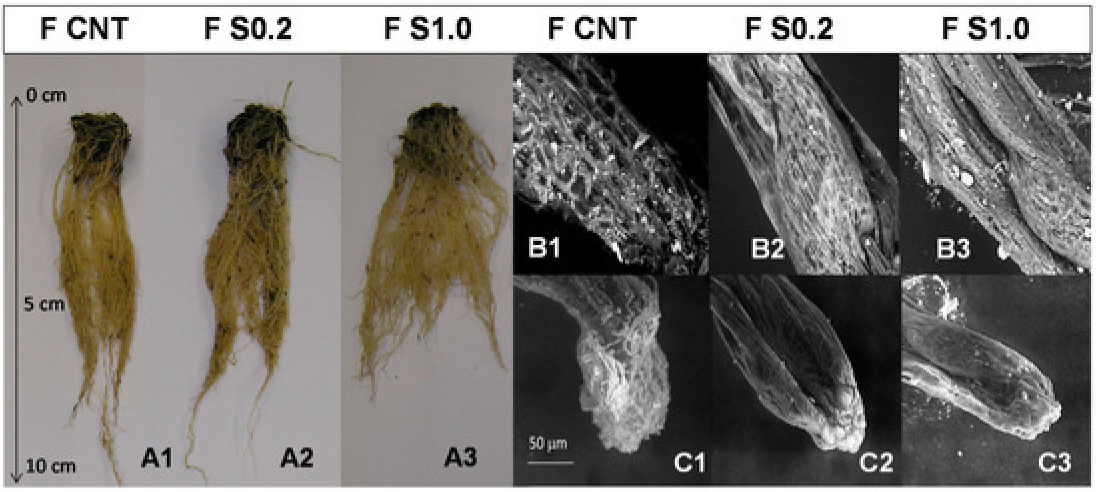
Exogenous Root Applications of Wetting Agents in Soilless Media

Introduction

Dry peat, coir, rockwool or bark mixes can become water repellent, which creates uneven moisture and nutrient delivery around roots. Wetting agents reduce surface tension and restore wettability by improving water contact with hydrophobic surfaces, an effect well documented for organic growing media used in horticulture (6). In soilless systems, exogenous root applications are used to correct dry-back, stabilize irrigation performance, and improve nutrient distribution. This post reviews what has been tested, how these agents affect mineral nutrition, water uptake, yield and quality, known toxicity limits, and realistic application rates.



Effect of surfactants on roots. Taken from (7)

Evidence and discussion

Types tested

Most root-zone wetting agents in horticulture are nonionic surfactants such as alcohol ethoxylates, block copolymers, or organosilicone derivatives; anionic formulations are less common for routine root use due to higher phytotoxic risk, while cationic types are generally avoided; amphoteric agents are used less frequently but appear in some products. The role of wetting agents to counter water repellency in organic media is supported by a comprehensive review of wettability mechanisms and amendments (6).

Water uptake and distribution

In rockwool and coir, adding a nonionic surfactant to the fertigation stream at doses from 2 to 20 000 ppm showed that a **minimal** dose could be sufficient: **2 ppm** increased easily available water by more than 600 percent, while higher concentrations gave no extra benefit (1). Across peat, coir, and bark, wetting agents improved hydration efficiency, although severely dry materials retained some hydrophobic pockets that were not fully overcome by surfactant treatment (2).

Mineral nutrition

In a melon crop on rockwool and reused coco fiber, weekly fertigations with a nonylphenol ethoxylate at about **1000 ppm** reduced nitrate and potassium losses in drainage and increased potassium uptake, while leaving total water use and pH unchanged (3). In lettuce, fertigation with a nonionic organosilicone-type surfactant at **200 ppm** and **1000 ppm** improved nutrient use efficiency without increasing yield, indicating better capture of applied nutrients for the same biomass and specifically in field trials with a methyl-oxirane nonionic surfactant. Direct lettuce evidence of improved nutrient use efficiency and root-zone wetting with **~200–1000 ppm** doses comes from an in-field trial using a nonionic methyl-oxirane surfactant (6) and is detailed further under quality effects below.

