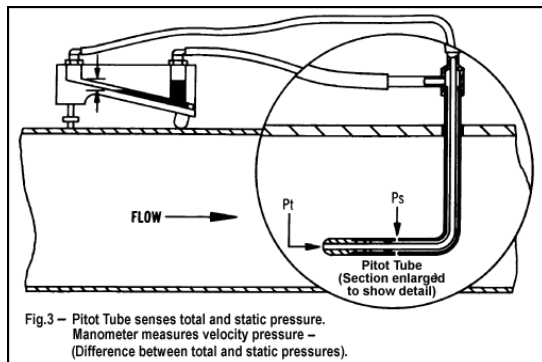


Wind is considered to be a major erosive agent in arid and semi-arid regions where vegetation cover and surface roughness is minimal and soil is loosened by human activity. Wind erosion can remove the most productive surface soil layers, alter vegetation species composition and contribute to land condition degradation.

Methodology. Air velocity measurements through a wind tunnel have been successfully used to evaluate changes in the threshold friction velocity (u^*) required to entrain mineral soil particles at the surface due to changes in surface characteristics. These changes have included increases in aggregation and surface roughness, soil retention and soil crust strength, surface soil water content and degree of soil surface disturbance.

To simulate the movement of air by wind through a tunnel, fans or blowers are usually used. They work by imparting motion and pressure to the air with a screw propeller or paddle wheel action. When force or pressure from the fan blades causes the air to move, the moving air acquires a force or pressure component in its direction or motion due to its weight and inertia. This force is called the velocity pressure and is measured in inches of water column. In an operating wind tunnel or any duct system a second pressure is always present that is independent of air velocity or movement. Known as the static pressure it operates equally in all directions, also measured in inches of water column. In exhaust systems like our wind simulator setup, a negative static pressure will exist on the inlet side of the blower, it is positive at the discharge end. Total pressure is the combination of static and velocity pressures and is expressed in the same units. Total pressure is easy to determine, allowing us to estimate velocity pressure by subtracting static pressure from total pressure.

To estimate velocity pressure, it is necessary to determine these effects fully and accurately. This is usually accomplished with an impact tube that faces directly into the air stream. A Pitot tube consists of an impact tube that receives total pressure input fastened concentrically inside a second tube of slightly larger diameter that receives static



pressure from radial sensing holes. The air space between the inner and outer tubes permits transfer of pressure from the sensing holes to the static pressure at the opposite end of the Pitot tube and then, through connected tubing, to the low or negative pressure side of a manometer. When the total pressure tube is connected to the high pressure side of the manometer, velocity pressure is indicated directly. Because accurate readings cannot be taken in a

turbulent air stream, the Pitot tube needs to be inserted at least 5 tunnel diameters below a

flow straightener. The tunnel diameter needs to be at least 30 times the diameter of the Pitot tube.

Experimental Design. At the Boorman and Gies farms, treatment plots were established to evaluate the effectiveness of mustard as a cover crop on the threshold friction velocity of soil particle entrainment. Two treatments were applied to the soil surface, the growth of mustard and exposed mineral soil without mustard. Both treatments were irregularly covered by wheat straw. The two treatments with five replications without sampling included mustard and no mustard. The plots were installed on each farm with the following configuration:

	I	II	III	IV	V
Mustard	Yes	No	No	Yes	No
Plot	6	7	8	9	10
	I	II	III	IV	V
Mustard	No	Yes	Yes	No	Yes
Plot	1	2	3	4	5

Plot	Rep	Trt
	1	1 No
	2	2 Yes
	3	3 Yes
	4	4 No
	5	5 Yes
	6	1 Yes
	7	2 No
	8	3 No
	9	4 Yes
	10	5 No

Fig. 1—Plot layout for mustard treatments at the Boorman and Gies farms.

Data Analysis. Threshold wind velocity data were analyzed for differences among mustard treatments on the Boorman farm by a fixed effects General Linear Models Analysis of Variance (GLM ANOVA) using the 2003 release of Number

Cruncher Statistical System (NCSS) (Hintze 2001). Rain during the wind simulation on the Gies farm stopped data collection. The small number of samples precluded statistical analysis, though the data illustrates some interesting but non-significant trends.

Results. Threshold wind velocity for plots treated with mustard showed significant differences among treatments at the Boorman farm (Fig. 2). The GLM ANOVA model had an F-Ration of 3.71 and a probability level of 0.54 at $\alpha=0.09$.

Mean Threshold Friction Velocity By Mustard Treatment

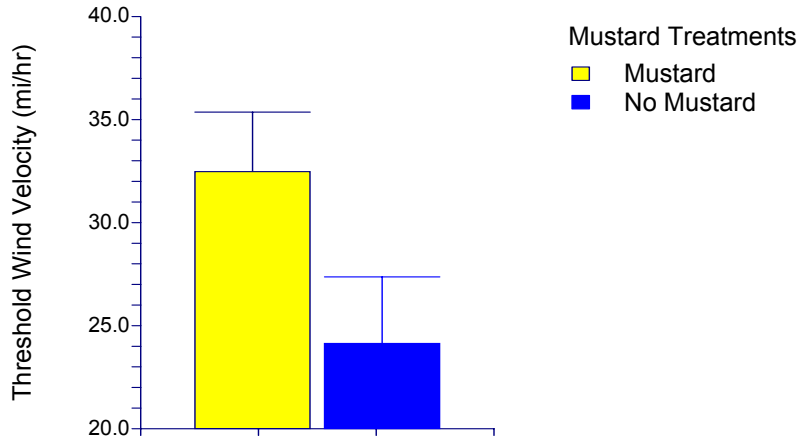


Fig. 2—Threshold wind velocities required to entrain surface soil particles on plots with and without mustard, Boorman Farm.

Threshold wind velocity for plots treated with mustard showed no significant differences among treatments at the Gies farm (Fig. 3). However all treatment plots were sampled after a transient surface crust had formed following raindrop impact. Note the difference in wind velocities before and after the surface crust was physically removed.

Mean Threshold Friction Velocity By Mustard Treatment

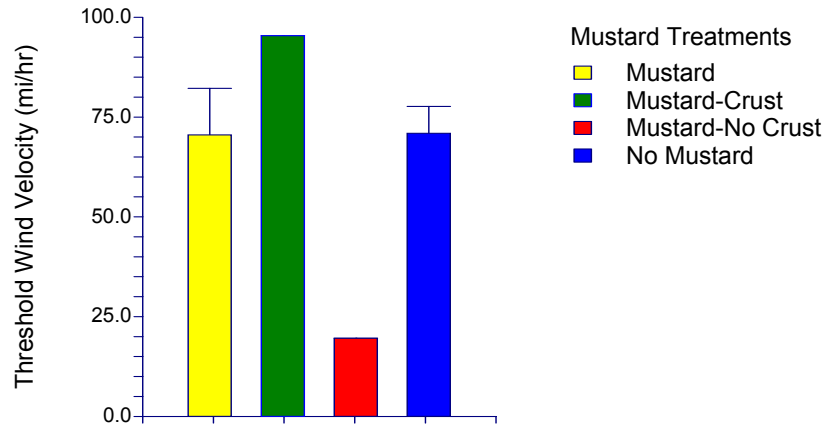


Fig. 3—Threshold wind velocities required to entrain surface soil particles on plots with and without mustard, Gies Farm, limited sampling.

