# Effect of Canopy Leaf Distribution on Sand Transport and Abrasion Energy

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## INTRODUCTION

In thin crop canopies, wind erosion can abrade plants, uncover roots, and deplete the soil resource.

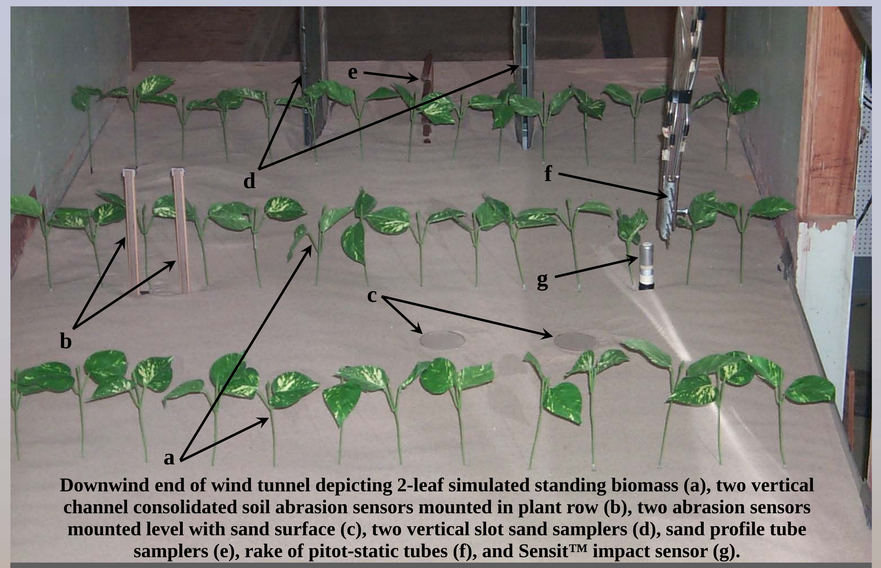
Several studies have investigated erosion among standing stalks, but few have considered effects of number and position of leaves.

## OBJECTIVE

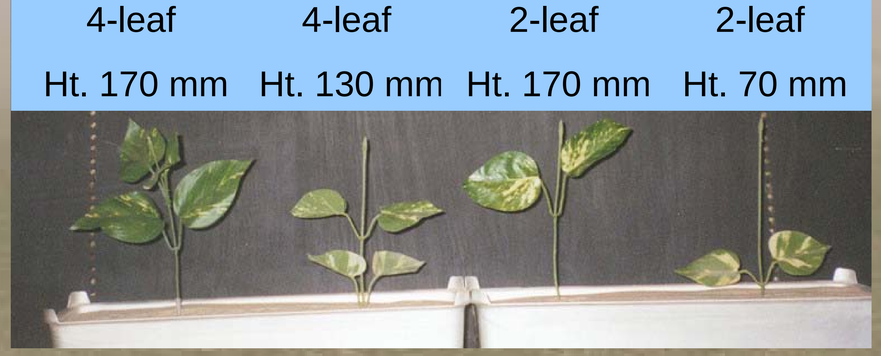
To determine threshold velocities, sand transport capacities, and relative abrasion energy of impacting sand grains in simulated dicotyledonous plant canopies.

## METHODS

Simulated plants were tested in a wind tunnel. Measurements included wind speed profiles with pitot-static tubes, sand discharge with slot samplers, and abrasion with both flat and vertical containers of consolidated fine, sandy soil.




Downwind end of wind tunnel depicting 2-leaf simulated standing biomass (a), two vertical channel consolidated soil abrasion sensors mounted in plant row (b), two abrasion sensors mounted level with sand surface (c), two vertical slot sand samplers (d), sand profile tube samplers (e), rake of pitot-static tubes (f), and Sensit™ impact sensor (g).




## CONCLUSIONS

Transport capacity was reduced more by leaves positioned high above the surface compared with low for canopies with LAI < 0.1.

Airborne sand abrasion energy on plants increased directly with the wind speed above threshold.

Sand abrasion energy on inter-row flat soil was smaller than airborne energy in the canopy and was independent of wind speed.

Vertical location of maximum abrasion energy increased with wind speed.

Leaves near the surface can modify the vertical abrasion profile and deflect sand impact energy upward in the wind stream.

**Table 1. Plant characteristics and means of dimensionless aerodynamic parameters of simulated plants in wind tunnel tests.**

| Leaf Area Index (LAI) ($m^2/m^2$) | Maximum Leaf Height (mm) | Leaves Per Plant (number) | Zo / H (mm/mm) | D / H (mm/mm) | $U_{*soil}$ / $U_{*Canopy}$ ($m\ s^{-1}/m\ s^{-1}$) |
|---|---|---|---|---|---|
| 0.19 | 170 | 4 | 0.065 | 0.518 | 0.273 |
| 0.19 | 130 | 4 | 0.109 | 0.460 | 0.221 |
| 0.095 | 170 | 2 | 0.097 | 0.333 | 0.297 |
| 0.095 | 70 | 2 | 0.062 | 0.811 | 0.361 |
| 0.047 | 170 | 2 | 0.057 | 0.261 | 0.389 |
| 0.047 | 70 | 2 | 0.052 | 0.597 | 0.502 |