ridges covered for a horizontal distance of 1 m (this may be the intended definition), then the ridge roughness is sensitive to ridge height (values in parentheses, Table 1). The agreement is still not good between the two methods of calculation for ridge roughness.

Further, suppose ridge no. 7 were superimposed on ridge no. 5, first parallel and then perpendicularly. This superimposition could represent indentations from drills traveling parallel and perpendicular to irrigation furrows. The oriented roughness calculated by the procedure suggested by Saleh (1993, Eq. [3]) is 50 for the ridges parallel to each other and 0 for the ridges perpendicular to each other. Both results are unreasonable.

Based on this analysis, I urge caution in the interpretation of the chain method of measuring soil surface roughness and its application to wind erosion.

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References

Reply to “Comments on Chain Method for Measuring Soil Roughness”

Skidmore (1997) has raised two important issues surrounding the use of the chain method to measure soil surface roughness. First is the application of the chain method for a fixed chain length or a fixed horizontal distance and, second, confusion associated with application of the chain method for oriented roughness measurement.

Surface Roughness Index. The surface roughness index is based on the principle that if a string of given length, L1 (e.g., 1 m), is placed across the soil surface, the horizontal distance covered, L2, decreases as roughness increases (Case I, Fig. 1 [upper]). The surface roughness index is expressed by the following equation:

\[ R = \log (1 - g) \]  

If horizontal distance L2 in Eq. [1] is kept constant, then LI (string length) has to extend to cover the roughness elements within the length of L2 (Case II, Fig. 1 [lower]). Table 1 shows the measured LI and L2 for the ridges described by Skidmore (1997) when Case I or II is applied (Fig. 1). The calculated R would be the same whether Case I or II is employed (Table 1).

Field and laboratory experiments have shown that using a roller chain is much easier than using a string to measure roughness. A chain with the smallest links possible will follow the soil roughness. At the time the chain method was developed, a chain with 0.01-m links was the smallest chain available on the market. Field and laboratory observations indicate that the differences in measurements made with the chain and measurements made with the string are negligible when roughness elements are >0.01 m.

Counting the Number of Roughness Peaks

Woodruff (1951) proposed a ridge roughness factor, K, which describes ridge roughness with respect to ridge height and spacing. The K is based on 1:4 ridge height (H) and spacing (S) ratio and expressed as follows:

\[ K_r = \frac{4H^2}{S} \]

To include H and S effects on the surface roughness index, Saleh (1993) converted R values obtained from ridge measurements to a K_{(chain)} value computed by the Zingg and Woodruff (1951) method as follows:

\[ K_{(chain)} = \frac{CR}{N} \]

Saleh (1993) reported a constant C of 0.02118 representing an average ridge roughness condition. This value is based on an empirical relationship of K_r (Eq. [2]) and the RIN ratio. The variable N is the number of ridges covered by the chain during the measurement (Fig. 1 [upper]). It is extremely important that the N value be correct. The consequence of an incorrect N is an incorrect K_{(chain)} value. Skidmore (1997) correctly identified this problem (Table 2, Column 8). Therefore, further derivation using Eq. [1], [2], and [3] were completed to obtain K_{(chain)} directly from ridges...