

Understanding and Using Fertigation with Vegetable Crops

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Before you can get started developing a fertigation program, you've got to take care of some upfront issues. Preplant soil testing, determining your crops estimated nutrient requirements and your yield goals, what nutrients are to be applied at soil preparation, and the pH and alkalinity of your irrigation water. With these considerations firmly in place, developing a nutrient program becomes much simpler.

Your soil test prior to planting should include: P, K, Ca, Mg, Organic matter, and pH. Nitrogen levels are not useful at this stage as available N can change quickly based on temperature and moisture levels. It's best to apply N, P, K, Ca and Mg based on 30-50% of your crops estimated needs. Knott's Handbook for Vegetable Growers, 5th Edition, is an excellent reference for determining these early levels. Experience has proven that application closer to 50% of these estimated levels makes more sense with today's high yield varieties. You can make up most nutrient deficiencies through fertigation. However, starting low makes keeping up more challenging. Be sure to factor in manure applications when estimating preplant fertilization levels. Poultry and hog manure can add significant levels of nutrients while cow, beef, and horse manures tend to be primarily organic matter.

Soil pH and irrigation water pH have a major impact on the availability of nutrients. Maintaining proper nutrition in tomatoes and peppers is much easier when the soil solution pH is in the 6.2-6.5 range. Many growers use sulfuric acid to lower pH. The Purdue / NC State Alkalinity Calculator is an excellent tool to determine how much acid to use. Organic growers can use powdered citric acid to lower pH. Generally, 9oz. of powdered citric acid per 100 gallons of water will lower pH by about 1 point. This will vary greatly due to the many minerals that are dissolved into water. When adjusting irrigation water acidity, a good pH meter with fresh calibration solutions is a requirement. *Important Safety Note: When using acids, always add acid to water.*

We're going to focus on tomato irrigation, but all of the concepts apply equally to any fruiting crop. Tomatoes have distinct life stages where their nutritional needs vary considerably:

- 1) From transplanting a 6-8 week old plant through first flowers we need to bulk up the plants to carry a heavy fruit load. Here we use a balanced fertilizer such as 20-20-20, 20-30-20 or any other 1-1-1 ratio fertilizer.
- 2) At the first sign of flowers, it is essential to tissue test to determine N, P, K, Ca and Mg values. Switch to a high K, moderate P fertilizer at this time such as 9-15-30, 4-6-9, 5-10-27....
- 3) During fruit development, maintain vigilance on the same values as in #2 bi-weekly through tissue testing as these nutrients are consumed rapidly with heavy fruit loads. Be sure to keep N levels at around 4% to maintain growth, but prevent soft fruit.

- 4) During fruit ripening you have a decision to make. If you are working with indeterminate plants, then continued vigilance as in #3 is required, but if you are working with determinate plants and are succession planting, then reduce or eliminate nutrient applications as the first fruit color. There are probably plenty of nutrients in the plant and soil to harvest for 3 weeks or so. However, even determinate plants will continue to develop flowers and fruit if kept fed.

Plan to tissue test every 2 weeks. Collect tissue samples under similar conditions, so you accurately monitor changes in plant nutrient levels. Plants are solar pumps, so soil moisture, time of day, cloud cover and temperature can affect tissue levels. Work with a tissue testing laboratory that can return results in no more than 3 days. Older results become less and less useful. Always collect tissue samples prior to foliar nutrient applications.

Fertigating more often is better than less. During fruit development, plants use K, P, Ca and Mg very quickly. Under raised-bed plastic mulch, the root zone is very confined, so it is very easy for plants to remove all of the nutrients between feedings. At the Penn State Southeast Research and Extension Center, we generally fertigate twice each week and apply foliar nutrients at least once a week. We are considering moving to a system that allow constant feeding.