

*"Adding Epsom salts to gardens is a safe, natural way to increase plant growth"*

## The Myth

With the increased interest in managing gardens and landscapes sustainably, products are likewise being marketed as safe and natural. Epsom salts, also known as magnesium sulfate ( $\text{MgSO}_4$ ), is touted as "one of the most perfect nutrients for gardens and plants." Numerous claims are made to its effectiveness in increasing seed germination, improving uptake of other nutrients, and enhancing growth and overall health. "Tried and true tips" are provided, which include specific formulations for houseplants, vegetables, turf, shrubs, and trees. Dangers of nutrient overload are minimized by assurances that Epsom salts are "not persistent so you can't overuse" them.

## The Reality

Epsom salts have been used to relieve magnesium deficiency found during intensive cropping of many fruit and vegetable species worldwide. These include commonly grown North American crops such as alfalfa, apple, beets, carrots, citrus, cauliflower, cotton, grains, hops, kale, nuts, okra, peppers, plums, potatoes, snap beans, sugar beets, sweet potatoes, tobacco, tomatoes, watermelon, and wine grapes, as well as more exotic species including banana, cacao, coffee, rubber, Swedish turnips, and tea. Conifer species grown for timber use have also been treated with Epsom salts under magnesium-deficient conditions.

Amongst the diverse plant materials that have been studied under treatment with Epsom salts, there are two commonalities: *all are intensively produced crops* and *all were suffering from magnesium deficiency*. It is important to keep these two points in mind as we examine the claims and recommendations regarding Epsom salt use in the landscape.

### Causes of deficiency

There are two primary causes of magnesium deficiency in plants: an actual lack of soil magnesium, or an imposed deficiency caused by mineral imbalances in the soil or plant. Magnesium deficiencies most commonly occur in soils described as light, sandy, and/or acid, though occasionally clay soils under intensive production can show magnesium deficiency as well. Regardless of type, soils that are heavily leached by rainfall or irrigation are more likely to exhibit magnesium deficiency. Thus, soil addition of highly soluble Epsom salts under leaching conditions does not improve magnesium-deficient plants but does increase mineral contamination of water passing through the system.

Excessive levels of potassium contribute to a mineral imbalance that causes magnesium deficiency in a variety of species, even when soil levels of Mg are adequate. High levels of soil potassium apparently interfere with root uptake of magnesium. Addition of nitrogen and/or reduction of available potassium are both recommended to overcome this indirect magnesium deficiency; trees high in nitrogen were found to be less susceptible to magnesium deficiency than those with reduced nitrogen levels.

### Examining the claims

*"...unlike most commercial fertilizers, which build up in the soil over time, Epsom Salt is not persistent so you can't overuse it."*

Several researchers have expressed concern with possible toxicities associated with excessive applications of Epsom salts. Most commonly, Epsom salt solutions have been sprayed on foliage, resulting in leaf scorch; inclusion of a wetting agent can relieve this. Excessively applied Epsom salts were also linked to root disease of sugar cane grown on clay soils, and with increased incidence of apple bitter pit. One researcher directly contradicts the above statement, finding instead that "Mg residues from fertilizer unused by plants accumulate in the topsoil and are not rapidly removed by leaching." Unfortunately, this evidence is ignored in advertising literature and application instructions.

Epsom salts are a highly soluble form of magnesium, leading to the claim of non-persistence in the landscape. What is ignored, however, is that soluble nutrients applied in excess of what is needed by a landscape will end up somewhere else - often as a pollutant.

