Technical Note

Technical Note – Titanium as a Marker for Soil Contamination in Plant Testing

Introduction

Obtaining clean plant samples can be challenging at times, and the contaminant adhering to the outside of the plant sample can confound interpretation of some plant test results. This is largely to do with trace element result interpretation, but also affects feed test samples where Ash may be elevated if the feed sample has soil contamination, with a resultant depressed Organic Matter Digestibility and ME. Sample decontamination procedures are available, but are often ineffective as discussed below. Labs often suggest Iron (Fe) as a marker for soil contamination, but that can be difficult to interpret as plants do contain iron as an essential trace element within the tissue.

In early 2024, Hill Labs added Titanium (Ti) to the Basic Plant (BP) Profile, solely to be a marker for dust or soil contamination on the sample submitted for testing. The addition of the Ti test will be most useful for cereal, forage, silage and turfgrass samples, but as horticultural vine and tree-crop leaf samples will usually have a very low Ti result, it can largely be ignored on those sample types.

About Titanium

Titanium is considered a non-essential element for plant growth. It is the ninth most abundant element in the earth's lithosphere, and most forms are insoluble so accumulate in surface soils. Ti is generally found in very low concentration in plants (<1 mg/kg), due to the low solubility of most Ti forms found in soil i.e. it has very low bioavailability. This means that soil Ti is not readily absorbed into plant tissue, and therefore becomes a useful marker for dust and soil contamination on samples analysed in the laboratory.

Of interest however, is that some recent preliminary studies have shown Ti to be a beneficial element – where chelated forms of Titanium have been shown to possibly increase yield, fruit ripening and sugar content in fruit and increasing chlorophyll content of tomato leaves. It is thought that Ti may play a role in photosynthesis and N_2 fixation. NOTE: The insoluble forms of Ti found in soil and dust are unlikely to have any function in these processes, and Hill Labs does not suggest the reported Ti result be used in this way.

Sample Decontamination Procedures

The lab does offer two decontamination procedures that may be requested, but are not always fully effective. Some sample types are excluded for these procedures, where the wash may affect the sample adversely and compromise the test results. Decontamination of samples is not a routine part of plant testing, due to constraints such as labour and deionised water supply meaning higher test costs and slower turnaround-time. Submitting clean samples is the recommended advice.

Water Wash

A deionised water wash (WWash) may be requested on some sample types, and this is not currently charged for. Where samples are obviously dirty, the lab may elect to do a water wash even though it wasn't requested on the job submission. The lab cannot do a water wash on silage samples or some other feeds e.g. swede and fodderbeet bulbs where Dry Matter tests are required and those samples may absorb water. Grass and cereal herbage samples are particularly difficult to get fully clean, as soil is often caught in the tiller/sheath part of the plant which does not get exposed to the water wash directly.

A separate TWWash activity for turf grass samples is carried out as a pre-requisite for the Basic Plant profile test, as these samples are usually heavily soil contaminated during the sample collection by mower. The TWWash does incur a charge.

Acid Detergent Wash/AvoWash

An acid detergent wash (AcidDetWash) can be requested where recent sprays or liquid fertiliser may have left residue on the leaf surface. This is intended to aid in better results for plant trace elements copper, manganese and zinc, which are often elevated in horticulture crops following spray events. The lab does a default acid detergent wash (AvoWash) on avocado leaf samples as copper is a necessary fungicide in avocado orchards. The acid detergent solution used is very weak, so that no elemental extraction from within the leaf tissue occurs – but as such, it can sometimes be poor at removing all spray residues. Most modern spays are manufactured with adjuvants to stick to and penetrate the leaf cuticle for better efficacy, but this means the lab washing procedure is not always fully effective. The AcidDetWash activity does carry a charge per sample, or per fraction for Combined Grape or Combined Potato profile testing (where the leaf blade and the petiole are analysed as separate fractions)

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Interpretation

Hill Labs has suggested a soil or dust contamination scale, according to the Ti result measured.

Ti result (mg/kg)	Contamination level
<10	Free of Soil Contamination (Very Clean)
10-40	Slight Soil Contamination
40-80	Moderate Soil Contamination
80-120	High Soil Contamination
>200	Heavy Soil Contamination (Very Dirty)

Where the soil contamination is indicated as “moderate”, “high” or “heavy”, the reported Iron (Fe) result may need to be used with caution or even disregarded. In pasture herbages and forages, the test results for Cobalt (Co), Zinc (Zn) and Selenium (Se) may also be confounded due to the soil content in the plant sample. While livestock ingest significant amounts of soil during grazing, the bioavailability of these elements to the animal is not well understood.

Conclusion

The inclusion of the Ti element into the Basic Plant profile offered by Hill Labs is beneficial as a dust or soil contaminant marker. There is no additional cost to the BP profile with this inclusion, and it provides useful information to aid with interpretation of trace element analysis. It is also very helpful in understanding feed analysis tests affected by soil contamination in those samples.

An automatic comment is included in every certificate of analysis where Ti is reported, conditional on the level of Ti measured in the sample, to make it easy to interpret.

References

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