e-GRO Edible Alert

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N and K for Tomato Production

In this Alert we will discuss how to use nitrogen and potassium to achieve continuous tomato production in soilless media.

Sustained fruit production of tomatoes is achieved by timely adequate supply of nutrients and water, in addition to proper management of the environment.

The specific nutrient requirements for the crop are related to the developmental stage of the plant and seasonal conditions. A tomato fertilizer program must be adjusted for three production stages (1) transplant to 4-6 leaves, (2) normal feed, and (3) heavy fruiting.

Tomato production in greenhouses.
Photo courtesy: Richard McAvoy

At all times, the crop requires a complete nutrient solution. However, different proportions of potassium (K) and nitrogen (N) will determine if the crop grows vegetatively or forms flowers and fruit. In this article, we will focus on how to adjust N and K throughout the production cycle.

NITROGEN: The amount and form of N provided to the crop from nutrient solutions is a tool that can be used to steer vegetative growth into a desired direction. As with all essential elements, insufficient or excessive amounts of total N will reduce yields.

To promote vegetative growth at any time, increase the nitrogen in the solution, especially the ammonium form. Typically keep ammonium at 10% of the total N or less. These levels can be higher but only for a very brief time to promote vegetative growth.

Nitrogen application as a tool requires a trained grower to "read the plant and the environment". For example, applying too much nitrogen during low light conditions can lead to excessive vegetation which can be prone to foliar diseases and poor fruit yields and quality.

POTASSIUM: Potassium(K) plays an important role in fruit formation and ripening. Tomatoes have a relatively high K requirement. Insufficient or delayed application of K leads to inadequate fruit quality. An important consideration is that absolute values of potassium alone will not determine fruit formation, instead the ratio of K to N will be a major determinant of the quality of the fruit. The addition of potassium slows vegetative growth and redirects sugars to the fruit. Insufficient potassium results in blotchy ripening, boxy fruit, and green shoulders.

K:N RATIO: Prior to the first flower, the aim is to build the vegetative plant structure, and this can be achieved with a K:N ratio of 1:1. Between the 1st to 4th cluster, aim to get a K:N ratio of about 1.4:1. Finally, during the mature fruit to ripening stage, run a K:N ratio of 1.7:1.

The fertilizer program in the column at the right is an example of a tomato program developed by Professor Richard McAvoy from UConn Extension for Connecticut growers.

Please note that all rates below are for a ratio of 1:100 on the injector and that you must always have two stock tanks, because calcium at high concentration will cause the other elements to precipitate.

1. TRANSPLANT to 1st FLOWER:

Stock A:

Fertilizer: 5-11-26: 14.1 oz/gal

Stock B:

Calcium nitrate: 12.8 oz/gal

N	K	K:N ratio
200	226	1.1:1

2.1st to 4TH CLUSTER:

Stock A:

Fertilizer: 5-11-26: 14.1 oz/gal

Stock B:

Calcium nitrate: 10.24 oz/gal

Potassium nitrate: 1.44 oz/gal

N	K	K:N ratio
185	265	1.4:1

3.Formulation from the 4TH CLUSTER on:

Stock A:

Fertilizer 5-11-26: 14.1z oz/gal

Magnesium sulfate: 1.6 oz/gal

Iron Chelate 10% (Sprint 330): 1.0 oz/gal

Stock B:

Calcium nitrate: 8.3 oz/gal

Potassium nitrate: 2.9 oz/gal

N	K	K:N ratio
177	305	1.7:1

Seasonal adjustment: When light and temperature increase, the irrigation frequency should increase as well. However, the nutrient concentration should decrease. Make this change by season, not daily. For example, in the northeastern U.S., the optimum electrical conductivity (EC) for tomatoes in Spring and Fall is 2.5 to 3.5 mS/cm, whereas in the summer is 1.5 to 2.5 mS/cm.

The irrigation water volume is something you adjust daily to steer the plant to some extent towards a vegetative or reproductive stage —not as strong as the N:K ratio. A mild water stress will promote reproductive growth (flower and fruit). As a rule of thumb, in a substrate like peat, 8 to 10% dry down before the next irrigation is recommended to promote vegetative growth. This is something you can do if it seems like the fruit load is heavy and there is no foliage to support the fruit. In contrast, a mild stress where you let a 17% dry down between irrigation events may lead to reproductive growth.

Avoid chronic and extreme over and underwatering—frequent light irrigation cycles are the best option. Within the day, aim for slightly drier conditions at the end of the day.

Please note that extreme changes in irrigation patterns will affect fruit quality and yields.

Water and nutrients can be use as tools to sustain production of tomatoes throughout the season.

Additional Resources:

- McAvoy, R. 2020. Managing the Greenhouse Environment to Increase Tomato Yields: https://youtu.be/pOgBjgvvunI
- Richard Snyder. 2020. Tomato Abiotic Disorders: Identification and & Control https://www.youtube.com/watch?v=5scp2MoQdpc&t=22s