

Tillage and Compaction Impact On Soil Aggregate Associated Properties

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and

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Heavy farm machinery compacts the soil, both on tilled ground and no-tilled ground.

Plowing and subsoiling degrade soil structure by dispersing macro-aggregates.

Tillage breaks up roots, fungal hyphae and other important living organisms.

No-Till minimizes soil erosion, benefits soil biology, and increases soil aggregate stability.

Data on soil physical properties is useful to evaluate a soil.

Conclusions

Compaction from a big grain cart (18 Mg/axle) affected soil aggregate properties on both continuous no-till and annually subsoiled plots.

No-Till, to some extent, can improve the aggregate properties of soil.



Compaction research since 1988





Materials and Methods

Field experiment was established on Hoytville clay loam in 3 x 2 factorial arrangement of RCB design in Wood County, northwest Ohio.



Materials and Methods

The factors were:

- 1) Compaction: control, 9 and 18 Mg/axle loads
- 2) Tillage: no-till and annual tillage (subsoiling)



Compaction with a 600-bu grain cart
(full = 18 Mg/axle; half full = 9 Mg/axle)







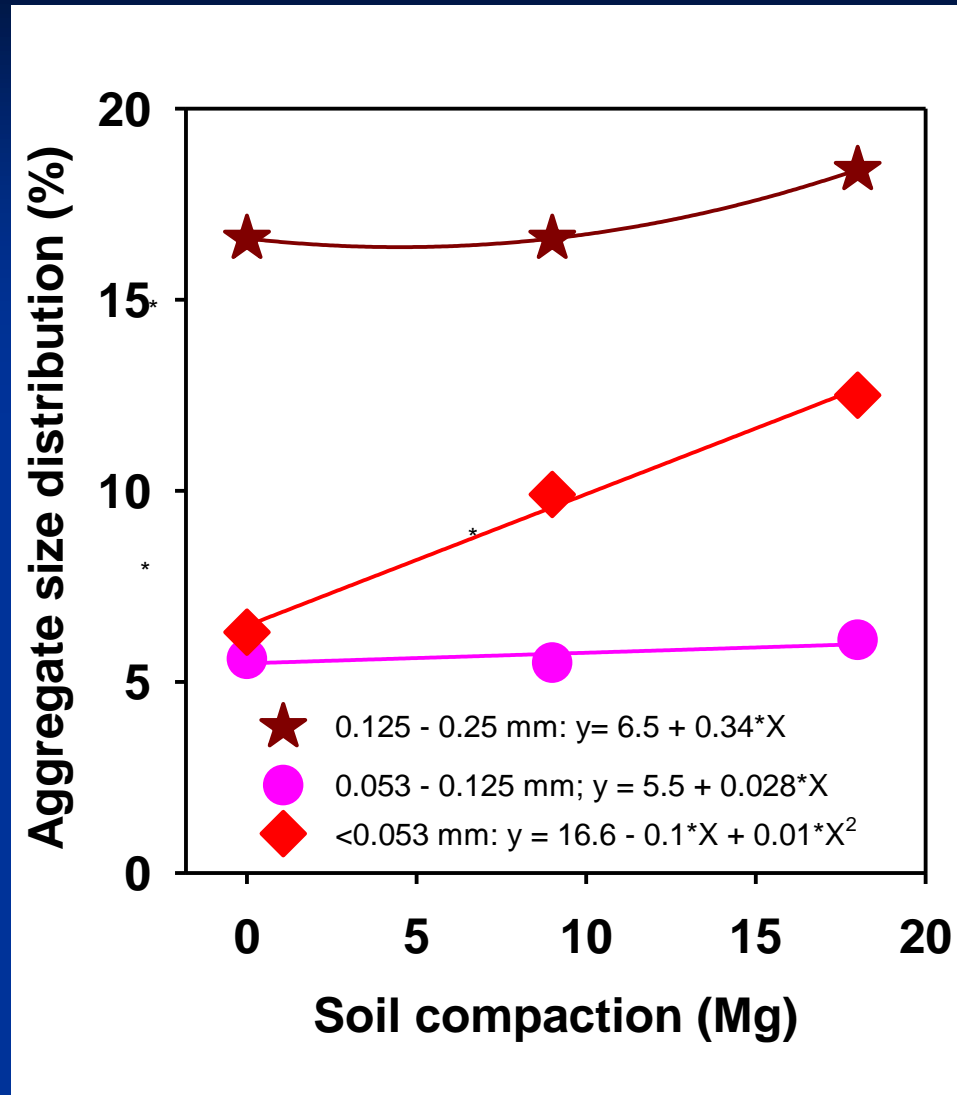
Results and Discussion

Compaction caused a **significant decrease** in:

