

# Minimizing Injury from Copper Fungicides

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Several crops are sensitive to copper, notably crucifers, lettuce, and strawberry. Most common injury is tiny black spots on outer leaves which, because of their location, receive best spray coverage. In contrast with spots caused by a disease, these injury spots tend to be smaller, diseases often start to develop on leaves inside the plant canopy where there is more moisture, injury usually appears all at once rather than develops slowly over time, and close examination with a hand lens often reveals affected tissue is sunken with a distinct border between dead and healthy leaf tissue. Phytotoxicity injury occurs when ionic copper moves into plant tissue and reaches a level the plant species cannot tolerate.

Amount of copper uptake depends partly on availability of copper on treated leaf tissue. Several factors affect this.

- Spray solution pH is important because low pH increases copper solubility and thus availability of copper ions. Some copper formulations are neutral. Alternatively, when the pH is low a buffering agent can be used or hydrated lime can be added at the ratio of 1 part copper to 2 parts lime to reduce potential damage.
- Smaller particles have greater surface area and thus greater potential to release more copper ions.
- Application rate and frequency affect amount of copper on leaves.
- Type of copper is another important factor. Copper hydroxide (active ingredient in many copper fungicides) is a small particle and has a rapid release of copper ions while copper oxychloride is a larger particle with a slower, more prolonged release of copper ions (Badge SC contains both ingredients). Copper sulfate also releases slowly (AI in Cuprofix Ultra 40). There are some newer formulations of highly micronized and chelated coppers that may be more prone to uptake of the copper ion by the plant and thus have a higher potential for crop injury.
- Water is necessary to solubilize copper ions, thus injury is more likely when leaves are wet, which could explain why phytotoxicity is more common in fall when long, heavy dew periods are common. Rain, irrigation, and fog are also important.
- Young plant tissue generally is most sensitive.

- Leaves and fruit are predisposed to injury by high temperatures.
- Newer copper formulations generally are less likely to cause phytotoxicity than old products because they are purer with less heavy metals, which can also cause phytotoxicity, and they consist of very small and uniform particles.
- Products with low metallic content have less potential for injury. Metallic copper equivalent (percentage) is listed on copper fungicide labels below the active ingredient. For dry formulations, divide MCE by 100 then multiply by the rate per acre to determine the MCE per acre that is applied. Labels for liquid formulations include information on the amount of MCE in lb per gallon. Use this figure to determine the MCE per acre that is applied with liquid coppers.

*Updated: July 2022*