e-GRO Alert

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Interpreting Water Quality Analysis Reports

A water source is suitable for irrigation when individual parameters are below thresholds that would negatively impact plant growth and quality or compromise irrigation systems.

The quality of irrigation water is crucial to develop nutrient programs that are compatible with the crops' needs.

In this Alert, we will discuss how to interpret the water quality analysis reports to evaluate chemical aspects of water quality that affect nutrient programs.

The first step to a good interpretation is properly collecting samples. In brief, collect the sample close to the source (avoid collecting contaminants such as fertilizer residues); let the water run for a few minutes before pouring into the container; use a clean container (avoid reusing containers that contain residues or bottled-mineral water containers); be consistent in how you collect samples; and send the sample(s) immediately. Find a step by step guide on how to collect water samples in this link http://e-gro.org/pdf/2021-10-09.pdf.

A summary of the interpretation for each parameter is included in table 1 (page 2). All parameters, except pH, below the threshold are optimum for irrigation (the lower, the better). When any element is above the optimum level, adjust the nutrient program. If plant essential elements are above the levels required by the crop, then select and apply fertilizers that do not have such element. In extreme cases, reverse osmosis or blending with other water sources might be required. Note that some elements can interact among themselves. For example, high levels of potassium can limit plant uptake of other elements such as calcium and magnesium. Finally, alkalinity above 150 ppm will raise the pH of the substrate overtime. Read this e-Gro http://e-gro.org/pdf/2017_610.pdf to learn how to use fertilizers to manage the pH of the substrate or use this calculator http://e-gro.org/alkcalc/ to estimate how much acid to inject to reach a target alkalinity.

The report of the water analysis informs potential problems. It provides information that we can use to adjust the fertilizer program before problems arise.

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PARAMETER	THRESHOLD	COMMENTS
Soluble salts (EC)	< 0.5	High EC leads to salt accumulation in the substrate resulting in stunted growth and root damage. Overhead watering may lead to salt burn on foliage. Water EC >3.0 mS/cm is not suitable for irrigation.
pH	5.0 - 7.0	Water with pH <4.5 is very acidic and contains zero alkalinity. High risk of phytotoxicity. Do not inject acid, use fertilizers with basic reaction (high in nitrate-N). When water pH >7.0, use alkalinity to match correct fertilizer. If pH and alkalinity are both high, adjust pH with acid injection (Use alkalinity calculator http://e-gro.org/alkcalc/ to estimate how much acid to inject). Inject acid if pH >8.9. Match pH to optimum pH solubility for agrichemicals.
Alkalinity ($CaCO_3$ equivalent)	< 200 ppm	Water alkalinity is a criteria use to select fertilizers. Moderate alkalinity (40 - 100 ppm) usually requires no action. In container production, low alkalinity (<40 ppm) can lead to low substrate-pH (micronutrient toxicity) and high alkalinity (>150 ppm) will lead to high substrate-pH (micronutrient deficiency).
Sodium (Na)	<70 ppm	Water with high sodium (>70 ppm) can burn foliage and roots. Periodic leaching may be necessary. Capturing and recirculating this water may result in severe crop burning. Reverse osmosis or blending with other water sources is ideal.
Chloride (Cl)	<70 ppm	Same as sodium.
Nitrogen Nitrate (NO_3) Ammonium (NH_4)	10 ppm	Water sources with nitrogen > 10 ppm suggest contamination from agricultural runoff. Reduce the fertilizer rates. Identify the source and remediate runoff with constructed wetlands.
Phosphorus (P) Phosphate (H_2PO_4)	5 ppm	Water levels above 0.1 ppm increase risk of eutrophication. Remediating phosphorus in water before it runs off the property with constructed wetlands.
Potassium (K)	<20 ppm	High levels of potassium can limit plant uptake of other required nutrients such as calcium and magnesium. As levels increase in the water source, decrease applied fertilizer.
Calcium (Ca)	<150 ppm	Same as K.
Sulfates (SO_4)	<45 ppm	High levels of sulfate-S contribute to water electrical conductivity. May interfere with calcium uptake under certain conditions. Reverse osmosis may be necessary.
Magnesium (Mg)	<75 ppm	High levels of magnesium can limit the uptake of other required nutrients such as potassium and calcium. As fertilizer level increases in water source, decrease applied fertilizer magnesium.
Manganese (Mn)	<1 ppm	Same as Mg.
Iron (Fe)	<2 ppm	High iron results in crop phytotoxicity in sensitive crops like geraniums and New Guinea impatiens, especially when the substrate pH is low. Treatment includes maintaining substrate-pH above 5.8. Remove iron from water if staining or iron bacteria are an issue via chemical oxidation with chlorine, ozone or potassium permanganate followed by sand filtration and settling in ponds.
Boron (B)	< 0.5 ppm	Boron can cause toxicity in sensitive plants. Treatment includes keeping the substrate-pH above 6.0 and use calcium-based fertilizers, or blend with a more pure water source.
Copper (Cu)	< 1.0 ppm	Copper can cause phytotoxicity on plants. Reduce or remove copper in fertilizer when water levels are high.
Zinc (Zn)	5 ppm	High levels cause crop toxicity. Reduce or remove copper in fertilizer when water levels are high.
Aluminum (Al)	5 ppm	May interfere with uptake of other micronutrients.
Fluoride (F)	1 ppm	Fluoride can cause toxicity symptoms in some crops. Water treatment with activated carbon filters can remove fluoride and keeping the substrate-pH above 6.0 with calcium-based fertilizers can be used for sensitive crops.

Online tools to help you manage water quality:

WaterQual—interprets the quality of a water source for use in irrigation of plants in greenhouses and nurseries www.cleanwater3.org/wqi.asp

Alkalinity Calculator—calculates the amount of acid to add to your irrigation water http://e-gro.org/alkcalc/

Waterborne Solutions—summarizes published research that tests control of plant pathogens and algae using water treatment technologies https://cleanwater3.org/gsearch.asp

Fertilizer pH - select a nitrogen ratio for pH management— this tool helps you predict the pH of the substrate. Select the crop type, water alkalinity, and nitrogen form in the fertilizer. https://www.backpocketgrower.org/cce2.asp

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In cooperation with our local and state greenhouse organizations