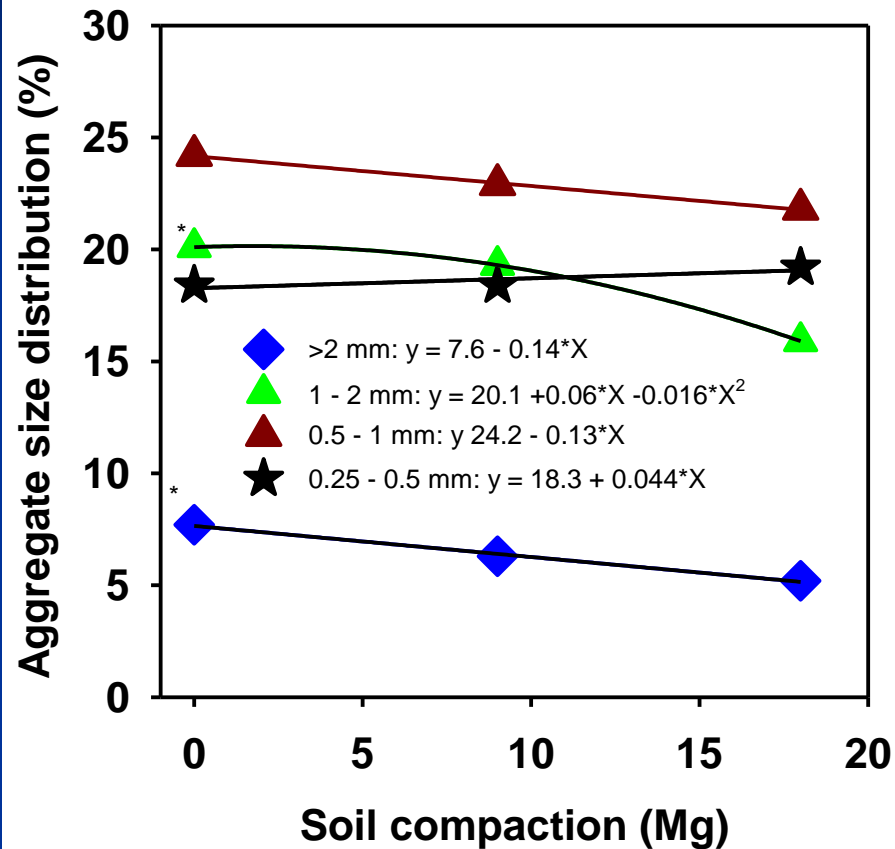
- Concentration of aggregates 1-2 mm
- Concentration of >2 mm, and
- Stability of macro- and micro-aggregate, MWD, GMD, and ratio of macro- and micro-aggregates.

Compaction **increased** concentration of smaller aggregates <0.053 mm.

More compaction means more small aggregates...

