

NUTRIENT ANTAGONISM

TOO MUCH OF A GOOD THING



Plants require a variety of nutrients to achieve optimal growth, yields and quality. The ratio of elements that must be available to the plants is often combined in commercial fertilizer or nutrient programs in a ready-to-use blend. However, this ratio may be based on conventional schools of thought, rather than a specific crop or growing environment.

TOO MUCH OF A GOOD THING

There is such a thing as “too much of a good thing.” Such a thing occurs with plant nutrients, in the soil or at the root zone. Many chemical reactions occur at the root zone; some are for the benefit of the plants, while some may be detrimental to plant nutrition. Chemical interactions can enhance or interfere with the uptake of some elements based on the concentration of other elements and whether they are synergistic or antagonistic (see Fig. 1). Synergism is a desirable reaction between elements that aids in the uptake or utilization of elements, while antagonism can limit uptake and lead to symptoms of nutrient deficiencies in the plant.

Table 1. Table of antagonistic elements

EXCESS ELEMENT	NUTRIENT(S) AFFECTED
Nitrogen	Potassium, Calcium
Potassium	Nitrogen, Calcium, Magnesium
Phosphorus	Zinc, Iron, Copper
Calcium	Boron, Magnesium, Phosphorus
Magnesium	Calcium, Potassium
Iron	Manganese
Manganese	Iron, Molybdenum, Magnesium
Copper	Molybdenum, Iron, Manganese, Zinc
Zinc	Iron, Manganese
Molybdenum	Copper, Iron
Sodium	Potassium, Calcium, Magnesium
Aluminum	Phosphorus
Ammonium Ion	Calcium, Copper
Sulfur	Molybdenum

NUTRIENT DEFICIENCIES

Nutrient deficiencies can lead to decreased terpene and cannabinoid production, stunted plants, poor yields, and ultimately, crop losses. Deficiencies can occur if one or more minerals are in excess. This may seem contradictory, but many elements have antagonistic effects on others. These antagonistic nutrients are often ions with the same charge, and occur when one is in excess in a solution or in the soil. If one is in excess, it will block the uptake of another, therefore causing a deficiency and affecting crop quality and yields. To better illustrate this concept, see Table 1 that highlights excess nutrients and nutrients affected. For example, an adequate amount of potassium can improve utilization of iron, but if potassium is in excess, it can interfere with the uptake of magnesium and calcium, among others.

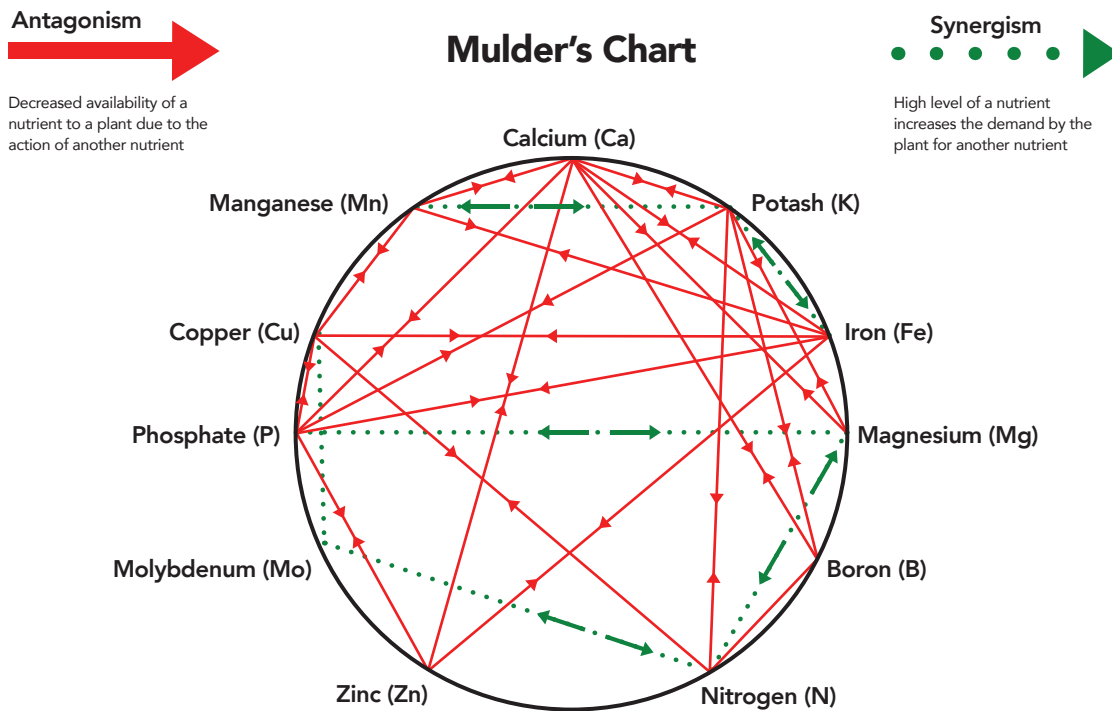


Figure 1. Mulder's chart of antagonistic (solid lines) and synergistic (dashed lines) elements

A common solution for an apparent deficiency is to add a supplement that can correct the deficiency. However, this can further complicate the problem in the soil. Excessive amounts of one element may not be taken up by plants, but that does not mean it is no longer present in the soil or the solution. If signs of a deficiency occur, but the nutrient program offers a complete nutrient profile, consider an antagonistic situation before adding more supplements. If additional supplements were added before the symptoms showed up, a good flush of the root zone with water or a weak nutrient solution may reverse the problem.

CONCLUSION

It is important to look closely at all inputs in the growing environment, including pH adjusters and organic soil amendments. Many of these provide some nutrient value, but may be problematic if they cause negative interactions with other nutrients. Understanding excess elements will help you to make informed decisions on how to correct deficiencies that appear. The goal of applying plant nutrients is to achieve synergism, while avoiding antagonism; in simpler terms, we want to optimize beneficial interactions while minimizing unwanted nutrient interactions.

For more detailed information, read:

R.P.J.J. Rietra, M. Heinen, C. Dimkpa and P.S. Bindraban, 2015. Effects of nutrient antagonism and synergism on fertilizer use efficiency. VFRC Report 2015/5. Virtual Fertilizer Research Center, Washington, D.C. 42 pp.; 17 tables; 1 fig.; 229 ref.