

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

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- **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



Venturi injector:  
<https://www.indiamart.com/proddetail/venturi-injector-9868073591.html>



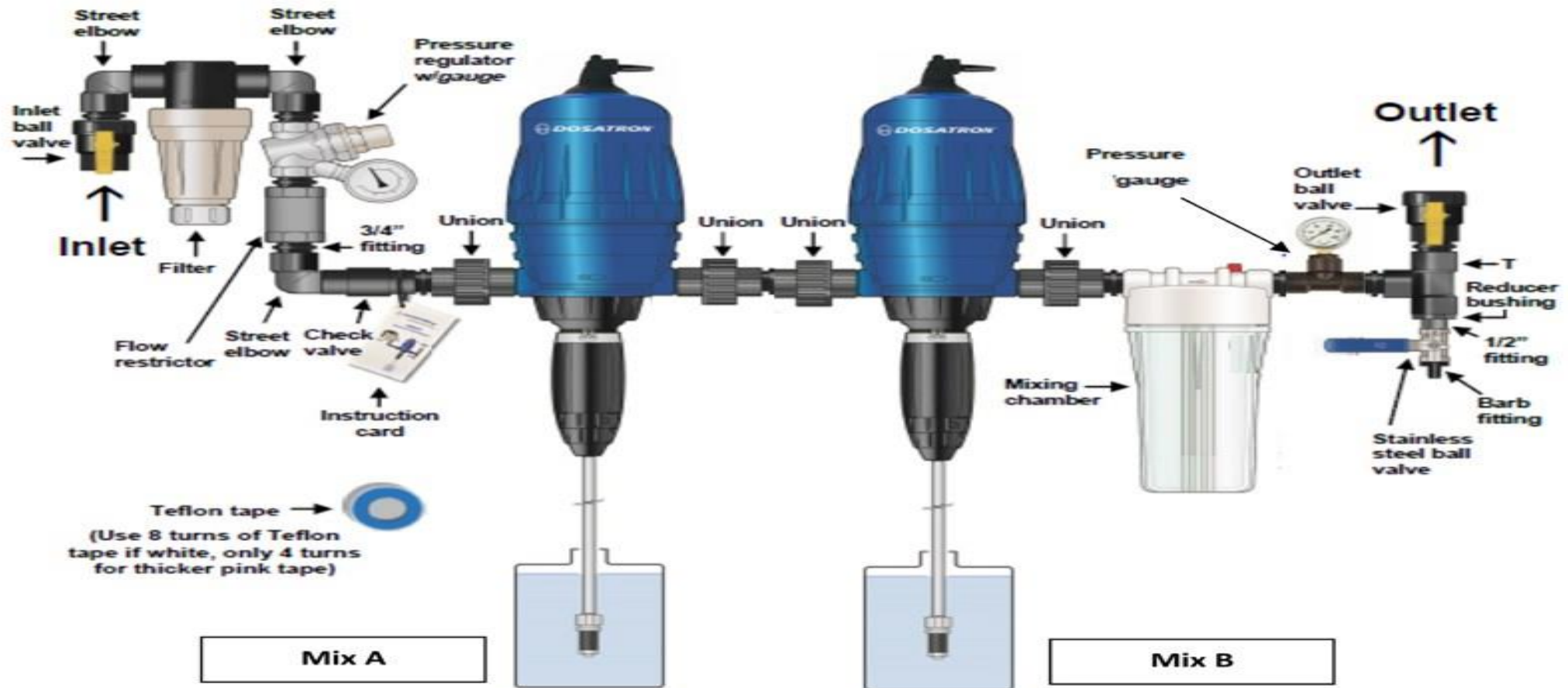
Venturi injector: Courtesy given by Dr. Timothy Coolong, UGA