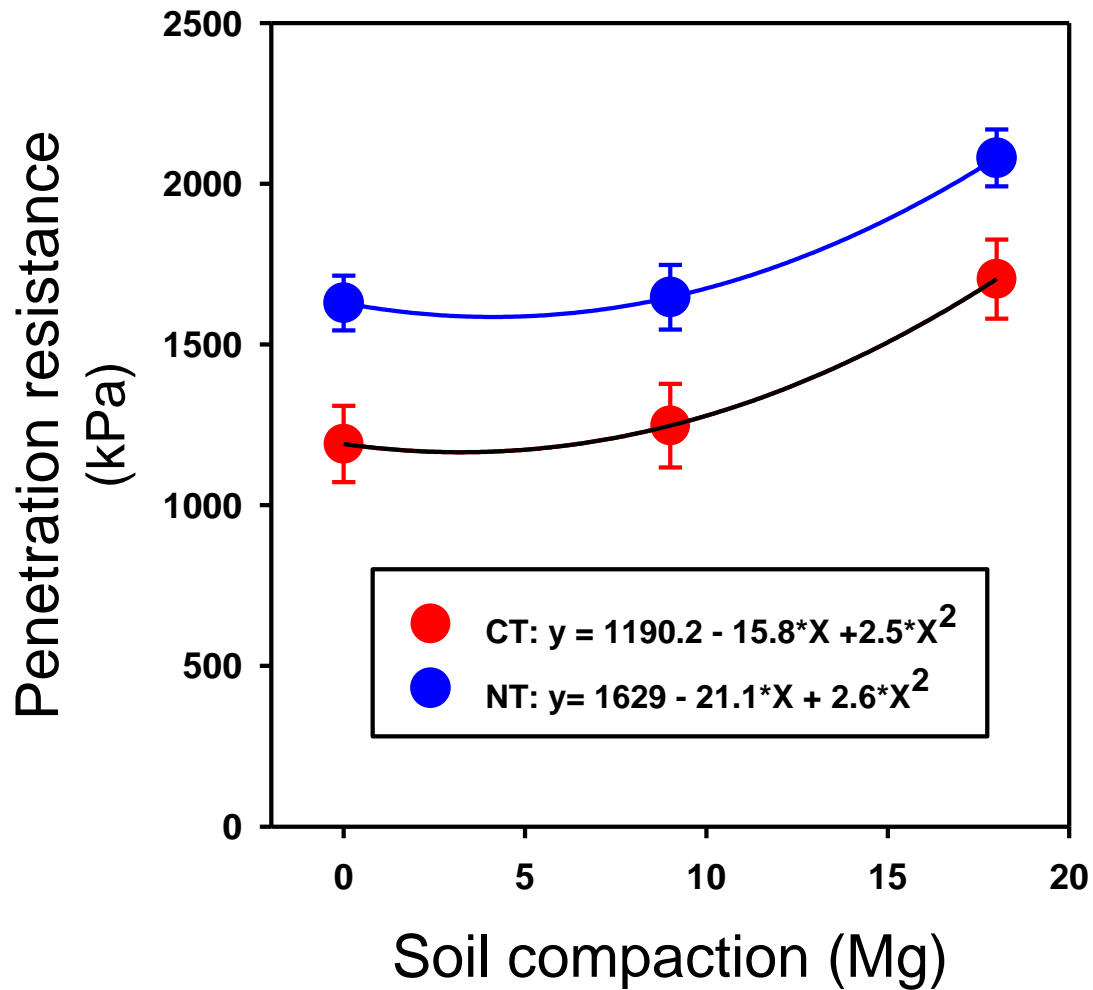


...and fewer large aggregates

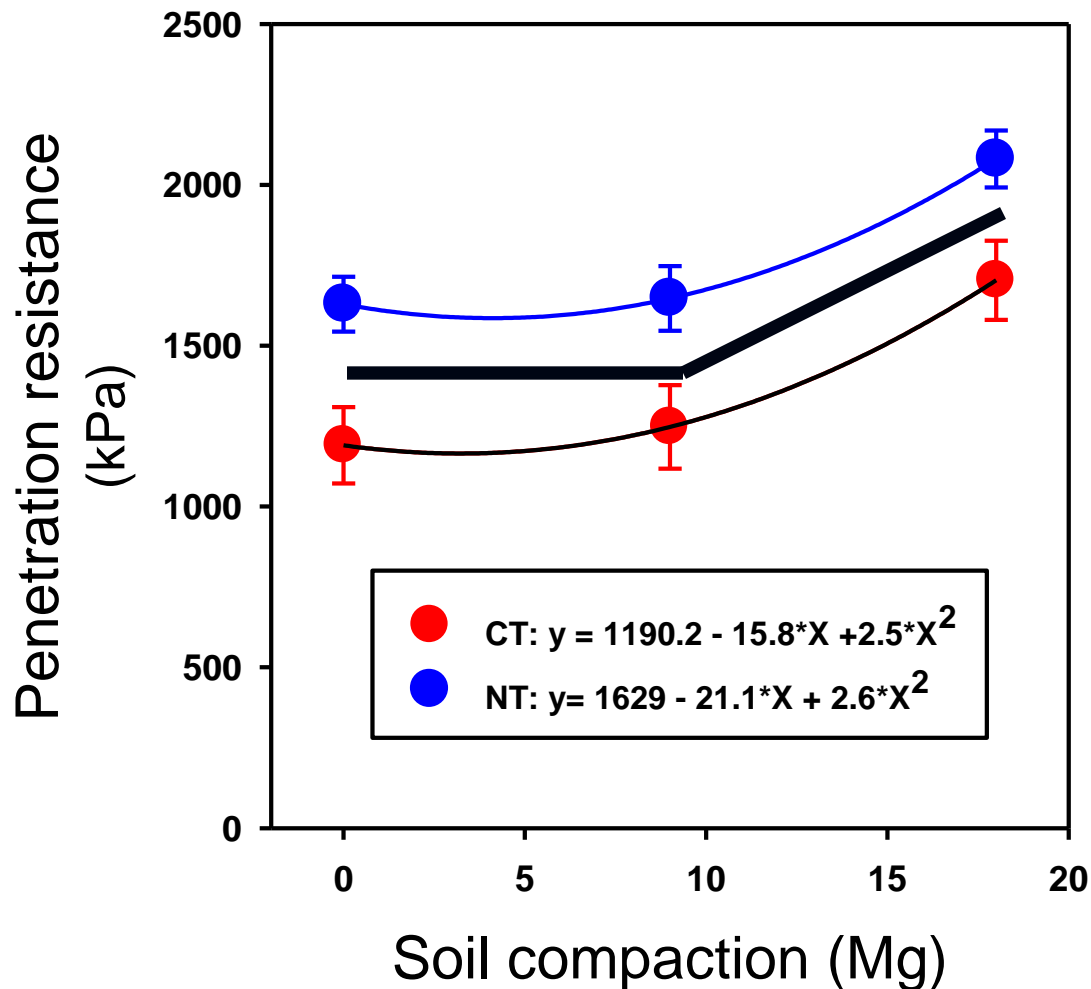


Compaction increased the cone penetration resistance and bulk density. The impact was mainly with the heavier axle load (18 Mg).

