2019 Elgin SCIA Compaction Event

Shedden, Ontario

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Elgin SCIA Compaction Event

- Elgin's compaction event was the first one conducted by the Ontario Soil Compaction Team.
- The soil at the site was a Tuscola Silt although most would classify it as a clay.
- Water was applied several times to mimic spring or fall soil conditions on the dry surface of the wheat stubble. It is not known how uniform the soil wetness was throughout the soil profile used in each sensing demonstration
- Prior to the event, water was applied to small parts of the field to wet the soil via sets of four 1000L totes arranged in a square with small holes drilled in the bottom of each. At more recent events the Team has created twin sets of sensor pits to compare wetted soil with the current soil conditions post wheat harvest. Several sets of pits were created so that we had lots of redundancy for comparing all the equipment supplied for testing. These sets of twin pits were marked to keep any but the test traffic off to reduce any chance of other pass effects impacting the results.
- The area watered needed to be longer and wider than any individual track or tire to be tested across the sensors to ensure that dry soil at the edge of the wet sensor pit was not supporting part of the weight of the implements compared to the wet portion of the area of the sensors which would skew the responses.
- All equipment was cataloged and weighed by each wheel/track on day 1 and run over the sensors on day 2.
- Sensors were installed at depths of 6”, 12”, 20” using a custom designed apparatus. At the time of installation we do not know definitively if the above depth targets are correct, but when the sensors are uninstalled we check each depth and from all installations and they have been within 1” for each target depth at each event.
- Sensors were connected to a large display screen to share with the audience the real time response of each piece of equipment detected by the sensors and was recorded for later reporting.
- Sensors were measuring “pressure” detected at each depth.
- Pressure is used as a proxy of compaction susceptibility and is not a direct measure of soil compaction.

Site Soil Details

- The soil at the site was a primarily a Tuscola Silt (16-24% clay, 51-54% clay) according to the county soil map although directly we would have classed it a clay

Ontario Soils Maps – OMAFRA Agmaps

https://www.lioapplications.lrc.gov.on.ca/AgMaps/Index.html?viewer=AgMaps.AgMaps&locale=en-CA

Site Layout

Site Soil Details (cont.)

TUSCOLA SOIL (TU)

GENERALIZED PROFILE CHARACTERISTICS

PARENT MATERIALS	Stratified, loamy textured lacustrine materials which most often have silt loam and loam textures
DRAINAGE	Imperfect
USUAL CLASSIFICATION	Gleyed Brunisolic Gray Brown Luvisol

MEAN HORIZON VALUES

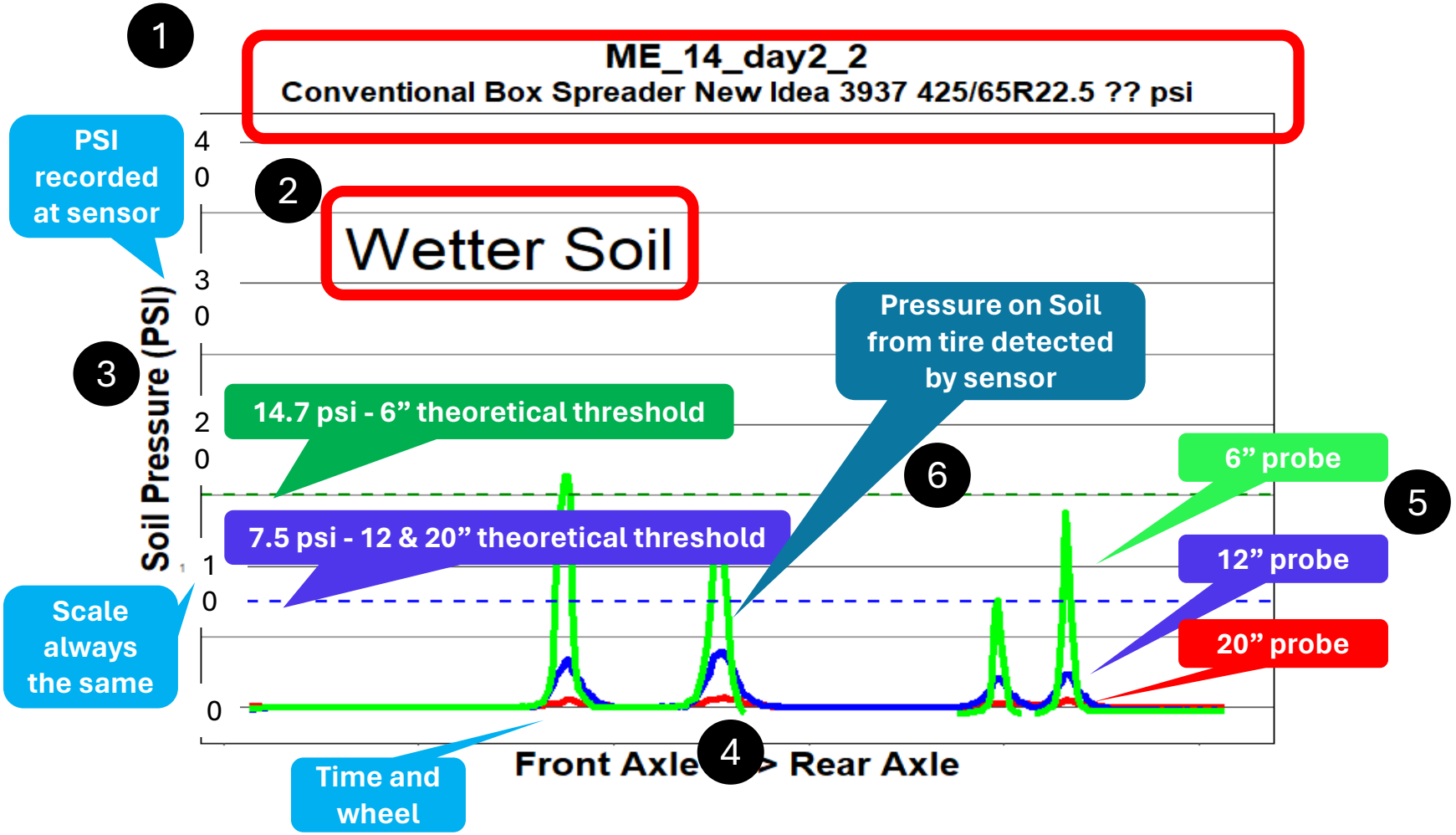
Horizon	No. of Samples	Depth to Horizon Base (cm)	Gravel %	Sand %	VF Sand %	Silt %	Clay %	Tex-ture	Organic Matter %	pH in $CaCl_2$	$CaCO_3$ %
Ap	55	24	1	33	19	51	16	SIL	2.8	6.9	0.6
Bmgj	23	48	0	32	22	52	16	SIL	0.6	7.0	0.6
Btgj	26	52	0	21	15	54	24	SIL	0.6	7.0	0.5
Ckgj	68		0	17	12	67	15	SIL		7.6	19.5

https://sis.agr.gc.ca/cansis/publications/surveys/on/on63/on63-v2_report.pdf

Interpreting the Data

- The data collected at these events is not rigorously collected scientific data but its aggregation shows trends that can direct us in the correct path to lower our risk of soil compaction.
- But it is more than simple “demonstration”!
- The data from an individual equipment pass should not be used for decision making.
- For a typical event, the team weighs and senses each piece of equipment. Multiple sets of Wet/Dry pits are prepared and used depending on how well the soil in the trafficked pits resists the stress. Thus different pieces of equipment or even the same equipment may have been tested on different sets of sensor pits and our experience has shown that we often get significant differences in response from the same equipment across different sensors located within as close as 30 feet of each other, and 30 feet is the distance we select to allow safe traffic flow around pits when preparing for an event.
- The other important variable to be aware of is that our sensor at the end of the pressure tubes is only 6” long, such that we may miss being directly over the critical sensing part of the sensor with the tire when an individual piece of equipment passes over. We try to ensure that any passes that are obviously not correct are abandoned and not included in the data.
- Refer to our overall Soil Compaction Event Learnings document for the aggregate determination of trends from all of the compaction events.

Typical Layout of Response Charts



Understanding the Charts

- Referring to the diagram on the page above, all exhibits receive a similar chart
- To support your interpretation of the exhibit, the charts are organized as follows:
    1. Title at the top that gives a brief description of the setup tested.
    2. Indicates whether the data is from a “Wet” or “Dry” pit, where the wet is one that has been watered and the dry is that condition of the field as it is.
    3. “Soil Pressure” in “Pounds per Square Inch” (PSI) is measured on the “Y” axis.
    4. Time/axle is measured on the “X” axis, and should be read from left to right, so the most left set of curves will be the first wheel to cross the sensor, usually the front wheel of the power unit, but not always since sometimes the front wheel is missed or mostly missed in lining up the rear dual of a tractor.
    5. The pressure response from the sensors to the travel of the tires over the sensor are “Green=6”, Blue=12” and Red=20” sensor”.
    6. From European work for a “general soil” there, scientists have estimated that 14.7 PSI is the theoretical threshold for which pressure should be below at the 6” depth (note dotted **GREEN** Line), and below 7.5 PSI at the 12” and 20” depths (note dotted **BLUE** Line). We have not validated those thresholds in Ontario but having them there offers the viewer an indication of the severity of compaction potential associated with a given configuration of equipment.

- **CAUTION – some of the equipment may not have directly navigated over the sensors, do not use an individual set of response curves as the definitive answer as to whether the observed equipment configuration is more or less prone to causing soil compaction**

Important Reminder

- Soil Compaction Events conducted by OSCIA and other event coordinators in cooperation with the Ontario Soil Compaction Team, **are not a COMPETITION!**
  - The equipment used in the events made possible from committee members, individual farmers and equipment sponsors are a platform to test various configurations of equipment
  - All of the platforms used can have similar configurations outfitted on them.
  - Any power unit or towed implement can be configured to lessen the risk of soil compaction.
  - Users of this information are encouraged to engage with others in finding the best solutions to their particular situations.

Key Learnings

- To lower the threat of soil compaction the compaction events have identified the following learnings:
  - Dryer soil is less susceptible to soil compaction than wet!
  - Lighter equipment is less likely to cause compaction compared to heavier equipment.
  - The more of (axles, duals, triples) and the better quality of tires (VF>IF>Radial>>>Bias) that are available on a piece of equipment that can operate at lower tire pressures will reduce the risk of soil compaction.
  - Where significant loads are carried routinely over roads and fields, Central Tire Inflation Systems (CTIS) are an important consideration to optimize tire pressure for the situation and therefor equipment operation to minimize the potential for soil compaction.
  - Compromising on tire pressure regarding road and field recommendations is highly discouraged, it just leads to trouble!
  - Tracks can be a good option where increasing tire size/number is not possible, BUT, you have to consider the cost, extra weight, extra maintenance that often come with converting to tracks.
  - Additionally with tracks, there is no doubt that they can go through more tough conditions BUT if they are carrying similar total and axle weight to a wheeled option, they run the same risk of soil compaction, if not worse because of tearing up the soil more than would happen when you elected not to put a wheeled piece of equipment in the field because the conditions were too marginal.

Addressing Soil Compaction

There are many ways to protect yourself from soil compaction. Compaction is not a moment in time issue. Avoiding compaction in the moment and being set to buffer against compaction is an ongoing management challenge but implementing some or all of the below is a good way to start!

1. Tile Drainage
2. Build Better Soils
3. Avoid Wet Soils
4. Bigger Tires
5. Lower Tire PSI
6. Use Inflation/Deflation Systems
7. Better Tires
8. More Tires/Axles
9. Less Passes
10. Less Tillage
11. Control Traffic
12. Lower Load Weights
13. Choose configurations carefully
14. Be Patient

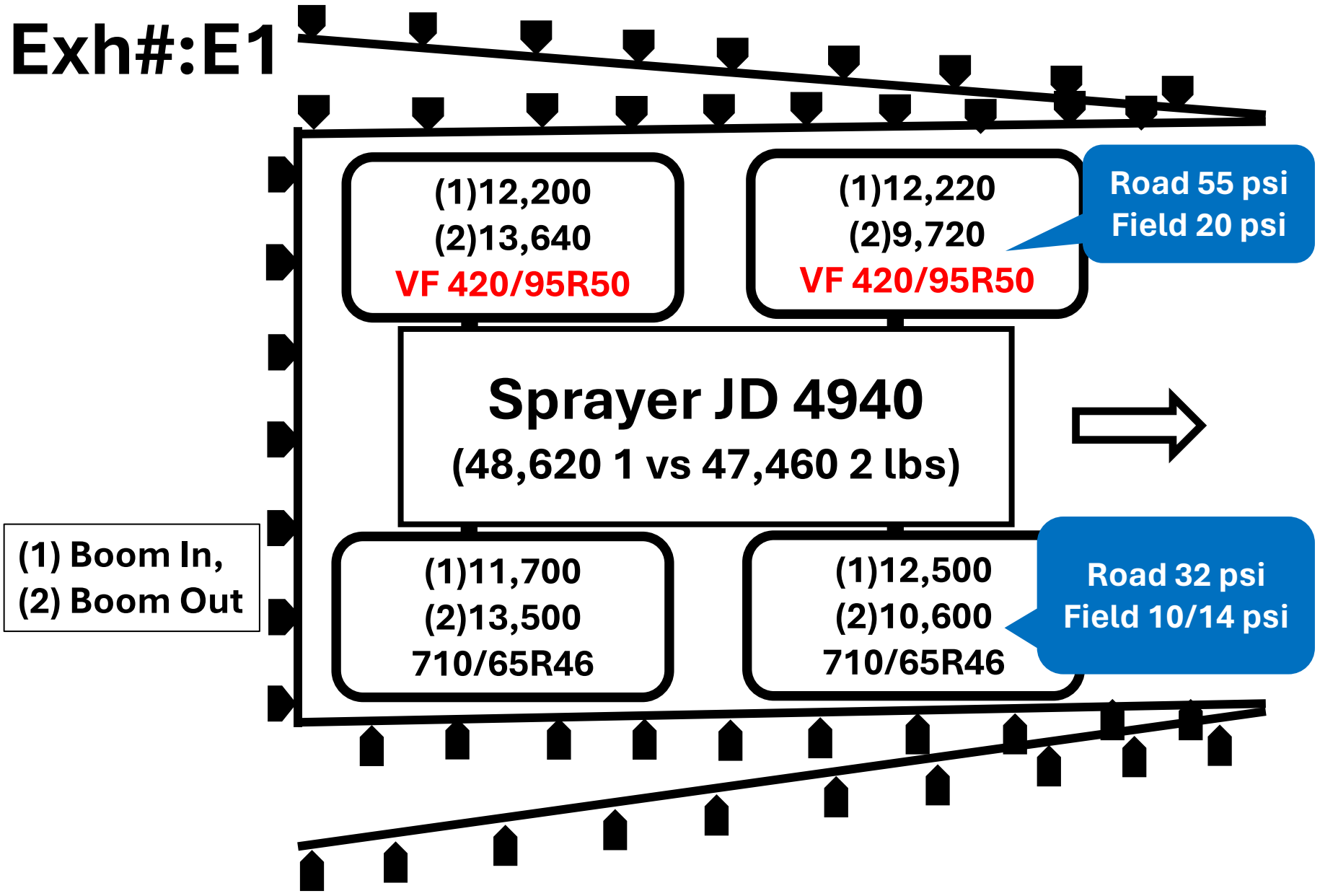
The management decisions listed that can reduce soil compaction are in no particular order.

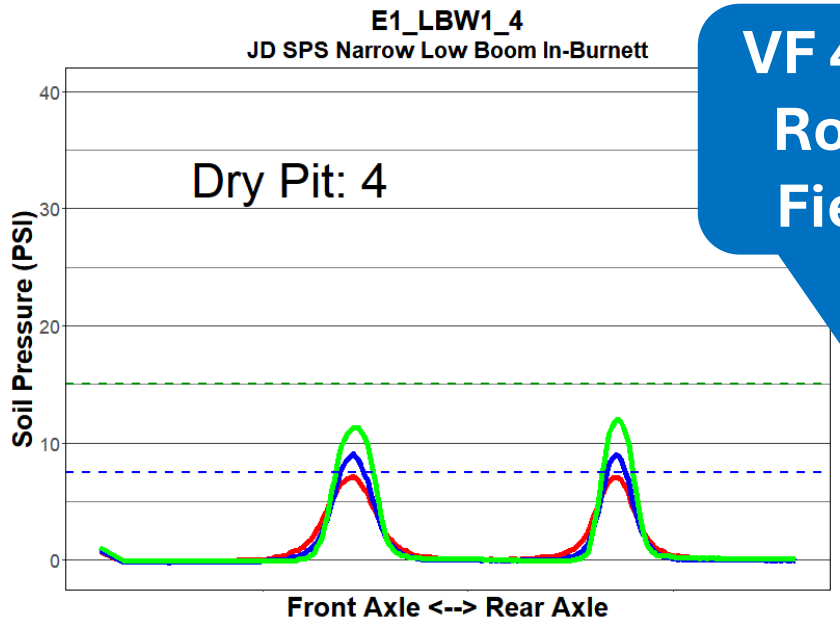
2019 Elgin Soil and Crop Compaction Event

Exhibit: E1
John Deere 4940 SP Sprayer with VF420/95R50s vs 710/65 R46 and CTIS

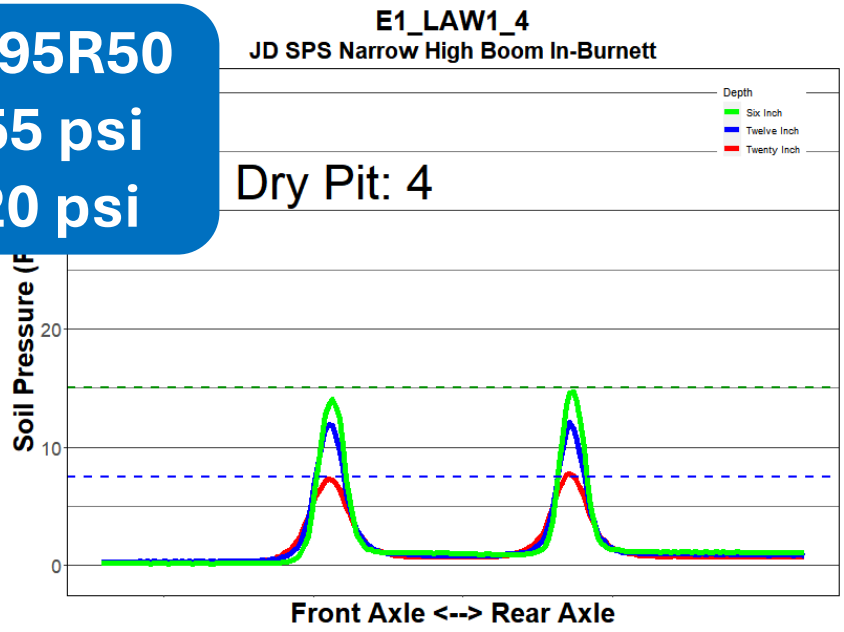

1
L+R
A+B
W1+2

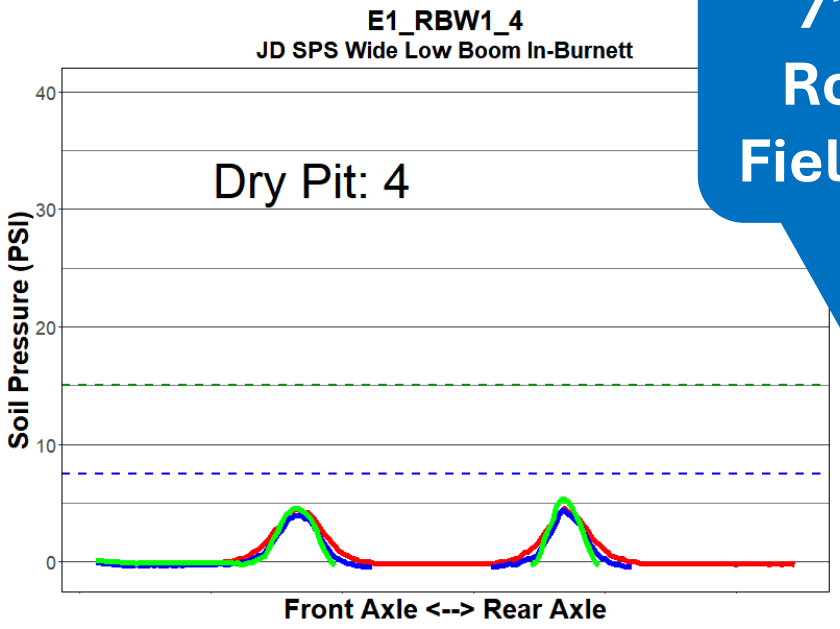
Exh#:E1


(1)12,200
(2)13,640
VF 420/95R50
(1)12,220
(2)9,720
VF 420/95R50
Road 55 psi
Field 20 psi
Sprayer JD 4940
(48,620 1 vs 47,460 2 lbs)
(1) Boom In,
(2) Boom Out
(1)11,700
(2)13,500
710/65R46
(1)12,500
(2)10,600
710/65R46
Road 32 psi
Field 10/14 psi

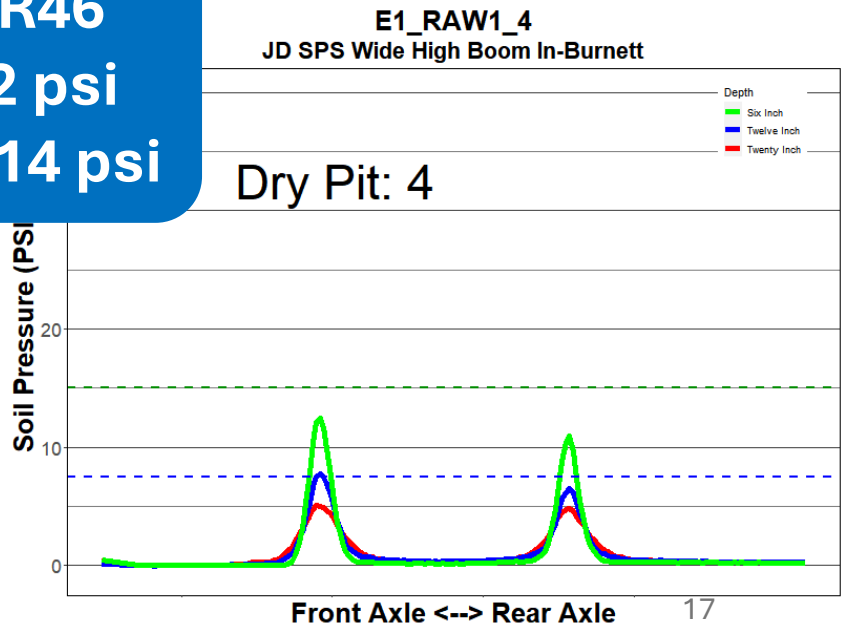


VF 420/95R50
Road 55 psi
Field 20 psi





710/65R46
Road 32 psi
Field 10/14 psi



Plot Comments – E1

- The narrow tires resulted in greater stress detected at each depth and each psi setting compared to the wider tires although given the dry soil conditions the load and configuration did not put damaging load into the soil.
- Lowering tire pressure reduces stress from equipment weight regardless of tire choice, but has greater impact with larger tires because of the volume of air that can be changed.
- The weight of the vehicle means that the stress at the 20 inch depth is not as effectively reduced by lowering the tire pressure.
- Lowering the axle weight would reduce the stress at the 20 inch depth.
- The machine was not able to be tested with the boom out due to a technical problem.

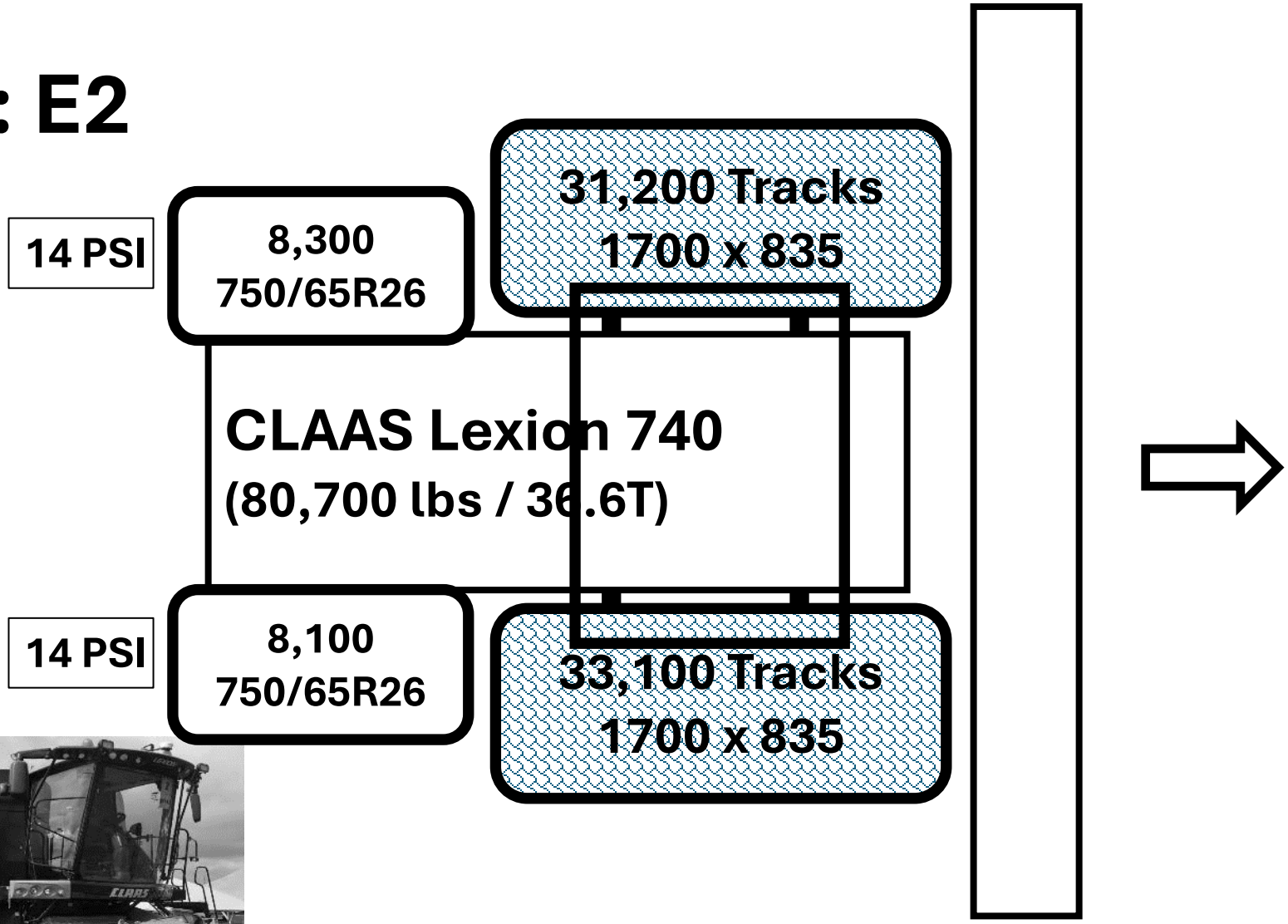

4940

2019 Elgin Soil and Crop Compaction Event

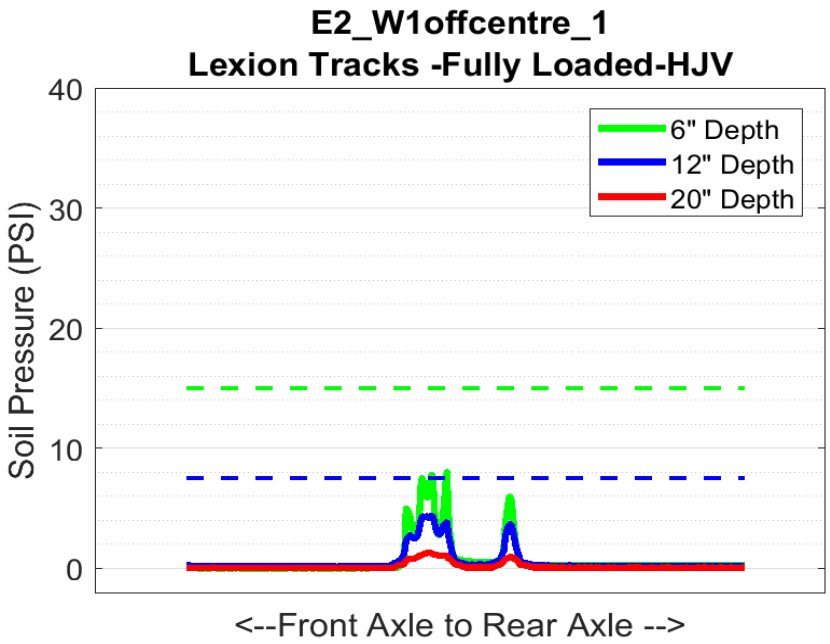
Exhibit: E2
Class Lexion 740T Tracked Combine with 750 Rears

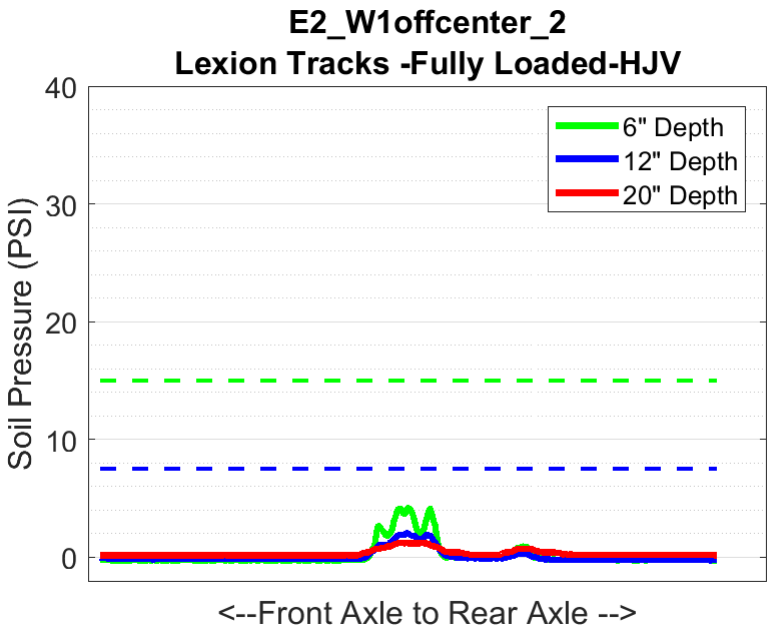

CLAAS
LEXION
740
GERINGHOFF

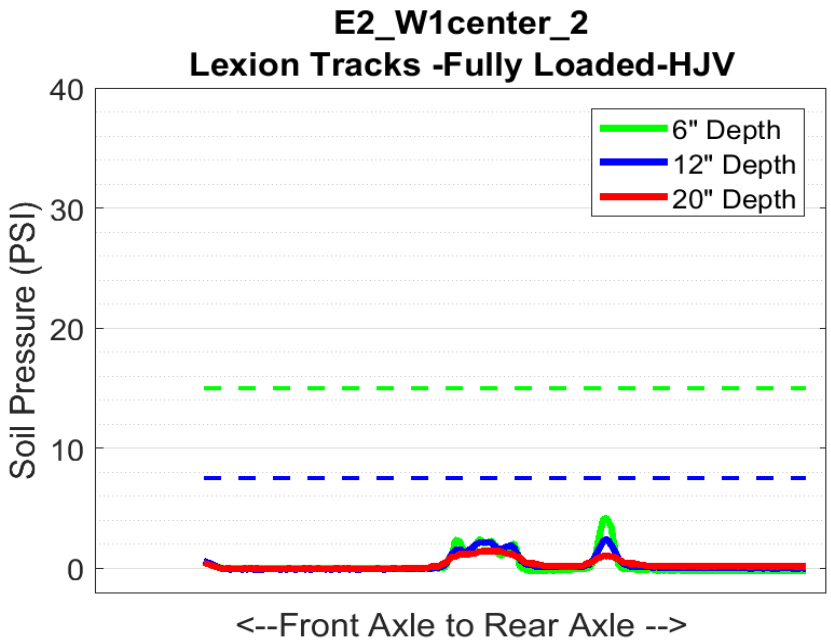
Exh: E2

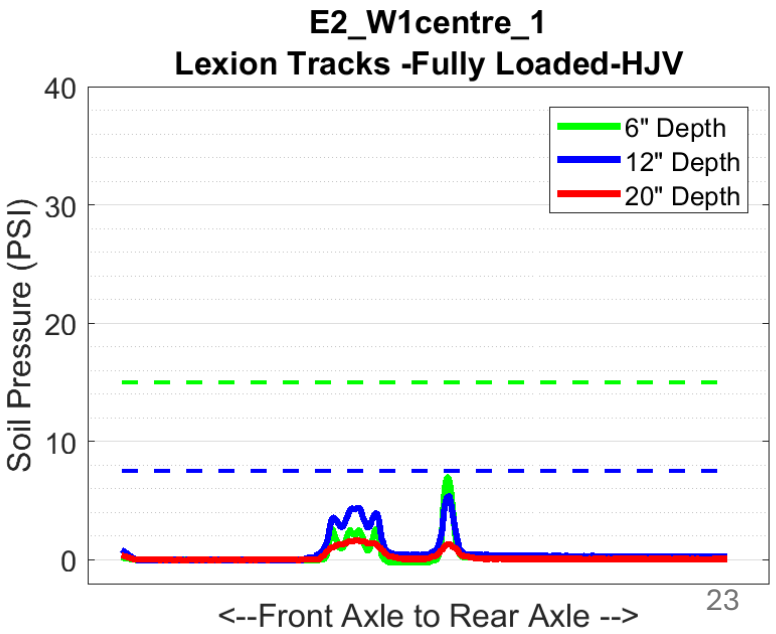

14 PSI
8,300
750/65R26
31,200 Tracks
1700 x 835
CLAAS Lexion 740
(80,700 lbs / 36.6T)
14 PSI
8,100
750/65R26
33,100 Tracks
1700 x 835


CLAAS


E2_W1offcentre_1
Lexion Tracks -Fully Loaded-HJV
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E2_W1offcenter_2
Lexion Tracks -Fully Loaded-HJV
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E2_W1center_2
Lexion Tracks -Fully Loaded-HJV
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E2_W1centre_1
Lexion Tracks -Fully Loaded-HJV
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->

Plot Comments – E2

- Note this is a good setup and that its consistent across two different test pits
- Note the track showing as a multi peaked response because of the bogie wheels
- This is an example of the variation in soil stress across the face of the Tire tread.
- The plots where the vehicle was off center show a higher soil stress directly under the rollers of the track unit.
- When comparing this unit with E47 you would expect a similar profile with a slightly lower soil pressure for this machine since it is overall less weight. However, this unit was tested on a different sensor pit which highlights the dependence on the soil profile to carry the load. The location where E47 was tested may have had a slightly wetter soil profile which increased the stress transferred into the soil despite only being a few feet away from the other sensor pit.


CLAAS
740
LEXION


CLAAS
LEXION


8,100
14 PSI


CLAAS
740
LEXION


CLAAS
740
LEXION
APS HYBRID


CLAAS
LEXION
CLAAS
740
LEXION

2019 Elgin Soil and Crop Compaction Event

Exhibit: E4 + E31

Challenger M775E Two Track Row Crop Tractor and Tracked Brent Avalanche 1594 Grain Buggy


BRENT
1594
1594

Exh: E4+E31

42,170
36 x 149 Track

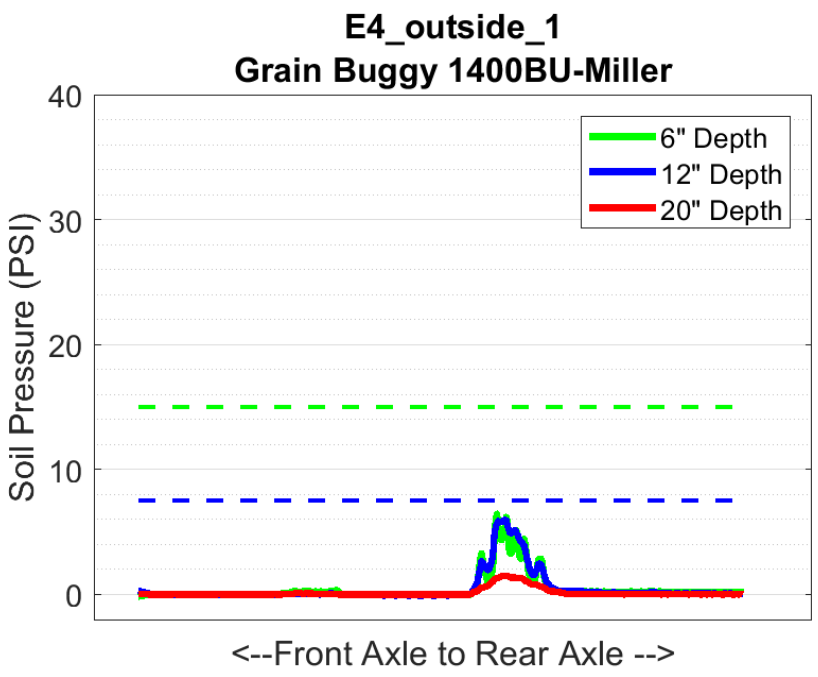
Brent
Avalanche
1594
Grain Buggy
(84,340
lbs/38.3T)

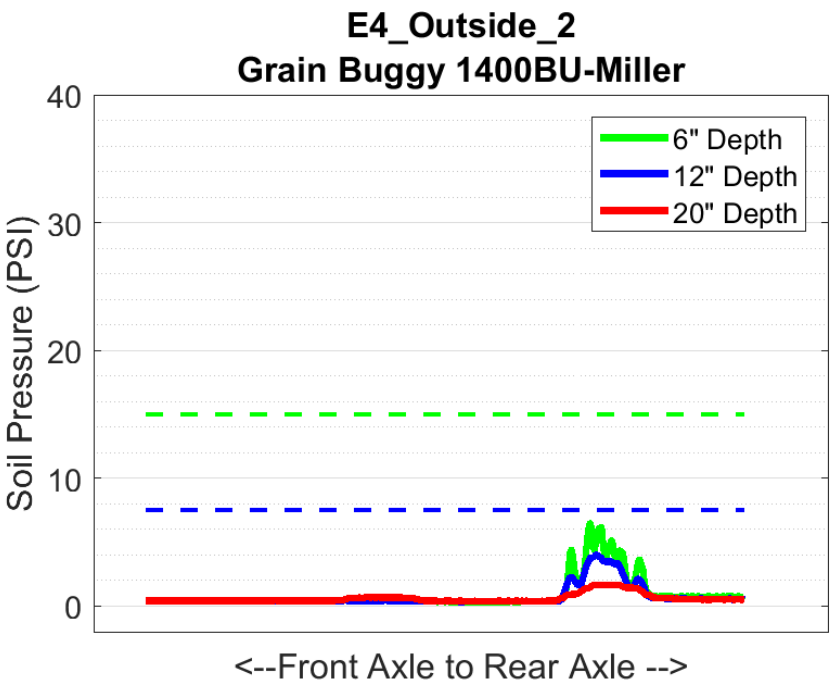
42,170
36 x 149 Track

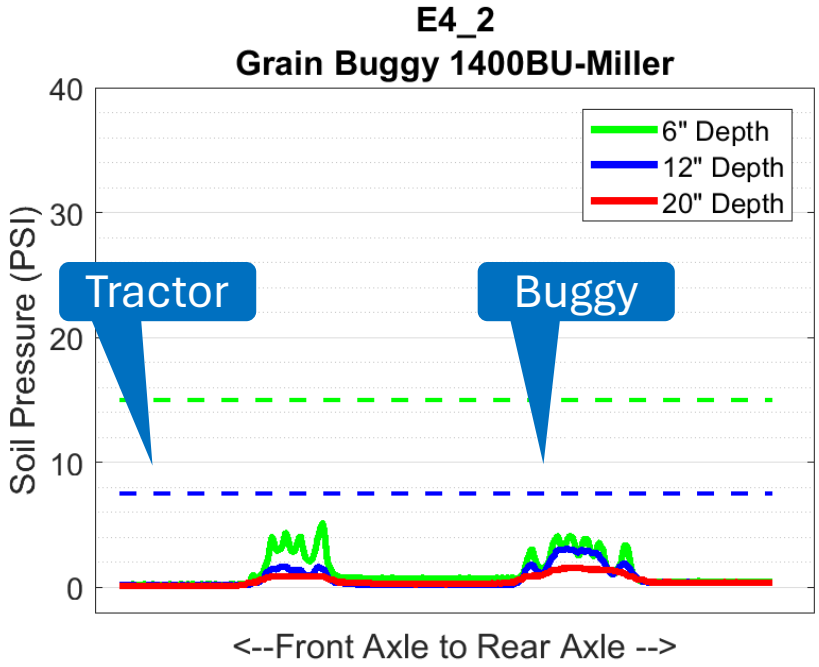
20,380

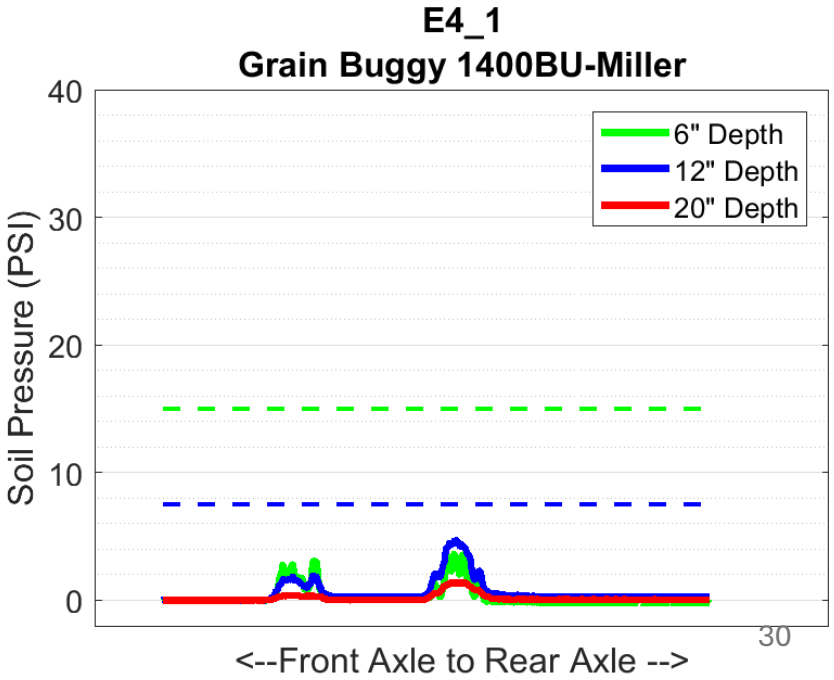
Challenger MT775E
(40,760/18.4T lbs)

20,380


E4_outside_1
Grain Buggy 1400BU-Miller
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E4_Outside_2
Grain Buggy 1400BU-Miller
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E4_2
Grain Buggy 1400BU-Miller
6" Depth
12" Depth
20" Depth
Tractor
Buggy
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E4_1
Grain Buggy 1400BU-Miller
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->

Plot Comments – E4 +E31

- This unit tested the grain cart tracks the first two plots were aligned over the center of the track face which shows a lower soil pressure for the buggy.
- The second two plots show the pressure under the outside third of the track face, directly under the track rollers. These plots did not record the track of the tractor since it was off the sensor.
- This shows that the pressure distribution across the face of the track is non uniform.