- 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

# Positive Displacement Injector/Pump

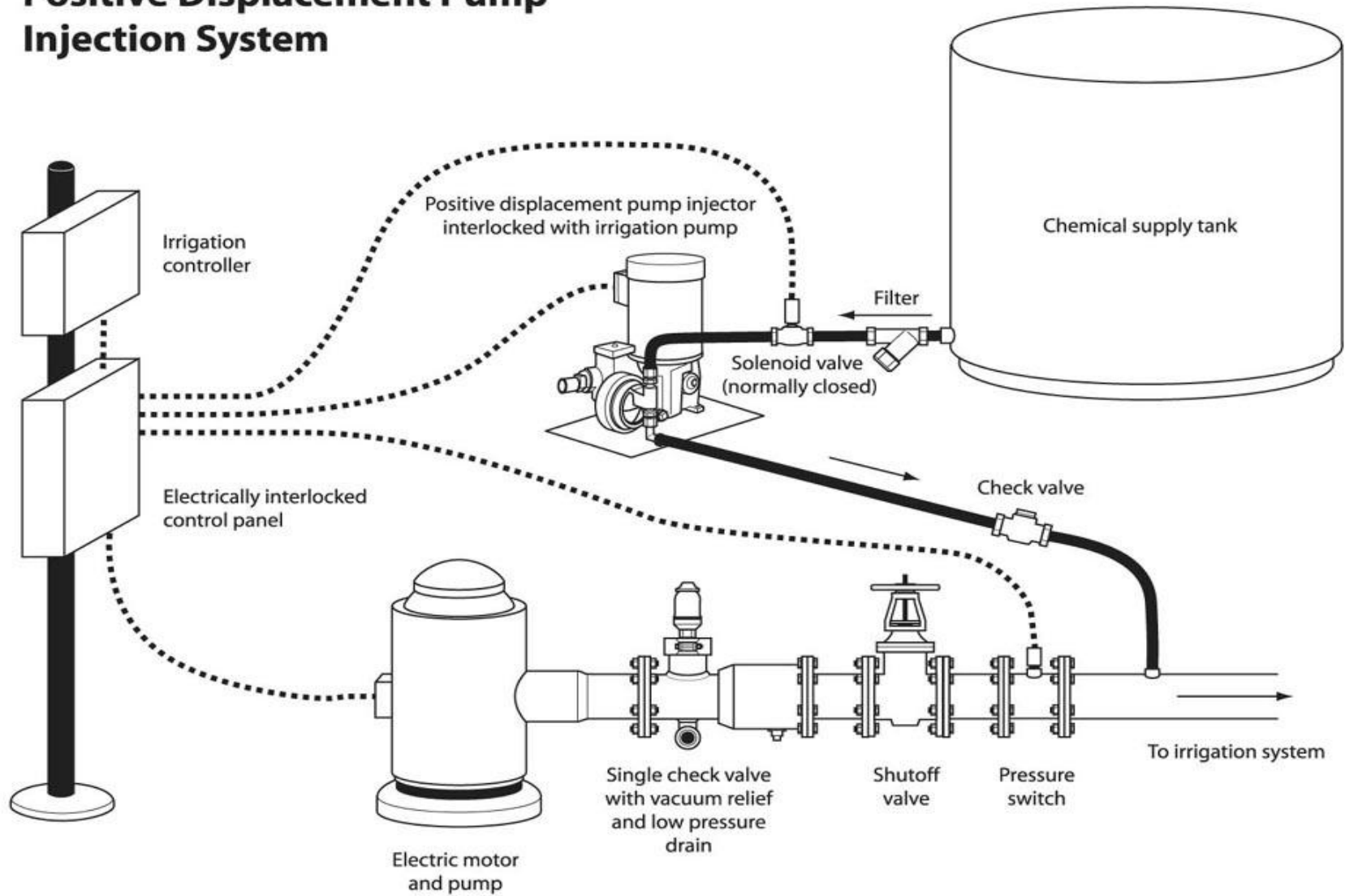


Greenhouse positive displacement injector: Courtesy given by Dr. Timothy Coolong, UGA



<https://hortamericas.com/dosatron-2-injector-assembly-set-up-built-in-bypass/>

# Positive Displacement Pump Injection System



Source: Lawrence Schwankl, Fertigation

**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?

$$\frac{\text{Desired concentration in parts per million} \times \text{Dilution factor (:1)}}{\% \text{ element in fertilizer} \times \text{Conversion constant}^*}$$

\*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

### Example:

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 =  $300 \text{ ppm} \div 3 = 100 \text{ ppm N}$

2) Use the formula to calculate ounces of fertilizer used to make a 1 gallon solution:

$(100 \times 500) \div (20 \times 75) = 33.3 \text{ ounces per gallon}$

3) Calculate ounces of fertilizer used to make 150 gallons stock solution:

$33.3 \times 150 = \text{roughly } 5000 \text{ ounces} = 312 \text{ pounds}$

### 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:  $312 \text{ lb} \div 25 \text{ lb/bag} = 12.48 \text{ bags}$**

