SOIL SCIENCE

Aluminium extracted by Neutral Citrate-Dithionite Reagent

THE neutral citrate-dithionite reagent of Aguilera and Jackson[1] is used widely to remove iron oxides from soils and soil clays prior to mineralogical analysis. It is also employed in a scheme for the fractionation of soil phosphorus[2], where it is used for extracting iron-bound, but not aluminium-bound, phosphorus occluded by secondary iron oxides. This communication describes a method for determining aluminium extracted from soils by this reagent and reports the amounts of aluminium extracted from an aluminium oxide, an aluminium phosphate, and some New Zealand soils. The oxide was prepared by adding ammonium to a solution of aluminium chloride and dialysing the precipitate until free of soluble salts; the hydrous oxide had been air-dried and stored for 2 years. The phosphate, a B.D.H. laboratory reagent, was washed with water until water-soluble phosphorus was reduced to 0·25 per cent.

0·4 gm. of the oxide and phosphate and 1 gm. of finely ground soil were extracted according to the procedure of Aguilera and Jackson[1]. The extracts were digested with hydrogen peroxide until oxidation of the sulphur was complete. An attempt to determine aluminium colorimetrically using aluminon failed because the aluminon was partially decolorized by an oxidizing agent in the extract. A volumetric method using disodium-ethyleminediaminetetraacetic acid [3,4] was found satisfactory. Before carrying out the titrations it was necessary to oxidize the solution with boiling concentrated nitric acid to destroy a complexing agent which formed during the peroxide oxidation. This complexing agent held both iron and aluminium aginst ethylenediaminetetraacetic acid at *p*H 6–7.

An aliquot of the citrate-dithionite reagent was oxidized with boiling concentrated nitric acid and then evaporated to dryness. The residue was taken up in 1 + 1 hydrochloric acid and the evaporation repeated. The residue was baked on the hot plate for 30 min. and was then taken up in 1 ml. of 1 + 1 hydrochloric acid, followed by about 30 ml. of water. The procedure of Longuyon[3] was followed except that, because the benzidine-ferro-ferri cyanide indicator was oxidised by the solutions from soil extracts, the titrations were done in 40 per cent ethanol using eriochrome black *T*[4].

Single extractions of the aluminium oxide and aluminium phosphate were made with the citrate reagent alone and with the citrate plus dithionite. The results (Table 1) show that the citrate is mainly responsible for the considerable amount of aluminium extracted. Between 20 and 25 per cent of the total aluminium was extracted from the oxide and phosphate. In addition, 28 per cent of the phosphorus was extracted from the phosphate by the citrate-dithionite reagent.

Table 1

	Total content		Estd. by citrate		Estd. by citrate-dithionite	
	Al (per cent)	P (per cent)	Al (per cent)	P (per cent)	Al (per cent)	P (per cent)
Oxide ..	28·5		6·95		5·95	
Phosphate ..	16·9	19·4	3·7	5·2	4·4	5·5

Double extractions were made with the citrate plus dithionite and with the citrate reagent alone on twelve New Zealand soils representing different parent rocks and stages of profile development. The aluminium extracted by citrate plus dithionite ranged from 0·32 to 2·2 per cent aluminium, which amounted to between 18 and 87 per cent of the iron extracted. The citrate reagent alone brought into solution between 70 and 90 per cent of the aluminium extracted by the citrate plus dithionite. Yuan and Fiskell[5] have found that when used as part of Chang and Jackson's method for fractionation of soil phosphorus, the citrate-dithionite reagent can extract an appreciable amount of aluminium. The procedure of Aguilera and Jackson is very useful for the removal of iron oxides from soils and soil clays, but it is evidently not specific for iron and should not be used uncritically in studies of soil colloids and soil phosphorus.

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BIOLOGY

Early Induction of Flowering in Birch Seedlings

IT is usual for 5–10 years to elapse before catkins are borne on seedling trees of birch (*Betula* spp.). The existence of this non-flowering or juvenile period (up to 40 years in some genera) is an important factor in tree-breeding, since the improvement of tree form and timber quality is hampered by the long and indefinite interval between successive generations.

An experimental attempt to shorten the juvenile period in birch (*Betula verrucosa, Ehrh.*) was started in 1957. This was designed to determine whether the tree develops the capacity for reproduction as a result of attaining a certain height or size, or as a result of undergoing a certain number of cycles of growth and dormancy. Accordingly, the two treatments applied were:

(1) Continuous growth under long-days or continuous illumination in a greenhouse at approx. 15°–25° C.

(2) Periodic growth, in which the trees made about 30 cm. of extension growth under the above conditions, and then their growth was stopped by short-day treatment (9 hr.). After six weeks' chilling at 0°–5° C. they were returned to long-days.

Birch seed was sown in February, 1957, and the seedlings made rapid growth under long-days in a heated greenhouse. In early June the 'periodic' series commenced short-day treatment, and controls were put outside under natural day-length conditions. The rate of growth of the 'continuous' series decreased during the autumn, and then in 8 out of the 14 plants increased again during the first three months of 1958. The remaining 6 plants became fully dormant, and were therefore chilled and re-started.

During the period November, 1957–February, 1958, when they were 1·9–2·7 m. high and less than one year old, 7 of the 14 trees in the 'continuous' series initiated catkins within buds of the upper part of the stem, as many as 75 being formed on one tree. These catkins began to emerge with the increased growth made by the trees during February and March, 1958,