University of California
Agriculture and Natural Resources
Cooperative Extension, Stanislaus County

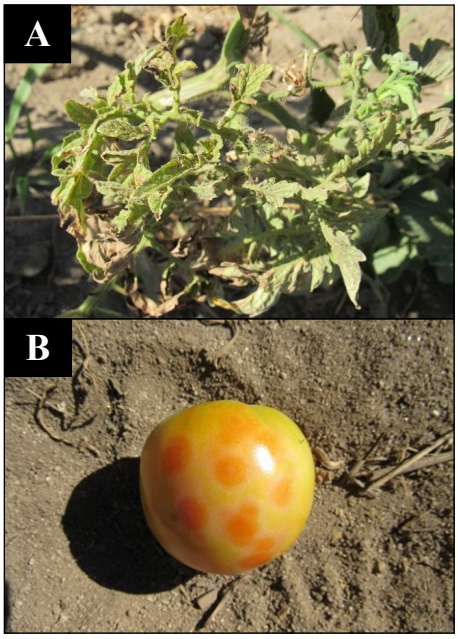
VEGETABLE VIEWS

SUMMER 2018, ISSUE #2

June Vegetable Walk

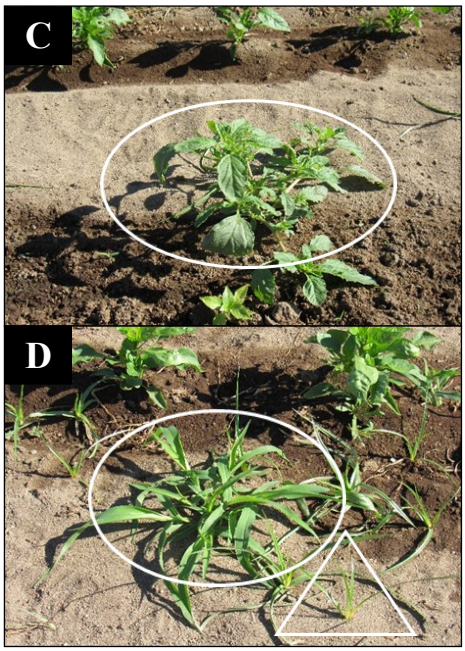
With continuously hot and dry conditions, field work remains in full intensity and mainly focuses on maintaining plant health, scouting growth disorders, and preparing for harvest. This month's Vegetable Walk covered five commercial vegetable farms growing multiple commodities.

In the central valley, open-field fresh market tomatoes are now under harvest, and harvests will continue through early October.



Tomato plants with TSWV have curled leaves and whole plant stunting (A). Having necrotic rings on fruit is another typical symptom (B). Photos were taken by Dr. Zheng Wang and permissions were given by the grower.

Field work at this moment involves inspecting for diseases, supplementing plants with micronutrients (fertigation), and cultivating to eliminate summer weeds to ensure reproductive growth and fruit quality. A tomato disease that appears quite often at present is tomato spotted wilting virus (TSWV). Scouts noted the presence of the disease on one of the visited farms. Damages included leaf curling and plant stunting. Particularly for fruit, necrotic rings on the fruit skin make the tomatoes unmarketable. If you suspect your plants are infected by TSWV, please let me know. Further investigation, such as using a TSWV testing kit, may be necessary. Once confirmed, infected plants should be removed from the field immediately, and weeds around the plants should be cleaned as well to prevent them from becoming new infection sources since many weeds are susceptible to TSWV. For more information about TSWV, please check the Spring Issue of Vegetable View Newsletter



Pigweeds (shown in the oval, figure C) can shade the pepper plants when outgrowing. Crabgrass and yellow nutsedge (shown in the oval and triangle, figure D) can significantly compete for nutrients and water, restrict crop root growth, and shed weed seeds. Photos were taken by Dr. Zheng Wang and permissions were given by the grower.