AVALANCHE


AVALANCHE


BRENT
1594

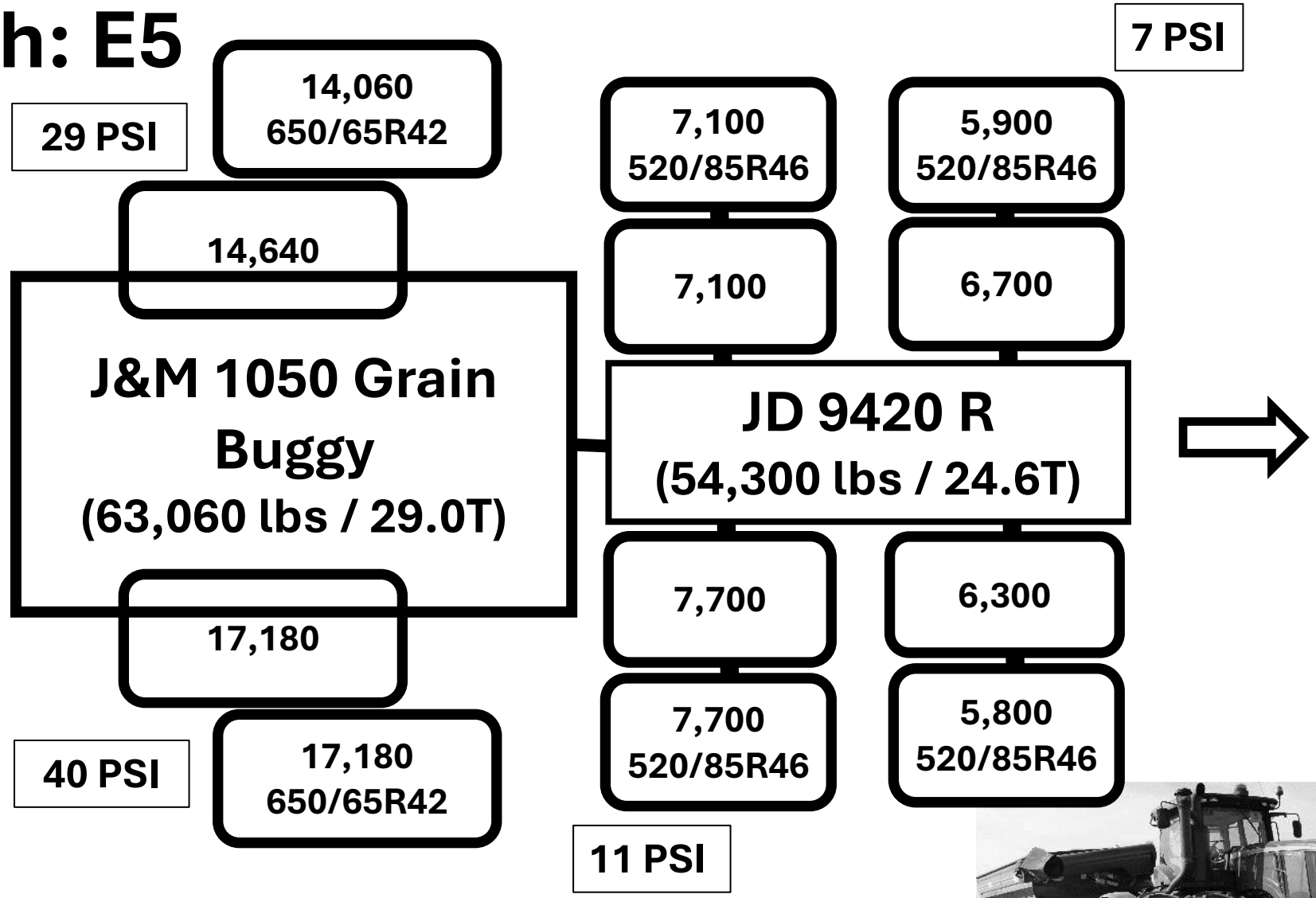

BRENT

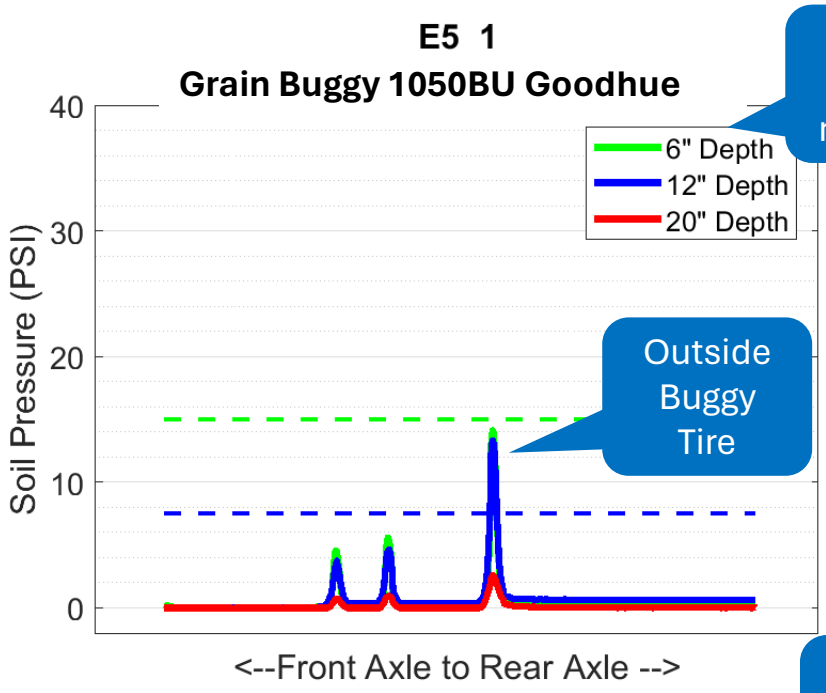
2019 Elgin Soil and Crop Compaction Event

Exhibit: E5
JD 9460R Articulated Dualled 520s + J&M 1050 Grain Buggy with Offset Tandem 650s at two PSI Levels


JOHN DEERE
9460 R
MICHELIN

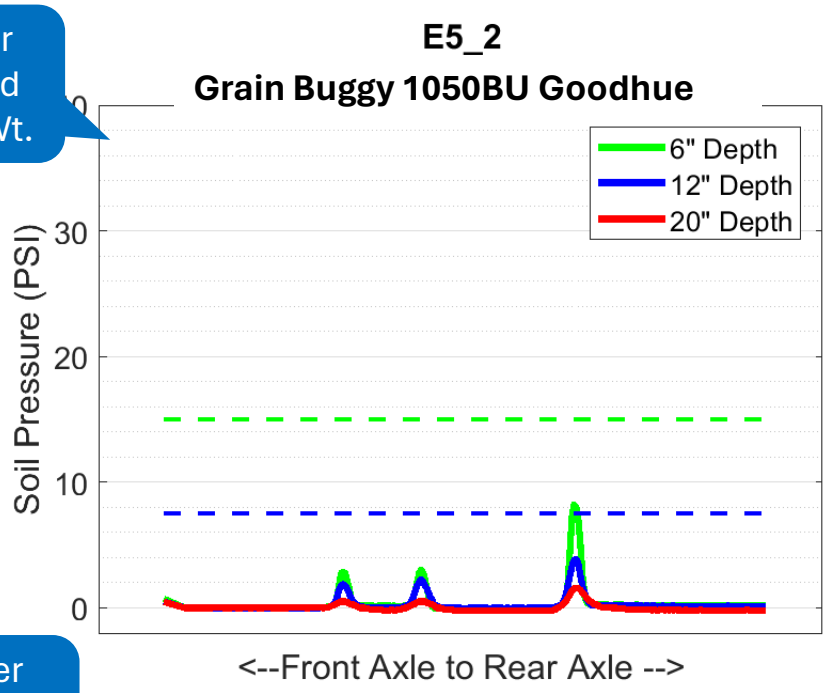
Exh: E5


29 PSI
14,060
650/65R42
14,640
J&M 1050 Grain Buggy
(63,060 lbs / 29.0T)
17,180
40 PSI
17,180
650/65R42
7 PSI
7,100
520/85R46
5,900
520/85R46
7,100
6,700
JD 9420 R
(54,300 lbs / 24.6T)
7,700
6,300
7,700
520/85R46
5,800
520/85R46
11 PSI

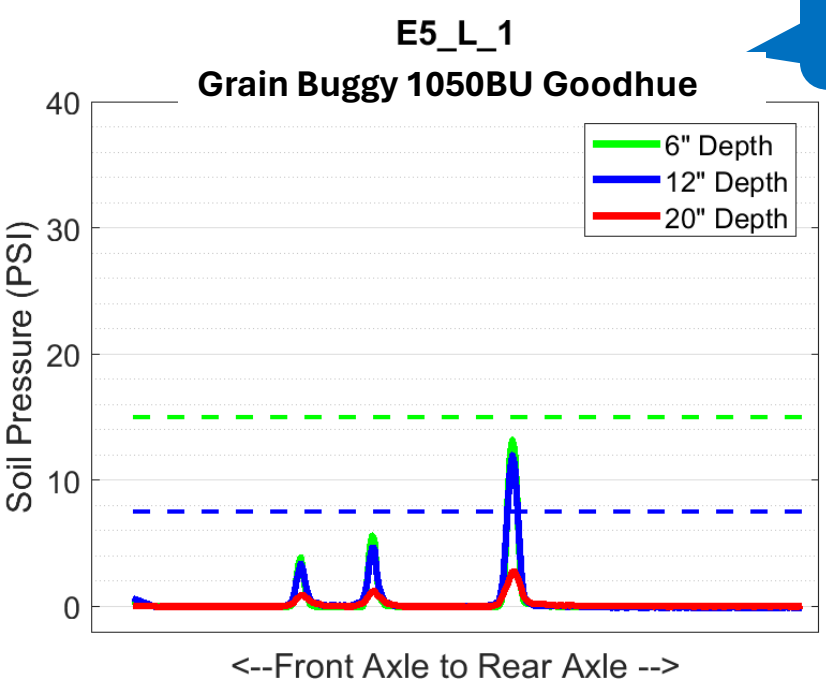


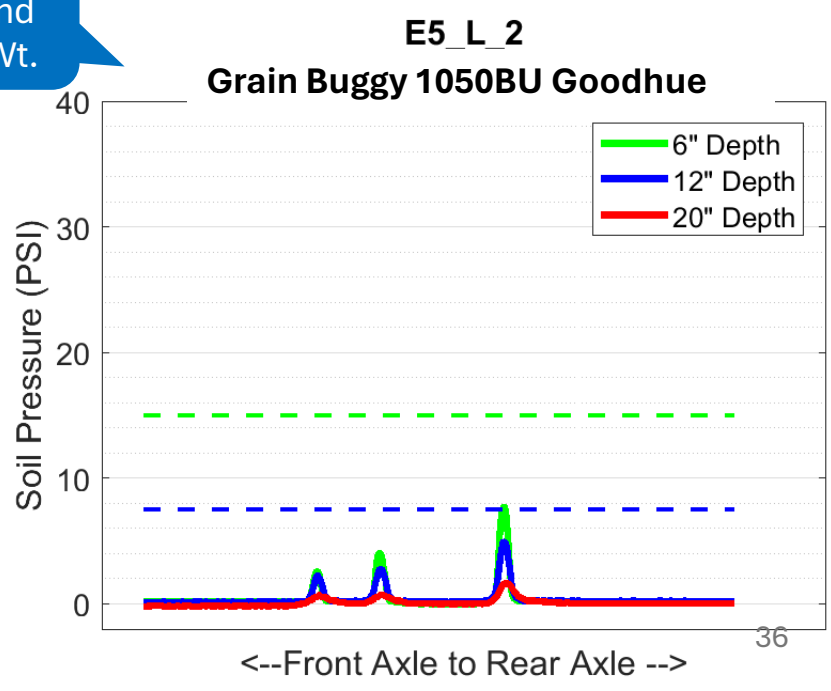
Higher PSI and more Wt.

Outside Buggy Tire



Lower PSI and less Wt.





Plot Comments – E5

- This vehicle compared high inflation pressure and low inflation pressure for the grain cart
- Notice also the high inflation tire was ~3000 lbs heavier
- Notice the last peak on the plots is slightly higher for the plots names E5_1 and E5_2
- Also notice the much higher overall response for the plots for the first sensor installation E5L_1 and E5_1. This may be explained due to differences in soil properties.
- The first two peaks on all plots were the tractor tires but do not account for the peak pressure so should be ignored as the tires were not centred on the sensors.

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Exhibit: E6
JD 7230R RC Tractor w Dualled 520s + Unverferth 7200 Grain Buggy with 30.5L-32 vs 900/60R32 Tires


Unverferth 7200
900/60R32
Radial Tire
30.5L-32
bias tire

Exh: E6

33 PSI

24,900
30.5L-32

Unverferth
7200 Grain
Buggy
(50,100 lbs/22.7T)

25,200
900/60R32

26 PSI

11 PSI

4,900

4,900
520/85R46

11 PSI

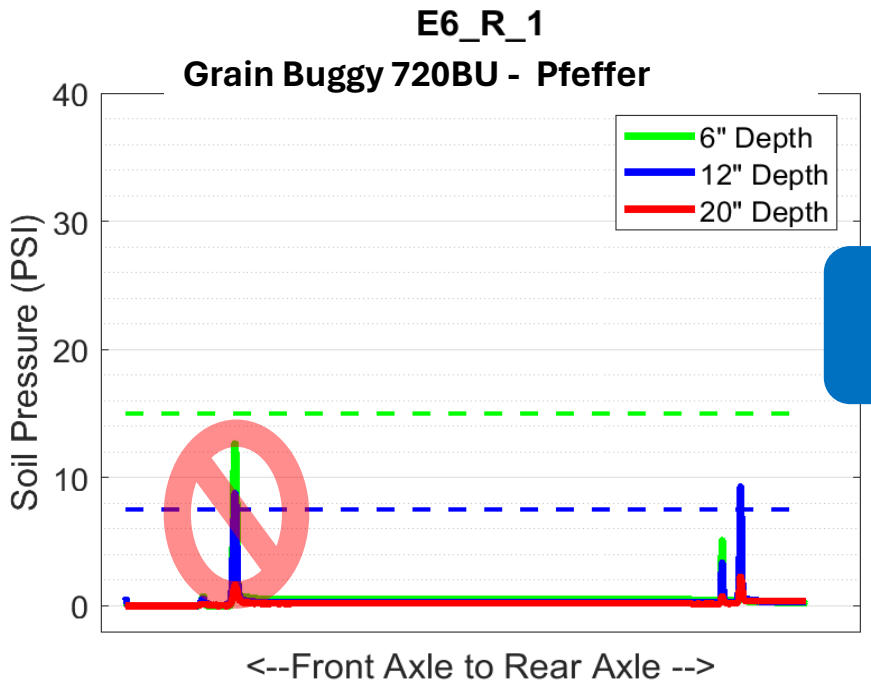
3,900
480/70R34

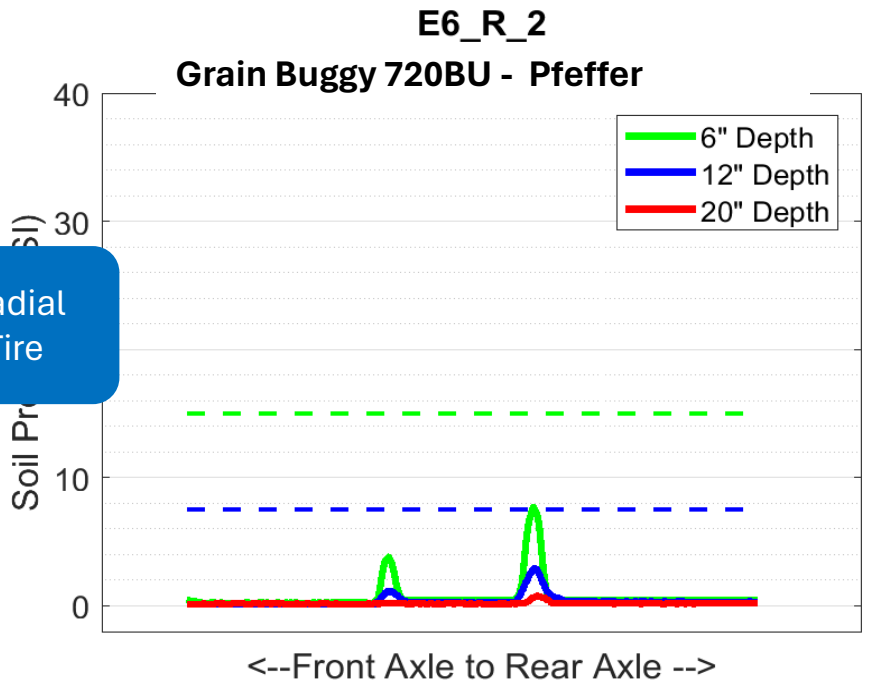
JD 7320R
(27,500 lbs/12.5T)

4,900
520/85R46

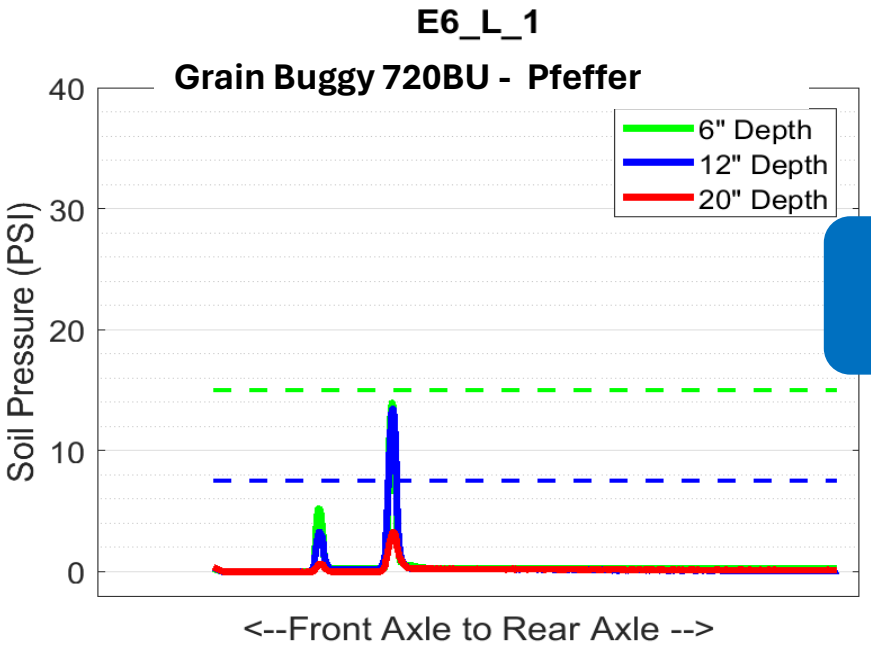
4,900

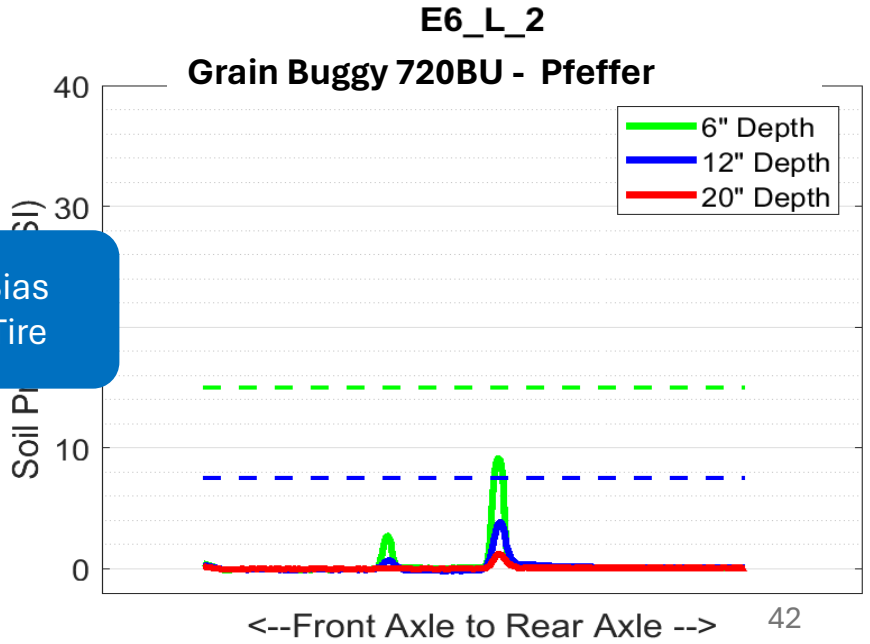
4,000
480/70R34





Radial Tire





Bias Tire

Plot Comments – E6

- The response curve to the left is partially the rear tire of tractor and right curve is the grain cart.
- This unit compares two common tires for a grain cart a 30.5L-32 bias tire and a much wider 900/60R32 radial. The bias tire is associated with the plots titled E6_L_1 and E6_L_2. The bias tire had a higher inflation pressure with approximately the same load.
- Plots named E6_L_1 and E6_R_1 had some issues hitting the sensor in both attempts. We later found out that this installation of sensors was misaligned.
- The plots E6_L_2 and E6_R_2 show that the bias ply tire had a slightly higher soil pressure response.
- There is a slight advantage to the radial tire for lowering soil stress but note that the load is very large and the benefits from larger volume tires or wider tires may not be as prominent as they would be with a lighter load or more axles. ie, this unit is too heavy for the tires used!

30.5L-32
bias tire

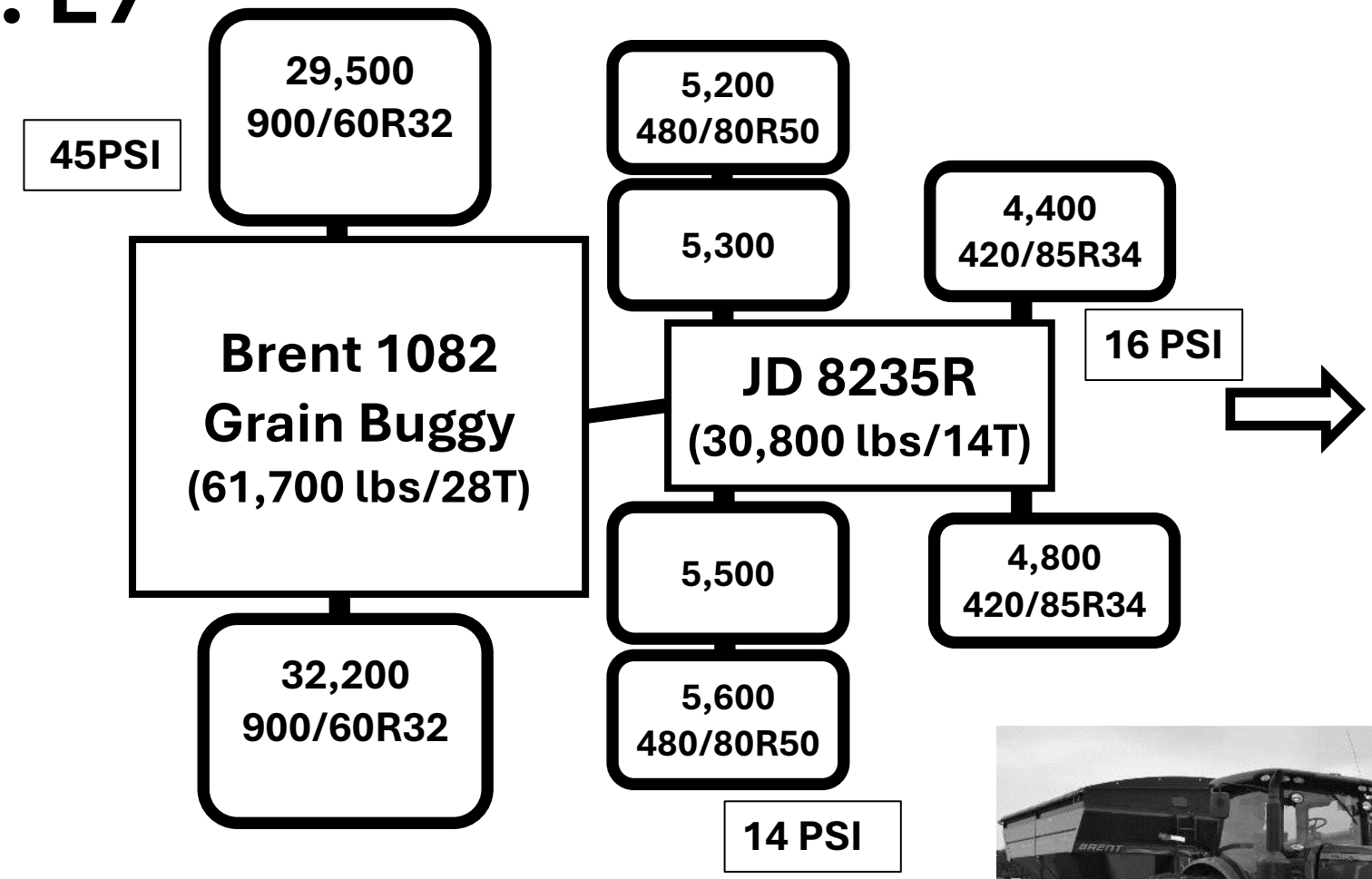
900/60R32
Radial Tire

2019 Elgin Soil and Crop Compaction Event

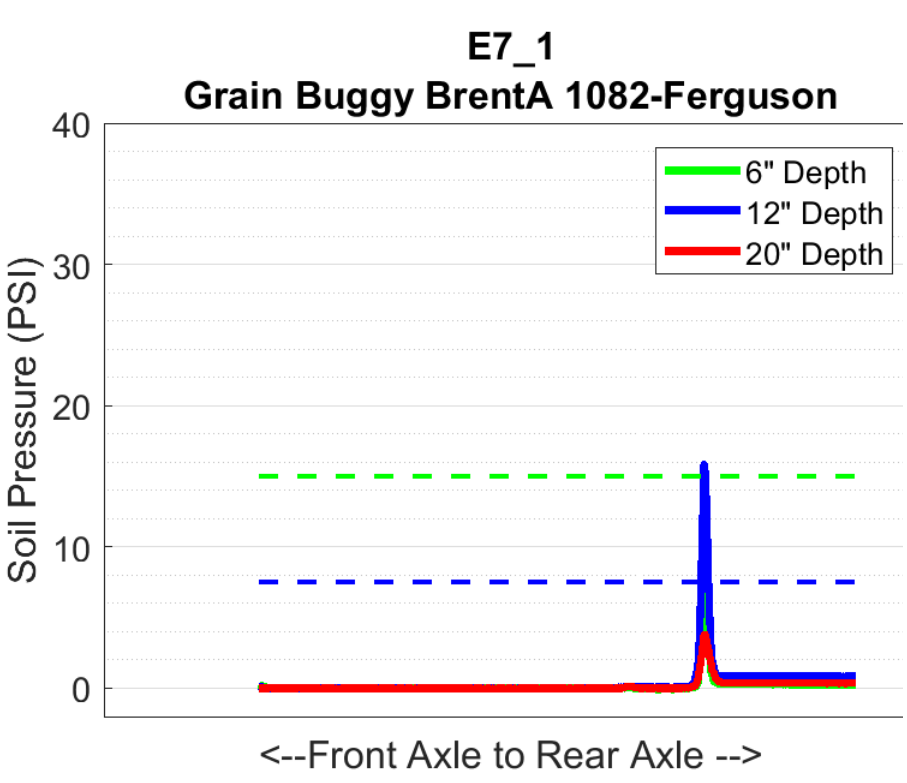
Exhibit: E7
JD 8235R RC Tractor w Dualled 420s + Brent 1082 Grain Buggy w 900 Big Singles

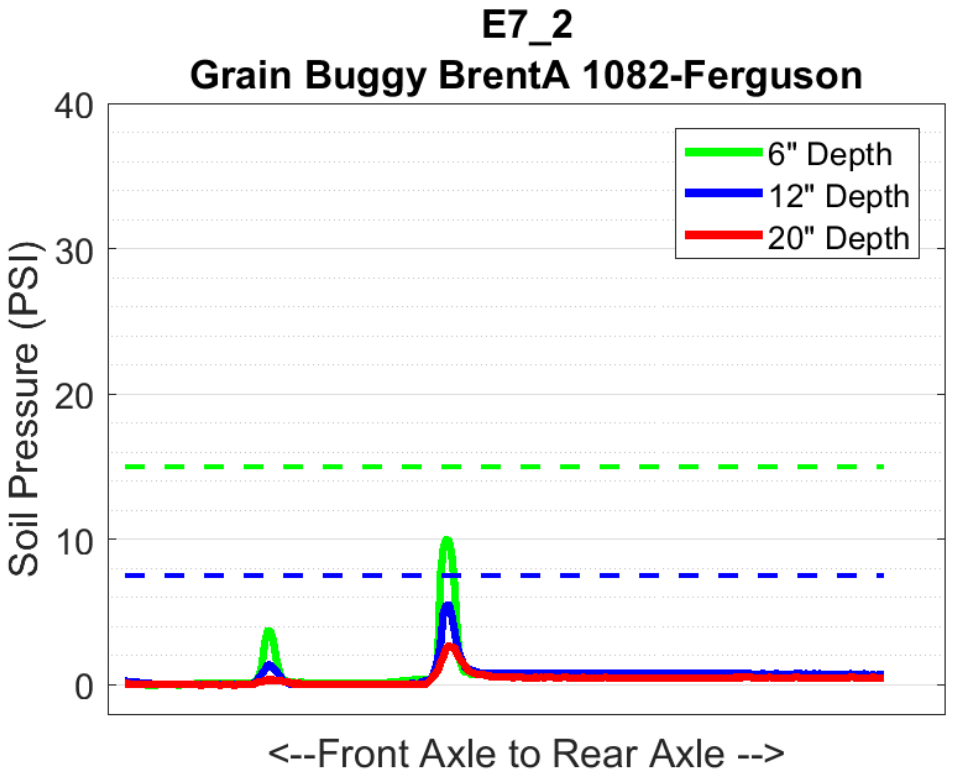

BRENT
JOHN DEERE
8235 R

Exh: E7


29,500
900/60R32
45PSI
5,200
480/80R50
5,300
4,400
420/85R34
16 PSI
Brent 1082
Grain Buggy
(61,700 lbs/28T)
JD 8235R
(30,800 lbs/14T)
5,500
4,800
420/85R34
32,200
900/60R32
5,600
480/80R50
14 PSI


BRENT


E7_1
Grain Buggy BrentA 1082-Ferguson
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E7_2
Grain Buggy BrentA 1082-Ferguson
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->

Plot Comments -E7

- This vehicle has the same radial tire that was seen on Unit E6.
- The plot E7_1 shows the left side and an overall larger response due in part to a wetter soil profile.
- The plot E7_2 shows the left side again with a similar response to the same tire on Unit E6.
- The soil pressure is slightly higher in this test due to a higher load and pressure (4300 lbs. increase) compared to the Unit E6.
- This load and configuration is good given the soil conditions at sampling time.


BRENT
1082


BRENT

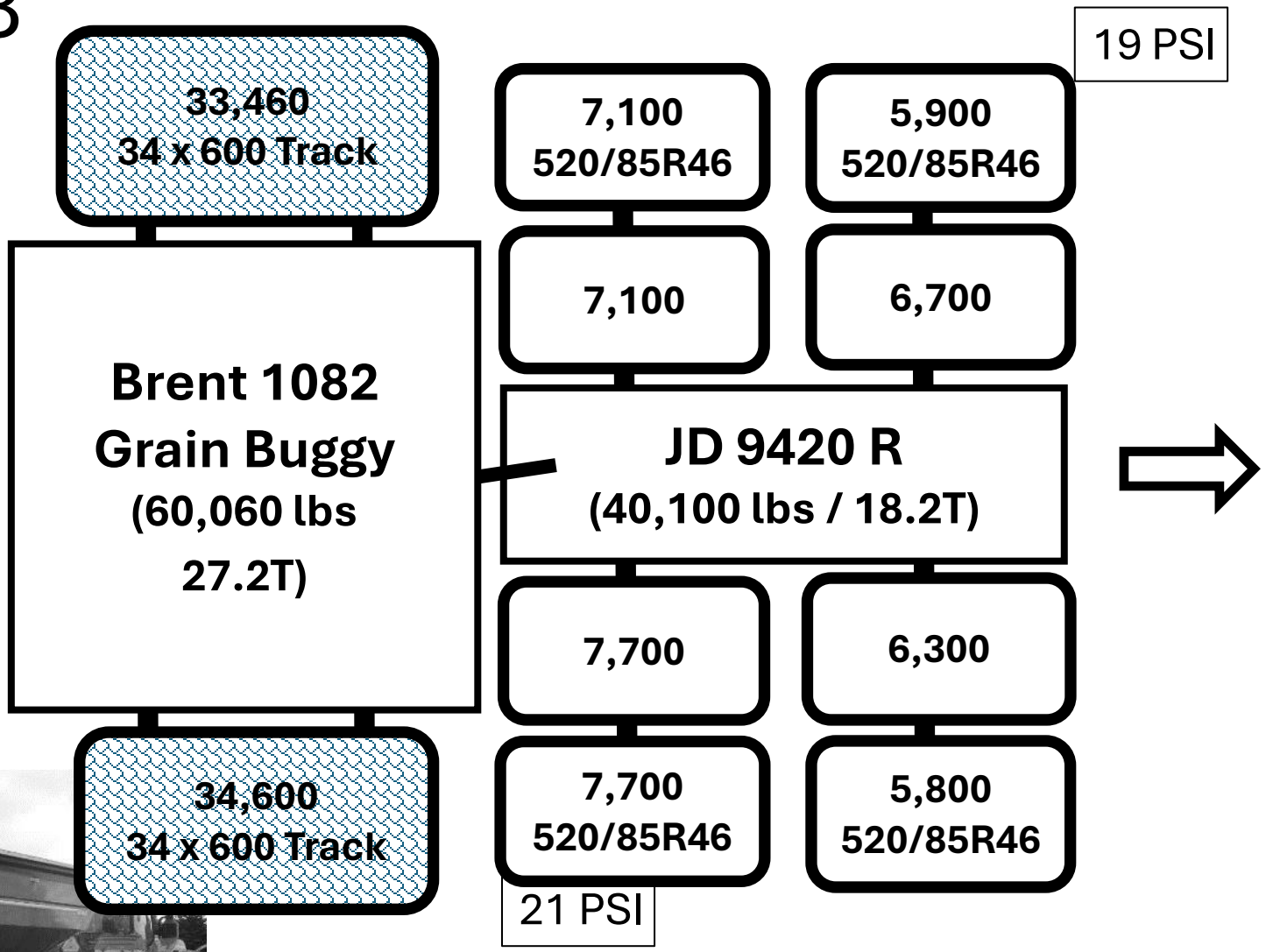

BRENT
B235 R

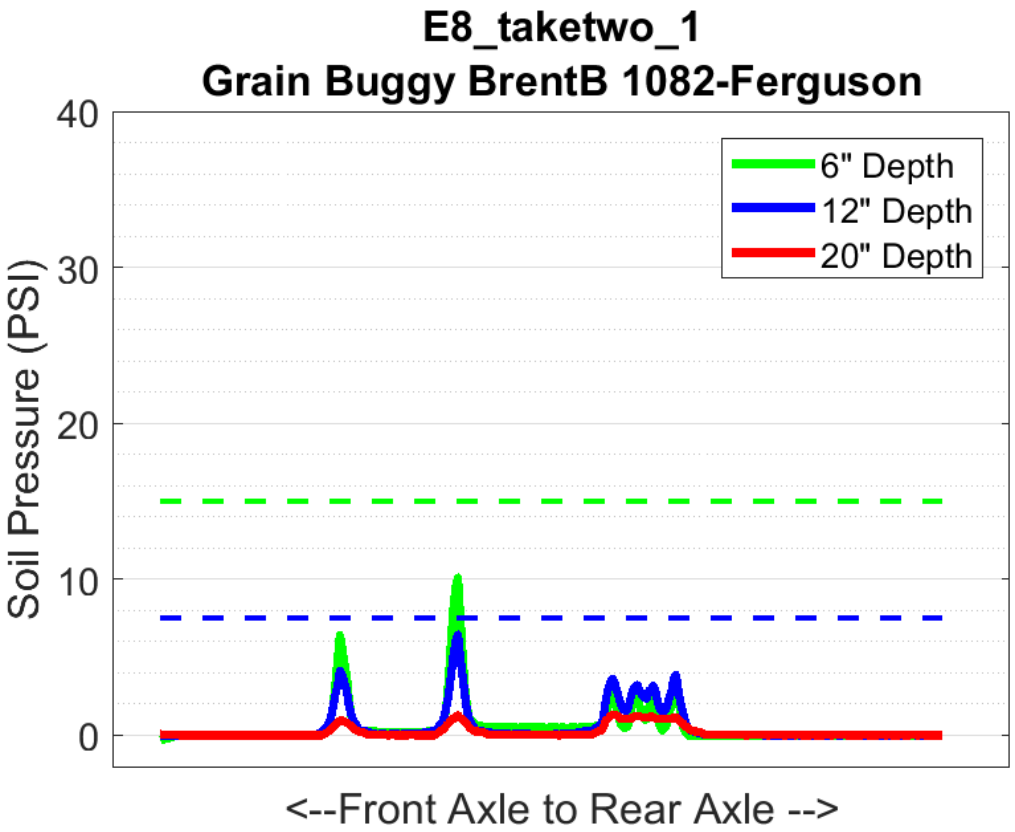
2019 Elgin Soil and Crop Compaction Event

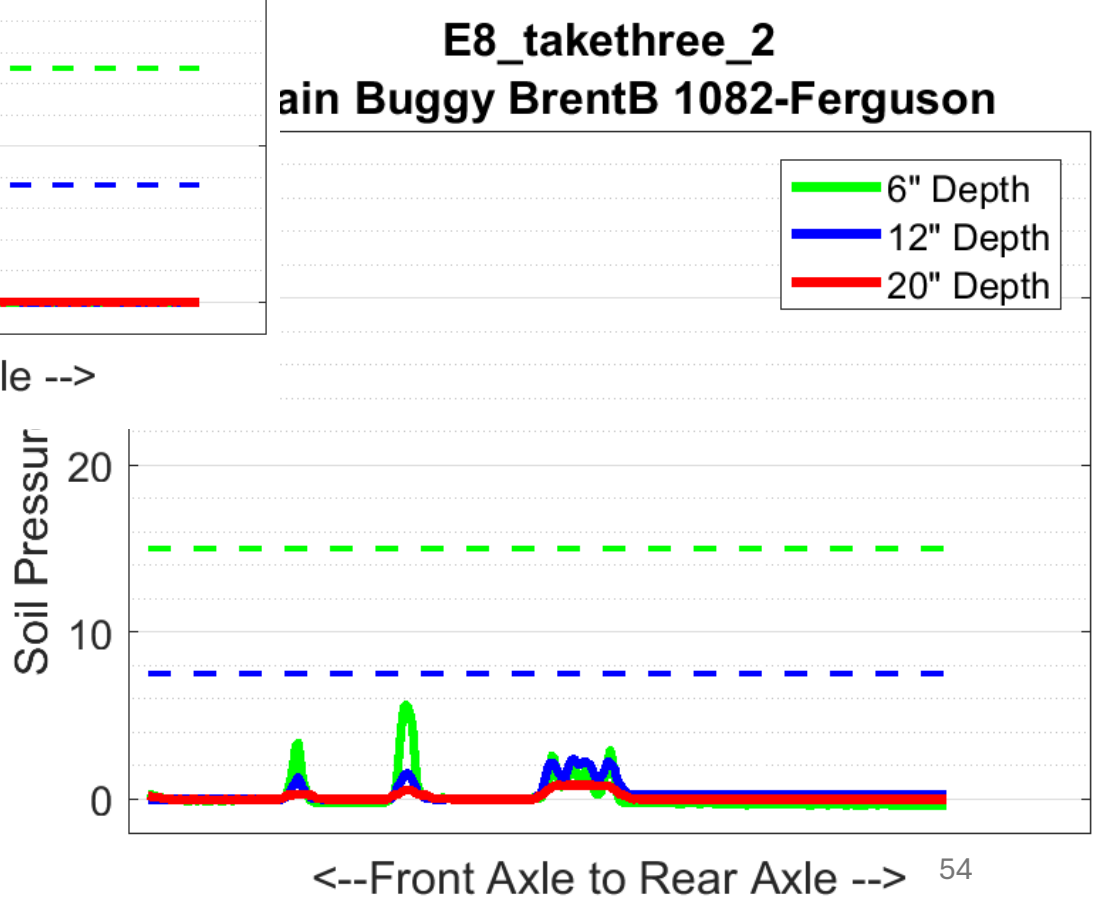
Exhibit: E8
JD 9420 R Articulated Tractor w Dual 520s + Brent 1082 Tracked Grain Buggy 34” Wide Track


JOHN DEERE
9420R
1082

Exh: E8


19 PSI
33,460
34 x 600 Track
7,100
520/85R46
5,900
520/85R46
7,100
6,700
Brent 1082
Grain Buggy
(60,060 lbs
27.2T)
JD 9420 R
(40,100 lbs / 18.2T)
7,700
6,300
34,600
34 x 600 Track
7,700
520/85R46
5,800
520/85R46
21 PSI


E8_taketwo_1
Grain Buggy BrentB 1082-Ferguson
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E8_takethree_2
ain Buggy BrentB 1082-Ferguson
6" Depth
12" Depth
20" Depth
Soil Pressur
20
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E8

- The combination is a tracked grain cart with a similar weight to Unit E7.
- The track unit on this machine appears much better suited to carrying this amount of weight.
- The two response curves are slightly different because they are different sensor installations showing soil differences in close proximity.
- The configuration would be substantially safer than a single tire for carrying this amount of weight.
- The outside dual on the tractor was almost in line with the rollers on the track unit. Notice that the tractor is exerting a lot more load on the soil compared (first two peaks on the plots) to the cart.
- Also note the characteristic spiked shape for the track response. Each little spike corresponds to a roller on the track unit.


BRENT


BRENT


BRENT


8
740
LEXION


BRENT
1082

2019 Elgin Soil and Crop Compaction Event

Exhibit: E9
CaseIH 8230 Tracked Combine w 750 Rears


CASE IH
AXIAL-FLOW
AFS
8230
CASE IH
TERRA FLEX
9

Exh: E9

750/65R26

8,180

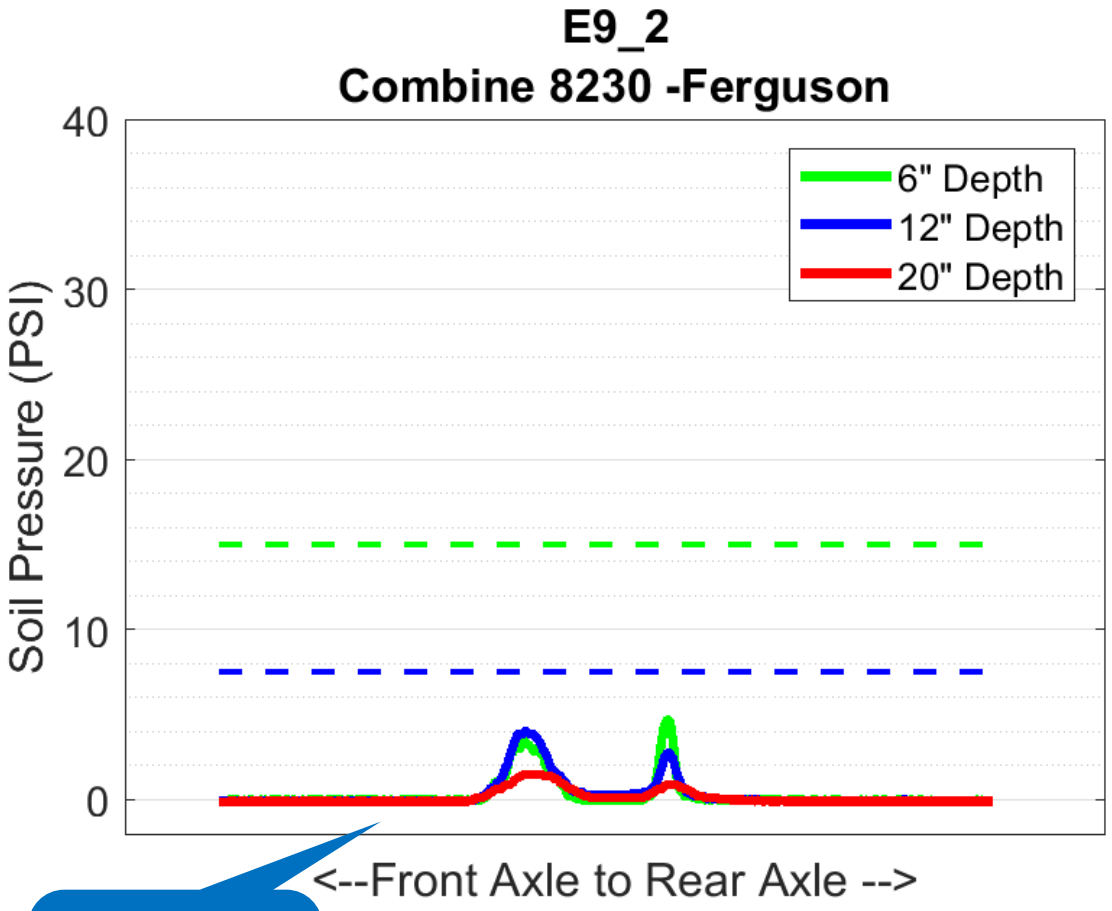
29,700
Track 36 X 80”

19 PSI

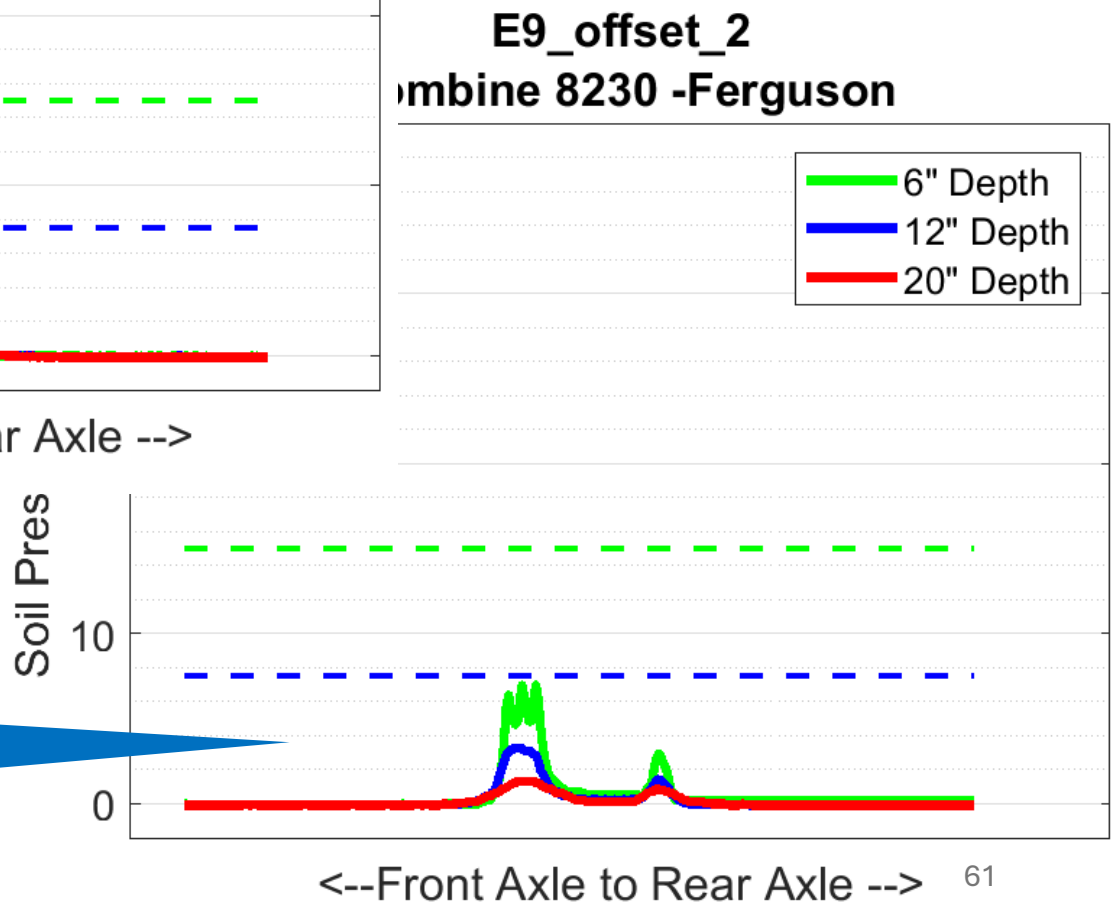
CIH 8230
(72,730 LBS/33.3 T)

8,100

26,750
Track 36 X 80”



Track Centred on Sensors



Track Offset on Sensors

Plot Comments – E9

- This combine with tracks was tested on the second installation only.
- The plot titled E9_2 was measured down the center of the track face, between the sets of rollers.
- The plot titled E9_offset_2 was the same track aligned with the outside set of rollers. The stress at the 6 inch depth is increased under these rollers showing that the pressure distribution is not uniform across the face of the track.
- Also notice that the 12 inch and 20 inch depths are similar in both cases. The stress at these depths is more associated with the weight of the vehicle and not the amount of flotation that the track or tire provides.


