

Quarterly Reminder Worksheet

[Reference Guide Link](#)

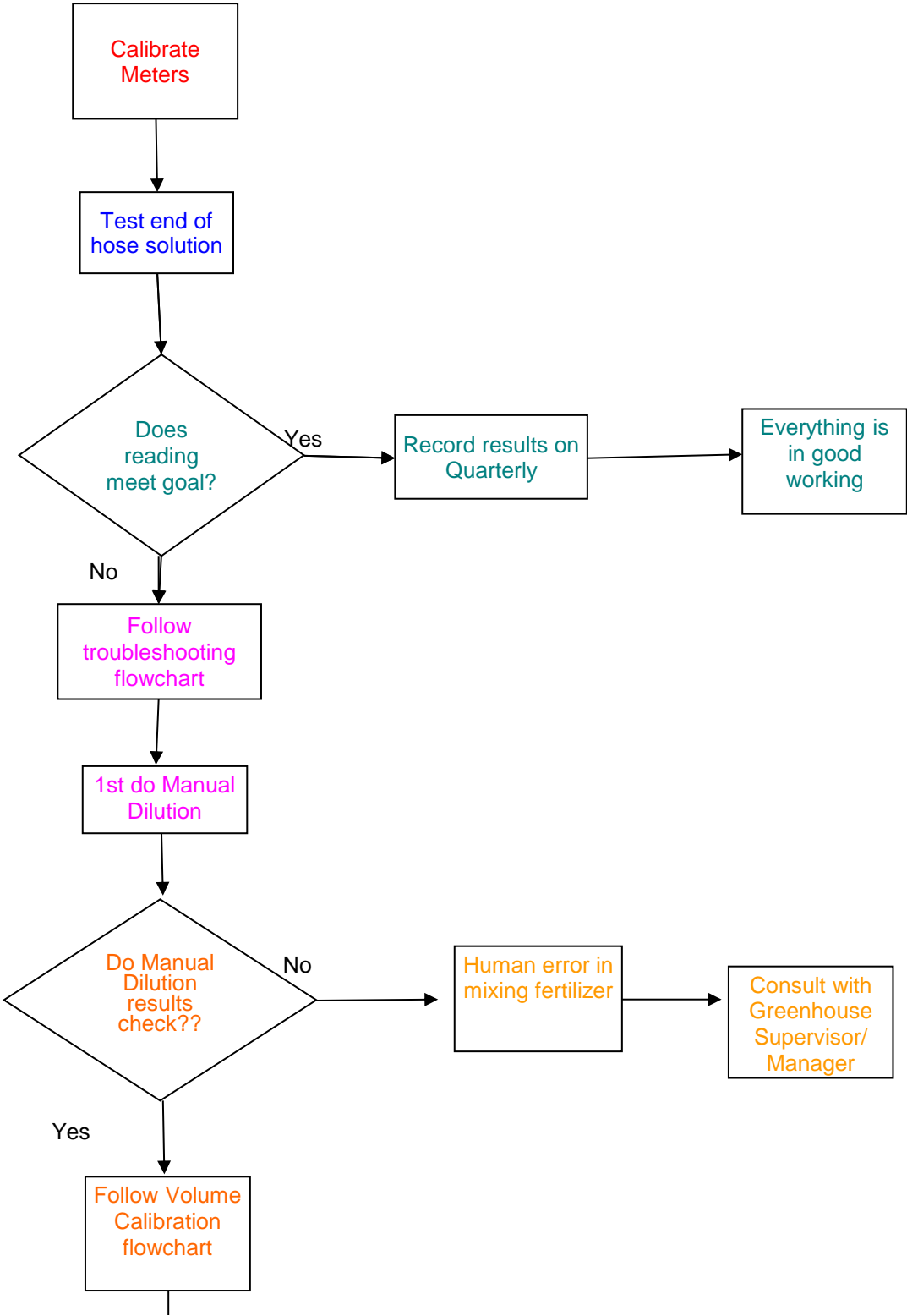
Greenhouse Location: _____

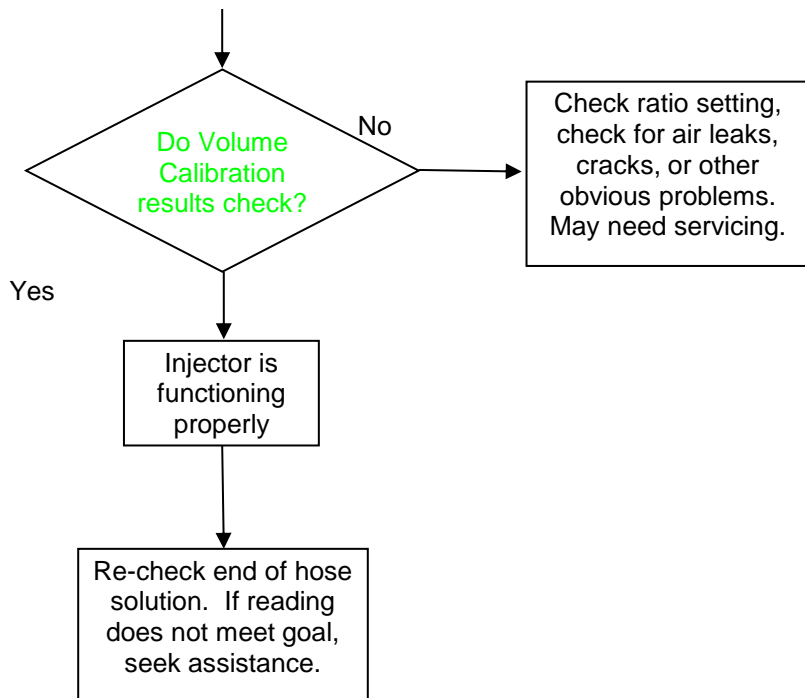
Date: _____

	Verify	Meter Reading	Verify	Verify	Verify	
Fertilizer Injector & Stock Tank Location	Fertilizer Stock Tank Integrity	End of Hose Solution EC *	EC Goal (fert. plus extras) *	Fertilizer Solutions Concentrations (manual dilution, page 4) * annually unless >10% off	Proper Fertilizer Injector Function (page 5) annually unless >10% off	Action: Yes/No Fertilizer Injector SOP (page 7)

* mmhos/cm=usx1000 verify tap water Ec (400 (.4))

Flowchart for testing proper injector function





STEP 2) TEST STOCK TANK BY DOING A MANUAL DILUTION

In this step, we take the injector out of the picture, we do the work of the injector, by manually conducting the dilution and then comparing this to the target EC to see if the stock solution was prepared correctly. (See Flowchart 2. Troubleshooting using Manual Dilution).

2A) Vigorously mix the fertilizer stock so that you will get a good reading – use a stirring stick that reaches all the way to the bottom of the container to vigorously mix the stock solution.

2B) Use a 10 mL graduated cylinder to collect 10 mL of stock concentrate. **MEASURE CAREFULLY!**

2C) Pour the 10 mL stock solution into a 1 Liter graduated cylinder. Fill to the one liter line with tap water. **AGAIN MEASURE CAREFULLY!**

2D) Mix the 1 liter solution very well, you may need a separate bucket or container to do this

2E) Take a sample and test

What was the manual EC reading? _____ mmhos/cm