Yield and quality

Yield responses depend on whether water distribution was limiting. In lettuce, the nonionic surfactant improved nutrient use efficiency but did **not** increase marketable yield under well-watered conditions. Quality can benefit: lettuce fertigated with a nonionic methyl-oxirane surfactant at **~1000 ppm** showed a significant reduction in leaf nitrate accumulation compared with controls, alongside indications of shallower, more uniform wetting of the upper root zone (6).

Persistence and accumulation

Repeated use matters. In sand models, a polyoxyalkylene polymer surfactant (PoAP) sorbed to particles and **increased hydrophobicity** after repeated applications, whereas an alkyl block polymer (ABP) maintained or improved wettability and did not leave a hydrophobic residue. Chemistry dictates long-term behavior, so product choice is critical (4).

Toxicity

There is a hard ceiling for some agents. Hydroponic lettuce exposed to the anionic detergent Igepon showed acute root damage at **≥250 ppm**, with browning within hours and growth suppression, although plants recovered after the surfactant degraded in solution (5). Practical takeaway: avoid harsh anionic detergents and keep any surfactant well below known toxicity thresholds.

Tables

Table 1. Water behavior in soilless substrates after root-zone wetting agents

Study (Ref)	System and media	Surfactant and dose	Key outcome
(1)	Rockwool and coir, new and reused	Nonionic surfactant, 2–20 000 ppm	**2 ppm** raised easily available water by >600 percent; higher doses gave no additional gain
(2)	Peat, bark, coir under different initial moistures	Commercial wetting agent, low to high	Hydration efficiency improved across materials, but extremely dry media retained some hydrophobic zones

Table 2. Nutrient dynamics, yield, quality, and safety

Study (Ref)	Crop and system	Regime and dose	Observed effect
(3)	Melon in rockwool and reused coco	Weekly fertigation at ~1000 ppm	Lower nitrate and potassium leaching, higher K uptake, no change in water use or pH
(6)	Lettuce, fertigated field context	Nonionic surfactant ~200–1000 ppm	Improved nutrient use efficiency; neutral yield response; reduced leaf nitrate at higher dose

Study (Ref)	Crop and system	Regime and dose	Observed effect
(4)	Sand columns, repeated applications	PoAP vs ABP, repeated dosing	PoAP accumulated and increased hydrophobicity; ABP maintained or improved wettability
(5)	Lettuce in hydroponics	Anionic detergent ≥250 ppm	Acute root phytotoxicity at and above 250 ppm; recovery after degradation of the agent

Practical rates

In closed hydroponic or recirculating fertigation, start conservatively. Research showing benefits without injury typically used **~50–1000 ppm**, with several studies centering on **~1000 ppm** weekly pulses in drip systems, or **~200–1000 ppm** continuous-equivalent dosing in trials on leafy greens (3) (6). Very low concentrations can already fix wettability issues, as the 2 ppm result illustrates (1). Always monitor for foaming, root browning, or oily films. Avoid cationic disinfectant-type surfactants at the root zone and keep anionic detergents far below the **250 ppm** lettuce toxicity threshold (5). Choose chemistries that do not accumulate with repeated use (4).

Conclusion

For soilless production, exogenous root applications of wetting agents are a precise way to restore uniform wetting, stabilize nutrient delivery, and improve nutrient use efficiency. Expect neutral yield when irrigation is already optimal, but better quality in leafy greens via lower leaf nitrate, and less nutrient loss in drain when media are reused or prone to channeling. Use the lowest effective ppm, prefer nonionic chemistries validated in horticultural systems, and be wary of products that persist or sorb to media. Done right, wetting agents are a small, high-leverage tweak that keeps the entire root zone working for you, not against you.