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## A plain and simple checklist for injector problems, testing and common maintenance.

*Nothing lasts forever, and fertilizer injectors are no exception. Part failures are often not discovered for days, even weeks. The best management practice is to test, maintain and calibrate often.*

Fertilizer injectors are a mainstay of the greenhouse industry. They allow us to apply large volumes of fertilizer while using relatively small stock tanks. They save labor, time and money, and for the most part, they work like a charm. We all have a tendency to just assume all is well. Sadly, as my student and I found out recently, some malfunctions are not easily found until the crop declines. There are two types of malfunctions: absolute suction failure, and the much harder to discover injection degradation. Here is a checklist to go through if you suspect your injector/proportioner is not doing the job correctly.

1) Check your stock tank for precipitate/debris. This is a

very common cause of injection degradation. Clean siphon filter and flush tank.

2) Check your feed line. Many growers use a clear tube to verify fertilizer solution is going up into the injectors. I have seen several feed hoses semi-choked with algae/bacteria from setting over the summer unused. Flush that feed tube or replace it!

3) Check your water pressure. Make sure some in-line valve down the way isn't adjusted incorrectly. Many injectors will not be affected by water pressure unless it is very low, but its worth a look to ensure proper pressure for drip lines and other options.

4) Make sure that there is no improperly adjusted valve, solenoid or some evil hose

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crimp between your injector and the business end of the hose. This can affect efficiency by causing back-pressure. 5) Make sure any air bubbles are removed from the line before use. Most injectors have a bleed valve near the top. Air can obstruct flow, reduce suction pressure and piston pull efficiency. 6) If things don't seem to be working, but you don't have time for an over-haul, try injecting hot water. Sometimes running clear, hot water through the system dissolves salts, and softens seals, allowing them to seat properly. By no means is this a fix all, but it does work, especially if the unit hasn't been used in a while (see Figure 1). 7) If your injector/proportioner has moving parts, do you hear movement? Click-

ing? If not, you may have a broken seal, sand between a seal and the casing, or contaminants such as calcium phosphate deposits, fungicides, etc clogging the plunger seals (Figure 2). In this case, taking the unit apart and cleaning all parts (with soap and water) may solve the issue, or at least allow you to discover the real cause. Re-install the seals with a coating of silicone, but not soap or Vaseline or WD-40, which can themselves degrade the seals over time. 8) Look for scoring on your piston heads if your unit has them. If sand does get in, it can scratch deep enough to allow solution to bypass the piston. If found, order a new piston unit to improve things. 9) Make sure all the components of the injectors, in-



Figure 1. Small issues that have big effects! Calcium deposits and dried fertilizer salts on these seals caused failure, as did the 5 year old, stiff seal seen on right.

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cluding bell/chamber covers are screwed down snugly! Loose= injection loss. This is a common un-noticed problem. To maintain suction and proper efficiency, adding silicon coating to the screw on sections will prevent them from getting stuck and makes it easier to snug the item down. If not sure, repeat.

10) Look for cracks along the stem, or base of the bell cover. Especially in hoop houses, injectors installed near a wall can freeze, cracking ever so slightly the plastic parts. If cracks are found, these parts must be replaced.

11) Make sure the injector stem isn't bent or pulled out of position. Slightly warped

or offset stems do not work well. You'd think this would be hard to do, but its happened in our greenhouses, twice. Re-install the stem with silicon added to seals... if things don't work, you'll need to replace the stem.

12) Finally, check your sand filter and back-flow preventer. You should have both! The sand filter is essential. I know of no moving part injectors that can tolerate sand. The back-flow preventer is a required piece of equipment in most states. It prevents fertilizer concentrate from being pulled into the municipal or well water supply. When operational, they are essential. Occasion-



Figure 2. This main piston had an excessive amount of fertilizer, (and maybe fungicide) encrusted in between the seal and the piston, calcium deposits didn't help.

ally, they also have issue and can reduce water flow, or fail. If you've done everything else, it may be one of these.

**Calibration:** There are two simple methods to retest your injector after you have adjusted or performed maintenance. The first is testing with an EC meter. EC or electrical conductivity happens to be a fairly accurate way to assess salt levels in solution. To do this you must first find a published table that indicates what the EC should be for any one concentration of fertilizer. Manufacturers usually have this online. Secondly, you need a water test. You need the baseline EC of your water supply. To test a 200 ppm solution of fertilizer coming out the end of the hose, you must first add the EC from the fertilizer table, and the EC of your water to get your goal value. If that combined EC value doesn't come close to what your EC meter is reading on the end of hose solution, you may have a problem with your fertilizer weighing scale, your calculations, the EC meter or the injector. Always be sure to calibrate your EC meter before using it to assess your fertility delivery system. Common scales used to measure out fertility can be easily tested using known weights of common materials. Your calculations are easily verified using one of the internet based fertilizer calculators now available. With a little prep, you should have no issues.

The second method is the Volume Test. We know that an injector set at 1%, or 1/100 should use up 1 gallon of stock for every 100 gallons of water that goes through the injector. The easiest way to test is to find an empty 50 gallon garbage can. Fill a small water bucket with exactly 1/2 gallon plain water. Place your siphon tube in the small bucket, turn on

the injector(water) and fill the 50 gallon bucket. Sometime shortly before you fill that bucket, your siphon end should be almost exposed due to most of the water being siphoned out of the small bucket. This proves your system has reasonable suction and is at least functioning. When you have more time, you can go back and test EC as described previously to ascertain accuracy and detect any small issues.

Finally, a word about indicator dyes. Surely you have all been told this little diddy, or have yourself told this to every employee you've ever had. "If you live by the dye, you'll die by the dye! The indicator dyes, used by most fertilizer producers, is not an indicator for concentration!!! At best it tells you that some amount of stock tank solution has made it into the water stream. It is best used as an indicator as to when the wave of fertilizer water reaches the end of your hose and tells you when to start each fertilization.

Of course, if you just cannot seem to find the reason your injector isn't working, contacting the manufacturer is always a good idea. My experience is that they want to keep you as a customer and will help you out, sending replacement parts, seal kits and instructions. Finally, the best piece of advice I was given was this. Always have a spare injector! Our greenhouse manager here at UGA saved our bacon more than once because she had a spare ready to drop in place when our unit went down. Proper planning....

Finally, things don't last forever. If you have had your injector for 5-7 years, it might be a good idea to call the manufacturer and see if they recommend an overhaul, or replacement.