Remember, this is a reading using a 1:100 dilution; you can compare this reading directly to the hose-end readings and target EC if you are using a 1:100 injector ratio. If you are using a different injector ratio you need to divide by the last number of the ratio and then multiply by 100. Examples:

- Using the manual dilution you measured EC to be 2.0, and you are using a 1:100 injector
 - No additional calculation is necessary because:
$$\text{EC} \rightarrow 2.0 / 100 (\text{injector ratio}) \times 100 = 2.0 \text{ mmhos/cm}$$
- Using the manual dilution you measured EC to be 2.0, but you are using a 1:200 injector
 - $\text{EC} \rightarrow 2.0 / 200 \times 100 = 1 \text{ mmhos/cm}$
- Using the manual dilution you measured EC to be 2.0, but you are using a 1:64 injector
 - $\text{EC} \rightarrow 2.0 / 64 \times 100 = 3.125 \text{ mmhos/cm}$

How does this compare to the target EC?

If the reading was not correct, then your fertilizer stock was mixed incorrectly.

If the reading was correct, then the solution was mixed correctly, but the injector is not operating correctly (check injector ratio setting, check for cracks or air leaks, it may need servicing).

Continue to Part 3.

STEP 3) TEST INJECTOR CALIBRATION

In this step we will calculate the ratio that the injector is operating at. In some cases, this may not match the ratio setting on the machine (due to cracks, air leaks, machine age, etc.). (See Flowchart 3. Troubleshooting using Volume Calibration).

3A) Fill a graduated cylinder with water up to 500 mL.

3B) Make sure there are no bubbles in the suction tube, place injector suction tube into graduated cylinder.

