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Soil Characteristics and Wind Erosion Potential of Wheat–Oilseed–Fallow Cropping Systems

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Oilseeds are integral to the production of biofuels and diversifying rainfed cropping systems in the US Pacific Northwest (PNW). However, there is evidence to suggest greater potential for wind erosion when growing oilseeds in wheat (*Triticum aestivum* L.) rotations. Little is known concerning the impact of growing oilseeds on the soil surface characteristics that affect erosion. Soil characteristics were examined during the fallow phase of three crop rotations: (i) winter wheat–summer fallow (WW-SF), (ii) winter wheat–camelina (*Camelina sativa* L. Grantz)–summer fallow (WW-C-SF), and (iii) winter wheat–safflower (*Carthamus tinctorius* L.)–summer fallow (WW-S-SF) at Lind and Ritzville, WA. Crop residue biomass and soil water content, roughness, surface strength, and aggregate size distribution were measured immediately after sowing winter wheat. Camelina and safflower did not affect soil water content, random roughness, penetration resistance, geometric mean diameter, or the erodible fraction, possibly due to the short duration over which the rotations were monitored in this study. Flat residue biomass and cover, however, tended to be greater in the WW–SF rotation. The Revised Wind Erosion Equation suggested that sediment transport could be from 57 to 212% greater for the WW-C-SF or WW-S-SF than the WW-SF rotation due to differences in crop residue characteristics after sowing wheat. These results indicate that crop residue must be carefully managed to minimize the occurrence and intensity of wind erosion from dryland oilseed cropping systems in the PNW. Specifically, no-till management may be required to manage crop residues during the fallow phase of a wheat–oilseed–fallow rotation to control wind erosion.

Abbreviations: PM10, particulate matter ≤10 μm in diameter; PNW, Pacific Northwest; RWEQ, Revised Wind Erosion Equation; SAI, silhouette area index; SLR, soil loss ratio; WF, weather factor; WW–SF, winter wheat–summer fallow; WW-C-SF, winter wheat–camelina–summer fallow; WW-S-SF, winter wheat–safflower–summer fallow.

Core Ideas

- **Oilseeds are integral in producing biofuel in the Pacific Northwest.**
- **Wind erosion may escalate as a result of growing oilseeds in rotation with wheat.**
- **The impact of oilseeds on soil properties that govern wind erosion is largely unknown.**
- **Oilseeds resulted in less residue biomass and cover than conventional wheat rotations.**
- **Oilseed crop residue must be carefully managed to minimize wind erosion.**

Wind erosion is a threat to sustainable agriculture and the preservation of natural resources worldwide. Wind erosion removes the smaller and less dense constituents of the soil such as clay, silt, and organic matter. These constituents have large surface areas that strongly bind nutrients. For this reason, wind erosion degrades the most fertile component of the soil (Zhang et al., 2003; Zobeck and Fryrear, 1986). Off-site transport and subsequent deposition or suspension of fine soil particulates can impact the quality of water and air resources, respectively. Wind erosion is most prevalent in arid and semiarid regions where water limits vegetative growth. Vegetative cover protects the soil surface against the shear forces of wind, thus is one of the principle parameters when simulating wind erosion processes.

Wind erosion is a major concern in the low precipitation zone (<300 mm annual) of the Inland PNW where WW-SF is the dominate crop rotation. Wind erosion is particularly acute during the summer fallow phase of the rotation, when

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