In This Issue

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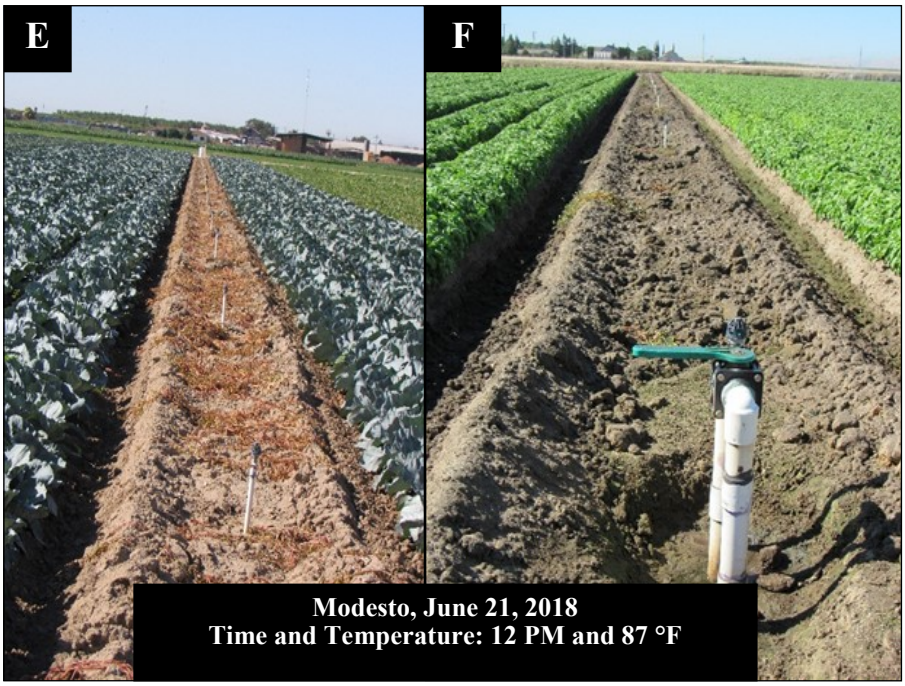
(http://ucanr.edu/springvegviews).

Peppers are now transitioning into the flowering and fruiting stages, and harvest will begin in a month. Mid-season weeds in pepper fields are problematic because use of herbicides is restricted even with proper shield protection especially when dealing with broadleaf weeds. For organic practices, mechanical cultivation is also difficult as plants are growing big enough to block tilling tines or disks from getting close to the weeds. Hand weeding has low efficiency and usually should be prevented under high heat conditions. Pigweed, yellow nutsedge, and crabgrass are three of the most common summer weeds in vegetable fields throughout the U.S. Identification at their early stage is helpful to prevent spreading the population into larger areas and more importantly to reduce the incidence of transmitting diseases. Visit the UC-IPM for detailed weed descriptions (Redroot pigweed: http://ipm.ucanr.edu/PMG/WEEDS/redroot_pigweed.html; yellow nutsedge: http://ipm.ucanr.edu/PMG/WEEDS/yellow_nutsedge.html; crabgrass: http://ipm.ucanr.edu/PMG/WEEDS/crabgrasses.html).

In the central valley, the unique cool night temperatures (around 60°F) significantly favor cool-season vegetable growth in the summer. In addition, selecting heat/bolting-tolerant varieties and cooling plant surfaces in the daytime are extremely important to prevent bolting. Sprinkler irrigation is usually applied to lower leaf surface temperature, but schedules have to be made strategically to either separate from regular irrigation at a long interval or just overlap the regular irrigation as much as possible. The purpose is to prevent over-irrigation as the closure of plant foliage reduces the soil surface evaporation. Therefore, soil may stay wet for a longer period after being irrigated. Over-irrigation not only reduces water use efficiency but favors the growth of many pathogenic fungi primarily attacking crop roots. Later, when irrigation water splashes mud onto aboveground tissues, diseases may spread to the entire plant.



Sprinkler irrigation is used to lower cabbage (E) and basil leaf (F) temperature. Photos were taken by Dr. Zheng Wang and permissions were given by the grower.

Foliage of swiss chard closes the gaps in-between (G) thereby slowing the soil evaporation. Frequent irrigation lets the soil stay wet for a longer period and increases the incidence of root diseases. Swiss chard root in Figure H is suspicious for fungal root rot, though further inspection may be needed to confirm. Photos were taken by Dr. Zheng Wang and permissions were given by the grower.

A Quick Way to Calculate Fertilizers Needed for Fertigation

The process of delivering nutrients to vegetables through an irrigation system is called fertigation. The principal method of fertigation is to mix totally soluble fertilizers into water in a container (e.g., water tank) to make stock solutions and then apply them with a fertilizer injector. To make accurate fertilizer stock solutions to meet crop needs requires growers to understand how to calculate the amount of fertilizer needed for making solutions. Although many fertilizer manufacturers provide fact sheets of preparing stock solutions, the information sometimes does not apply to a grower-by-grower situation. Herein, growers can calculate the amount of fertilizers to prepare stock solutions for fertigation using the following formula.

