

Executive Summary

The reviewed evidence comprises 13 independent Innoveins laboratory-report summaries evaluating AQUAHOLDER as a seed-treatment adjuvant across corn, soybean, sunflower, oilseed rape, wheat, barley, and sugar beet. The studies cover seed safety and compatibility, fungal and insect control, systemic active-ingredient uptake, vertical mobility/leaching, microbial root colonisation, and early growth under nutrient or osmotic stress.

Overall, AQUAHOLDER appears broadly non-phytotoxic and generally compatible with seed treatment under controlled laboratory conditions. However, its performance is not consistently positive across crops, active ingredients, pathogens, application methods, or stress conditions. The strongest and most repeatable positive evidence concerns enhanced cyantraniliprole uptake in soybean for selected AQUAHOLDER variants—particularly Bio and BIOSAFE—whereas support for improved disease control, drought tolerance, water-use efficiency, or commercial agronomic performance remains limited or unproven. All evidence is laboratory- or climate-chamber based; no field trials or yield data are available.

Key conclusions

- **Seed safety is the most robust evidence domain.** Across corn, soybean, oilseed rape, and sunflower studies that assessed phytotoxicity, AQUAHOLDER caused no reported chemical phytotoxicity. Maximum germination was maintained in most systems, particularly in corn and soybean.
- **Germination responses are nevertheless crop- and treatment-specific.** Certain combinations caused relevant adverse outcomes, including reduced germination in oilseed rape with Scenic Gold 1N plus AQUAHOLDER, reduced germination in sunflower in the broad compatibility screening, and poorer germination uniformity in selected sunflower and soybean treatments.
- **Fungal disease-control performance is mixed in vitro and unsupported in soil.** Petri-dish assays showed both positive and negative effects on fungal outgrowth depending on the pathogen and fungicide. For example, AQUAHOLDER alone reduced *Phoma* outgrowth in sunflower, and it improved low-dose Vibrance performance against *Rhizoctonia* in soybean. In contrast, it reduced early Redigo-M performance against *Fusarium* in corn and reduced Lumiflex activity in another screening. Crucially, none of the four dedicated soil-tray disease trials showed a statistically significant reduction in seedling disease incidence or severity when AQUAHOLDER was added to the fungicide treatment.
- **Insecticide efficacy against aphids was maintained but not enhanced.** In the soybean aphid study, Lumiposa with AQUAHOLDER controlled aphid infestation at a statistically equivalent level to Lumiposa alone. This supports compatibility with the insecticide under the tested conditions, but the study does not demonstrate superior aphid control.
- **The clearest performance opportunity is cyantraniliprole uptake in soybean.** Three separate soybean studies provide a generally consistent directional signal that certain AQUAHOLDER formulations can increase plant uptake of cyantraniliprole during vegetative development. In one study, Aquaholder Bio increased uptake by 29% and BIOSAFE by 18%, while the Classic formulation reduced uptake by 10%. In a subsequent BIOSAFE study, the two-step coating approach increased uptake relative to Lumiderm alone at the seed, first-leaf, second-leaf, and third-leaf stages, although uptake was lower at emergence.

