Water Source, Water Quality and Water System

Good water quality should be one of the priorities of any grower. Water is not only a way to transport nutrients and plant transpiration to allow photosynthesis, it has to be safe for the crop. Watering systems can be very different from one facility to another regarding source and further management but water quality should be considered and monitored very often to avoid crop issues.

1. Water Source

Greenhouse businesses have two major potential water sources.
If the facility is situated in sufficiently rainy area, rain water collected on the roof of the greenhouse is certainly the best solution.
If not possible, a well can provide the necessary amount of water.
Let's compare the sources :
Rain Water :

+ Free of nutrients (salts)
+ pH is generally close to neutral (7)
- Necessitates huge storage to cover periods between rains
- Bacteriological development in storage
- Storage has to be dark to avoid development of algae

Well Water :

+ Small storage just as a buffer
- pH may not be in the range usable for watering => necessitates to correct it.
- Through soil layers, water accumulates salts => Deal with present elements for watering.

=> For greenhouse operations, it is easier to use rain water (starting form scratch) and add necessary nutrients rather than dealing with elements already present and hard to remove from well water.
Anyway, it is really important to know your water source quality (complete analysis) and monitor often (send a sample to the lab) to highlight quality variations and take action before a severe issue on the crop.

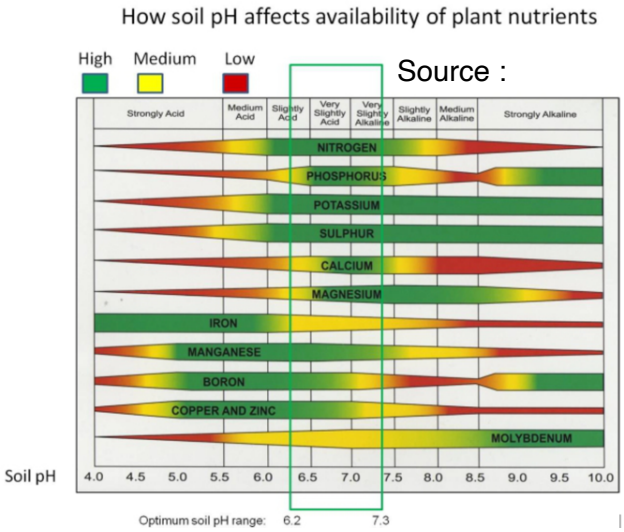
2. Water Quality

Water quality is characterized by :

Salinity
Saline water contains concentrations of dissolved salts.
Reverse Osmosis is the main treatment allowing to remove dissolved salts.

Alcalinity
Alkalinity is the strength of water to resist pH changes.

pH
pH is the potential of hydrogen. It can be corrected by adding different acids (phosphoric acid, nitric acid, citric acid) if pH is higher than 7 or adding soda if pH is lower than 6. The goal is to stay in the range of pH where necessary nutrients are accessible to the plant (see graph besides).



Element concentration
Ec (electro-conductivity measures the concentration of salts =TDS in water solution) gives indication on total salts in solution but no information on which ions are present or their concentration.

Pathogen presence
Desinfection solutions are : Chlorination, ozonation, bromination, copper ion generators hydrogen peroxyde and UltraViolet lights.

3. Water System

Most greenhouses are now recycling irrigation water runoff to avoid releasing nutrients in the rivers and lakes.
It has a lot of benefits, reducing water usage and fertilizers consumption but it is more difficult to keep it safe for the crops.
It can be a source of pathogenic fungal mainly Pythium or Phytophtora but other diseases also, and if water is reused, it can spread from a few plants to the whole production.
Moreover, nutrients are encouraging growth of micro organisms likes algae.

Plant nutrition balance
Not all plants use the same amount of nutrients and it is very important to know the nutrient balance needed for each crop produced and for each stage to reach optimized growth performance.
The easiest way is to find the nutrient balance you need in premix fertilizer from your supplier but the most accurate growers implement their own recipes, like a chef. They purchase basic fertilizers and prepare a premix solution with the closest nutrient balance to the plant needs.
Detailed analysis (lab) of the media can help tweaking the recipe.

The two main incorporation systems are :

Mixing the fertilizer in the watering tank and check the Ec before watering. It needs a mixing pump to make sure it is homogeneous and avoid fertilizers to settle.

Injecting on the go directly in the watering line (Injection rate proportional to flow) and control Ec at the end of the hose before watering.

Adapt the fertilization based on the media control.
Check Ec media (2 hours after watering) once a week to adapt watering Ec. Watering Ec may change according to growing conditions (light, temperature, humidity) reducing or increasing the plant nutrient uptake for growth. The goal is to be as close as possible to the plant uptake to avoid reducing its growth by lacking nutrient or poisoning it with high salt concentration in the media.
For leaves symptoms, please refer to our article : "Reading nutrition issues on leaves"

Conclusion :
Watering systems are very complex and necessitate frequent controls to anticipate plant issues. All this information from the different controls (pH, Ec, water analysis…) is key in consistent production quality. Moreover, controls as tasks description should be documented in Standard Operational Procedures to avoid mistakes (Here is the link to our article on Standard Operating Procedures).
The more details in the tacking the better it is for a team to follow the production. This can include watering date/time, Ec and pH of the solution, volume used and has to be consolidated with media controls and other data.

Comment or questions?
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Sources:
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