Soil pH and Aluminium

The soil pH is the single most important factor controlling the amount of Al^{3+} available for plant uptake in the soil solution. Aluminium will become plant available when the pH begins to drop below pH 6.0. However, in most soils the increase in aluminium in solution does not seriously affect crops until the pH drops below pH 5.5. Soluble Al rises dramatically in nearly all soils as pH drops below pH 5.0. Under these conditions, yield reductions are expected for just about all crops. In these very acid soils, only species adapted to low pH and thus high Al in solution (e.g. blueberries, cranberries, acid-loving ornamentals and many Australian natives) and the few crop species bred to tolerate high soil solution Al levels, can be expected to do well.

Soil aluminium can be determined by several methods. The intention usually is to determine the risk of losing crop productivity to Al toxicity at low pH. Some soil extractants remove all or most of the total extractable Al from clay and organic soil fractions; others attempt to determine the plant available fraction of aluminium only.

It has been shown that across a range of soil types, total extractable or reactive Al is not a particularly good predictor of crop response. The aluminium saturation as percentage of the total or effective cation exchange capacity (CEC) is considered more applicable to judge aluminium effects on crops.

The Mehlich 3 extraction determines the total extractable reactive aluminium. We are using this measurement as part of determining the Phosphorus Saturation Ratio (M3 PSR), which is an indicator of the soil's P buffering capacity.

To determine potential Al toxicity, we measure the exchangeable acidity, which is the aluminium plus hydrogen saturation percentage as a proportion of effective CEC. Below pH 5 the proportion of Al as part of exchangeable acidity increases rapidly. When a high proportion of the effective CEC is occupied by exchangeable Al, a sharp increase in the Al concentration of the soil solution and a corresponding decrease in plant growth is expected for most plant species on most soils.

Soil pH (H2O)	% Al Saturation
4.45	82
4.90	27
5.60	13
5.90	6