

**ABOVE AND BELOW-GROUND COMPETITION FOR SOLAR
RADIATION AND SOIL MOISTURE IN A WINDBREAK- SOYBEAN
SYSTEM**

by

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Abstract (Lay version)

Even though windbreaks benefit in agricultural systems by protecting crops from damaging effects of wind and controlling soil erosion, some farmers are reluctant to plant windbreaks in their fields because of the reduction of crop yields in the area close to the windbreaks due to tree competition. Windbreak-soybean competition for soil moisture and light was studied during two crop seasons (1996 and 1997) at Mead, Nebraska. The effects of windbreak orientations (east, west and south windbreaks), and the effects of tree root pruning (pruned and non-pruned) on soybean growth and yield were studied. Windbreaks were mature trees formed by two rows of green ash combined with eastern redcedar or Austrian pine. Tree root pruning was done at 7 m from the windbreak line and at 0.75 m depth. Neither irrigation nor fertilization were applied on soybean in either crop season. The most critical period of windbreak-soybean competition for soil moisture occurred during soybean flowering, pod formation, and grain filling. Windbreak-crop competition for soil moisture existed at east and west leeward sides up to $0.75H$ from the windbreak (H = windbreak height), but no competition for soil moisture was detected at south windbreak (north leeward). Soybean yield was increased by 22% at west leeward, by 40% at east leeward and by 6% at north leeward on root-pruned plots compared with non-pruned plots. Windbreak shading effects reduced soybean yield by 68.6% at north leeward side at $0.5H$,

and by 17 to 40% at north leeward at 0.75H from the windbreak, compared with yields at 3.0H. However, shade by trees in the north leeward helped conserv soil water availability and offset the root competition for soil moisture. Since south oriented windbreaks were less competitive for soil moisture they are recommended for dry land areas. East and west windbreaks were more competitive for soil moisture but less competitive for light, hence they are recommended for locations under irrigation or with enough rainfall. Searching for some productive alternative such as shade tolerant crop varieties or shade tolerant hay species to plant in the area of tree-crop competition would help make the idea of planting windbreaks in agricultural fields more attractive.