So Many Details, So Little Time: Take-Home Message You Can Get About Plant Fertigation

Zheng Wang, PhD
UCCE Stanislaus County
May 9, 2018
Zheng Wang

- UCCE Vegetable and Irrigation Farm Advisor since March 2018
- University of Kentucky: PhD
- The Ohio State University: Postdoc
- Optimizing regional and statewide vegetable production
Today’s Presentation (20-25 mins + Q&A)

Get you repaid by providing the most essential, dry “biomass” about getting the most from fertigation.
Fertigation or Chemigation: Not a Word Game

Fertilizer + Irrigation = Fertigation

Fertigation + Chemical Controls = Chemigation

People use them without a universal rule. But I want to clarify here.
Fertigation is NOT an easy process.
Regardless of crops, production practices, scales, and locations of your operation, you want to fertilize:

Correctly
Uniformly
Responsibly
Please remember over-fert and under-fert are all bad: waste of money and time.

Recommendations from companies: you provide information, they give you the amount.

- Common for large scale production and maybe experienced growers
- Convenient
- Calculate by yourself? -----Soil test report, experience, or extension agent help
Know your injector or pump

- Common in vegetable production, use pressure difference to draw nutrient solution into main irrigation line
- Clogging emitter can happen
- Type of fertilizer and mesh size

Venturi injector: Courtesy given by Dr. Timothy Coolong, UGA

University of California
Agriculture and Natural Resources
Positive Displacement Injector/Pump

Greenhouse positive displacement injector: Courtesy given by Dr. Timothy Coolong, UGA
Positive Displacement Pump Injection System

Source: Lawrence Schwankl, Fertigation

University of California
Agriculture and Natural Resources
Injector ratio (Venturi and Positive Displacement Pump) varies dramatically.

E.g., An injector ratio of 1:100 indicates 1 part of stock fertilizer solution with 99 parts of water flowing to the plants through irrigation line).

Ratio can range from 1:10 to 1:4000.
Amount of fertilizer to add to make 1 gallon solution?

**Desired concentration in parts per million x Dilution factor (:1)**

\[
\% \text{ element in fertilizer} \times \text{Conversion constant}^* 
\]

*Conversion constant:
- Ounce per gallon stock: 75
- Pound per gallon stock: 1200
- Gram per liter: 10

**Advantage:**
- Used with any injector ratio
- Used with any target fertility
- Used with common imperial units

Source: Thomas Boyle, Univ. of Florida
You have an injector with a 1:500 ratio and a fertilizer of 20-20-20. You want to apply 300-ppm N within three weeks, with evenly applied per week as a constant feed to your almond trees. How many ounces of fertilizer should you add to make 150 gallons of stock solutions per week?

Solution:
1) Desired fertility per week = 300 ppm ÷ 3 = 100 ppm N
2) Use the formula to calculate ounces of fertilizer used to make a 1 gallon solution:
   \[
   \frac{100 \times 500}{20 \times 75} = 33.3 \text{ ounces per gallon}
   \]
3) Calculate ounces of fertilizer used to make 150 gallons stock solution:
   \[
   33.3 \times 150 = \text{roughly 5000 ounces} = 312 \text{ pounds}
   \]

Conclusion:
The grower needs to add 312 pounds of 20-20-20 to make 150 gallons nutrient solution to fertilize his almond field at 100-ppm N per week. IS THIS THE END?

1. Fertilizer solubility (chart available) and water temperature
2. Ease of application: 312 lb ÷ 25 lb/bag = 12.48 bags
Can we not open the 13th bag and just use the entire 12 bags to have 300 lbs of 20-20-20 to make the same fertility level: yes we can! Let’s make 145 gallons of stock solution.
Regardless of crops, production practices, scales, and locations of your operation, you want to fertilize:

Correctly
Uniformly
Responsibly
- Completely pressurized before injecting (Irrigate enough time)

- Be uniform from the first tree to the last in each row---give fertilizer time to travel, e.g., fertilizers need 45 min to 1 h to reach the furthest emitter or trees.

- Always check your filter to flush out dirt and any others may clog emitters

- Do not turn off irrigation once fertigation is done---needs time to clean the residual fertilizers in pipes
Regardless of crops, production practices, scales, and locations of your operation, you want to fertilize:

Correctly
Uniformly
Responsibly
BACK-FLOW CHECK!

Required by law

Some regions require dual preventers

Source: Bob Schulthesis, Univ. of Missouri Extension
Permission given by the grower

Backflow check with vacuum relief
Shift to the reliance on biologicals to partially replace chemical fertilizers, such as microbial biofertilizers.

- Soil-derived
- Nitrogen fixation
- Phosphorous solubilization
- Enrich soil microbial community
- Use through drip/micro-sprinkler irrigation

**Bacteria:** Pseudomonas, Bacillus, Streptomyces, Azotobacter

**Fungi:** Glomus, Rhizopogon, Trichoderma
Conclusion

Goal: Equip yourself basic knowledge of fertigating precisely, uniformly, and environmentally-friendly.

Control fertigation by yourself.
GOOD LUCK!
THANKS and QUESTIONS?

Zheng Wang, PhD
UCCE Vegetable and Irrigation Advisor
Stanislaus, Merced, and San Joaquin Counties
209.525.6822
zzwwang@ucanr.edu