3C) Open water valve at hose end into the 5 gallon bucket. Fill to line in bucket (20 L).

3D) Remove suction tube from graduate cylinder and determine how much solution was used from the graduate cylinder.

Solution used = 500 mL (initial reading) – final reading

What is the your solution used amount? _____ mL

3E) Calculate the injector ratio:

Proportion of irrigation water used = $1 / \text{solution used (mL)} \times 20,000 \text{ mL}$

Example calculations:

- 200 mL used
 - Proportion = $1 / 200 \times 20,000 = 100$
- 100 mL used
 - Proportion = $1 / 100 \times 20,000 = 200$
- 400 mL used
 - Proportion = $1 / 400 \times 20,000 = 50$

What is your proportion? _____

The injector ratio is 1:proportion (that you just calculated), ex: 1:100

What is your injector ratio? _____

Now that you have calculated the actual injector ratio, you can adjust the ratio setting on the injector to achieve the desired ratio (you will then need to repeat step 3 to test). Service to the injector may be required if it is difficult to achieve a desired ratio or if other symptoms of wear are visible – seek assistance

Fertilizer Injector Volumetric Calibration Test

Date Tested: _____ Injector Serial #: _____ Initials: _____

Steps:

1. Set fertilizer injector to 1:100 ratio.
2. Make sure there are no bubbles in suction tube. (Place suction tube in bucket of water and run injector until bubbles are out- a few minutes.)
3. Fill graduated cylinder with water up to 500ml. (Water represents stock solution)
4. Place injector suction tube into graduated cylinder.
5. Open water valve, place hose end into bucket, and add water to the fill line. Fill to 20L.
6. Remove suction tube from graduated cylinder and determine how much solution was used from the graduated cylinder.

Calculations:

Calculations determine how much solution was injected.

1. Subtract final reading from 500ml. This is the amount of **solution injected**.

Example: 500ml (start volume) minus 290ml (remaining volume in graduated cylinder) equals 210ml (volume solution injected)

$$500\text{ml minus }290\text{ml} = 210\text{ml}$$

2. Divide the total amount collected at the end of the hose (20L) by the amount injected from the graduated cylinder. This is the injected ratio.

Example: 20,000ml (volume collected in bucket at the end of the hose) divided by 210ml (volume of solution injected) equals 95.2 (injector ratio)

$$20,000\text{ml divided by }210\text{ml} = 95.2$$

Note: 1:100 = 1.00% 1:50 = 2.00% 1:200 = 0.50% 1:95.2 = 1.05%

Smith fertilizer injectors are pre-set at desired ratio through manufacturer

Items needed for test: 2 buckets (one with fill line 20L), graduated cylinder, pencil

References & Credits: *Flow-through Check* prepared by Missy Bidwell, Grower & Andy Leed, Manager, and William Thompson, Grower-specializing in injector maintenance, Cornell University

Fertilizer Injector SOP for CUAES Greenhouses

Last Updated Tuesday, November 27, 2018

CUAES facilities use Dosatron™ injectors to apply water-soluble fertilizers to plants. These devices inject a proportioned quantity of concentrated solution into an irrigation line so that proper concentrations of a desired fertilizer is applied at the hose-end to maintain healthy plants. The purpose of this SOP is to help facilitate verification of dispensing accuracy, SHEM environmental compliance, and stewardship of our equipment.

Checking the Accuracy of Your Fertilizer Injector

Fertilizer injectors should be checked periodically to be sure they are operating accurately. This can be done by testing the electrical conductivity (EC) of the fertilizer solution and comparing the results to an EC chart from the Fertilizer and Iron Reference Chart.

Quarterly Fertilizer Injector Flow-through Test

Complete the SHEM Dosatron™ Fertilizer Injector Maintenance Form after completing the quarterly test. Keep these files for your greenhouses and share results with your supervisor.

Items needed for test: 2 buckets (one with fill line 20L), graduated cylinder, pencil, and SHEM Quarterly Reminder Worksheets:

- o <https://oeh.cals.cornell.edu/sites/oeh.cals.cornell.edu/files/shared/documents/greenhouses/DosatronMaintenanceForm.pdf> and

1. Set fertilizer injector to 1:100 ratio
2. Make sure there are no bubbles in suction tube (place suction tube in bucket of water and run injector until bubbles are out- a few minutes.)
3. Fill graduated cylinder with water up to 500ml (water represents stock solution)
4. Place injector suction tube into graduated cylinder
5. Open water valve, place hose end into bucket, and add water to the fill line. Fill to 20L
6. Remove suction tube from graduated cylinder and determine how much solution was used from the graduated cylinder
7. Disassemble, clean and replace the filter
8. Check the check-valve for leaks and report if any are found

Calculations determine how much solution was injected.

