



# Considerations in Choosing the Right After-Market Tractor Seat Cushion

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# Session Description

AgrAbility professionals are asked to provide advice when selecting after-market cushions for additional support, comfort, and skin protection on the tractor seat.

The needs of different users in selecting the best cushion for their situation is made difficult, since there is very little research on the subject.

This session will help AgrAbility professionals determine situations where general cushions may suffice, and where they may want to seek consultation with seating specialists.





# Tractor operations

- Operators carry out numerous actions:
  - Steering
  - Operating levers
  - Operating buttons
  - Applying brakes and clutch pedals
  - Look behind
  - Maneuver machine
  - All from a seated posture which creates a pattern of loading on the body joints of the operator
  - Accumulation of long hours= back pathologies, nerve and vascular issues
    - Romano, et al. (2019). Journal of Industrial Ergonomics

# Research on Tractor Seat Comfort

- Romano et al. (2019)
- Tested three tractor seats: low cost (mech. Susp), med. cost (pneumatic), high cost (auto-adjusted pneumatic)
- Tested during ploughing, harrowing, and haying
- N=8 healthy males, average size
- Variables: highest max pressure, average pressures
- Measures taken at the butt/seat interface using pressure mapping
- Findings:
  - Pressure distribution between body and seat and posture are the main factors leading to discomfort
    - Not vibration or seat geometry
  - Low cost seat performed the worst
  - High cost seat performed best
    - However, peak pressures were still high

# Research on Tractor Seats Using Pressure Mapping

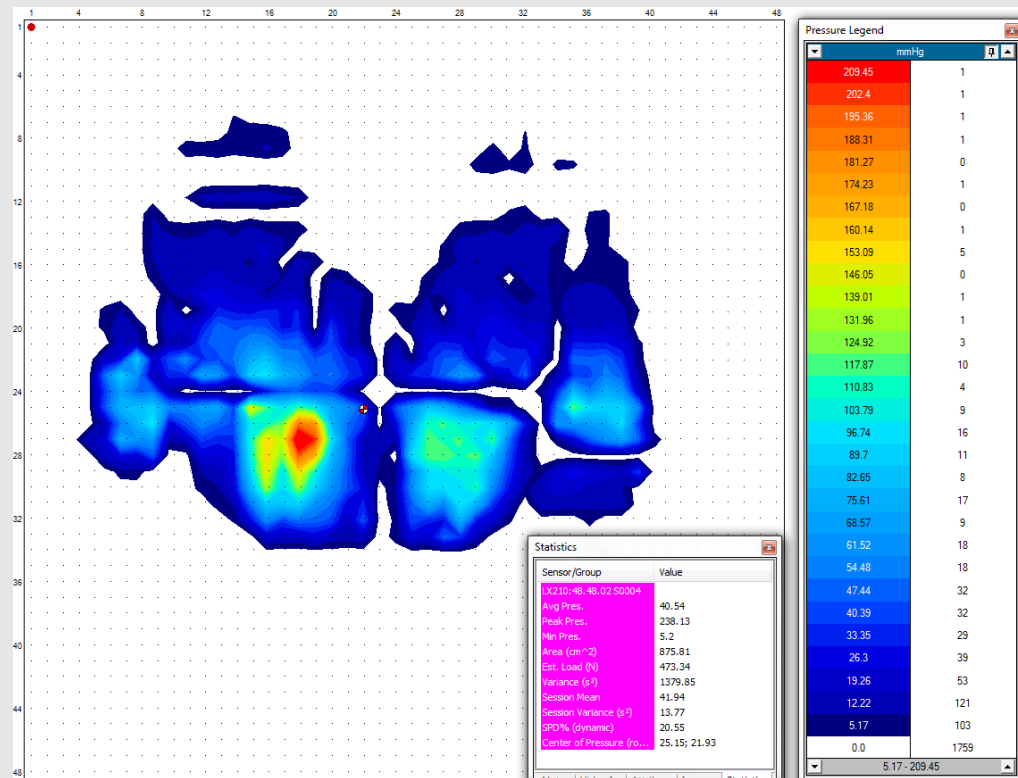
(Wilhite, et al. unpublished data)