- **Improved active-ingredient uptake has not yet been linked to superior pest or disease control.** The aphid study measured nearly doubled cyantraniliprole tissue concentration with AQUAHOLDER, but aphid-control outcomes were not statistically better than Lumiposa alone. The analytical uptake studies also did not include concurrent pest- or pathogen-challenge assessments. Therefore, higher uptake should not currently be interpreted as demonstrated agronomic or biological efficacy.
- **Active-ingredient uptake does not generalize across all chemistries.** The broad multi-crop active-ingredient screening found no overall trend. Effects varied by crop, active ingredient, tissue, and growth stage; some treatments increased uptake while others reduced it or yielded non-detectable results. This indicates that uptake claims should be limited to defined crop–active ingredient–formulation combinations, rather than positioned as a universal AQUAHOLDER effect.
- **AQUAHOLDER reduced vertical mobility of several fungicides in sand columns.** Across two distinct laboratory column studies, it reduced calculated leaching or washout of fludioxonil and metalaxyl by approximately 34–74%. It also reduced mobility of imazalil and boscalid in the later study. Pyraclostrobin was an exception, showing a small increase in calculated washout.
- **Leaching-control evidence remains preliminary.** The column studies used artificial industrial sand, low replication, no reported statistical analysis, and heavy demineralized-water leaching regimes. They did not assess plant uptake, disease control, residue behavior in agricultural soil, or environmental fate under field conditions. The results support further investigation, but not a field-level environmental or efficacy claim.
- **Drought and biostimulant effects are highly conditional.** Under moderate PEG6000-induced osmotic stress, sunflower showed substantial improvements in plant area, biomass, and rooting with AQUAHOLDER. However, the effect was not consistent at greater stress levels or across other crops. Soybean showed no clear benefit, sugar beet showed slower germination and reduced rooting under some conditions, and oilseed rape showed reduced leaf area under normal moisture conditions.
- **Direct water-use efficiency has not been demonstrated.** Despite two reports being associated with “water use efficiency,” none measured water consumption, transpiration, soil-water retention under agronomic conditions, or biomass produced per unit water. Therefore, AQUAHOLDER cannot currently be substantiated as improving water-use efficiency.

Evidence quality and interpretation

The 13 reports should be treated as a body of exploratory and development-stage laboratory evidence rather than a unified, poolable dataset. The studies differ materially in crop species, seed properties, AQUAHOLDER variants, application rates, carriers, crop-protection products, pathogens, stress models, substrates, sample timing, endpoints, analytical methods, and replication.

Several report groups are sufficiently related to support directional conclusions:

- The four disease-screening studies in corn, sunflower, oilseed rape, and soybean consistently show that Petri-dish effects do not translate into statistically significant soil-tray disease control.

- The two vertical-mobility studies consistently indicate reduced movement of fludioxonil and metalaxyl through industrial sand.
- The soybean cyantraniliprole studies support a formulation-specific uptake effect for Bio and BIOSAFE, especially at leaf stages.

However, numerical pooling across most reports would be scientifically inappropriate. In particular, agar outgrowth results should not be combined with soil disease data; uptake results expressed in different units and sampled at different plant stages should not be pooled; and sand-column leaching results should not be extrapolated directly to agricultural soils or field conditions.

A data-quality issue should also be resolved before external use: within Report 1314, the sunflower protocol contains an unresolved pathogen-identification inconsistency and repeats the same numerical results reported for the oilseed rape protocol. In addition, AQUAHOLDER application rates are missing or reported only as “done by Pewas” in multiple reports, limiting reproducibility and interpretation.

Commercial implications

The current evidence supports a cautious, targeted technical position:

- AQUAHOLDER can be described as a generally non-phytotoxic seed-treatment adjuvant under the laboratory conditions tested.
- Compatibility must be verified for each crop, seed-treatment recipe, formulation variant, dose, carrier, and application process.
- The most promising value proposition is enhanced systemic uptake of cyantraniliprole in soybean with AQUAHOLDER Bio or BIOSAFE, particularly when using a defined two-step coating approach.
- Reduced vertical movement of selected fungicides in artificial sand columns is a credible research observation, but requires validation in representative agricultural soils and under realistic rainfall, irrigation, and field conditions.
- Claims regarding improved fungicide efficacy, disease suppression, aphid control, water-use efficiency, drought tolerance, yield, or commercial crop performance are not adequately supported by the present data.

In summary, AQUAHOLDER has a credible laboratory safety profile and a promising, but narrowly defined, potential to improve cyantraniliprole uptake in soybean. Its broader agronomic value remains to be demonstrated through standardised, replicated, and field-relevant validation.