**Can we not open the 13<sup>th</sup> 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**



Permission given by the grower

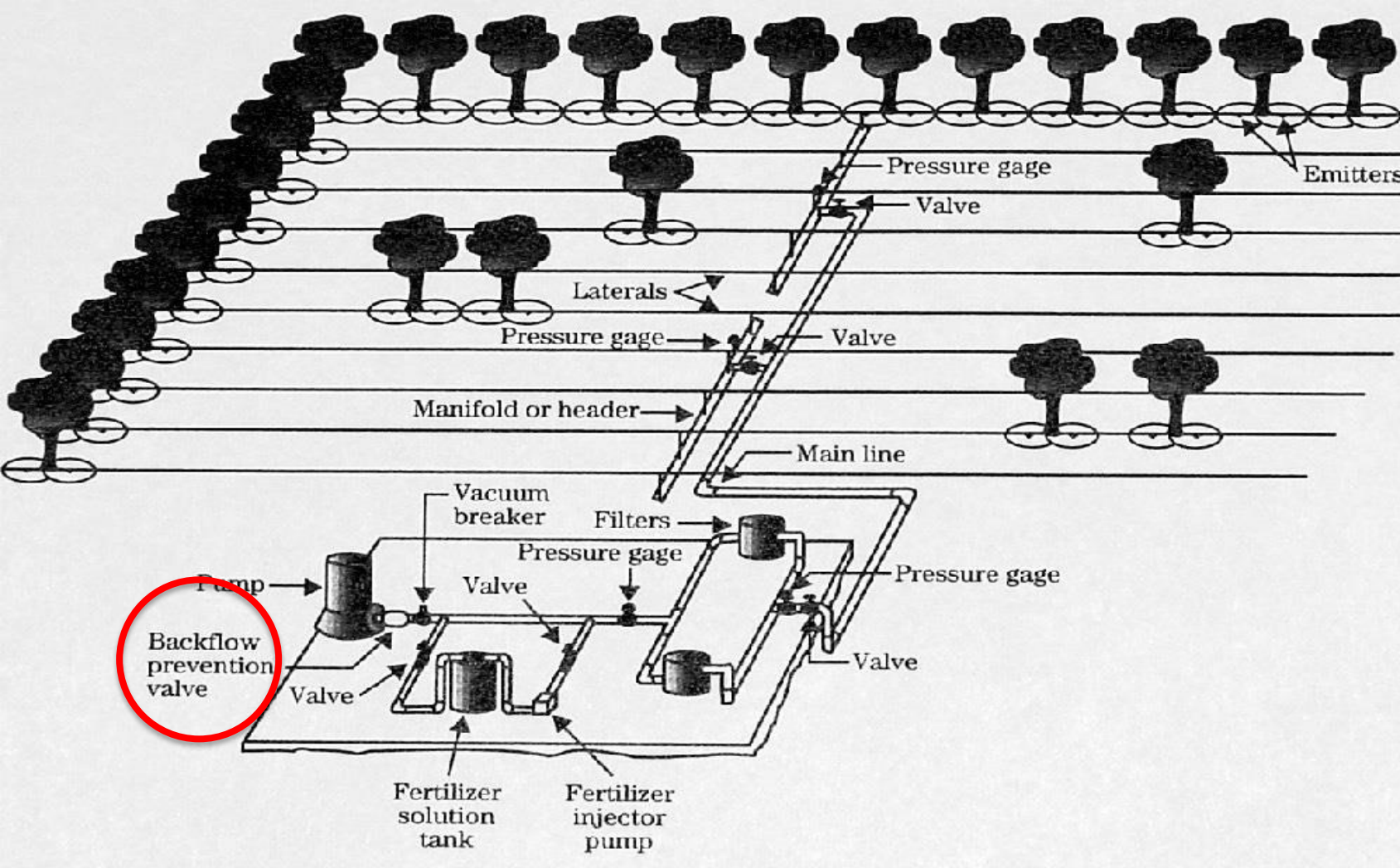
- Completely pressurized before injecting (Irrigate enough time)
- Be uniform from the first tree to the last in each row---give fertilizer time to travel, e.g., fertilizers need 45 min to 1 h to reach the furthest emitter or trees.
- Always check your filter to flush out dirt and any others may clog emitters
- Do not turn off irrigation once fertigation is done---needs time to clean the residual fertilizers in pipes

