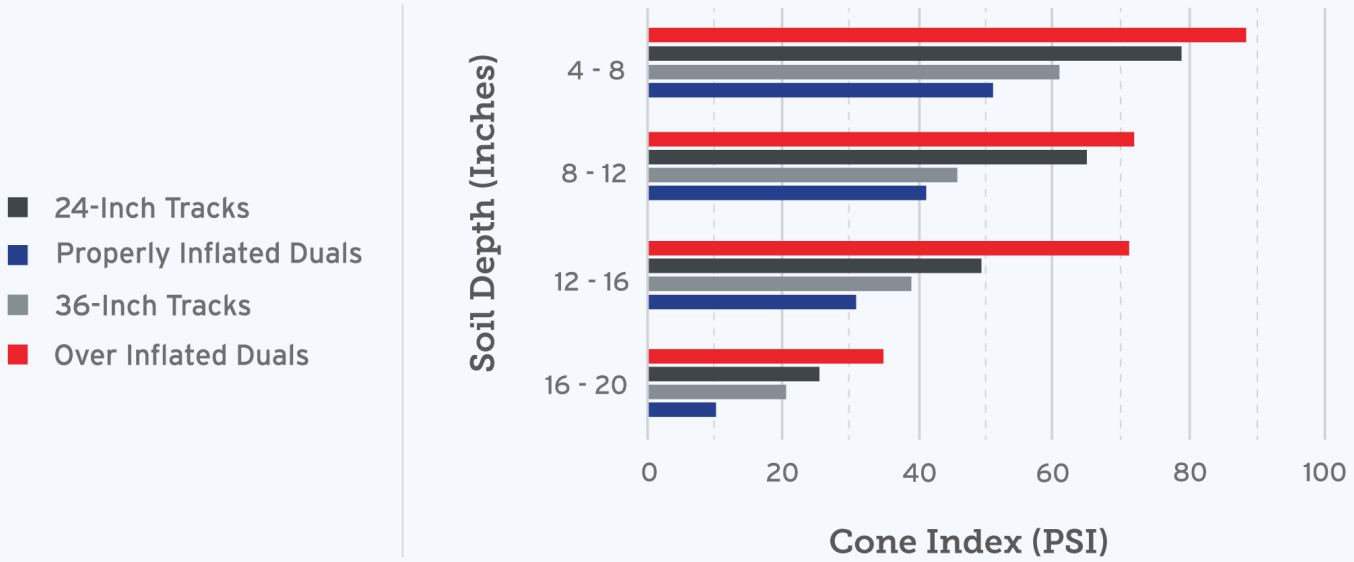
<20 PSI:	Tires beat tracks with less contact pressure to the soil.
20–35 PSI:	Tires and tracks cause same amount of contact pressure.
>35 PSI:	Tracks beat tires with less contact pressure to the soil.

Firestone. "Tractor Tracks vs. Tires – What You Need to Know." https://commercial.firestone.com/en-us/agriculture/resources/what-are-the-differences-between-rubber-tracks-vs-tires. Accessed July 21, 2023

Crouch, James, Alliance Tire Americas. "Ag Tracks vs. Tires: Manufacturers Answer." https://agtiretalk.com/ag-tracks-vs-tires-manufacturers-answer/. Accessed July 21, 2023.

A study by the University of Minnesota found a similar pattern. In the U of M study, the "over inflated" duals (710/70R38s) were set to 24 psi. The "properly inflated" duals were set to 6 psi (front) and 7 psi (rear) respectively.

Soil Compaction Levels



Source: University of Minnesota Extension

Firestone. "Tractor Tracks vs. Tires – What You Need to Know." https://commercial.firestone.com/en-us/agriculture/resources/what-are-the-differences-between-rubber-tracks-vs-tires. Accessed July 21, 2023

Crouch, James, Alliance Tire Americas. "Ag Tracks vs. Tires: Manufacturers Answer." https://agtiretalk.com/ag-tracks-vs-tires-manufacturers-answer/. Accessed July 21, 2023.

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