CASE
8230


CASE
8230

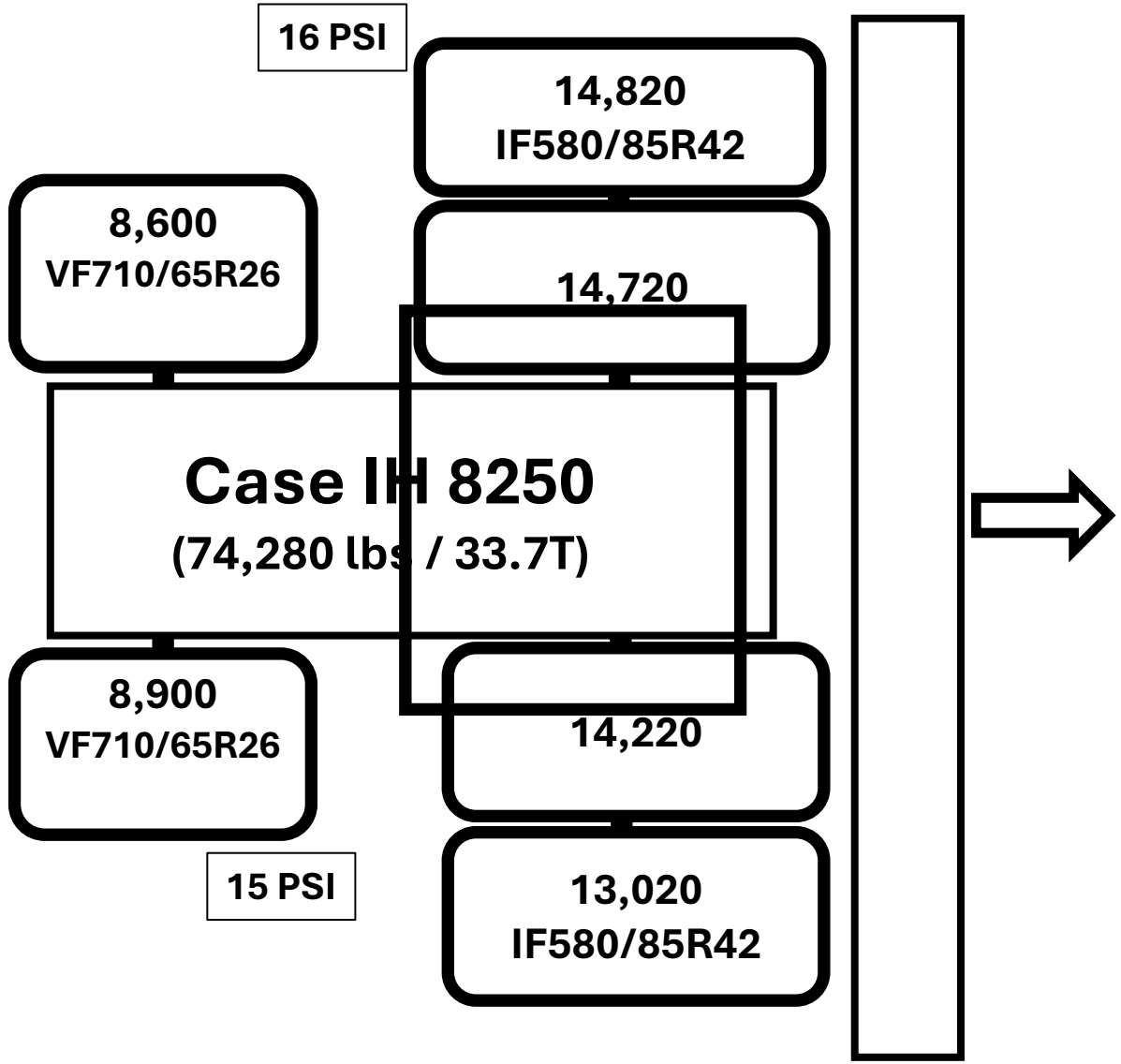
2019 Elgin Soil and Crop Compaction Event

Exhibit: E10

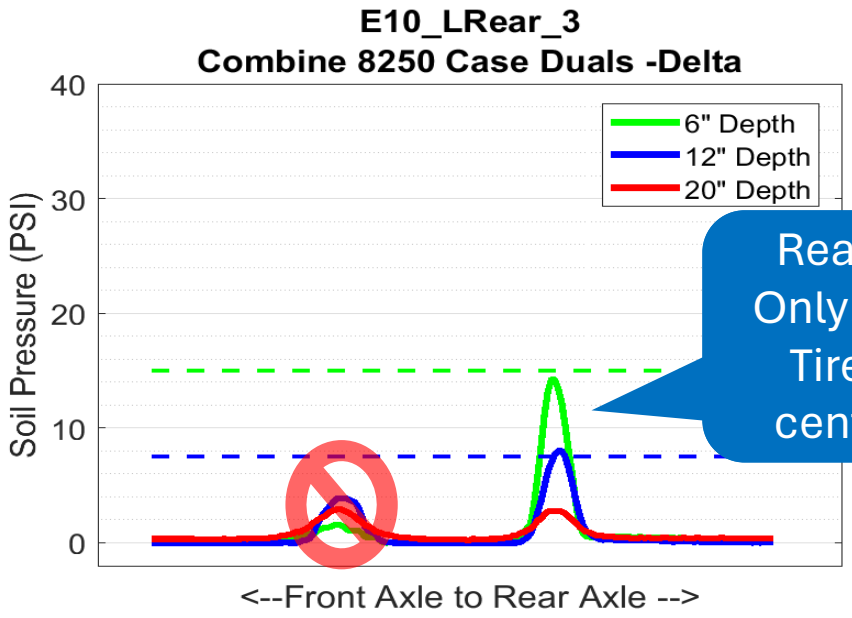
CaseIH 8250 Combine Dualled IF580/85 R42 w VF 710 Rears

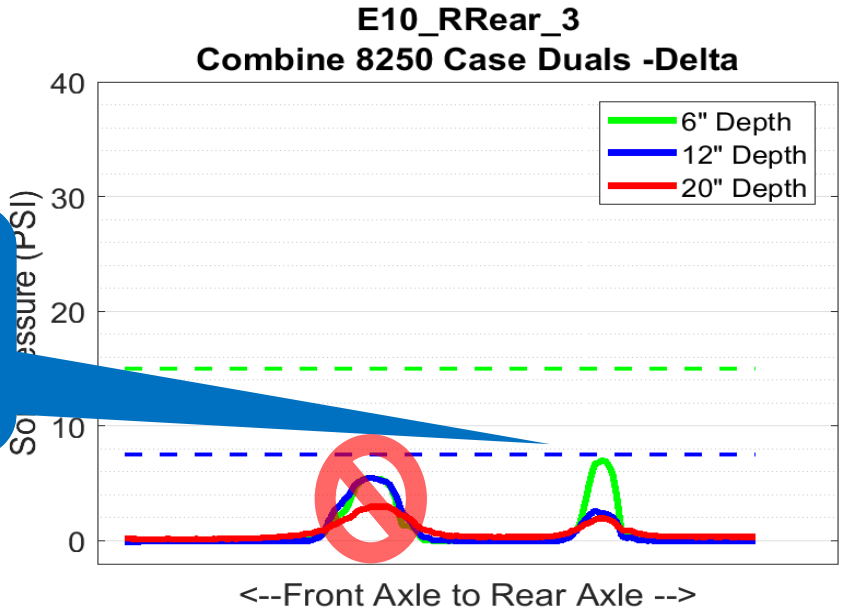

CASE IH

Exh: E10

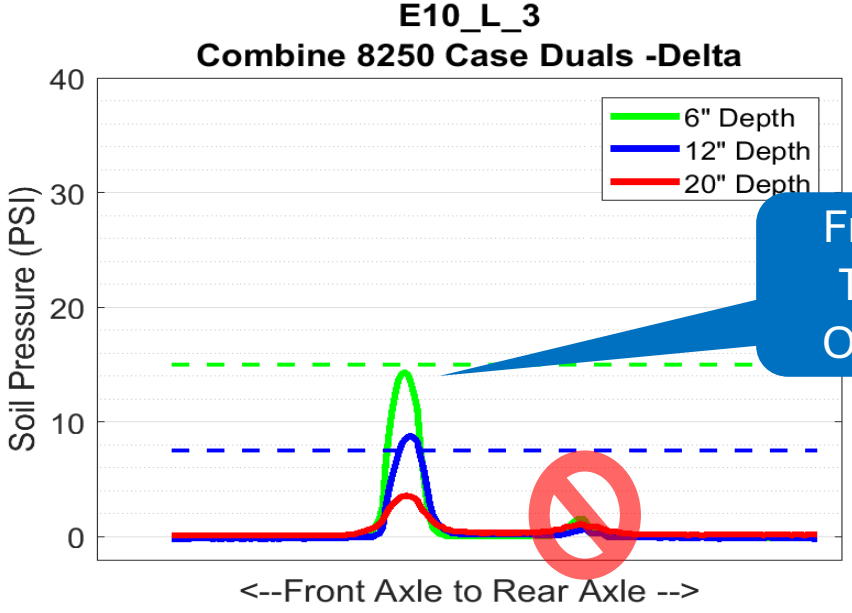

16 PSI
14,820
IF580/85R42
8,600
VF710/65R26
14,720
Case IH 8250
(74,280 lbs / 33.7T)
8,900
VF710/65R26
14,220
15 PSI
13,020
IF580/85R42

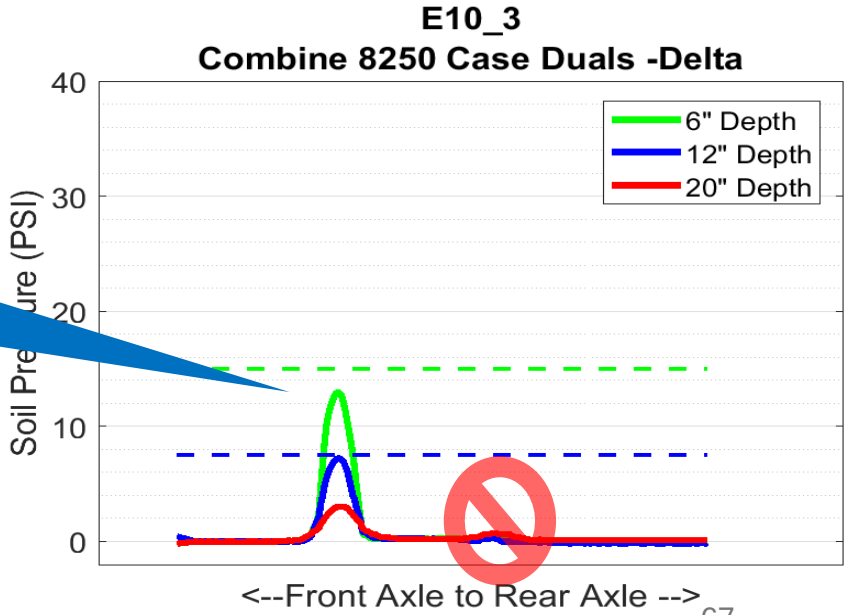

8250
CASE IH





Rear Tire Only! Front Tire not centered





Front Tire Only!

Plot Comments – E10

- This unit is a good example of a combine set up.
- The IF (front) and VF (rear) tires are allowing for a much lower tire pressure than one might normally expect on a combine.
- Overall the small footprint of these tires may mean that the stress is not as small as one would expect with a low tire pressure.
- The stress on the left rear (E10_LRear_3) is roughly the same as the front dual tire.
- The right rear tire (E10_RRear_3) appears to be much lower. This could be explained by the relatively large spacing between the lugs on this tire. The tire lugs were not sinking into the soil during this event and therefor the weight was being carried by the lugs. The measured soil pressure would have been higher if the sensor was directly below the lug on the tire.


CASE IH

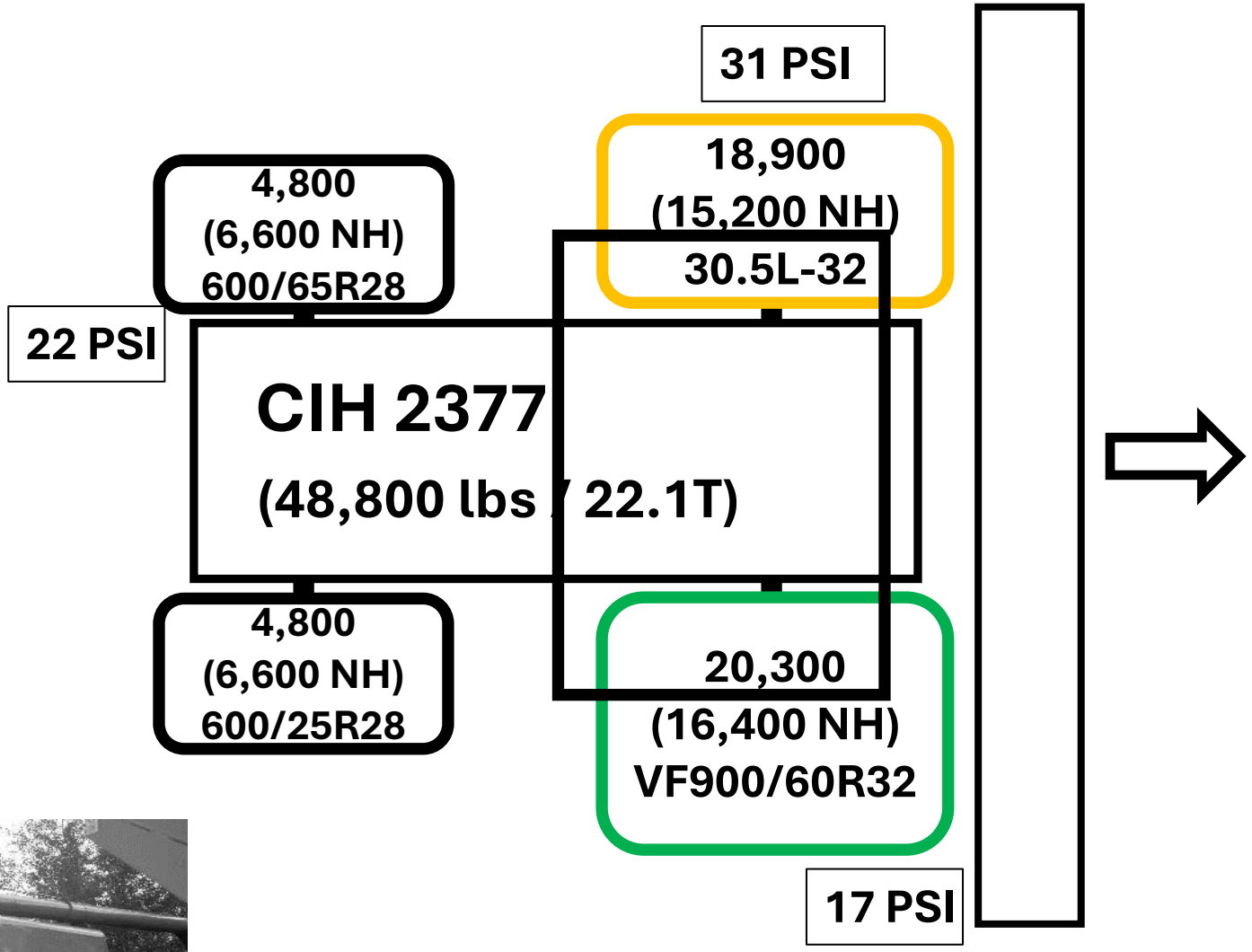

8250
CASE IH

2019 Elgin Soil and Crop Compaction Event

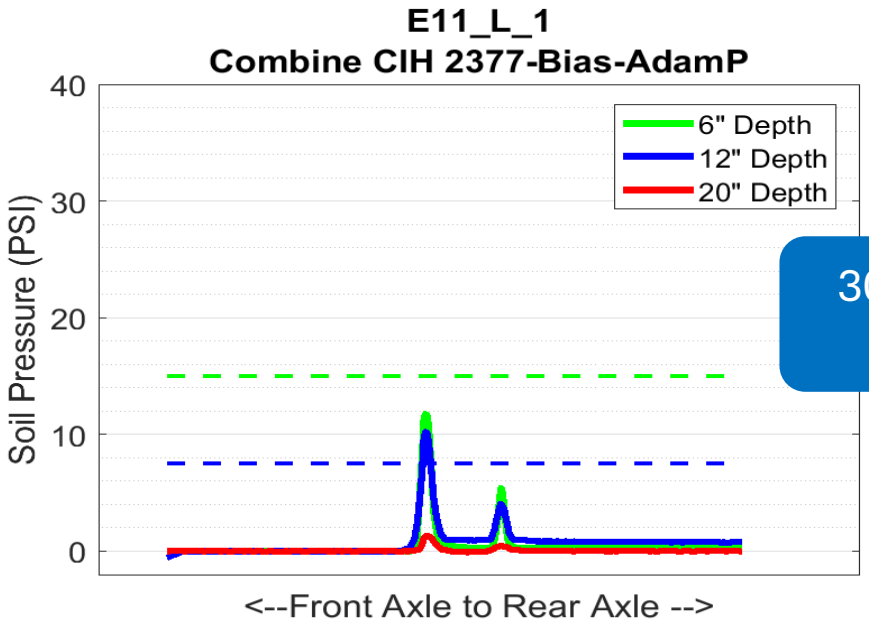
Exhibit: E11
CaseIH 2377 Combine
30.5L-32 vs VF900/60 R32
Bias/Radial
Singles w 600 Rears


11
L+R
ADVANCED WIND-REEL SYSTEMS
2377 AXIAL-FLOW
CASE IH

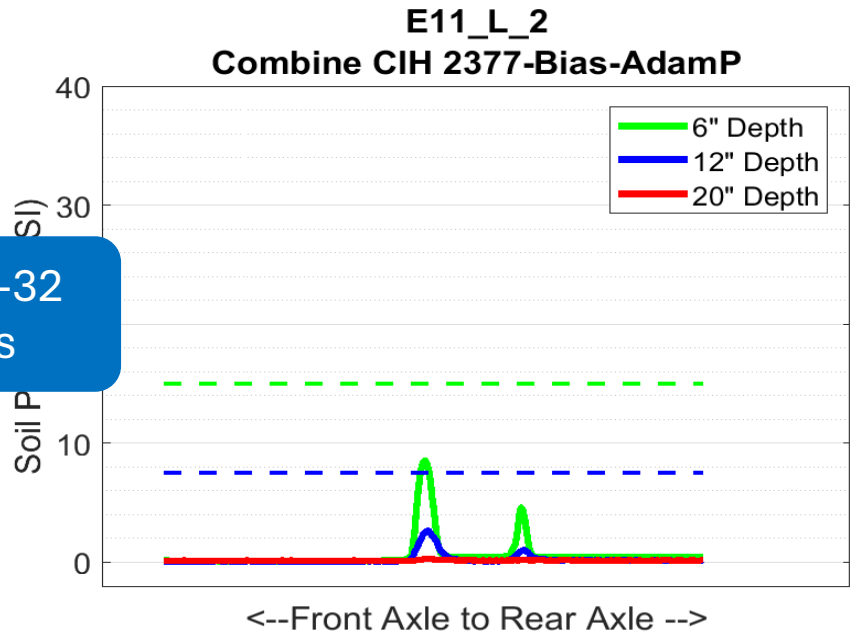
Exh: E11

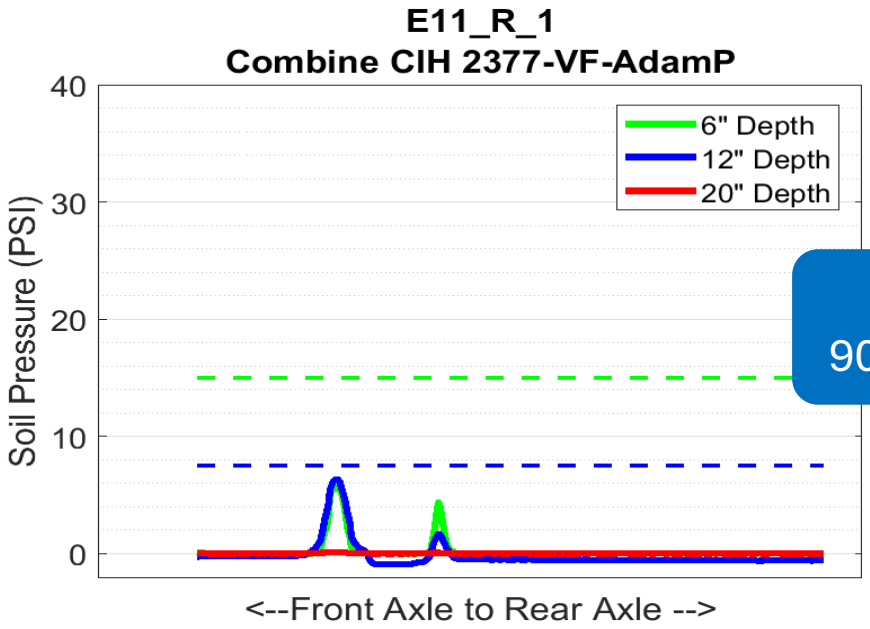


NH = No header

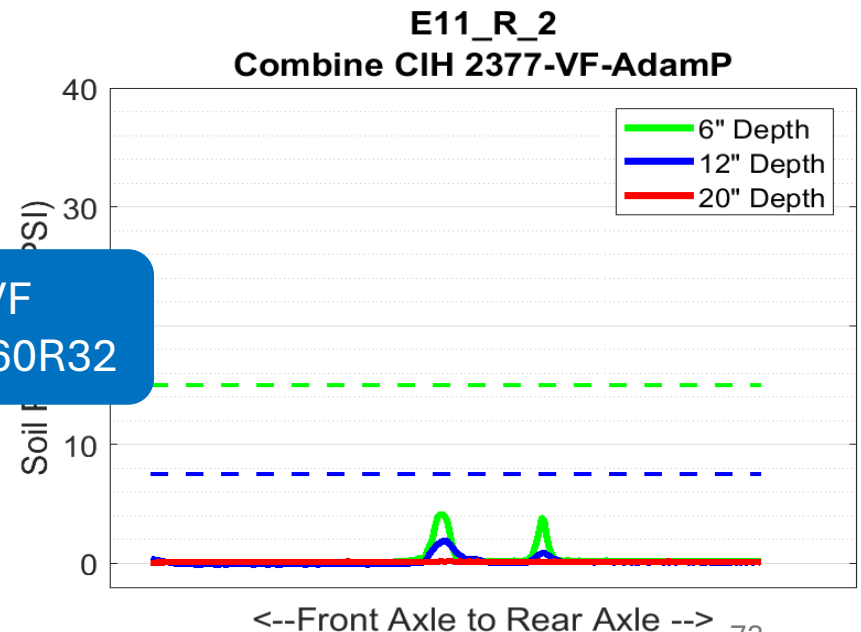


30.5L-32
Bias





VF
900/60R32



Plot Comments – E11

- This combine compares a bias tire to a VF radial tire.
- For both sensor locations 1 and 2, the bias ply tire (E11_L_1 and E11_L_2) exerted a higher force on the soil than the VF tire (E11_R_1 and E11_R_2) although given the soil conditions, both were exceptable.
- The rear tires in both test were measured approximately the same giving good confidence in the measurement setup as the rear tires were set up equally.
- Note: This Unit did not test on the same location as the tracked combine. Comparison between E10 and E11 should not be made.


11
L+R


11
L+R


2377
AXIAL-FLOW
CASE

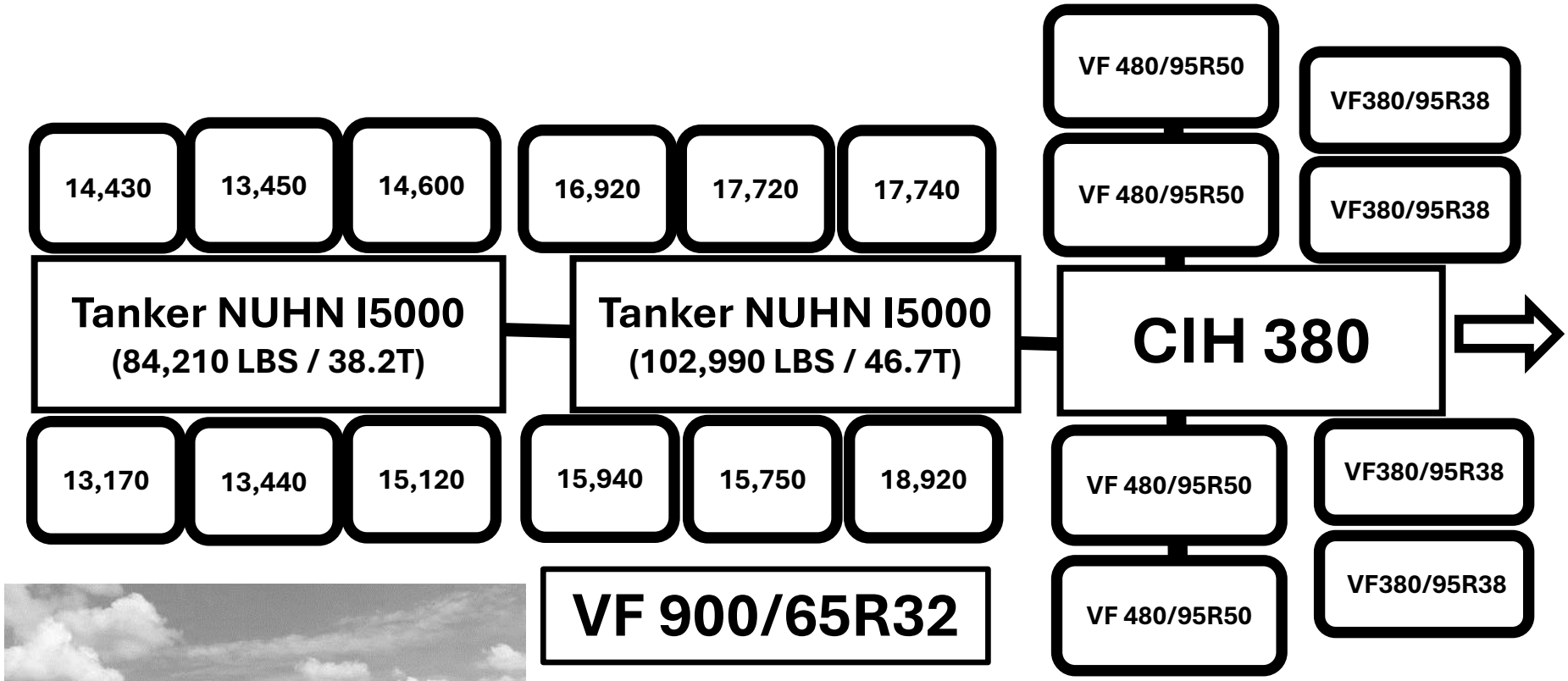

CASE
AXIAL-FLOW
2377

2019 Elgin Soil and Crop Compaction Event

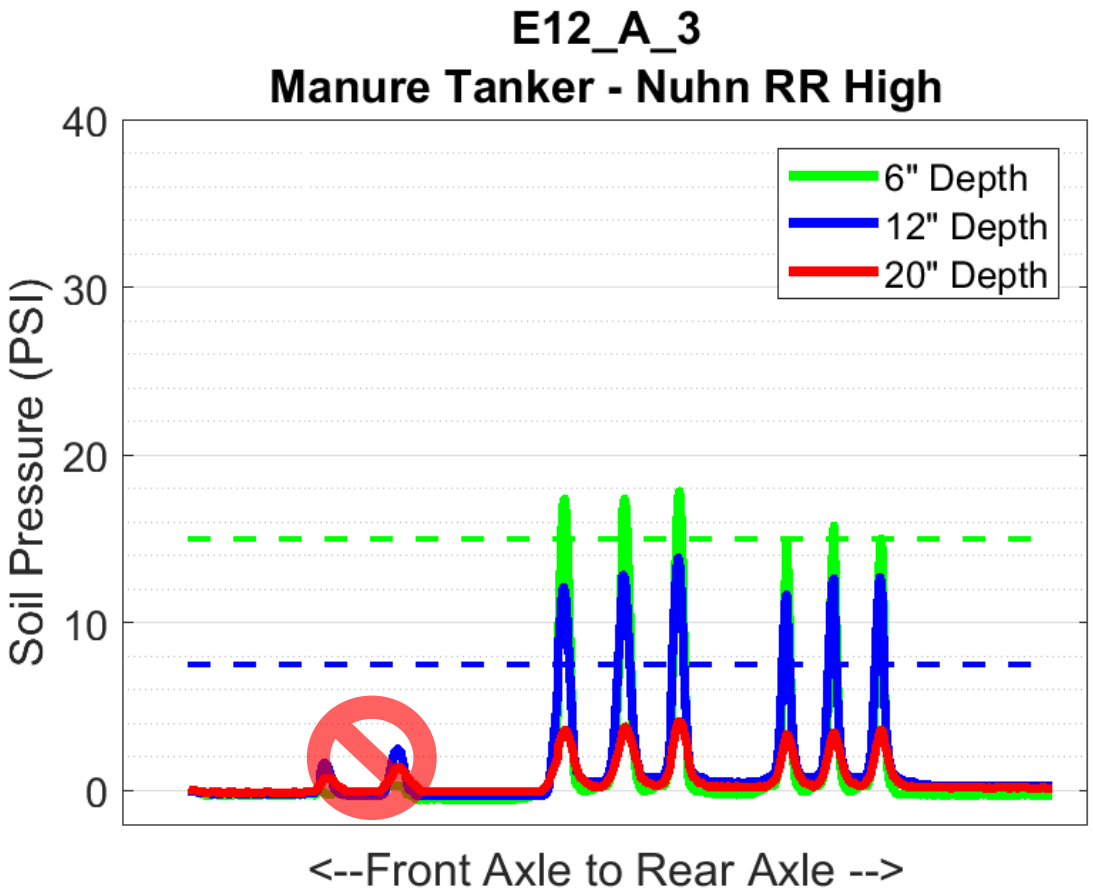
Exhibit: E12
CaseIH Magnum 380 + Nuhn 15000 gal Quad Steer Manure Tanker with VF 900s and CTIS

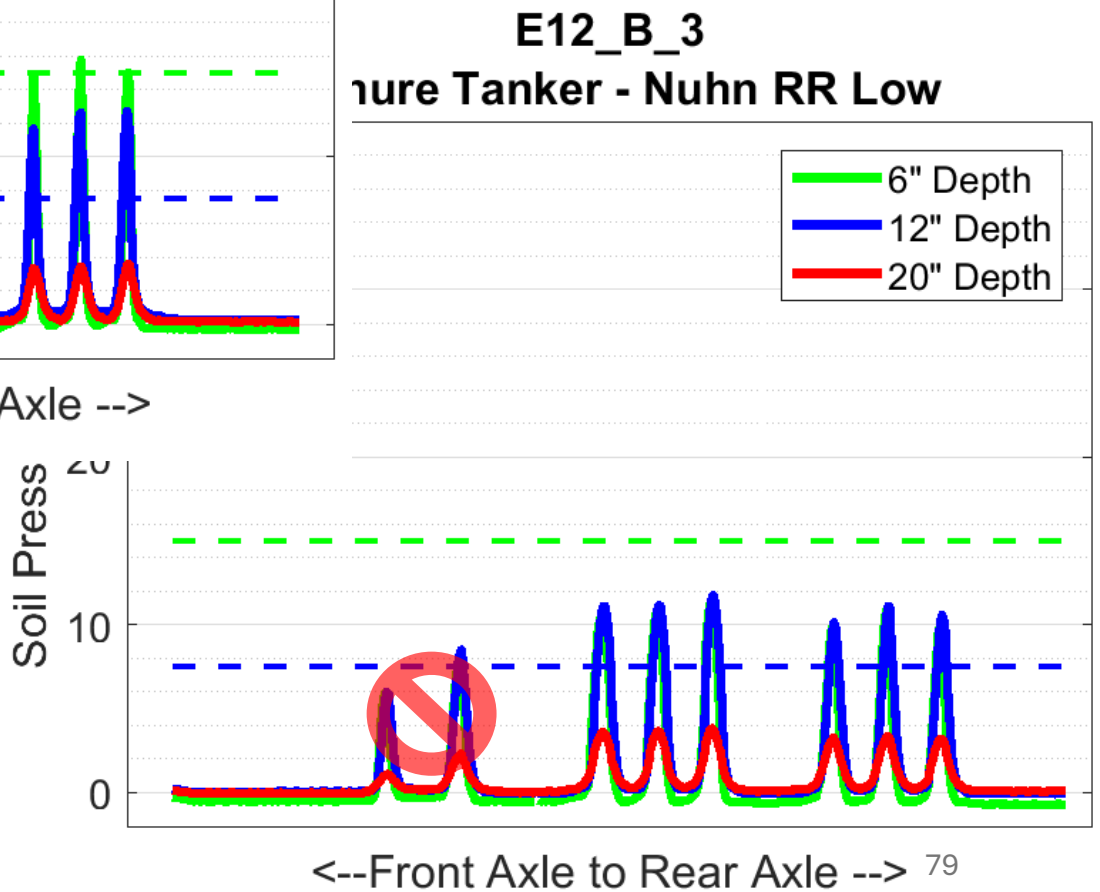

CASE
380
CVT
MAGNUM
KUHN
5000

Exh: 12



CTIS: Road @40 and Field @15 psi


E12_A_3
Manure Tanker - Nuhn RR High
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E12_B_3
ıure Tanker - Nuhn RR Low
6" Depth
12" Depth
20" Depth
Soil Press
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E12

- This Unit was equipped with a central tire inflation system (CTIS).
- This is a good example of the impact of high and low pressure tires.
- The load on the soil is reduce for the 6 inch depth when the tire pressure is reduced.
- The load at the 12” and 20” depth is not reduced by the same magnitude since the total weight of the machine did not change and this needs to be considered in terms of the risk to deep compaction.
- The tractor tires were not centred on sensors and should be ignored.


NUHN


NUHN
CASE IH


15000
NUHN


17.7+0

2019 Elgin Soil and Crop Compaction Event

Exhibit: E13+E32
CaseIH LB333 Large Square Baler with Bias 500/50-17 + Tracked JD 8410T Tractor 24” Left vs 18” Right Track


JOHN DEERE
32
13
LB333
CASE

E13+E32

30 PSI

4,800
500/50-17

4,460
500/50-17

15,540
Tracks 18”

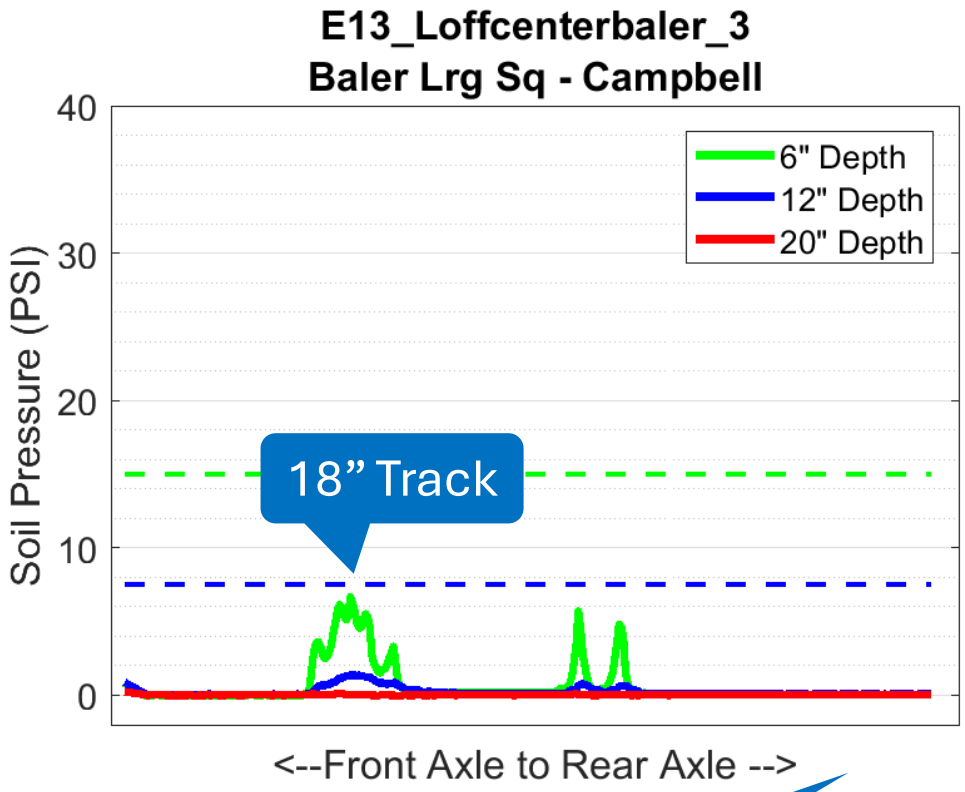
CaseIH Lrg Sq Baler
(18,850 lbs)

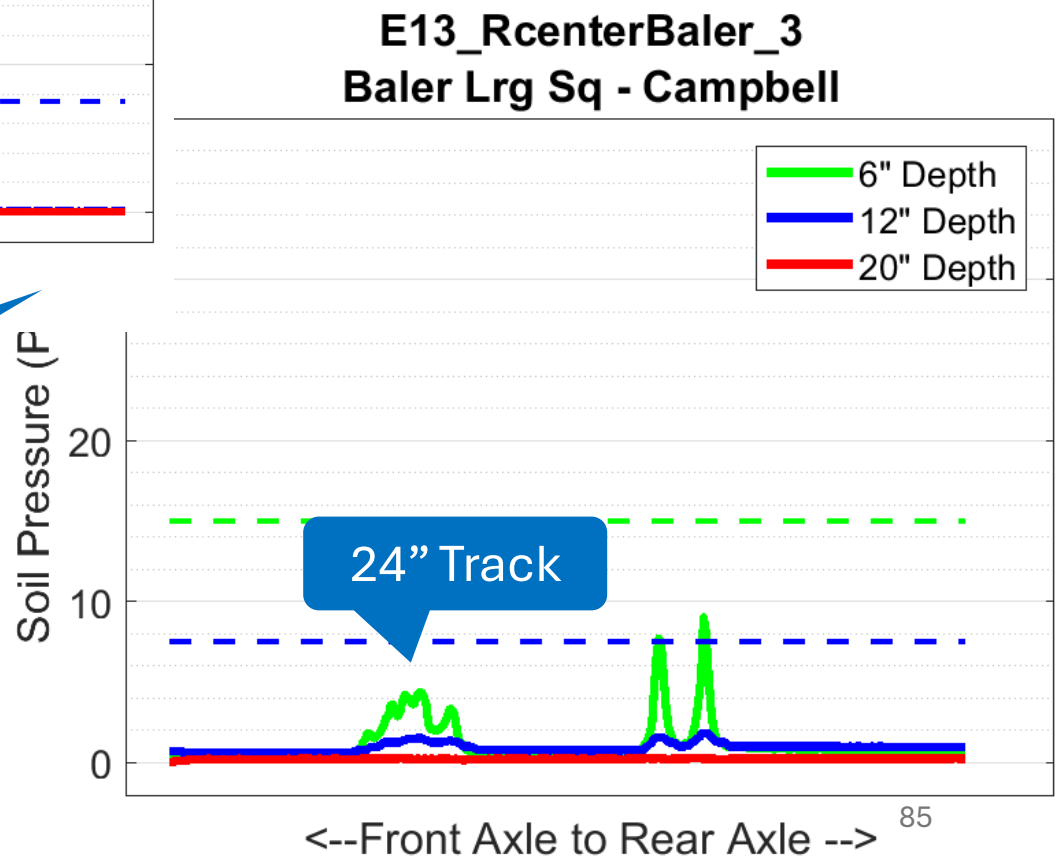
JD 8410 T
(29,860 lbs)

4,620
500/50-17

4,700
500/50-17

14,320
Tracks 24”





Left chart centered tire sensing on the tractor track, while right chart centered sensing on the tandem axle of the baler.

Plot Comments

- This set of plots shows the tractor and baler tires centred and off centre (opposite charts) between the two implements
- The right two peaks of each chart show the baler tire response while the left peaks of each chart are the tractor (18” vs 24” track width).
- These baler tires are well balanced and equally loaded. However notice the increase in soil pressure in the center of the face of the tire. The pressure is reduced when measured about 1/3 across the face of the tire where the 18” track was aligned with the sensors.
- A tire with a flatter tread face may be better at distributing the soil pressure across the full tread.


13


32
13
JOHN DEERE
8410T


LB333
CASE IH


13
JOHN DEERE
8410T

2019 Elgin Soil and Crop Compaction Event

Exhibit: E15

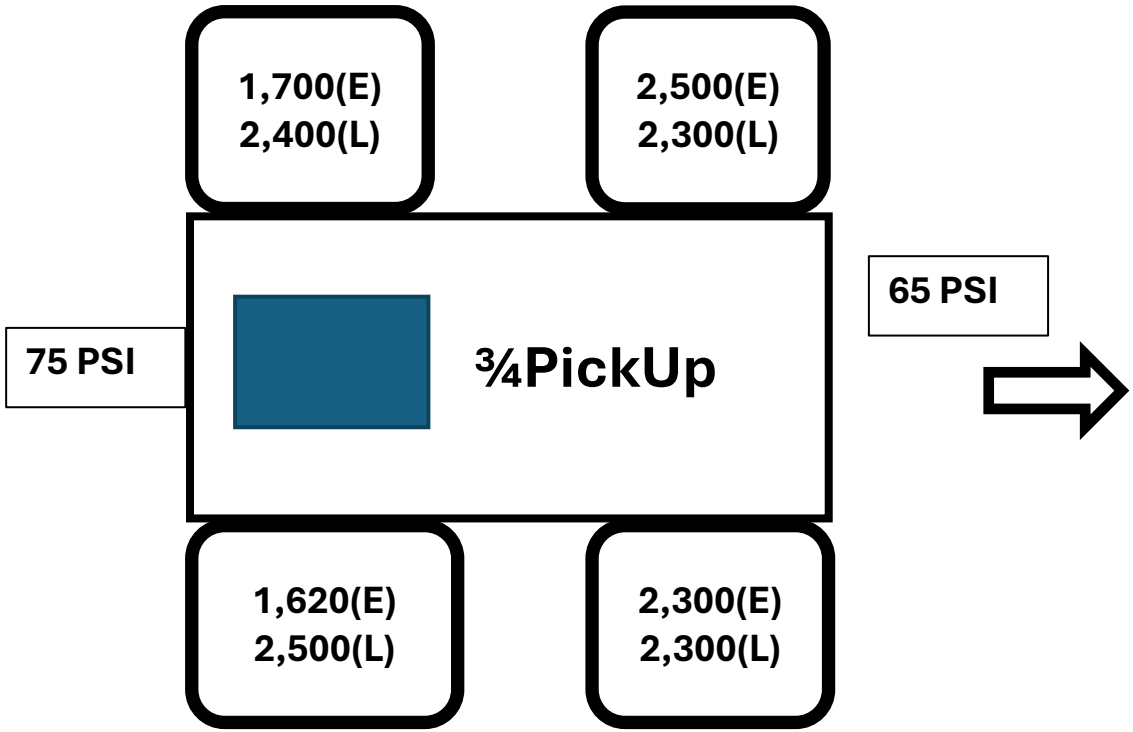
¾ Ton Pickup Empty vs Loaded

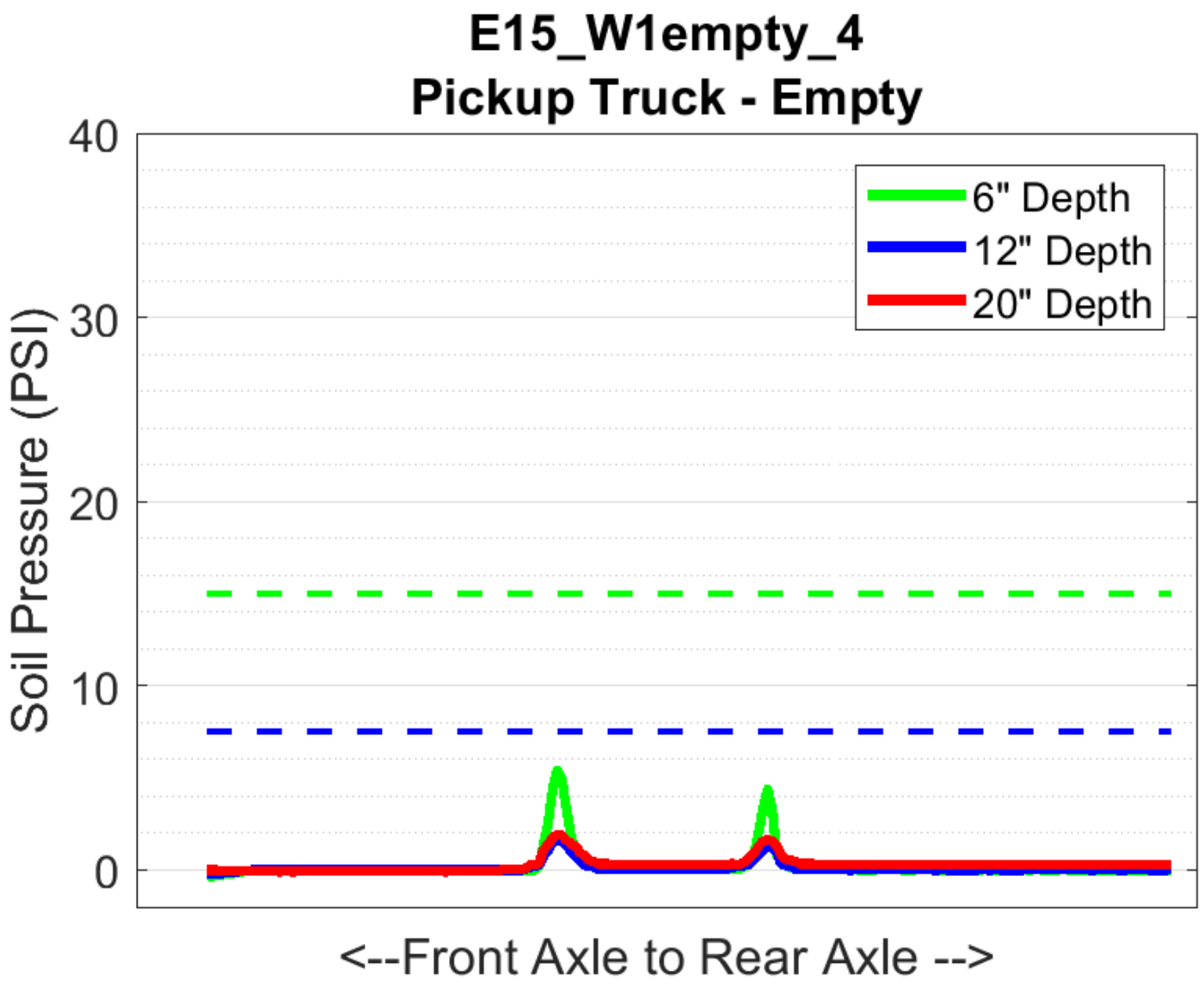

GMC
DURAMAX
HD

E15

Weight
Empty (E) – 8120 lbs
Loaded (L) – 9500 lbs

Tires - LT265/70R18




E15_W1empty_4
Pickup Truck - Empty
40
30
20
10
0
Soil Pressure (PSI)
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->

Plot Comments

- Unfortunately, data for the load picture was not obtained.
- However, notice that the truck loads the soil on the front tires more than the rear in the empty condition.
- The rear peak would have been slightly higher if the loaded test was collected.
- Also note that a lot of the stress is measured in the 6 inch depth and less so in the deeper sensors. The total weight of the pickup is generally not enough weight to generate much stress at depth. Consider that the total weight of the truck is less that the weight on the average dual of a combine or grain cart.