Amount of fertilizers needed to make 1 gallon or liter of stock solution:

$$\frac{\text{Injection factor} \times \text{desired nutrient concentration in ppm}}{\%\ \text{element in fertilizer} \times \text{conversion factor}}$$

This formula has been previously mentioned in extension articles and presentations. To better understand the formula and make your fertigation more efficiently, you should:

1. **Know your injector and its injection ratio.** There are usually two types of injectors used in vegetable production: Venturi Injector and Positive Displacement Pump. The principle of Venturi Injector is to draw nutrient solution from the stock into the main irrigation line using the pressure difference. When the valve shuts the main line, water will flow through the by-pass line creating a pressure difference between the line and stock solution. Suction then happens to draw fertilizer solutions into the by-pass water line and flow together through the main line to deliver solutions to the plants (figure A). Positive Displacement Pumps are piston or diaphragm pumps that inject stock solutions mixing with the flowing water. The pump can be powered by electricity, gasoline, or water. The Positive Displacement Pump system is more expensive and complex than the Venturi Injector and more commonly used in large-scale field production and controlled greenhouse systems (figures B to E).

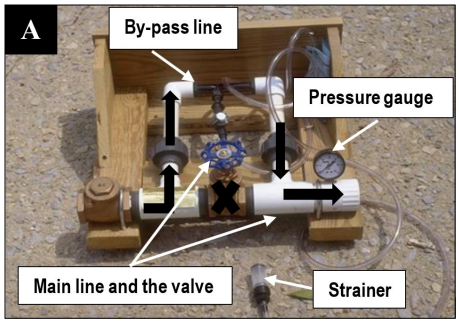


Figure A. Venturi Injector hooked on the irrigation line. Black arrows: flow direction; Black cross: main line valve shuts. Courtesy given by Dr. Timothy Coolong, Univ. of GA.

The injector ratio indicates the volume of water flowing through the irrigation system for every unit volume of stock fertilizer solutions sucked or pumped. For example, an injector ratio of 1:100 indicates 1 part of stock fertilizer solution with 99 parts of water flowing through irrigation lines. The injector ratio varies dramatically from 1:10 to 1:4000. In the formula, the injection factor indicates **<u>the larger number of an injector ratio</u>**.

2. **Know your fertilizer solubility.** It is highly recommended to use water soluble fertilizers for fertigation. However, water soluble fertilizers do not mean the solubility is indefinite. Solubility limit depends on fertilizer types, volume and temperature of water for mixing, and your container size. If the amount of fertilizer cannot be totally dissolved (exceeding solubility limit), fertilizers will precipitate and settle down in the tank making cleaning more difficult. Worse, plants will not receive a full dose of nutrients and irrigation tubes and emitters will be clogged. The table below lists the maximum solubility of some fertilizers when mixed in cold water. The values in the table may increase when water becomes warmer. Additionally, the maximum amount of fertilizers that can be totally dissolved is limited by your

Maximum solubility of fertilizers mixed in cold water.

Fertilizer	Pounds per 100 gallons of water
Ammonium nitrate	984
Calcium nitrate	851
Diammonium phosphate	358
Potassium chloride	290
Potassium nitrate	108
Sodium nitrate	608
Urea	651

Source: The Basics of Injecting Fertilizer for Field-Grown Tomatoes. Mississippi State University Extension Service.

Author: Zheng Wang, PhD, UCCE Vegetable and Irrigation Advisor, Stanislaus County

Figures B and C. A gasoline-powered pump is pumping fertilizer solutions from the tank (Permissions given by the grower).

container volume. Therefore, you may dissolve the fertilizers more than once to reach the desired nutrient concentration. For example, after calculation, you need to inject 216 lbs. of potassium nitrate to your tomatoes but your tank volume is only 55 gallons. You probably have to add 54 lbs. of potassium nitrate maximally into 50 gals. of water and repeat the step for another three times to inject all 216 lbs. of fertilizers to reach crop demands.

3. **Be mindful to the unit of your calculation**. The conversion factor in the formula differs from different imperial or metric units. If your result is ounces of fertilizer per gallon, the conversion factor is 75. For pounds of fertilizer per gallon and grams per liter, the factors are 1200 and 10, respectively.

Now it is the example moment. **Please note that the figures are for example / demonstration purpose only and do not reflect the real situation of tomato nutrient requirements.**

Example: A grower wants to apply 300-ppm N within three weeks with evenly applied per week as a constant feed to his tomatoes. Assuming his injector ratio is 1:500, he uses a water-soluble fertilizer 20-0-0 with urea as the total N, and the volume of stock solution is 150 gals. How many pounds of fertilizer should he add to make the 150 gals. of stock solution per week?