*"Spray [roses] with Epsom Salt solution weekly to discourage pests"  
[Epsom salts] "deter pests, including slugs and voles"*

The first article I found testing the pesticidal claim is from a 1915 paper investigating chemical controls for larval control of flies. Of Epsom salts, the authors found "no apparent larvicidal effect." Interest in Epsom salts languished until the late 1930's with a preliminary report that Epsom salts could control grasshoppers on beans. However, these results were refuted in later research. Likewise, Epsom salts were found to be ineffective against nutgrass armyworm, caterpillar pests on tomatoes, and the alfalfa snout beetle. Interest again waned after these negative results and there is no current research to suggest any insecticidal activity. There is no literature that reports activity of Epsom salts against slugs or voles, and the sole published report on potential rabbit repellency was negative. No science can be found to substantiate claims of control on any pest species.

Though disease control is not specifically mentioned in these claims, other popular websites avidly recommend Epsom salts for this purpose. There are two research reports from the early 1960's claiming a reduction in powdery mildew on apples, but no peer-reviewed articles resulted from these initial findings. A third research report found Epsom salts to have no effect upon apple scab occurrence.

*"Research indicates Epsom Salt can...help seeds germinate"*

This rather misleading claim has no scientific basis in scientific research. Most seeds are able to germinate in the absence of external nutrients. Most seeds contain enough essential minerals to initiate root and shoot growth on paper toweling moistened only with pure water.

*"Research indicates Epsom Salt can...make plants grow bushier"*

Nebulous terms like "bushier" are difficult to quantify, yet I approached this claim with a great deal of latitude. Plants of any species that suffer magnesium or sulfur deficiency have chlorotic leaves that are less productive and more likely to senesce early; thus, relieving the deficiency will improve leaf growth and return overall plant health to normal. Many scientific articles have demonstrated improved growth and production of magnesium- or sulfur-deficient plants once a usable source of the missing nutrient is supplied. Most importantly, there is no evidence that excessive levels of nutrients provided as Epsom salts or anything else will cause plants to "grow bushier" or have any other measurable positive effect.

*“Research indicates Epsom Salt can...produce more flowers”*

Only two articles in my search specifically addressed flower initiation or production. One reported that Epsom salts provided as a foliar spray 9 times annually for two years enhanced flower cluster numbers in the apple cultivar Cox's Orange Pippin. This cultivar is particularly sensitive to magnesium deficiency and responds well to Epsom salts application; thus, it is not surprising that flowering may increase once a nutrient deficiency has been relieved. The other research article investigated the role of magnesium in flower initiation of orchids; there was no increase in flowering associated with addition of Epsom salts. As other orchid researchers have stated, “there is no scientific evidence that suggests the application of Epsom salts to orchids or any other plant will induce them to flower.”

*“Research indicates Epsom Salt can...increase chlorophyll production”*

Magnesium is a physical part of the chlorophyll molecule. A deficiency of magnesium will cause a corresponding reduction in chlorophyll production (leading to the leaf chlorosis often used as an indicator of magnesium deficiency). Epsom salts added to adequately-fertilized plants will not increase chlorophyll production over what is normal for that species.

*“Research indicates Epsom Salt can...improve phosphorus and nitrogen uptake”*

Plants deficient in magnesium and/or sulfur will be stressed and less able to take up and utilize other nutrients, including phosphorus and nitrogen. Relieving the deficiency will improve nutrient uptake and usage. Any source of available sulfur or magnesium will accomplish this - but excessive amounts will not increase normal uptake. This claim not only suggests that Epsom salts alone will have this effect, but implies that somehow uptake will be greater than normal.

Examining the recommendations

*“Trees: Apply 2 tablespoons per 9 square feet. Apply over the root zone 3 times annually.”*

Though more effective in treating magnesium deficiency, application of foliar sprays to large trees may not be practical; thus, soil application of fertilizer is more common in treating magnesium deficient tree plantations. Not surprisingly, soil application of Epsom salts was found to be ineffective in treating magnesium deficiency of coffee, hazelnuts, pine and plum trees; slow-release magnesium sources are better choices. Very heavy applications of Epsom salts might temporarily correct magnesium deficiency but chemical overdosing is not an environmentally sustainable practice. Furthermore, practices that are geared towards intensive production of trees as a crop cannot be logically applied to ornamental landscapes.