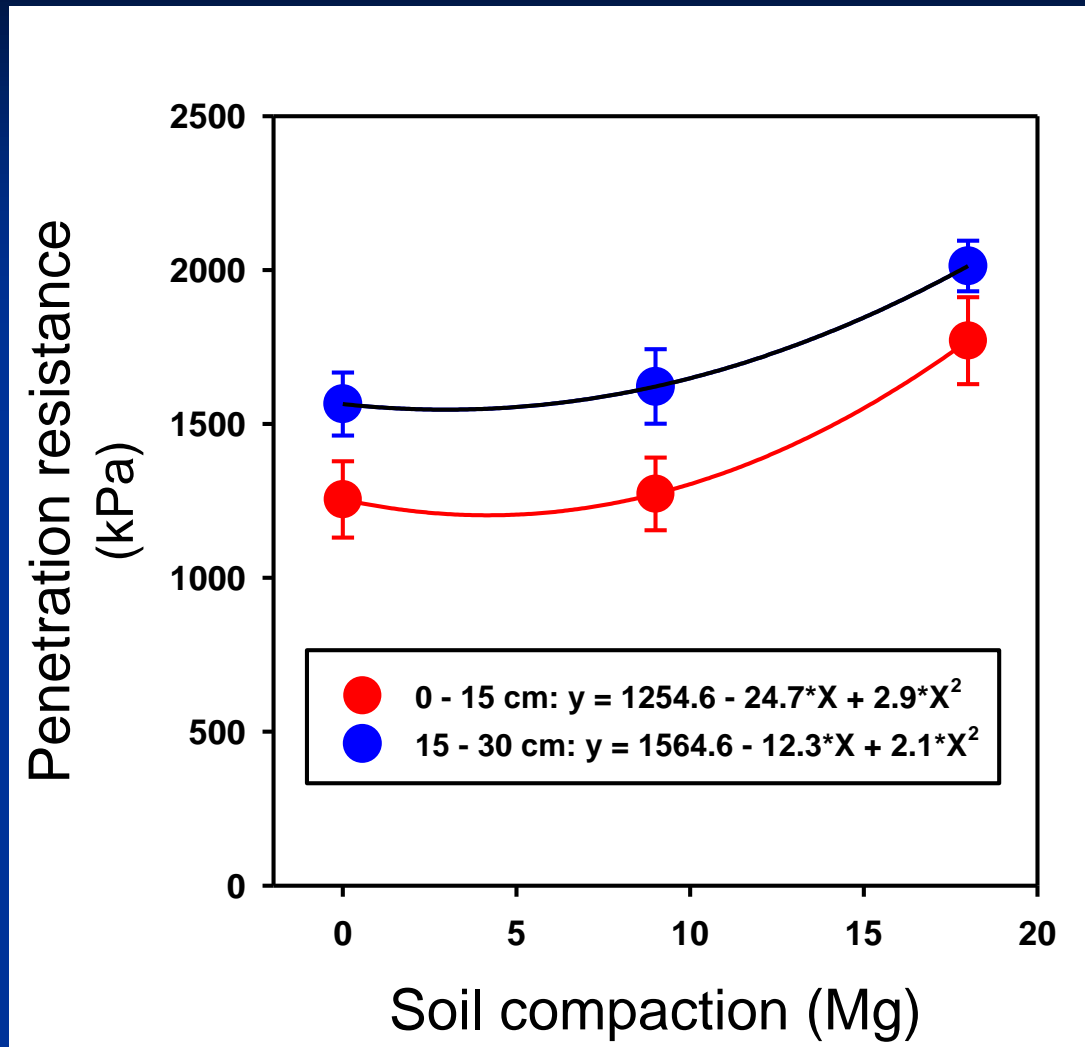
Cone penetrometer resistance (depth, 0-30 cm)



Cone penetrometer resistance (depth, 0-30 cm)