- Tractor: New Holland T5070, hp 120
- 3 Male subjects ages: 40, 42, 70
- No health conditions
- Driven on pavement, off road pasture
- Seating conditions: contour seat, gel foam, three ROHO cushions
- X-Sensor Pressure Map system
- Procedures

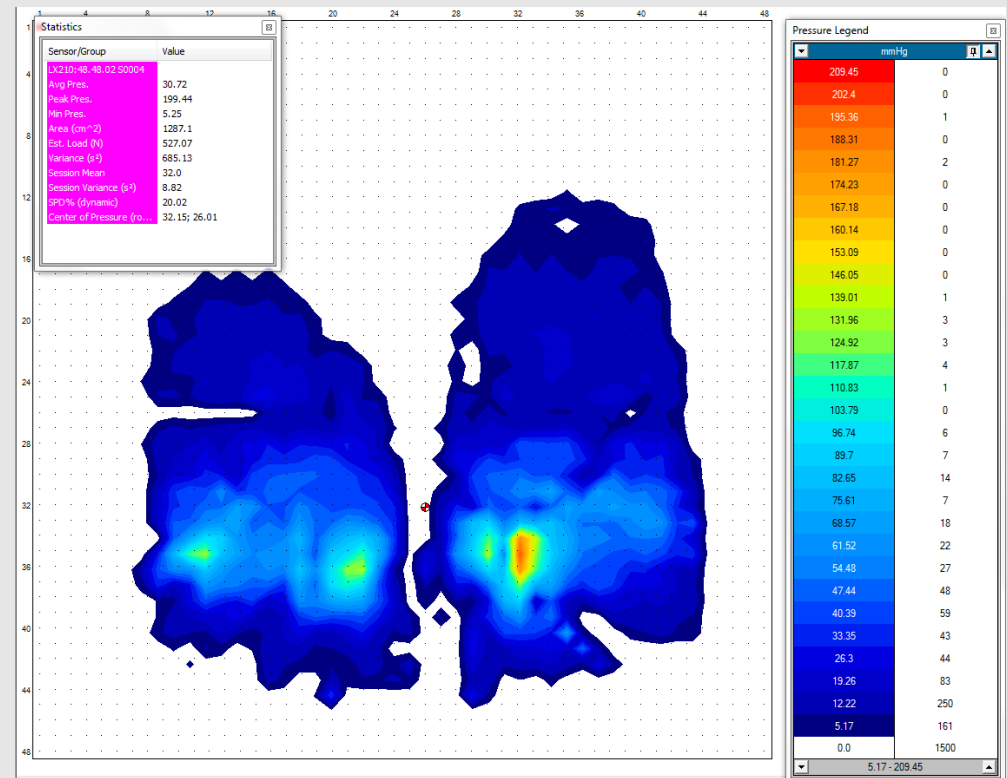


# Results Subject Three: 42 yoa

## Contour Seat



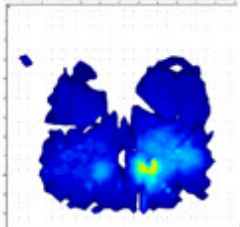
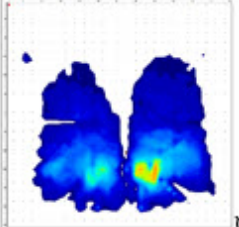
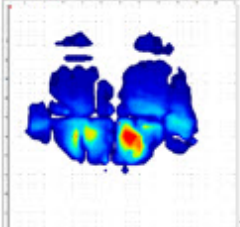
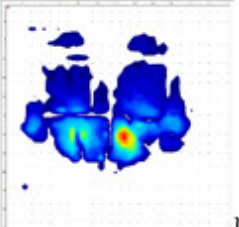
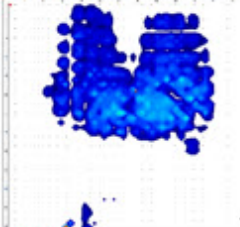
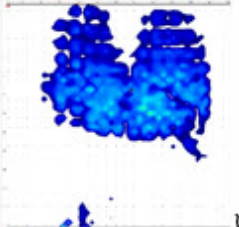
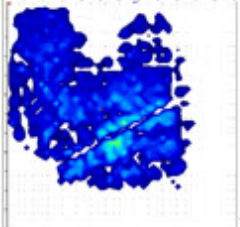
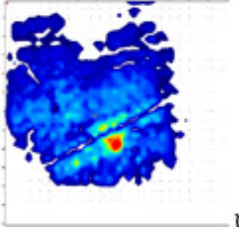
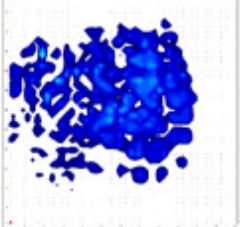
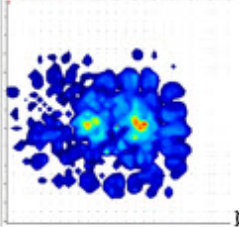
## Gel Foam





# All cushions Subject One Age 70

Subject-One-Pressure-Map-and-Intervention-Condition¶

SUBJECT-ONE¶	Settle¶	Post-Relief¶	Legend¶	
Foam¶			Settle¶ Avg. Pressure (kPa): 3.64¶ Peak Pressure (kPa): 20.97¶ Area (cm²): 1350.0¶ Est. Load (N): 490.85¶ Variance (s²): 8.67¶	Post-Relief¶ Avg. Pressure (kPa): 4.36¶ Peak Pressure (kPa): 27.08¶ Area (cm²): 1469.35¶ Est. Load (N): 639.93¶ Variance (s²): 12.31¶