*“Shrubs (evergreens, azaleas, rhododendron): 1 tablespoon per 9 square feet. Apply over root zone every 2-4 weeks.”*

As with the information on trees (above), there are no published studies that address shrubs in the landscape. Research on shrubs is limited to a single paper on nursery production, in which azalea, blueberry, juniper, and holly were grown in containers of sand and pine bark

(hardly a nutrient-rich medium). Soil addition of Epsom salts improved leaf color in these magnesium-deficient plants. It would be simplistic to apply these results to landscape materials.

*"Lawns: Apply 3 pounds for every 1,250 square feet with a spreader, or dilute in water and apply with a sprayer."*

Epsom salts have been used to relieve magnesium deficiencies on grasses used in turf and pastureland. Magnesium deficiency is a serious disorder in grazing cattle and thus the magnesium content of highly grazed pastures must be managed. Soil application of Epsom salts will rapidly increase the magnesium content of pasture grasses, but the effect is short-lived. This is due to the highly soluble nature of Epsom salts, the leaching of which not only negates long-term benefits but contributes to water pollution. In one study, 49% of applied Epsom salts was lost in this manner. Less soluble forms of magnesium are generally recommended for more lasting magnesium supplementation.

In contrast to pastureland studies, turf research is sparse; a single report from 1951 suggests that Epsom salts can treat fairy rings (fungal diseases) in lawn. While Epsom salts is a quick fix for intensively managed turf systems (e.g. golf courses), magnesium deficiency does not appear to be a serious issue for most turf grasses and therefore Epsom salts addition is unnecessary. The excessive leaching of Epsom salts documented elsewhere is further incentive not to apply this material indiscriminately to lawns.

*"Roses:*

*1 tablespoon per foot of plant height per plant; apply every two weeks.*

*Also scratch 1/2 cup into soil at base to encourage...new basal cane growth.*

*Soak unplanted bushes in 1 cup of Epsom Salt per gallon of water to help roots recover.*

*Add a tablespoon of Epsom Salt to each hole at planting time."*

There is no published, scientific research on Epsom salt effects upon roses. The origin of these "research based" recommendations is unclear.

*"Garden Startup: Sprinkle 1 cup per 100 square feet. Mix into soil before planting."*

Unless your garden has been intensively cultivated for crop production, and/or soil tests indicate a magnesium deficiency, there is no reason to add unnecessary chemicals. No scientific research could be found to support this recommendation.

*"Houseplants: 2 tablespoons per gallon of water; feed plants monthly."*

Generally houseplants should receive a balanced fertilizer that contains all necessary macro- and micronutrients. Providing increased levels of magnesium and sulfur is not a rational approach to houseplant maintenance, especially in the absence of any signs of deficiency. Excessive nutrients will build up in the container (as they cannot leach away) and can cause salt-related damage to leaves.

*"Tomatoes: 1 tablespoon per foot of plant height per plant; apply every two weeks."*

There are two reports from over 60 years ago on tomato production. When tomatoes are grown on magnesium deficient soil, a foliar application of Epsom salts can relieve magnesium deficiency in tomato plants; no effect on yield was reported. An automatic application of Epsom salts to plants or soils that are not magnesium deficient is a poor management strategy that can injure the plants and contaminate the soil.

### The Bottom Line

The urge to use common household products as garden fertilizers and pesticides is compelling for many consumers who want simple, cheap approaches to landscape management. However, the use of any chemical in a landscape should be thoughtfully considered:

- Is it necessary?
- Can it cause damage?

The science behind the use of Epsom salts is only applicable to intensive crop production in situations where magnesium is known to be deficient in the soil or in the plants. It is irresponsible to advise gardeners and other plant enthusiasts to apply Epsom salts, or any chemical, without regard to soil conditions, plant needs, and environmental health.

(A complete bibliography of the scientific and gray literature on Epsom salts is available by email from the author.)

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