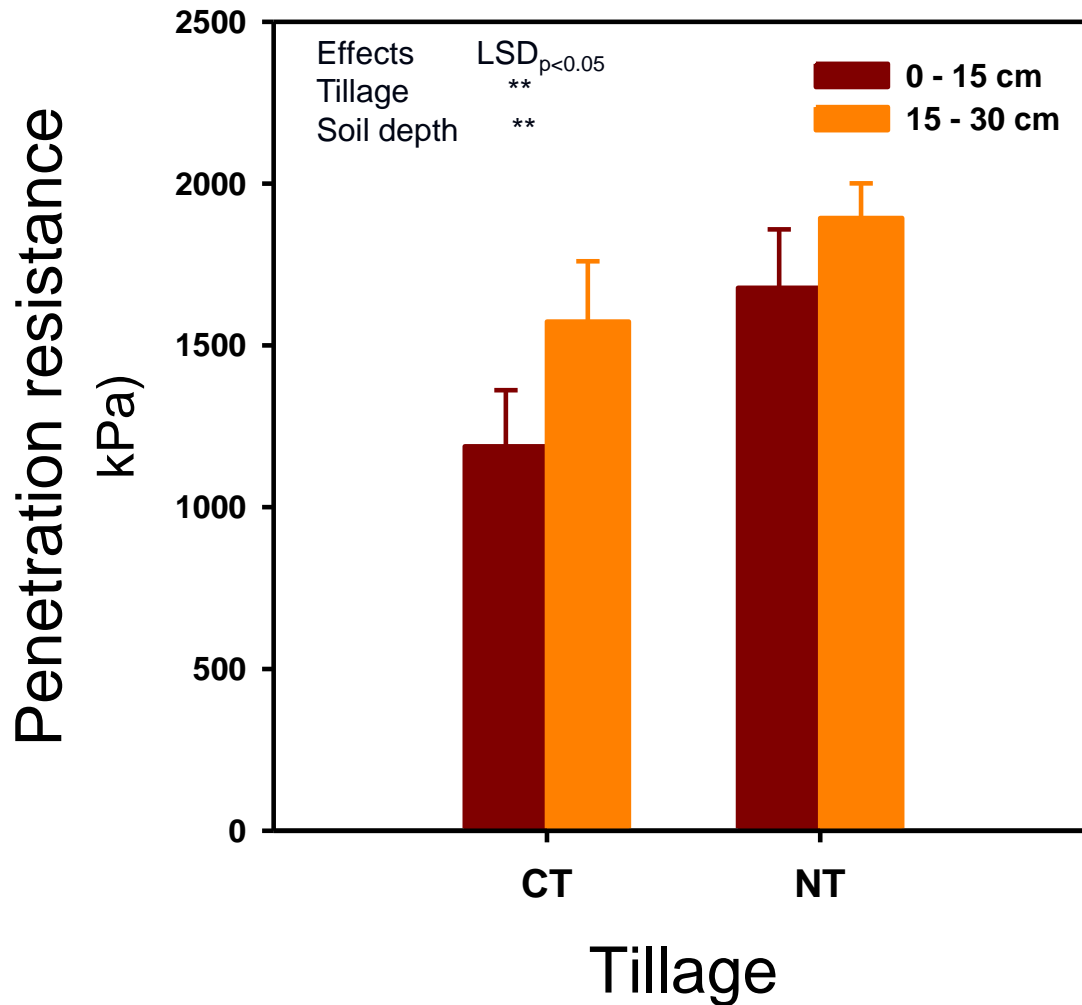


Compacting load had more effect near surface



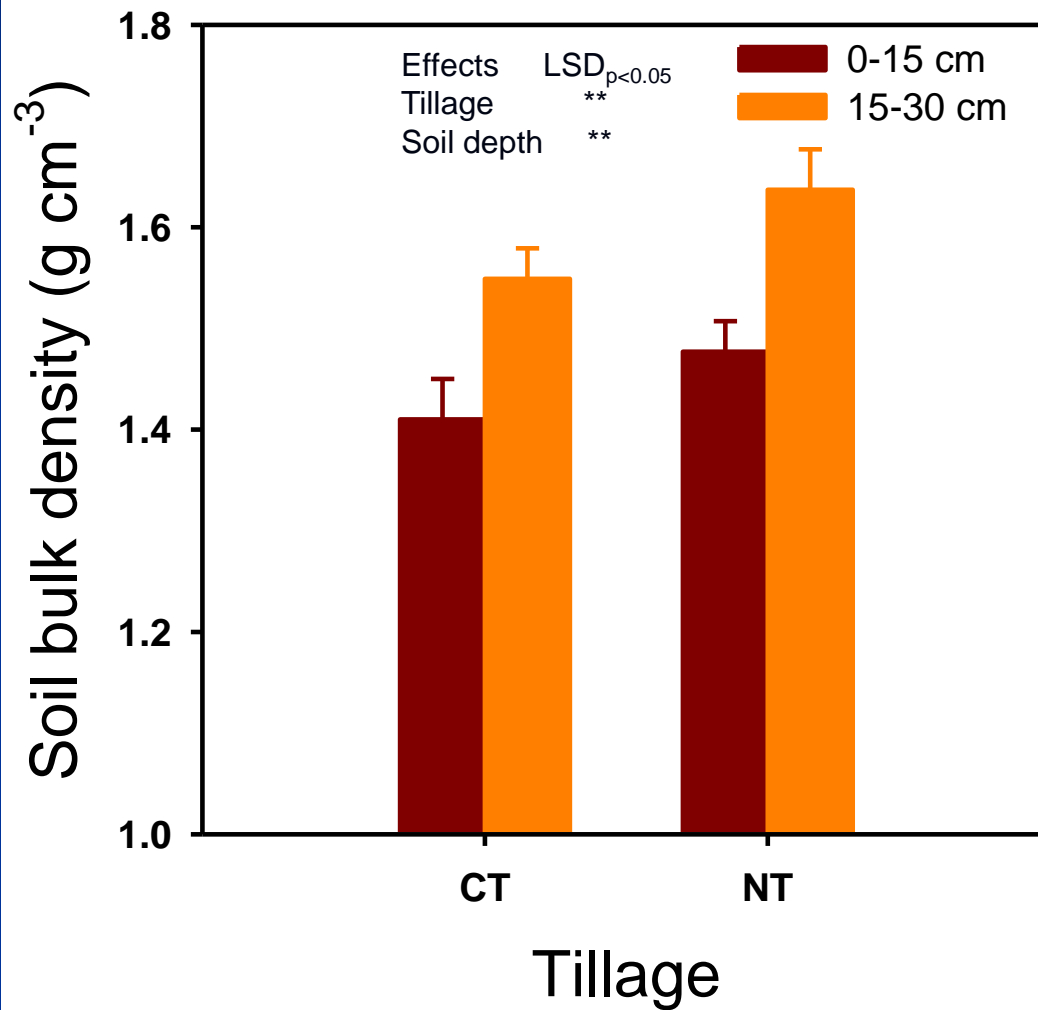
No-Till increased cone penetration resistance and soil bulk density compared with subsoiling.