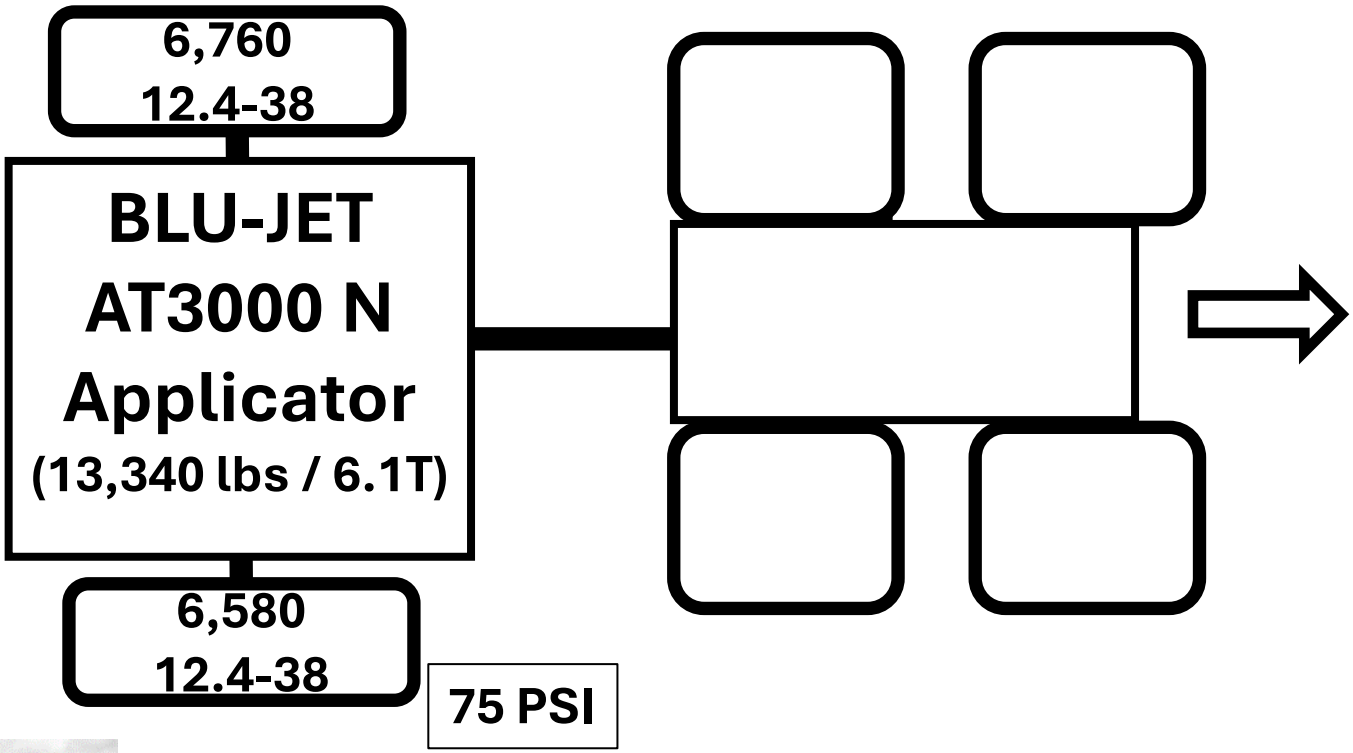

W1+2 15
GMC
ONTARIO
FARM 711 8FT
YOURS TO DISCOVER

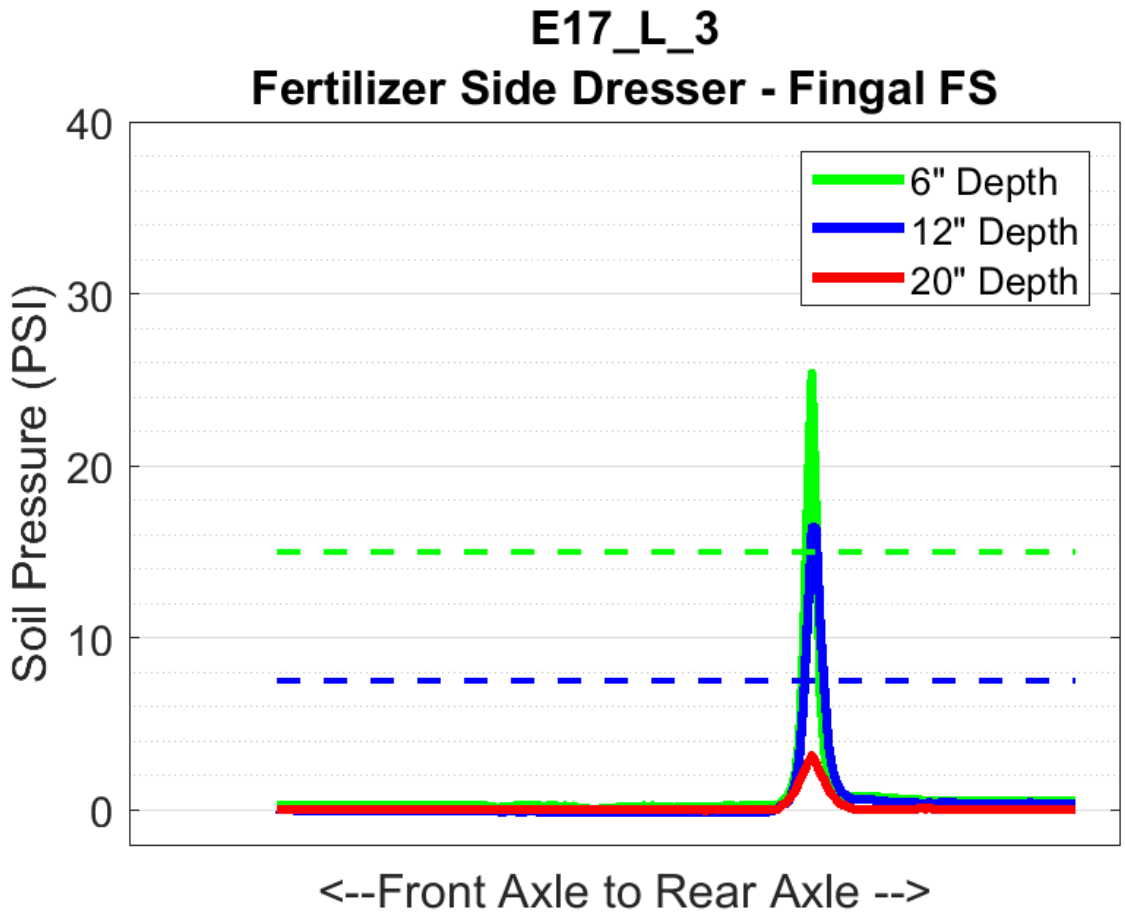
2019 Elgin Soil and Crop Compaction Event

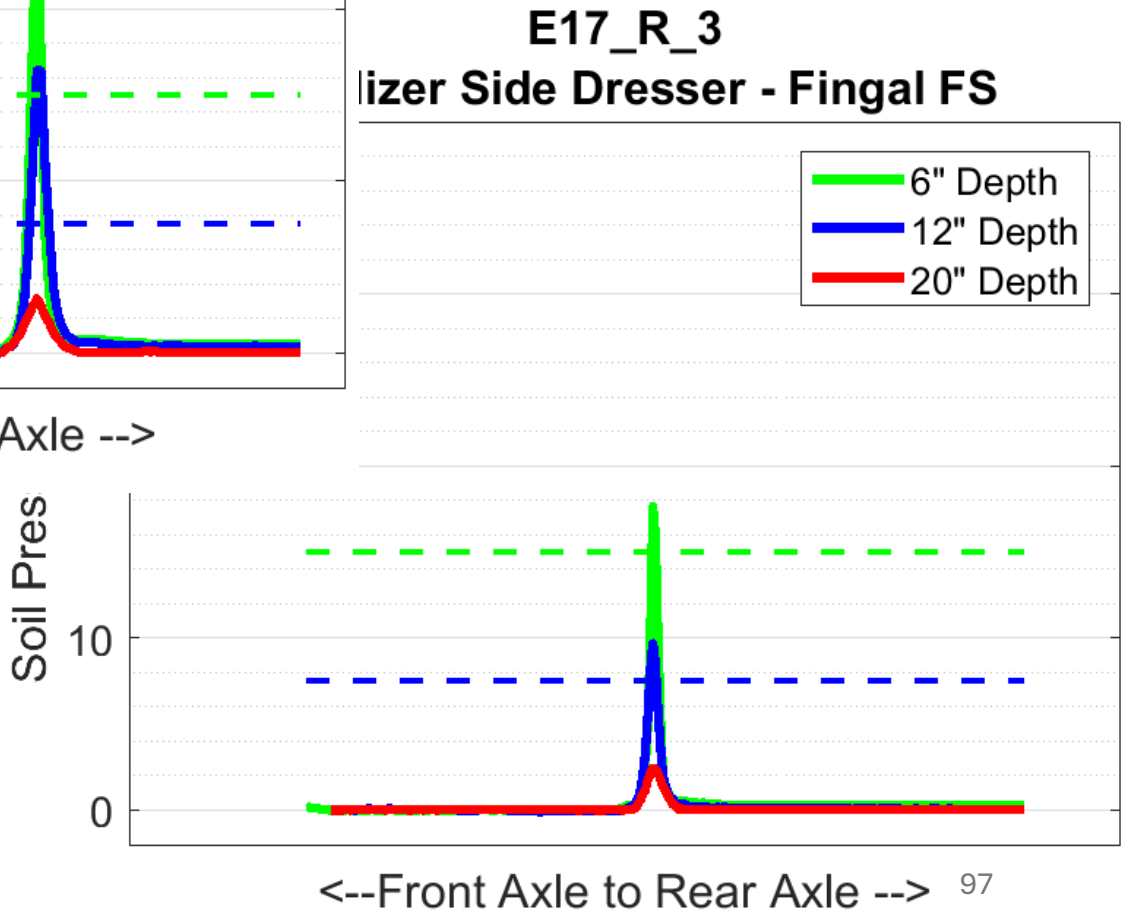
Exhibit: E17
BlueJet AT3000 Sidedress Nitrogen Applicator w 12.4-38 Bias


2
AT3000

Exh: E17


6,760
12.4-38
BLU-JET
AT3000 N
Applicator
(13,340 lbs / 6.1T)
6,580
12.4-38
75 PSI


E17_L_3
Fertilizer Side Dresser - Fingal FS
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E17_R_3
lizer Side Dresser - Fingal FS
6" Depth
12" Depth
20" Depth
Soil Pres
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E17

- This Unit had a high load on very narrow bias ply tires with high pressure.
- The plots show the variability in pressure across the face of the tread as it was difficult to consistently hit the sensor with the center of the tire.


AT3000


AT3000

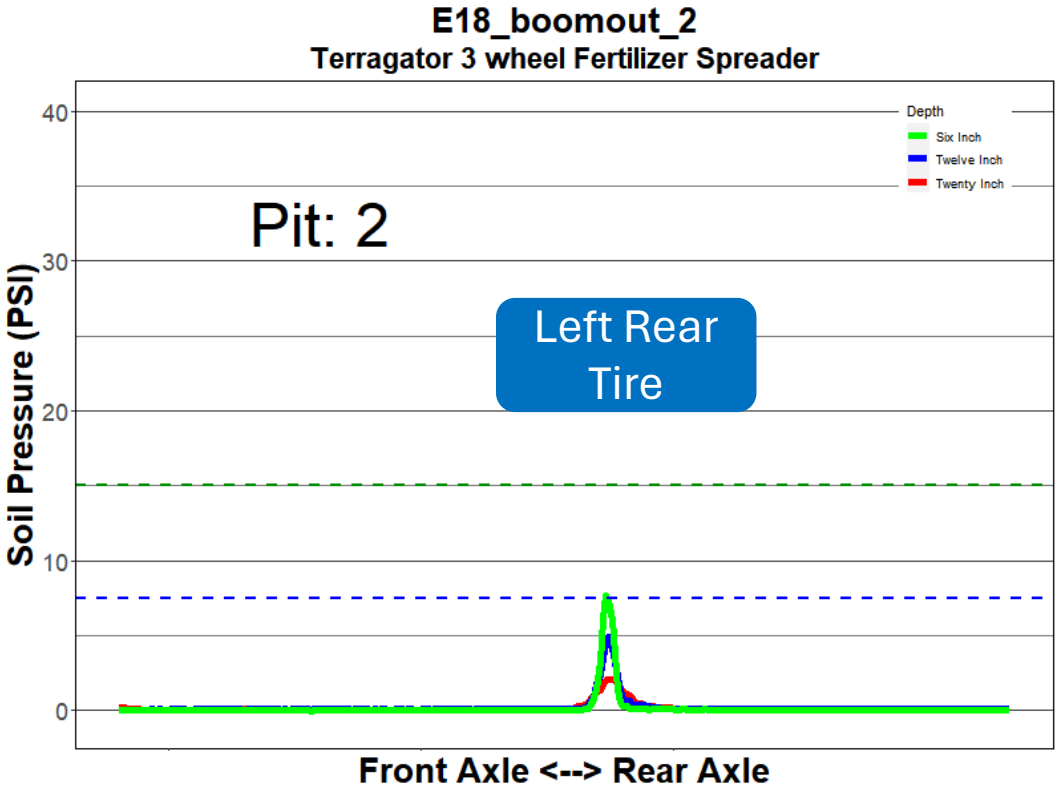
2019 Elgin Soil and Crop Compaction Event

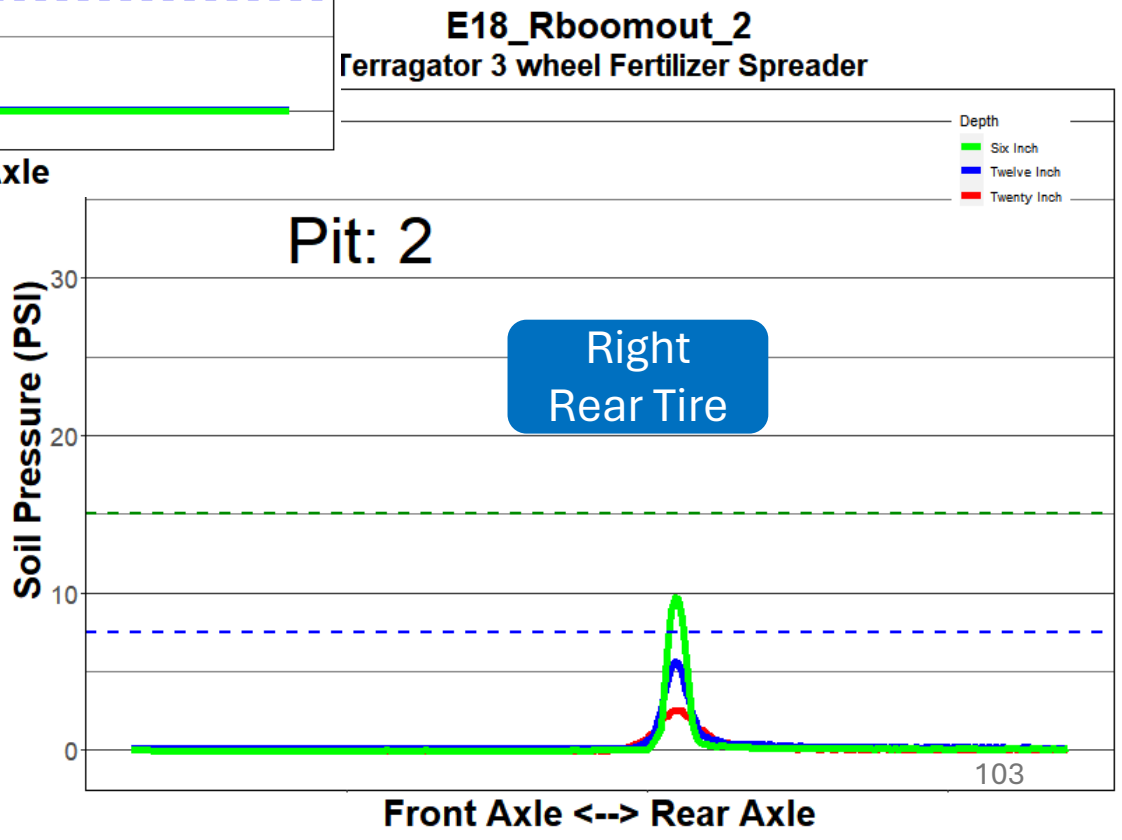
Exhibit 18

Terragator 3 Wheel Dry Fertilizer Applicator w 1000/50R25


18

E18


E18_boomout_2
Terragator 3 wheel Fertilizer Spreader
Depth
Six Inch
Twelve Inch
Twenty Inch
Pit: 2
Left Rear Tire
Soil Pressure (PSI)
40
30
20
10
0
Front Axle <--> Rear Axle


E18_Rboomout_2
Terragator 3 wheel Fertilizer Spreader
Depth
Six Inch
Twelve Inch
Twenty Inch
Pit: 2
Right Rear Tire
Soil Pressure (PSI)
30
20
10
0
Front Axle <--> Rear Axle

Plot Comments – E18

- This is a well configured unit although it was not fully loaded with product.
- The front tire was not tested.
- The stress detected is below theoretical threshold for both rear tires.
- Despite the high psi on the rear tires, the sheer tire volume based on tire size means the compaction threat is reduced in most situations.


18
TerraGator
CVT
9


18
TerraGator
CVT
9

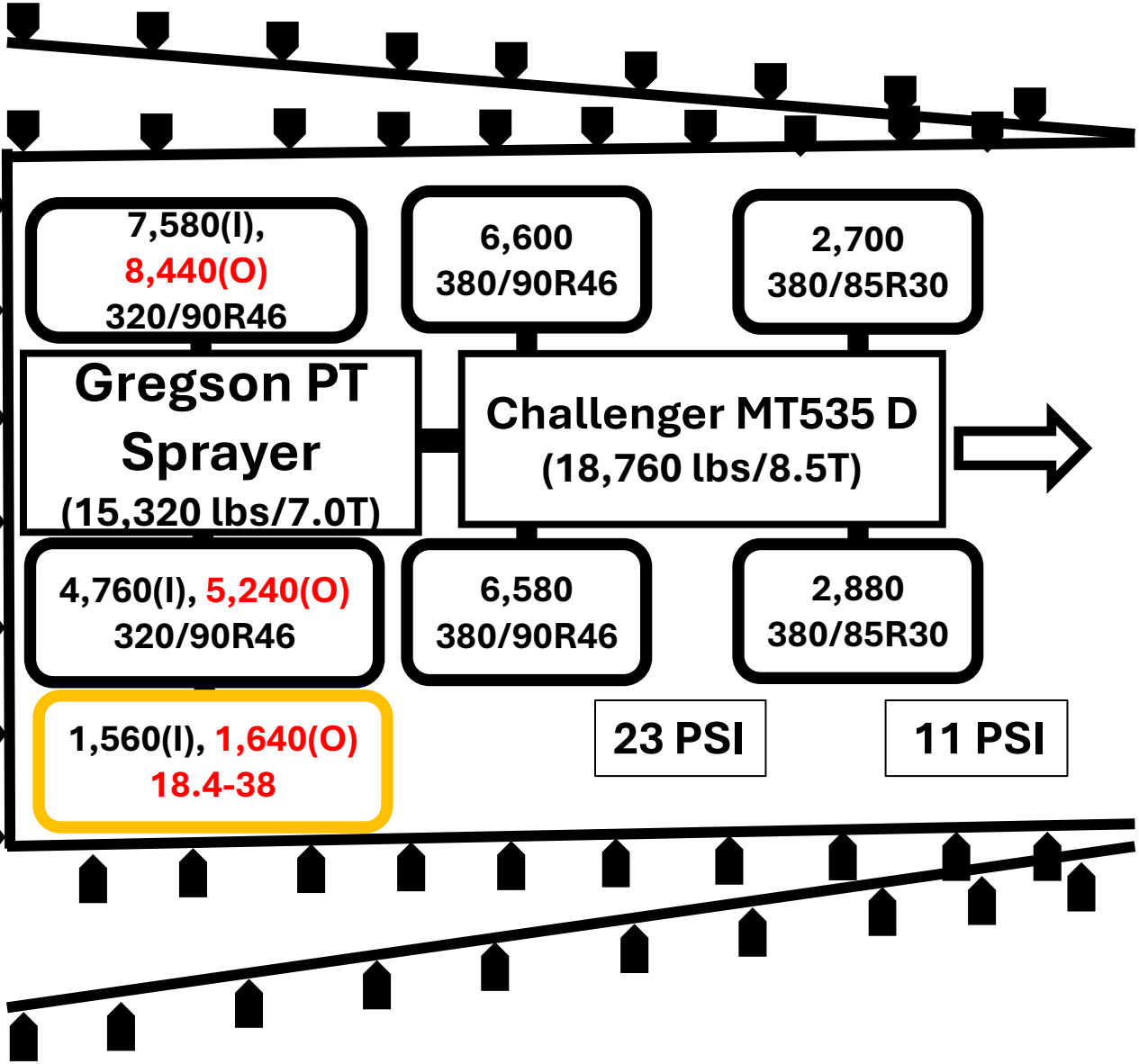
2019 Elgin Soil and Crop Compaction Event

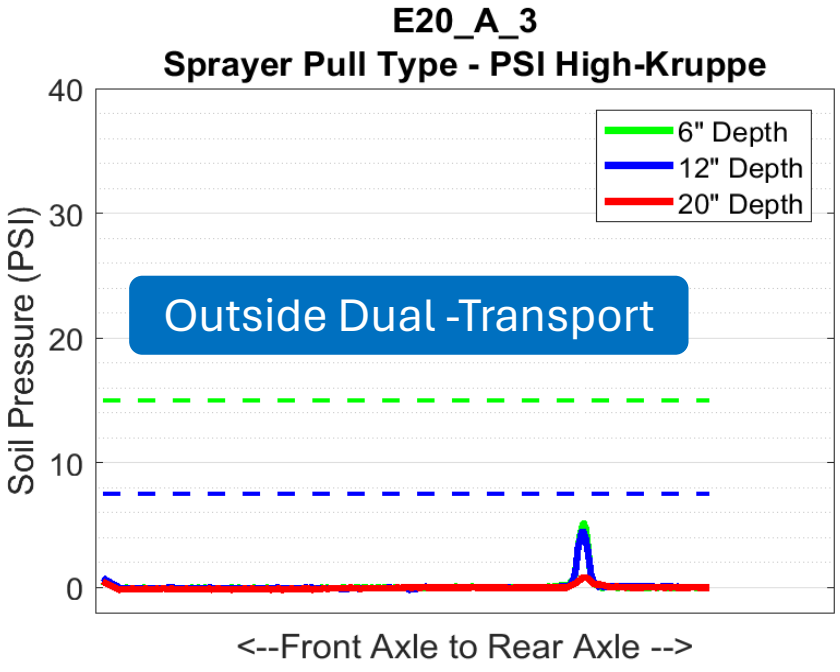
Exhibit: E20
Gregson PT Sprayer 380/90R46 Single vs Dual + Challenger MT535D Row Crop Tractor

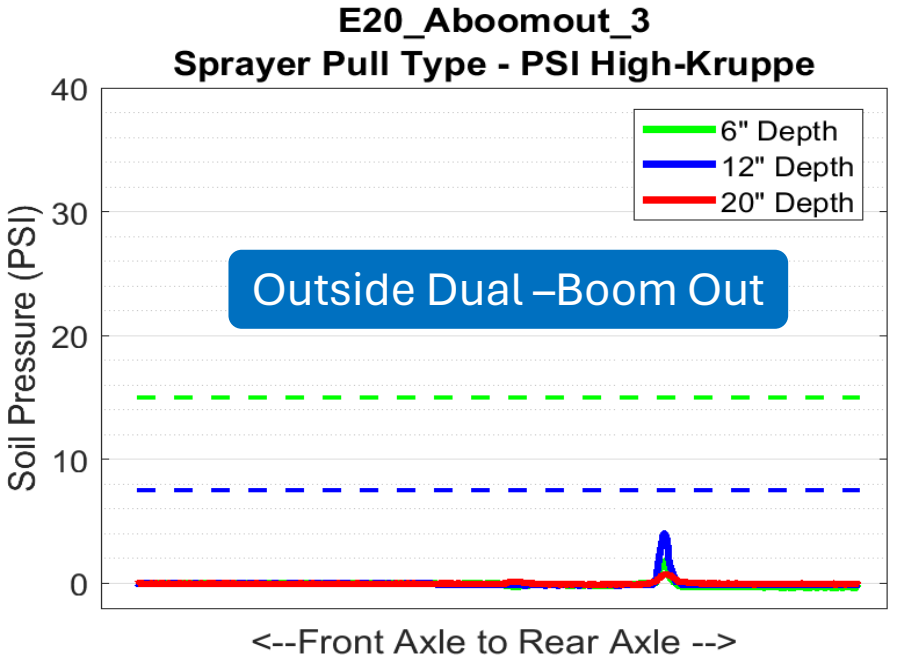

MT535D
Dual
Single

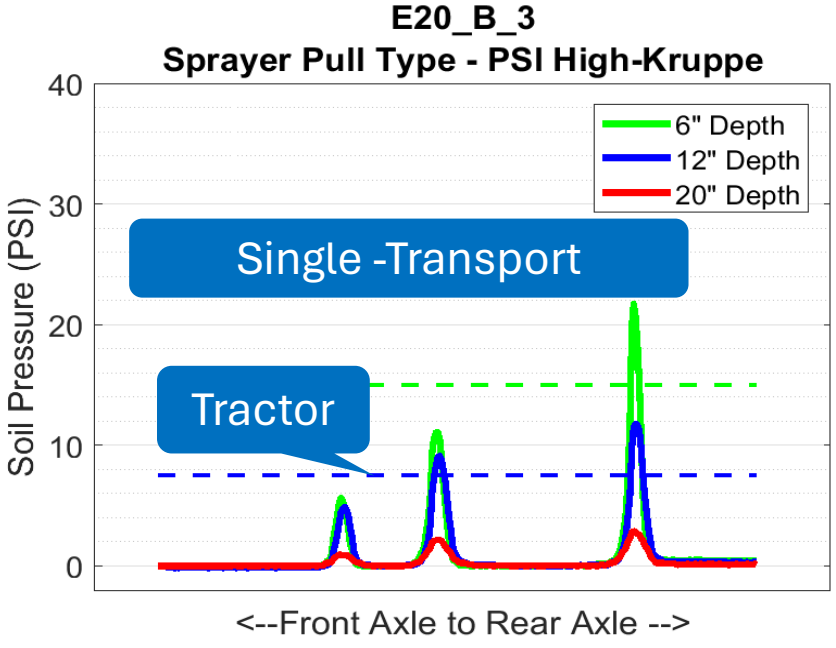
Exh: E20

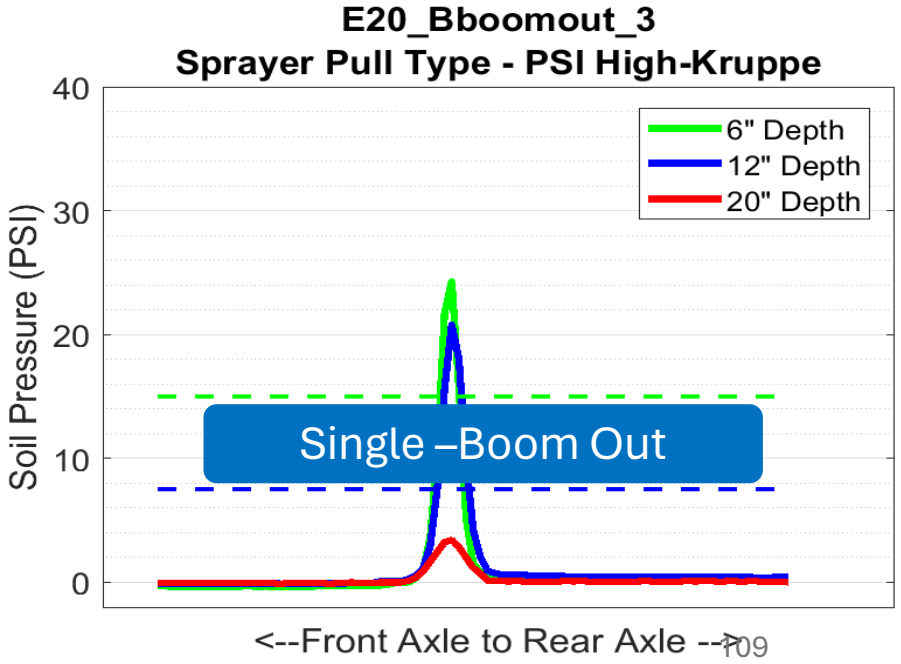

Dual
Single


I=Boom IN (Road), O=Boom OUT (Field)
68 PSI
7,580(I), 8,440(O) 320/90R46
6,600 380/90R46
2,700 380/85R30
Gregson PT Sprayer (15,320 lbs/7.0T)
Challenger MT535 D (18,760 lbs/8.5T)
I=29/O=12 PSI
4,760(I), 5,240(O) 320/90R46
6,580 380/90R46
2,880 380/85R30
1,560(I), 1,640(O) 18.4-38
23 PSI
11 PSI


E20_A_3
Sprayer Pull Type - PSI High-Kruppe
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
Outside Dual -Transport
<--Front Axle to Rear Axle -->


E20_Aboomout_3
Sprayer Pull Type - PSI High-Kruppe
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
Outside Dual –Boom Out
<--Front Axle to Rear Axle -->


E20_B_3
Sprayer Pull Type - PSI High-Kruppe
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
Single -Transport
Tractor
<--Front Axle to Rear Axle -->


E20_Bboomout_3
Sprayer Pull Type - PSI High-Kruppe
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
Single –Boom Out
<--Front Axle to Rear Axle -->

Plot Comments – E20

- This Unit shows how unbalanced duals can be misleading (29 vs 12 psi).
- The plots E20_A_ 3 show the high peak for the single tire but when compared to the outer dual in plots E20_B_3 the stress is substantially reduced. Notice that the weight being carried by the outer dual is very low compared to the inner dual. In subsequent events we determined the proper PSI setting for all tires and adjusted accordingly before sensing.
- Dual tires are only effective for reducing stress when they can share load equally. Inside dual would likely have measured high stress!
- There may be a stability advantage to having this dual.


MT535D


MTS35D

2019 Elgin Soil and Crop Compaction Event

Exhibit: E21
Central Fill Corn Planter JD 1770 NT w 11-22.5 Bias vs VF295/75R22.5 Tires + JD 8320R RC Tractor


21
L+R
8320 R
AULARI


VAULARI
ALB 3002
VAULARI
JOHN DEERE
MaxEmerge XP

Exh: E21

E = empty and F = loaded

5,080(E)
6,940(F)
11-22.5 NHS

4,280(E)
4,540(F)
11-22.5 NHS

58 PSI

Planter JD 1770 NT
(19,180 empty; 21,600 loaded road;
25,420 field lbs)

4,980(E)
4,540(F)
VF295/75 R22.5

4,840(E)
5,580(F)
VF295/75 R22.5

61 PSI

9,540
480/80R50

8,380
480/80R50

9 PSI

3,040
480/70R34

JD 8320 R
(42,790 lbs)

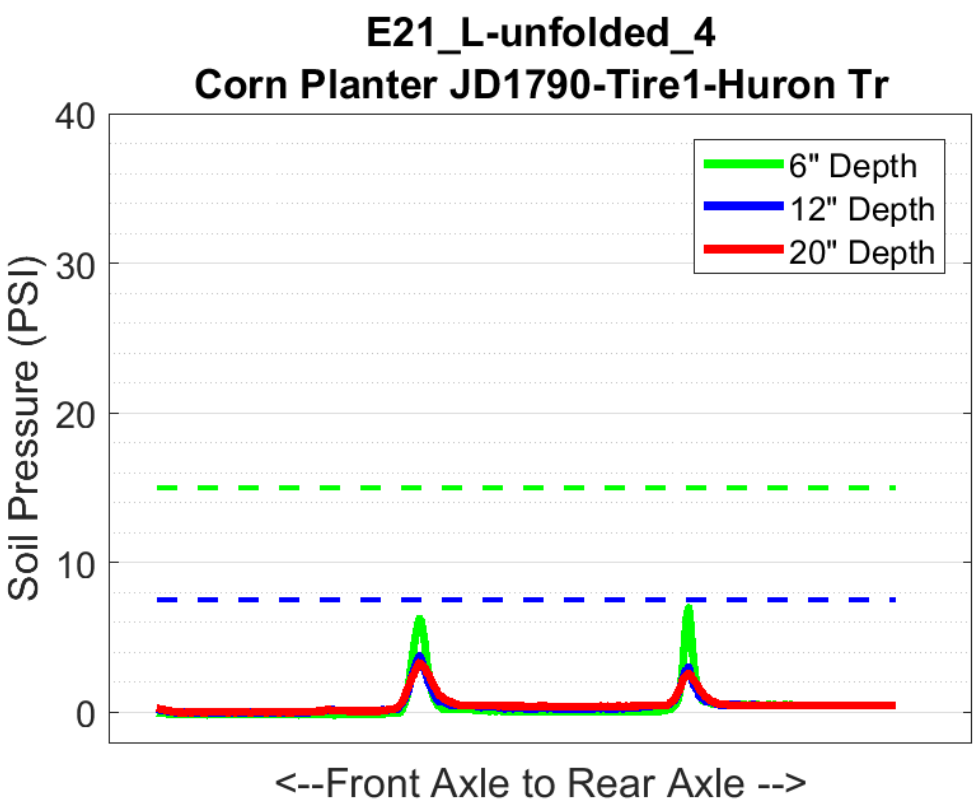
9,440
480/80R50

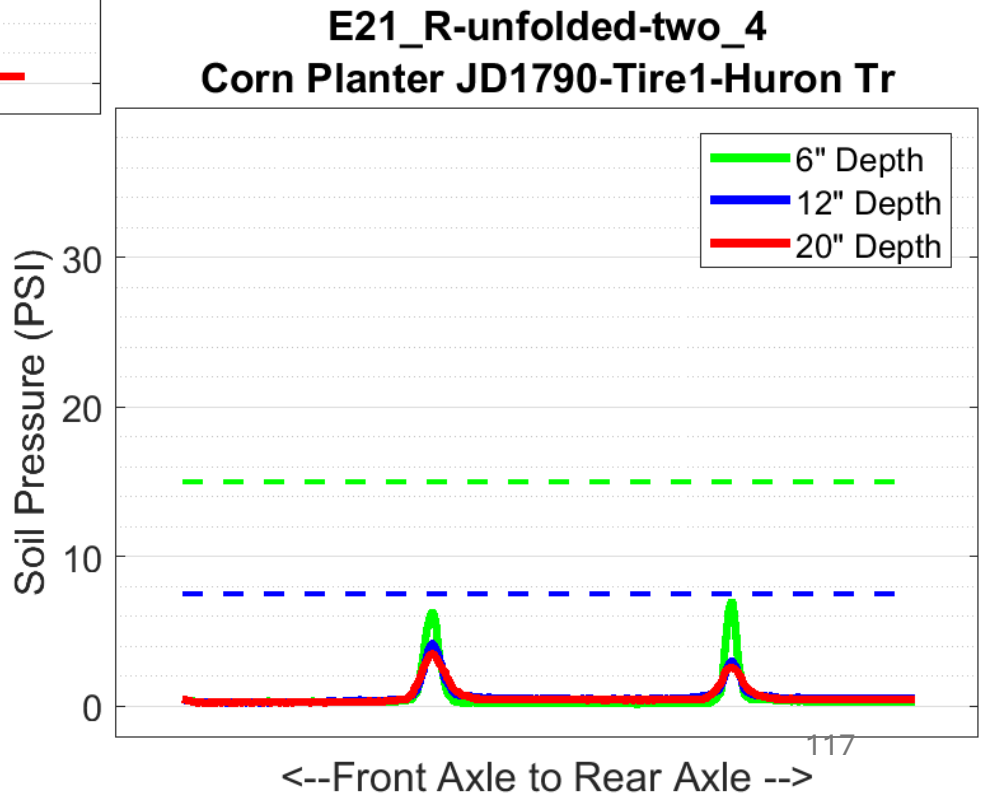
9,500
480/80R50

2,980
408/70R34

13 PSI

Field Position Weights (left to right) (lbs)
1. 4100, 2. 200, 3. 4890, 4. 5020, 5. 5700, 6. 5420


E21_L-unfolded_4
Corn Planter JD1790-Tire1-Huron Tr
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E21_R-unfolded-two_4
Corn Planter JD1790-Tire1-Huron Tr
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
30
20
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E21

- The planters were not fully loaded, and as such we discourage giving weight to these results. As well the sheer length of the drawbar and small size of the tires makes getting the planter tires correctly aligned with the sensors very difficult.
- This Unit compared a bias ply tire and a VF tire on the center section of a central fill corn planter but the psi settings seem to be incorrect.
- Note that the sensor pressures for this unit are similar and in fact the VF tire was inflated to a higher pressure which is not what would be expected.
- To carry the load on the bias ply tire, the inflation pressure would need to be much higher. This was the maximum that the tire installers were willing to inflate for safety reasons. This bias ply tire is not suited for this application at this weight.
- Interestingly the plots look almost identical but should not be considered as such.
- Contrast to E22 with the tracked planter being 4000 lbs heavier and lower soil stress recorded.
- DO NOT USE THESE RESULTS! Presented only to show the problems associated with trying to test these types of implements in compaction events.





4540-I
6,910
580/85 R38
VF


5080-E
5500
Bias

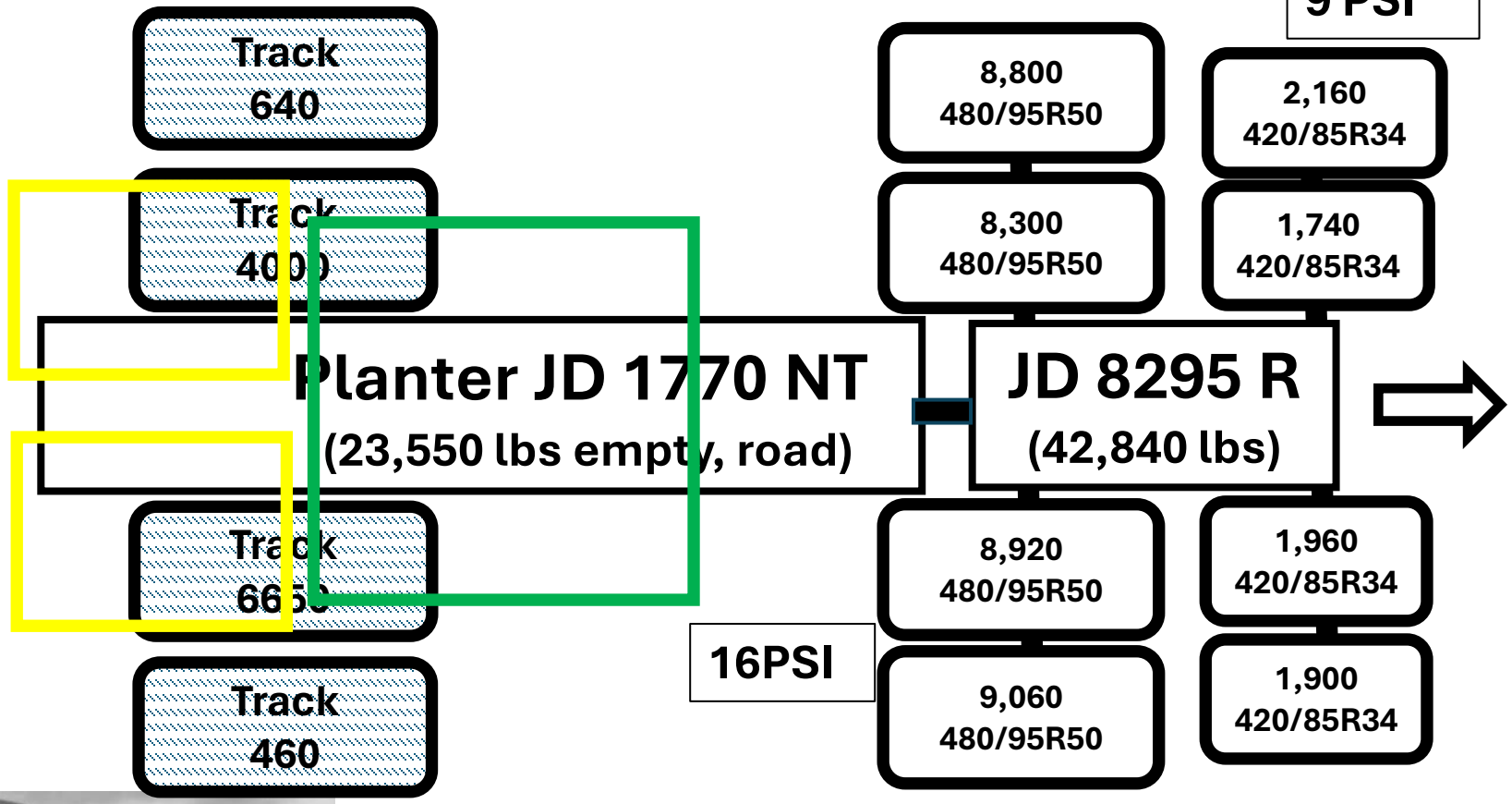
2019 Elgin Soil and Crop Compaction Event

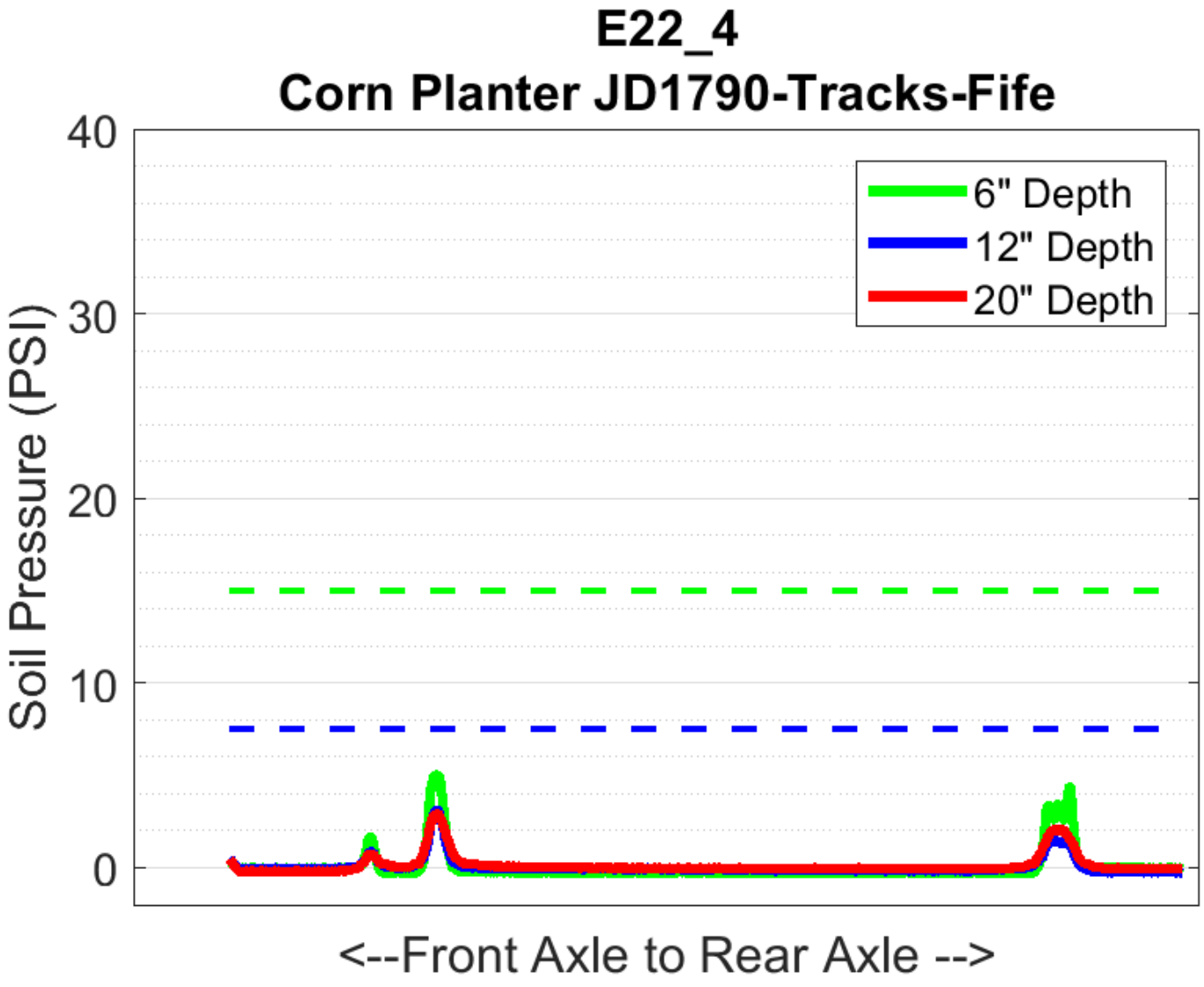
Exhibit: E22

Central Fill Corn Planter JD 1770 w Soucy 1120WU38-2 Tracks + JD 8295 R Tractor


22
JOHN DEERE
8295 R
AULARI

Exh: E22


9 PSI
Track 640
Track 400
Track 665
Track 460
Planter JD 1770 NT
(23,550 lbs empty, road)
JD 8295 R
(42,840 lbs)
16PSI
8,800 480/95R50
8,300 480/95R50
8,920 480/95R50
9,060 480/95R50
2,160 420/85R34
1,740 420/85R34
1,960 420/85R34
1,900 420/85R34


E22_4
Corn Planter JD1790-Tracks-Fife
40
30
20
10
0
Soil Pressure (PSI)
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->

Plot Comments

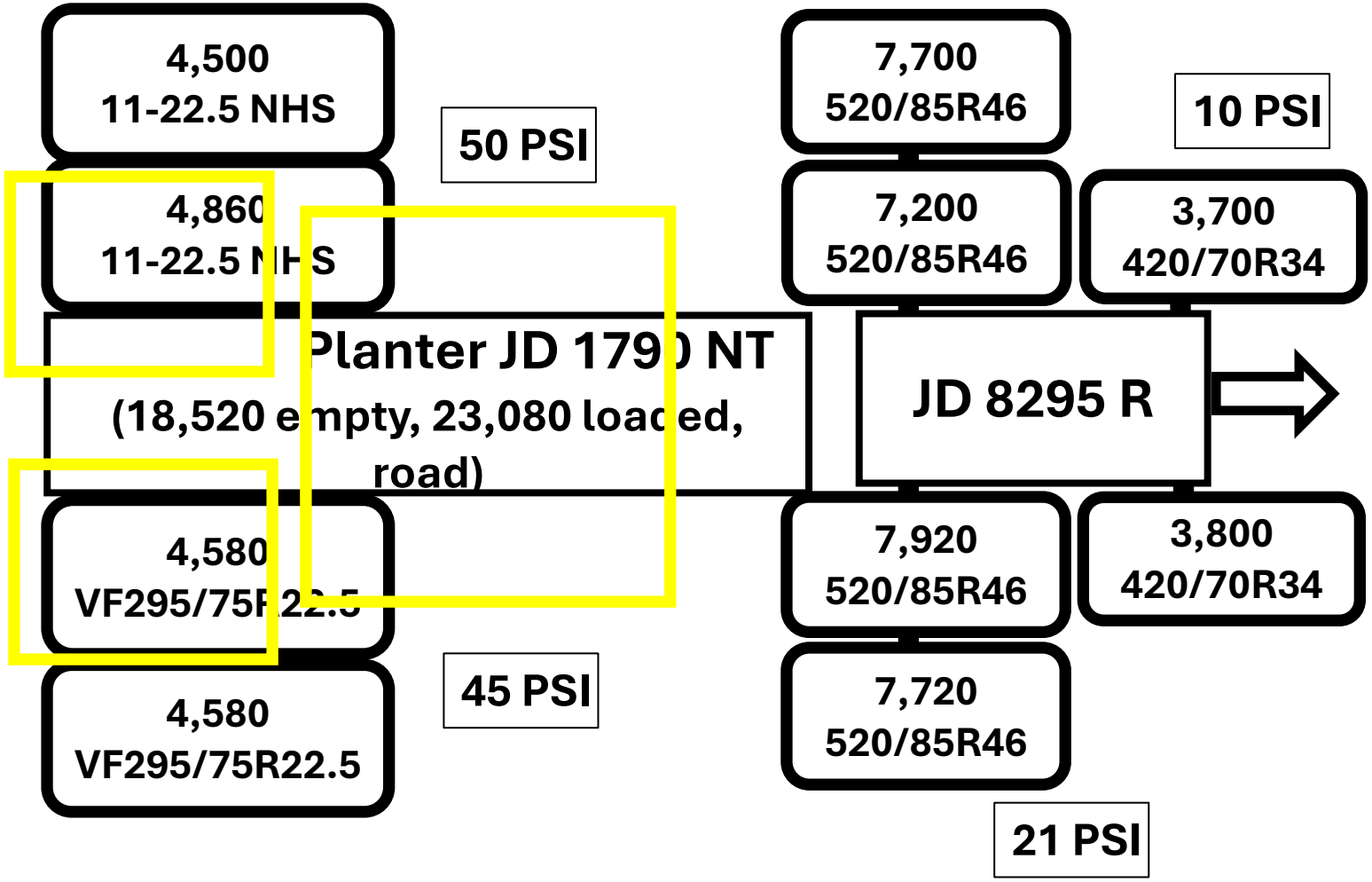
- This unit was NOT loaded to field full weight and so interpretation should account for that.
- This track unit was much better suited to this application compared to the tires that were tested on Unit E21+E23.
- From load carrying and soil compaction, the track system outperformed tires for this empty load.
- There remains a significant compaction threat with this type of implement setup because there is no place to add the amount of rubber needed to support these units loaded weight.
- In general, tires are overloaded on planters, so considering soil stress, safety, magnitude of weight, tracks may be the best option.