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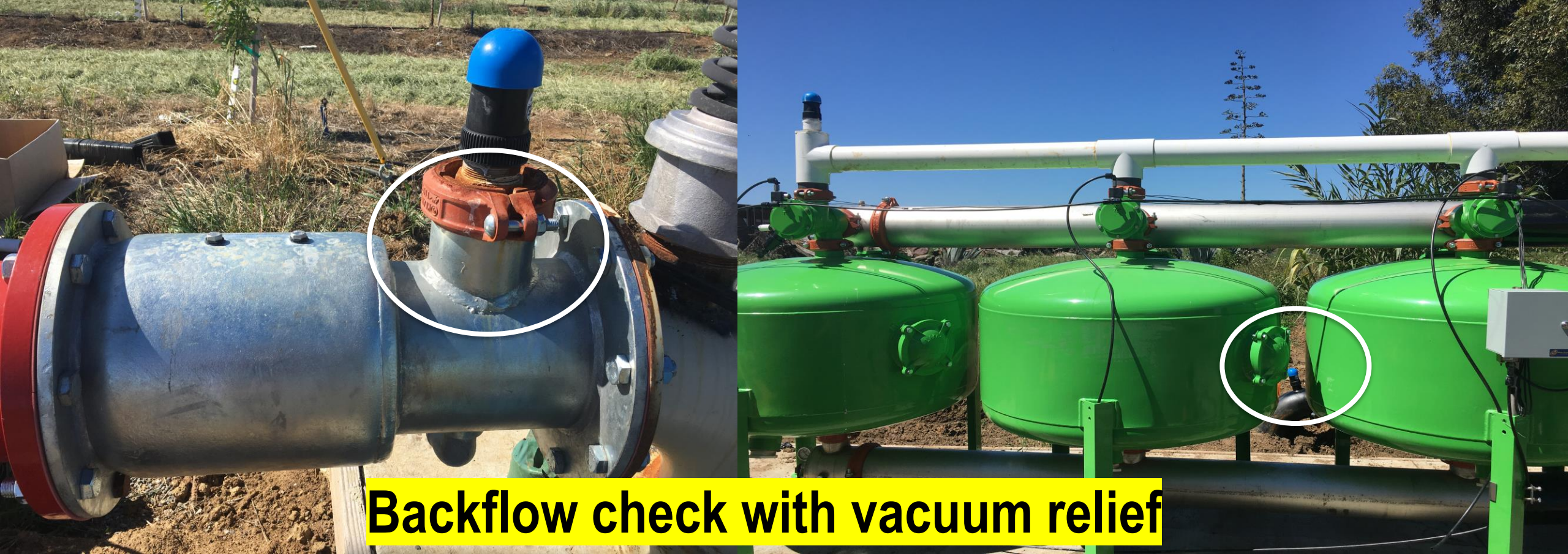


**BACK-FLOW CHECK!**

**Required by law**

**Some regions require dual preventers**

Source: Bob Schulthesis, Univ. of Missouri Extension



**Backflow check with vacuum relief**

Permission given by the grower

# 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*

**NUTRIO BIOSOAK™**  
0-0-1

**WILBUR-ELLIS**  
Ideas To Grow With

**GENERAL INFORMATION**  
NUTRIO™ BIOSOAK™ is a premium additive designed to be added to irrigation water as a soil amendment and wetting agent. In addition, NUTRIO BIOSOAK also provides 3 million colony forming units of soil-enhancing bacteria per gallon. Its use is suggested as a supplement to a regular, balanced fertilizer program to enhance yields and improve quality. NUTRIO BIOSOAK should be used as part of a comprehensive Total Nutrition System® for optimizing plant growth, development, yield and quality.

**DIRECTIONS FOR USE**  
**IRRIGATION APPLICATIONS:** Apply 5 gallons per acre into irrigation water.  
NUTRIO BIOSOAK can be applied through center pivot or drip irrigation systems, but check your water source prior to application for calcium or other impurities. Always jar test with water source for precipitation prior to actual field use.

**COMPATIBILITY**  
The compatibility of NUTRIO BIOSOAK with other products may vary. Always jar test new combinations for compatibility prior to field mixing.  
**EXPIRATION DATE:** Two years from date of manufacture.  
**DATE OF MANUFACTURE:** \_\_\_\_\_

**GUARANTEED ANALYSIS**  
Soluble Potash (K<sub>2</sub>O).....1.00%  
DERIVED FROM: Potassium Hydroxide and Potassium Thioculfate.

