

# The importance of continuous high dissolved oxygen levels in irrigation water



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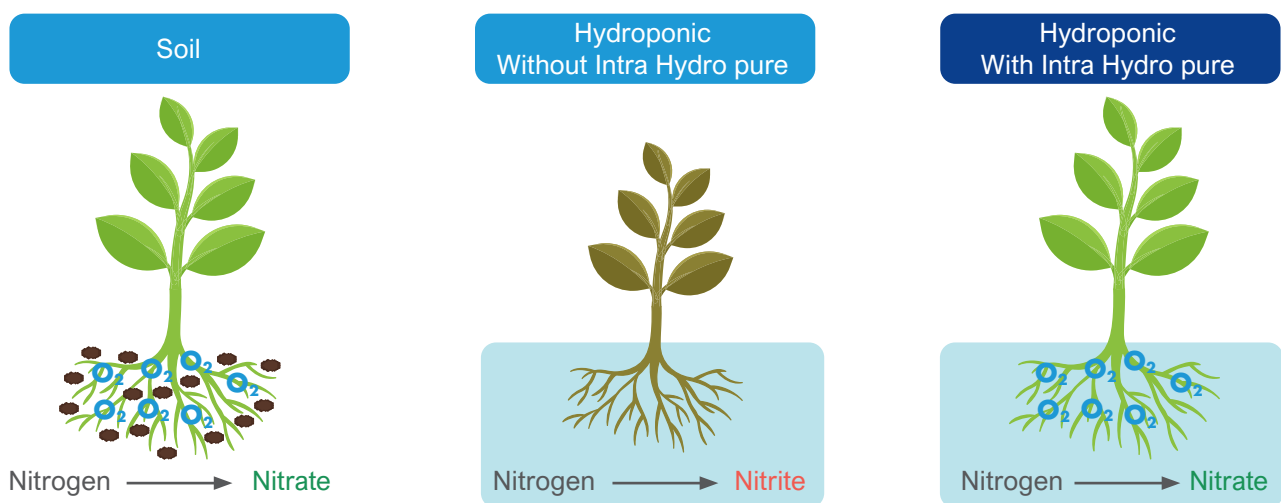


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Oxygen is essential for a healthy plant development. Although plants generate oxygen as a by-product during photosynthesis, they require oxygen for energy production during the night. Also the roots of a plant require oxygen for a proper development and bacteria in the rhizosphere use oxygen to transfer nitrogen into plant-available nitrate and ammonia. In the soil, roots obtain their oxygen from air that is present in pockets between the soil particles, but in hydroponic systems oxygen levels may rapidly drop below the required level of 8 mg/l (**Figure 1**).

Under extreme low-oxygen anaerobic conditions, bacteria start to generate energy by the oxidation of nitrate into nitrite, especially at a low pH. When nitrite accumulates in the substrate, this can quickly reach levels that are toxic to the plant. Plants that are exposed to dangerous levels of nitrite show root browning, leaf wilting and impaired growth. Growth inhibition particularly occurs at low pH levels: the lower the pH of the irrigation water, the higher the growth restriction. It is therefore important to prevent anaerobic conditions by maintaining sufficient oxygen levels at the root zone.

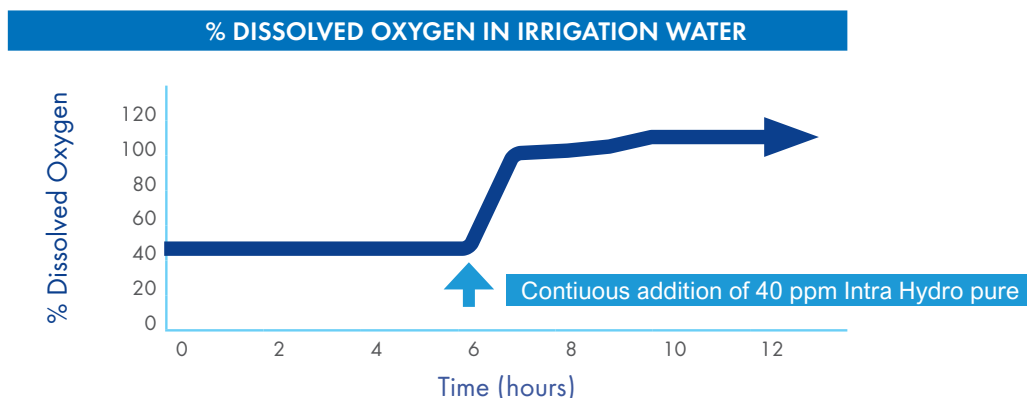
Intra Hydro pure is a unique silver-stabilized disinfectant based on hydrogen peroxide that slowly decomposes after reaction in water and oxygen. Next to effective water disinfection, this paper shows that the addition of Intra Hydro pure to irrigation water increases the dissolved oxygen concentration to a stable level that keeps plants healthy.