2019 Elgin Soil and Crop Compaction Event

Exhibit: E23
Central Fill Corn Planter
JD 1790 NT 11-22.5 Bias vs VF295/70R22.5 Load Tires + JD 8295 R Tractor

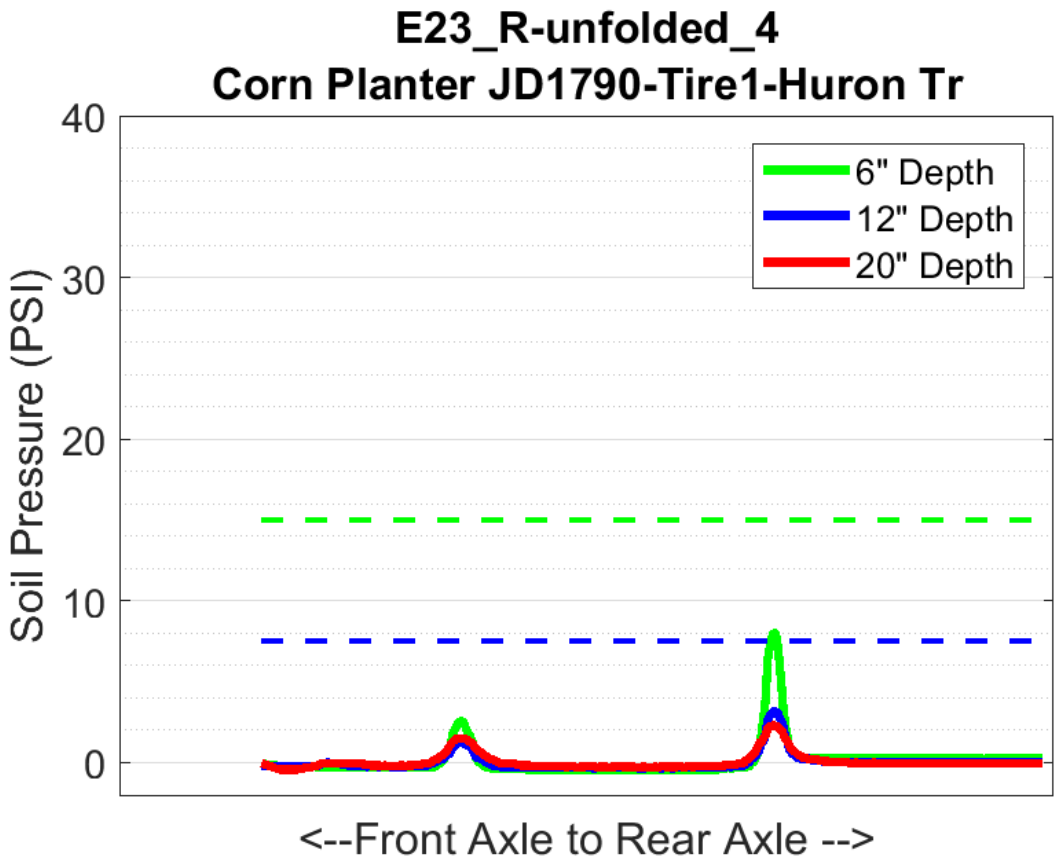

JOHN DEERE

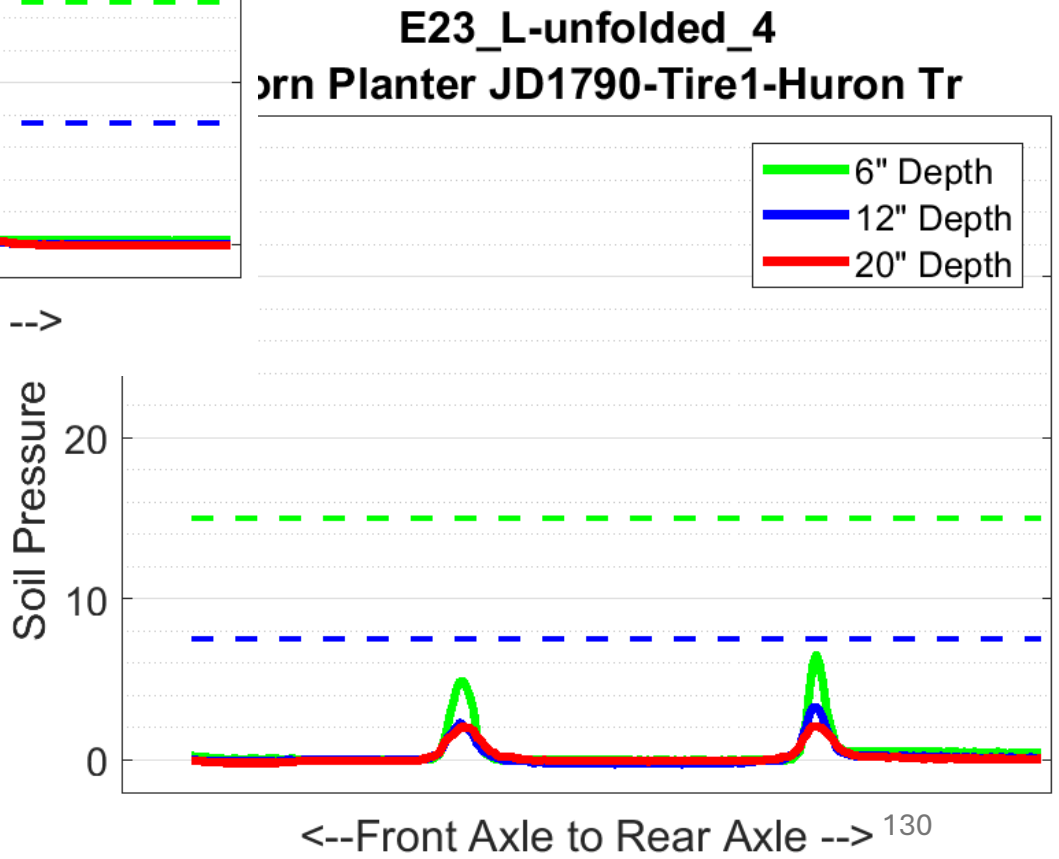
Exh: E23



Field Position Weights (left to right in lbs)

1. 2100, 2. 2300, 3. 4840, 4. 4780, 5. 5420, 6. 5500, 7. 2300, 8. 2100 = 29,340
2. Tire 7 and 8 estimated!


E23_R-unfolded_4
Corn Planter JD1790-Tire1-Huron Tr
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E23_L-unfolded_4
orn Planter JD1790-Tire1-Huron Tr
6" Depth
12" Depth
20" Depth
Soil Pressure
20
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E23

- Like with E21+22, we discourage using this data in making tire decisions for planters. The planters were not fully loaded and it was difficult to hit the sensors properly!
- This Unit again tested a bias and a VF radial tire on the center section of the planter
- Inflation pressure are similar in both tires. It may be the case that the bias ply tire was at the maximum inflation pressure and would not be suited to carry this load.
- Soil pressure is similar between the two tires. The slightly lower pressure for the bias tire (E23_L-unfolded_4) may be due to the tire being off center as these were very narrow tires.
- The first peak on both plots was the outer dual of the tractor, slightly off of the sensor.





JOHN DEERE

2019 Elgin Soil and Crop Compaction Event

Exhibit: E 25
Tracked Articulated JD 9570 RX Tractor


JOHN DEERE
9570 RX
25


25

Exh: E25

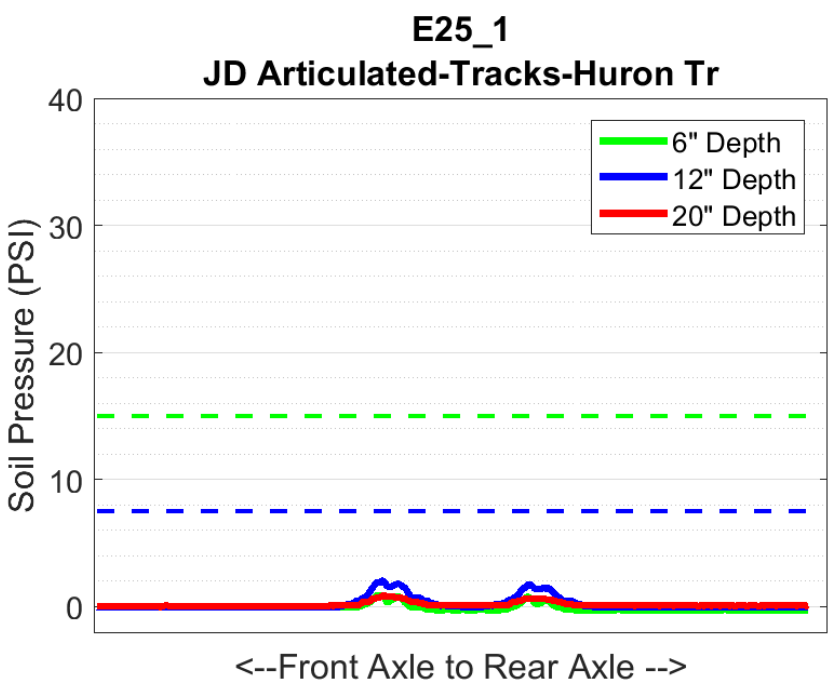
13,800
30 inch trac

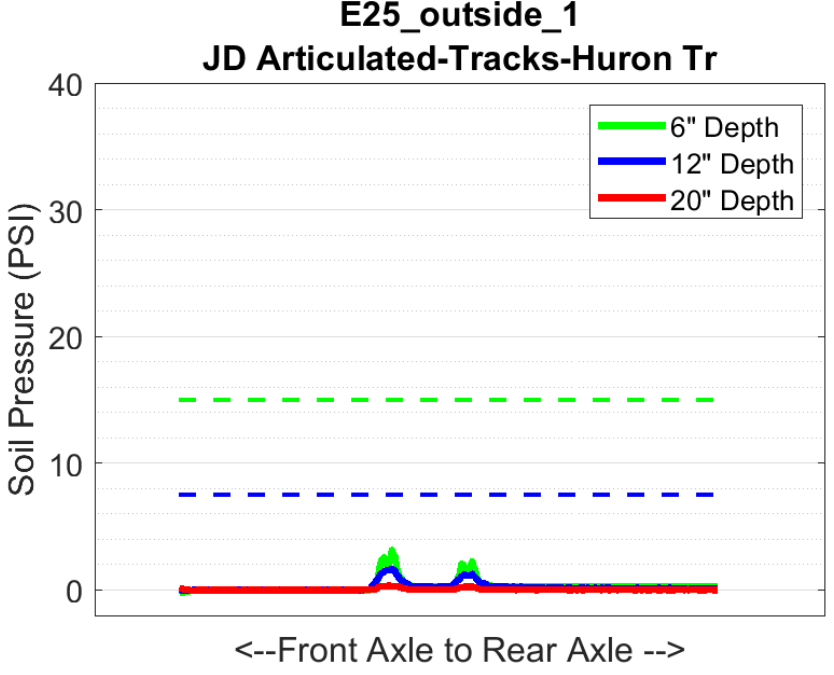
17,300
30 inch trac

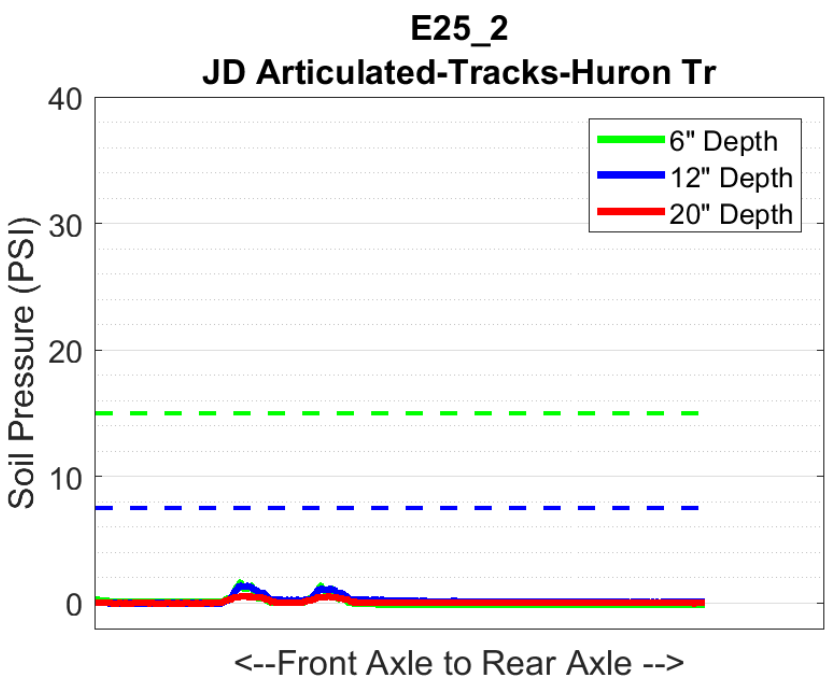
JD 9570 RX
(61,600 lbs / 27.9T)

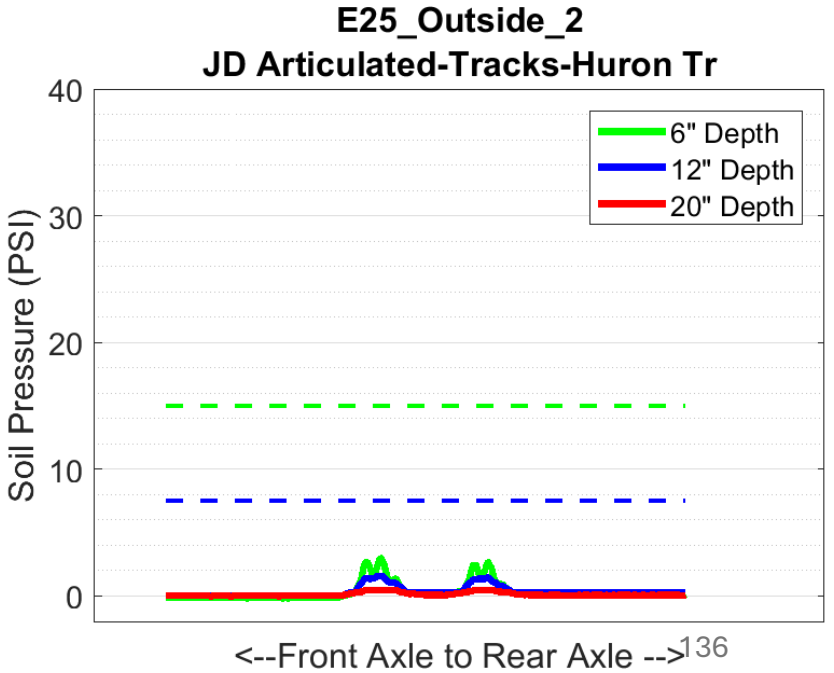
14,000
30 inch trac

16,500
30 inch trac


E25_1
JD Articulated-Tracks-Huron Tr
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->


E25_outside_1
JD Articulated-Tracks-Huron Tr
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->


E25_2
JD Articulated-Tracks-Huron Tr
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->


E25_Outside_2
JD Articulated-Tracks-Huron Tr
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->

Plot Comments – E25

- This Unit again shows the varying pressure distribution across the face of a track.
- The pressure under the rollers in the track unit is higher that the pressure in the center of the track face.
- But the level of pressure transmitted to the sensors at all depths is good and would unlikely result in soil compaction occurring with this configuration.


25
9570 RX

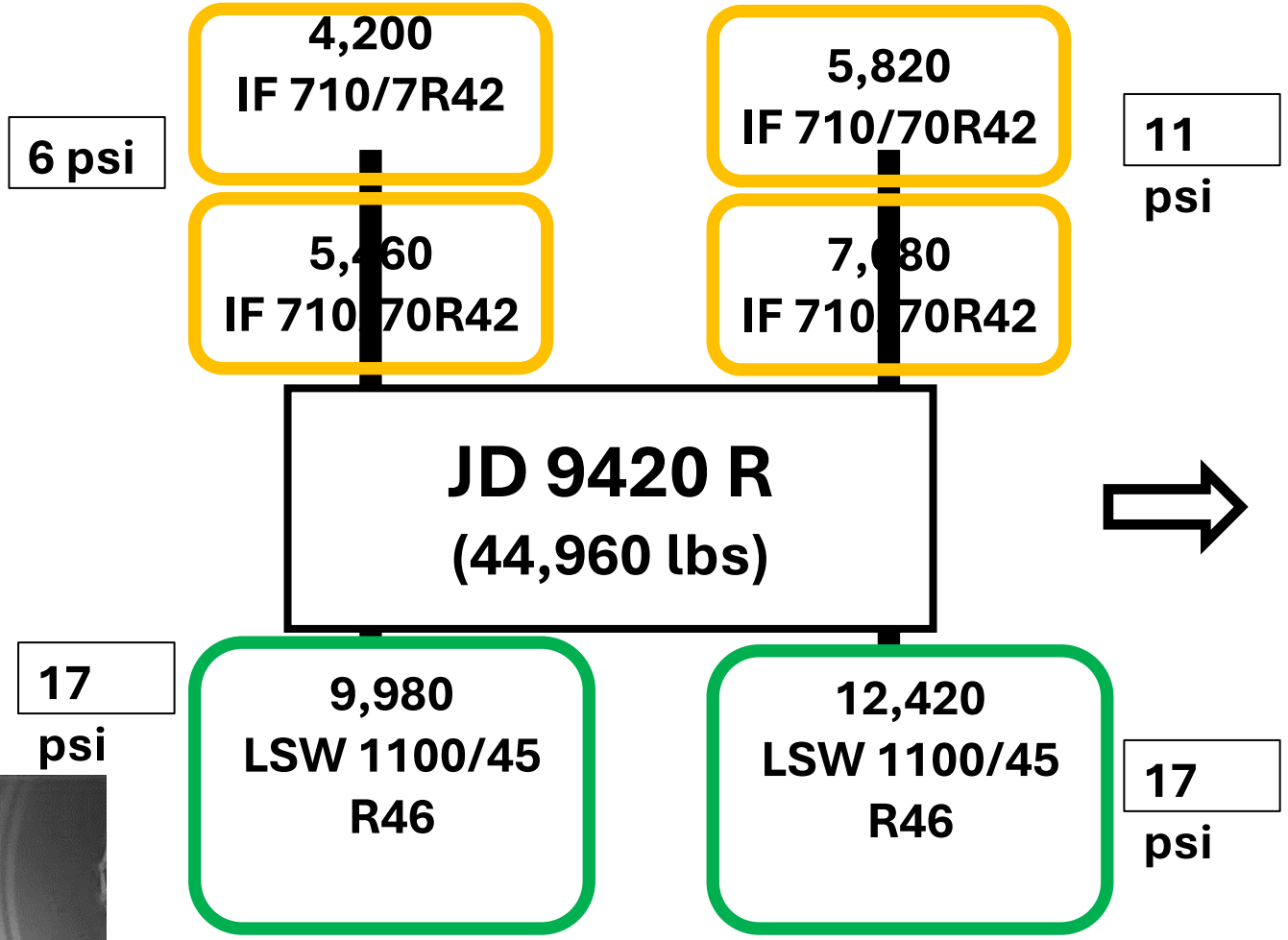

JOHN DEERE


25

2019 Elgin Soil and Crop Compaction Event

Exhibit: E26
JD 9420R Tractor w Dual IF 710/70R42 vs LSW 1100/45R46 Single

Exh: E26


4,200
IF 710/7R42
5,820
IF 710/70R42
6 psi
11
psi
5,460
IF 710/70R42
7,680
IF 710/70R42
JD 9420 R
(44,960 lbs)
17
psi
9,980
LSW 1100/45
R46
12,420
LSW 1100/45
R46
17
psi


This unit was tested in 3 configurations:
1. Single IF 710/70R42
2. Dual IF 710/70R42
3. Single LSW 1100/45R46
26
L+R

Exh: E26

6 psi

4,200
IF 710/70R42

5,460
IF 710/70R42

5,820
IF 710/70R42

7,080
IF 710/70R42

11 psi

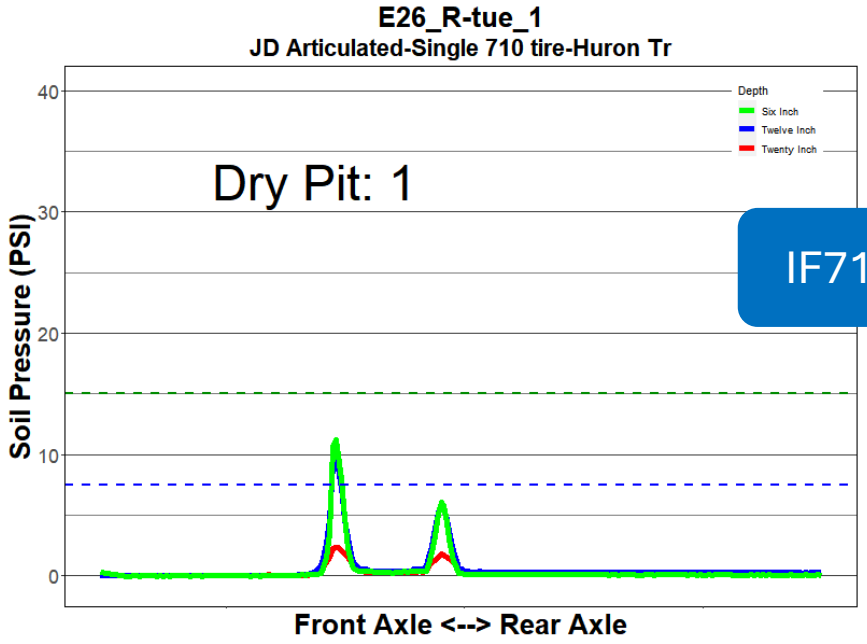
JD 9420 R
(44,960 lbs / 20.4T)

15 psi

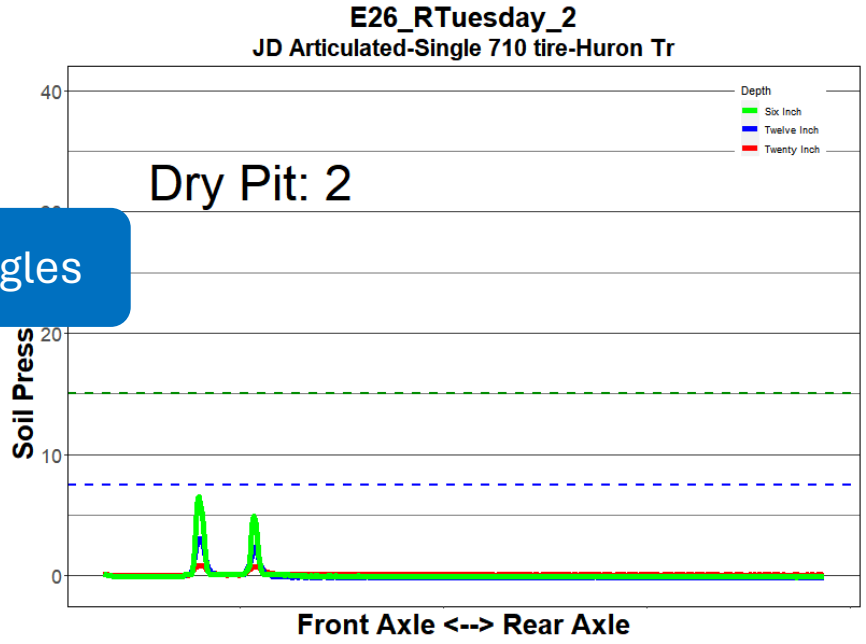
9,980
IF 710/70R42

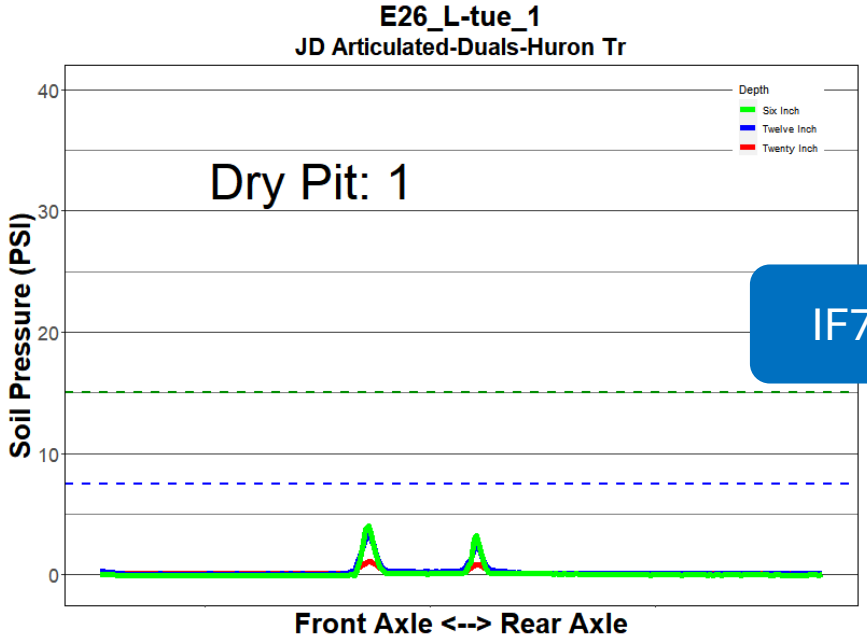
12,420
IF 710/70R42

17 psi

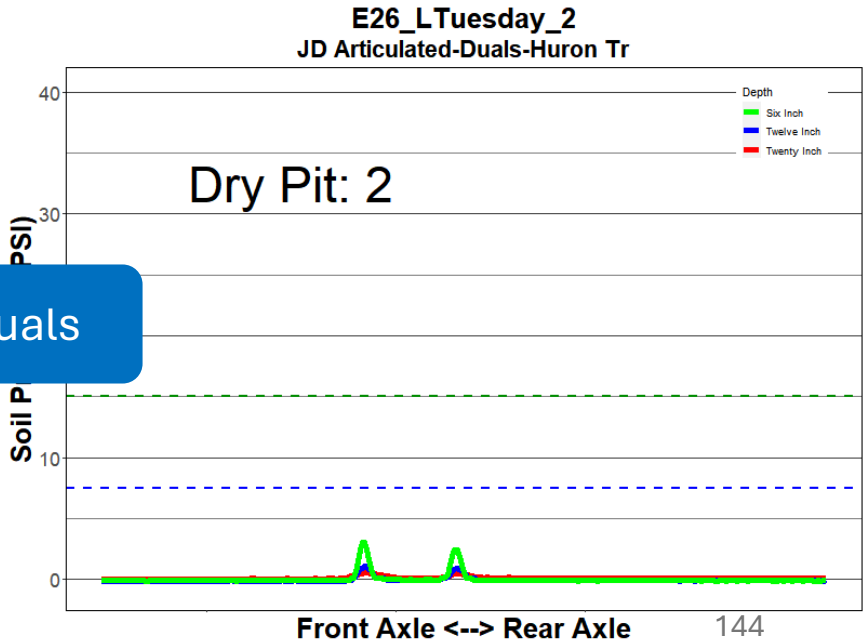


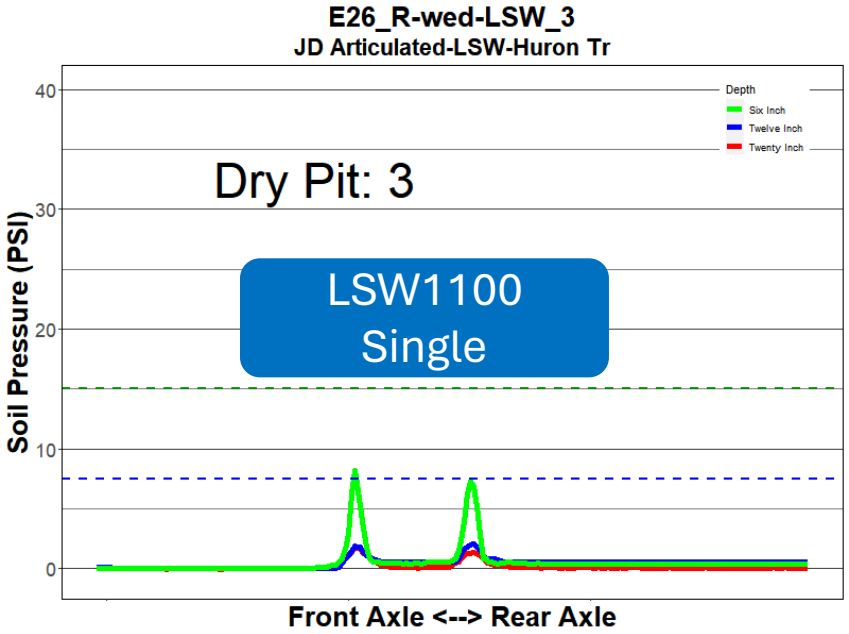
IF710 Singles

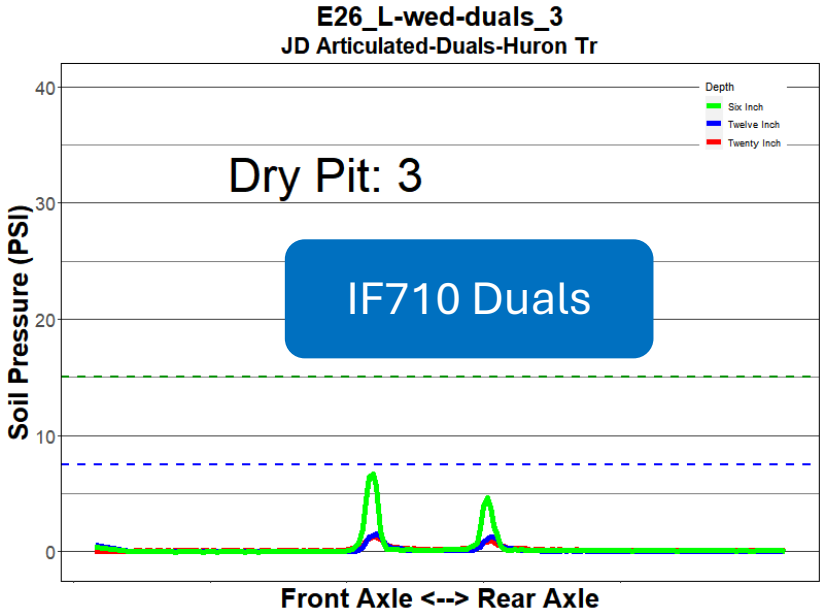


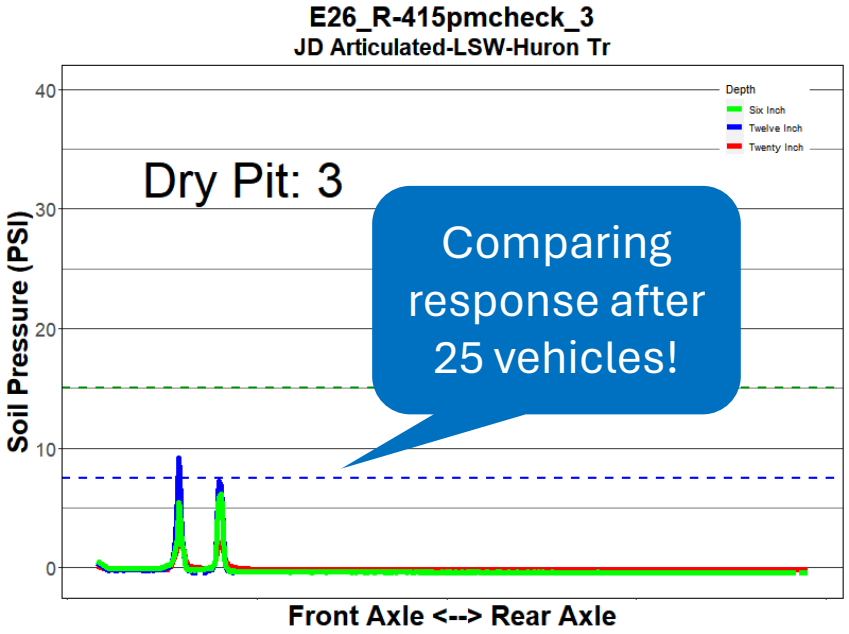


IF710 Duals




E26_R-wed-LSW_3
JD Articulated-LSW-Huron Tr
Depth
Six Inch
Twelve Inch
Twenty Inch
Dry Pit: 3
LSW1100
Single
Soil Pressure (PSI)
40
30
20
10
0
Front Axle <--> Rear Axle


E26_L-wed-duals_3
JD Articulated-Duals-Huron Tr
Depth
Six Inch
Twelve Inch
Twenty Inch
Dry Pit: 3
IF710 Duals
Soil Pressure (PSI)
40
30
20
10
0
Front Axle <--> Rear Axle


E26_R-415pmcheck_3
JD Articulated-LSW-Huron Tr
Depth
Six Inch
Twelve Inch
Twenty Inch
Dry Pit: 3
Comparing response after 25 vehicles!
Soil Pressure (PSI)
40
30
20
10
0
Front Axle <--> Rear Axle

Plot Comments – E26

- This unit compared IF710 dual tires to IF710 single and Low Sidewall (LSW) 1100 tires.
- The plots label with Tue and Tuesday did not have the LSW tire installed and only compares duals and singles.
- In that case the duals reduced the load on the soil compared to the single tire
- The plots label "Wed" show that the Duals and the LSW tire were similar in soil response.
- Under these conditions all 3 configurations showed they were under the theoretical threshold for causing soil compaction under the conditions tested.


26
L+R

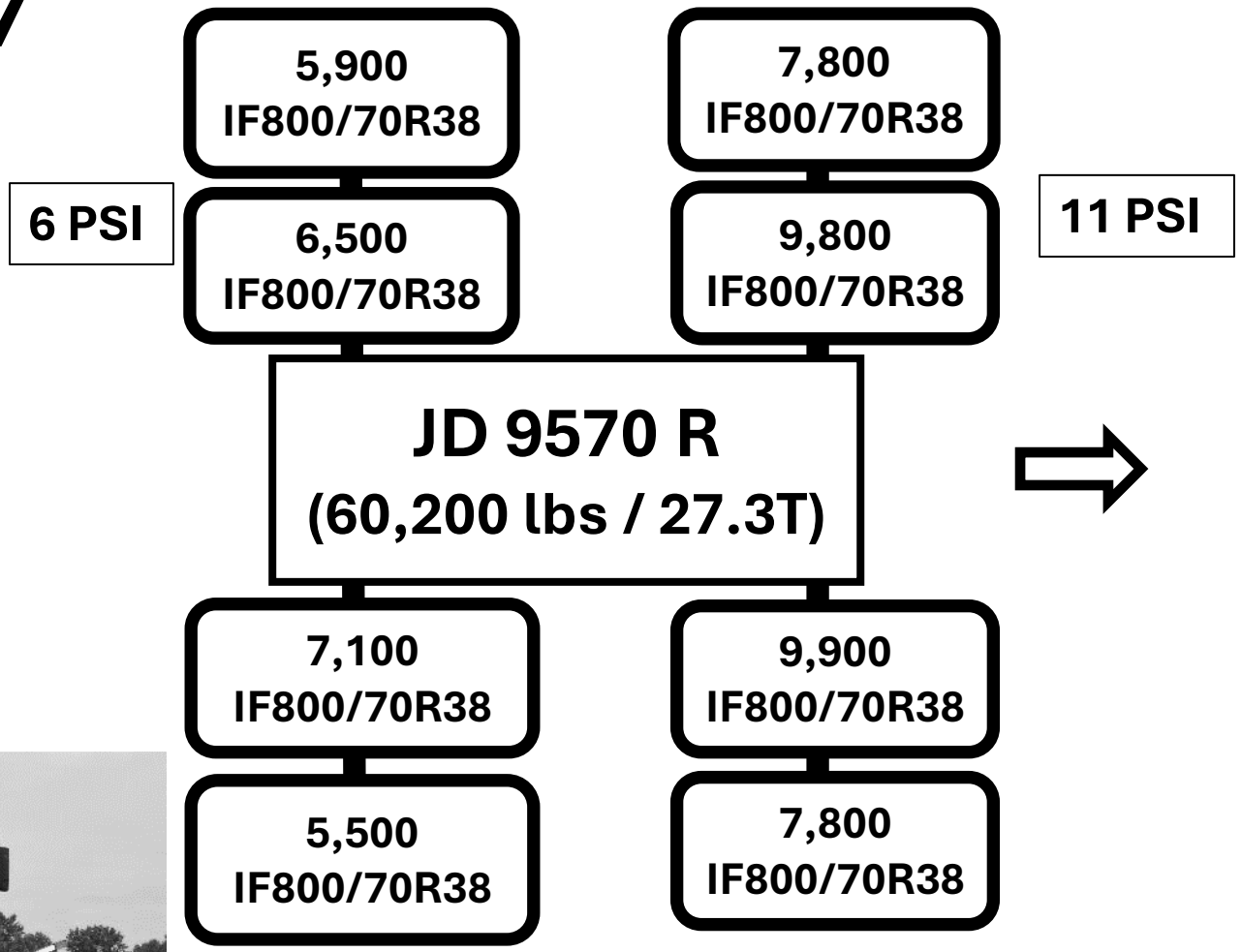

26
L+R
9420R

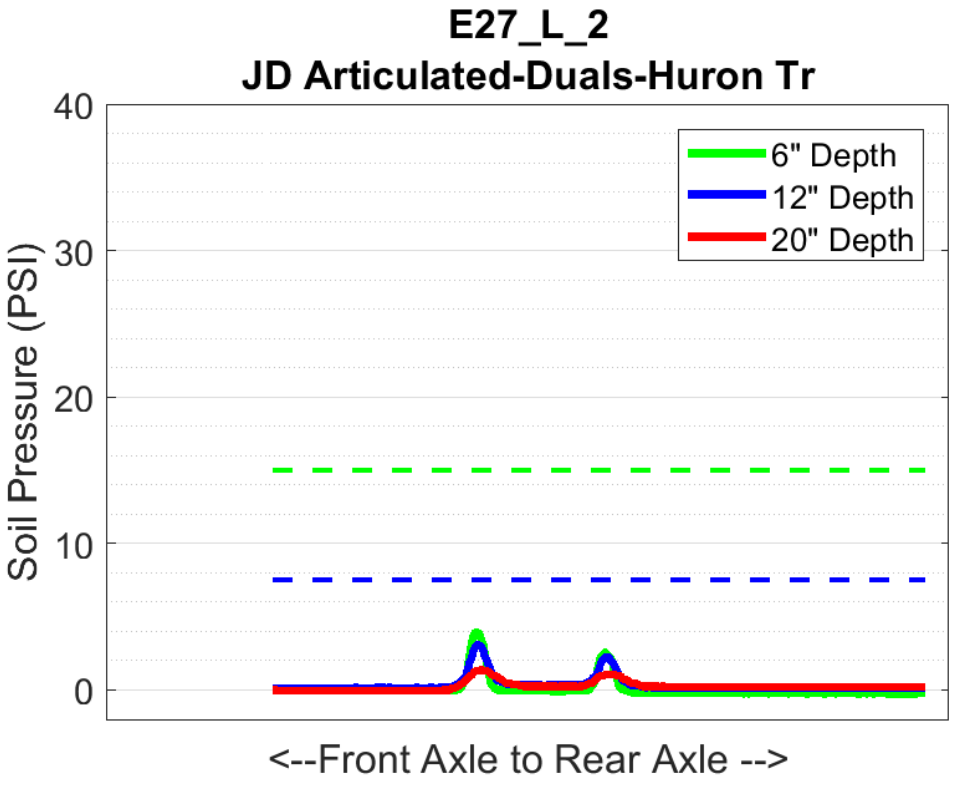
2019 Elgin Soil and Crop Compaction Event

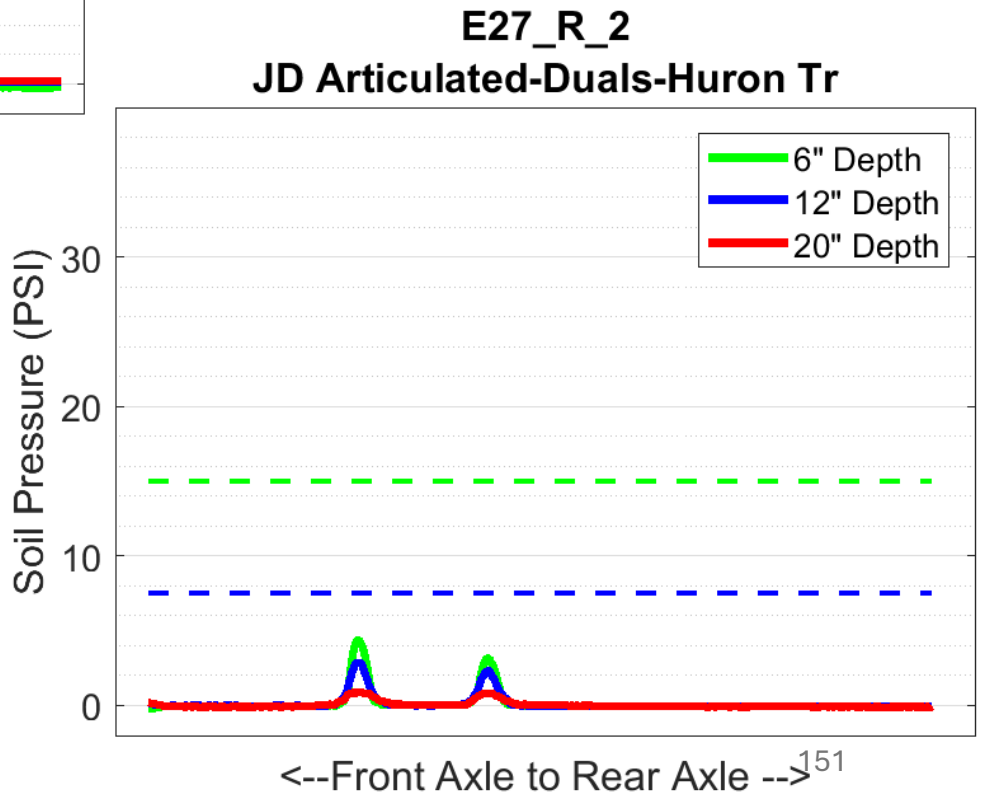
Exhibit: E27
JD 9420 R Tractor w IF 800/70R38 Duals


27

Exh: E27


5,900
IF800/70R38
7,800
IF800/70R38
6 PSI
6,500
IF800/70R38
9,800
IF800/70R38
11 PSI
JD 9570 R
(60,200 lbs / 27.3T)
7,100
IF800/70R38
9,900
IF800/70R38
5,500
IF800/70R38
7,800
IF800/70R38


E27_L_2
JD Articulated-Duals-Huron Tr
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E27_R_2
JD Articulated-Duals-Huron Tr
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
<--Front Axle to Rear Axle -->

Plot Comments – E27

- This Unit is a very nice demonstration of well balance duals on an articulated tractor
- This setup did not have much weight on the tractor and draft load from any equipment would increase the pressure on the rear tires.
- This is a great example of equipping a tractor with sufficient rubber contact area to reduce the threat of soil compaction under a wide range of conditions.