Cone Penetrometer resistance

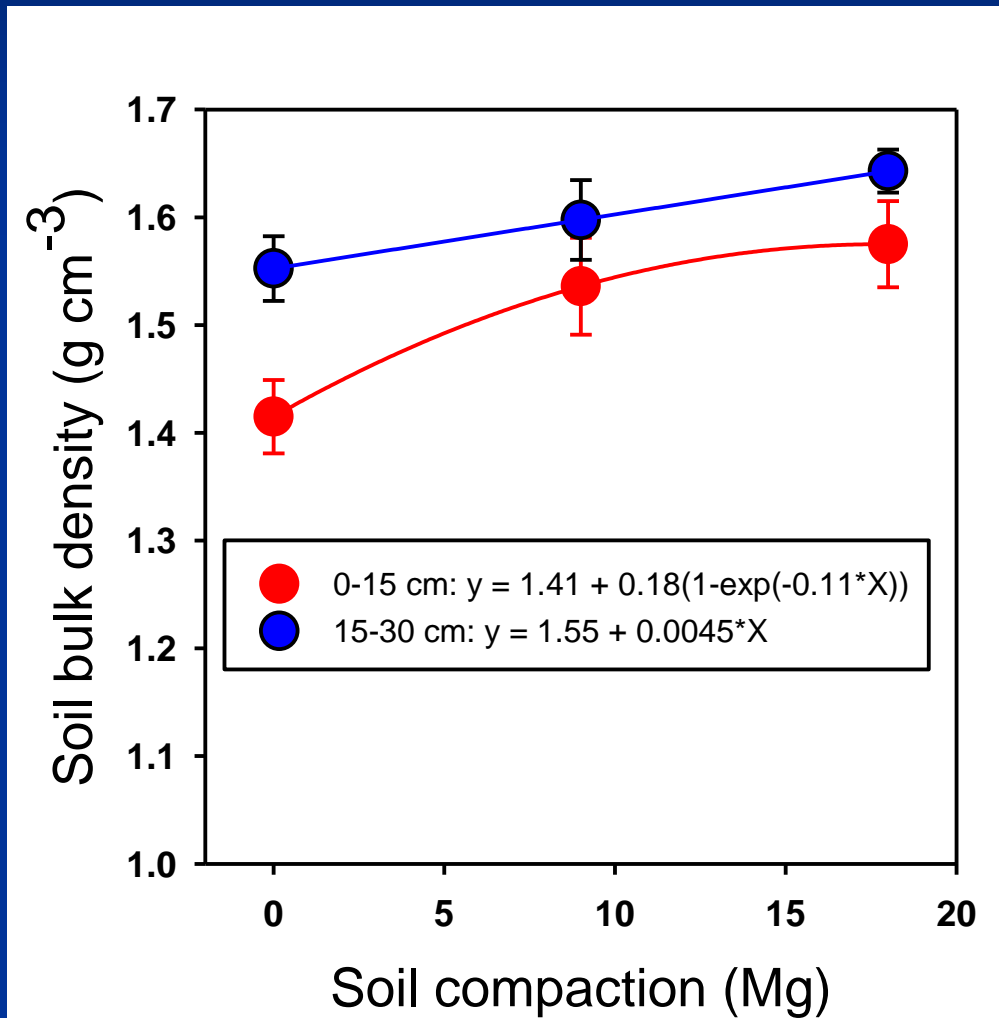


* 95% **99% ***99.9%

Soil Bulk Density



9 Mg axle load had more effect on soil density near surface;
Adding 9 Mg did not double the change in density.
Deeper soil started at higher density; linear relationship for axle load

