

# This Week's Citation Classic

McKeague J A & Day J H. Dithionite- and oxalate-extractable Fe and Al as aids in differentiating various classes of soils. *Can. J. Soil Sci.* **46**:13-22, 1966. [Soil Res. Inst., Canada Dept. Agriculture, Ottawa, Canada]

This paper presented the first specific criterion used in Canada for distinguishing Podzolic B horizons from others. The criterion was based upon acid ammonium oxalate extractable Fe + Al in the B horizon as compared with that in the C horizon. Data for a wide range of soils were used in developing the criterion. [The *SCI*<sup>®</sup> indicates that this paper has been cited over 140 times since 1966.]

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"This work was undertaken to find a simple, objective method for distinguishing the form of Fe accumulated in the B horizons of Podzolic soils from that in other reddish brown soil horizons. It followed from previous research that showed misclassification as Podzolic of other kinds of soils that had horizons of iron accumulation. The first step was that of testing numerous published methods-for the extraction of 'free iron oxide' to determine their degree of specificity for the Fe accumulated in Podzolic B horizons. Schwertmann's results indicated that acid ammonium oxalate was a promising extractant for this purpose as it dissolved X-ray amorphous iron oxide.<sup>1</sup> Preliminary testing gave positive results.

"John Day, a colleague in the Canada Soil Survey, and I, with the help of local pedologists, sampled a wide range of soils, including Podzolic soils, in many areas of Canada. We extracted separate subsamples of horizons of these soils with acid ammonium oxalate at pH 3, and with dithionite-

citrate-bicarbonate which extracts most forms of non-silicate iron from finely ground soils. Analysis of the data showed that Podzolic B horizons consistently had at least 0.8% more acid ammonium oxalate extractable (Fe + Al) than the associated C horizons. This criterion was adopted as a basis of distinguishing Podzolic soils from others in Canada. Some Gleysolic B horizons had a marked accumulation of dithionite-extractable Fe that was not extracted by oxalate. As indicated by Schwertmann such iron oxide was crystalline; goethite was the mineral found.

"The frequent citation of this simple experimental work seems surprising as it extended published information in only a minor way. Indeed, acid ammonium oxalate was used in Sweden in the 1920s as an extractant of the accumulated material in Podzol B horizons, and Lajoie and DeLong<sup>2</sup> tested it on some Canadian soils in 1945. However, this work was essentially forgotten in North America in the 1940s and 1950s when the emphasis was on crystalline clay minerals in soils. The popularity of our paper stems from the fact that it was timely. A new system of soil taxonomy had been published in the United States in 1960; it based classification on soil properties that could be measured quantitatively. In Canada and other countries objective soil classification criteria were being sought to avoid the ambiguity of earlier systems. In addition, renewed interest had emerged in the amorphous constituents of soils. Thus this paper filled a need at the time; it put forward a specific classification criterion based upon experimental evidence of the accumulation of secondary, amorphous materials in Podzol B horizons

"Subsequent work has resulted in the development of improved classification criteria for Podzolic B horizons that do not use acid ammonium oxalate as an extractant. The paper is cited by workers who showed the limitations of the work as well as by those who followed the procedure suggested."

1. Schwertmann U. The differentiation of iron oxide in soils by photochemical extraction with ammonium oxalate. *Z. Pflanzenernahr. Dung. Bodenkunde* **105**:194-201. 1964.
2. Lajoie P G & DeLong W A. The acid-oxalate extracts of Podzol and Podzolic soils. *Sci. Agr.* **25**:215-20. 1945.