2019 Elgin Soil and Crop Compaction Event

Exhibit: E28

Tracked Articulated CaseIH Quadtrac 350 Tractor w 24” Track

Exh: E28

13,900(E)
12,160(F)
24’’ Tracks

15,000(E)
18,760(F)
24’’ Tracks

Fert Tank

CaseIH Quadtrac 350
(58,300 empty,
62,250 tank full, lbs)

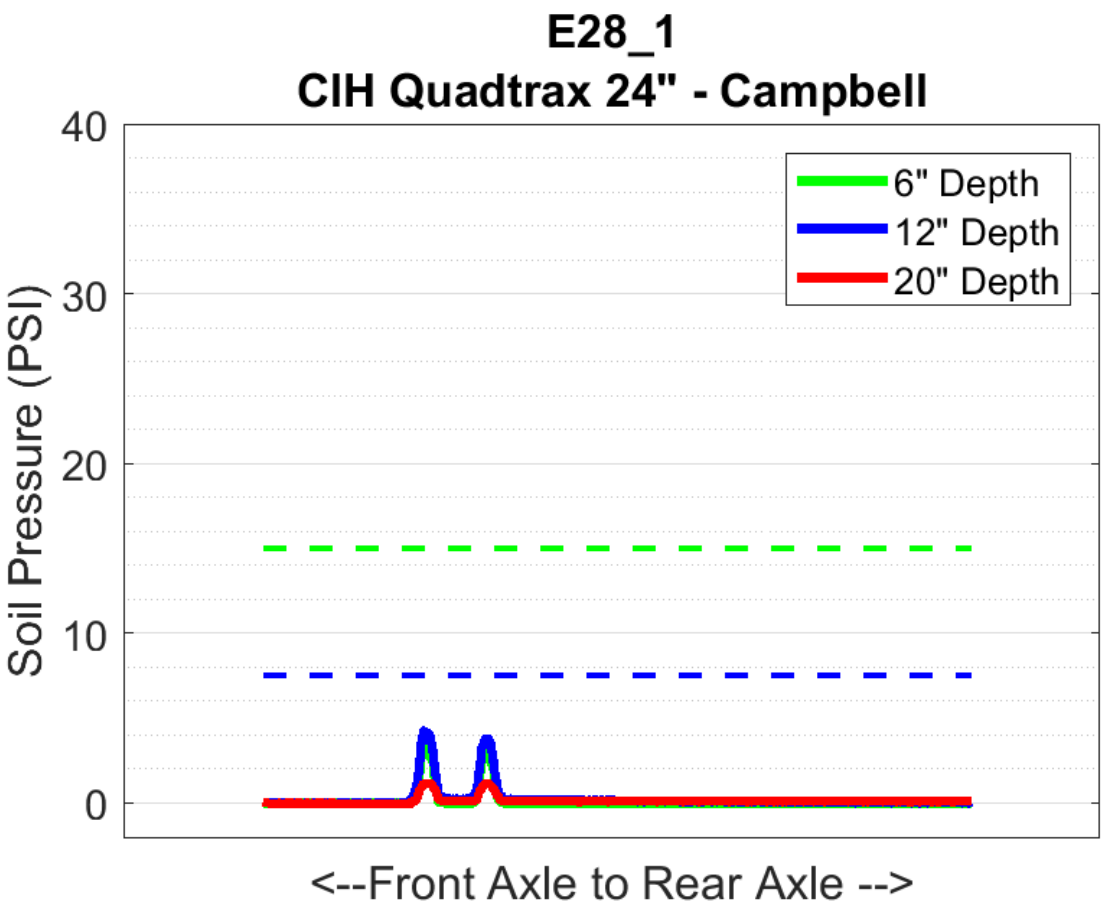
Fert Tank

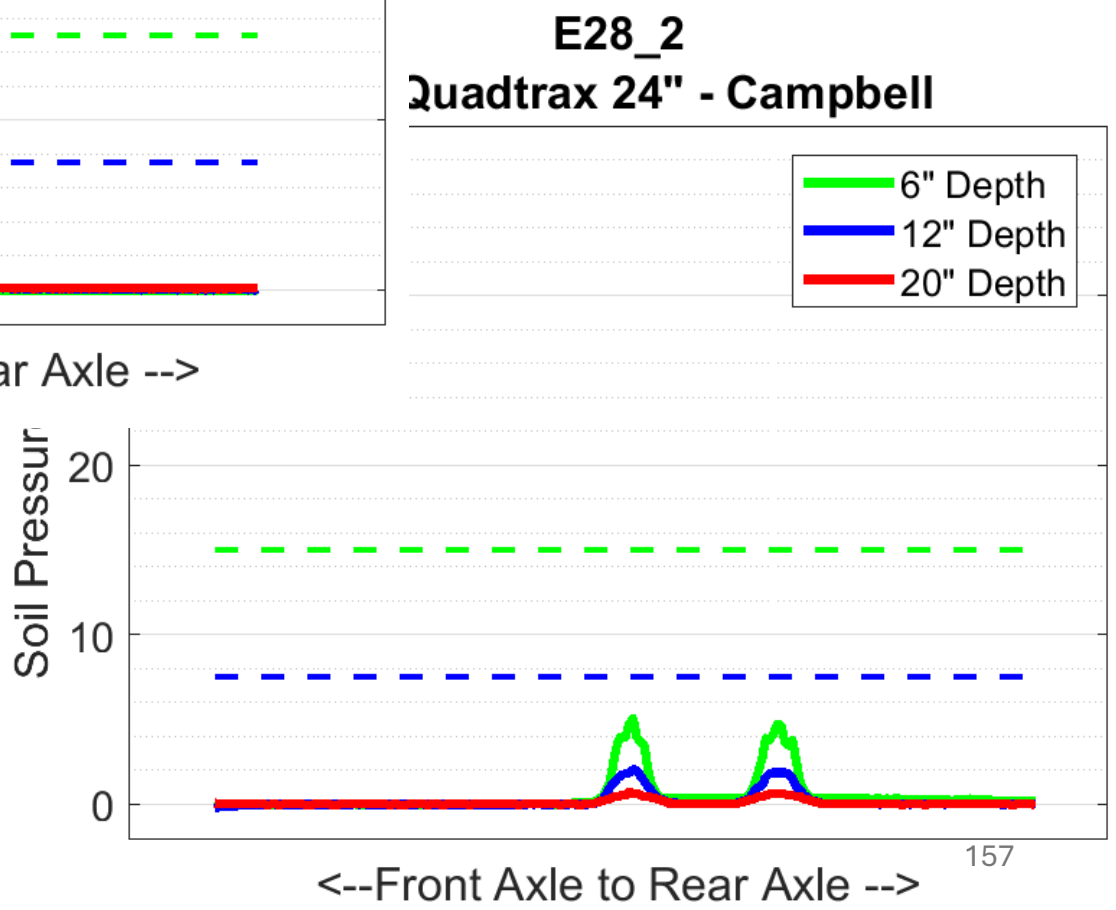
13,800(E)
12,380(F)
24’’ Tracks

15,600(E)
18,950(F)
24’’ Tracks

E= empty fertilizer tank
F= full fertilizer tank (water)


28
CASE
Demco
Demco


E28_1
CIH Quadtrax 24" - Campbell
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E28_2
Quadtrax 24" - Campbell
6" Depth
12" Depth
20" Depth
Soil Pressur
20
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E28

- This Unit again shows the relatively low pressure exerted on soil by articulated tractors with large tires or tracks.
- Note the difference between the two plots for this tractor is likely due to the change in soil properties between sensor installations.
- This demonstrates that the soil conditions can have a big impact on how the load is carried.
- However, in both cases the amount of stress transferred to the 3 sensors is relatively low.


CASE
QUADTRAC


28
CASE

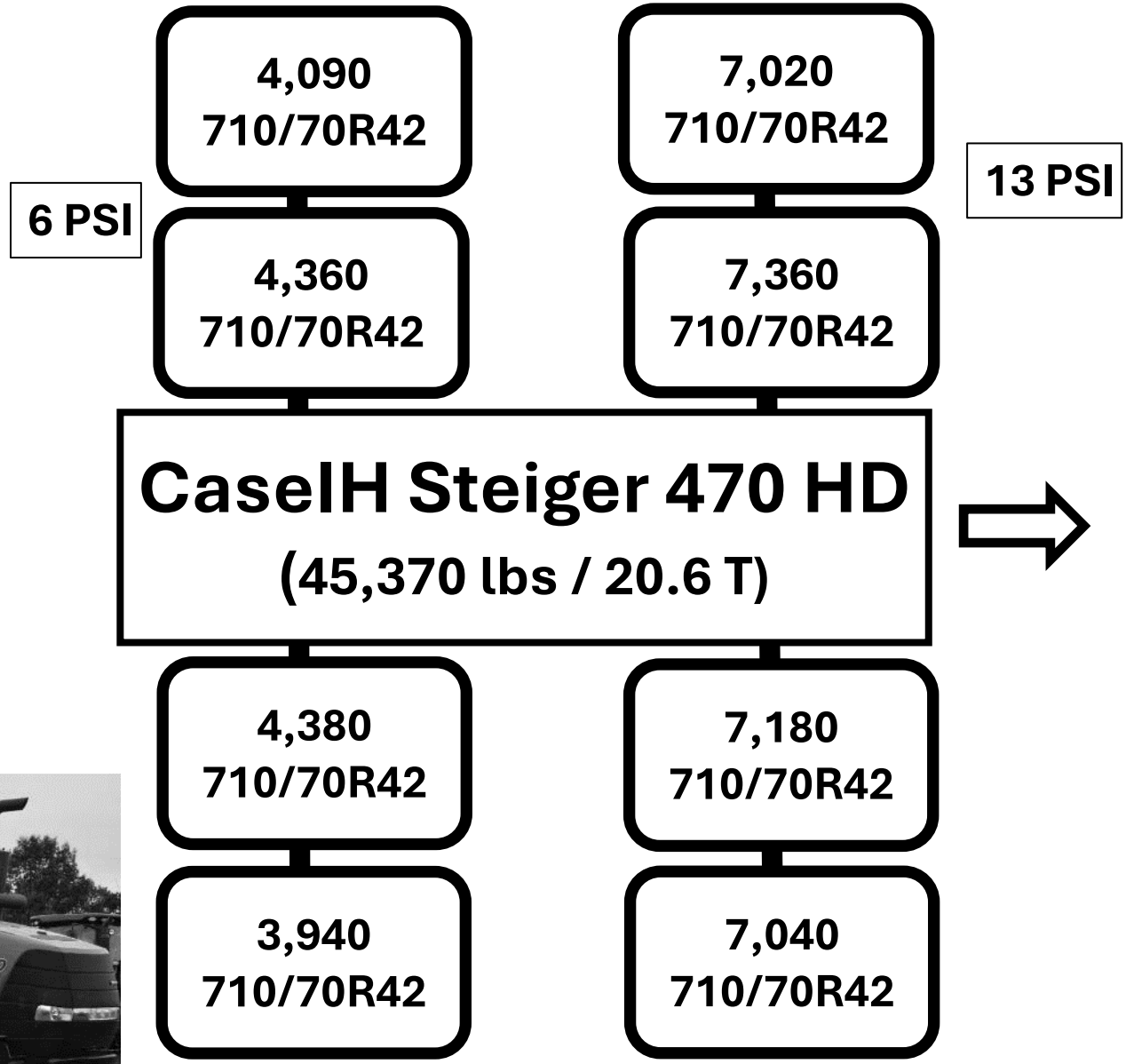

CASE

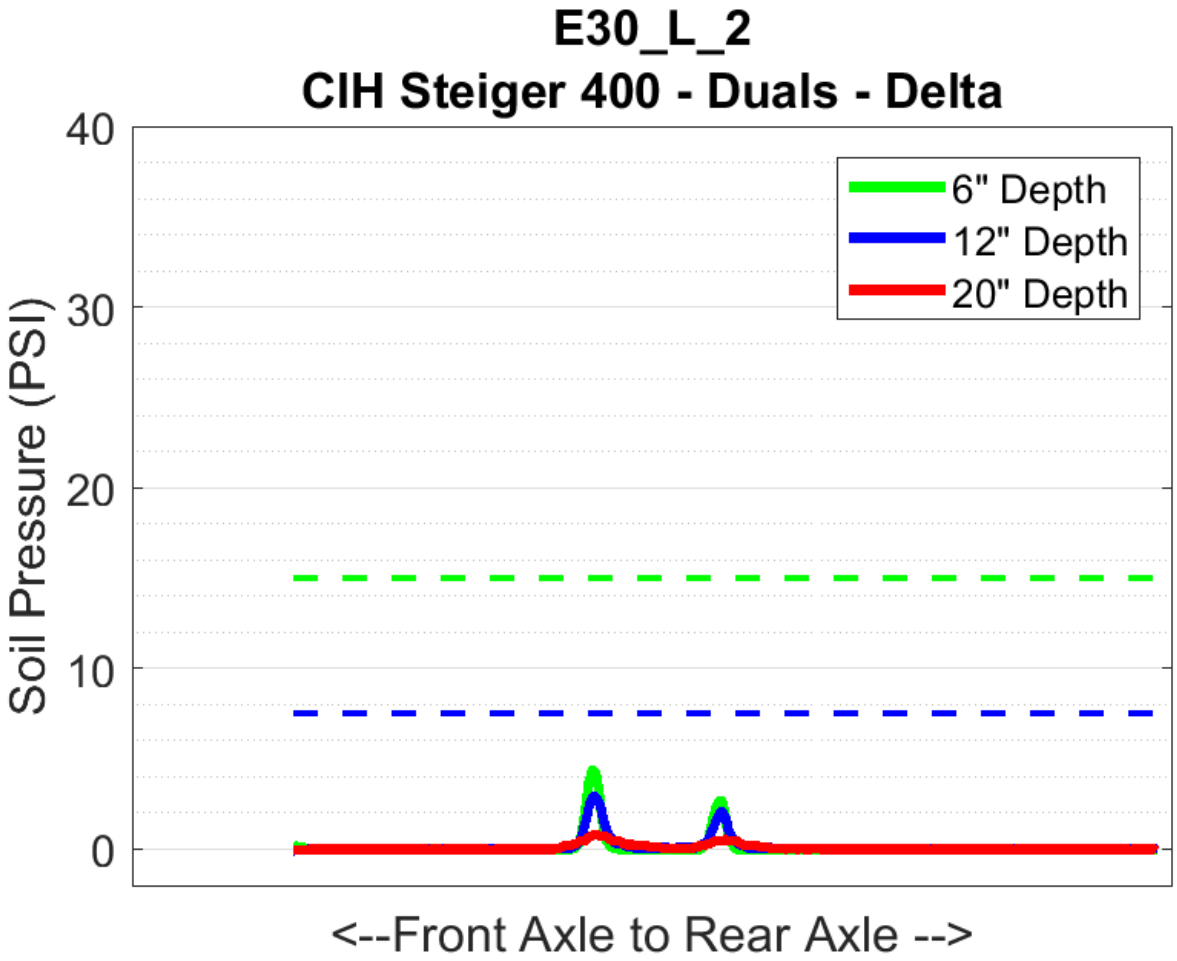
2019 Elgin Soil and Crop Compaction Event

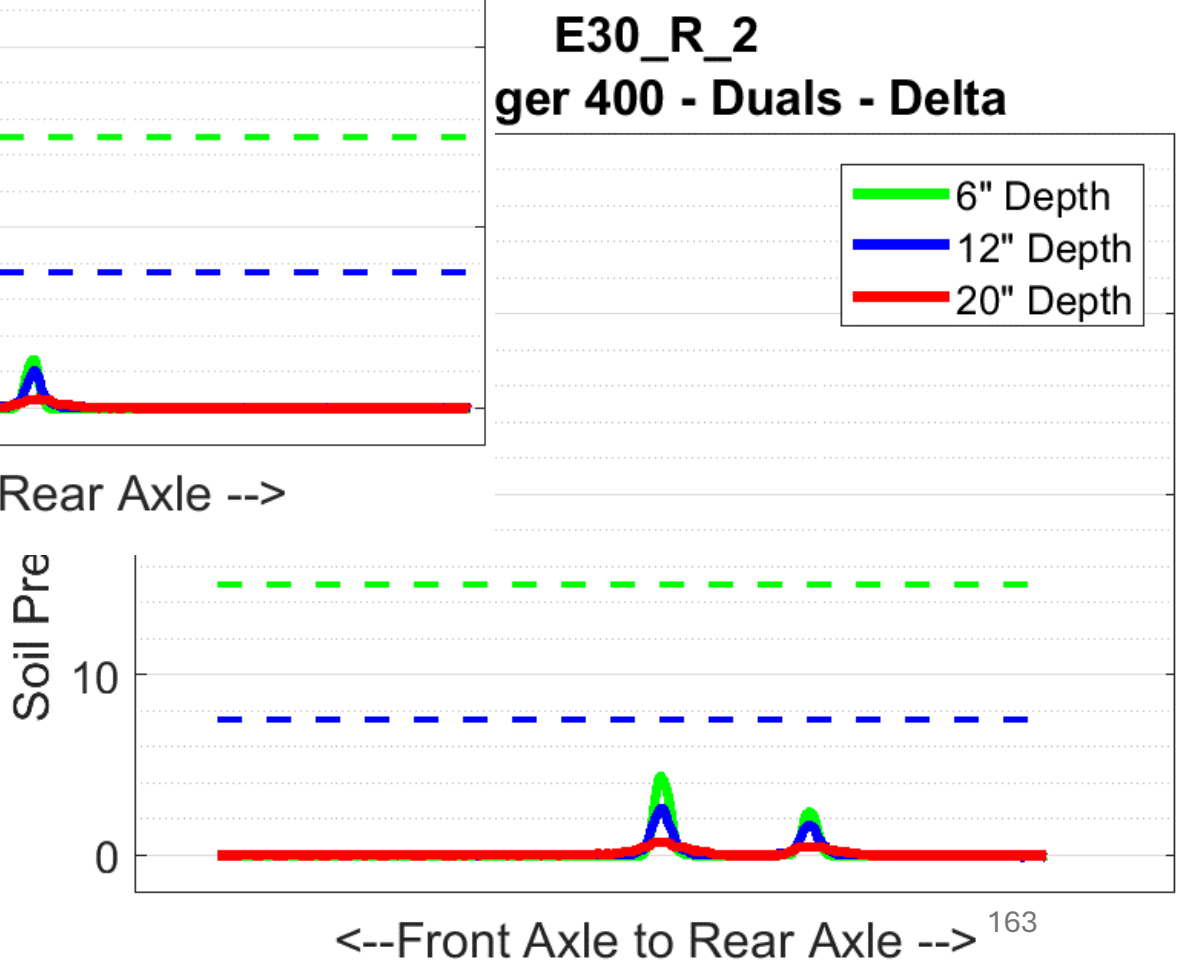
Exhibit: E30
CaseIH Steiger 470HD 710/70R42 Dualled Articulated Tractor

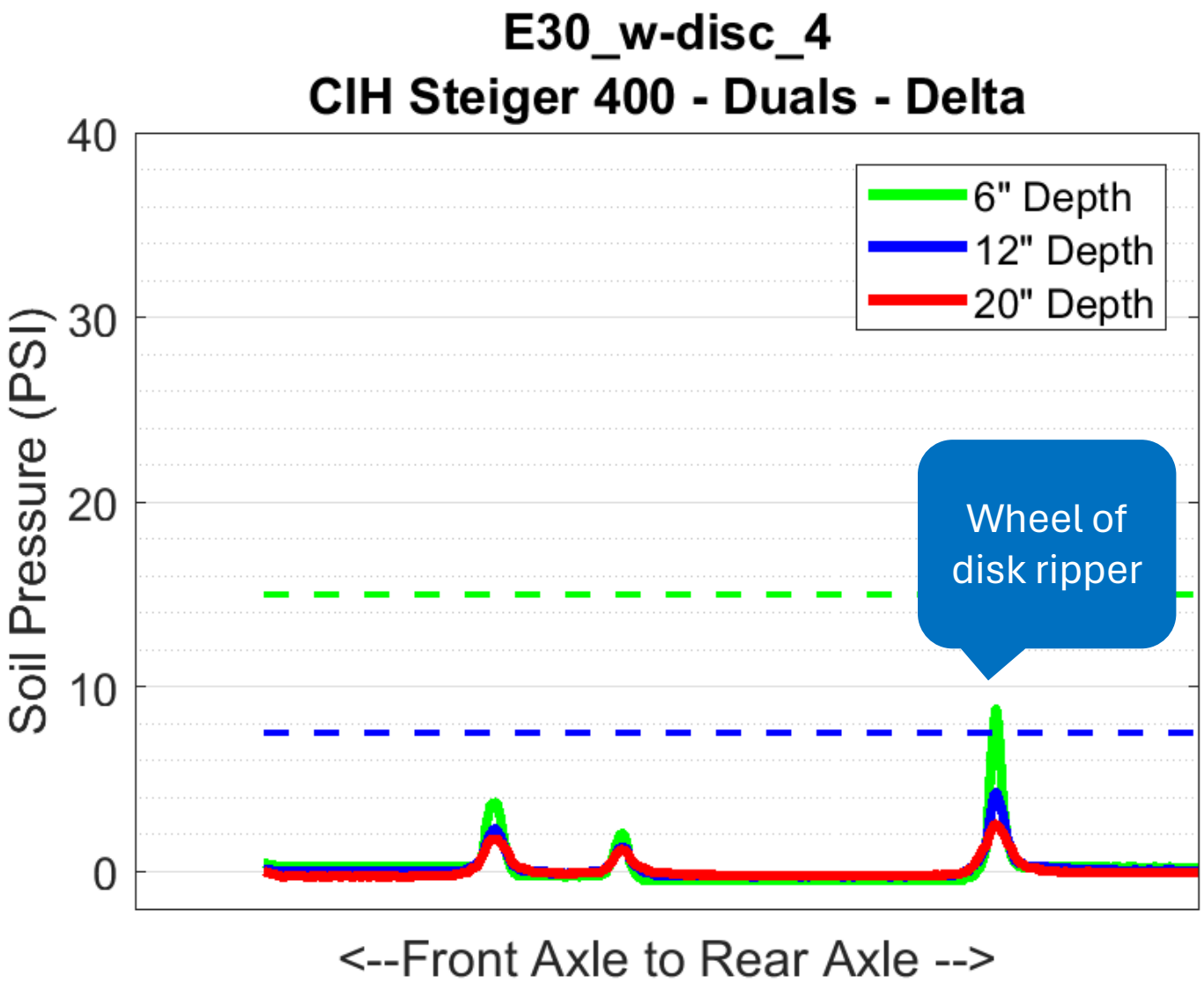

30
CASE

Exh: E30


4,090
710/70R42
7,020
710/70R42
6 PSI
13 PSI
4,360
710/70R42
7,360
710/70R42
CaseIH Steiger 470 HD
(45,370 lbs / 20.6 T)
4,380
710/70R42
7,180
710/70R42
3,940
710/70R42
7,040
710/70R42


E30_L_2
CIH Steiger 400 - Duals - Delta
40
30
20
10
0
Soil Pressure (PSI)
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->


E30_R_2
ger 400 - Duals - Delta
6" Depth
12" Depth
20" Depth
Soil Pre
10
0
<--Front Axle to Rear Axle -->


E30_w-disc_4
CIH Steiger 400 - Duals - Delta
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
Wheel of disk ripper
<--Front Axle to Rear Axle -->

Plot Comments – E30

- This Unit was tested on sensor locations 2 and 4. Notice how the 12” and 20” stress was slightly higher for the location 4 (E30_w-disc_4).
- Also notice how the disc-ripper in the raised position was placing a much higher stress on the soil than the tractor.
- All tires tested on this unit were well below what would be a concern for soil compaction but the differences are interesting, especially the stress sent deep into the soil by the tillage unit wheels.


CASE IH
STEIGER
470


CASE IH
470

2019 Elgin Soil and Crop Compaction Event

Exhibits: E24 + E33
Pull Type JD1910 Dry Fertilizer Aircart w 66x43-25
+ JD8520 Row Crop Tractor 480/620 Single vs Duals


24
33
L+R
8520
JOHN DEERE

Exh: E33 + E24

26 PSI

10,040
66x43-25NHS

JD 1910
Aircart
(19,130 lbs)

21 PSI

9,090
66x43-25NHS

31 PSI

13,100
620/70R46

JD 8520
(32,020 lbs)

5,840
620/70R46

3,900
620/70R46

7 PSI

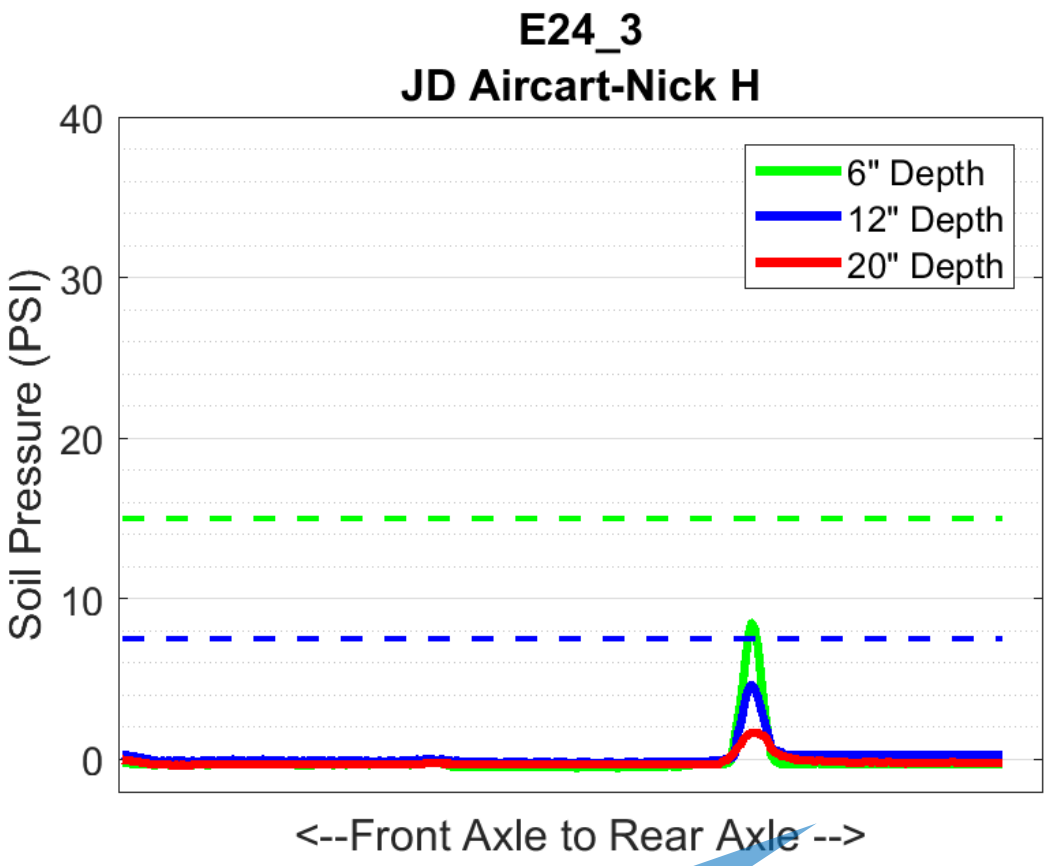
17 PSI

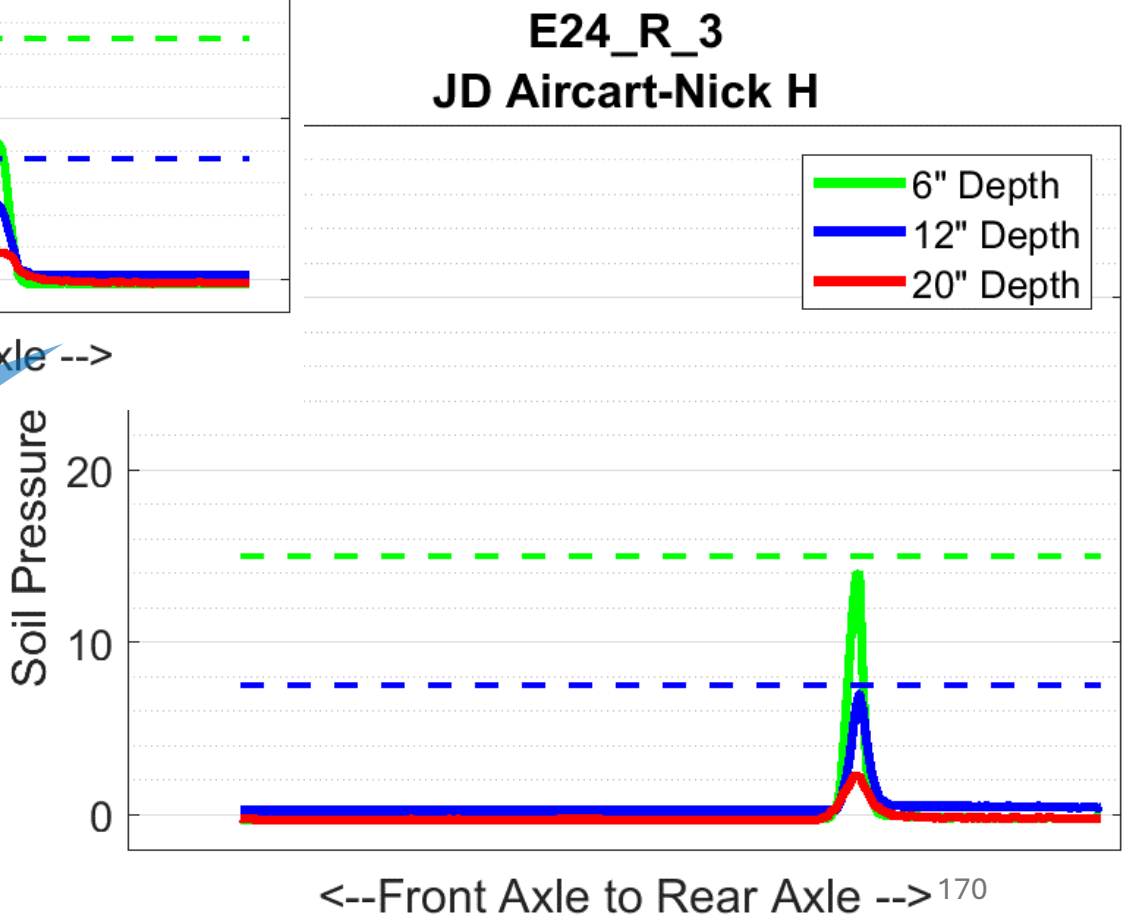
4,500
480/70R34

3,280
480/70R34

1,400
480/70R34

6 PSI





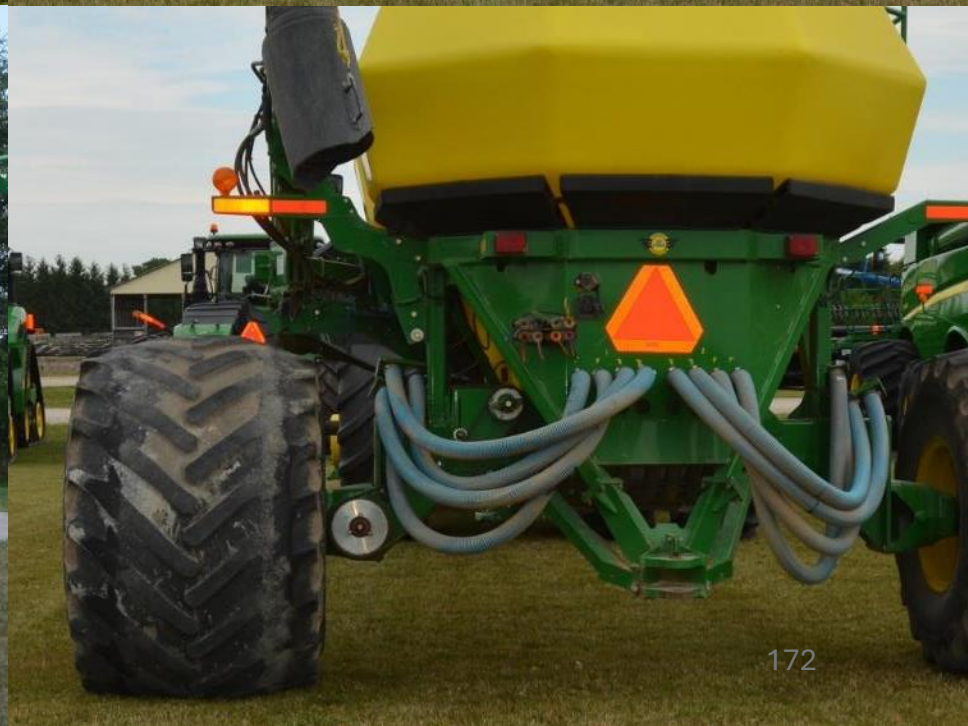
Aircart tire centered over sensor on this chart only. The left chart shows the response of the tire partially engaging the sensor.

Plot Comments – E34 + E33

- Due to alignment the tractor was not able to drive over the sensors so only the cart tires were tested.
- The round profile of the face of this tires meant that the pressure response was non uniform across the face. This meant that the center of the tire applied more soil load (E24_R_3). In the other plot the tire was not exactly centered over the sensor and thus soil stress was lower since the sensor was unable to detect the full weight on the tire.


24
33
L+R
8520
JOHN DEERE


1910
JOHN DEERE



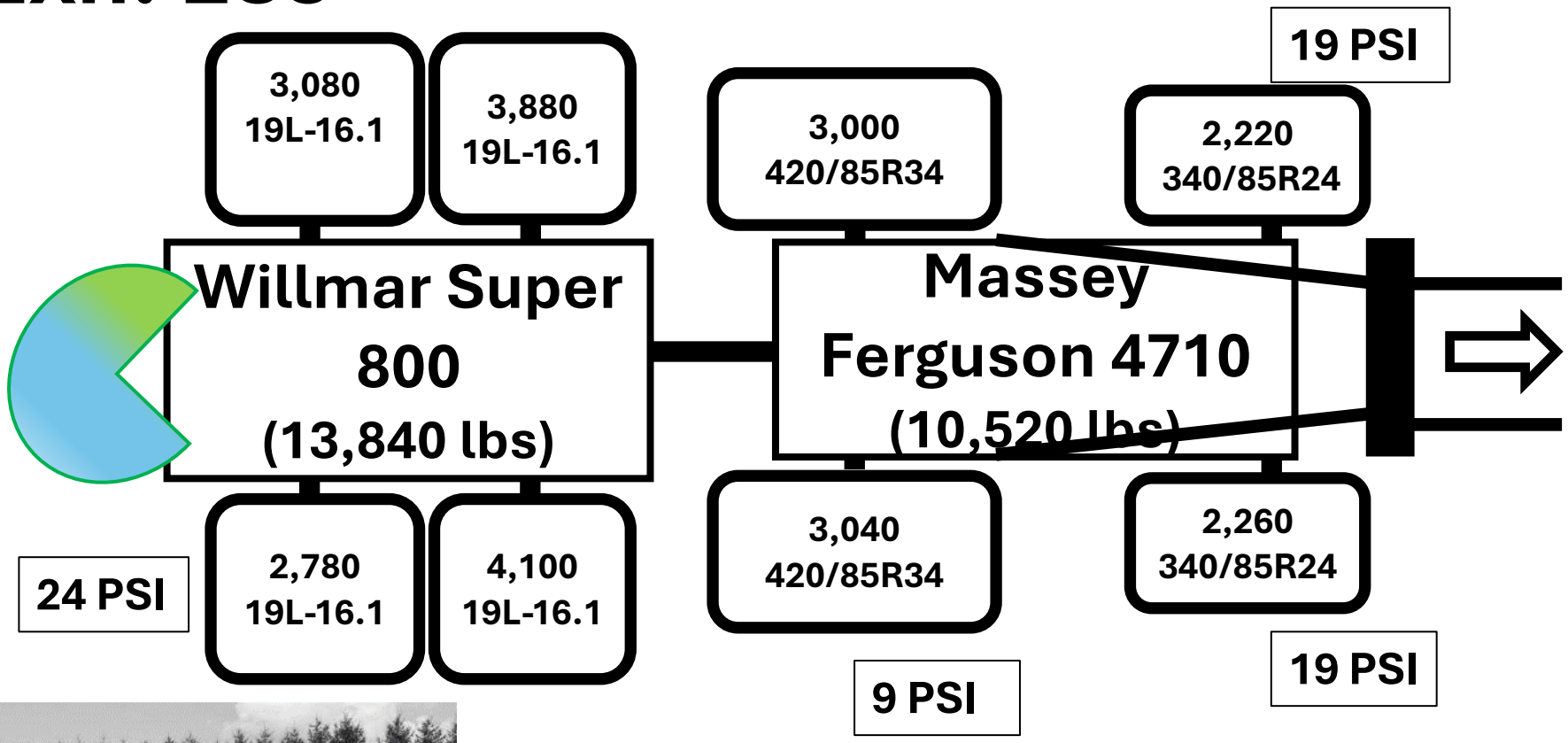
2019 Elgin Soil and Crop Compaction Event

Exhibit: E35

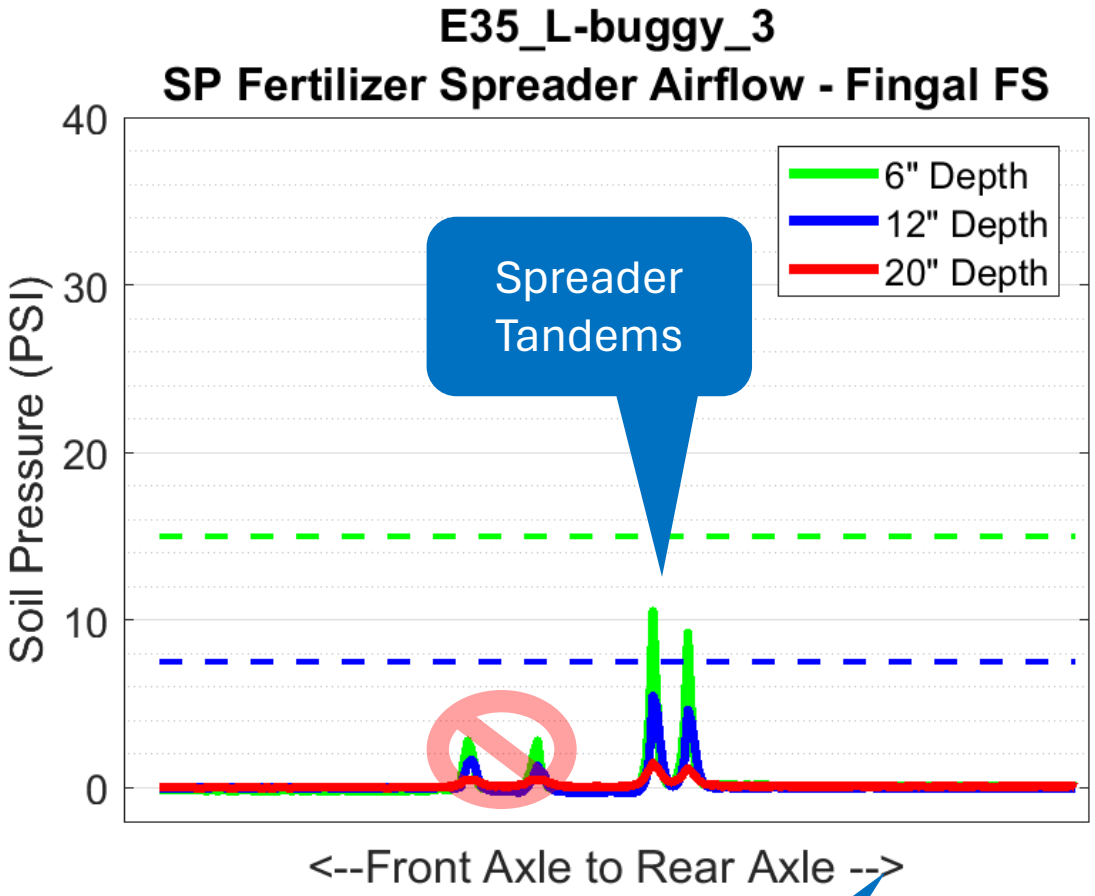
Pull Type Dry Fertilizer Spinner Spreader w Tandem 19L-16.1Bias + MF 4710 Utility Row Crop Tractor

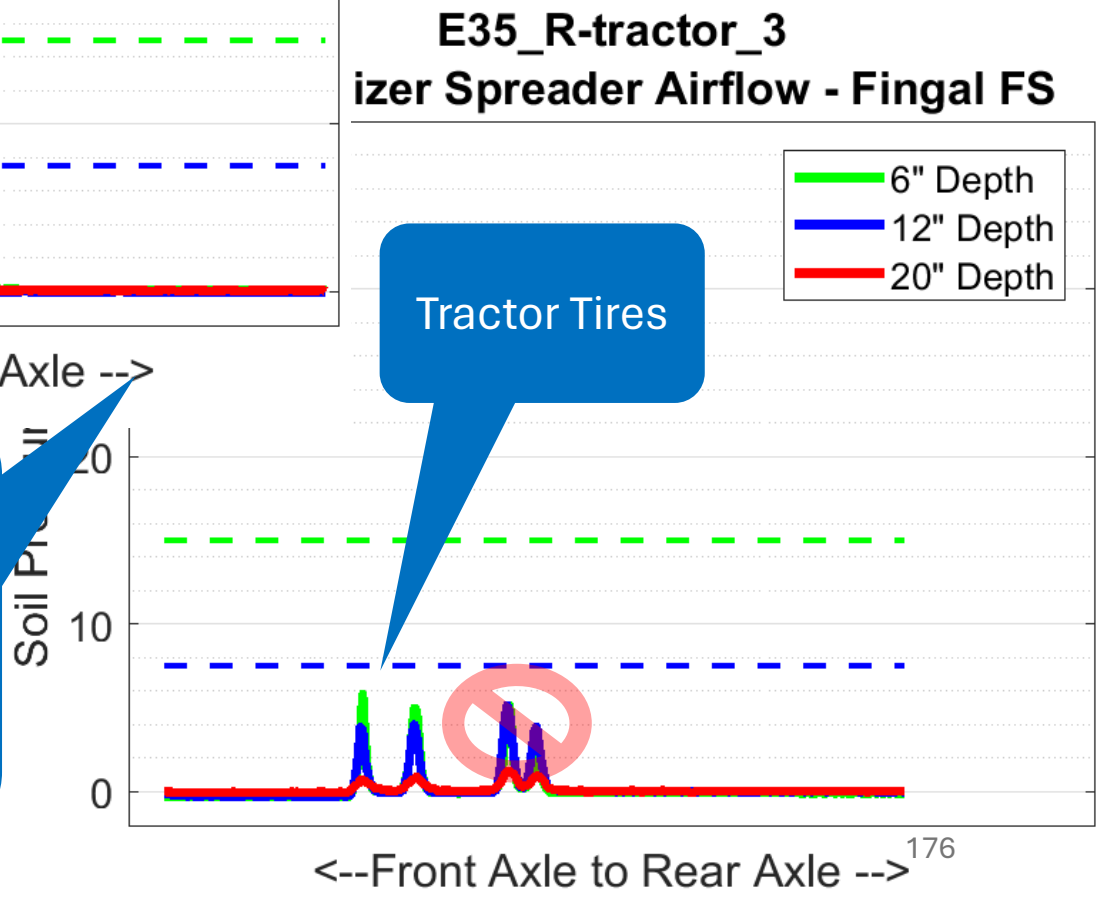

Fingal
Farm
Supply
Limited
Agromart
GROUP
MASSEY FERGUSON
X 1356

Exh: E35


3,080
19L-16.1
3,880
19L-16.1
3,000
420/85R34
19 PSI
2,220
340/85R24
Willmar Super
800
(13,840 lbs)
Massey
Ferguson 4710
(10,520 lbs)
24 PSI
2,780
19L-16.1
4,100
19L-16.1
3,040
420/85R34
2,260
340/85R24
9 PSI
19 PSI


WILLMAR





The tractor response on the left chart is excluded because the alignment to centre the spreader off set the tractor tires. On the right chart, the response of the spreader is excluded as the target was the tractor.

Plot Comments – E35

- The response of the fertilizer spinner spreader is typical of an implement with moderate weight and high inflation bias tires. Response at the surface is much higher than it could be with a low inflation tire, but the moderate amount of weight does not generate much stress at the 20” depth.
- The response of the tractor (first two peaks on E35_R-tractor_3) show a low response as well. Low pressure tires and moderate weight.
- These types of spreaders often have overloaded bias tires which can be quite compacting.


MASSEY FERGUSON
Fingal Farm Supply Limited
35
50' SPREAD


Fingal Farm Supply Limited
Super 800
WILLMAR


Fingal Farm Supply Limited
Agromar
Super 800
24PSI

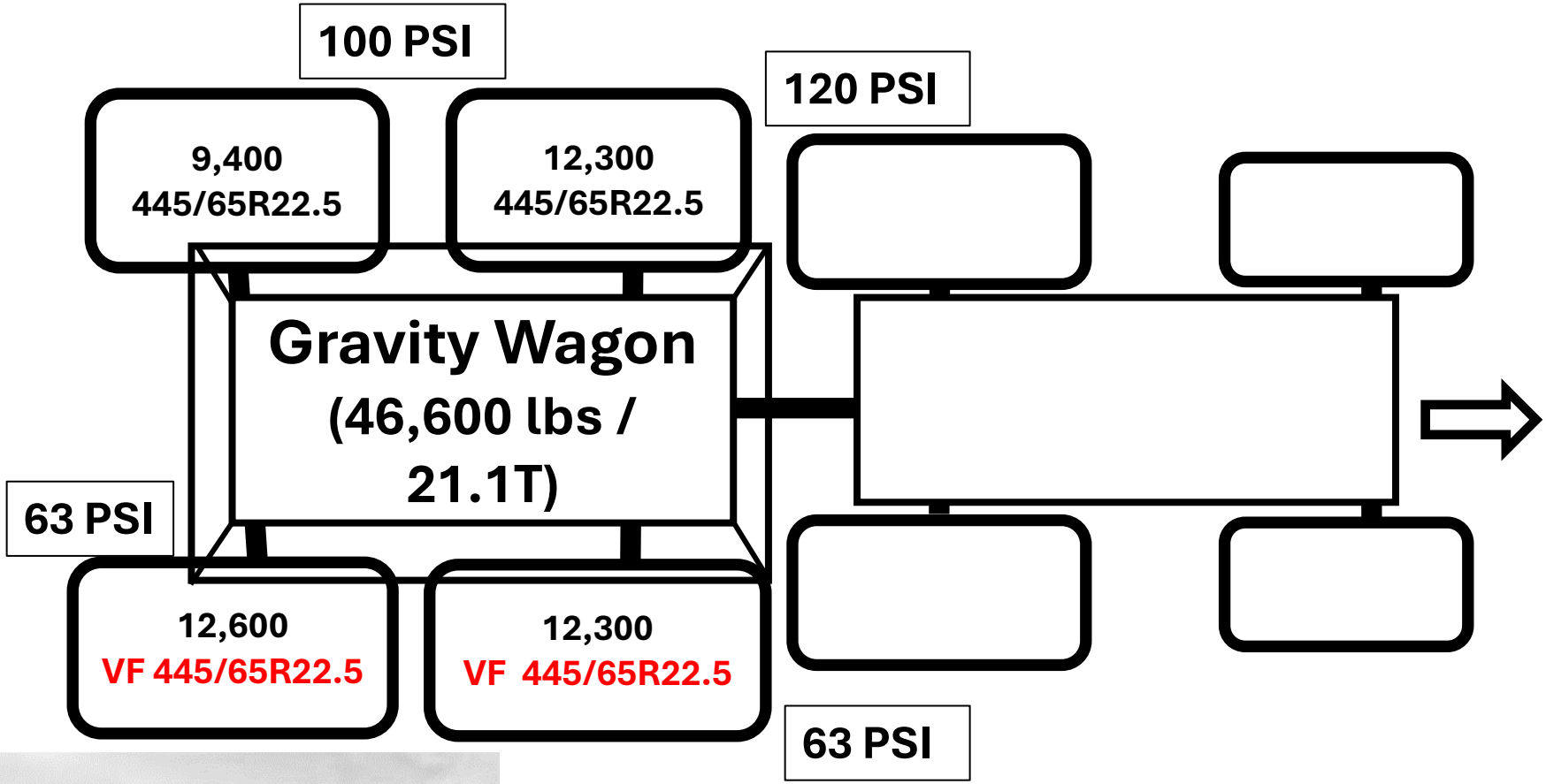

AGRI-COVER
Fingal Farm Supply Limited
35
50' SPREAD

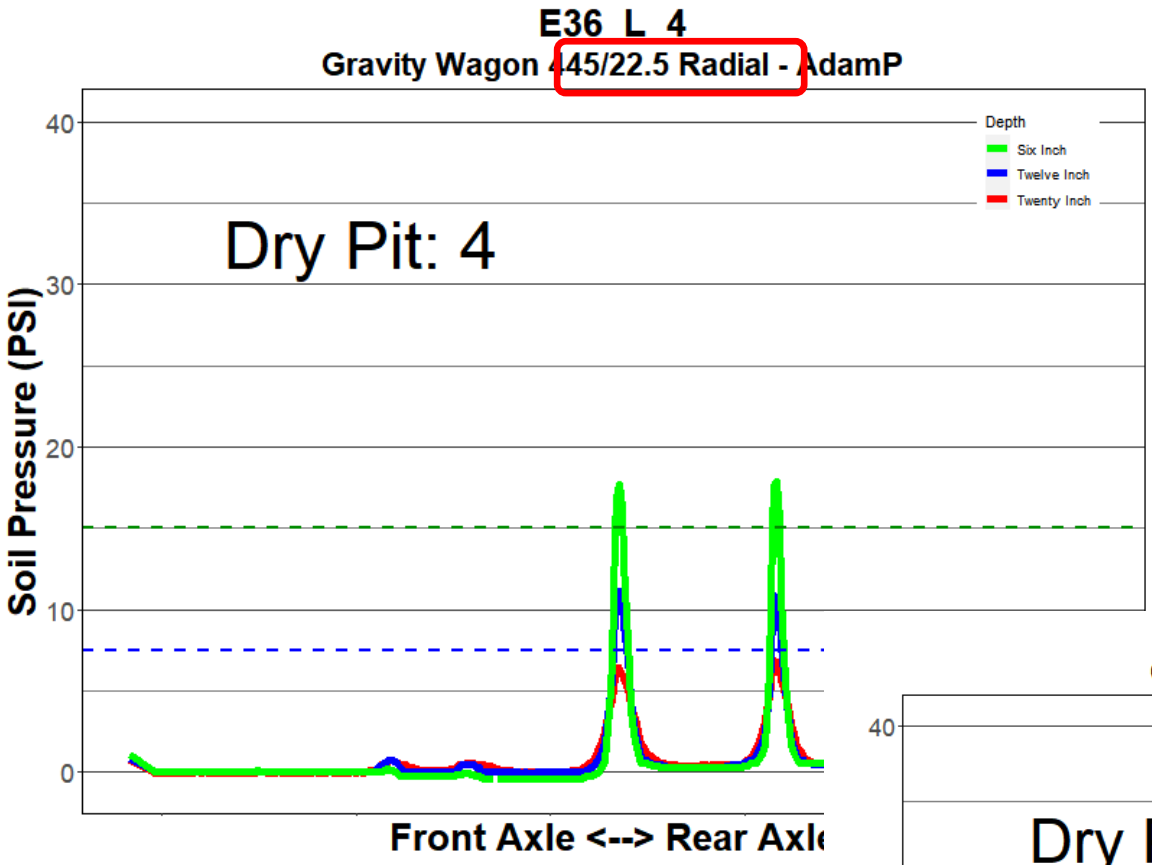
2019 Elgin Soil and Crop Compaction Event

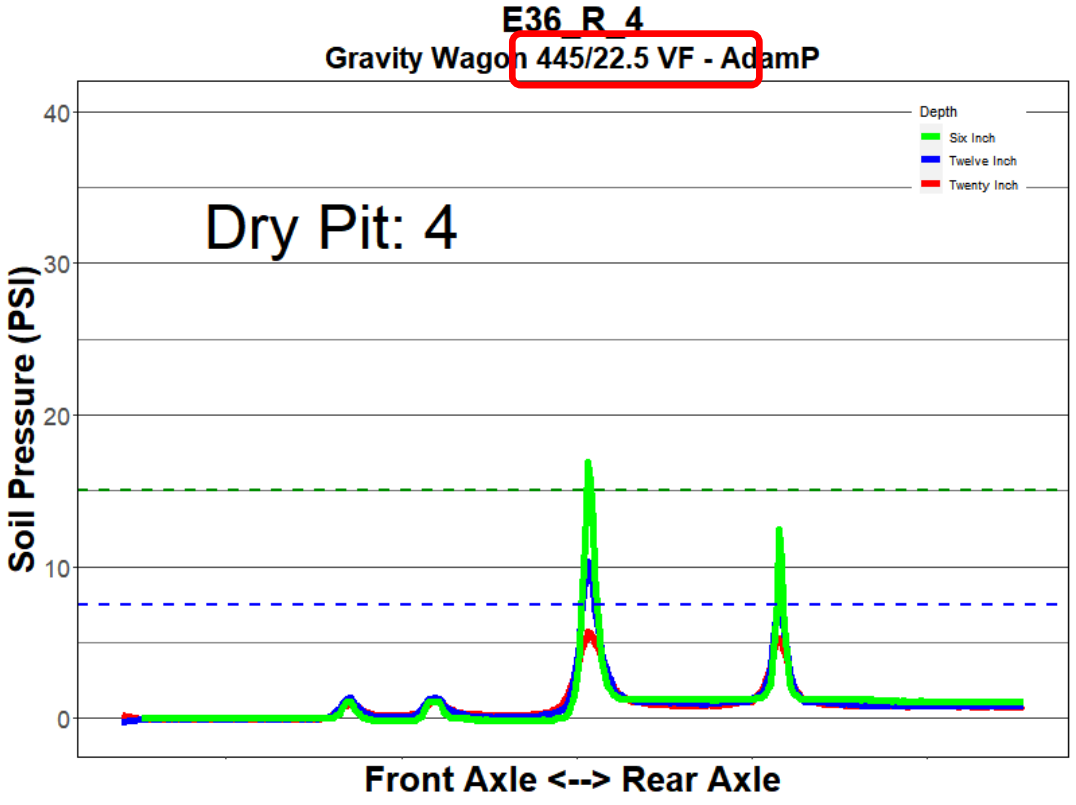
Exhibit: E36
Standard Gravity Wagon w 445/65R22.5 Bias vs VF445/65R22.5 Radial Tires


RJ EQUIPMENT
36
L+R
HORST
445/65R22.5
VF 445/65R22.5
RJ EQUIPMENT
HORST
VF 445/65R22.5

Exh: E36


100 PSI
120 PSI
9,400
445/65R22.5
12,300
445/65R22.5
Gravity Wagon
(46,600 lbs /
21.1T)
63 PSI
12,600
VF 445/65R22.5
12,300
VF 445/65R22.5
63 PSI


E36_L_4
Gravity Wagon 445/22.5 Radial - AdamP
Depth
Six Inch
Twelve Inch
Twenty Inch
Dry Pit: 4
Soil Pressure (PSI)
40
30
20
10
0
Front Axle <--> Rear Axle


E36_R_4
Gravity Wagon 445/22.5 VF - AdamP
Depth
Six Inch
Twelve Inch
Twenty Inch
Dry Pit: 4
Soil Pressure (PSI)
40
30
20
10
0
Front Axle <--> Rear Axle

Plot Comments – E36

- This shows a typical gravity wagon with a normal radial vs a VF tire.
- Gravity wagons are routinely configured with insufficient rubber on the ground for the weight they typically carry
- The final peak on the plot E36_R_ 4 would be expected to be higher. However the challenge of aligning both left wheels over the sensor meant that it did not measure under the center of the tread face.
- There was not a substantial difference between these two tires in this test due to the high inflation pressure of both types of tires.
- Under wetter conditions we would expect better response from the VF tire do to lower inflation PSI.