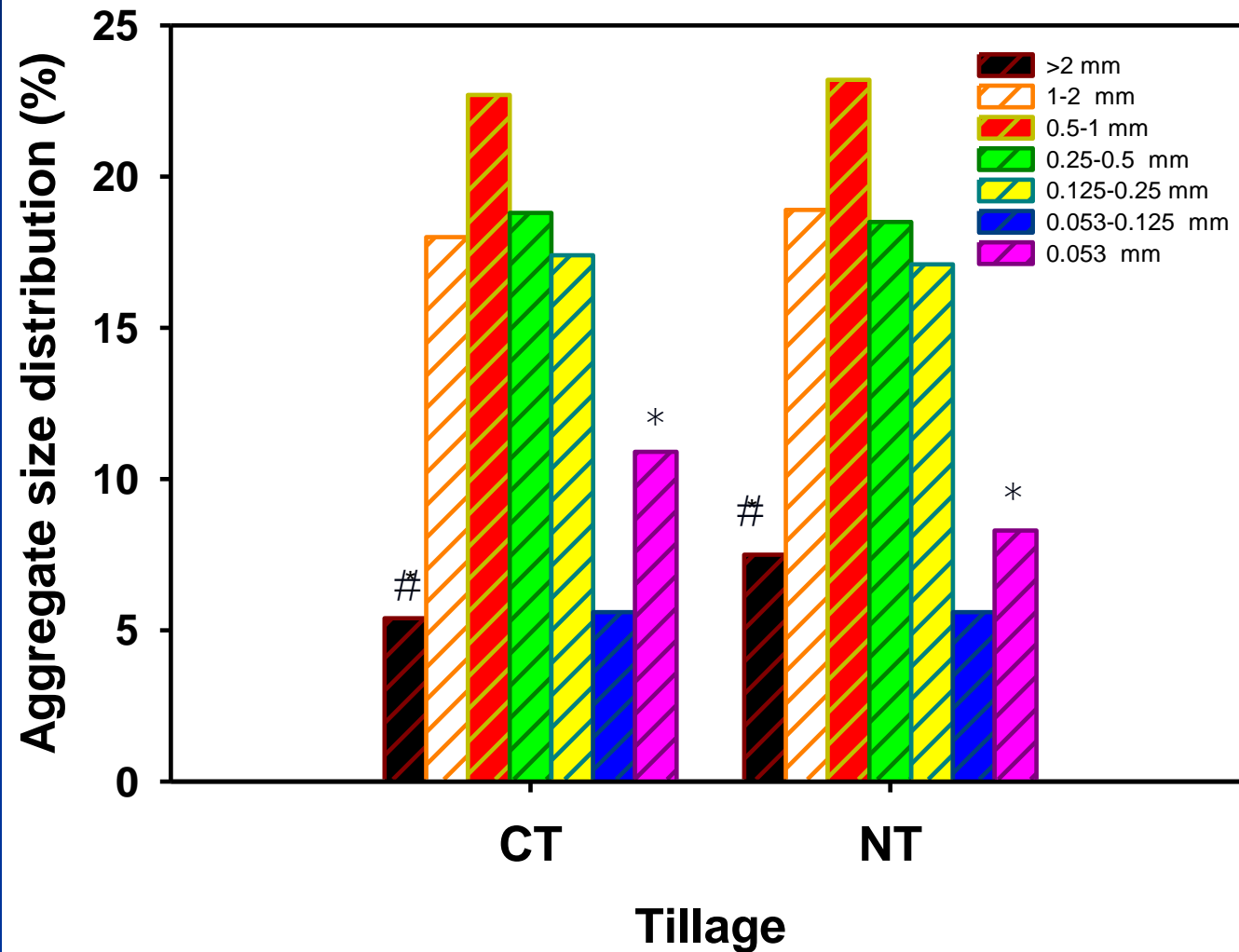


No-Till **significantly increased:**

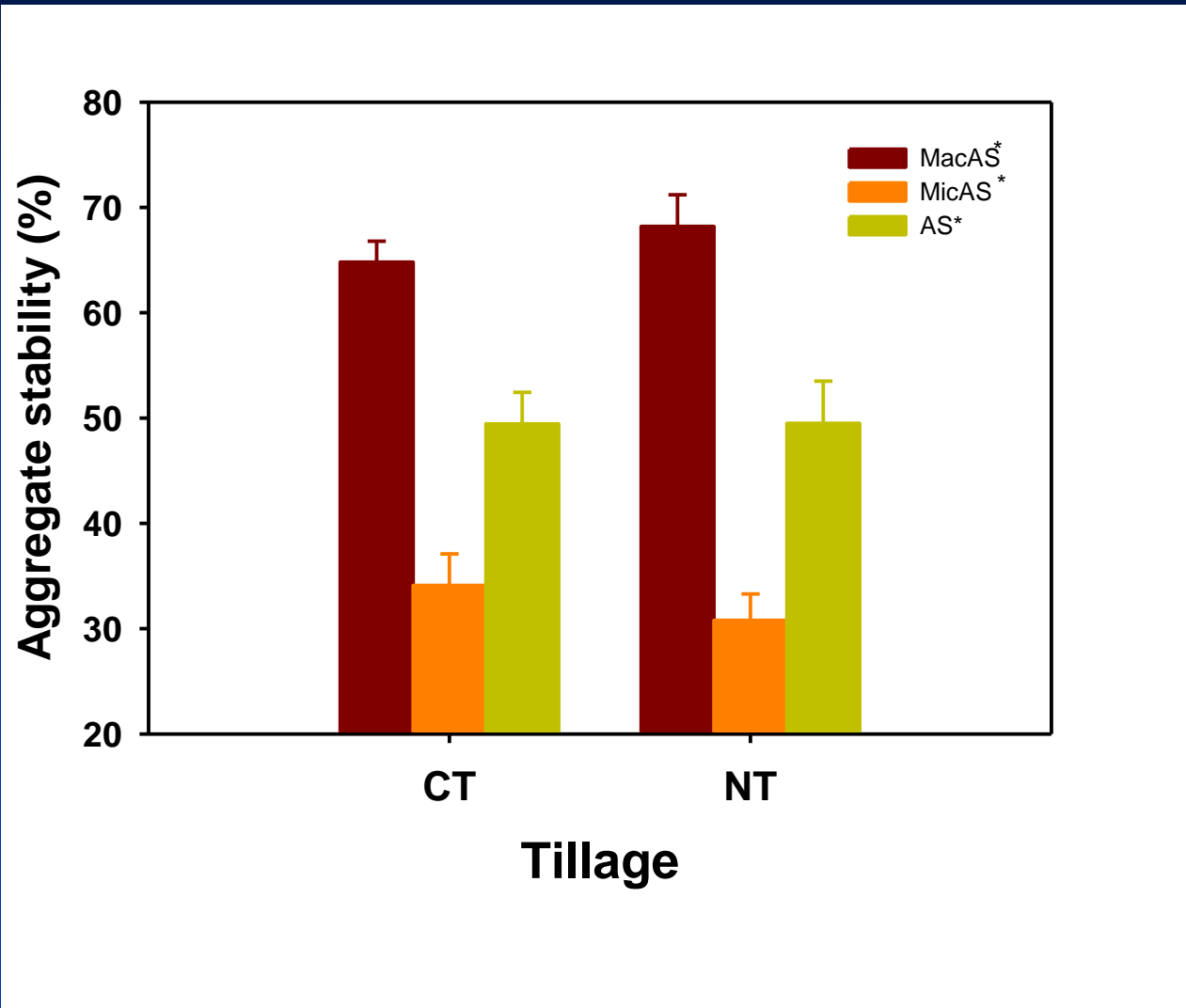
- Proportion of >2 mm size aggregates
- Macro- and micro-aggregate stability
- Mean Weight Diameter (MWD)
- Geometric Mean Diameter (GMD)

Change in soil aggregate associated properties decreased significantly with **depth**.

