

MEASURE AND MANAGE

Aluminum

By Dale Cowan
dcowan@agtest.com
Agri-Food Laboratories CCA.On

We have been asked at times why we do not report aluminum on our AgTest Soil Report. The simple answer is we feel that knowing the aluminum value does not add to the agronomic knowledge; it does not improve recommendations by knowing it. In calcareous high pH soils aluminum simply cannot affect root growth. Aluminum is a problem on low pH acidic soils with pH <5.5 and certainly at pH < 5.0 aluminum is phyto-toxic. The remedy of course is to lime to an appropriate pH level and improve overall nutrient availability. We should be skeptical of recommendations that are made justifying additional P fertilizer and limestone because of an extracted aluminum value on calcareous soils.

The concern arises over the use of the Mehlich (pronounced “may-lick”) 3 Extraction to determine aluminum (Al) in high pH soils. The Mehlich 3 extraction is a strong acid extraction used to universally extract P, K, Mg, Ca, Zn, Mn, Cu, Fe and Al. In Quebec and the Maritimes the Mehlich 3 is the official extraction method. The soils in Quebec are acidic as a matter of fact 95% of the soils are very acidic with pH values in the range of 4.9 to 5.5. In Quebec the Provincial government has researched and calibrated the Me 3. In particular they use a ratio of Me P/ Me Al to determine P responsive soils. Further they have used this ratio to establish soils that should not receive any applications of manure or fertilizer P due to greater runoff of potential of soluble P. This ratio is used as an Agri-Environmental indicator.

Contrasting this with Ontario soils where we are 95% calcareous, soils typically in the 7 to 7.9 pH range (Less than 2% of our soils are acidic) the soil chemistry is different. Universally accepting methods from other areas should not be done. The use of the Me 3 was initially designed and is still used by jurisdictions that have soils of granitic, coarse texture and low in base elements. In Ontario our Accredited Methods are Sodium Bicarbonate for P, Ammonium Acetate for the K and Mg, DTPA for Zinc and Phosphoric acid for Manganese. To be an accredited lab you must demonstrate proficiency in a check sample program with OMAF. The Nutrient Management Act stipulates the use of accredited tests.

Mehlich is not recognized in Ontario as an official method. Mehlich 3 is the only method that can extract Aluminum at the magnitudes being reported.. Agri-Food Laboratories believes that if you are an Accredited Lab you should be a compliant one as well. We do

the Me 3 extraction for our customers in Quebec and the Maritimes as it is their official method and we clearly indicate the method on the report.

In Ontario unless otherwise indicated Agri-Food Laboratories use the OMAF methods as our standard protocol. Using Mehlich in a calcareous soil to extract Aluminum leads to assumptions that this Al is exchangeable. In soils with $\text{pH} > 5.5$ it is a chemical impossibility for Al to affect plant root growth. The assumption is that extracted values are available values. The strong acid of the Mehlich simply digests Al out of the soil matrix. Perchloric acid an even stronger acid will extract a higher level of aluminum should we therefore assume that that aluminum is also affecting agronomic performance? Extracted aluminum at this point is merely a number unrelated to crop performance at neutral pH, we should not confuse more numbers on soil report equating to more knowledge. We need to be mindful of the difference between information and knowledge.

Until such a time proper research is done by and peer reviewed by qualified people to ascertain the Me P/Me Al ratio as a relevant agri-environmental indicator for high pH soils we need to be skeptical of recommendations justified on the basis of extracted Al. Regular soil sampling programs done with accredited tests, ethically interpreted by qualified CCAs, and following best management practices will keep your soils productive and free of harmful substances.