Tractor-Seat¶			Settle¶ Avg. Pressure (kPa): 5.3¶ Peak Pressure (kPa): 34.06¶ Area (cm²): 875.81¶ Est. Load (N): 464.37¶ Variance (s²): 31.37¶	Post-Relief¶ Avg. Pressure (kPa): 4.87¶ Peak Pressure (kPa): 28.06¶ Area (cm²): 898.39¶ Est. Load (N): 437.81¶ Variance (s²): 20.94¶
Low-Profile-ROHO™¶			Settle¶ Avg. Pressure (kPa): 4.54¶ Peak Pressure (kPa): 53.11¶ Area (cm²): 1312.9¶ Est. Load (N): 596.54¶ Variance (s²): 12.75¶	Post-Relief¶ Avg. Pressure (kPa): 4.53¶ Peak Pressure (kPa): 44.86¶ Area (cm²): 1098.39¶ Est. Load (N): 497.76¶ Variance (s²): 9.75¶
Mid-Profile¶ ROHO™¶			Settle¶ Avg. Pressure (kPa): 3.93¶ Peak Pressure (kPa): 19.81¶ Area (cm²): 1488.71¶ Est. Load (N): 585.12¶ Variance (s²): 7.79¶	Post-Relief¶ Avg. Pressure (kPa): 5.12¶ Peak Pressure (kPa): 35.6¶ Area (cm²): 1553.23¶ Est. Load (N): 794.77¶ Variance (s²): 17.25¶
High-Profile¶ ROHO™¶			Settle¶ Avg. Pressure (kPa): 3.35¶ Peak Pressure (kPa): 17.7¶ Area (cm²): 1120.97¶ Est. Load (N): 375.58¶ Variance (s²): 4.36¶	Post-Relief¶ Avg. Pressure (kPa): 4.77¶ Peak Pressure (kPa): 31.45¶ Area (cm²): 1093.55¶ Est. Load (N): 522.16¶ Variance (s²): 16.28¶

# Types of Foam Cushions

- **Foam Cushions**
- PROS: Foam is inexpensive and comfortable.
- Cons: they get out of shape with time and wear out relatively quickly. Because of this, they are not recommended for heavy use long term.