Conclusion: The grower need add 312 lbs. of 20-0-0 to make 150 gals. of nutrient solution to fertilize his tomatoes to reach 100-ppm N per week.

Solution
1) Desired fertility per week = 300-ppm ÷ 3 weeks = **100-ppm N per week.**
2) Based on the formula, pounds of fertilizer added to prepare a 1-gal. solution = (500 × 100-ppm) ÷ (20 × 1200) = **2.08 lbs./gal.**
3) Pounds of 20-0-0 to make 150 gals. of stock = 2.08 lbs./gal. × 150 gals. = **312 lbs**.
4) Check fertilizer solubility: 312 lbs. in 150 gals. of water is equivalent to 208 lbs. in 100 gals. of water, which is lower than the solubility limit of urea.

In some cases, there are tips that can simplify the fertigation process. For instance, this tomato grower purchased the fertilizers in 25 lb. bags. To realize the fer-

Figure D. A regular Positive Displacement Pump irrigation system in a greenhouse (Dr. Timothy Coolong, Univ. of GA).

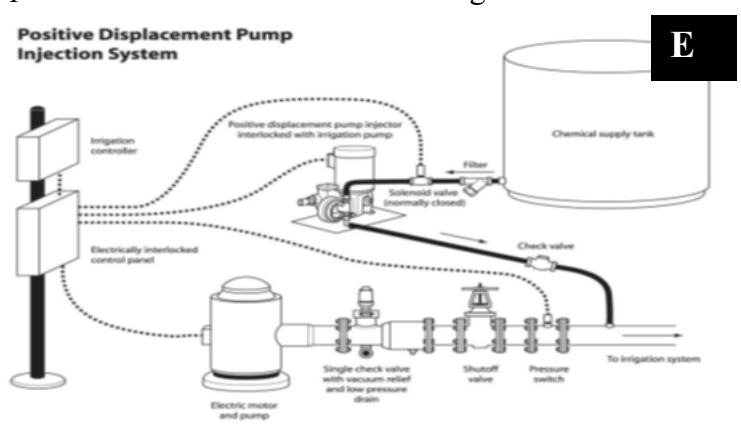


Figure E. A schematic layout of an electricity-powered Positive Displacement Pump injection system (Lawrence Schwankl).

tility target, the grower needs 12.5 bags (312 lbs. ÷ 25 lbs./bag= 12.5 bags) per week. In other words, he has to open 13 bags but may leave a half bag open and unused for at least one week. Summer hot weather and lack of secure storage (cool, dry, and dark) can make fertilizers absorb moisture, causing elements run-away and decomposition. In this example, the grower can just open 12 bags and proportionally reduce the solution volume to 145 gals. [(12 bags × 25 lbs./bag) ÷ 2.08 lbs./gal.= 145 gals.].

In summary, the formula can be used with any injector ratio, any pre-determined fertility, and most common imperial and metric units. However, calculations need solubility check and may be modified to accommodate situations and ease the fertigation process.

NEW MASTER GARDENER PROGRAM IN STANISLAUS COUNTY

The primary mission of the UC Master Gardener Program is to educate the public about home gardening and pest management. This program is the link between home gardeners and the University of California's research-based information. For more information about how to become a coordinator or a volunteer, please follow this link:

http://ucanr.edu/scmg

Upcoming Events

2018 CA Specialty Crops Tour

When: August 6-10, 2018

Where: Bus tours starting from and returning to Sacramento

Purpose: To increase knowledge, dialogue, and linkage with stakeholders in CA

Topics: From specialty crop production to pest management and more

Link to details: http://specialtycrops.org/crop_tour.htm

Note: The next issue of the Vegetable View Newsletter will be a special edition summarizing my experience with the tour.

Fresno County Processing Tomato Showcase

When: Thursday, July 19, 2018, 10:00 am – 1:00 pm

Where: Worth Farms (Use the link below to see the location)

Link to details: http://bit.ly/FresnoTomatoShowcase

Processing Tomato Season Opener

When: July 17-18, 2018

Where: Westside Transplants Huron and Errotabere Ranches (Use the link below to see the locations)

What: A two-day event starting with dinner on Tuesday, July 17, at Westside Transplants Huron, and a field trial on Wednesday, July 18, at Errotabere Ranches.

Link to details: http://bit.ly/TomatoSeasonOpener

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