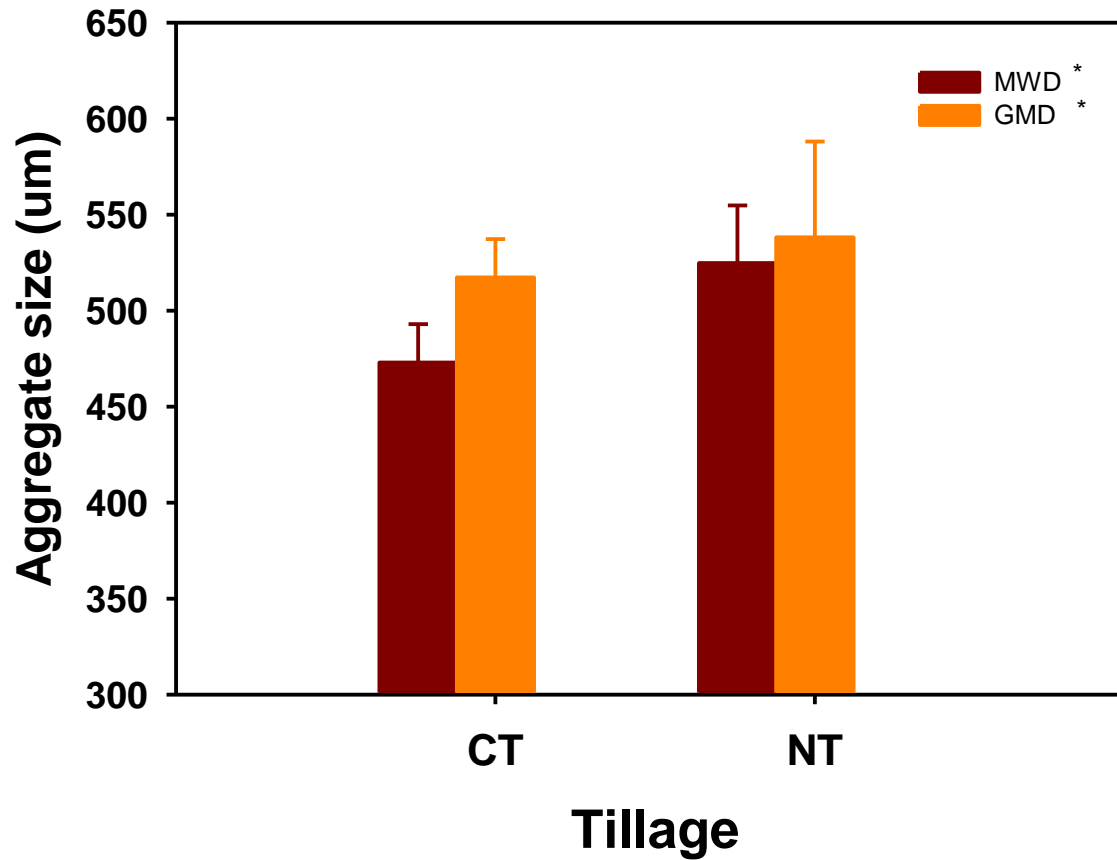
With No-Till, more large aggregates, fewer small ones



No-Till increased Stability of Macro-Aggregates

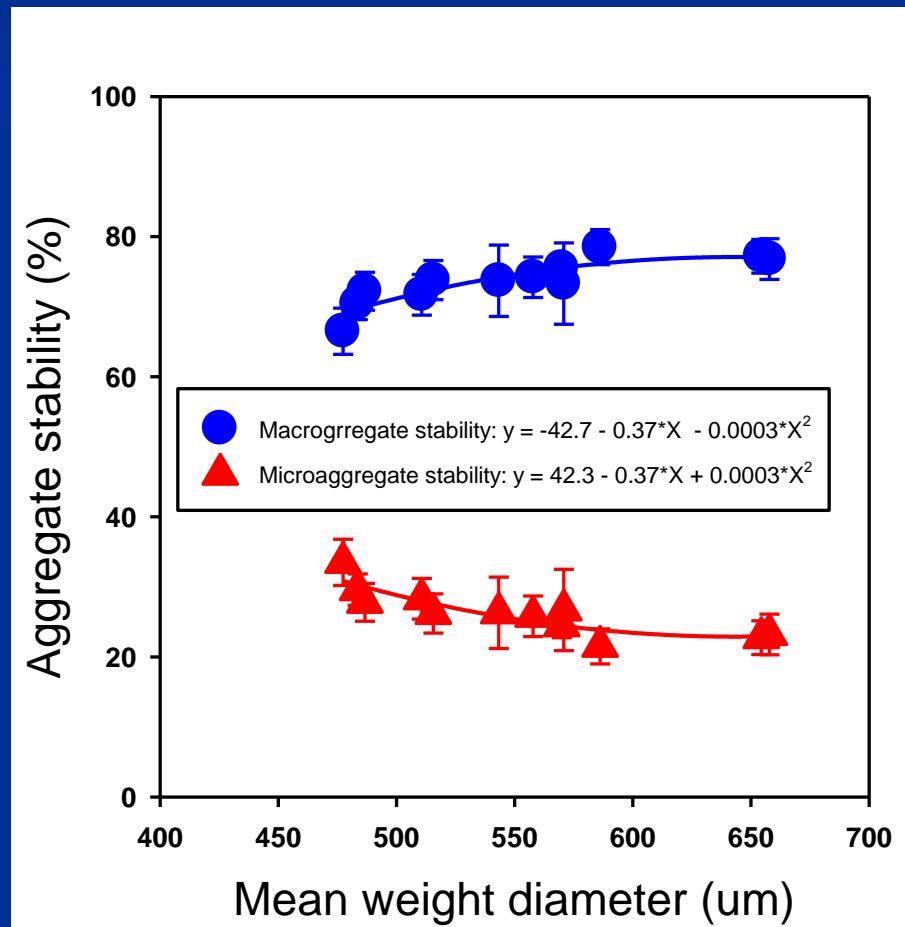


No-till increased MWD and GMD



As mean weight diameter (MWD) of aggregates increased:

Macro-aggregate stability increased and
Micro-aggregate stability decreased.



No significant interactive effects of **soil depth** with compaction or tillage on aggregate properties.

No significant impact of **compaction x tillage** interaction on soil aggregate size.

Conclusions

Compaction consistently affected soil aggregate properties, for both no-till and subsoiling systems.

No-Till, to some extent, can improve the aggregate properties of soil.

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