**ALSO CONTAINS NON-PLANT FOOD INGREDIENTS:**  
1.20% Humic Acid derived from Leonardite  
1.50% Triblock Copolymer  
0.50% Glucoethers

**KEEP OUT OF REACH OF CHILDREN**  
**PRECAUTION**  
Do not ingest. Avoid contact with skin, eyes or clothing. Avoid breathing dust, vapor or mist.

**FIRST AID**  
In all cases, call a poison control center or doctor for further treatment advice.  
**IF SWALLOWED,** call a poison control center or doctor immediately. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to by a poison control center or doctor. Do not give anything to an unconscious person. **IF ON SKIN,** take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. **IF INHALED,** move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration. **IF IN EYES,** hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.

**For chemical spills, leaks, fire or exposure, call CHEMTREC: (800) 424-9300.**

**STORAGE AND DISPOSAL**  
Do not contaminate water, food or feed by storage, disposal or cleaning of equipment.  
Store in a safe manner. Store in original container only and keep tightly sealed when not in use. Do not store at temperatures over 110°F. Do not store in direct sunlight for longer than 2 weeks. Dispose of unused product and empty containers in accordance with federal, state and local regulations.

Information regarding the contents and levels of metals in this product is available on the Internet at <http://www.aspico.org/metals.htm>

**CONTAINS NON-PLANT FOOD INGREDIENTS:**  
Contains 3 million colony forming units (CFU) per gallon of the following:

<i>Rhodopseudomonas palustris</i> .....	113 CFU/ml
<i>Bacillus brevis</i> .....	113 CFU/ml
<i>Bacillus licheniformis</i> .....	113 CFU/ml
<i>Streptomyces griseus</i> .....	113 CFU/ml
<i>Bacillus megaterium</i> .....	113 CFU/ml
<i>Rhodococcus rhodochrous</i> .....	113 CFU/ml
<i>Lactobacillus plantarum</i> .....	113 CFU/ml

**Conditions of Sale and Limitation of Warranty and Liability:**  
Notice: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using the product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.  
The Directions for Use of the product should be followed carefully. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness, or other unintended consequences may result because of many different factors including, without limitation, manner of use or application, weather, combination with other products, or crop conditions. All such risks shall be assumed by Buyer and User, and Buyer and User agree to hold Manufacturer and Seller harmless from any claims relating to such factors. **SELLER warrants that this product conforms to the chemical description on the label. EXCEPT FOR THIS WARRANTY, THE PRODUCT IS FURNISHED "AS-IS," AND NEITHER SELLER NOR MANUFACTURER MAKES ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO THE SELECTION, PURCHASE OR USE OF THIS PRODUCT; SELLER AND MANUFACTURER SPECIFICALLY DISCLAIM ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Buyer and User accept all risks arising from any use of this product, including without limitation users contrary to label instructions, under abnormal conditions, or under conditions not reasonably foreseeable to (or beyond the control of) Seller or Manufacturer.**  
To the extent permitted by law, neither Manufacturer nor Seller shall be liable for any incidental, consequential or special damages resulting from the use or handling of this product. **THE EXCLUSIVE REMEDY OF THE BUYER OR USER, AND THE EXCLUSIVE LIABILITY OF MANUFACTURER AND SELLER, FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THIS PRODUCT, OR, AT THE ELECTION OF MANUFACTURER OR SELLER, THE REPLACEMENT OF THE PRODUCT.**  
These Conditions of Sale and Limitation of Warranty and Liability shall be interpreted in accordance with the laws of the State of California, excluding its conflicts of laws rules, and may not be amended by any oral or written agreement.  
WILBUR-ELLIS logo, Ideas to Grow With and Total Nutrition System are registered trademarks, and BIOSOAK, NUTRIO and NUTRIO logo are trademarks of Wilbur-Ellis Company, LLC. K-07016  
519024-Y1  
Manufactured by: WILBUR-ELLIS COMPANY LLC  
7 E. Washington Ave., Yakima, WA 98903

**NET CONTENTS:** ■ 5 GALLONS (18.93 Liters) ■ 30 GALLONS (113.56 Liters) ■ 270 GALLONS (1022.06 Liters) ■ BULK  
WEIGHT PER GALLON: 8.5 POUNDS at 68°F

**University of California**  
Agriculture and Natural Resources

# Conclusion

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

**Control fertigation by yourself.**

**GOOD LUCK!**

**THANKS and QUESTIONS?**

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