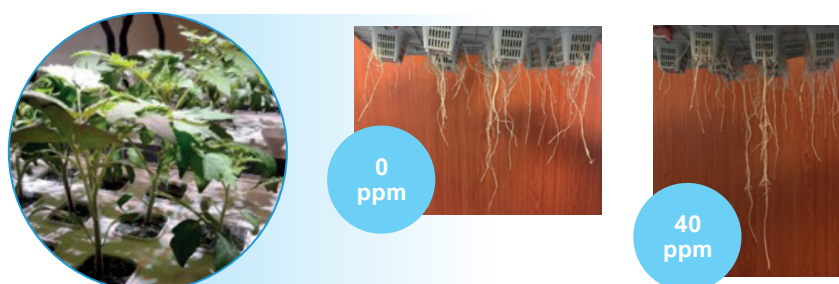
**Figure 1.** In nature, the roots of a plant obtain their oxygen from air pockets between the soil particles. In hydroponic culture systems, the oxygen level in the root zone may be too low, leading to toxic nitrite accumulation. The addition of Intra Hydro pure to the irrigation water increases the dissolved oxygen levels, restoring the conversion of nitrogen into plant-available nitrate.

## Intra Hydro pure increases the amount of dissolved oxygen

Tomato (*Lycopersicum esculentum*) was seeded on water soaked rockwool plugs and placed under 17 hours light per day. Germinated seedlings were transferred to pumice stones in a hydroponic culture system containing fertilizer water with or without 40 ppm Intra Hydro pure. The plants were grown for 5 weeks under 17 hours of light per day. Water without Intra Hydro pure contained 40 – 50% dissolved oxygen. The addition of 40 ppm Intra Hydro pure increased dissolved oxygen to a stable level of 100 – 110% within one hour (**Figure 2**). The plants grown in water with and without Intra Hydro pure had a comparable appearance, but the roots grown in 40 ppm Intra Hydro pure were visibly longer (**Figure 3**).

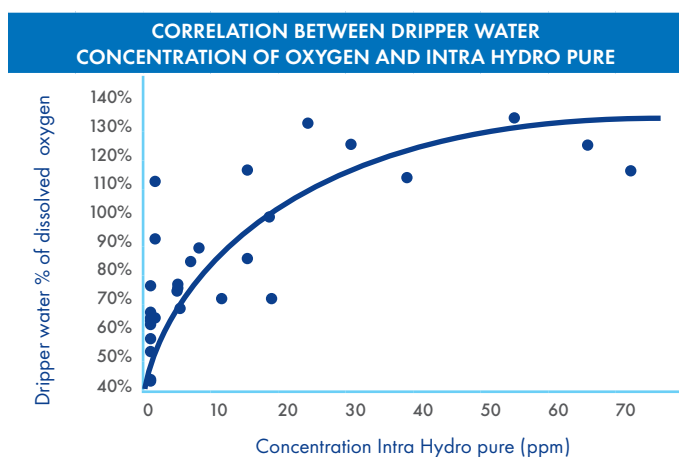


**Figure 2.** The addition of 40 ppm Intra Hydro pure increased the dissolved oxygen in irrigation water from 40-50% to a stable 100-110% within one hour.



**Figure 3.** Tomato plants grown in irrigation water with Intra Hydro pure had a normal appearance, and their roots were visibly longer.

At a commercial Gerbera grower, the irrigation water from six different drippers was sampled for five times in a time period of 14 months (**Figure 4**). These measurements clearly demonstrate that a higher amount of Intra Hydro pure in the irrigation water correlates with a higher level of dissolved oxygen.



### To summarize the benefits of Intra Hydro pure:

- An unparalleled disinfecting capacity;
- Doubles the dissolved oxygen concentration to a constant level;
- Prevents anaerobic oxygen levels that may lead to toxic nitrite accumulation;
- Improves conversion of nitrogen into plant-beneficial compounds;
- And results in visibly longer roots.



**Figure 4.** Correlation between the concentration of Intra Hydro pure and oxygen level in water from different drippers.