1. Subtract final reading from 500ml. This is the amount of solution injected
Example: 500ml (start volume) minus 290ml (remaining volume in graduated cylinder) equals 210ml (volume solution injected) 500ml minus 290ml = 210ml
2. Divide the total amount collected at the end of the hose (20L) by the amount injected from the graduated cylinder - this is the injected ratio

Example: 20,000ml (volume collected in bucket at the end of the hose) divided by 210ml (volume of solution injected) equals 95.2 (injector ratio)
20,000ml divided by 210ml = 95.2

Note: 1:100 = 1.00% 1:50 = 2.00% 1:200 = 0.50% 1:95.2 = 1.05%

Next Steps Following Results:

- If variation is less than 5%, no further action needed
- If variation is between 5-15%, change calibration and troubleshoot any repairs needed
- If variation is more than 20%, order replacement unit and comprehensive rebuild of older unit if still current model (see <https://oeh.cals.cornell.edu/sites/oeh.cals.cornell.edu/files/shared/documents/greenhouses/QuarterlyDosatron.pdf> for a maintenance checklist)
- At any time, if unit is leaking, you may need to replace dominant O-ring and tighten fasteners and tubes

Quick Check if you Suspect Something wrong Outside the Quarterly Test:

Let plain water (no fertilizer) run a little, then collect water in a clean bucket. Take a sample of the plain water from the bucket. Check the EC of the untreated water supply.

1. Mix up your fertilizer as you normally do and run it through the injector and hose. Let it run a little to be sure you get an accurate sample. Take a sample of the fertilizer-injected water from the end of the hose and use your meter or soil test laboratory to check the EC of the sample.
2. Subtract the EC value of the untreated water from the EC value of the fertilizer water.
3. Compare the results to an EC chart from the fertilizer manufacturer or fertilizer bag. The chart will correlate the EC measurement with the ppm Nitrogen so you can determine if your injector and mixing procedure is accurate.

Please remember to check the calibration with the 1410 uS/cm³ calibration solution that should be in each pH/EC kit. If you need more calibration solution, it is at KPL in the flower cooler. The Dosatron Quarterly Worksheet may be of help to document your EC test.

References and Resources:

- Boyle, T. 2003. [Fertilizer Calculations for Greenhouse Crops](#).
- Pennisi B. and R.Kessler. 2012. [Fertilizer Injectors: Selection, Maintenance and Calibration](#). University of Georgia Extension.
- Flow-through Test prepared by Missy Bidwell, Andy Leed and William Thompson
- Cornell SHERM Fertilizer and Nutrient Management at <https://oeh.cals.cornell.edu/greenhouses/fertilizer-nutrient-management/>

Quarterly Dosatron® Fertilizer Injector Maintenance Check List

Date Inspected: _____ Injector Serial #: _____ Initials: _____

- Update manufacturer/dealer contact information for maintenance concerns.
- Record date that maintenance was completed.
- Do not use tools when servicing or disassembling unit.
- Rinse injection areas.
To do this, insert suction tube into container of clear water and inject for 3-5 minutes.
- Evaluate working order of pistons and piston motor by listening to the pumping sounds as it runs.
- Bleed air from unit after fertilizer stock tank change.
This is done by slowly opening water supply valve and pressing black button on top. After steady flow of water comes out, slowly open water inlet valve to permitted maximum flow.
- Check for contaminated, worn, or missing check valve parts and replace.
For procedure, see manual page 11 under "Check Valve"
- Check for proper suction of solution.
Listen for clicking pistons and/or blue water from hose end (run water into white pail to make it easier to see)
- Check that suction tube and strainer are not blocked or clogged.
- Check if check valve seal is present, is not dirty or worn.
- Check if plunger seal is present, is not dirty or worn. Also check for wearing of injection stem.
For procedure, see operation manual under "Injection System"
- Check that diffuser seal (in the body) is positioned correctly and is not damaged.
- Check bell housing for damage, proper positioning and presence.
- Check motor, injection, and dosing seals to ensure precise injection and replace as needed.
Dosatron sells seal kits for this intended purpose.

References: The perfect solution! DI 16-11 GPM Operating Manual Dosatron^R International 01/01
William Thompson & Philip Davis, Cornell Growers-specializing in injector maintenance

Prepared by A. Roberts 3/20/03;
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