RJ EQUIPMENT
36
L+R


RJ EQUIPMENT

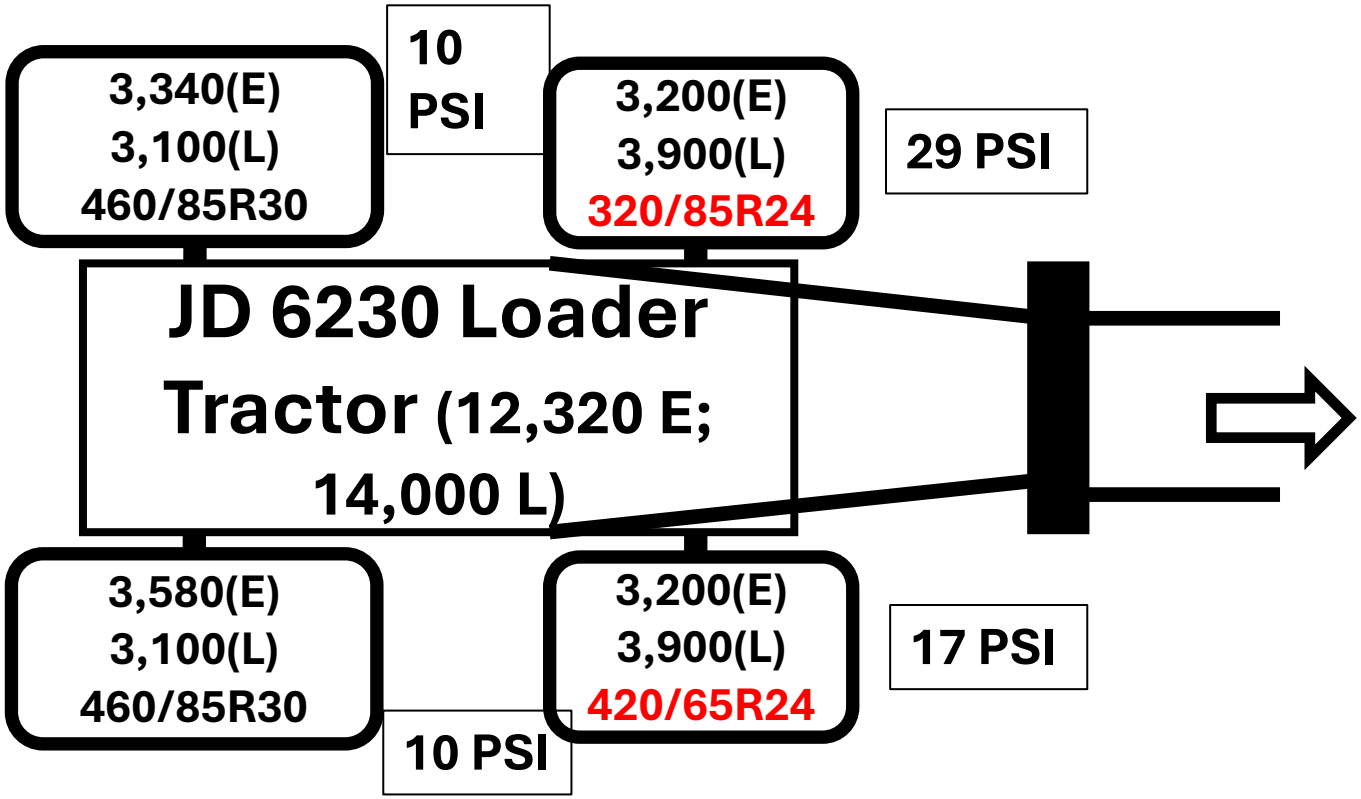

RJ EQUIPMENT
36
L+R
37

2019 Elgin Soil and Crop Compaction Event

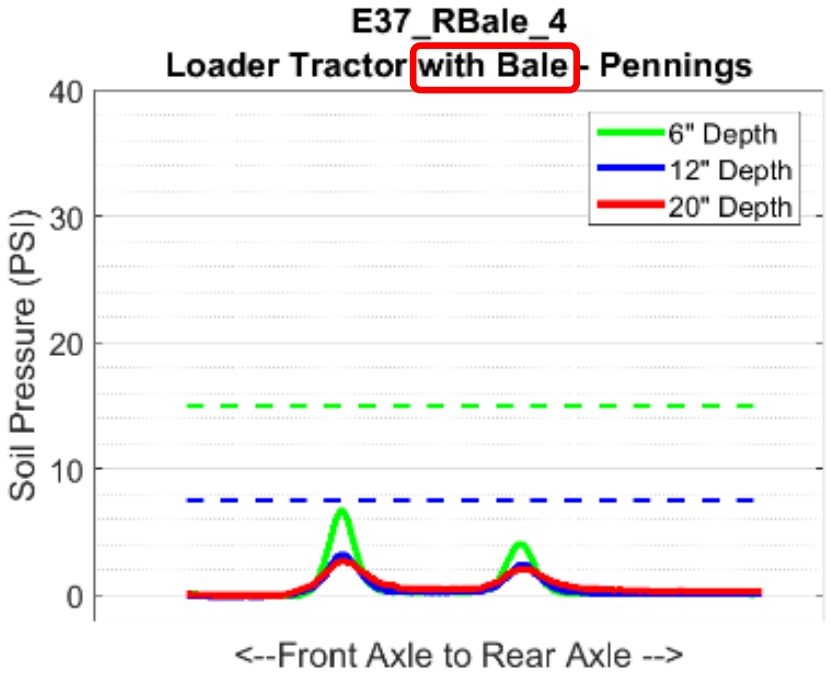
Exhibit: E37
Row Crop JD 6230 Utility Loader Tractor w/wo Hay Bale

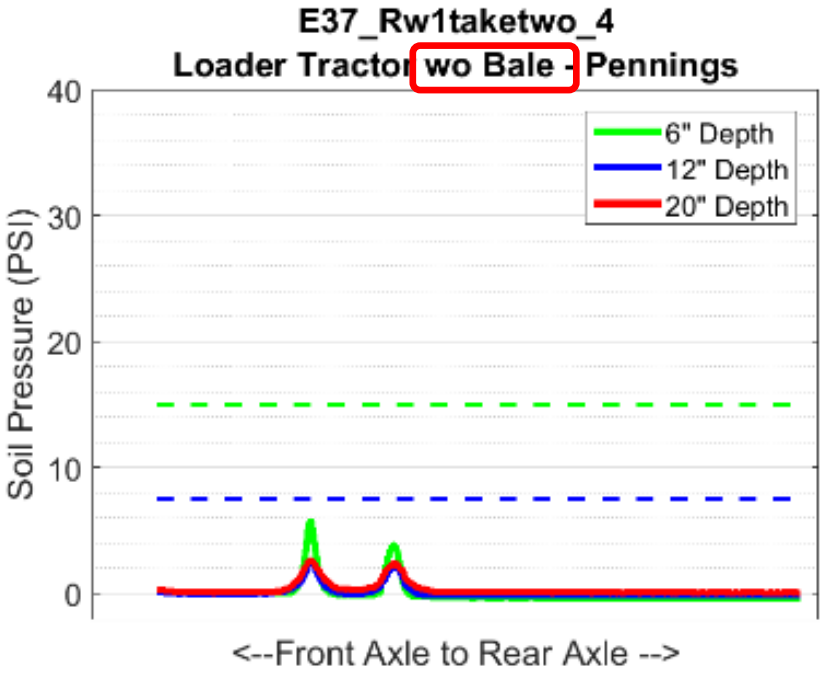

6230

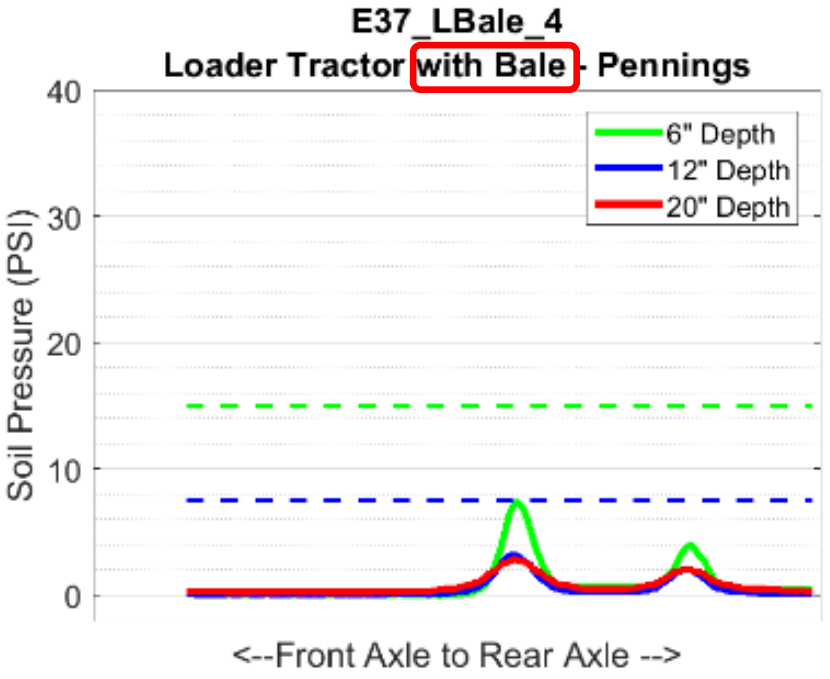
Exh: E37

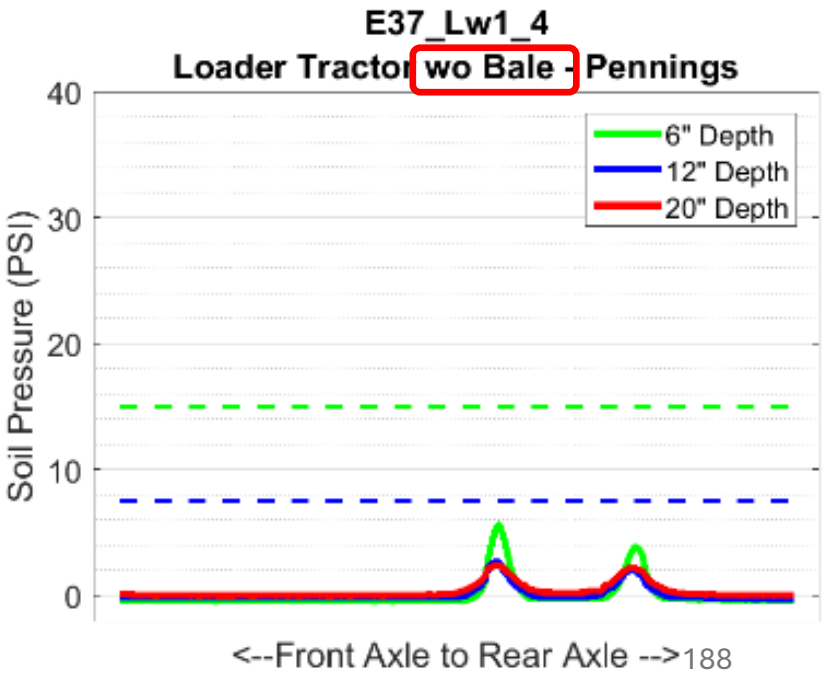


Loader: E=empty; L=Loaded (large round bales)


E37_RBale_4
Loader Tractor with Bale - Pennings
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E37_Rw1taketwo_4
Loader Tractor wo Bale - Pennings
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E37_LBale_4
Loader Tractor with Bale - Pennings
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E37_Lw1_4
Loader Tractor wo Bale - Pennings
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->

Plot Comments – E37

- This is a small loader tractor with and without a bale.
- The front right tire was slightly wider than the left side but there was not much of a decrease in soil stress with the wider tire.
- In both instances the bale added load to the front tire.

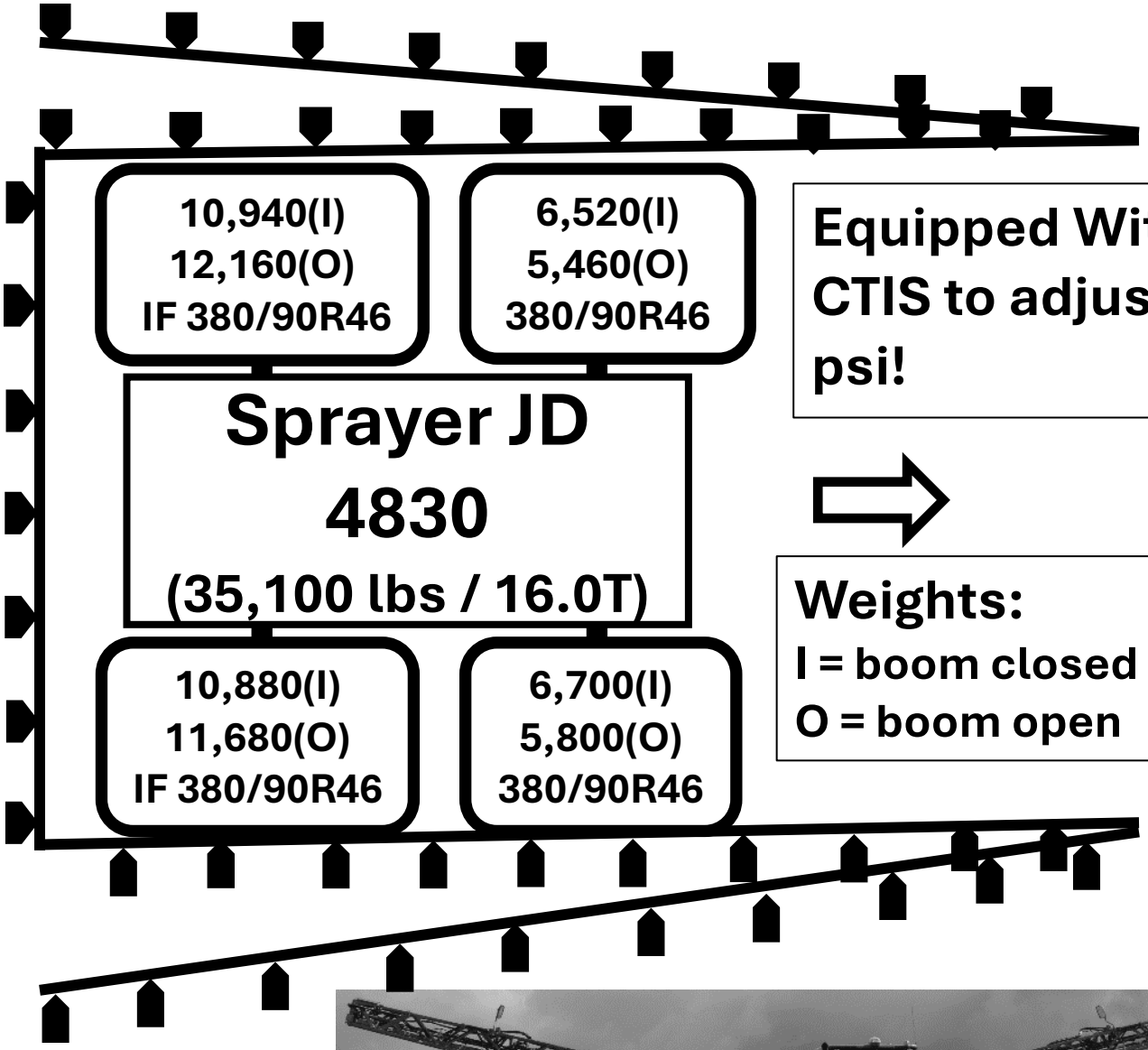

37
W1+2

2019 Elgin Soil and Crop Compaction Event

Exhibit E39
JD 4830 Self Propelled Sprayer w 380/90R46 Front
vs
IF 380/90R46 Rear + CTIS

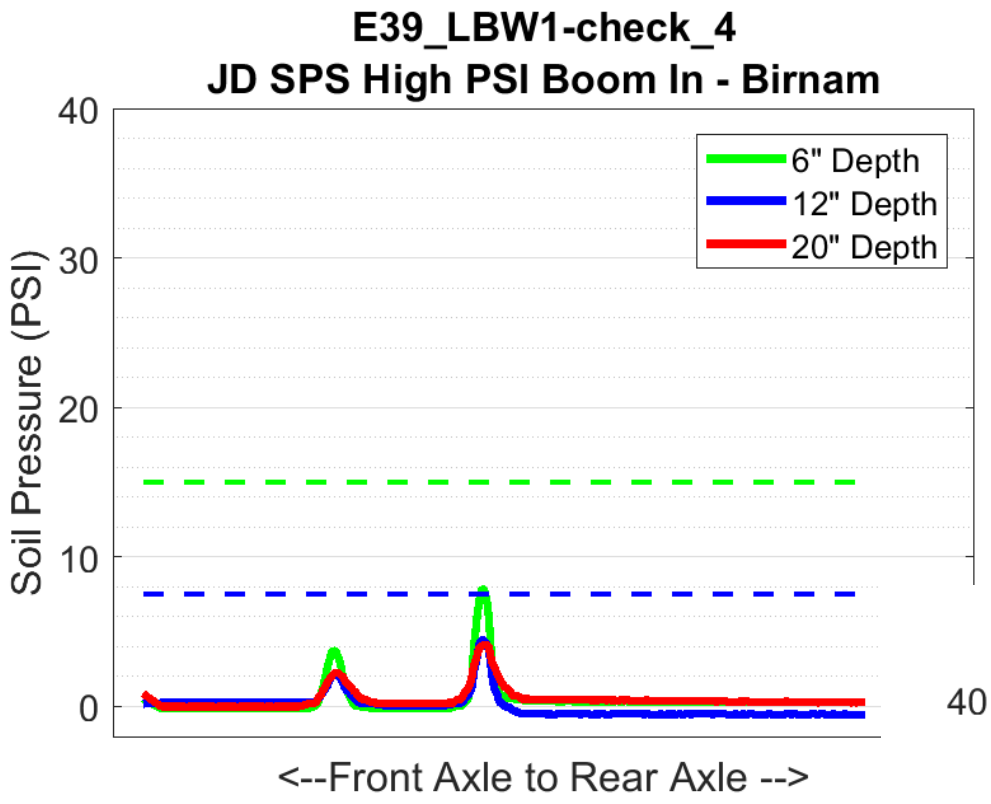

39
A+B
W1+2
PTG
TreadRight
RDS/radial 2L with digital control
Dual line tire inflation system for
tractors with full-floating axle
• Actual service life of more than
10,000 tractor operating hours
• Switchable tire valves with
anti-kickback attachment
(line system at zero pressure when switched off)
• No loss of tire pressure if the line comes off
PROVIDES UP TO:
6% BETTER YIELD FROM LESS SOIL COMPACTION
10% BETTER FUEL ECONOMY
20% BETTER TIRE WEAR
20% MORE TRACTION

Exh: E39

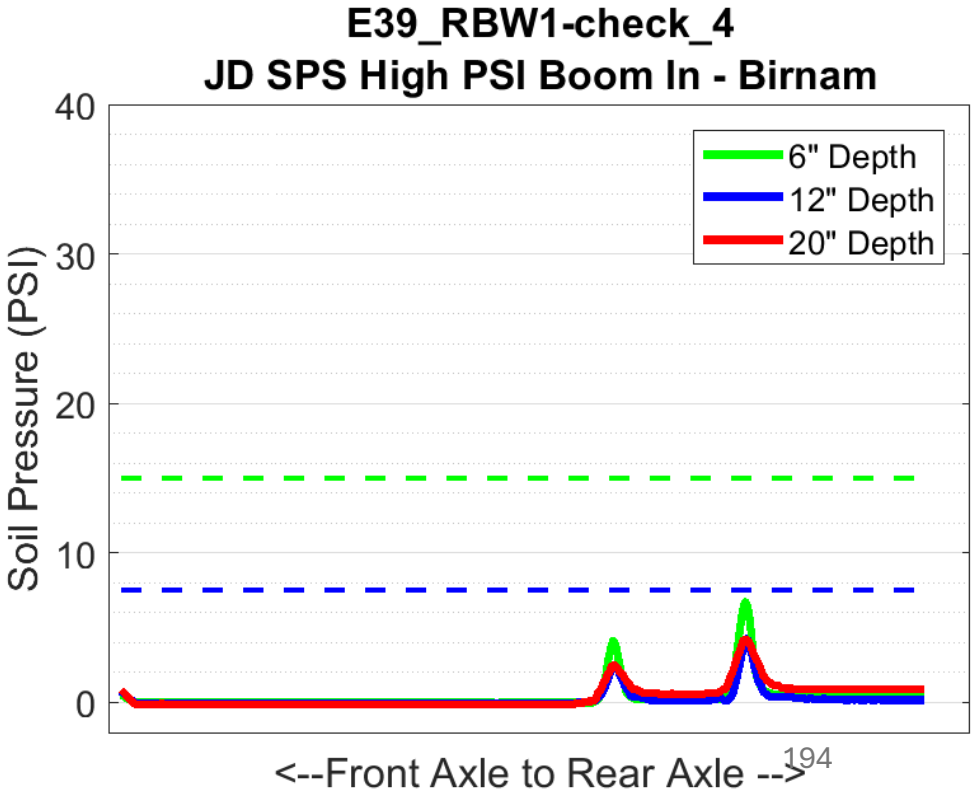


Equipped With CTIS to adjust psi!

Weights:
I = boom closed
O = boom open



Front – Radial 380/90R46
Rear – IF 380/90R46



Plot Comments - 39

- This sprayer was equipped with CTIS however it was not used to test different tire pressures.
- The plots show the balance between the left side and right side tires.
- The peaks on the plot show the balance of the machine with most of the weight on the rear tire (last peak on plot).
- The boom was in the folded position for this test, so it is expected that more weight would be transferred to the rear axle when the boom is unfolded.


4830


10949


TreadRight

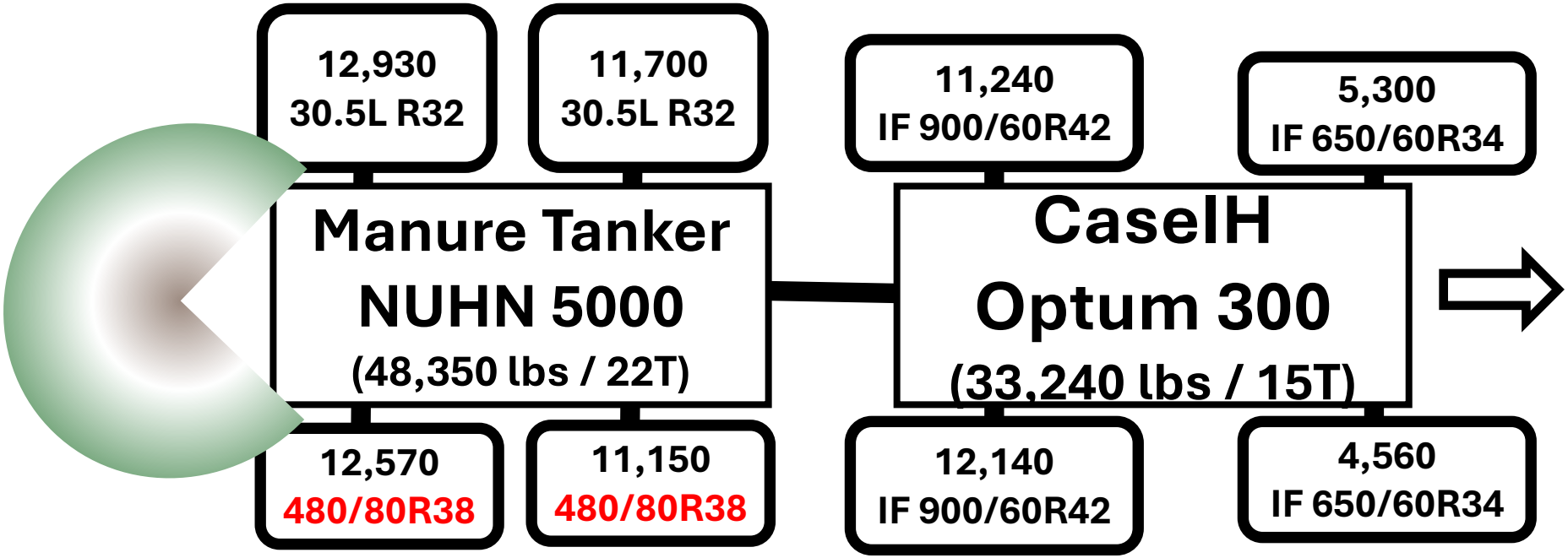
2019 Elgin Soil and Crop Compaction Event

Exhibit: E40

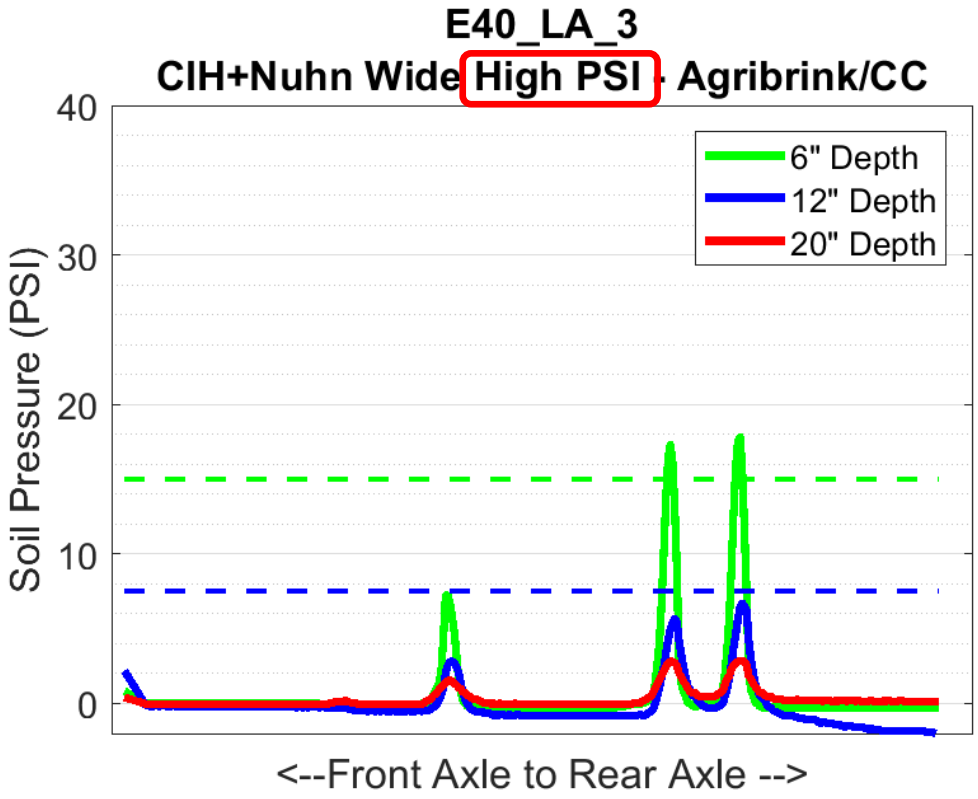
Nuhn Tandem 5000 Manure Tanker w 30.5LR32 Bias vs 480/80R38 Radial + CaseIH Magnum 300 RC Tractor With CTIS on Both


40
L+R
A+B
300
HÜRH

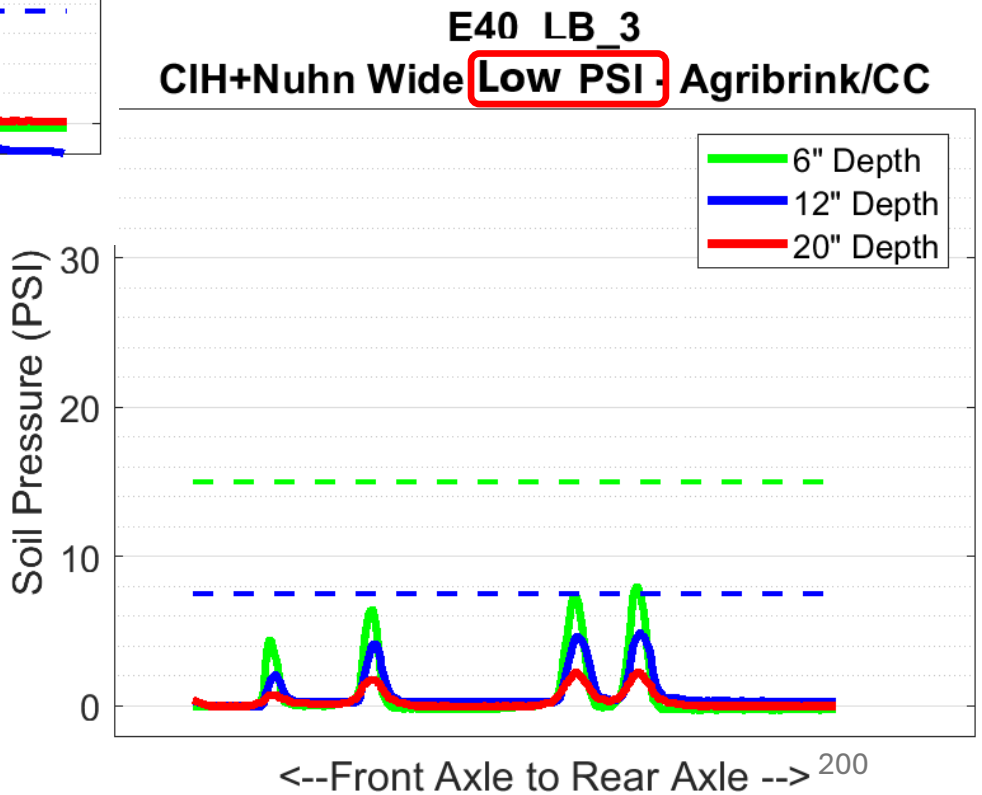
Exh: E40

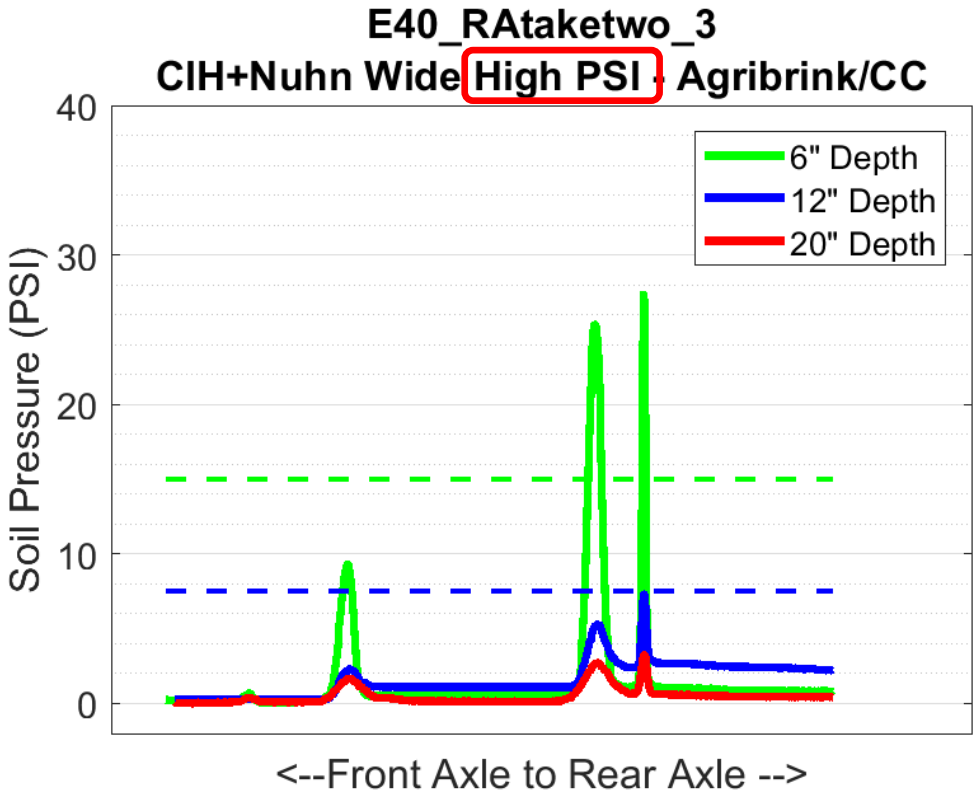


CTIS Equipped
- In field @ 12 PS
- On Road @ 40 PSI

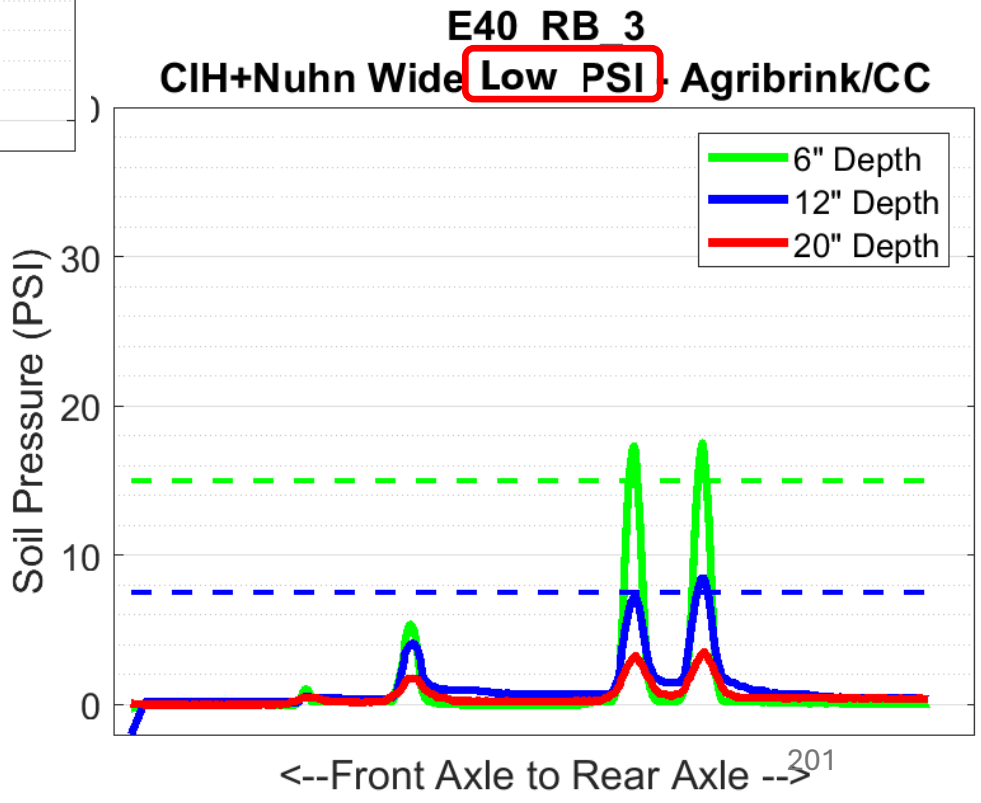


30.5LR32 Tires





480/80R38 Tires



Plot Comments – E40

- This Unit is another good example of the advantages or Central Tire Inflation (CTIS)
- On both the left and right sides the plots show a reduction in soil pressure when tire pressure was lowered.
- This particular tire on the right hand side is a very round tread face and generates a high soil stress in the center of the tread face. This tire created a deep rut over the sensors despite being a radial tire.


NUHN
A.I.D. Control

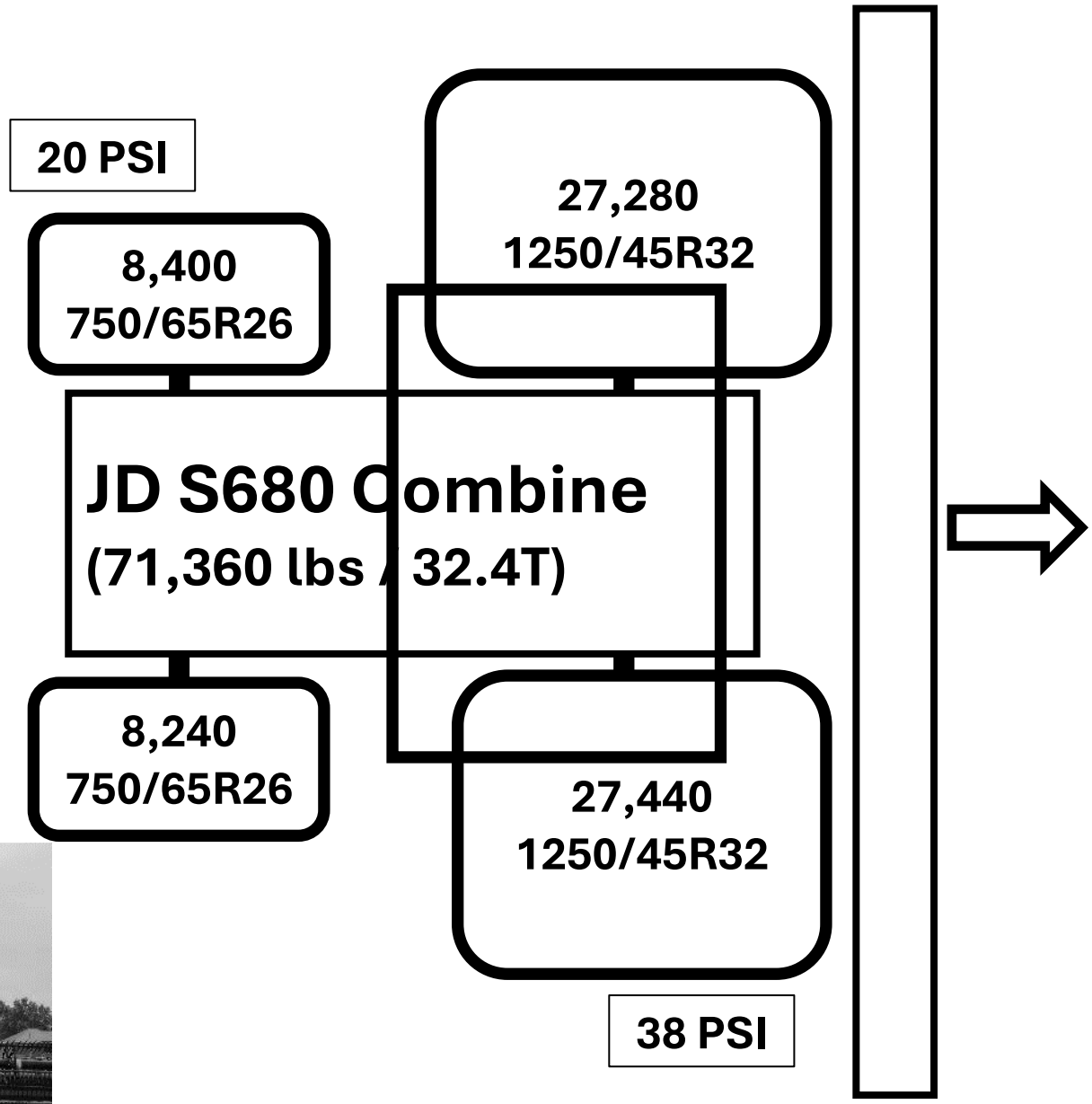

NUHN

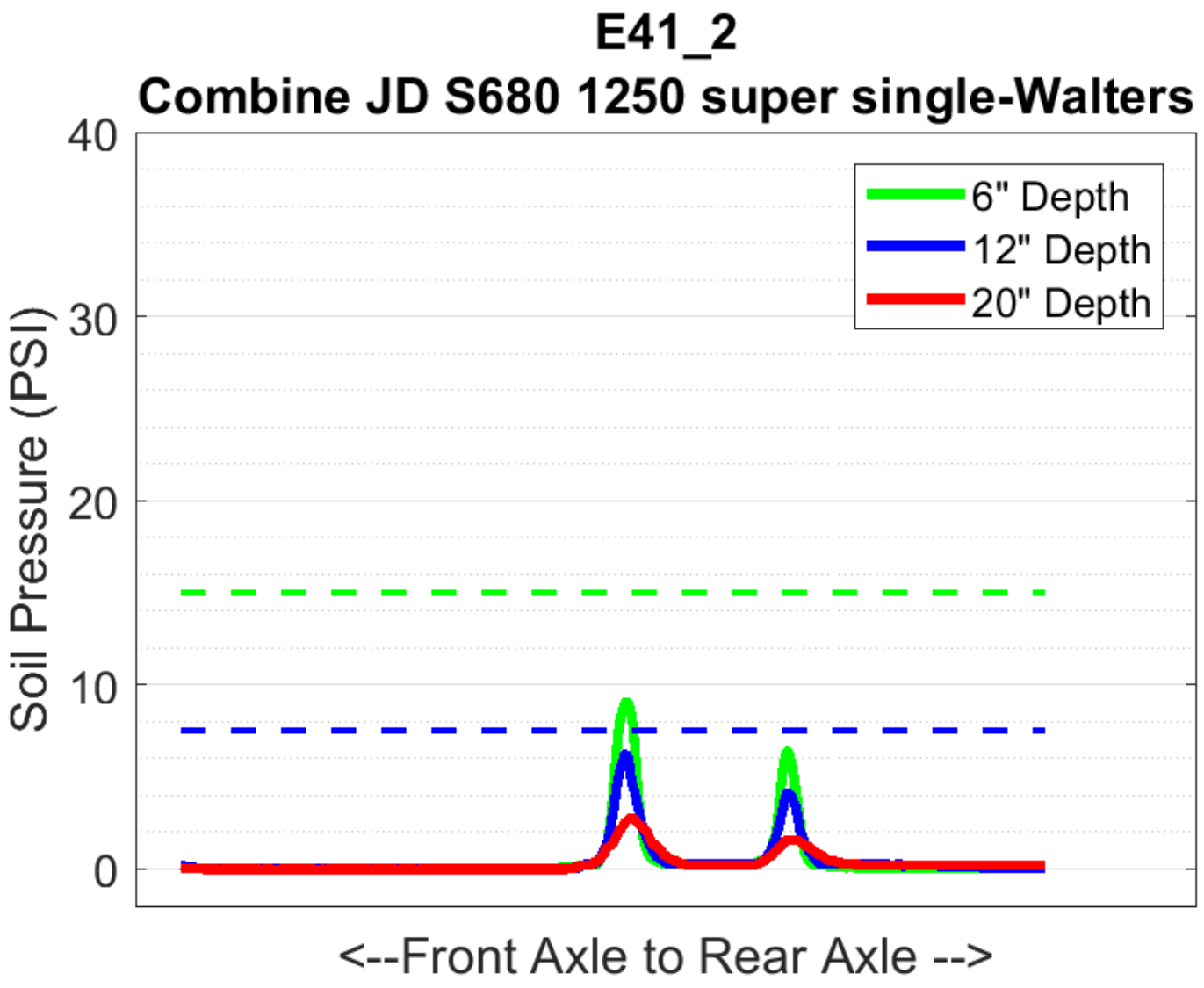
2019 Elgin Soil and Crop Compaction Event

Exhibit: E41
JD S680 Combine with 1250/45R32 Super Singles


41

Exh: E41


20 PSI
8,400
750/65R26
27,280
1250/45R32
JD S680 Combine
(71,360 lbs / 32.4T)
8,240
750/65R26
27,440
1250/45R32
38 PSI


E41_2
Combine JD S680 1250 super single-Walters
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->

Plot Comments – E41

- This combine with the large singles showed a relatively low soil pressure at 6” despite having a tire pressure that is well above 20 PSI.
- The large footprint of this tire helps the tire float.
- There is still a high pressure being developed at 12” and 20” due to the total weight of the combine but like with other combines in this event, the tires were good at protecting the soil from soil compaction given the current conditions on test day.


