

## K is for Cucumbers

Cucumber plants, like all plants, require all the essential elements to complete its life cycle. However, cucumber plants are particularly “hungry” for potassium (K), they need more potassium than nitrogen to result in high yields.

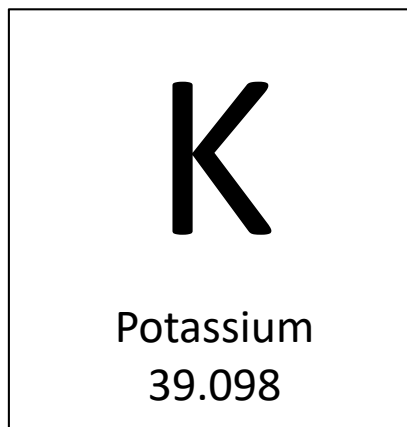
In this e-Gro *Edible Alert*, we cover the role of K in plant growth, the characteristics of K deficiency symptoms, and how to develop a hydroponic nutrient program for production of cucumbers.

### The Role and Mobility of Potassium in Plants

Potassium plays a key role in plants including activation of enzymes, water balance regulation, energy and protein synthesis, K is involved in photosynthesis and osmotic pressure regulation.

Potassium is a highly mobile element. As described by Horst Marschner (2005) “It is characterized by high mobility at all levels- within the individual cells, within tissues, and in long-distance transport via xylem and phloem.” Unlike most other essential elements, potassium does not become part of the plant, hence its high mobility.

Deficiency symptoms of mobile elements are first observed in older tissue, whereas toxicity is observed first in younger tissue.



Potassium  
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## Potassium Deficiency Symptoms in Cucumbers

Potassium deficiency symptoms appear first in the lower or older leaves (*this is an important diagnostic feature to remember*). Older leaves show cupping, crinkled tissue within the veins, and chlorotic margins (Figure 1). Symptoms advance with chlorosis from the margins towards the area between the veins as yellow speckles, further resulting in interveinal chlorosis. Fruit presents abnormal growth, brown spots, and spongy-like texture.

When identifying nutrient disorders, growers must pay attention to the location of the symptoms and the overall complex of signs. For example, cupping of younger leaves is a symptom of calcium deficiency, however calcium deficiency does not result in marginal chlorosis.

Interveinal chlorosis in younger leaves is a symptom of iron deficiency. Interveinal chlorosis of older leaves (similar to K deficiency) is a symptom of magnesium deficiency - however this deficiency does not include leaf cupping or puckering.

Additional indicators of the problem include knowing the crop's tendency to a problem and nutrient levels in the tissue, the growing media, or nutrient solution.

Sonnevelt and Voogt (2009) suggested that the optimum K levels in young fully-grown leaves should be between 3.1-3.9%.



Figure 1. Early stages of potassium deficiency on cucumbers grown in hydroponics systems.

- 1A . Young plants showing marginal chlorosis in the older leaves.
- 1B. Cucumber leaf showing marginal chlorosis, crinkled tissue within the veins, leaf cupping, and tip burn.
- 1C. Cucumber leaf curling and marginal chlorosis.



## Creating a nutrient program for cucumbers

Nutrient programs for cucumbers typically have three stages with K:N ratios between 1.8:1 and 2.1:1 and electrical conductivity (EC) between 1.5 and 3.0 mS/cm.

- Stage 1: Transplant to 4-6 leaves
- Stage 2: Normal feed
- Stage 3: Heavy fruiting

Steps to develop a nutrient program:

1. Select a base fertilizer, ideally one with high K concentration (for example, 4-18-38).
2. Estimate how much base fertilizer you need to meet the phosphorus requirement, then use calcium nitrate to match calcium requirement.
3. Estimate the total amount of nitrogen and potassium added on step 2 and calculate K to N ratio by dividing total K by total N.
4. Add other essential elements by using other fertilizers such as Epsom salts to supplement Mg (magnesium), potassium nitrate to increase potassium & nitrogen as needed.

Typical nutrient ranges (ppm) for cucumber production in hydroponics:

N	P	K	Ca	S	Mg	Fe
160	40	200	325	120	60	1
-	-	-	-	-	-	-
210	60	350	370	140	75	2

Note that in addition to potassium, cucumbers also have high calcium and magnesium requirements.

Recommended reference:

Publication 836, Growing Greenhouse Vegetables in Ontario ([www.omafra.gov.on.ca](http://www.omafra.gov.on.ca))

## Adjustments

**To promote vegetative growth and vigor** - Decrease K:N ratio by increasing N. Specifically, the proportion of ammonium-N can be increased to promote vegetative growth. However, ammonium-N should always remain less than 14% of the total N.

**If plants growth too vegetative and fruit set and quality fall off** - Increase the K:N ratio by increasing the potassium rate through the base fertilizer or potassium nitrate.

**Seasonality.** Match fertigation with environmental conditions. Water uptake increases or decreases with light and temperature changes. For example, when light and temperature increase (as in Summer) so does water uptake by plants, therefore the concentration of the nutrient solution should decrease and viceversa. While it sounds counterintuitive, this strategy will help growers maintain high yields and avoid phytotoxicity.

For example, Connecticut growers maintain an EC of 2.5-3.5 mS/cm during early Spring and Fall and 1.5-2.5 mS/cm in Summer.

In summary, make sure you add enough K to the nutrient solution to avoid K deficiency and achieve high yields. Adjust the nutrient solution based on your individual situation/.

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