Closed cell foam @ \$25-70 range

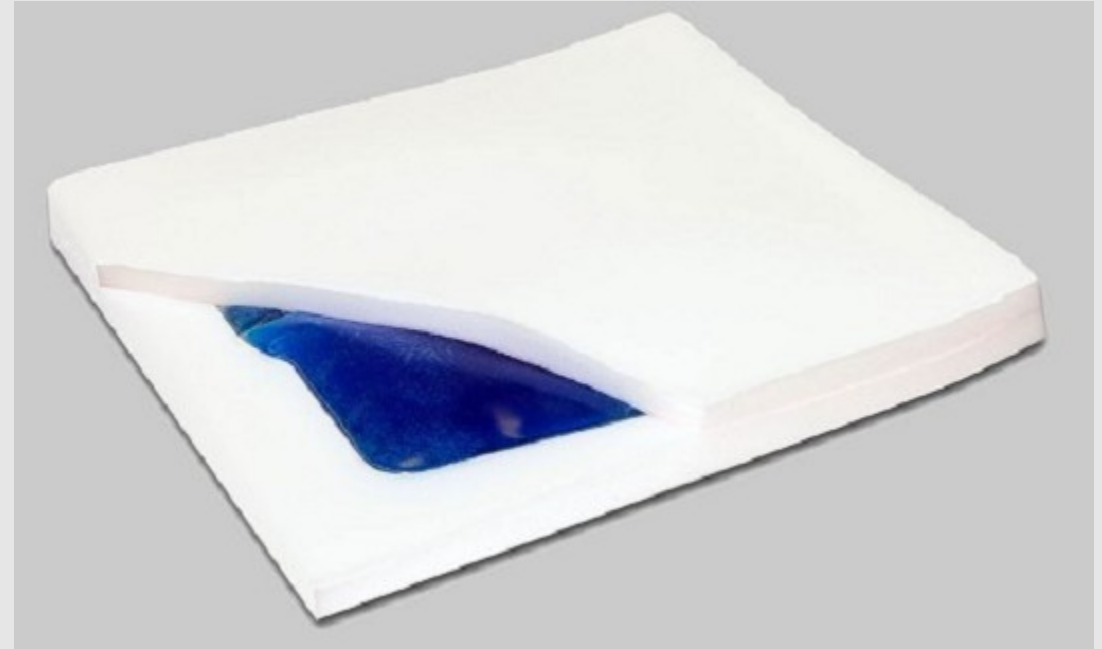
# Four main cushion types

- Foam
  - Gel
  - Air
  - Honeycomb
- 
- NOTE: There are numerous combination cushions that try to get the “best” features out of each material and they also have pros/cons

# Gel Cushions

Pros: These are made by adding a gel pouch on top of a base of foam. Comfortable, good immersion into cushion surface

Cons: The cushion is fairly heavy, may puncture and leak gel; if left in tractor gel freezes



**Gel Cushion \$90-200 range**

# Air cushions

Pro: Offers most immersion, comfort, and redistribution of seated pressure

Con: Air is the only support in these kinds of cushions. If it goes flat, the person is on harder surface. They aren't as stable as other cushions and are not recommended for users who tend to move around a lot (i.e. think tractor)

Leaking is also a possibility in these cushions. Deteriorate in sun UV light



ROHO Quatro \$500, Airhawk \$99

# Urethane honeycomb

Pro: distributes the weight of the body really well, comfortable, last longer than regular foam, increased airflow, shock absorbent, lightweight.