MacDon
FD140

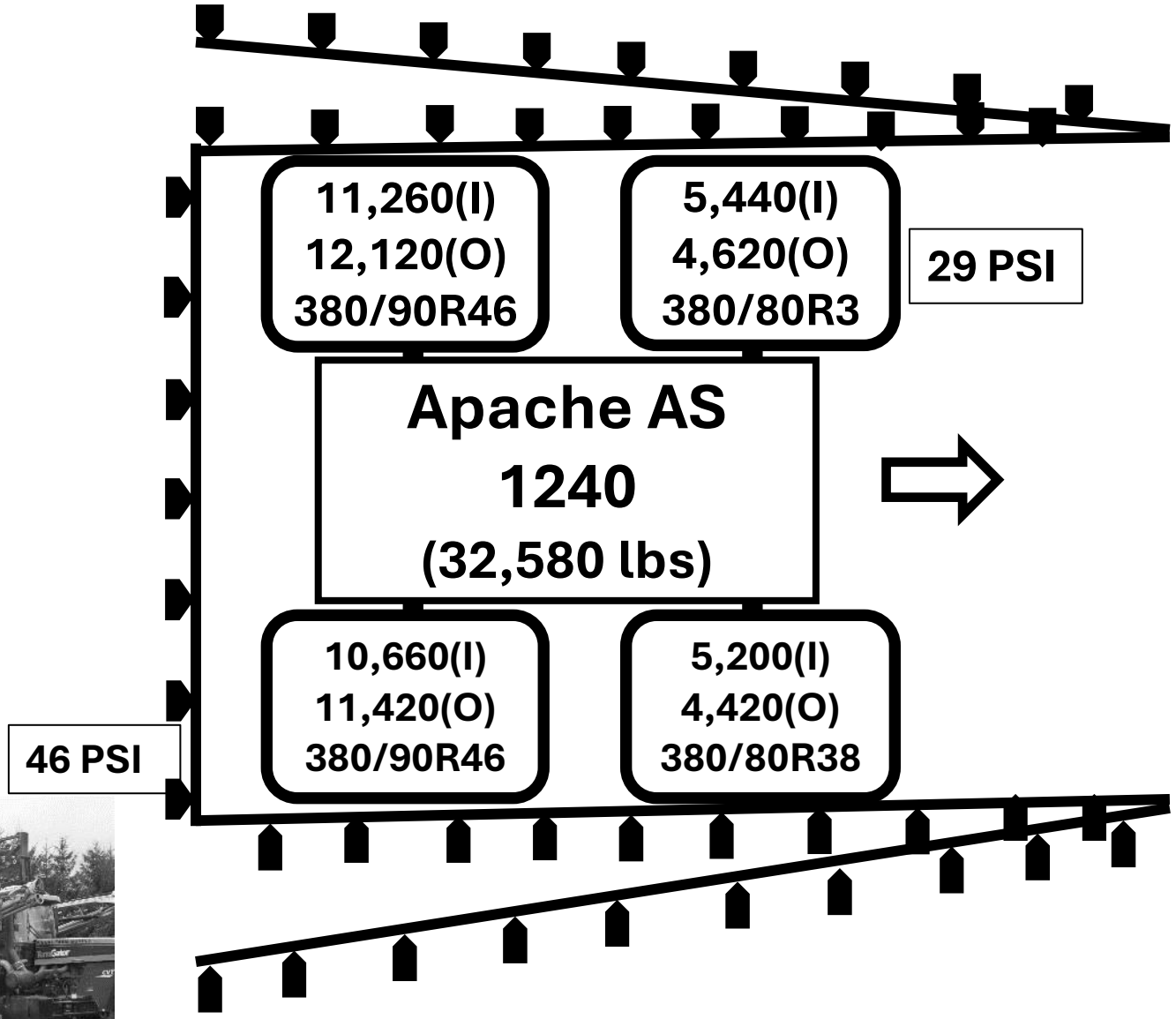

JOHN DEERE

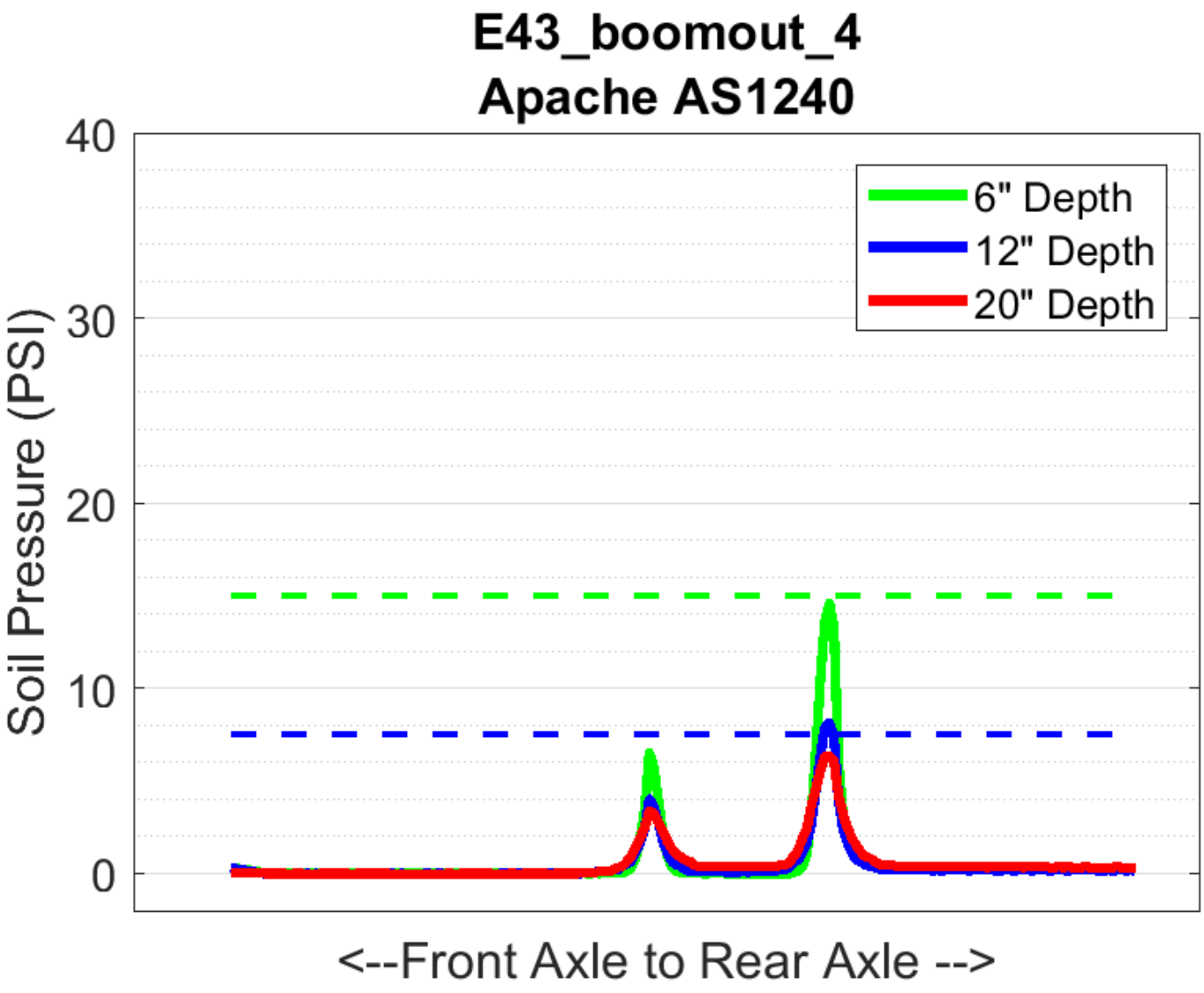
2019 Elgin Soil and Crop Compaction Event

Exhibit: E43
Apache 1240 SP Sprayer w 380s


43
APACHE

Exh: E43


11,260(l)
12,120(O)
380/90R46
5,440(l)
4,620(O)
380/80R3
29 PSI
Apache AS
1240
(32,580 lbs)
10,660(l)
11,420(O)
380/90R46
5,200(l)
4,420(O)
380/80R38
46 PSI


E43_boomout_4
Apache AS1240
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->

Plot Comments – E43

- The machine is a self-propelled sprayer with different sized tires front and back.
- The response shows that the rear axle is much heavier than the front axle suggesting that load sharing could be improved.
- Viewing the 12” and 20” response curves it shows that the unit weight was being transferred deeper in the soil, almost to theoretical threshold because of less rubber contact area than with many SP sprayers. Using a wider set of tires or using during the dryer summer months would avoid any issues with this transfer of stress to depth.


APACHE


APACHE


APACHE


CLEANLOAD

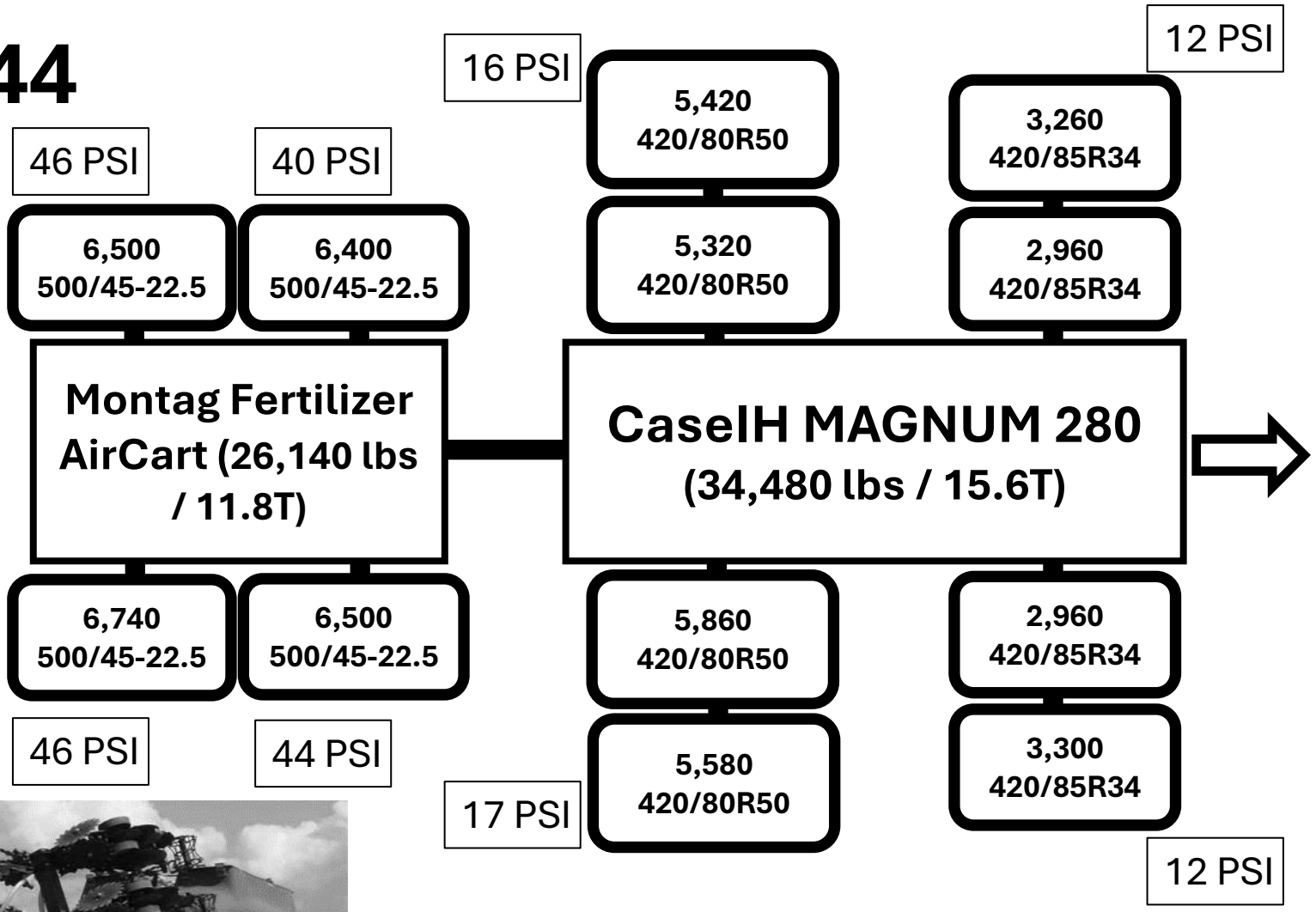
2019 Elgin Soil and Crop Compaction Event

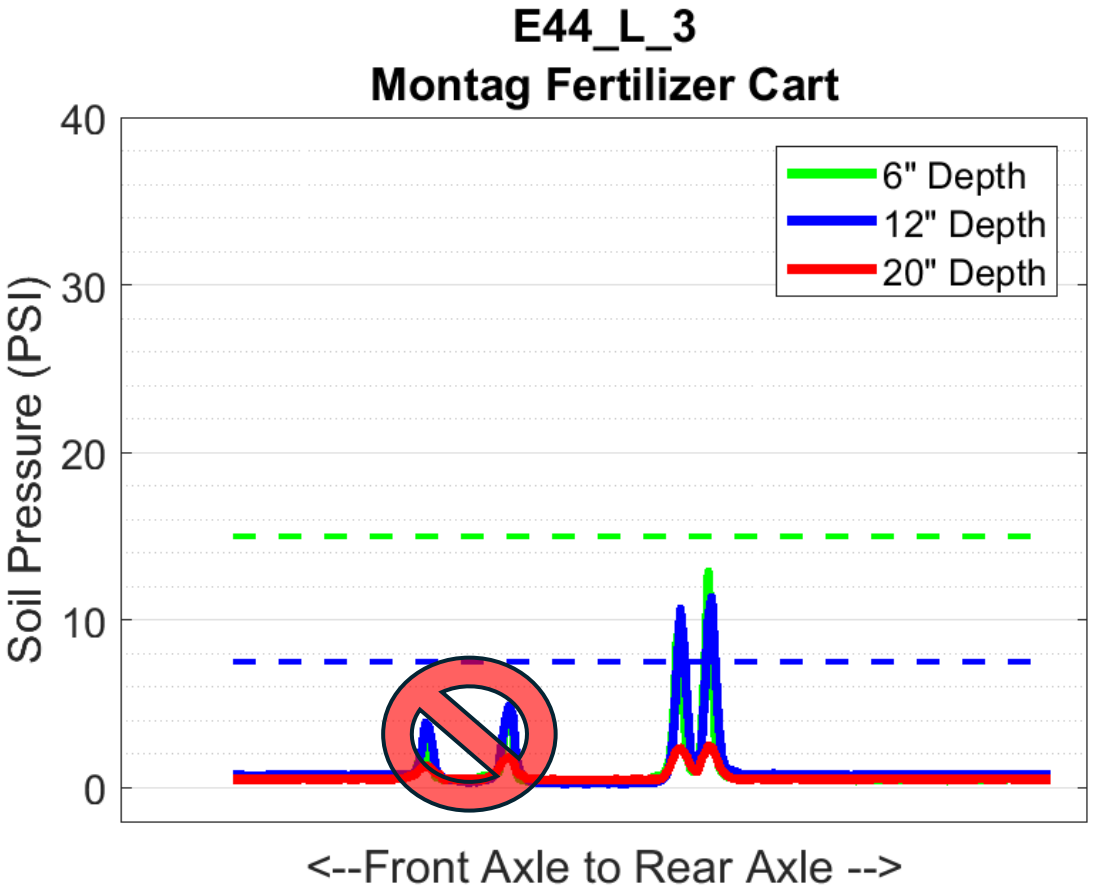
Exhibit: E44

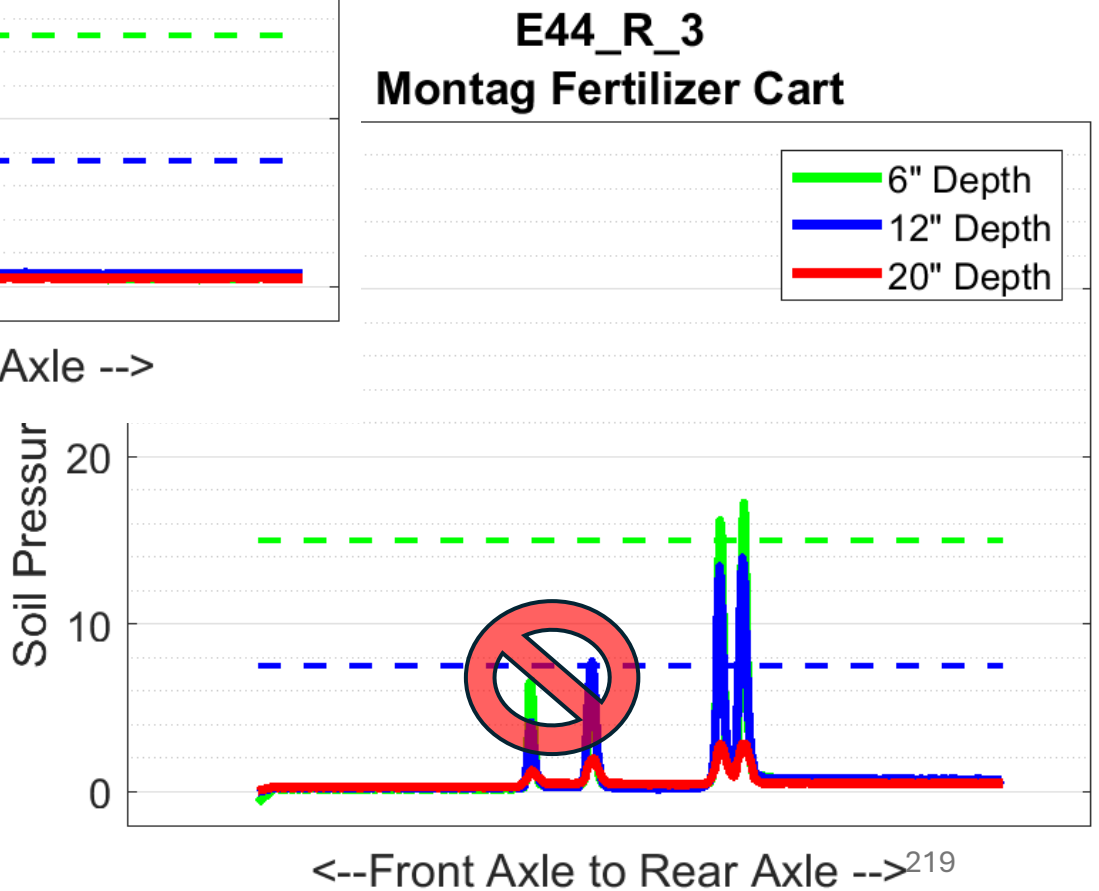
Montag Dry Fertilizer Aircart w Tandem 500/45-22.5 Bias + CaseIH 280 Row Crop Tractor w Dual 420s


CASE IH
280
MAGNUM
Montag

Exh: E44


46 PSI
40 PSI
6,500
500/45-22.5
6,400
500/45-22.5
Montag Fertilizer
AirCart (26,140 lbs
/ 11.8T)
6,740
500/45-22.5
6,500
500/45-22.5
46 PSI
44 PSI
16 PSI
5,420
420/80R50
5,320
420/80R50
CaseIH MAGNUM 280
(34,480 lbs / 15.6T)
5,860
420/80R50
5,580
420/80R50
17 PSI
12 PSI
3,260
420/85R34
2,960
420/85R34
2,960
420/85R34
3,300
420/85R34
12 PSI


E44_L_3
Montag Fertilizer Cart
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E44_R_3
Montag Fertilizer Cart
6" Depth
12" Depth
20" Depth
Soil Pressur
20
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E44

- This shows the response of the air cart (last two peaks on plot)
- The response is similar on both sides of the machine suggesting even weight distribution.
- The lower response on the left side was due to misalignment with the sensor.
- The tractor tires didn’t line up to cross the sensors.
- Bias ply tires should be avoided as shown by the6” and 12” sensors receiving over theoretical threshold stress! The total load weight wasn’t enough to drive that stress to 20” but if the cart was fully loaded it might be different.

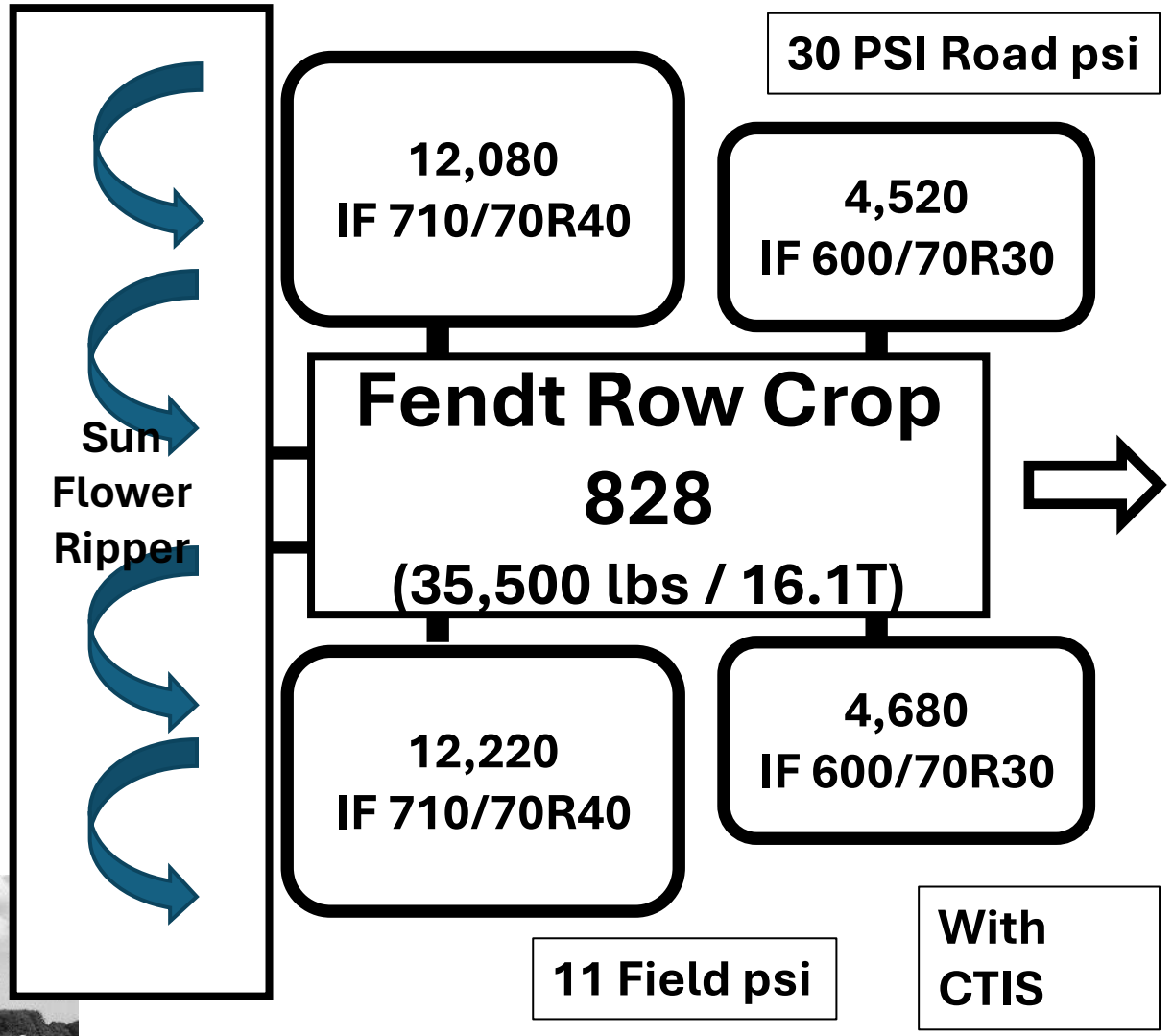

CASE IH
280
MAGNUM
44
5320-1
5420-0
2,960-1
3,300-0

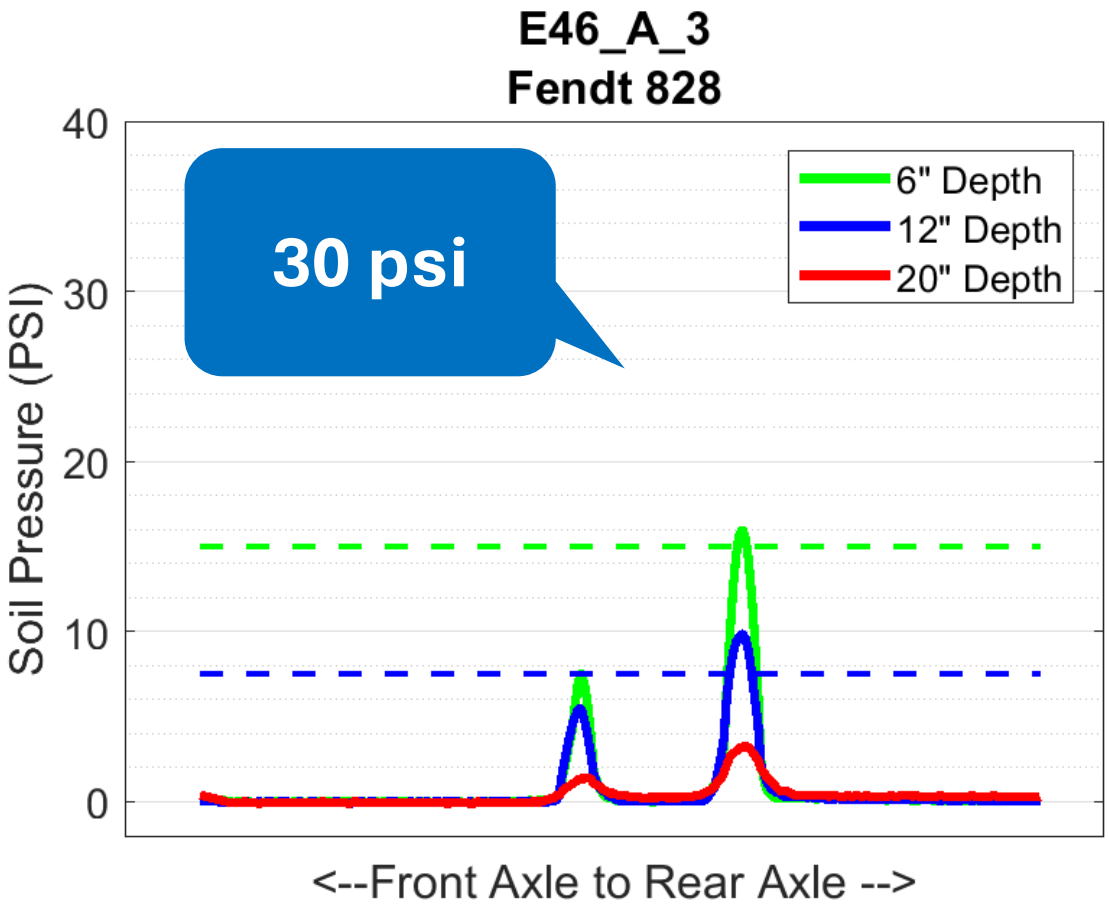
2019 Elgin Soil and Crop Compaction Event

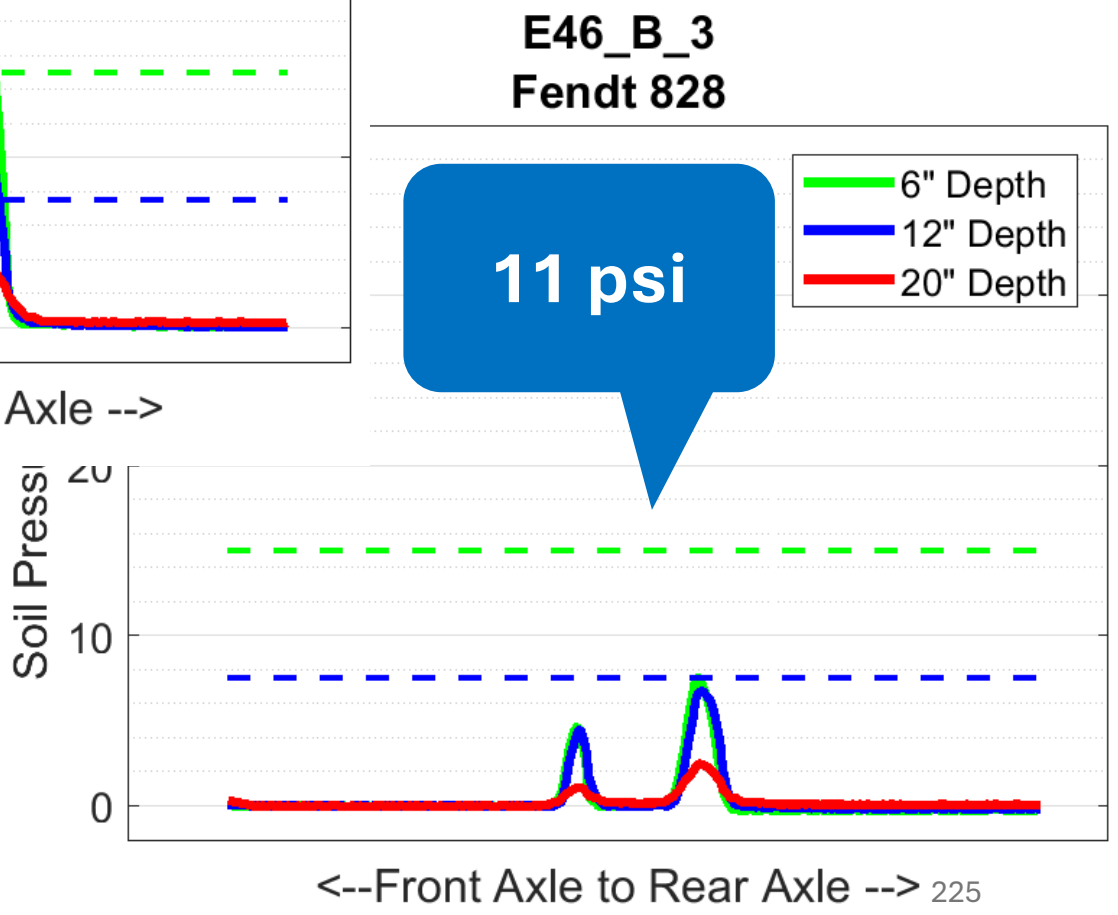
Exhibit: E46
Fendt 828 Row Crop Tractor with IF 600/710 Tires + CTIS


FENDT
46

Exh: E46


30 PSI Road psi
12,080
IF 710/70R40
4,520
IF 600/70R30
Sun
Flower
Ripper
Fendt Row Crop
828
(35,500 lbs / 16.1T)
12,220
IF 710/70R40
4,680
IF 600/70R30
11 Field psi
With
CTIS


E46_A_3
Fendt 828
30 psi
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
40
30
20
10
0
<--Front Axle to Rear Axle -->


E46_B_3
Fendt 828
11 psi
6" Depth
12" Depth
20" Depth
10
0
<--Front Axle to Rear Axle -->

Plot Comments – E46

- The reduced tire pressure in the Field inflated tires (11 psi) on this machine reduces soil stress at the 6 inch depth (E46_B_3), the (E46_A_3) is the same tires inflated to 30psi for road travel by the onboard CTIS system.
- The data supports the advantages of employing CTIS to optimize tire pressures for road and field operations
- There is a slight reduction at the 12 inch depth
- There is no real noticeable reduction at the 20 inch depth because the total unit weight is not excessive.


FENDT


4710


FENDT 828
FENDT
VARIO GRIP

2019 Elgin Soil and Crop Compaction Event

Exhibit: E47
Claas Lexion 8800 Class 10 Tracked Combine


CLAAS
47

Exh: E47

14 PSI

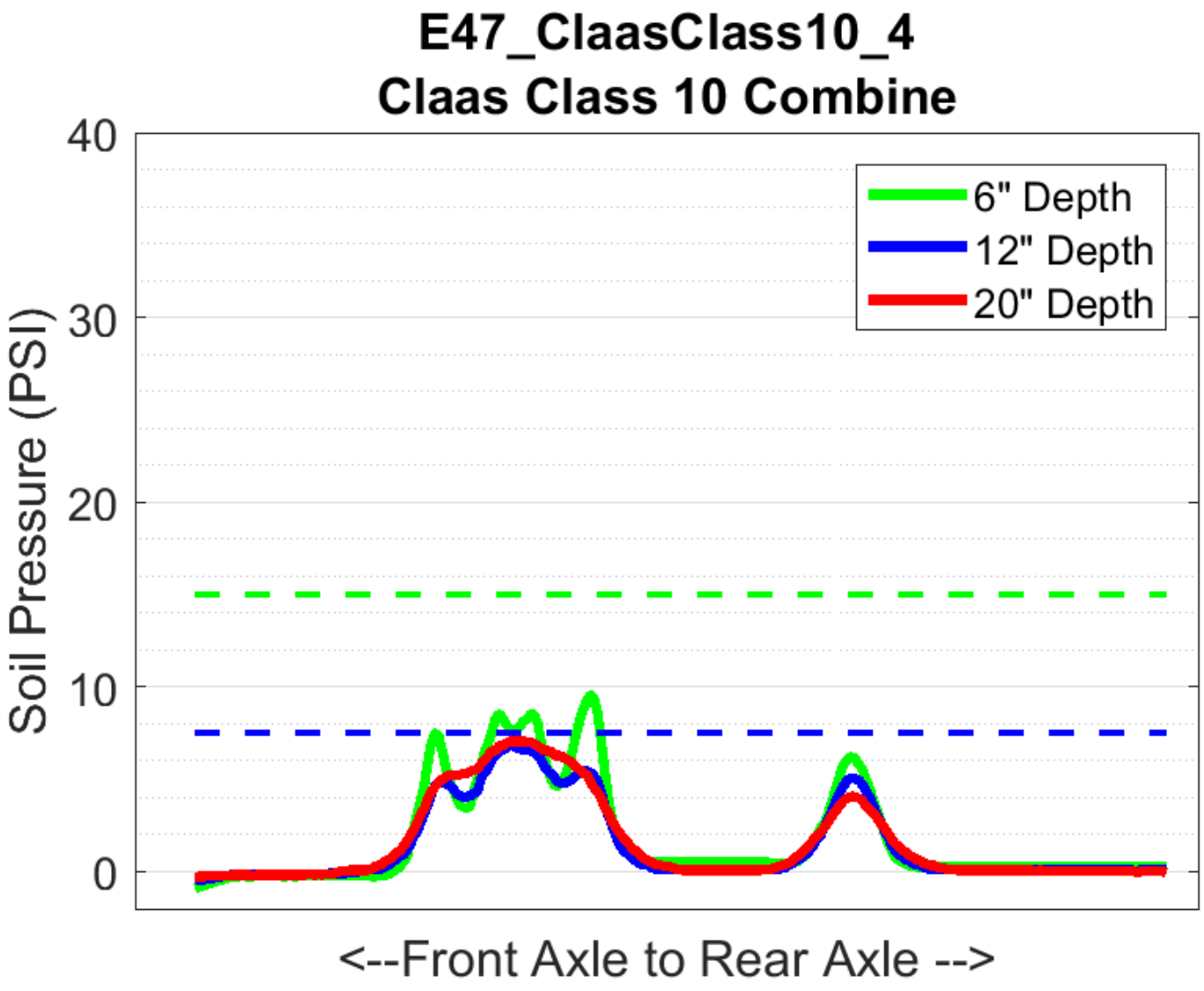
9,100
710/65R30

34,860
Tracks 6’x36’’

Combine
Lexion 8800
(90,720 lbs / 41.1T)

9,200
710/65R30

37,560
Tracks 6’x36’’


E47_ClaasClass10_4
Claas Class 10 Combine
Soil Pressure (PSI)
40
30
20
10
0
6" Depth
12" Depth
20" Depth
<--Front Axle to Rear Axle -->

Plot Comments – E47

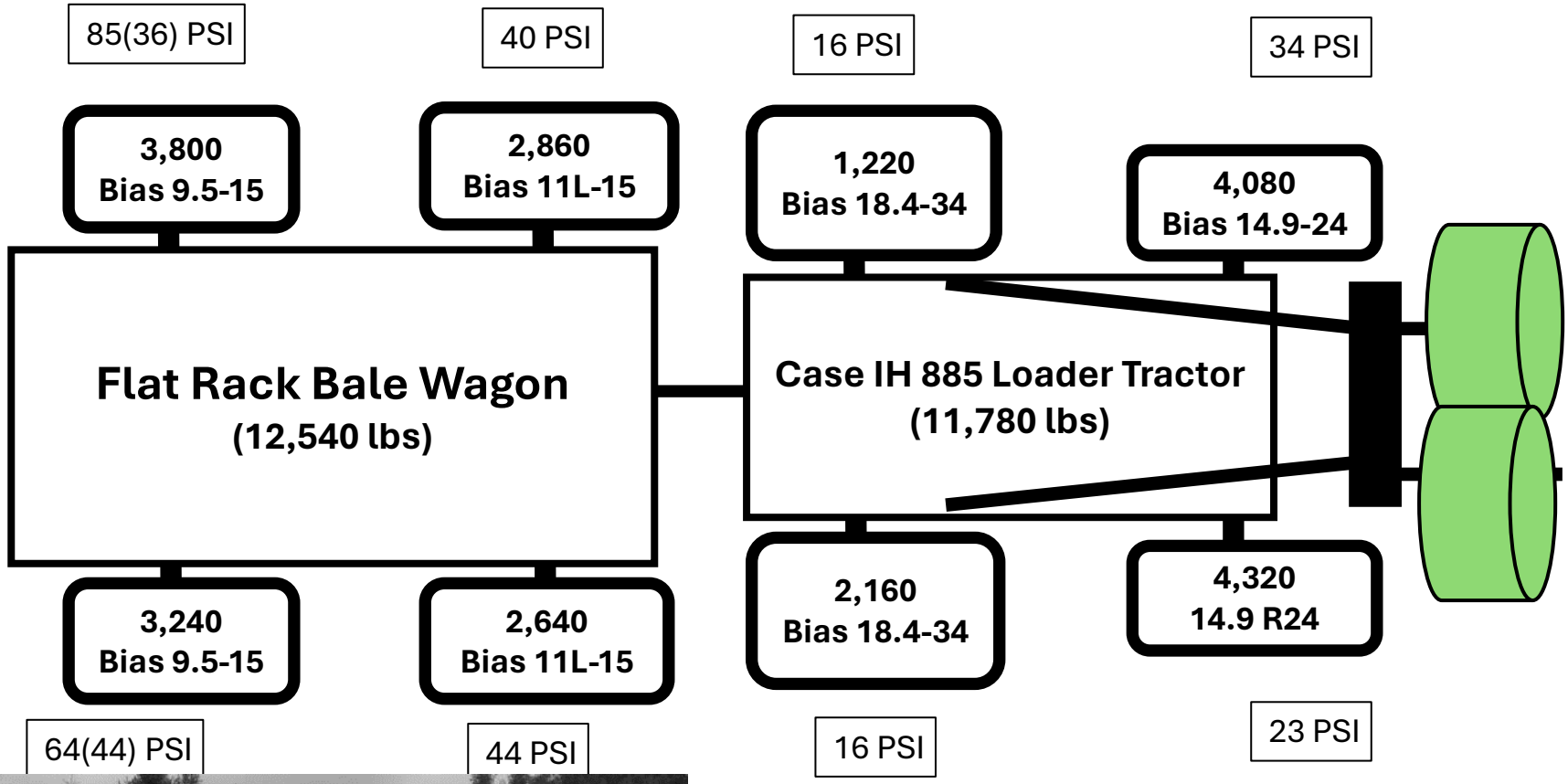
- The tracks on this combine do a good job to limit pressure at 6 inches
- The excessive weight of this combine means that soil stress deeper in the profile will be high regardless of the amount of flotation from the tracks. Note the blue and red lines approaching the dotted blue line which is the theoretical threshold for these depths.
- The rear tire in this instance looks like it is not applying much load to the soil but notice that the heavy corn head is counterbalancing the rear axle but again the blue and red lines are approaching the threshold.

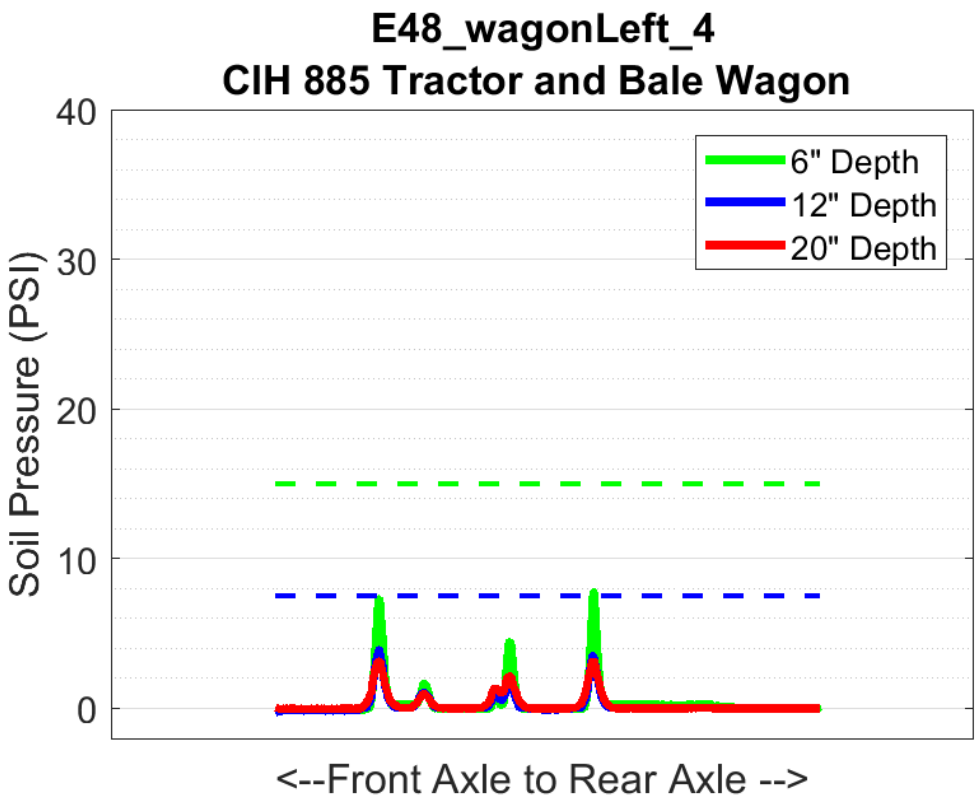

LEXION
47

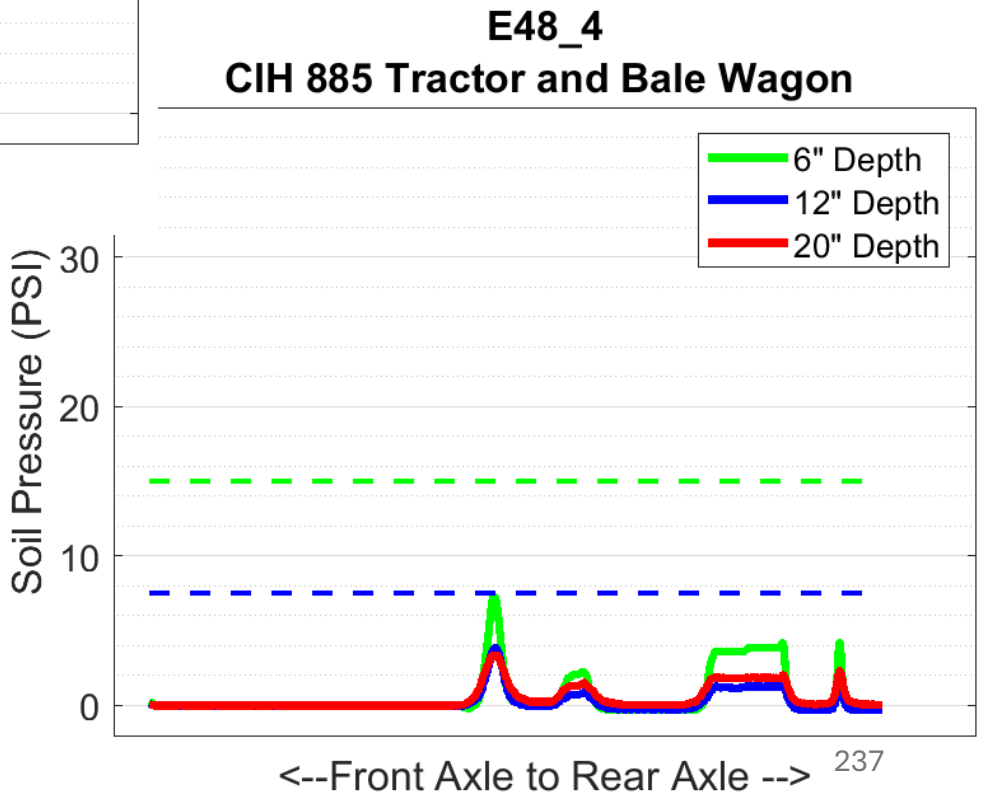
2019 Elgin Soil and Crop Compaction Event

Exhibit: E48
Flat Rack Hay Wagon and CaseIH 885 Loader Tractor

Exh: E48


85(36) PSI
40 PSI
16 PSI
34 PSI
3,800
Bias 9.5-15
2,860
Bias 11L-15
1,220
Bias 18.4-34
4,080
Bias 14.9-24
Flat Rack Bale Wagon
(12,540 lbs)
Case IH 885 Loader Tractor
(11,780 lbs)
3,240
Bias 9.5-15
2,640
Bias 11L-15
2,160
Bias 18.4-34
4,320
14.9 R24
64(44) PSI
44 PSI
16 PSI
23 PSI


E48_wagonLeft_4
CIH 885 Tractor and Bale Wagon
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
40
<--Front Axle to Rear Axle -->


E48_4
CIH 885 Tractor and Bale Wagon
6" Depth
12" Depth
20" Depth
Soil Pressure (PSI)
0
10
20
30
<--Front Axle to Rear Axle -->

Plot Comments – E48

- The vehicle was challenging to get aligned with the sensor due to the wagon axles not being perfectly aligned.
- The tires on the wagon and the tractor had similar weights
- The stress for the wagon tires would be expected to be much higher than the tractor in this instance.
- Notice the consistent level of pressure at the 20 inch depth.