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OXALATE-EXTRACTABLE Al AS A CRITERION FOR IDENTIFYING PODZOL B HORIZONS[1]

It has been shown that extractable Fe and Al can be used as a laboratory criterion for differentiating certain kinds of soil horizons (3, 5) and the National Soil Survey Committee has adopted the limit, $\Delta(Fe + Al)$[2] > 0.8, for the Bf horizons of Podzols (6). A re-examination of the data upon which this limit was based (5), combined with data accumulated more recently, suggests that extractable Al alone would be a simpler and better basis for differentiating Podzol B horizons from others.

Data for 132 soils separated into seven classes on the basis of morphology, together with analyses of organic matter, extractable Fe and Al, pH, and exchange chemistry show that oxalate Al and $\Delta(Fe + Al)$ values have similar distributions (Fig. 1). However, the oxalate-Al values generally are clustered more closely than the $\Delta(Fe + Al)$ values, and a limit of 0.6% for oxalate Al gives an excellent separation of Podzol B horizons from others. The limit, $\Delta(Fe + Al) > 0.8$, also provides a good separation, but a few Brunisolic and Gleysolic soils have B horizons with $\Delta(Fe + Al) > 0.8\%$ and a few Podzol B horizons fail to meet the limit. The failure of two of the Humic Podzols to meet the limit is not serious, as the definitive horizon of these soils is a Bh horizon.

[1]Contribution No. 277.
[2]$\Delta(Fe + Al)$ = percent oxalate-extractable Fe + Al in a horizon — percent oxalate-extractable Fe + Al in the C horizon.

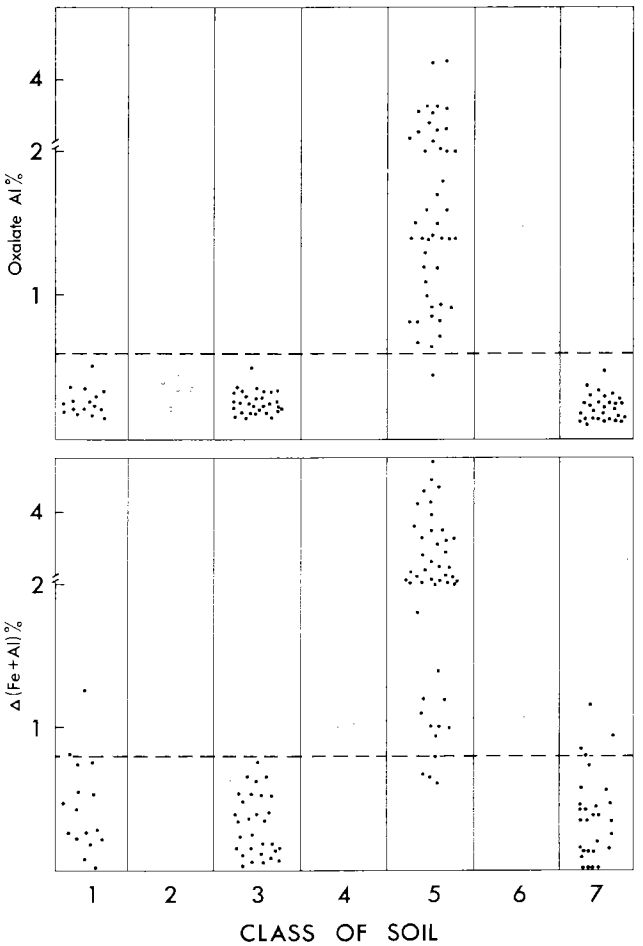

FIG. 1. Oxalate Al and Δ(Fe + Al) values for the B horizons of various classes of soil: 1, Eutric Brunisols and Melanic Brunisols; 2, Dystric Brunisols; 3, Gray Luvisols and Gray Brown Luvisols; 4, Bisequa Gray Luvisols; 5, Humo-Ferric Podzols, Ferro-Humic Podzols and Sombric Podzols; 6, Humic Podzols; and 7, Gleysolic soils.

Extractable Al alone as a criterion of Bf horizons has several practical advantages over Δ(Fe + Al):

1. It is simpler, as only the B horizon must be analyzed instead of the B and the IC. In a few soils, the oxalate-Al contents of the C horizon were almost 0.6% (5). The fact that the samples concerned contained more organic matter than most C horizons, together with more recent results for soils sampled to depths up to 3 m (4), suggests that this problem was at least partly due to insufficient depth of sampling.
2. For soils lacking IC horizons, the calculation of Δ(Fe + Al) is impossible.
3. It provides a better split than does Δ(Fe + Al) between Podzol B horizons and the A and B horizons of some Gleysolic soils. For example, the Ah or

Ap horizons of three Humic Gleysols from Ontario had Δ(Fe + Al) values of 1.6, 1.1 and 0.90%. The corresponding values for oxalate Al percent were 0.51, 0.35 and 0.43. Also, some Aeg horizons of Eluviated Gleysols have Δ(Fe + Al) values greater than 0.8%, but the oxalate-Al values are less than 0.6%. This is not a serious problem for virgin soils, but it might cause confusion in the identification of cultivated Sombric Podzols associated with Gleysolic soils.

4. Dithionite-Al values (5) are closely related to oxalate-Al values. Thus, if only dithionite values were available they would provide a useful indication of Bf horizon development. Substitution of dithionite-Al values for oxalate-Al values in Fig. 1 would move only 4 points across the limit line.
5. It eliminates the problem arising from the dissolution of Fe from minerals such as magnetite (1) and olivine that occur in some soils.

Many more data are required, especially for weakly developed Podzols, integrades between other soils and Podzols, and for a wide range of parent materials, before it can be stated with certainty either that extractable Al is the best basis for establishing a limit for Bf horizons or that 0.6% is the best limit. Furthermore, it is recognized that many properties are useful in characterizing Podzol B horizons: morphology, organic matter, Fe, pH-dependent charge, etc. However, the information now available indicates that extractable Al is the most useful single criterion and it correlates closely with pH-dependent charge (2). It should be tested further and adopted if it proves to be satisfactory.

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