Cons: will need replacement with heavy use



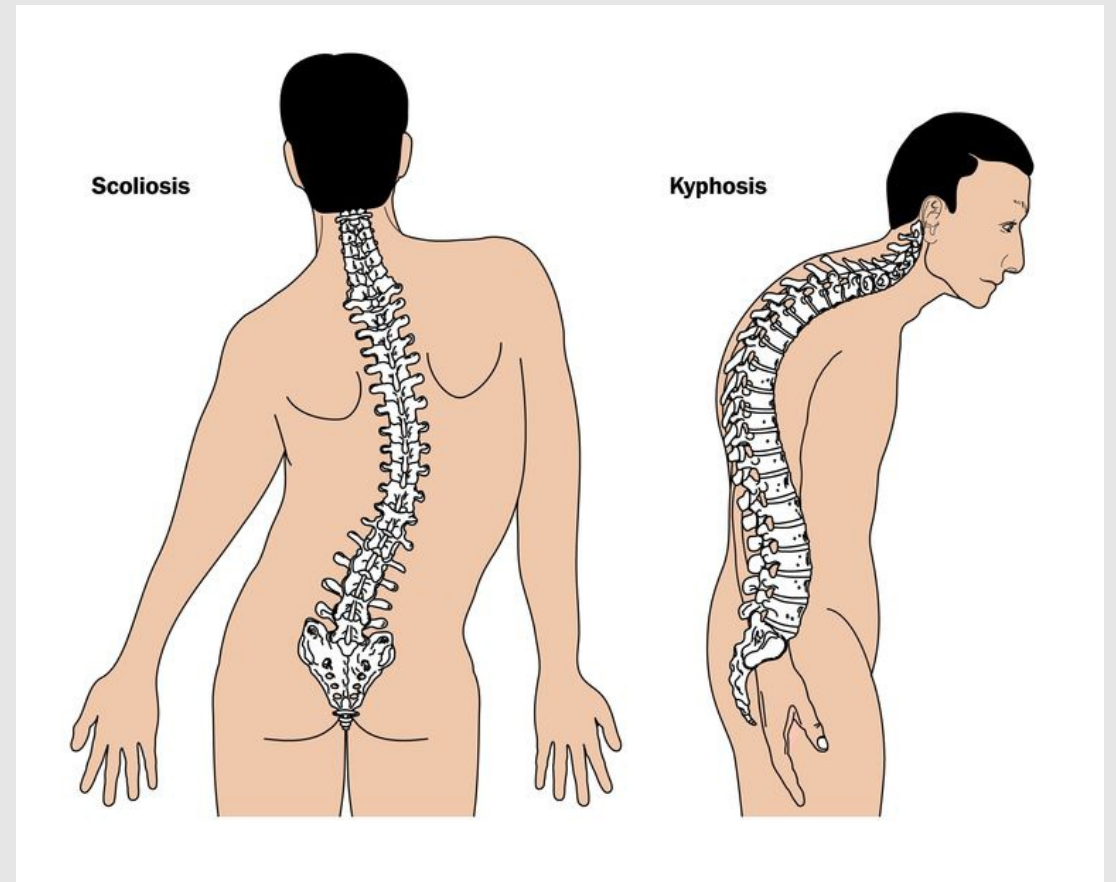
Honeycomb \$59-250 range

# Recommended Process for Selecting Cushions

- Safe to assume “low cost” tractor seats are inefficient at redistributing seated pressure for people with neck or back pain, arthritis, sensory issues, muscle pain (i.e. fibromyalgia)
- Consider upgrade of mechanical suspension to pneumatic air, or auto air (check K&M machinery)
- Consider additional “low profile” cushion
- Discuss pros/cons of all cushioning materials with tractor operator
- “Test” drive cushions for 1-2 hours
- Eliminate “uncomfortable” cushions until you arrive at “best” choice for the individual

# When to consider calling in professionals

- Spinal cord injuries
- Complex neck, back, or spinal surgeries
- Major skeletal deformities
- Poor postural control
- Loss of sensation in butt/genitourinary area





# Summary

- No one “size fits all” solutions
- Anticipate changes in variables can have consequences for other parts of the operation system
- Low-cost tractor seats may indicate the need for seating interventions for elderly operators or operators with health conditions
- Four basic kinds of cushions, each with pros and cons
- Try each type to find best “fit” for comfort
- Call in professionals (wheelchair seating specialists) when the case is complex

Thank you and Discussion!

