e-GRO Alert


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Verifying the proper functioning of fertilizer injectors

In this alert, we describe two methods to determine if the fertilizer Injectors are working properly.

Injectors are an important component of irrigation systems in greenhouses and nurseries.

Regular inspection of proper functioning is needed to ensure that injectors are delivering the intended concentration of fertilizer to the crop.

Inspect injectors functionality at least once before each growing season to prevent nutrient disorders caused by excessive or insufficient nutrients.

Figure 1. Fertilizer injector.

Before starting with any procedure, the following materials are needed: a calibrated scales, a 20-ounce graduated cylinder, a 5-gallon bucket, a reliable and properly calibrated electrical conductivity (EC) meter, and a fertilizer bag. The measurements will only be as good as your tools, make sure your instruments are properly calibrated.

The first method - **the flow method -** calculates the actual injection ratio, while the second method—**the EC method—** estimates the final EC of the fertilizer solution.

USDA
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The flow method step-by-step

This method aims to check if the injector delivers the correct volume.

1. Prepare a fresh fertilizer stock solution following the fertilizer manufacture instructions.
2. Turn on the water, charge the system with the solution, and let it flow through the injector and garden hose until all bubbles disappear.
3. Set the injector at a 1:100 dilution ratio.
4. Fill the graduated cylinder with an initial known amount of concentrated stock solution *(e.g., 20 fl. oz.)*.
5. Move the injector's siphon or suction hose into the graduated cylinder.
6. Fill the 5-gallon bucket (640 fl. oz.) with the diluted solution to the top using the garden hose.
7. Once the bucket is filled, turn off the hose, remove the siphon from the graduated cylinder, and put it back into the stock solution tank.
8. Record the final volume of solution remaining in the graduated cylinder *(e.g., 13.6 fl. oz.)*.
9. To have the "injected stock solution," subtract the initial volume from the final volume of the solution in the cylinder.

Figure 2. Setup of the injector at a 1:100 dilution ratio.

Figure 3. The injector siphon inside the graduated cylinder with a concentrated fertilizer stock solution.

Figure 4. 5-gallon bucket with the diluted fertilizer solution.

Let's check the math for the example:

$$Injector\ ratio = \frac{Diluted\ volume}{Injected\ stock\ solution}$$

$$Injector\ ratio = \frac{640\ fl.oz.}{20\ fl.oz. - 13.6\ fl.oz.}$$

$$Injector\ ratio = 100$$

The EC (Electrical Conductivity) method step-by-step

This method aims to determine the accuracy of the final fertilizer concentration is correct—it accounts for injector function and proper fertilizer estimations and measurements.

1. For this method, it is necessary to know the electrical conductivity of the water source. Let the water run for a few minutes to clear the pipes, collect a sample of irrigation water at the nearest point to the water source, and measure the EC of the sample using a properly calibrated EC meter *(e.g., 0.21 millisiemens per centimeter - mS/cm).*
2. Prepare the stock fertilizer solution and adjust the injector for a specific concentration. For example, to give 200 parts per million nitrogen using a 13-2-13 fertilizer and a 1:100 injector ratio, 20.5 oz/gal should be applied to prepare the stock solution.
3. Let the solution run through the hose for at least 30 seconds and collect a sample of about 2 gallons (256 fl. oz.) of diluted fertilizer solution in a clean bucket. For this method, you do not need to track the exact volume of the solution.
4. Collect a sample from the diluted solution using a clean container, measure the EC, and record *it (e.g., 1.76 mS/cm).*
5. Based on the fertilizer label, match the target rate to the column with the injection setting. For 13-2-13 fertilizer, 200-ppm N should give an EC of 1.5 mS/cm.

Let's check the math for the example:

Final EC fertilizer = EC fertilizer solution – EC irrigation water

$$Final\ EC = 1.76 mS/cm - 0.21 mS/cm$$

$$Final\ EC = 1.55\ mS/cm$$

For both methods, 2% to 3% variation is acceptable. If the values are inaccurate, consider what other factors may have played a role (the scale or meter calibration, the water volume used, injector functionality etc.)

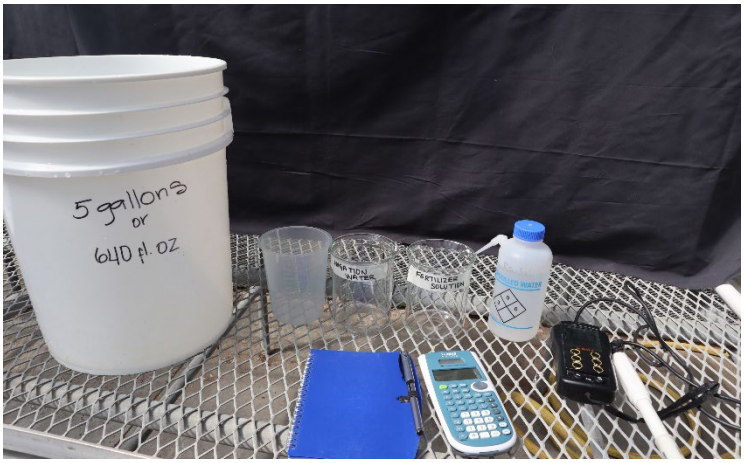

Figure 5. Materials necessary to carry out the two methods to inspect the correct operation of the injectors.

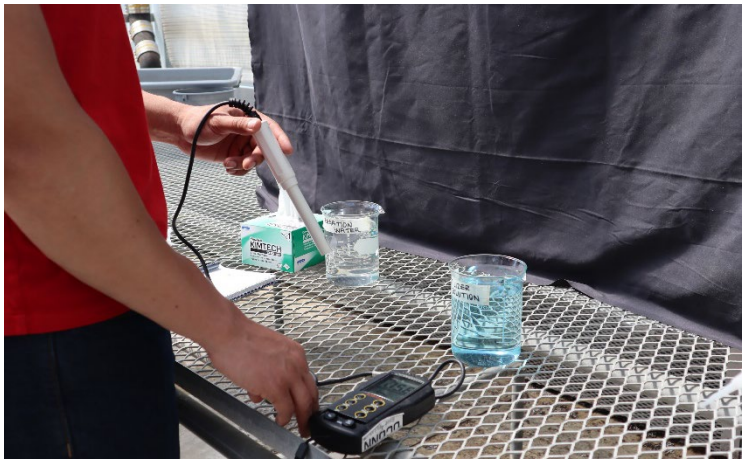

Figure 6. Measurement of the EC of the irrigation water and the stock fertilizer solution.

Figure 7. Stock solution tanks and hoses.

Figure 8. Cover of the extension video on our YouTube channel, "The Greenhouse Channel."

Take Home Messages and Additional Considerations

1. Regular calibration is needed to ensure that injectors are operating properly. You should complete both methods listed here to ensure accuracy. While the flow method assesses the injector's functionality, the EC method checks the accuracy of the final fertilizer concentration.
2. All injectors need maintenance. Do not wait until there is a problem with plant nutrition to calibrate them.
3. If the injector is malfunctioning properly, contact the manufacturer for maintenance, repair, or replacement options.

Additional Resources

To learn more about this topic, do not miss our extension video, "Inspect the proper function of fertilizer injectors" on our YouTube channel, "**The Greenhouse Channel.**" This and other valuable and engaging content in English and Spanish is discussed in our videos.

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