Field Wind Tunnel Testing of Two Silt Loam Soils on the North American Central High Plains

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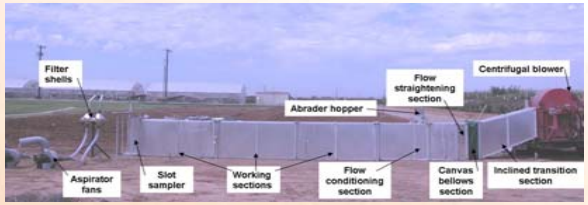
Background

- It's well understood that reducing tillage and selecting high-residue crop rotations protect the soil from wind erosion.
- Many soil physical, chemical, and micro-biological properties are also enhanced by reducing tillage and increasing surface residue retention.
- Little is known about the effects of reduced tillage and surface residue management on the intrinsic erodibility of soil and fugitive dust emissions by wind.
- We conducted wind tunnel tests on long-term tillage and rotation study plots at Tribune, KS (KSU SWREC) and Akron, CO (USDA-ARS Central Great Plains Research Station) using a portable boundary layer wind tunnel with a 6 m X 0.5 m test section.

Methods

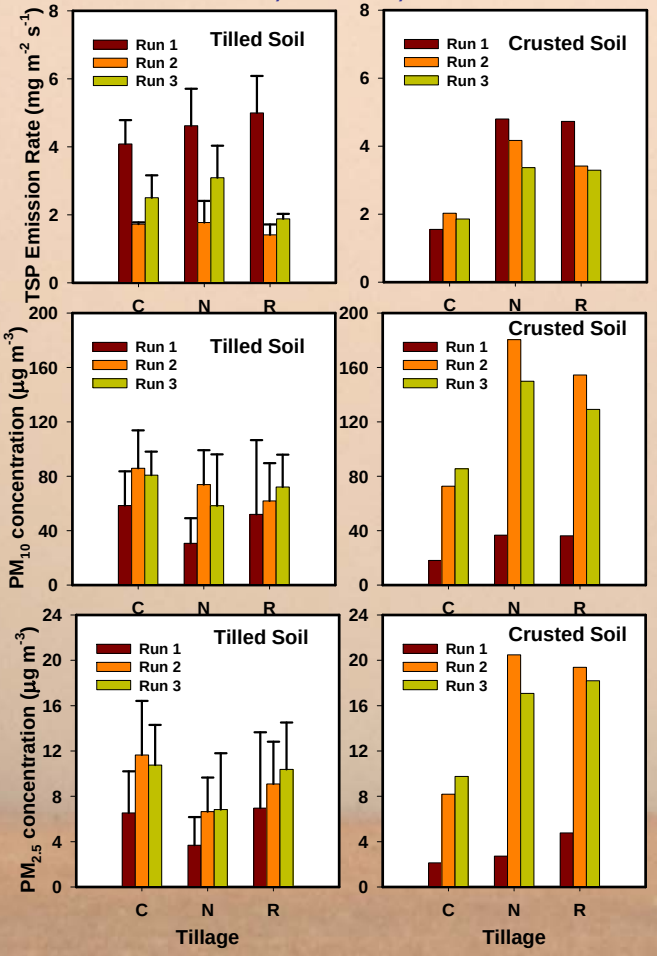
- We removed crop residues, rototilled, raked, and rolled the soil to achieve a bare, flat, smooth, highly erodible surface.
- We blew the surface at 12 m s^{-1}:
  - Run 1 – Five minutes without any introduced quartz sand abrader.
  - Run 2 – Twenty minutes of abrader introduction at 10 g m^{-1} width s^{-1}.
  - Run 3 – Ten minute repeat of Run 2.
- We measured Total Suspended Particulates (TSP) from an isokinetic slot sampler on glass fiber filters and $PM_{2.5}$ and PM_{10} using an inline optical particle analyzer.



Portable boundary layer field wind tunnel used in the investigations.

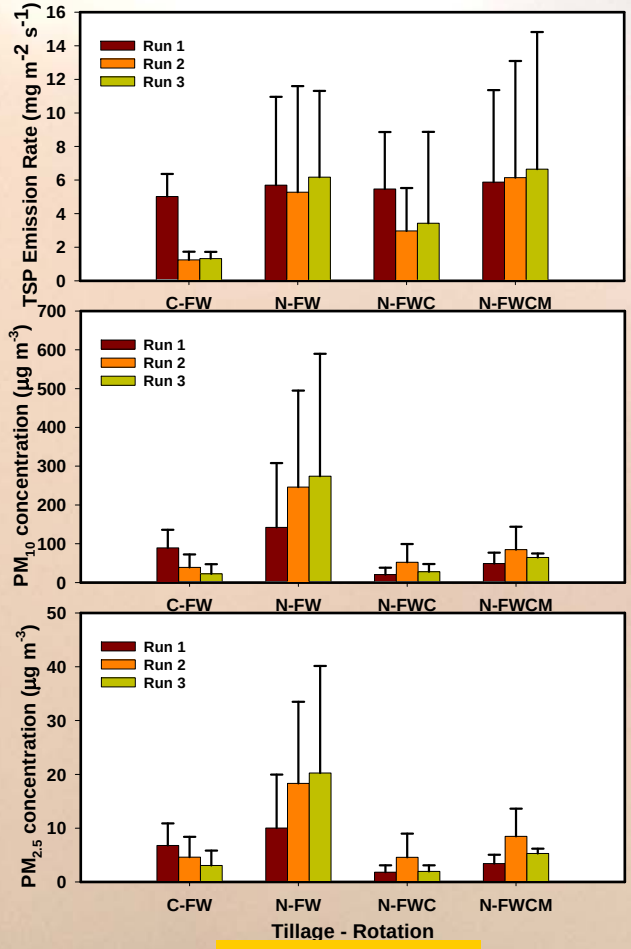
Tribune, KS

- Richfield Silt loam 0 – 1 % slopes
- Wheat – Grain sorghum – Fallow rotation with conventional, reduced, and no-till.



Akron, CO

- Weld Silt Loam 0 – 2 % slopes
- Conventional till with Wheat – Fallow rotation
- No-till with Wheat – Fallow, Wheat – Fallow – Corn and Wheat – Fallow –Corn – Millet rotations



Conclusions

- Tillage and residue management do not appear to affect intrinsic soil erodibility or dust emissions.
- Keep crop residues on the surface to protect the soil from wind erosion!!

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